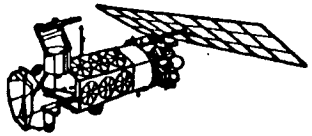
CONTRACTOR LIBRARY



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DMSP SENSORS

DMSP SENSOR DIRECTORATE

MARCH 20, 1992

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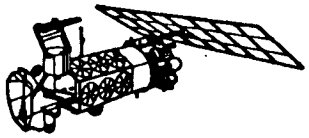
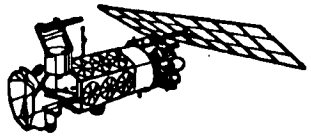


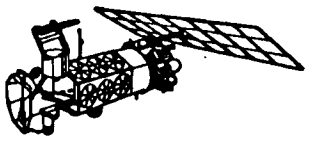
DMSP SENSORS

INTRODUCTION	DR. NEAL BAKER
OPERATIONAL LINESCAN SYSTEM	FRANK BARCATTA
MICROWAVE SENSORS	JEROME REDMANN
SPACE ENVIRONMENT SENSORS	DR. T.P. YANG
OTHER SENSORS	DR. NEAL BAKER



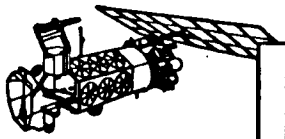
INTRODUCTION

- PURPOSE
- BRIEF METSAT HISTORY
- MISSION REQUIREMENTS
- SENSOR EVOLUTION
- USER AND SYSTEM REQUIREMENTS
- PRINCIPLES OF RADIOMETRY
- DMSP SENSORS



PURPOSE

TO PROVIDE AN UNDERSTANDING OF THE OPERATING PRINCIPLES OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM SENSORS



EARLY METSAT HISTORY

1 APR 1960 TIROS I LAUNCHED WITH TWO TELEVISION CAMERAS, ONE WIDE ANGLE AND ONE NARROW ANGLE - VISIBLE LIGHT ONLY

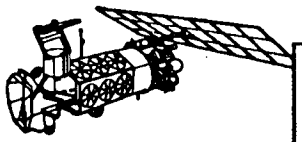
1960 - 1965 NINE TIROS (TELEVISION AND INFRARED OBSERVATION SATELLITE) LAUNCHED, ABOUT HALF WITH INFRARED RADIOMETER

1966 - 1969 NINE ESSA (ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION) SATELLITES LAUNCHED, IMPROVED VIDICONS FROM NIMBUS - AUTOMATIC PICTURE TRANSMISSION (APT) STARTED

1966 - 1976 APPLICATIONS TECHNOLOGY SATELLITE (ATS) SPIN SCAN CAMERA

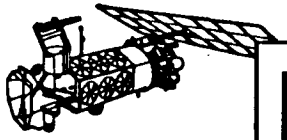
1966 - 1977 DMSP BLOCK IVA & B VIDICON CAMERAS WITH 1.5 NAUTICAL MILES RESOLUTION AT NADIR

1970 - 1977 DMSP BLOCK VA, B, & C - SENSOR AEROSPACE VEHICLE ELECTRONICS PACKAGE (SAP) 0.3 NAUTICAL MILES RESOLUTION AT NADIR



LATE METSAT HISTORY

1970 - 1975	SIX NOAA SATELLITES LAUNCHED
	- VERY HIGH RESOLUTION RADIOMETER
	- VERTICAL TEMPERATURE PROFILE RADIOMETER
	- SCANNING RADIOMETER (SR)
1974 - 1982	SYNCHRONOUS METEOROLOGICAL SATELLITE (SMS)
	- VISIBLE AND INFRARED SPIN-SCAN RADIOMETER
1975 - 1987	GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES)
	- VISIBLE AND INFRARED SPIN-SCAN RADIOMETER
1977 - 1982	BLOCK 5D1
	- OPERATIONAL LINESCAN SYSTEM (OLS)
	- MICROWAVE TEMPERATURE SOUNDER
1978 - 1986	EIGHT TIROS -N WITH NEW INSTRUMENTS
	- ADVANCED VERY HIGH RESOLUTION RADIOMETER
	- TIROS OPERATIONAL VERTICAL SOUNDER (TOVS)



MISSION REQUIREMENTS

DMSP

TO PROVIDE ACCURATE POINT FORECASTS AND ANALYSIS TO SUPPORT DOD AND OTHER

PRIMARY

GLOBAL CLOUD IMAGERY TO WEATHER CENTRALS

REAL TIME CLOUD IMAGERY TO TACTICAL USERS

OTHER

PROVIDE ATMOSPHERIC VERTICAL TEMPERATURE AND WATER VAPOR SOUNDINGS TO WEATHER CENTRALS

NOAA

TO PROVIDE ACCURATE SYNOPTIC SCALE FORECASTS TO SUPPORT CIVILIAN AGENCIES

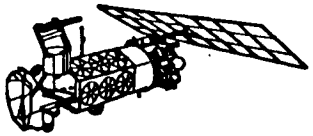
PRIMARY

ATMOSPHERIC TEMPERATURE SOUNDING IN SUPPORT OF U.S. WEATHER FORECASTS

CONDUCT SEARCH AND RESCUE UNDER INTERNATIONAL AGREEMENT

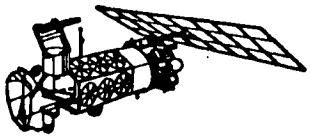
OTHER

REAL TIME CLOUD IMAGERY TO DOMESTIC AND INTERNATIONAL USERS



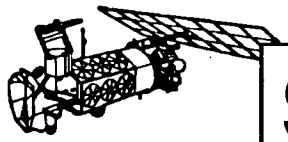
SENSOR EVOLUTION

- CURRENT DMSP SENSOR SUITE HAS EVOLVED FROM BOTH THE DOMESTIC AND MILITARY SATELLITE SYSTEMS TO MEET THE CURRENT DOD REQUIREMENTS
- THE CAPABILITIES OF THE SPACECRAFT TO SUPPORT THE ADVANCED SYSTEMS HAS GROWN
- NEWER SENSORS HAVE GENERALLY IMPROVED RESOLUTION AND RADIOMETRIC ACCURACY OVER THEIR PREDECESSORS
- GREATER EXPLOITATION OF THE MICROWAVE REGION IS NOW POSSIBLE THROUGH ADVANCES IN TECHNOLOGY
- NEW SENSOR SYSTEMS ARE LIMITED BY THE ABILITY TO PROCESS DATA ON THE GROUND



USER REQUIREMENTS

- REQUIREMENTS ARE CHANGING FROM QUALITATIVE TO QUANTITATIVE
- IMAGERY IS USEFUL BUT DOES NOT HELP WEATHER PREDICTION UNLESS TURNED INTO QUANTITATIVE NUMBERS
- USER NEEDS ENVIRONMENTAL PARAMETERS
  - CLOUD TYPE AND AMOUNT
  - VERTICAL TEMPERATURE PROFILES
  - ABSOLUTE HUMIDITY PROFILES
  - UPPER AIR TEMPERATURE PROFILES
  - WIND FIELDS
  - PRECIPITATION
  - SEA ICE
  - SEA SURFACE TEMPERATURES
  - SOIL MOISTURE
  - LIQUID/SOLID WATER CONTENT
  - SNOW COVER
  - LAND SURFACE TEMPERATURES
  - AURORAL EMISSIONS AND AIR GLOW
  - ELECTRON DENSITY PROFILES
  - PRECIPITATING ELECTRONS AND IONS
  - IN-SITU ELECTRIC FIELDS

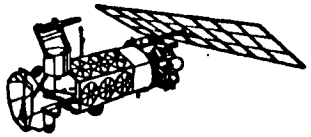


SYSTEM REQUIREMENTS

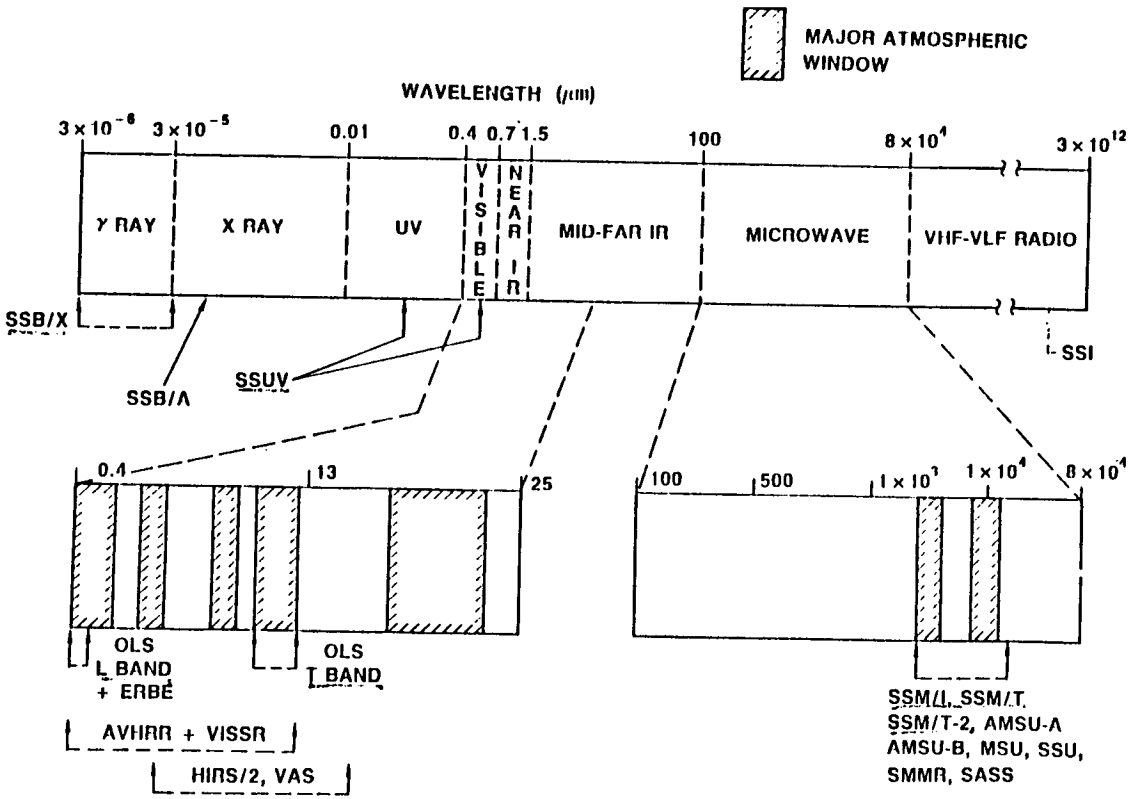
- DESIRABLE SYSTEM ATTRIBUTES
- HIGH RESOLUTION
- GLOBAL COVERAGE
- ACCURATE RADIOMETRIC MEASUREMENTS
- HIGH SIGNAL TO NOISE RATIOS
- ACCURATE EARTH LOCATION
- TIMELINESS OF DATA

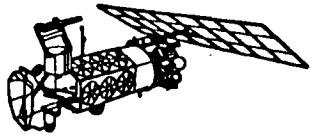
PRINCIPLES OF RADIOMETRY

- SENSORS ARE DESIGNED TO MEASURE THE TOTAL RADIATION FALLING UPON A DETECTOR IN A DESIRED PASS BAND FROM A SMALL AREA FROM THE EARTH BELOW
- THE RADIATION RECEIVED IS A FUNCTION OF A VARIETY OF PHYSICAL PROCESSES OF THE ATMOSPHERE BELOW AND THE GROUND
- PASS BANDS ARE SELECTED TO SEPARATE OUT THE DESIRED PHENOMA
- IMPORTANT PHYSICAL PROCESSES INCLUDE:
  - EMISSION
  - ABSORPTION
  - SCATTERING
  - REFLECTION

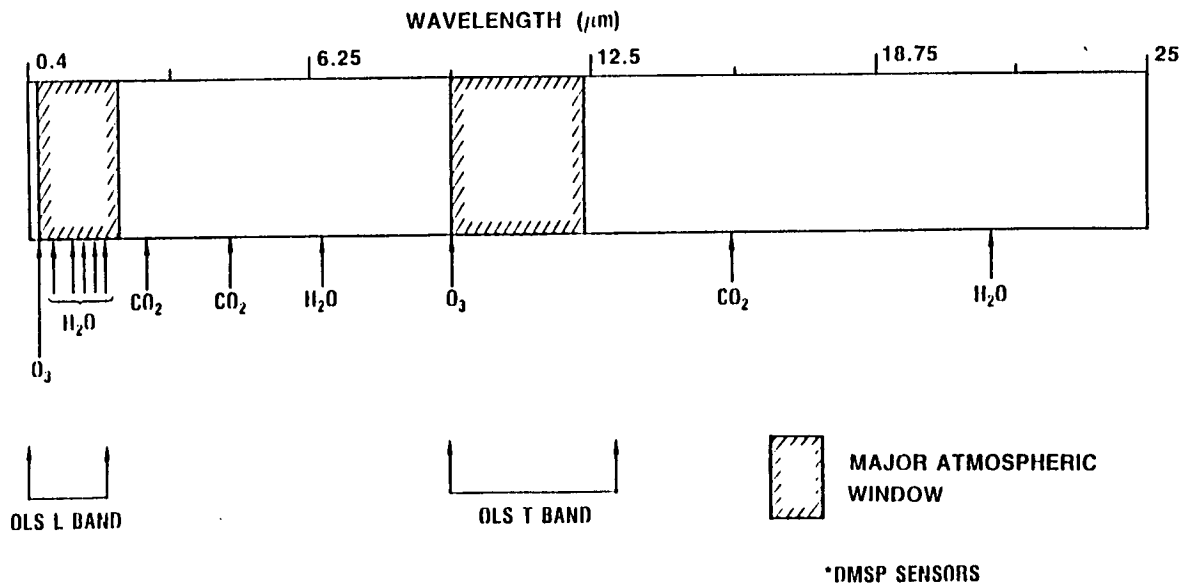


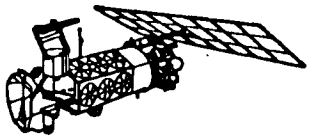
DMSP REMOTE SENSING SPANS THE ENTIRE ELECTROMAGNETIC SPECTRUM



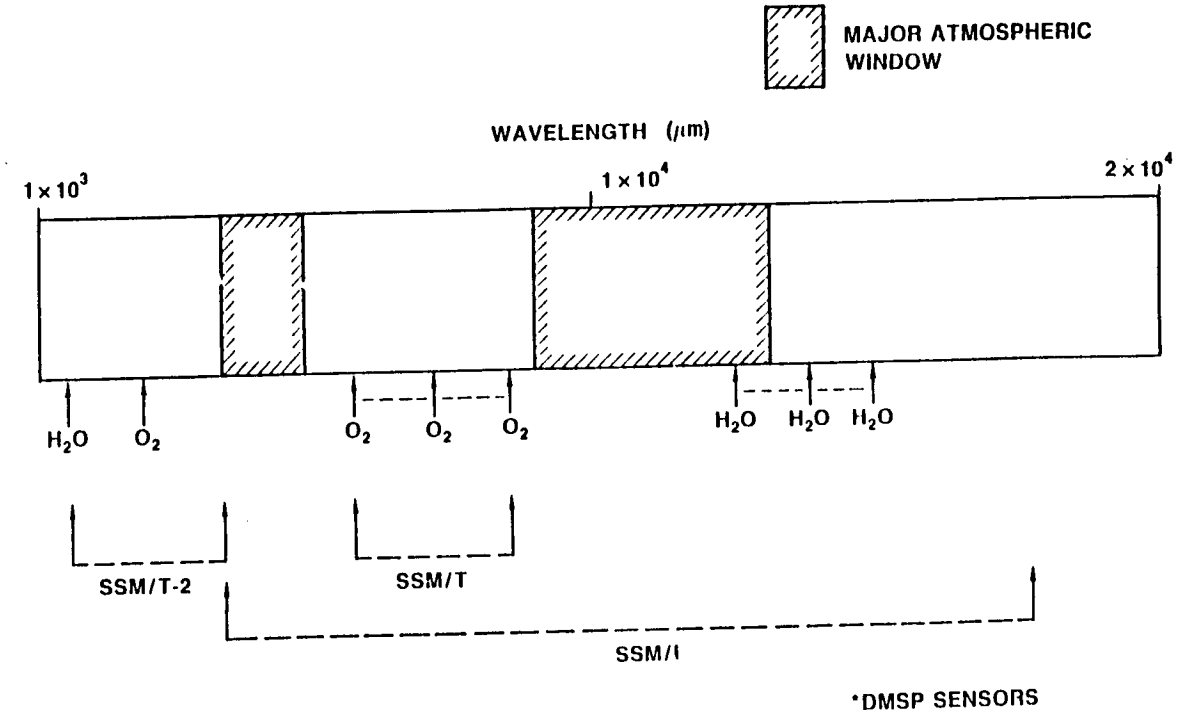


VISIBLE TO MID INFRARED



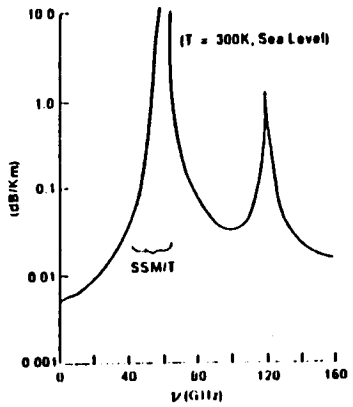


MICROWAVE REGION

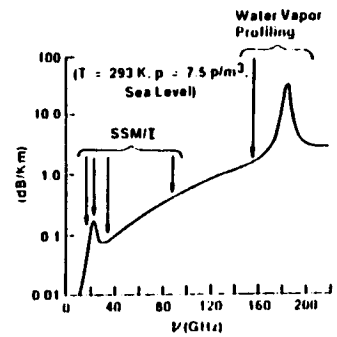


*DMSP SENSORS

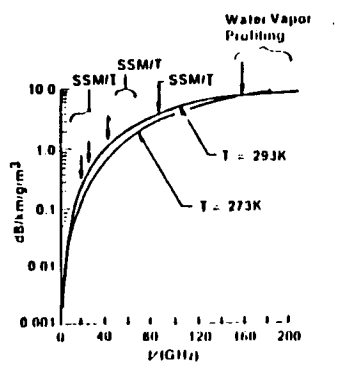
MICROWAVE ABSORPTION CHARACTERISTICS OF ATMOSPHERIC CONSTITUENTS



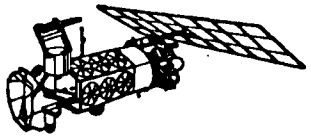
Absorption Coefficient of Dry Air



Absorption Coefficient of Water Vapor in Air at Sea Level



Absorption Coefficient of Small Water Droplets



OPERATIONAL LINESCAN SYSTEM

(OLS)

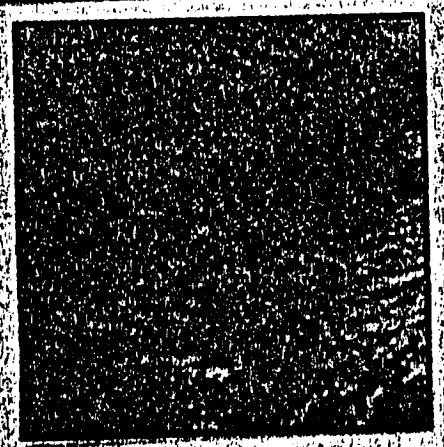
Space Division

OLS
Visible and Infrared Imaging

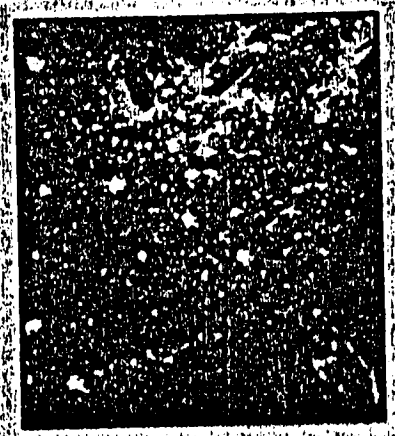
OLS

DMSP

Day-Night Imagery

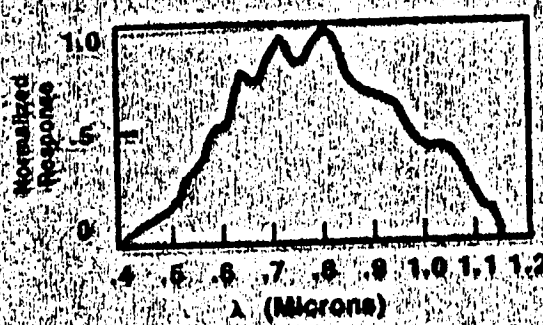


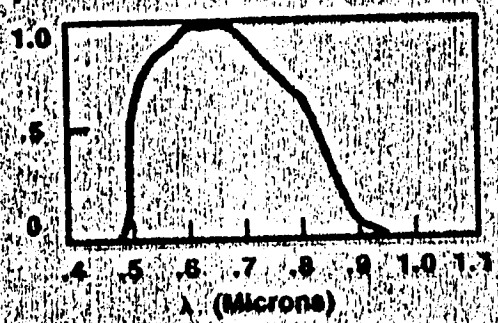
Visible-Day

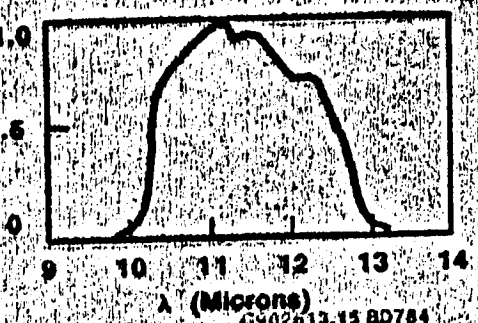


Visible-Night

Infrared







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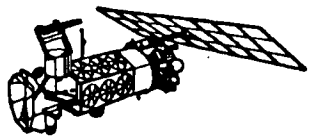
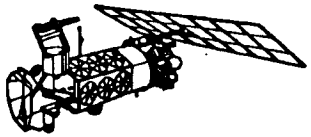


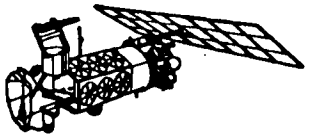
OLS OVERVIEW

- DMSP CLOUD IMAGING SENSOR
  - VISIBLE AND THERMAL INFRARED SPECTRAL CHANNELS
  - GLOBAL DAY-NIGHT AND TERMINATOR COVERAGE
  - REALTIME AND STORED DATA CAPABILITY
  - HIGH ACCURACY CONSTANT RESOLUTION IMAGERY DATA
- ONBOARD SENSOR DATA PROCESSING AND STORAGE
  - PERFORMS ALL SENSOR DATA PROCESSING FUNCTIONS
  - PROVIDES COMMANDS TO AND ACCEPTS DATA FROM UP TOTWELVE ADDITIONAL MISSION DATA SENSORS
  - PROVIDES MULTI-ORBIT STORAGE FOR ALL MISSION AND TELEMETRY DATA
- SYSTEMS OPERATIONAL SINCE 1976



OLS PERFORMANCE SUMMARY

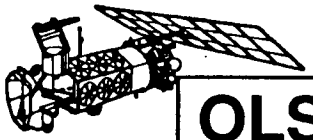
- SPATIAL RESOLUTION
  - 0.3 NMI - VISIBLE DAY
  - 1.5 NMI - VISIBLE NIGHT
  - 0.3 NMI - INFRARED
- SPECTRAL BANDS
  - 0.4 to 1.1 MICRONS - VISIBLE DAY
  - 0.5 to 0.9 MICRONS - VISIBLE NIGHT
  - 10 TO 13 MICRONS - INFRARED
- MULTI-ORBIT ONBOARD DATA STORAGE CAPABILITY
  - UP TO 4 REVS AT LOWEST RECORD SPEED
- MULTIPLE RECORD/PLAYBACK RATES
  - RECORD - 67.666; 1,331 KBPS
  - PLAYBACK - 1,331; 2,662 KBPS



OLS OPERATIONAL HISTORY

- FLIGHT HISTORY

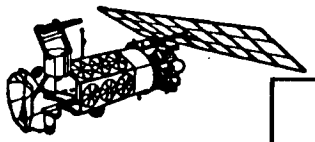
F1	OLS 1	5D1	30 MONTHS	SPACECRAFT FAILURE
F2	OLS 2	5D1	32 MONTHS	SPACECRAFT FAILURE
F3	OLS 3	5D1	58 MONTHS	OLS ELECTRONIC PART FAILURE
F4	OLS 6	5D1	14 MONTHS	SPACECRAFT FAILURE
F5	OLS 5	5D1	-0-	LAUNCH VEHICLE FAILURE
F6	OLS 8	5D2	56 MONTHS	OLS BEARING WEAROUT
F7	OLS 9	5D2	47 MONTHS	OLS BEARING WEAROUT
F8	OLS 10	5D2	41 MONTHS	OLS BEARING WEAROUT
F9	OLS 11	5D2	48 MONTHS	OLS BEARING WEAROUT
F10	OLS 7	5D2	LAUNCHED 12/1/90	OPERATIONAL
F11	OLS 13	5D3	LAUNCHED 11/28/91	OPERATIONAL



OLS OPERATIONAL HISTORY - CONTINUED

- **ORBITAL LIFE REQUIREMENT**

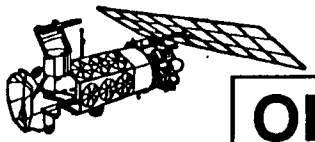
5 D1 SYSTEMS OLS 1-6	18 MONTHS WITH DESIGN WEAROUT 24 MONTHS
5D2 SYSTEMS OLS 7-11	Ps = 0.8 FOR 36 MONTHS @ 60% CONFIDENCE
5D3 SYSTEMS OLS 12-16	Ps = 0.8 FOR 36 MONTHS WITH 48 MONTH GOAL
5D3 SYSTEMS OLS 17-21	Ps = 0.8 FOR 36 MONTHS WITH 60 MONTH GOAL



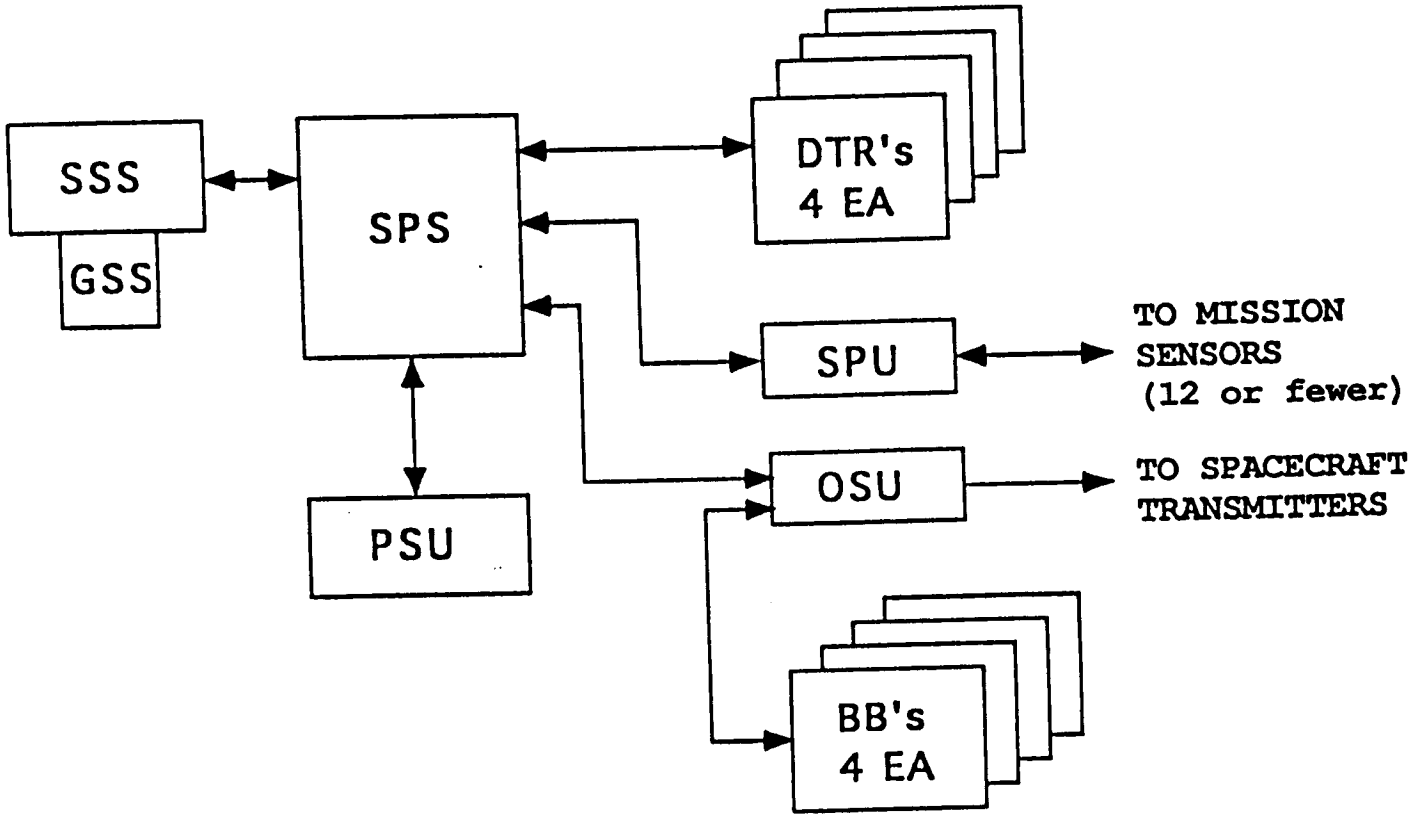
OLS

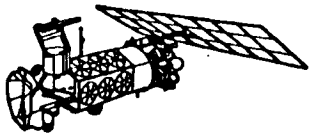
WEIGHT AND POWER CONSUMPTION

	5D1	5D2	5D3
SENSOR SCANNING SUBSYSTEM	52.73	55.30	57.76
GLARE SUPRESSION SUBSYSTEM	8.76	8.76	7.48
SIGNAL PROCESSING SUBSYSTEM	49.52	69.10	57.53
BIB	1.74	-	-
OUTPUT SWITCHING UNIT	1.86	3.51	3.53
DIGITAL TAPE RECORDERS	67.73(3)	82.20(4)	86.25
CABLES	11.37	21.98	37.97
POWER SUPPLY UNIT	-	23.92	26.45
SPECIAL PROCESSING	-	17.13	17.34
ENCRYPTERS	8.50(2)	10.75(3)	10.77(3)
TOTAL MASS (LBS)	202.21	291.65	286.34
POWER (WATTS)	3.7-134	77.5-253	88-215

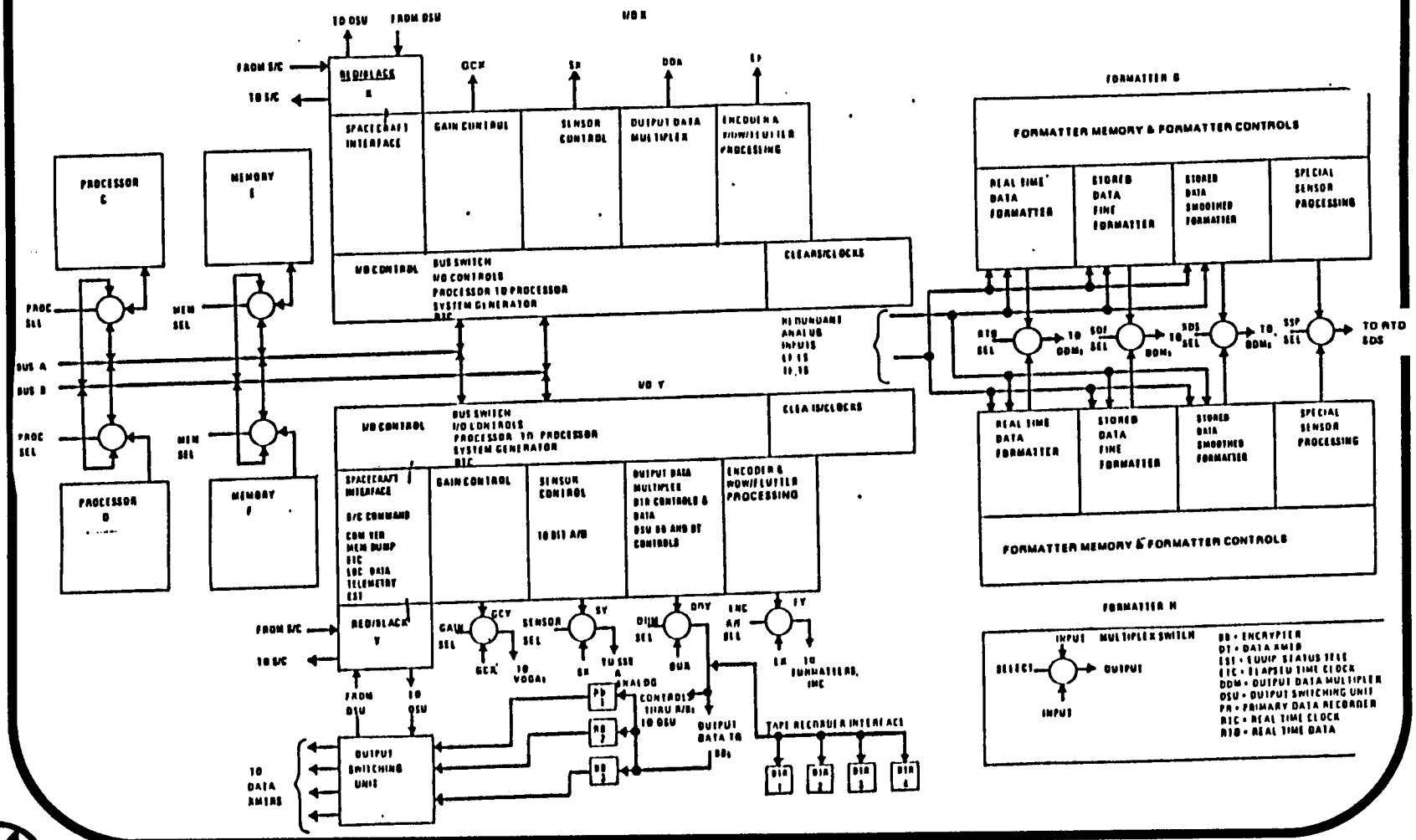


OLS SUBSYSTEM INTERCONNECTIONS AND DATA FLOW

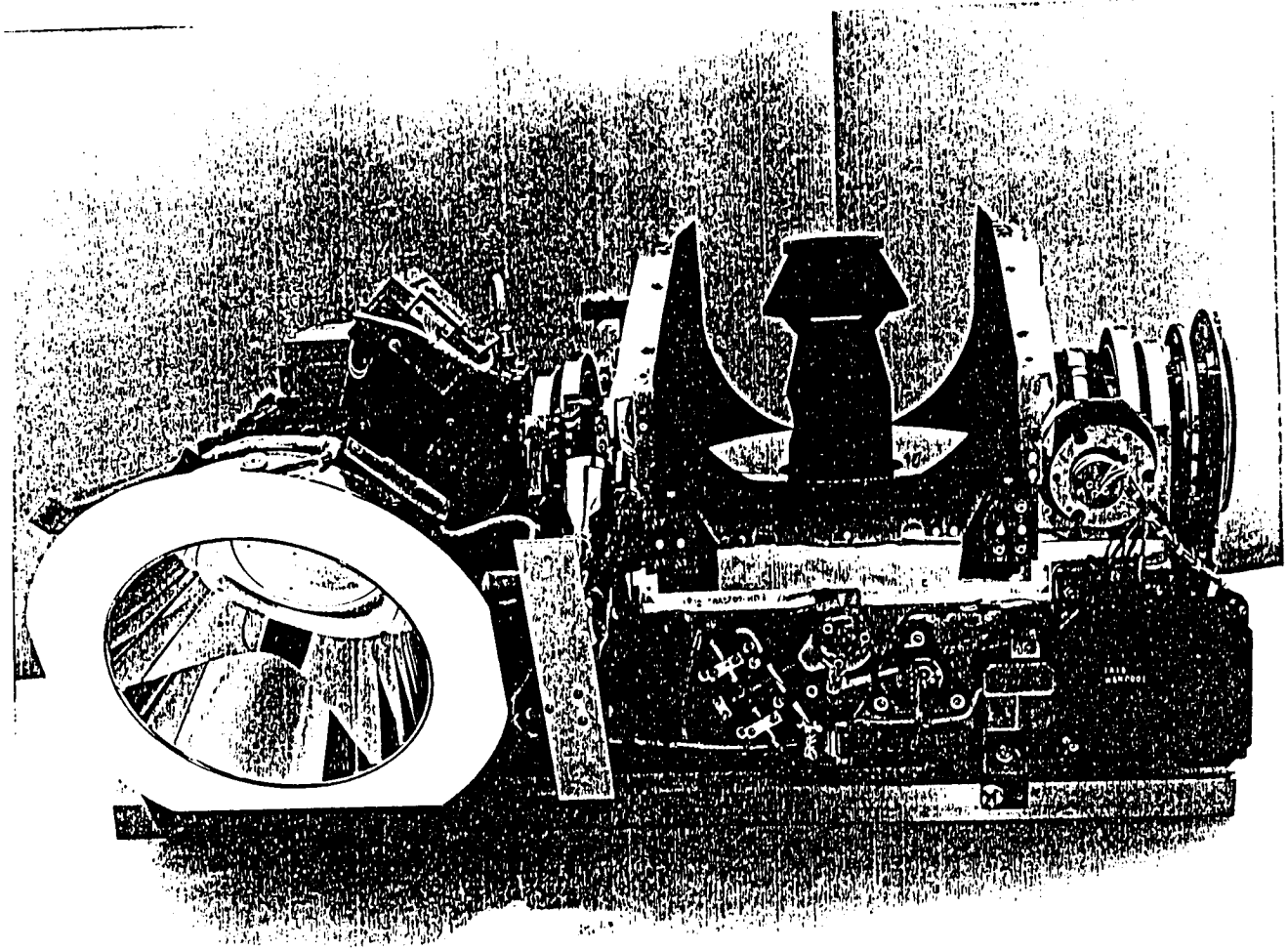


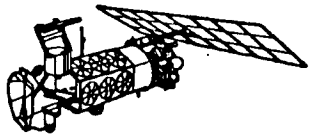


OLS SYSTEM BLOCK DIAGRAM AND REDUNDANCY

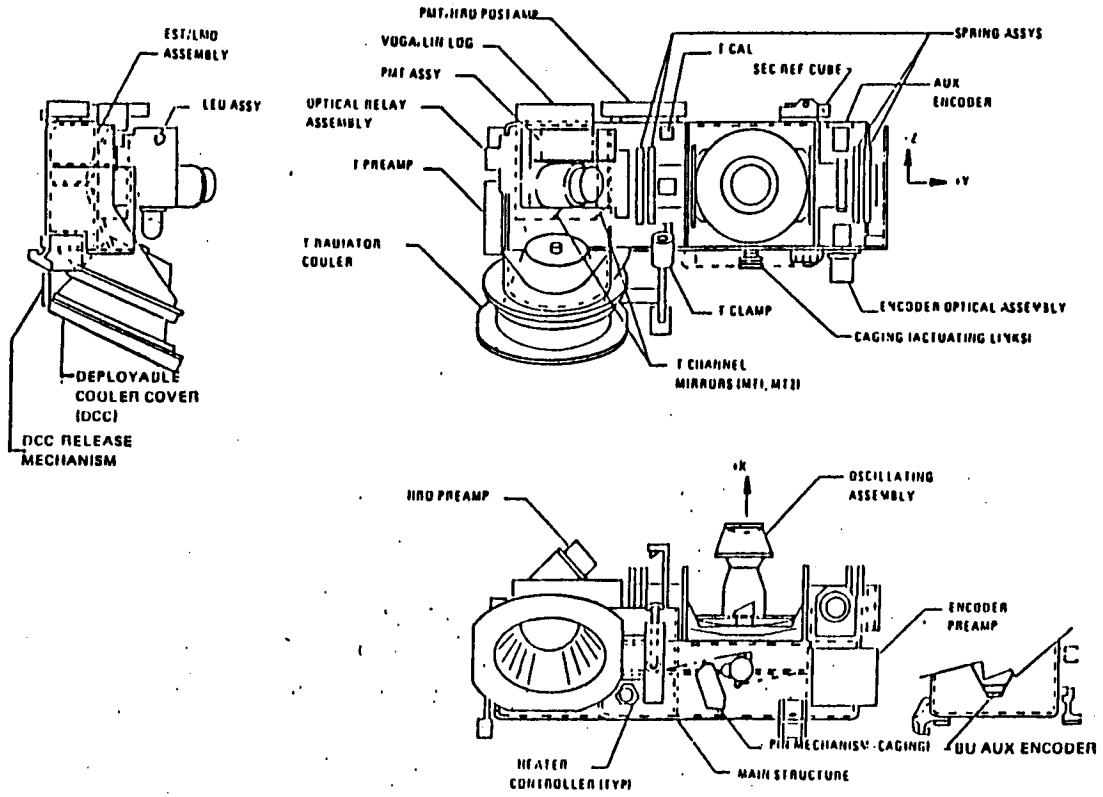


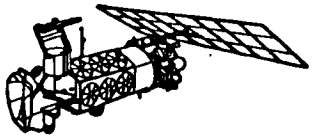
SENSOR SCANNING SUBSYSTEM (SSS)



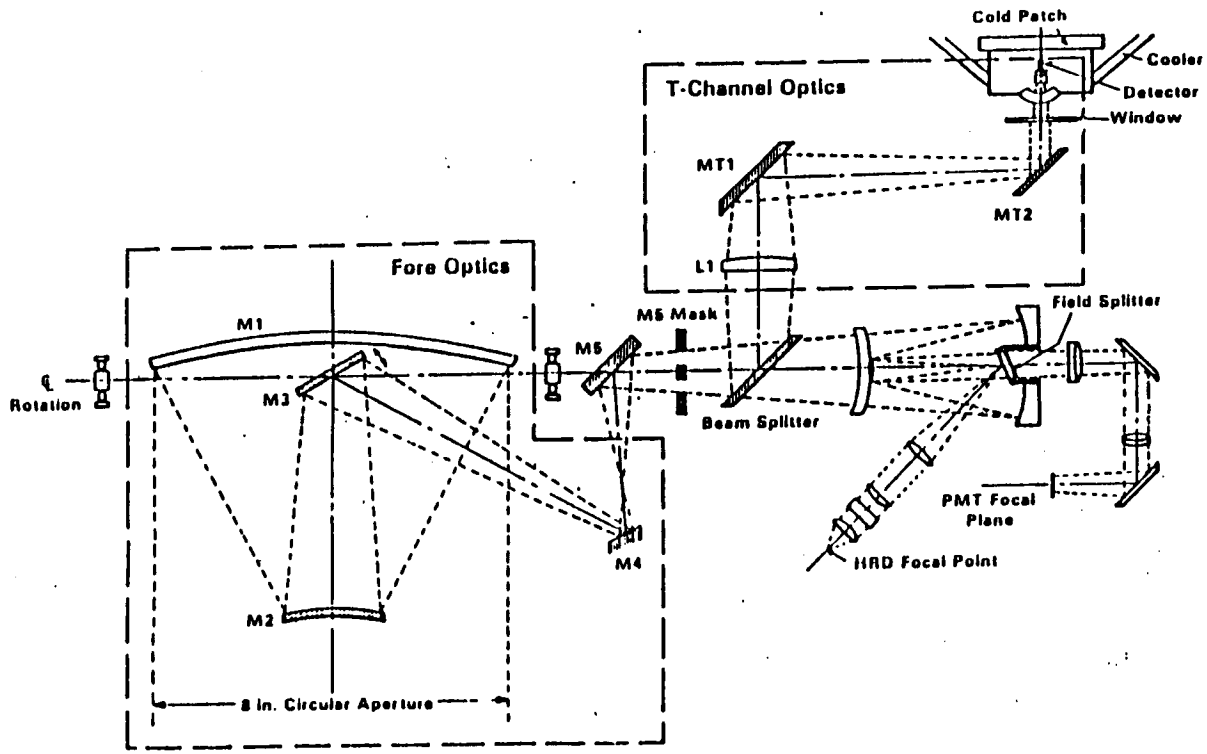


SSS PHYSICAL ARRANGEMENT

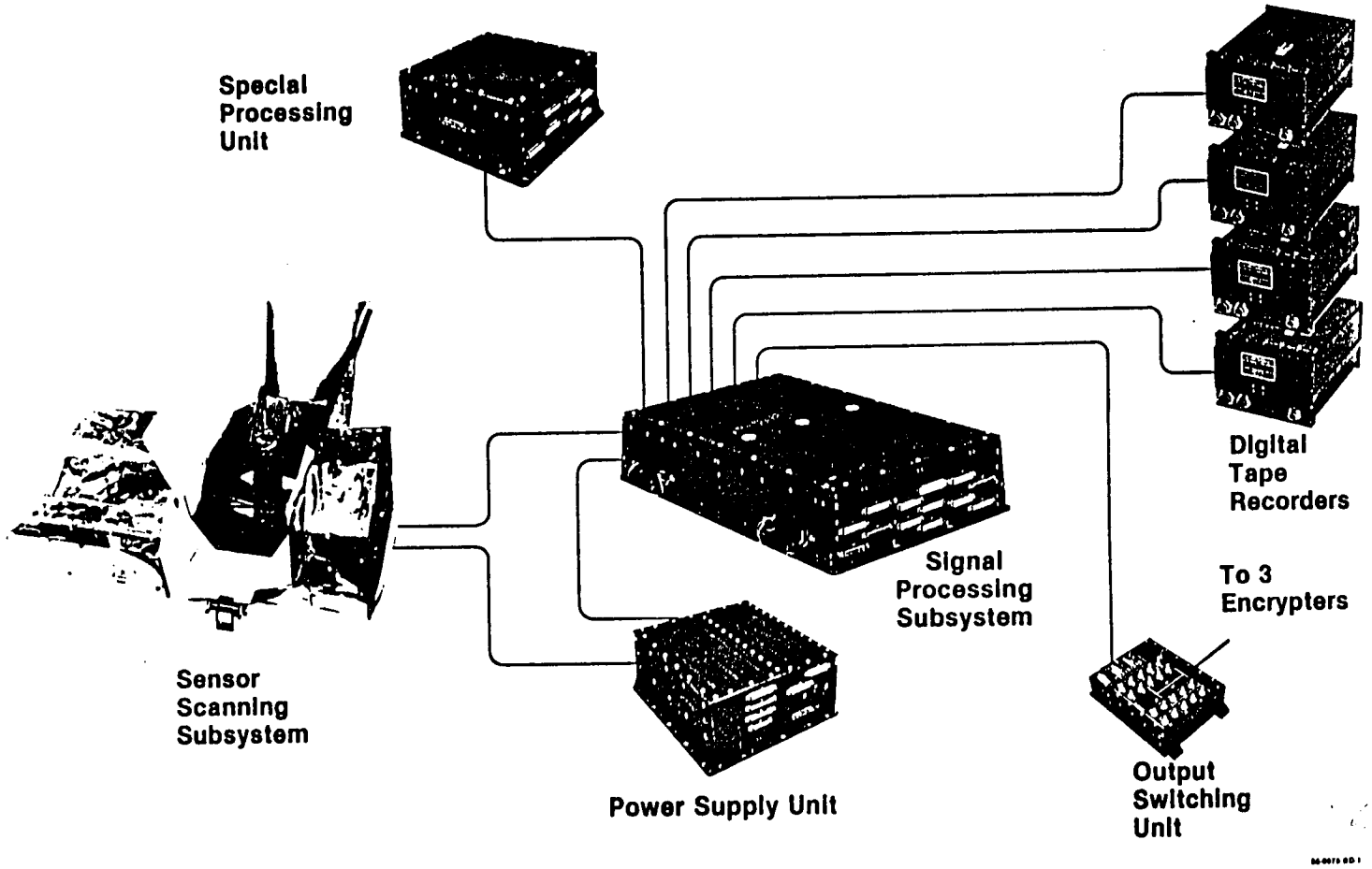


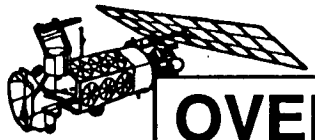


OLS OPTICS


Cold Patch
Cooler
Detector
Window
T-Channel Optics
MT1
MT2
L1
Fore Optics
M1
M5 Mask
M5
Field Splitter
℄
Rotation
M3
Beam Splitter
PMT Focal Plane
M4
HRD Focal Point
M2
8 in. Circular Aperture

OLS SYSTEM 5D3

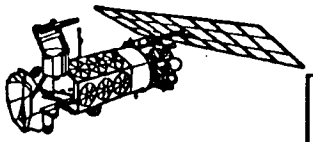




OVERVIEW OF DMSP MICROWAVE SENSORS

- SSM/T-1 ATMOSPHERIC TEMPERATURE SOUNDER
- SSM/T-2 HUMIDITY SOUNDER
- SSM/I MICROWAVE IMAGER
- SSMIS MICROWAVE IMAGER AND SOUNDER

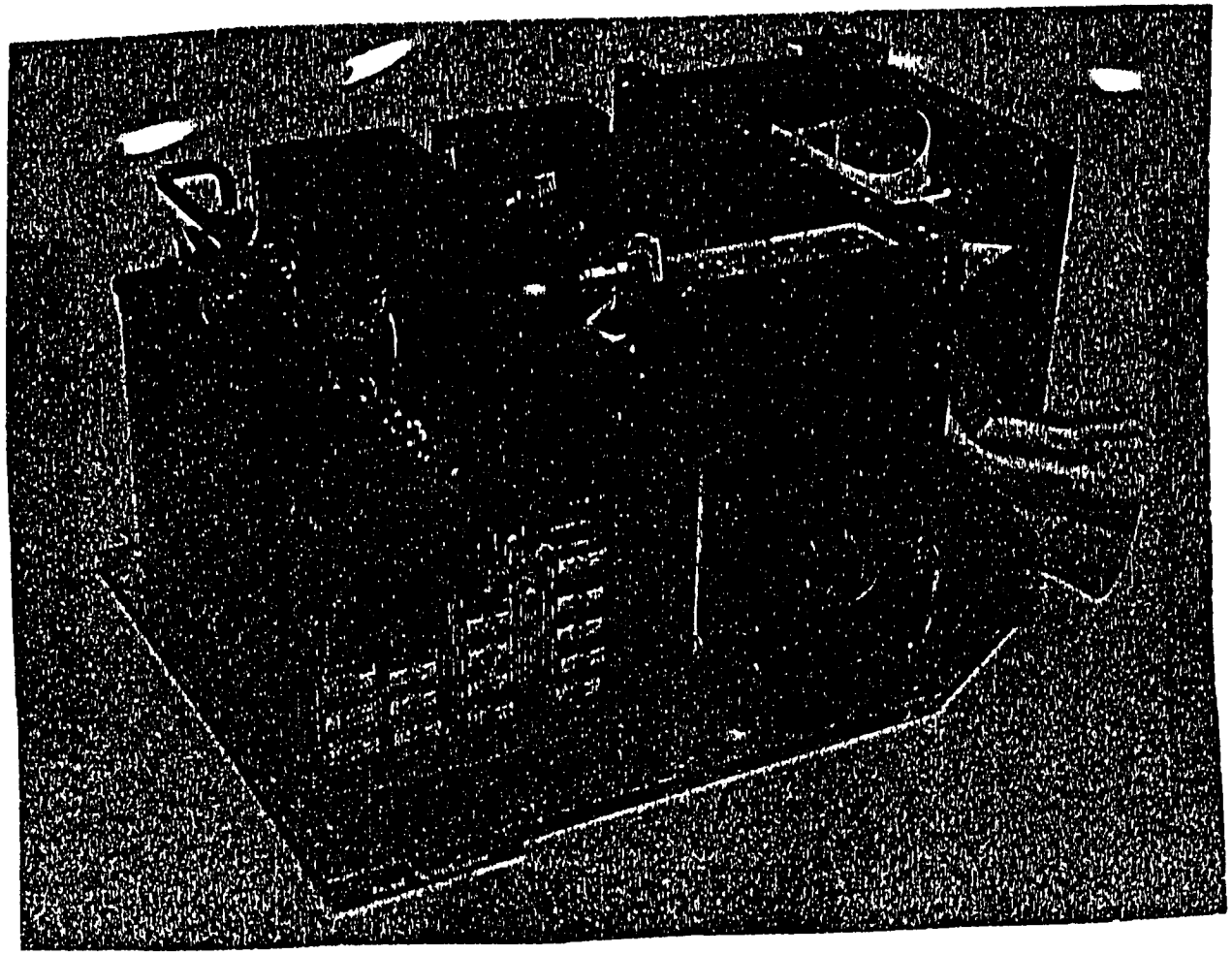
JERRY REDMANN, PROJECT ENGINEER
DMSP SENSORS

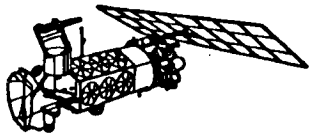


SSM/T-1 TEMPERATURE SOUNDER

- 7 - CHANNEL MICROWAVE RADIOMETER, 50-60 GHZ (OXYGEN MOLECULAR ABSORPTION)
- WEIGHT: 25 POUNDS POWER: 14 WATTS
- DATA RATE: 144 BITS/SEC
- SCAN
  - CROSS-TRACK
  - 7 BEAM POSITIONS
  - 12° IFOV
  - 2.7 SEC DWELL,
  - 32 SEC SCAN PERIOD
- HOT AND COLD CALIBRATIONS EACH SCAN
- CONTRACTOR: AEROJET, AZUSA,CA.

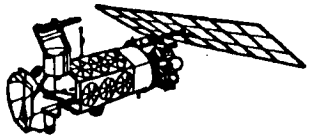
SSM/T MICROWAVE TEMPERATURE SOUNDER





SSM/T-1 PARAMETERS

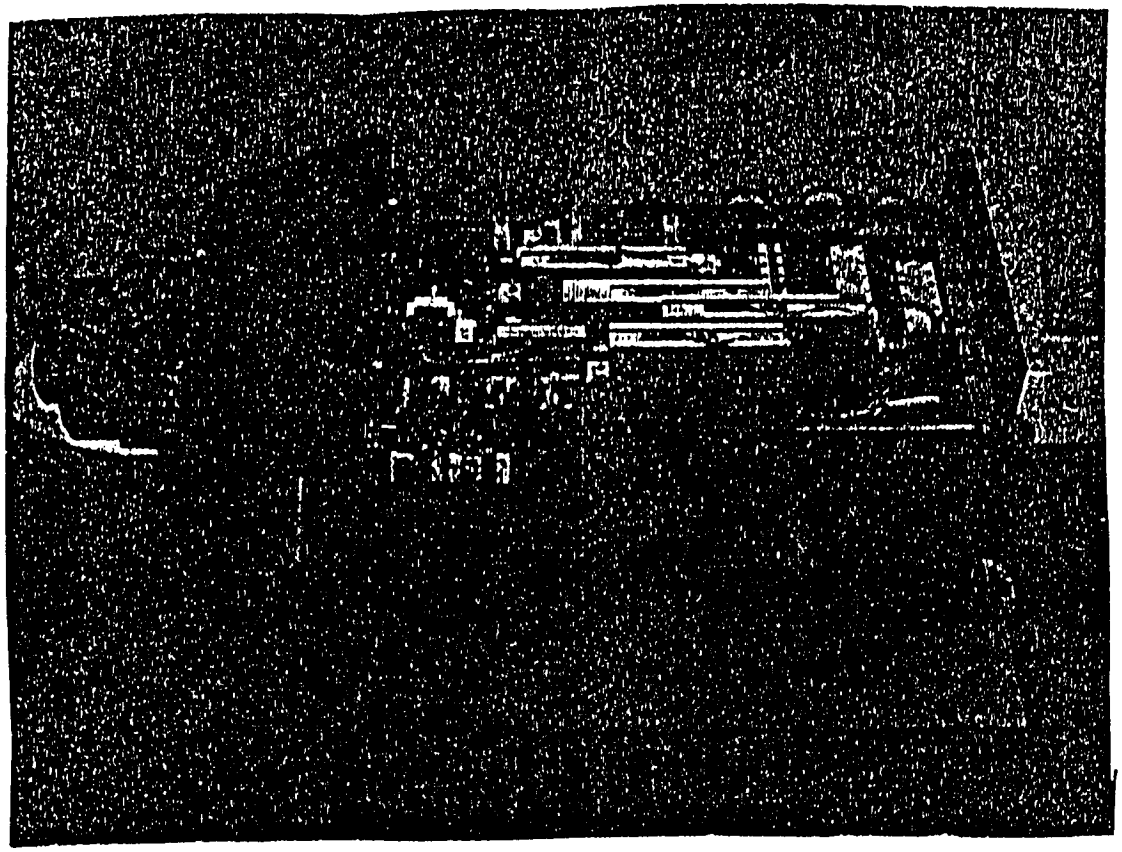
- DATA PROCESSED ON GROUND TO PROVIDE TEMPERATURES AT 15 MANDATORY PRESSURE LEVELS AND TROPOPAUSE

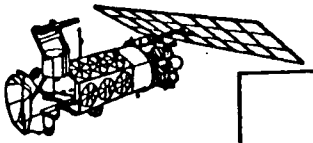


SSM/T-2 HUMIDITY PROFILER

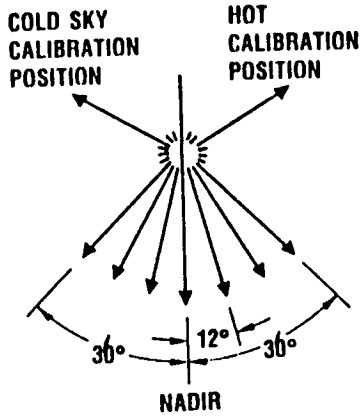
- 5 CHANNEL MICROWAVE RADIOMETER
  91, 150, 183± 1, 183 ± 3, 183 ± 7 GHZ
- POWER: 30 WATTS WEIGHT: 30 POUNDS
- DATA RATE: 324 BITS/SEC
- SCAN PARAMETERS:
  - CROSS TRACK
  - 8 SECOND PERIOD
  - SAMPLE SPACING 50 km ALONG TRACK
  - ACTIVE SCAN ANGLE: ±42° FROM NADIR
  - 28 SCENE STATIONS
- HOT AND COLD CALIBRATIONS EACH SCAN
- CONTRACTOR: AEROJET, AZUSA, CA.

SSM/T-2 INSTRUMENT

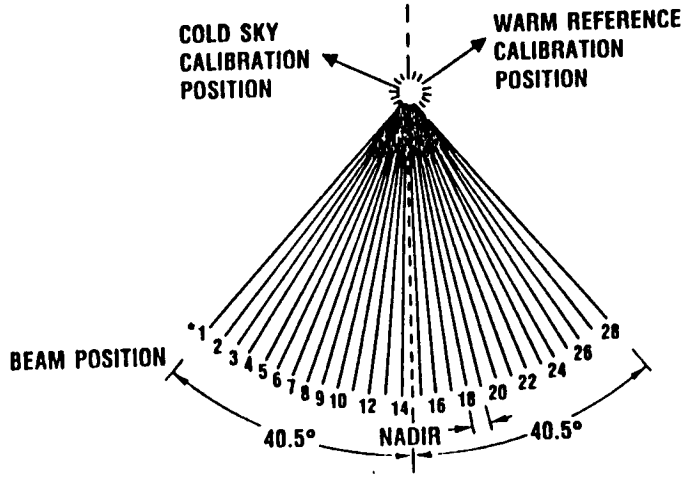




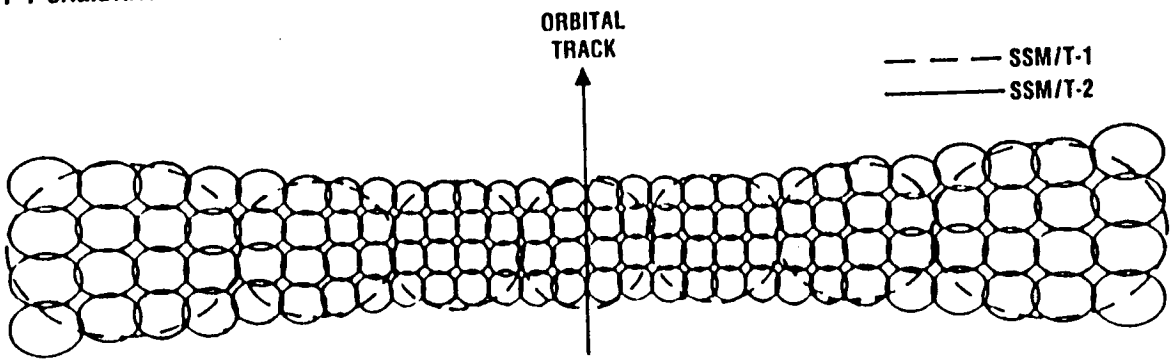
SSM/T SCAN GRID PATTERN AND FIELD OF VIEW PROJECTED ON EARTH

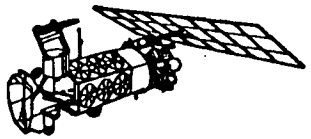


SSM/T-1 CALIBRATION AND SCAN GEOMETRY



SSM/T-2 CALIBRATION AND SCAN GEOMETRY





SSM/T-2 PARAMETERS

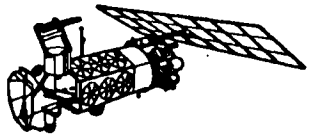
- DATA PROCESSED ON GROUND TO PROVIDE WATER VAPOR MASS INFORMATION IN FOUR ATMOSPHERIC LAYERS:

  SURFACE TO 850 MB

850	700
700	500
500	0

- RELATIVE AND SPECIFIC HUMIDITY AT 5 LEVELS

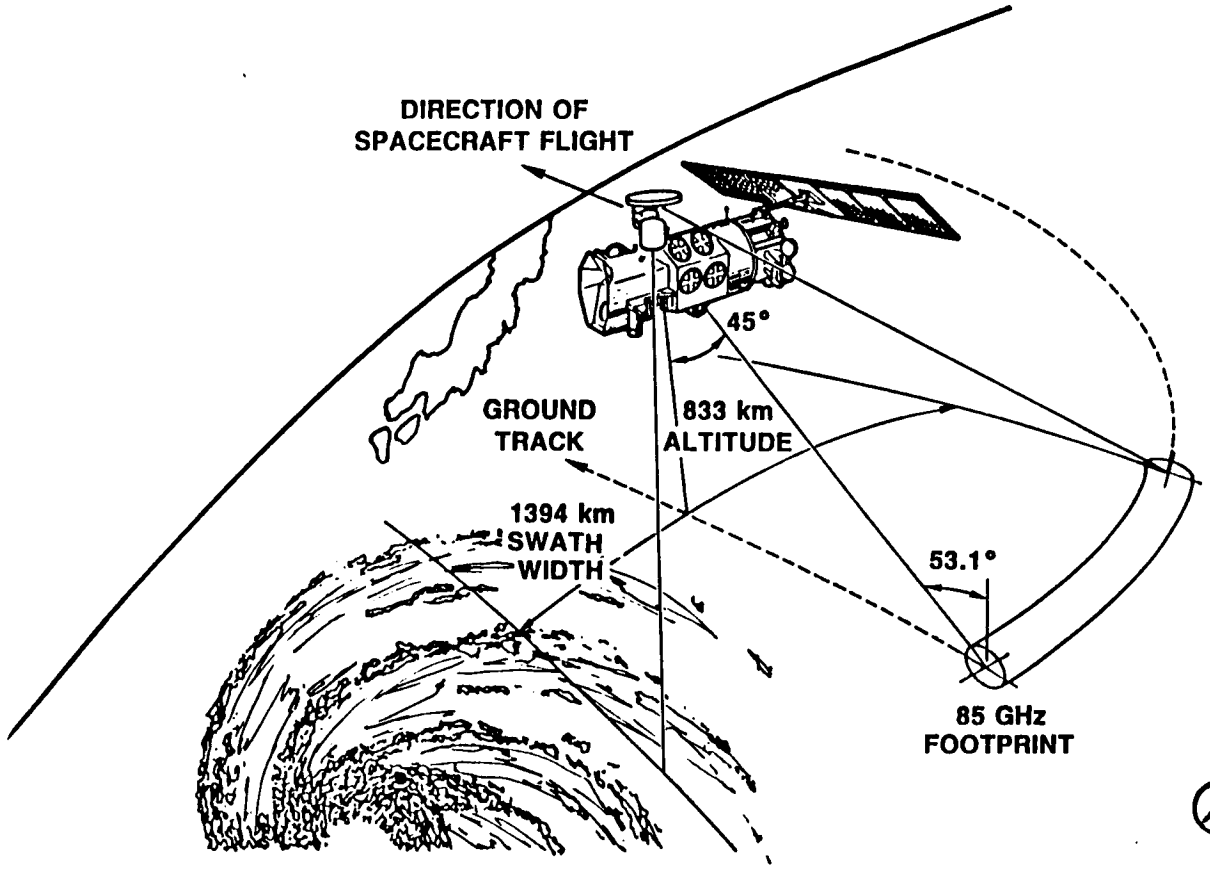
- RESULTS USEFUL FOR FORECASTING CLOUD FORMATION AND DISSIPATION, AND ATMOSPHERIC TRANSMISSION AND REFRACTIVITY.



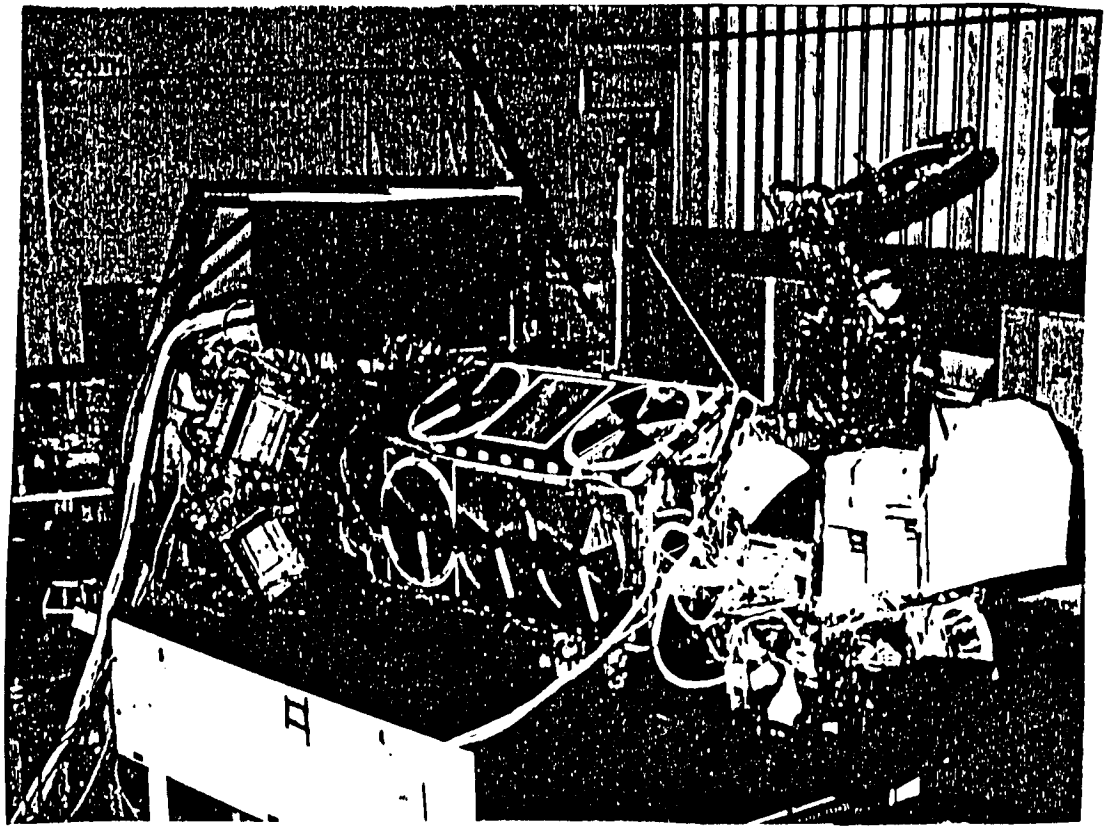
SSM/I MICROWAVE IMAGER

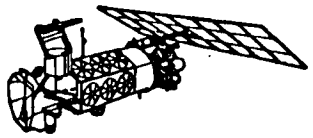
- 7 - CHANNEL MICROWAVE RADIOMETER
  19V, 19H, 22V, 37V, 37H, 85V, 85H GHZ
- WEIGHT: 125 POUNDS POWER: 45 WATTS
- DATA RATE: 3276 BITS/SEC
- CONICAL SCAN, AXIS 45° TO LOCAL VERTICAL, ACTIVE DURING 101° OF ROTATION,
- SWATH WIDTH: 1394 KM
- 24 - IN ANTENNA DISH, 1.9 SEC SPIN PERIOD, ALONG TRACK SAMPLE SPACING OF 12.5 KM (85V AND 85H), AND 25 KM (OTHER CHANNELS)
- CALIBRATED EACH SCAN BY VIEW OF NON-ROTATING WARM LOAD AND COLD SKY REFLECTOR
- MOMENTUM OF SCANNING SENSOR COMPENSATED WITH MOMENTUM WHEEL
- CONTRACTOR: HUGHES, EL SEGUNDO (ALSO GROUND PROCESSING SOFTWARE)

SSM/I SCAN GEOMETRY



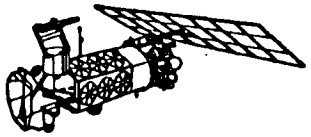
SSM/I MOUNTED ON SPACECRAFT





SSM/I PARAMETERS

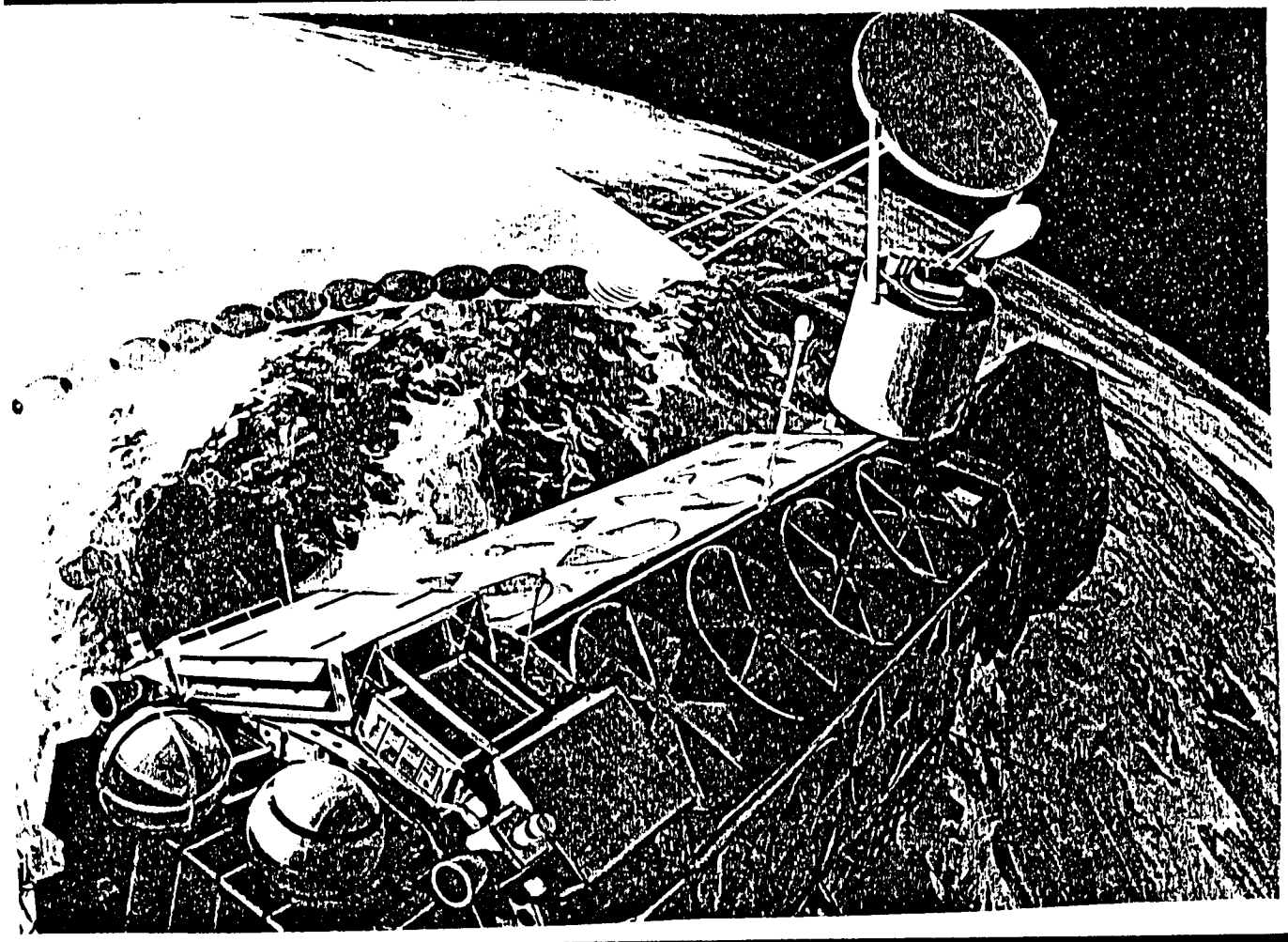
- DATA PROCESSED ON GROUND TO PROVIDE:
  - WIND SPEED OVER OCEAN
  - CLOUD WATER CONTENT
  - SOIL MOISTURE
  - SEA ICE LOCATION AND AGE
  - TOTAL WATER VAPOR MASS
  - SNOW WATER CONTENT
  - SURFACE TEMPERATURE OVER LAND

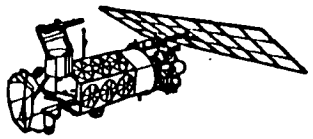


SSMIS DESCRIPTION

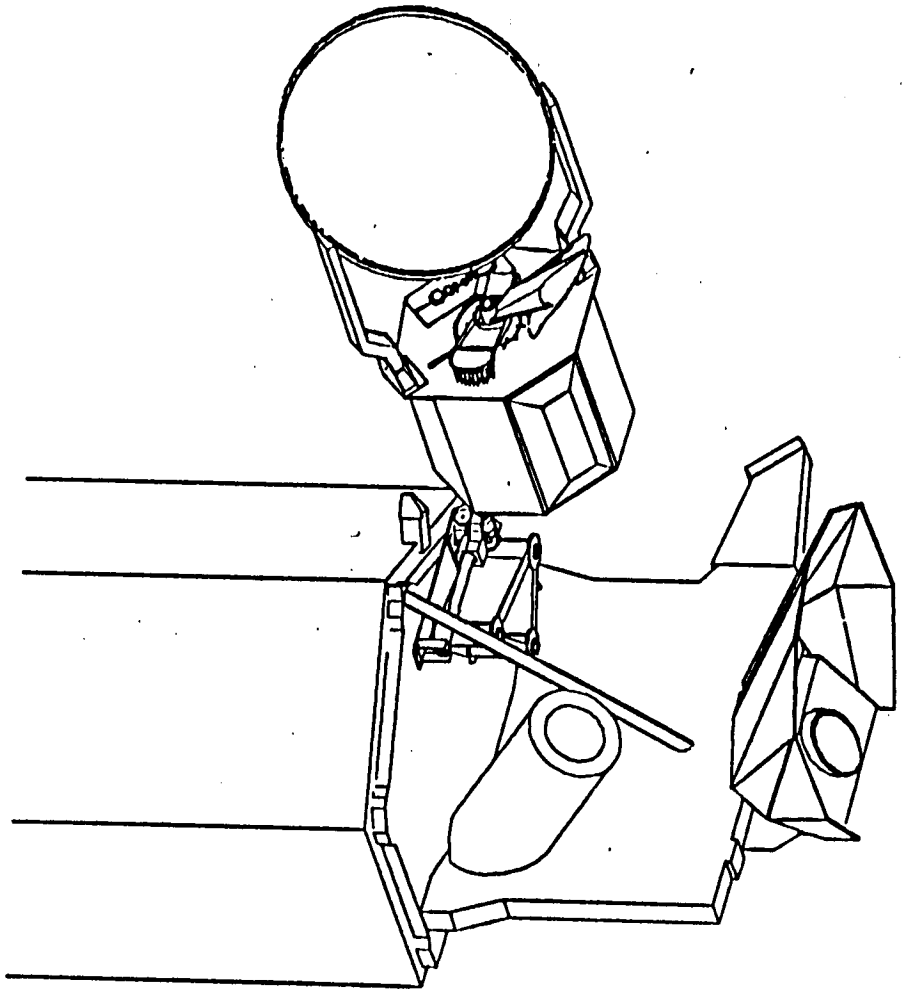
- 24 - CHANNEL MICROWAVE RADIOMETER, 19-183 GHZ; 6 FEED HORNS
- 24 IN x 27 IN OFF-SET PARABOLIC DISH, POINTED 45° FROM NADIR
- SENSOR HOUSING AND DISH ROTATE TOGETHER AT 31.6 RPM (1.9 SEC/SCAN)
- SWATH WIDTH: 1707 KM
- RESOLUTION/SAMPLE SPACING: 12.5 TO 50 KM
- CALIBRATION WITH VIEW OF NON-ROTATING WARM LOAD AND COLD SKY REFLECTOR ONCE EACH SCAN
- UP-LINKABLE SOFTWARE FOR PROGRAMMING FLEXIBILITY
- POWER: 145 WATTS WT: 175 LBS DATA RATE BITS/SEC: 14,220
- CONTRACTOR: AEROJET, AZUSA, CA.

SSMIS MOUNTED ON 5D3 SPACECRAFT (ARTIST'S CONCEPT)

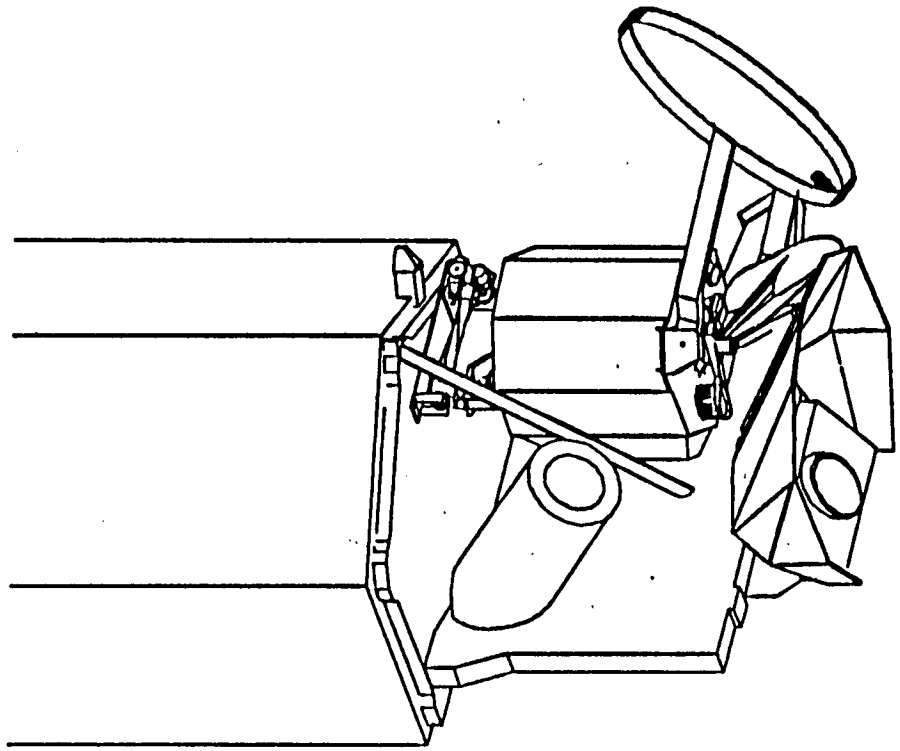


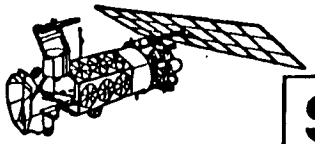


SSMIS DEPLOYED

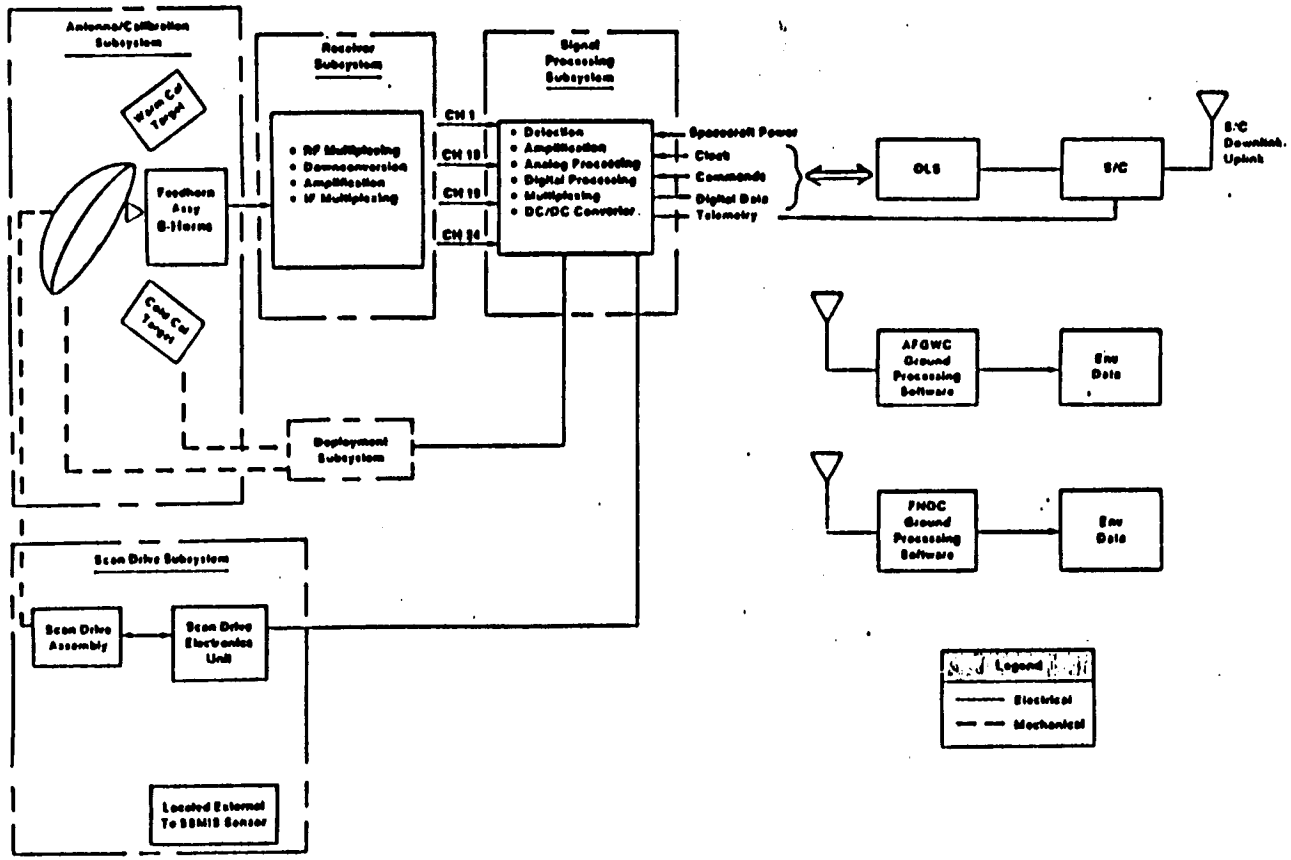


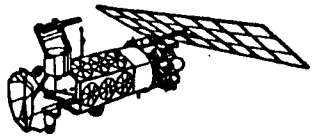
SSMIS STOWED





SSMIS SIMPLIFIED BLOCK DIAGRAM

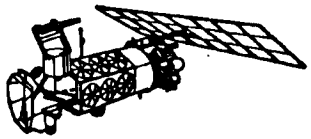




SSMIS

DATA PROCESSED ON GROUND TO PROVIDE:

- ATMOSPHERIC TEMPERATURE PROFILES (REPLACES SSM/T-1, AND ADDS UPPER ATMOSPHERE)
- ATMOSPHERIC HUMIDITY PROFILES (REPLACES SSM/T-2, IMPROVES COVERAGE)
- MICROWAVE IMAGERY
- ENVIRONMENTAL INFORMATION: (REPLACES SSM/I, IMPROVES COVERAGE)
  - WIND SPEED OVER OCEAN
  - SEA ICE LOCATION, AGE
  - CLOUD WATER
  - CLOUD AMOUNT
  - TOTAL WATER VAPOR MASS
  - SNOW WATER CONTENT
  - SURFACE TEMPERATURE OVER LAND



SPACE ENVIRONMENT SENSORS

- **SSIES**

  PLASMA MONITOR, IN-SITU ELECTRON AND ION DETECTORS

- **SSJ**

  PRECIPITATING CHARGED PARTICLE DETECTOR

- **SSM**

  MAGNETOMETER TO MEASURE FIELD-ALIGNED CURRENTS

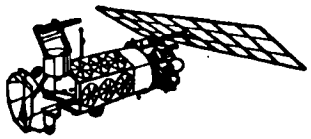
- **SSULI**

  REMOTE ULTRAVIOLET LIMB SCANNING SENSOR

- **SSUSI**

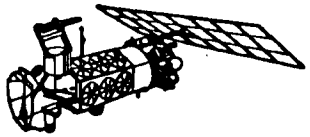
  REMOTE ULTRAVIOLET SPECTROGRAPH IMAGER PLUS NADIR LOOKING PHOTOMETERS

T P YANG PROJECT ENGINEER
DMSP SENSORS



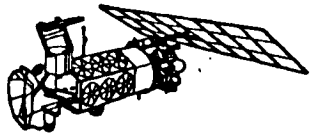
SSIES IONOSPHERIC SENSORS

- OBJECTIVES
  - PROVIDE IONOSPHERIC ELECTRON AND ION DATA FOR SPACE OPERATIONS AND IN-SITU DATA POINT FOR MODELS
- FOUR SENSORS
  - LANGMUIR PROBE
  - THREE COPLANAR ION SENSORS:
    - -- RETARDED POTENTIAL ION ANALYZER
    - -- DRIFT METER
    - -- SCINTILLATION METER
- DATA RATE 720-1080 BITS/SEC
- WEIGHT 20 LB
- POWER 12 WATTS
- CONTRACTORS: PHILLIPS LAB, UT DALLAS, ANALYTYX

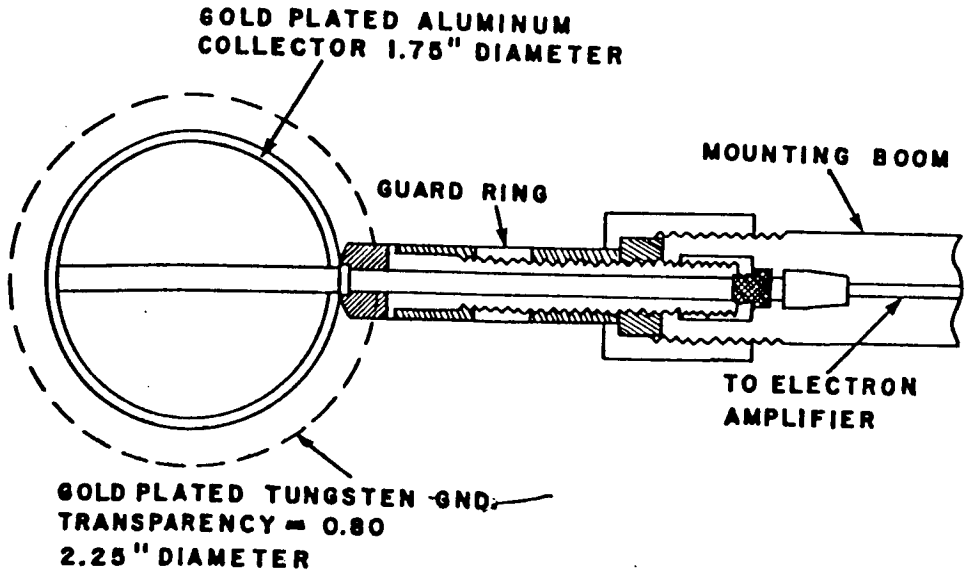


SSIES IONOSPHERIC SENSOR

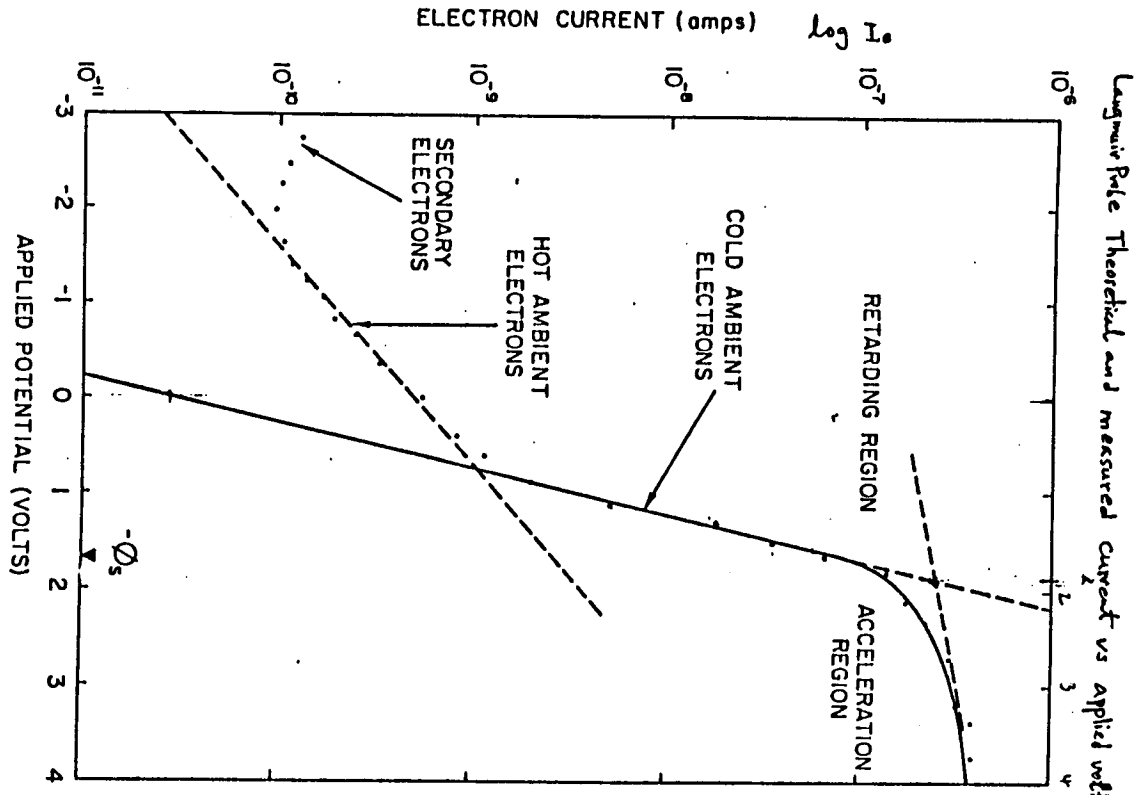
- ELECTRON SENSOR
  - DETERMINES ELECTRON DENSITY (Ne), TEMPERATURE (Te) AND SCALE HEIGHT
    - -- Ne: 1000 to 10000 /cm**3, Te: 1000 to 4000 °K
  - A CONDUCTING SPHERE SURROUNDED BY A SPHERICAL GRID WITH VARYING VOLTAGE TO MEASURE CURRENT.
- RETARDED POTENTIAL ANALYZER
  - DETERMINES ION DENSITIES, TEMPERATURES AND COMPOSITION (H, He, O)
  - RETARDED POTENTIAL ON GRIDS BEFORE A COLLECTOR PLATE
- DRIFT METER
  - DETERMINES ION DIRECTIONAL FLOW
- SCINTILLATION METER
  - DETERMINES SMALL SCALE DENSITY VARIATION

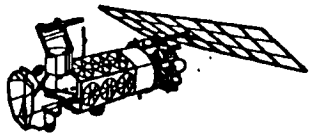


ELECTRON SENSOR

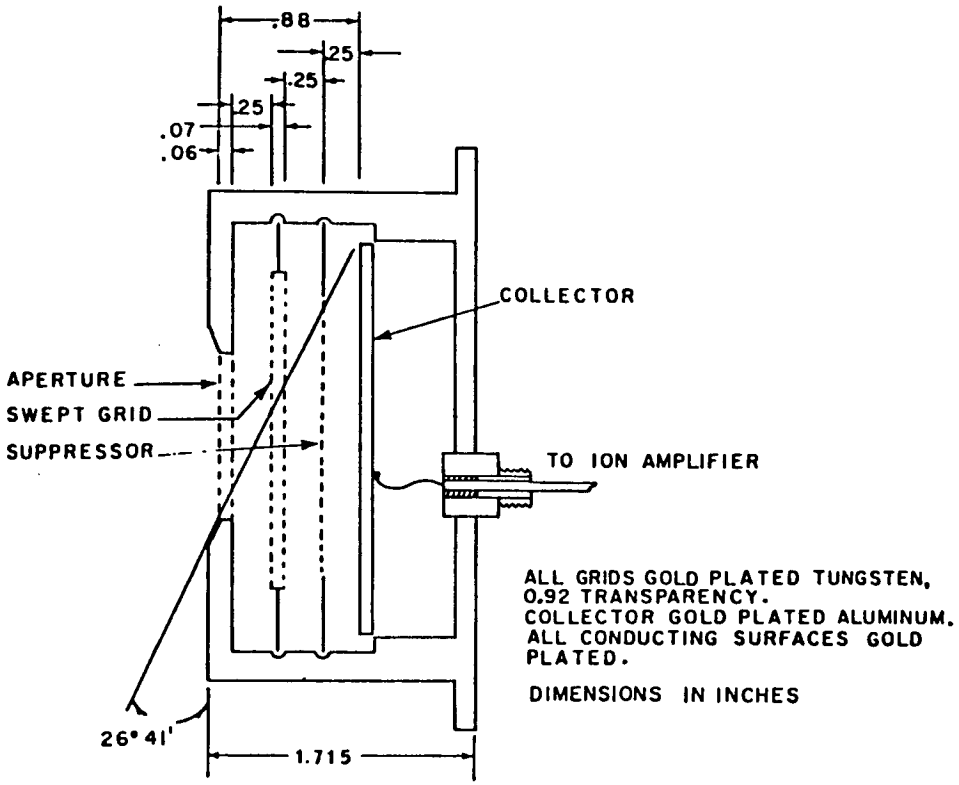


ELECTRON SENSOR DATA VS. THEORY



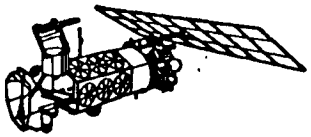


SSIES ION SENSOR

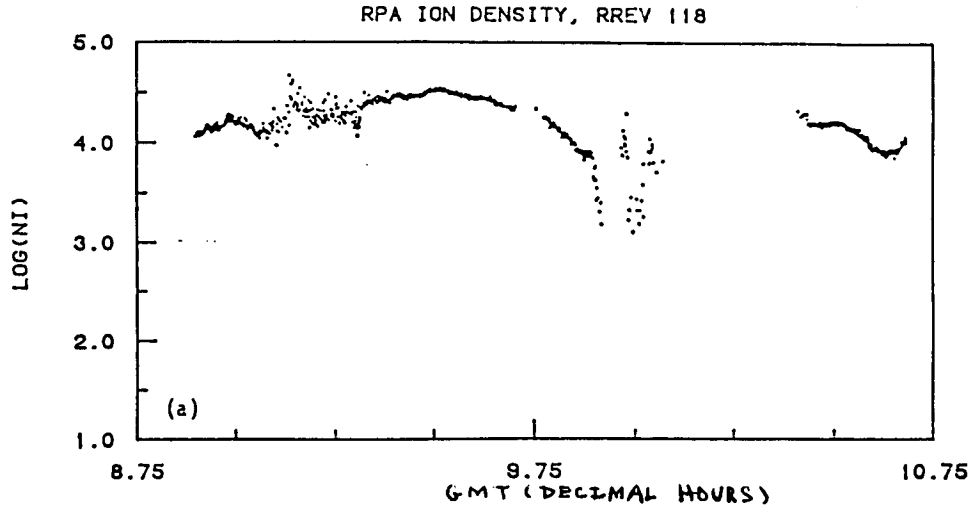


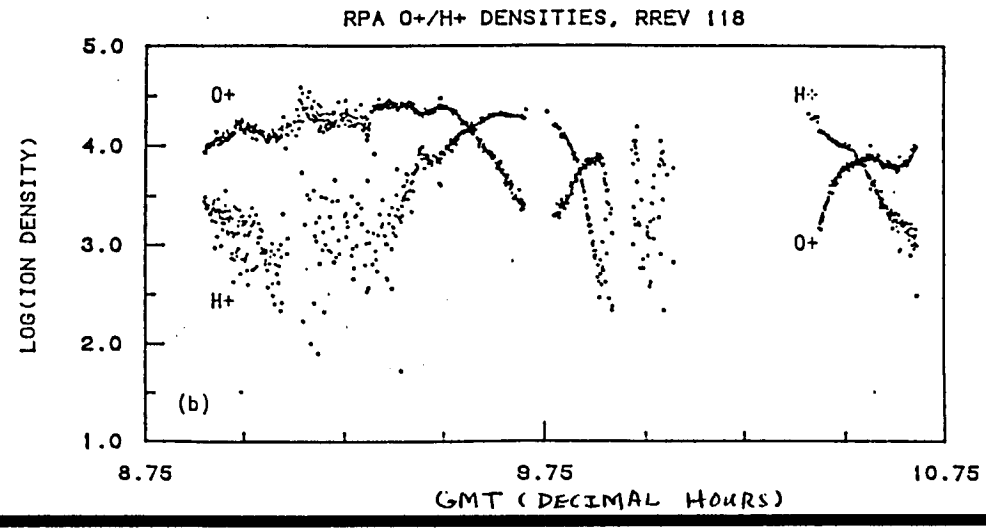
ALL GRIDS GOLD PLATED TUNGSTEN, 0.92 TRANSPARENCY.
COLLECTOR GOLD PLATED ALUMINUM.
ALL CONDUCTING SURFACES GOLD PLATED.

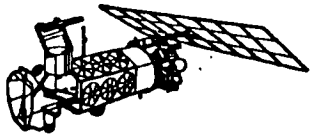
DIMENSIONS IN INCHES



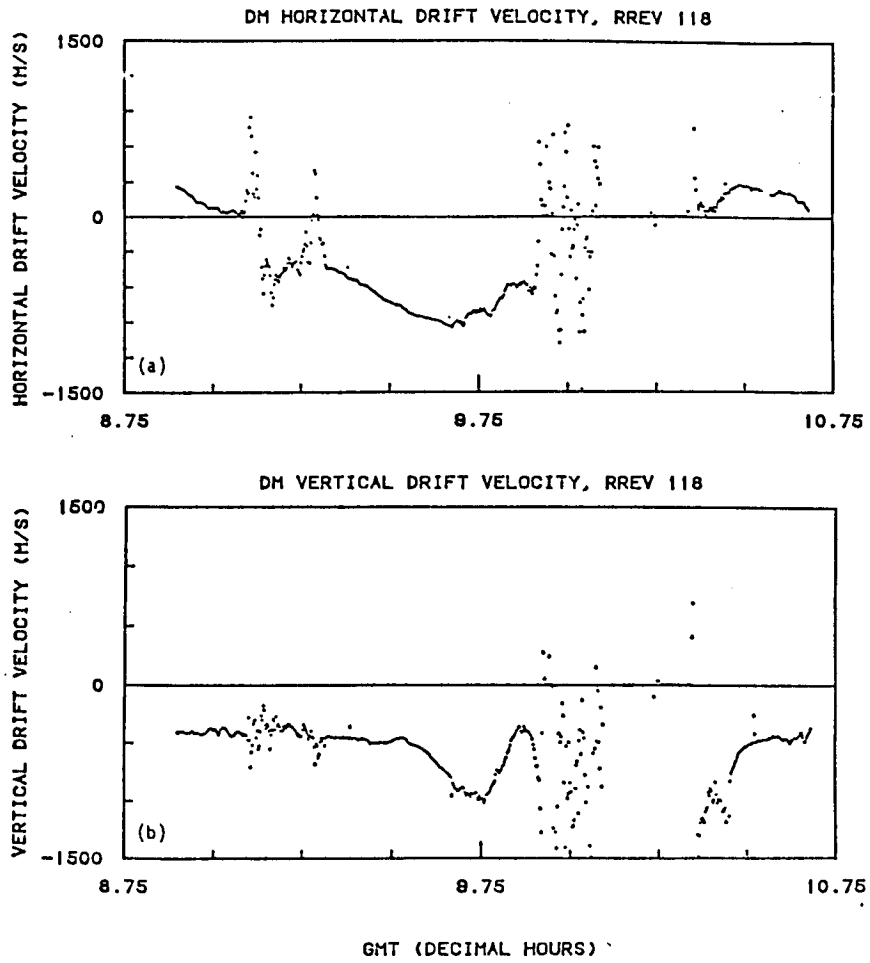
SSIES ION SENSOR DATA

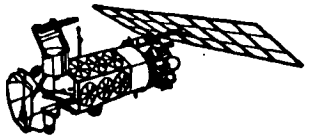






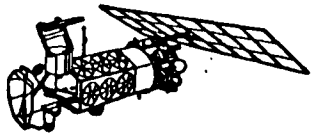
DRIFT METER DATA



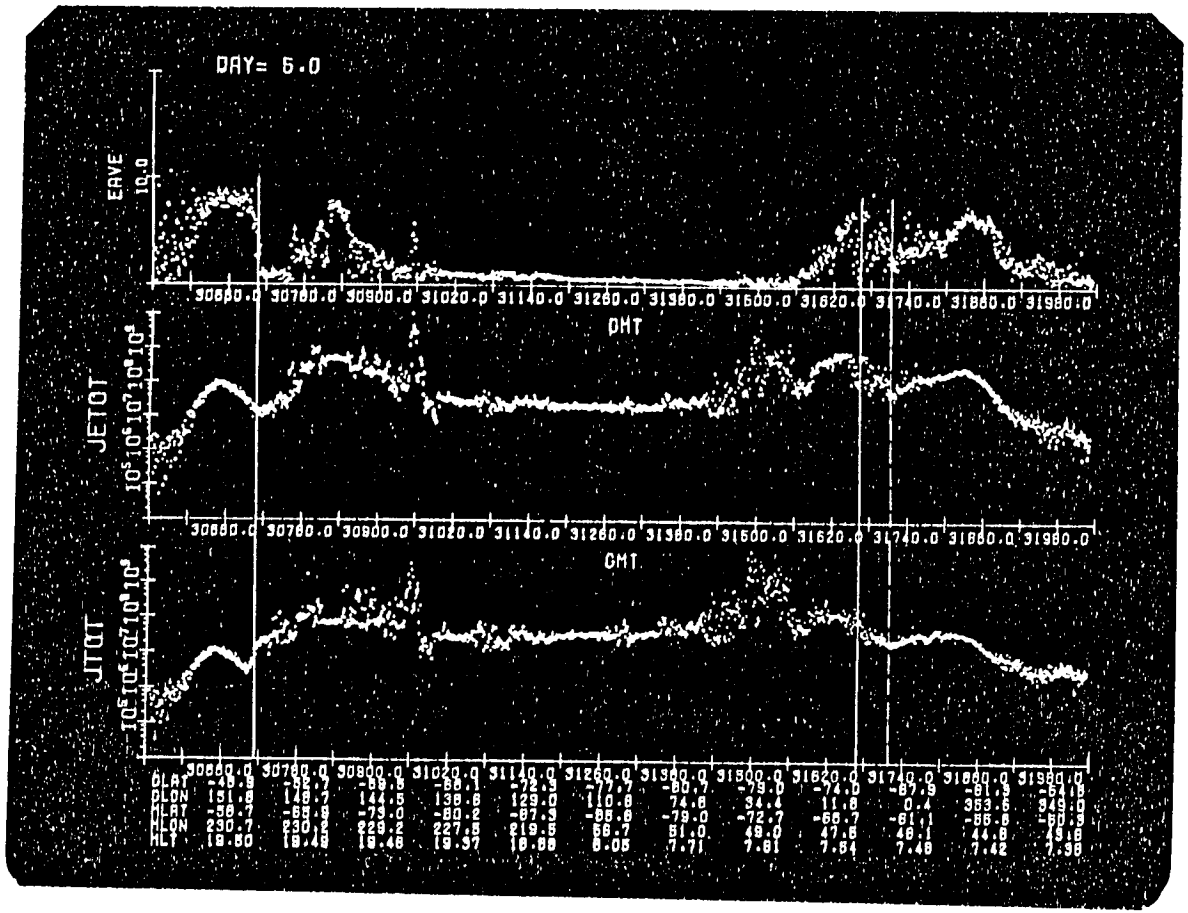


SSJ- PARTICLES DETECTOR

- PRECIPITATING CHARGED PARTICLES SPECTROMETER
  - TWO ELECTROSTATIC ANALYZERS AND A CHANNELTRON TO MEASURE FLUX AND ENERGY OF ELECTRONS AND IONS PRECIPITATING FROM EARTH'S MAGNETOSPHERE
  - ENERGY RANGE: 30 EV TO 1 KEV AND 1 KEV TO 30 KEV
- DATA RATE 360 BITS/SEC
- POWER 0.35 WATTS
- WEIGHT 6.4 LB
- CONTRACTORS: AMPTEK/ PHILLIPS LAB



SSJ DATA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EAVE
10.0
JETOT
JTOT
GMT
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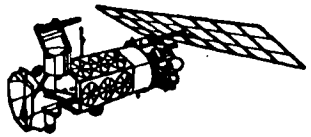
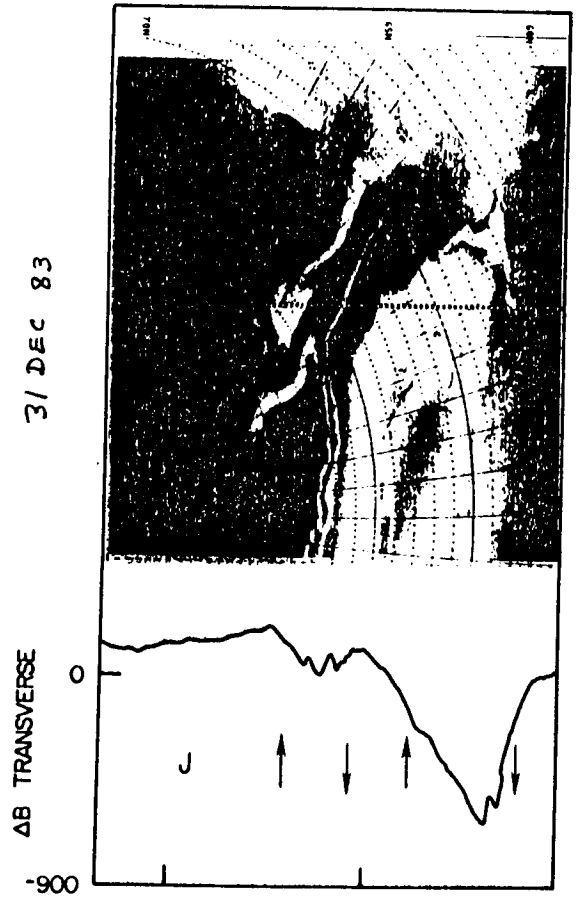
DLAT -45.9 -62.7 -69.8 -68.1 -72.5 -77.7 -80.7 -79.0 -74.0 -67.9 -61.9 -54.8
DLON 151.8 148.7 144.5 138.6 129.0 110.8 74.8 34.4 11.8 0.4 353.6 349.0
ALAT -58.7 -65.8 -73.0 -80.2 -87.3 -85.6 -79.0 -72.7 -66.7 -61.1 -56.6 -50.3
ALON 230.7 230.2 229.2 227.8 219.5 66.7 61.0 49.0 47.6 46.1 44.8 43.6
ALT 19.50 19.48 19.46 19.37 18.88 8.05 7.71 7.61 7.54 7.48 7.42 7.38



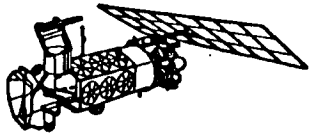
SSM MAGNETOMETER

- A TRIAXIAL MAGNETOMETER TO MEASURE EARTH MAGNETIC FIELD WITH 2 GAMMA ACCURACY
- MEASURES FIELD ALIGNED CURRENTS BY CHANGES IN MAGNETIC FIELD STRENGTH.
- WEIGHT 6.4 LB
- POWER 1.2 WATTS
- CONTRACTOR: GODDARD SPACE FLIGHT CENTER, PHILLIPS LAB

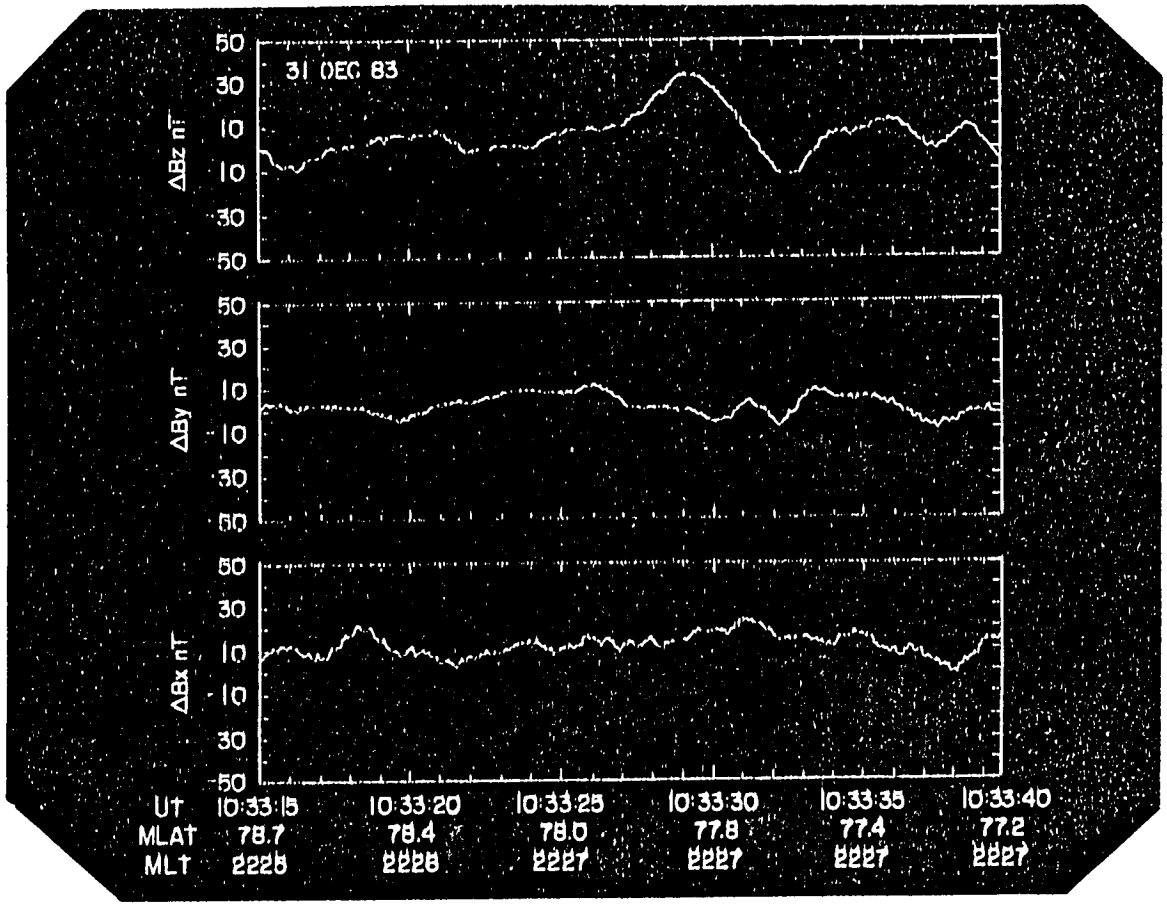
AURORAL SSM DATA

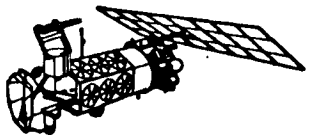


GLAT	80°	74°	64°
MLAT	87°	72°	59°
MLT	22.0	22.5	22.6



SSM SAMPLE DATA

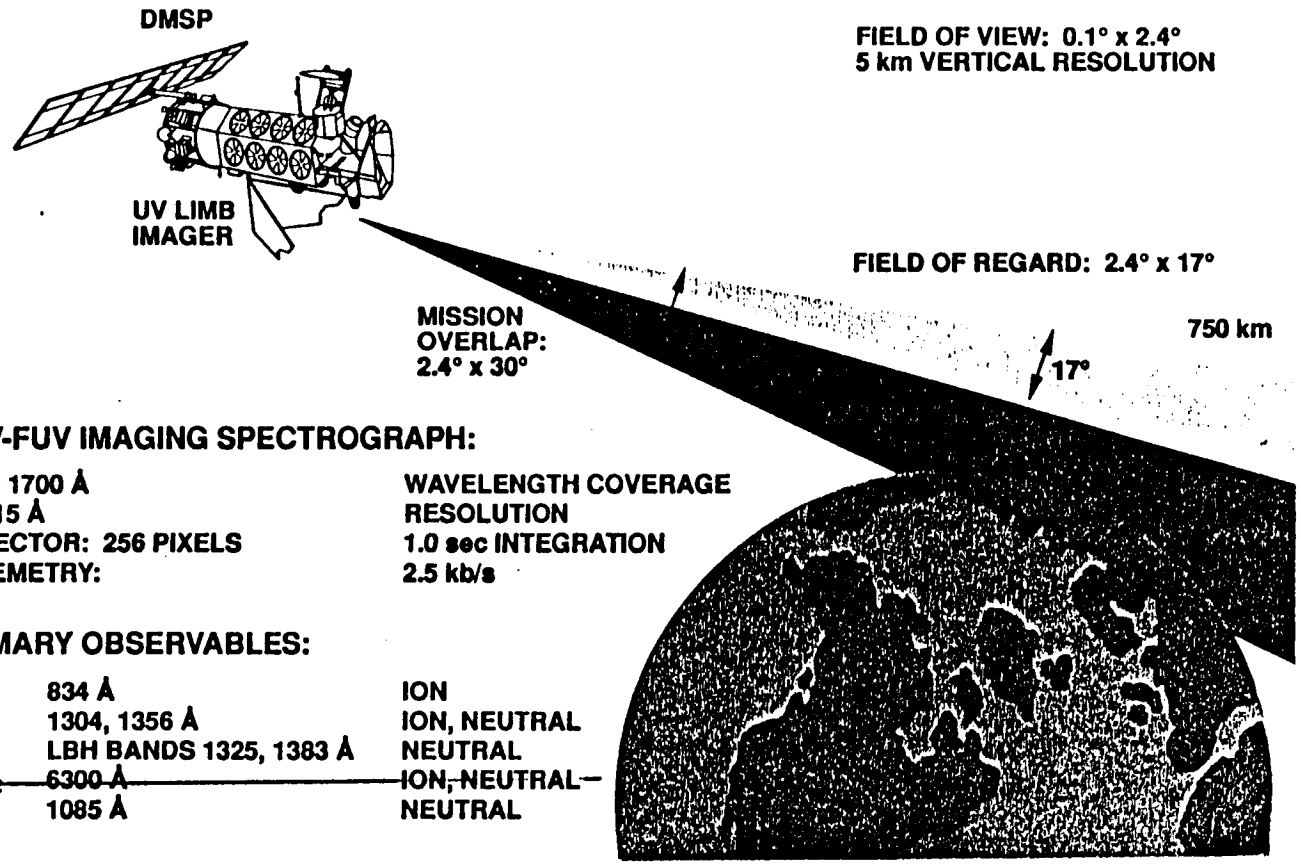




SSULI UV LIMB IMAGER

- OBJECTIVES
  - REMOTE ATMOSPHERIC AND IONOSPHERIC DETECTION WITH EXTREME AND FAR ULTRAVIOLET SPECTROGRAPH (800-1700 A)
  - PROVIDES GLOBAL ELECTRON DENSITY AND NEUTRAL DENSITY PROFILES FOR DAY AND NIGHT
- ALONG TRACK SCANNING OF EARTH LIMB AT VIEWING TANGENT ALTITUDES
  - 48 KM TO 750 KM
- DESIGN DERIVED FROM "RAIDS"
  - JOINTLY DEVELOPED BY NRL AND AEROSPACE
- CONTRACTOR NAVAL RESEARCH LAB

SSULI - Ultraviolet Limb Imaging Geometry



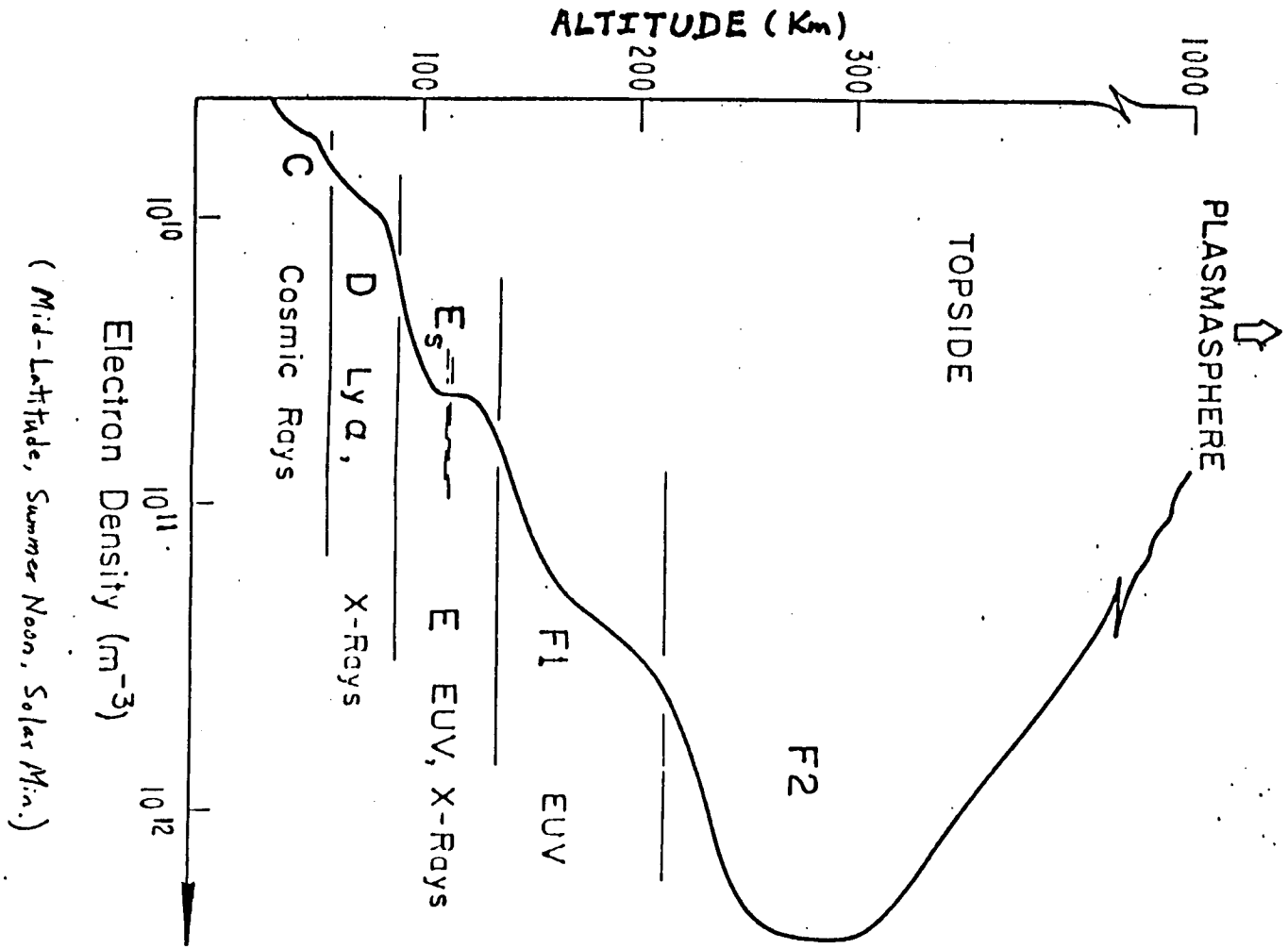
EUV-FUV IMAGING SPECTROGRAPH:

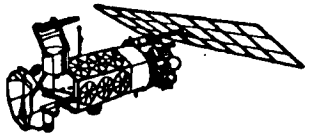
800 - 1700 Å	WAVELENGTH COVERAGE
11 - 15 Å	RESOLUTION
DETECTOR: 256 PIXELS	1.0 sec INTEGRATION
TELEMETRY:	2.5 kb/s

PRIMARY OBSERVABLES:

O^+	834 Å	ION
O, e-	1304, 1356 Å	ION, NEUTRAL
N_2	LBH BANDS 1325, 1383 Å	NEUTRAL
~~O_2^+, O_2~~	~~6300 Å~~	~~ION, NEUTRAL~~
N^+	1085 Å	NEUTRAL

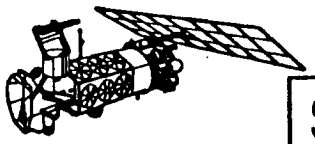
IONOSPHERE ELECTRON DENSITY DISTRIBUTION





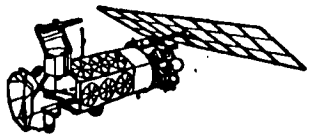
SSULI UV LIMB IMAGER

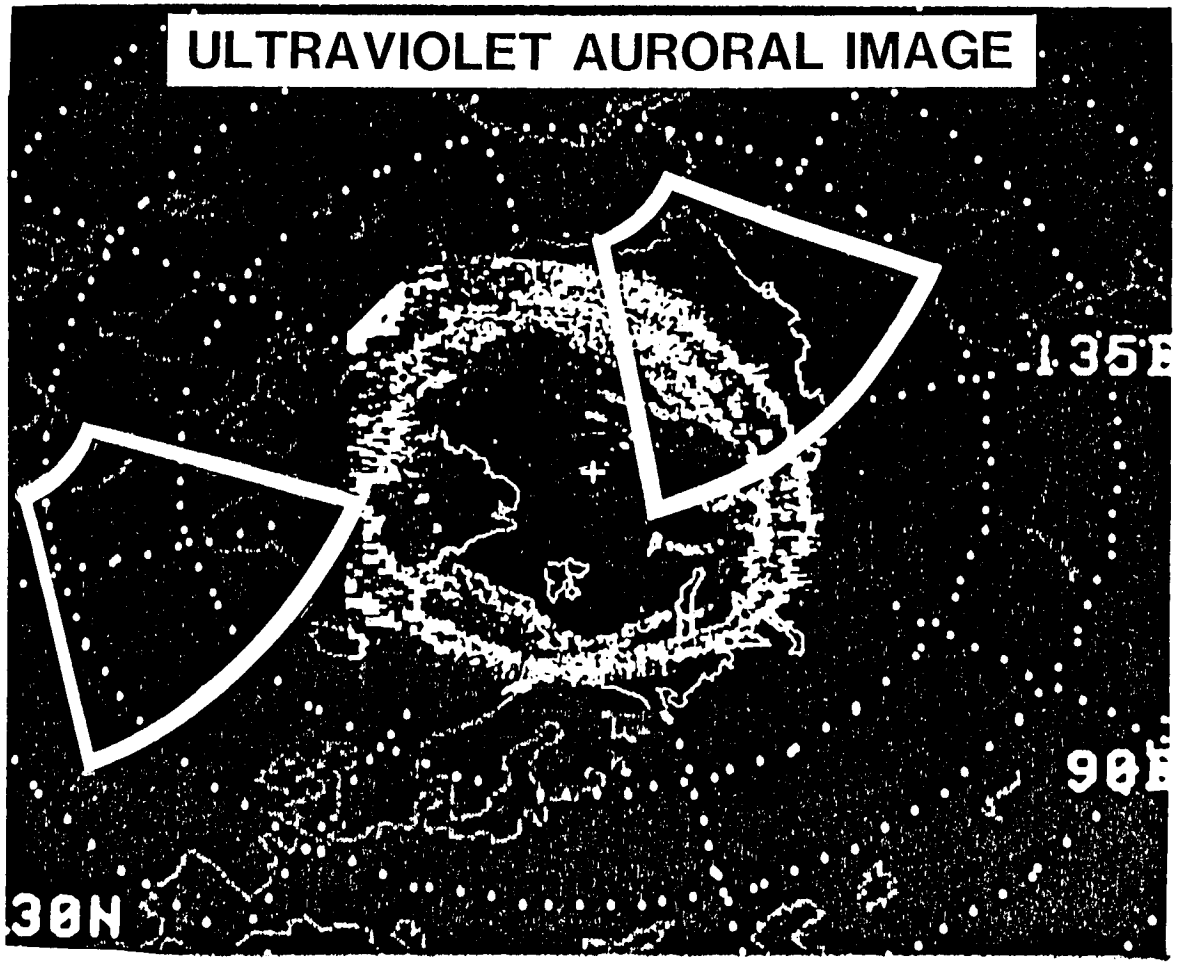
- INSTRUMENT PACKAGES
  - ULTRAVIOLET SENSOR ASSEMBLY
    - -- GRID COLLIMATOR
    - -- SCAN MIRROR (SiC COATING)
    - -- SiC GRATING (1600 GROOVES/MM)
    - -- MCP DETECTOR (WEDGE STRIP READOUT)
  - SSULI ELECTRONICS ASSEMBLY
- WEIGHT 41 LB
- POWER 25 WATTS



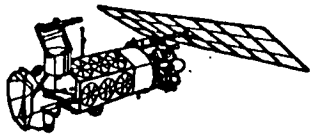
SSUSI UV SPECTROGRAPH IMAGER

- OBJECTIVES
  - REMOTE SENSING OF ATMOSPHERE/ IONOSPHERE AND AURORAL REGION FOR PARAMETERS ON A GLOBAL BASIS
  - RADIANCE MEASUREMENT TO PRODUCE
    - -- ELECTRON DENSITY PROFILE
    - -- F-LAYER HEIGHTS
    - -- AURORAL BOUNDARY
    - -- AURORAL ENERGY DEPOSITION RATE
- HERITAGE: POLAR BEAR EXPERIMENT
- CONTRACTOR: APPLIED PHYSICS LAB /JOHN HOPKINS UNIVERSITY

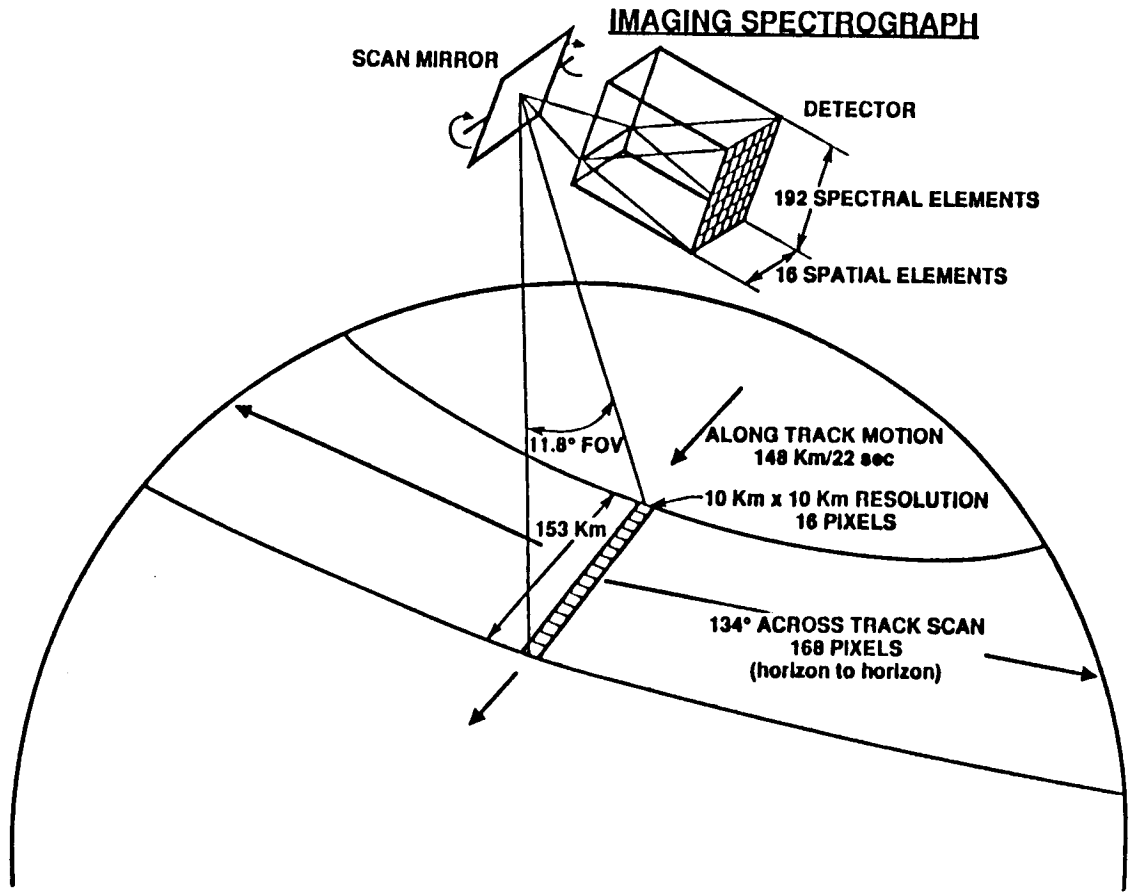


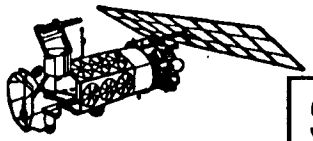


AFGL AIRS SENSOR / POLAR BEAR SATELLITE
POLAR COVERAGE OF OVER-THE-HORIZON (OTH) RADAR



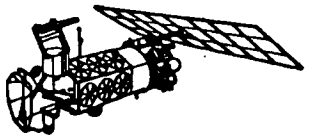
SSUSI IMAGING MODE





SSUSI UV SPECTROGRAPH IMAGER

- UV SPECTROGRAPH IMAGER (1100 - 1800 A)
  - SCAN MIRROR (3.6"), OFF AXIS PARABOLIC MIRROR, GRATING
    - -- IMAGING MODE : CROSS TRACK SCANNING FROM HORIZON TO HORIZON
    - -- SPECTROGRAPH MODE : FIXED MIRROR POSITION
    - -- MCP DETECTOR (WEDGE AND STRIP)
- 3 NADIR-LOOKING PHOTOMETERS FOR NIGHT-TIME OBSERVATION
  - 6300 A , 6290 A AND 4278 A
- WEIGHT 44 LB
- POWER 35 WATTS



OTHER SENSORS

- SSB GAMMA RAY DETECTORS
- SSC SNOW CLOUD EXPERIMENTAL SENSOR
- SSK CLASSIFIED SENSOR
- SSF CLASSIFIED SENSOR
- SSZ CLASSIFIED SENSOR