EARTH SATELLITE CORPORATION
(EarthSat)

1771 N STREET, N.W., WASHINGTON, D.C. 20036 / (202) 785-1123

January 12, 1973

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Attention: Distribution

RE: Six-Month Progress Report - New Jersey Coastal Mapping: NAS5-21765

Gentlemen:

The New Jersey Department of Environmental Protection and Earth Satellite Corporation (EarthSat) is pleased to submit a Type II Progress Report for the six-month period ending December 31, 1972. To facilitate NASA's review, a consistent format has been adopted for all progress reports prepared by the Geosciences and Environmental Applications Division.

A. TITLE: Application of ERTS-1 Data to the Protection and Management of New Jersey's Coastal Environment (SR #304).

B. PRINCIPAL INVESTIGATOR: Mr. Roland S. Yunghans, New Jersey Department of Environmental Protection

C. CO-PRINCIPAL INVESTIGATORS: Mr. Edward B. Feinberg, New Jersey Department of Environmental Protection

Dr. Frank J. Wobber, Earth Satellite Corporation

D. CO-INVESTIGATOR: Mr. Robert L. Mairs, Earth Satellite Corporation

E. CONTRIBUTORS: Mr. Donald Garofalo, Earth Satellite Corporation

Mr. David A. Thibault, Earth Satellite Corporation

Mr. Roger V. Amato, Earth Satellite Corporation

Mr. Lawrence R. Pettinger, Earth Satellite Corporation

CATALOGUE OF SELECTED REMOTE SENSING DATA OF THE STATE OF NEW JERSEY

JANUARY 1973

PREPARED FOR THE:

DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE OF NEW JERSEY
TRENTON, NEW JERSEY

EARTH SATELLITE CORPORATION
GEOSCIENCES AND ENVIRONMENTAL APPLICATIONS DIVISION
1771 N STREET, N.W., WASHINGTON, D.C. 20036 / (202) 785-1123

F. SUMMARY OF ACCOMPLISHMENTS: The primary accomplishments during the initial six-month period of the experiment are summarized on the following pages by phase. Accomplishments are detailed by task in the TASK STATUS REPORT (Appendix A).

PHASE I: PRE-LAUNCH PREPARATION

- Visits were made to the NDPF to establish an information feedback system to facilitate operations throughout the experiment.
- Remote sensing data collected by the NASA MSC Earth Resources Aircraft Program over the State of New Jersey has been reviewed and a catalog (Appendix B) of available imagery has been prepared.
- An introductory information package (Appendix C) was prepared and distributed to participating state officials. The package consisted of an introduction to the New Jersey experimental plan, an overview of the ERTS-1 program and system operation, and an introduction to remote sensing techniques and analysis of small scale imagery.
- A preliminary briefing and personal interviews with state officials who will be using ERTS-1 information products to be prepared by EarthSat has been completed.
- Contact has been established with the Coastal Engineering Research Center (CERC) to facilitate coastal resource data acquisition. All pertinent CERC scientific publications on shore protection research have been collected.
- All pertinent NOS, Navy, and USGS maps that include portions of the New Jersey coast have been acquired. Scales of these maps range from 1:24,000 to 1:1,200,000.
- Collateral information has been obtained from the NJDEP concerning shore protection, pollution, and water resources. These data are being used in the analysis of ERTS-1 and aircraft imagery.

- Data from two NASA MSC aircraft missions and photography from two NASA Ames aircraft missions has been obtained and color mosaics are being prepared of the coastline.

- A Final Report Outline has been prepared (Appendix D). Sections of the final report are being written as the experiment proceeds.

- Test areas of primary concern to the State and to which a concerted ground truth effort can be directed were established. A primary test area in northern New Jersey was established.

- A ground truth collection plan is being prepared to take advantage of a joint inter-disciplinary NOAA coordinated experiment in the northern New Jersey coastal area (New York Bight).

- Appropriate State officials within the NJDEP have been interviewed to finalize their organizational needs for ERTS-1 derived information products.

- The interviews with State officals have provided the initial information necessary for conducting a cost-benefit analysis. A preliminary methodology is being developed.

- Photography collected by the NJDEP's Bureau of Navigation over a 17 year period has been collected and is being analyzed in conjunction with the ERTS-1 imagery.

- Base maps at scales of 1:250,000 and 1:500,000 have been chosen for displaying information derived from the ERTS analysis.

PHASE II: FIRST LOOK ANALYSIS

- Imagery having portions of the coastal zone cloud-free have been obtained for six orbits:

  August 16
  September 3, 22
  October 9, 10, 27

- Clear, cloud-free imagery obtained on October 9-10, 1972 has been enlarged and printed at a scale of 1:500,000. These enlargements have been made in both positive and negative format and are being used as photo base maps for plotting information derived from ERTS-1 and aircraft imagery analysis.

- Analysis of ERTS-1 imagery indicates that many coastal circulation features can be identified from reflectance differences and by comparison of the four MSS bands. Significant sequential patterns can be deduced using these techniques in the estuarine, nearshore, and offshore waters.

- MSS bands 4 and 5 offer maximum information on reflectance of particulate matter in the coastal waters and are the best indicators of circulation dynamics.

- MSS bands 6 and 7 offer little information on circulation but are very useful for wetland boundary discrimination and determining cloud/haze effects by comparative interpretation with MSS bands 4 and 5.

- MSS band 7 printed at 1:500,000 scale in a negative format produces a base map with the water areas presented as white and the land areas presented black. This facilitates plotting information directly on the water areas as features are analyzed and interpreted.

- Disposal of wastes near the head of Hudson Canyon has been plotted sequentially with each orbit received. A composite map of these wastes (Appendix E) illustrates the extent of the dumping.

- Work is progressing on the discrimination of the three types of waste material (sewage sludge, dredge spoil, and toxic chemicals) based on reflectance characteristics in each MSS band.

- Discrimination of plankton blooms from suspended sediment shows promise by the use of MSS bands 4, 5, and 6.

- Initial enhancement of ERTS-1 imagery has been done using the I^2S Addcol instrument. By varying color filters and light intensity with each MSS band, circulation, patterns in the nearshore zone have been enhanced thus facilitating further analysis.

G. SIGNIFICANT RESULTS

- First look analysis of ERTS-1 images indicates that numerous coastal oceanographic patterns can be mapped on a sequential basis using ERTS-1 images.

- Analysis of imagery indicates a predominant southwesterly drift of dumped wastes in the surface waters. Turbulent diffusion greatly increases the geographical extent of these dumps.

- Initial analysis of imagery indicates that the effects of tidal flushing of New York Harbor extend as far south as Long Branch, New Jersey.

- Analysis of imagery from 9-3-72 (1042-15071) indicates a wide band of turbid water extending several miles offshore around Barnegat Inlet. It appears to be broken into several diffuse water masses probably resulting from several tidal changes and indicating a quite long flushing time for these coastal waters.

- First look analysis of imagery from 10-10-72 (1079-15133) illustrates the increased reflectance of turbid waters within the bays, sounds, and thoroughfares behind the barrier islands in the southern New Jersey shore area. The estuarine waters emanating from both Brigantine and Absecon Inlets are very turbid relative to the waters further offshore and to the north and south. The increased turbidity of these waters is at least partially caused by the large number and volume of sewage effluents (average daily flow of 25.6 million gallons per day, 85% of which is only receiving primary treatment) that are emptying into these waters. Because of the nearly uniform reflectance of these coastal waters, it appears that the very populous bathing beaches along this area of the coastline are definitely being affected by the sewage flow into the back bay waters.

  The tidal prism appears to be quite large but the movement of water once outside the inlets is not very rapid. The waters are not moving away from the coastline but rather along the coast.

H. PROBLEMS: None

I. RECOMMENDATIONS FOR TECHNICAL CHANGES: None

J. CHANGES TO STANDING ORDER FORMS:

A request has been submitted to the ERTS-1 User Services at the Goddard Space Flight Center (Appendix F).

K. OVERVIEW OF INVESTIGATION:

Pre-launch preparations have focused on the accumulation of complete and comprehensive ground truth information to facilitate more effective analysis of ERTS-1 data. Contact has been established and an information feedback system has been developed with the National Weather Service, the National Environmental Satellite Service, the Army Corps of Engineers, and the U.S. Coast Guard to provide near real time data.

Analysis of available aircraft and satellite data is proceeding on schedule. Data from two NASA MSC and two NASA Ames aircraft missions have been obtained and are presently being used in the analysis of ERTS-1 imagery while mosaics are being prepared.

A detailed interpretation of each orbit is made upon receipt of each imagery set. These interpretations are recorded and compared with each previous orbit's analysis. In this way, changes in the environment as described in the previous sections, can be readily observed and interpretation techniques are refined as an on-going process. ERTS-1 MSS bands 4 and 5 are best suited for observing near surface circulation dynamics, however, MSS bands 6 and 7 provide information useful in discriminating water features from atmospheric features and in determining wetland areas within the coastal zone.

Analysis of early ERTS-1 data along with the aircraft imagery indicates that the concept of repetitive looks at coastal circulation patterns along the New Jersey shoreline will provide the kinds of information (Appendix G) necessary for more effective decision making within the New Jersey Department of Environmental Protection.

Questions concerning this report should be directed to Dr. Frank J. Wobber at (202) 785-1123.

Sincerely yours,

Roland S. Yunghans
Environmental Scientist
New Jersey Department of Environmental Protection

Frank J. Wobber, Director
Geosciences and Environmental Applications Division

Attachments
FJW/kw

APPENDIX A

TASK STATUS REPORT

TASK STATUS REPORT

TASK	HEADING	STATUS	COMMENTS
		PHASE I	
3.1.1	Determine existence of Pre-ERTS imagery for analysis	Completed 10-1-72	Visits made to NASA MSC (Earth Resources Aircraft Data Bank) at Houston, Texas. A catalog of aircraft imagery has been prepared.
3.1.2	Assemble ERTS Data Analysis Equipment	Completed 9-1-72	NJDEP has acquired basic imagery analysis equipment at Trenton, New Jersey.
3.1.3	Analyze Pre-ERTS imagery set as a demonstration of technique	Completed 10-1-72	ERTS-1, Apollo, and aircraft imagery and their analysis were used to brief NJDEP officials.
3.1.4	Organize and conduct preliminary briefing with NJDEP	Completed 10-5-72	Briefing was held at NJDEP to demonstrate remote sensing techniques and possible products to be developed from ERTS.
3.1.5	Select candidate test sites	Completed 11-15-72	The Northern New Jersey Shore will be the primary test site with secondary test sites to be studied as NJDEP interest, or environmental problems arise.
3.1.6	Collect and organize existing ground truth data.	Completed 12-1-72	A bibliography has been prepared. Collection of pretinent ground truth will continue throughout experiment.
3.1.7	Perform reconnaissance of test area.	To Be accomplished in February	
3.1.8	Develop final interview plan and conduct interviews.	Completed 12-10-72	Interviews with key personnel in early December have led to initial plans for information products. Subsequent briefings after initial products are prepared will be needed.

TASK	HEADING	STATUS	COMMENTS
3.1.9	Prepare ground truth collection plan	Underway	A major ground truth effort is being planned for late April 1973. Because of late contract award, ground data collection will be postponed until spring.
3.1.10	Instrument test sites	Pending effort sited in 3.1.9	Preliminary sampling will be undertaken during reconnaissance survey.
3.1.11	Prepare aerial survey plan	Underway	Two High Altitude U-2 Missions have been completed. A multi-level effort is being planned for April 1973.
3.1.12	Collect ground truth data	Upcoming	Preliminary sampling during reconnaissance survey and extensive sampling during the April 1973 effort.
3.1.13	NJDEP shall assemble equipments specified in 3.1.9 at Toms River Facility.	Pending completion of 3.1.9	
3.1.14	Prepare line base maps for test area.	Underway	Due to the compression of Phase I and the early receipt thereof ERTS-1 imagery, maps are being prepared using ERTS data.
3.1.15	Use simulated ERTS imagery for candidate base maps.	Underway	Due to the compression of Phase I, ERTS-1 imagery is being used for candidate products. In addition, mosaics of aircraft imagery will be prepared.
3.1.16	Develop and conduct Preliminary Cost-Benefits Analysis	Underway	A preliminary methodology is being developed as a result of the initial interviews.

TASK	HEADING	STATUS	COMMENTS
3.1.17	Brief NJDEP on use of candidate information products	Pending	
3.1.18	Establish letter contacts with other States	Pending	Scheduled for February after candidate products are available.
3.1.19	Prepare plan for analysis of ERTS imagery	Completed 10-1-72	Due to compression of Phase I, initial analysis plan for ERTS Imagery was established during initial briefings with NJDEP.
	PHASE II		
3.2.1	First look analysis of first imagery	Completed 9-29-72	First look analysis document in first NASA progress report.
3.2.2	Analyze all ERTS imagery during Phase II	Underway	Documented analysis in 6 month progress report.
3.2.3	Analyze all ERTS imagery during Phase II by spectral band	Underway	Documented analysis in 6 month progress report.
3.2.4	Map coastal landforms and outline the wetlands	Underway	A coastal wetlands map at 1:500,000 scale is being prepared.
3.2.5	Use optical analysis equipment, & enhancement techniques in analysis of ERTS imagery	Underway	This is a continuing Task and will be underway throughout the experiment

TASK	HEADING	STATUS	COMMENTS
3.2.6	Review and finalize information distribution within NJDEP	Underway	An initial distribution network has been determined. System will be reviewed after initial products are distributed within NJDEP
3.2.7	Information products shall be distributed within NJDEP according to approved schedule	Pending Completion of 3.2.6	
3.2.8	Prepare preliminary data analysis report at completion of Phase II	Pending	
3.2.9	Prepare a revised data analysis plan for Phase III	Pending	
3.2.10	Preliminary data analysis report & revised data analysis plan sent to NASA	Pending	
3.2.11	Finalize format and content of information products package for Phase III	Pending	
	PHASE III		
3.3.2	Modify data analysis procedures	Pending	

TASK	HEADING	STATUS	COMMENTS
3.3.3	Distribute on a routine basis final information products	Pending	
3.3.4	Work closely with NJDEP to best apply and distribute information products and document benefits derived thereof	Pending	
4.3	Prepare final report	Underway	Sections of the final report are being written as the experiment progresses.
4.4	Prepare a program for continuing ERTS applications within New Jersey	Pending	
4.5	Prepare coastal states briefing package	Pending	

APPENDIX B

AIRCRAFT CATALOGUE

This catalogue of selected remote sensing imagery of the state of New Jersey was prepared by Earth Satellite Corporation for the state of New Jersey's Department of Environmental Protection as a part of their joint ERTS-1 New Jersey Coastal Mapping experiment.

The imagery included in this catalogue were reviewed at the NASA Earth Resources Research Data Facility of the Manned Spacecraft Center, Houston, Texas on September 25-27, 1972. Screening and Index Reports describing East Coast flight missions and test sites were studied and all flight lines over New Jersey were catalogued and mapped. The imagery from each of these flights was examined for areal coverage, photographic quality, cloud cover, and usefulness for coastal zone management. Copies of the Screening and Index Reports are available for each New Jersey mission and copies were obtained from the MSC Library for flight lines and technical data including mission and site numbers, date flown, aircraft used, altitude flown, scale of imagery, and remote sensors used such as camera type, film type, radar type, or thermal sensor type.

The Research Data Facility is primarily a reading and viewing facility, where earth resources investigators can examine and study the material obtained by the NASA Earth Resources Survey Program. Reading and viewing rooms are set aside for visitors. The facility does not presently lend or sell data, but does point out channels for purchase of data. The following are the services rendered:

- Retrieval of documents for user's study by ERRDF staff, and limited xerographic duplication.
- Retrieval of photography and other imagery for examination by visitors on viewing tables or on 16-mm cassette viewers.

- Examination of a limited amount of radiometric data, which have been reduced from magnetic tape to profile plots and microfilmed.

Purchase of documents. - Although the ERRDF itself does not sell documents, NASA has arranged that they can be purchased from:

Clearinghouse for Federal Scientific and Technical Information (CFSTI)
Port Royal Road
Springfield, Virginia 22151

Purchase of spacecraft photography. - NASA has also arranged that Gemini and Apollo spacecraft earth viewing photography can be purchased from:

Technology Application Center (TAC)
University of New Mexico
Albuquerque, New Mexico 87106

Purchase of aircraft photography and other imagery. - Plans are being finalized to permit the sale of this material. Visitors and correspondents should check on the status of this part of the operation when they contact the Research Data Facility.

Glossary of Descriptive Terms used in reviewing the color and color IR (false color) photography.

EXCELLENT: All colors are bright and clear. Colors have little or no haze effect.

VERY GOOD: Color rendition shows only minor effects of atmosphere haze. Colors have good contrast and brightness.

GOOD: Color of photography shows some effects of haze (bluish cast), however, does not greatly effect analysis capabilities.

GOOD TO FAIR: Color shows effects of haze. Color brightness and contrast are somewhat subdued, and analysis are slightly hampered.

FAIR: Colors are subdued, low color contrast color quality unlike natural appearance with considerable haze effect making accurate analysis difficult.

Contributors -

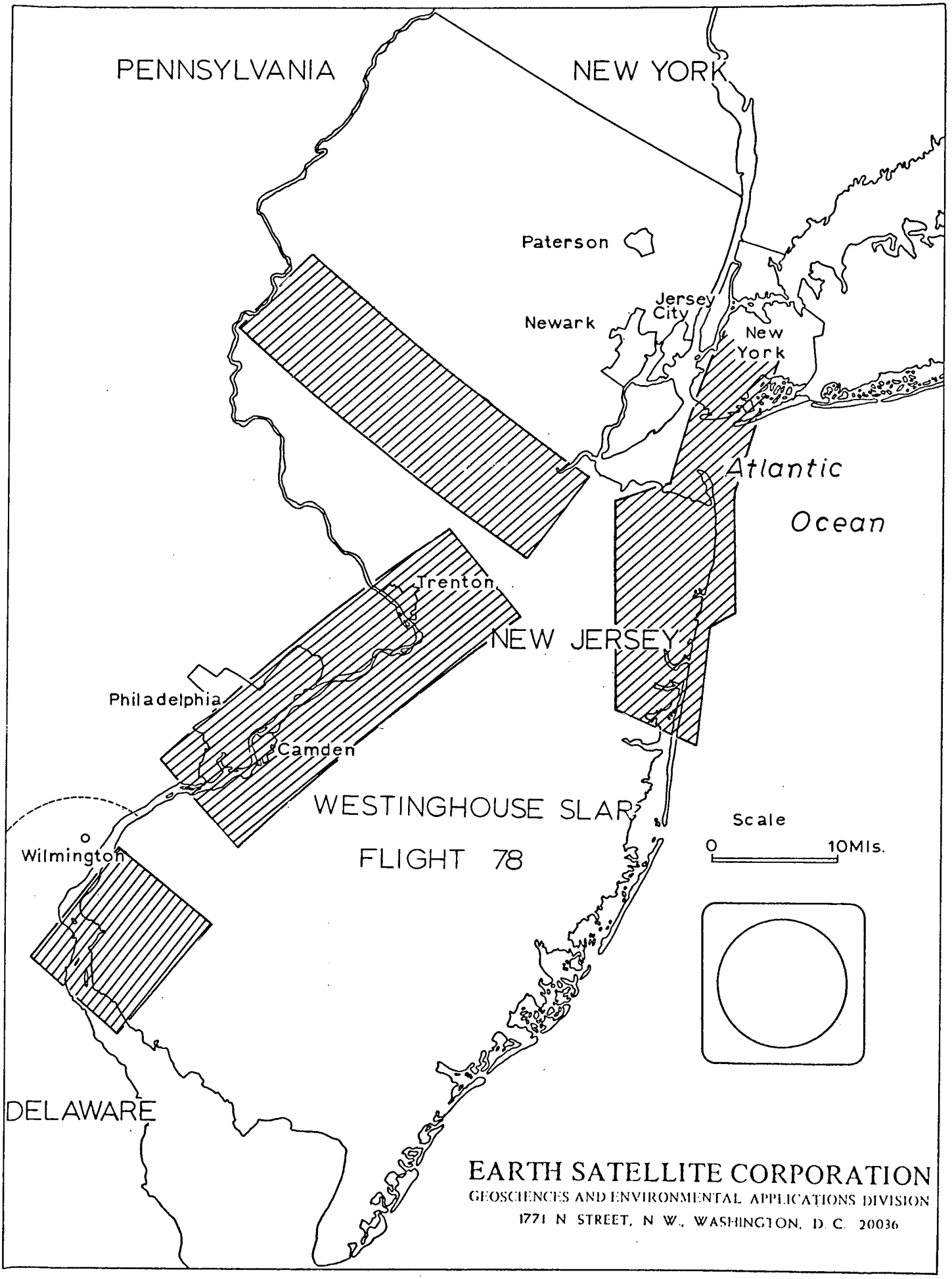
Roger Amato - Earth Satellite Corporation

Luis DeMendoza - Earth Satellite Corporation

Robert Mairs - Earth Satellite Corporation

NEW JERSEY IMAGERY

SOURCE	:	NASA Sensor Coverage Chart S-70-12741-S NASA-MSC, Houston, Texas
MISSION #	:	Westinghouse SLAR
SITE #	:	Lines 1, 2, 3 (Flight 78)
DATE	:	September, 1965
AIRCRAFT	:	YEA - 3A
ALTITUDE	:	N/A
SENSORS	:	Sidelooking Airborne Radar (SLAR) APQ-97 (XE-1)
SCALES	:	N/A
CLOUD COVER	:	—
OVERALL QUALITY	:	Very Good
GEOGRAPHICAL AREA:		Area 1 - From Camden to Trenton Area 2 - From New Brunswick to Washington, New Jersey Area 3 - From Breton Woods to Middletown
COMMENTS	:	Radar imagery of very little use in achieving the objectives of ERTS-1 proposal MMC-304.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DELAWARE
EARTH SATELLITE CORPORATION
GEOSCIENCES AND ENVIRONMENTAL APPLICATIONS DIVISION
1771 N STREET, N.W., WASHINGTON, D.C. 20036

NEW JERSEY IMAGERY

SOURCE : NASA-S-70-12741-S Sensor Coverage Chart
NASA-MSC, Houston, Texas

MISSION # : Westinghouse SLAR

SITE # : Flights 123, 124, 125

DATE : 123 - July 14, 1966
124 - July 19, 1966
125 - July 22, 1966

AIRCRAFT : YEA-3A

ALTITUDE : N/A

SENSORS : Sidelooking Airborne Radar (SLAR) APQ-97 (XE-1)

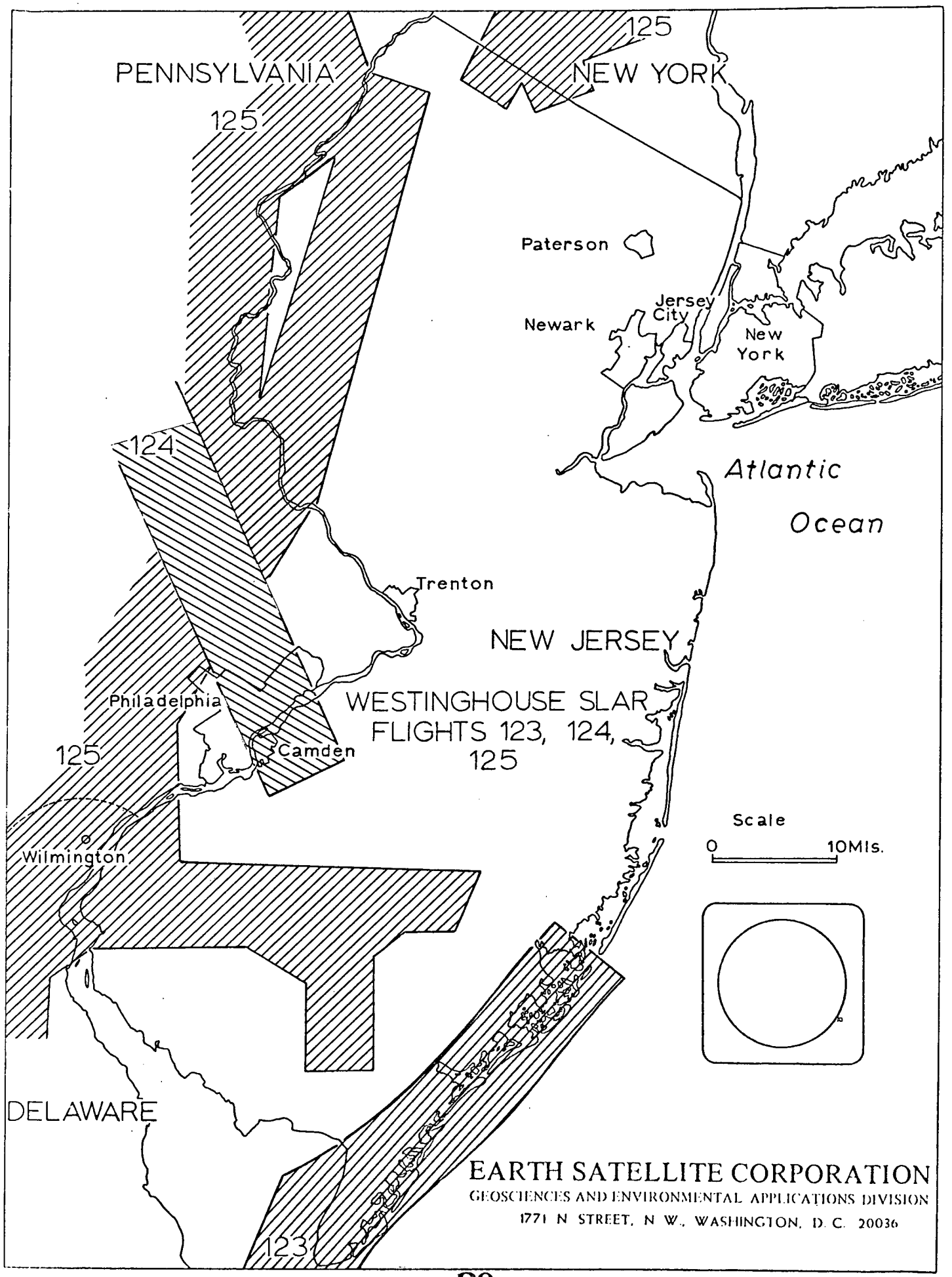
SCALES : N/A

CLOUD COVER :--

OVERALL QUALITY : Very Good

GEOGRAPHICAL AREA: Western and southern New Jersey

COMMENTS : Although quality of photography is very good, its use is limited to wetlands interpretations because of the limited areal coverage.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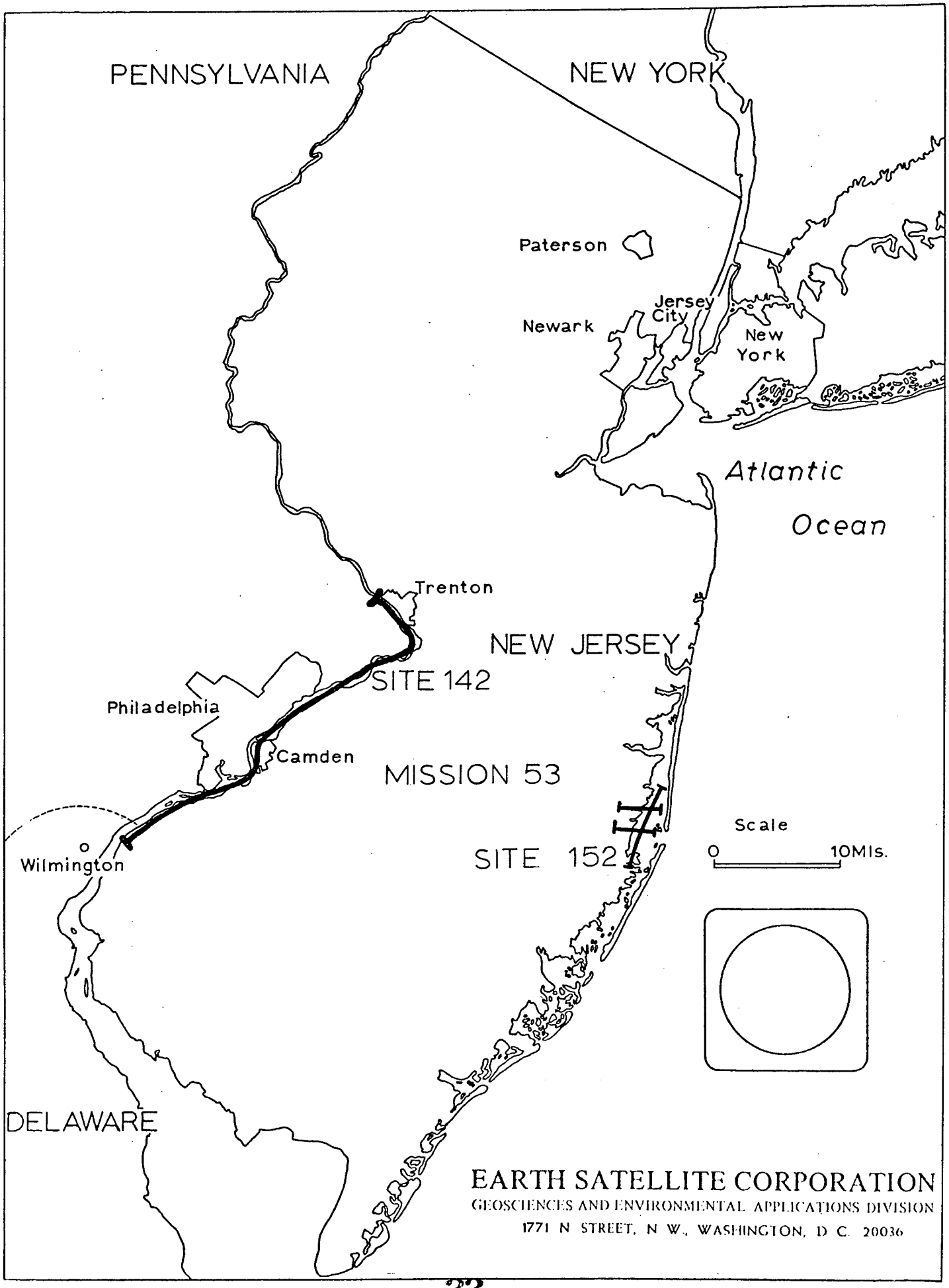
NEW JERSEY IMAGERY

SOURCE	:	NASA Screening and Index Report, Mission 53 NASA-MSC, Houston, Texas
MISSION #	:	53
SITE #	:	142,152
DATE	:	July 12, 13, 1967
AIRCRAFT	:	NP - 3A
ALTITUDE	:	142 - 6,000 and 15,000 feet 152 - 1,500 and 6,000 feet
SENSORS	:	RC-8 - Color and Color Infrared RS-7 - Thermal Infrared
SCALES	:	142 - 1:12,000 and 1:30,000 152 - 1:3,000 and 1:12,000
CLOUD COVER	:	0%
OVERALL QUALITY	:	Very Good
GEOGRAPHICAL AREA:		142 - Delaware Estuary 152 - Barnegat Bay
COMMENTS	:	Although quality of photography is very good, its use is limited to wetlands interpretations because of the limited areal coverage.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NEW JERSEY IMAGERY

SOURCE : NASA Screening and Index Report, Mission 65
NASA-MSC, Houston, Texas

MISSION # : 65

SITE # : 142, 152, 161

DATE : January 18, 1968

AIRCRAFT : NP-3A

ALTITUDE : 142 - 1,500 feet
152 - 1,200 and 6,000 feet
161 - 1,500 and 6,000 feet

SENSORS : RC-8 - Color and Color IR (Not on Site 142)
RS-7 - Thermal Infrared

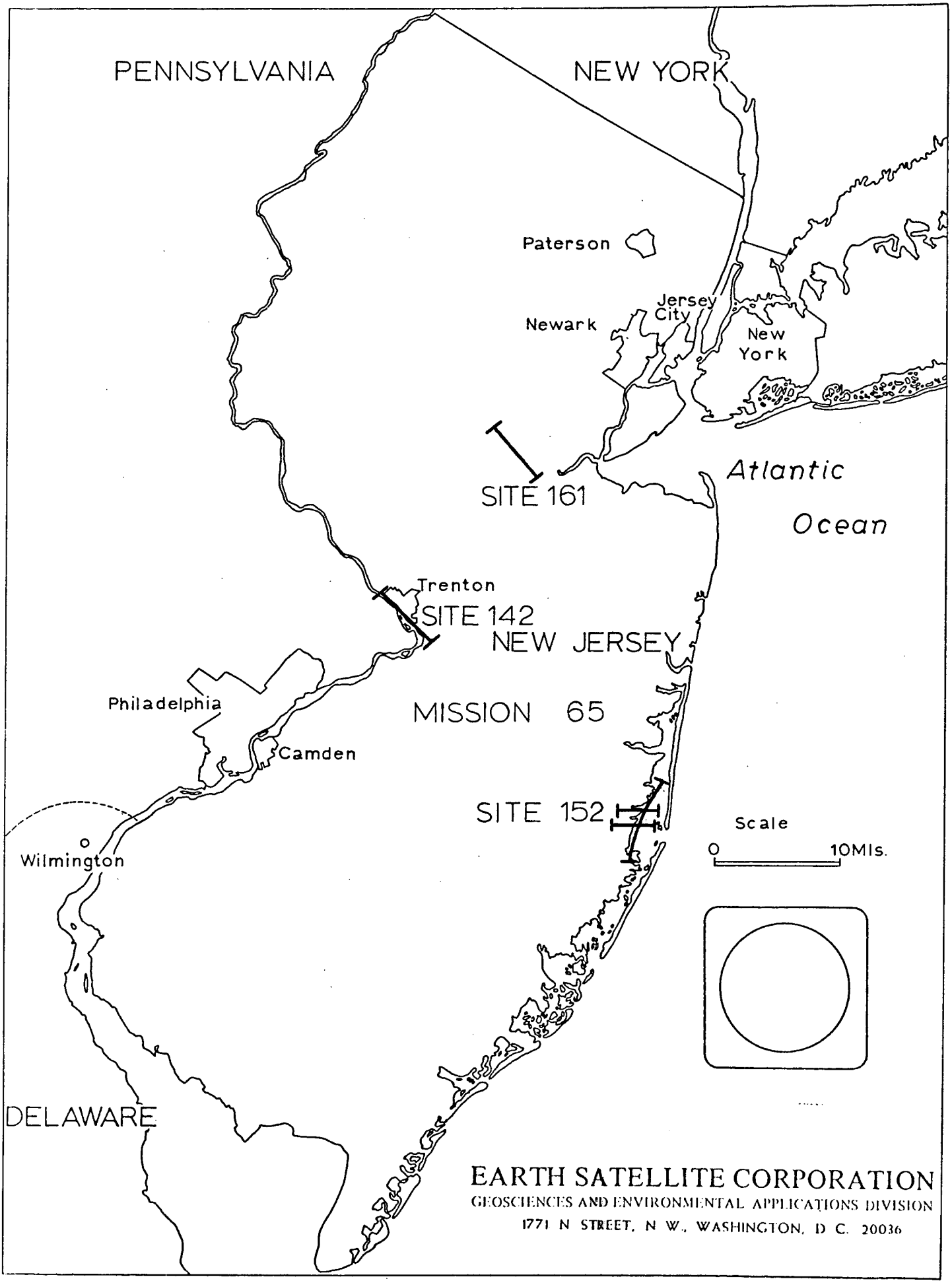
SCALES : 1:3,000 to 1:12,000

CLOUD COVER : 0%

OVERALL QUALITY : Very Good

GEOGRAPHICAL AREA: 142 - Delaware Estuary
152 - Barnegat Bay
161 - Raritan River

COMMENTS : Some snow cover and snow dust on most of mission. Although quality of photography is very good, its use is limited to wetlands interpretations because of the limited areal coverage.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DELAWARE
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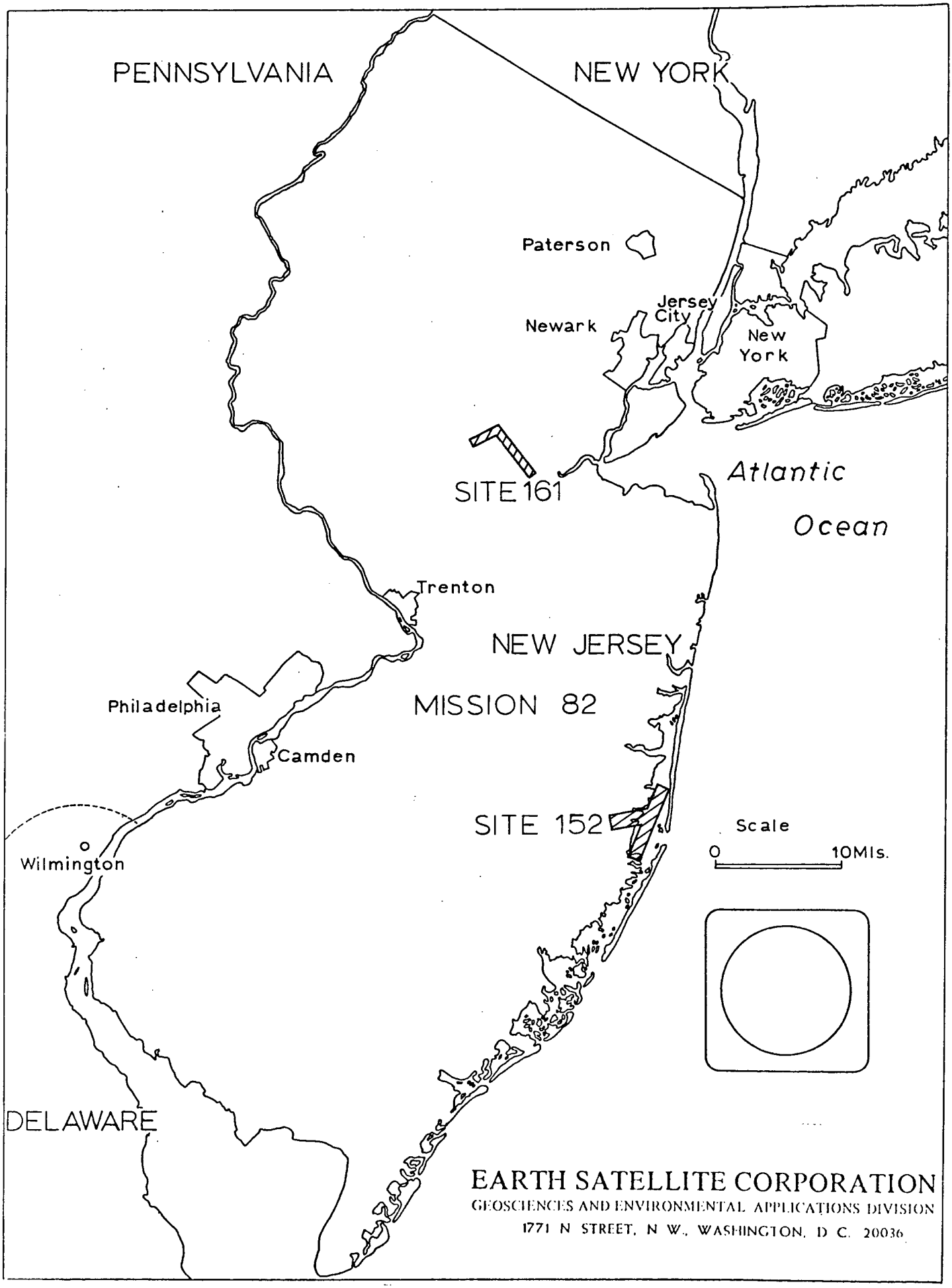
NEW JERSEY IMAGERY

SOURCE	: NASA Screening and Index Report, Mission 82 NASA-MSC, Houston, Texas
MISSION #	: 82
SITE #	: 152, 161
DATE	: November 6, 1968
AIRCRAFT	: CV- 240A
ALTITUDE	: 1,500 Feet
SENSORS	: RC-8 - Color, Color Infrared Reconofax IV - Thermal Infrared
SCALES	: 1:3,000
CLOUD COVER	: 0-25%
OVERALL QUALITY	: Good to Fair. Some frames of color and color IR underexposed
GEOGRAPHICAL AREA	: 152 - Barnegat Bay 161 - Raritan River
COMMENTS	: The photography covers only a limited portion of the test area in Barnegat Bay.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NEW JERSEY IMAGERY

SOURCE : NASA Screening and Index Report, Mission 103
NASA-MSC, Houston, Texas

MISSION # : 103

SITE # : 188 (New York Bight Area)

DATE : September 14, 1969

AIRCRAFT : RB - 57F

ALTITUDE : 60,000 feet

SENSORS : RC-8 - Color, Color Infrared
Zeiss - Color
Hasselblad - Color, Black and White

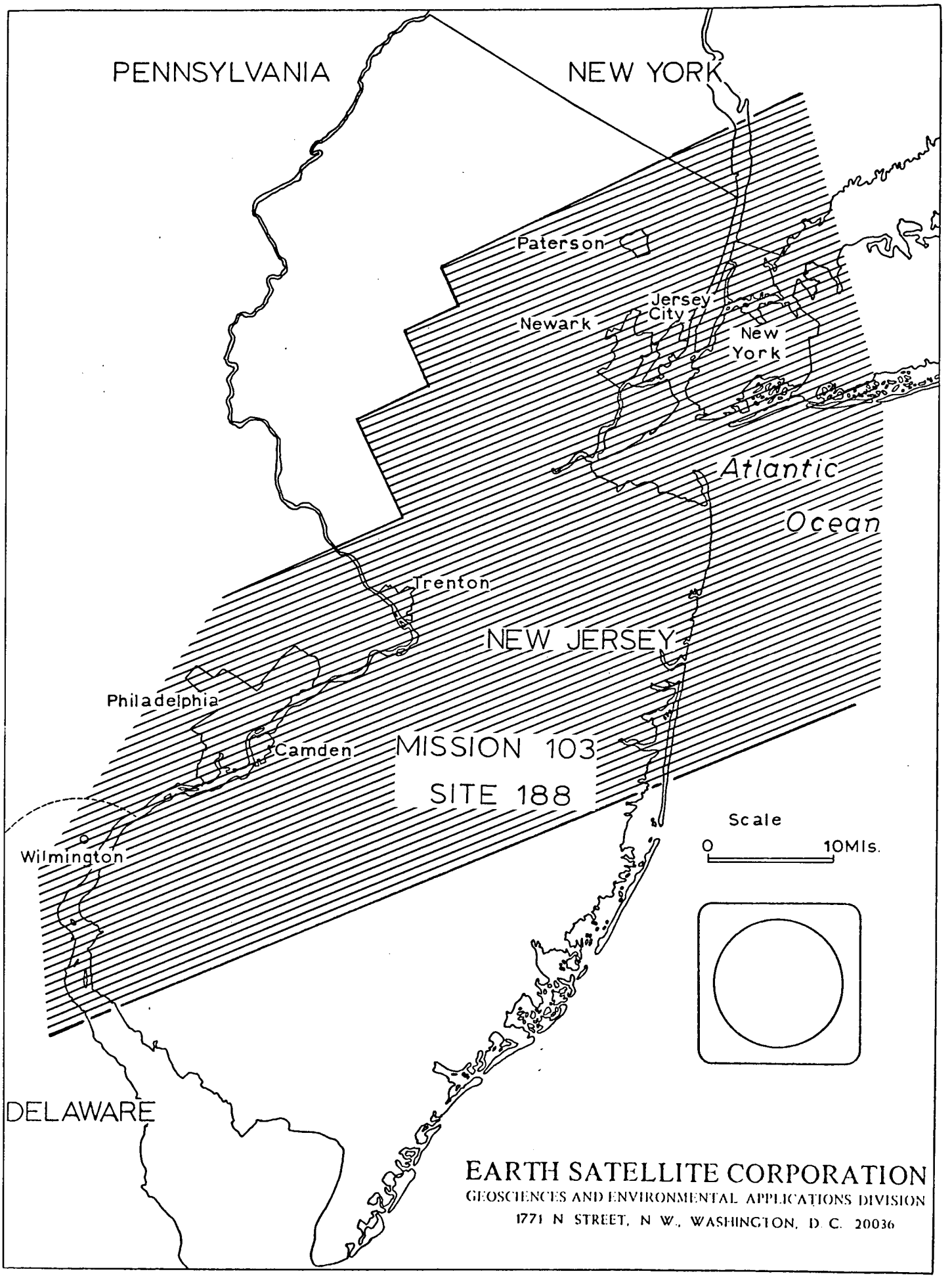
SCALES : 1:120,000

CLOUD COVER : 0%

OVERALL QUALITY : Good

GEOGRAPHICAL AREA: Central New Jersey

COMMENTS : Some very useful photography taken on this mission.
Analyses will be incorporated in information products.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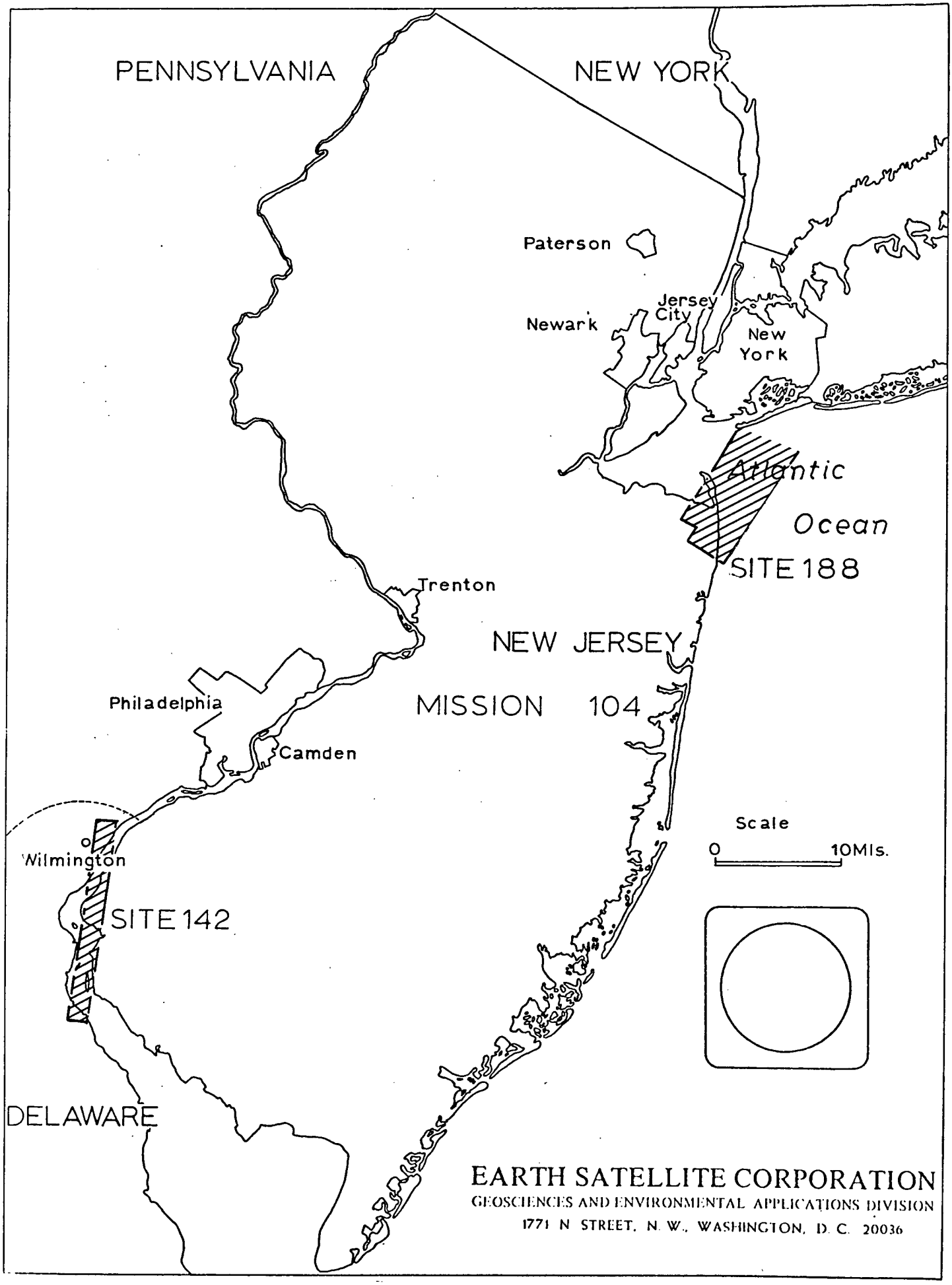
NEW JERSEY IMAGERY

SOURCE	: NASA Screening and Index Report, Mission 104 NASA-MSC, Houston, Texas
MISSION #	: 104
SITE #	: 142, 188 (New York Bight)
DATE	: September 16-18, 1969
AIRCRAFT	: NC-130B
ALTITUDE	: 142-10,000 feet 188-11,400 - 25,100 feet
SENSORS	: 142 - Reconofax IV - Thermal Infrared 188 - RC-8 - Color, Color Infrared Hasselblad - Color, Black and White Reconofax IV - Thermal Infrared
SCALES	: 1:20,000 - 1:50,200
CLOUD COVER	: 0%
OVERALL QUALITY	: Very Good - Excellent Detail
GEOGRAPHICAL AREA	: 142 - Delaware Estuary 188 - Sandy Hook area to Long Island
COMMENTS	: Ten frames of N.E. New Jersey coast showing wetlands Some very useful photography taken on this mission. Analyses will be incorporated in information products.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NEW JERSEY IMAGERY

SOURCE : NASA Screening and Index Report, Mission 119
NASA-MSC, Houston, Texas

MISSION # : 119

SITE # : 86

DATE : January 19-27, 1970

AIRCRAFT : NP-3A

ALTITUDE : 300-20,600 feet

SENSORS : RC-8 - Color, Black and white infrared
KA-62 - Black and white, Black and white infrared
Color Infrared

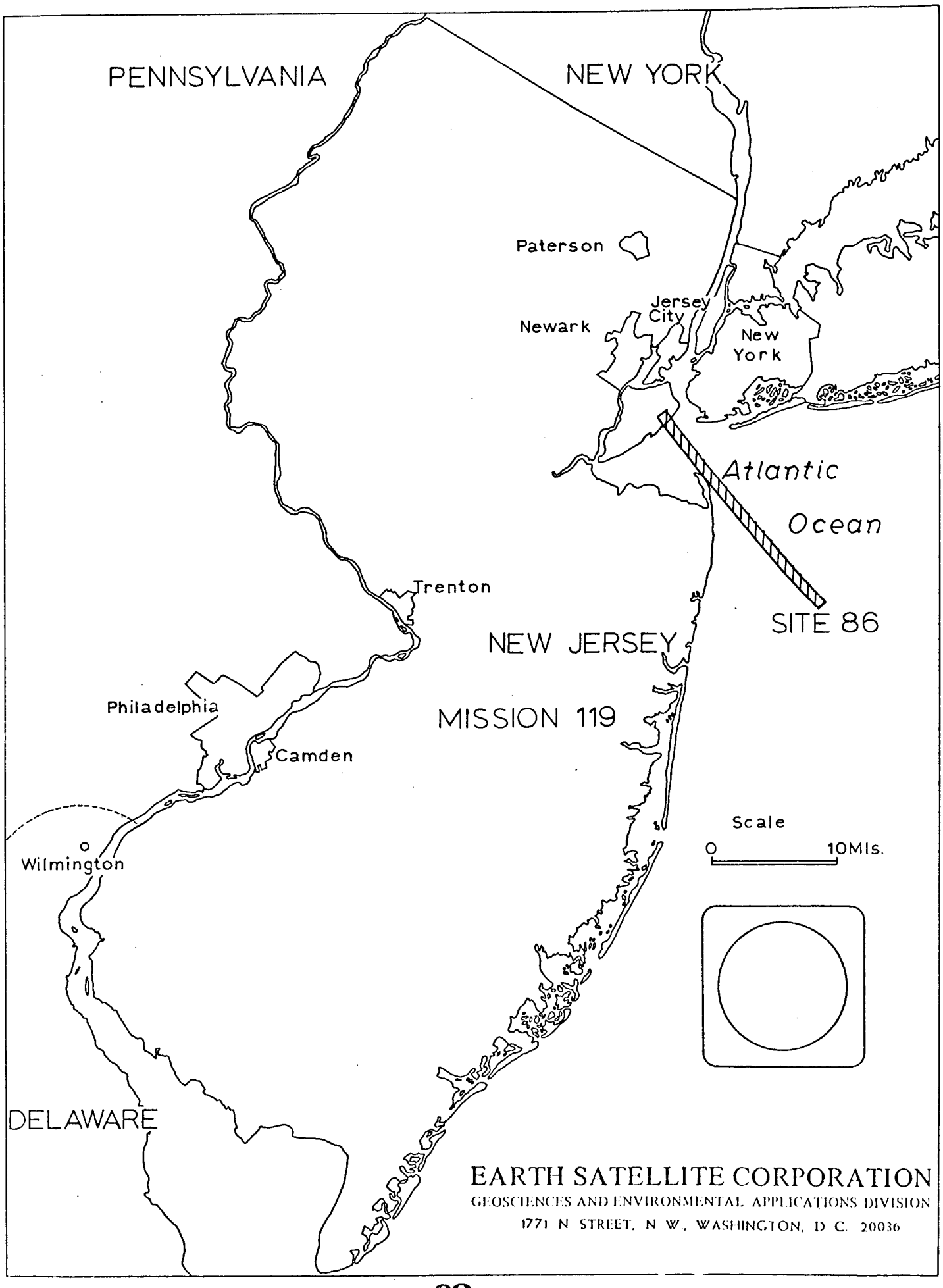
SCALES : 1:600 - 1:41,200

CLOUD COVER : 0%

OVERALL QUALITY : Good

GEOGRAPHICAL AREA: From Staten Island southeastward across New York Bay to Argus Isle

COMMENTS : A few frames at the beginning of mission will be useful for overall interpretation of coastal circulation and pollutant dumping.


PENNSYLVANIA
NEW YORK
Paterson
Jersey City
Newark
New York
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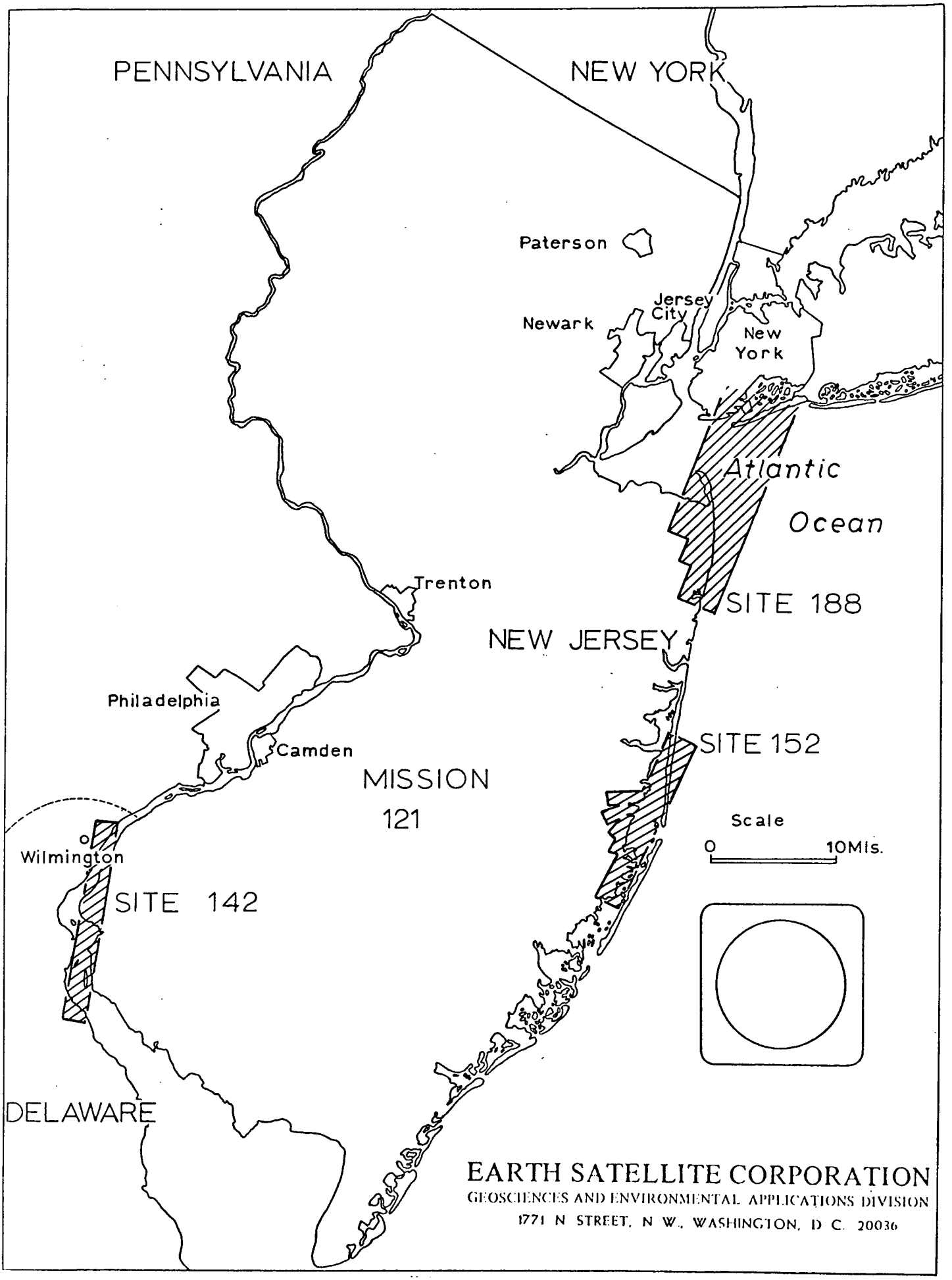
Ocean
SITE 86
Trenton
NEW JERSEY
MISSION 119
Philadelphia
Camden
Wilmington
Scale
0
10Mls.
DELAWARE
EARTH SATELLITE CORPORATION
GEOSCIENCES AND ENVIRONMENTAL APPLICATIONS DIVISION
1771 N STREET, N.W., WASHINGTON, D.C. 20036

NEW JERSEY IMAGERY

SOURCE	: NASA Screening and Index Report, Mission 121 NASA - MSC, Houston, Texas
MISSION #	: 121
SITE #	: 142, 152, 188
DATE	: February 18-29, 1970
AIRCRAFT	: NC - 130B
ALTITUDE	: 142-1,500-6,500 feet 152, 188-2,500-9,400 feet
SENSORS	: 142 - Reconofax IV - Thermal Infrared 152 - RC-8 - Color, Color IR, Reconofax IV - Thermal IR 188 - RC-8 - Color, Color IR Hasselblad - Color, Black and white Reconofax IV - Thermal Infrared
SCALES	: 1:3,000 - 1:18,000
CLOUD COVER	: 0%
OVERALL QUALITY	: Excellent color imagery, some color infrared is under-exposed.
GEOGRAPHICAL AREA:	142-Delaware Estuary 152-Barnegat Bay 188-Long Beach - Sandy Hook (New York Bight)
COMMENTS	: Good winter wetlands photography. Some very useful photography taken on this mission. Analyses will be incorporated in information products.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Philadelphia
Camden
SITE 152
MISSION
121
Scale
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10Mls.
Wilmington
SITE 142
DELAWARE
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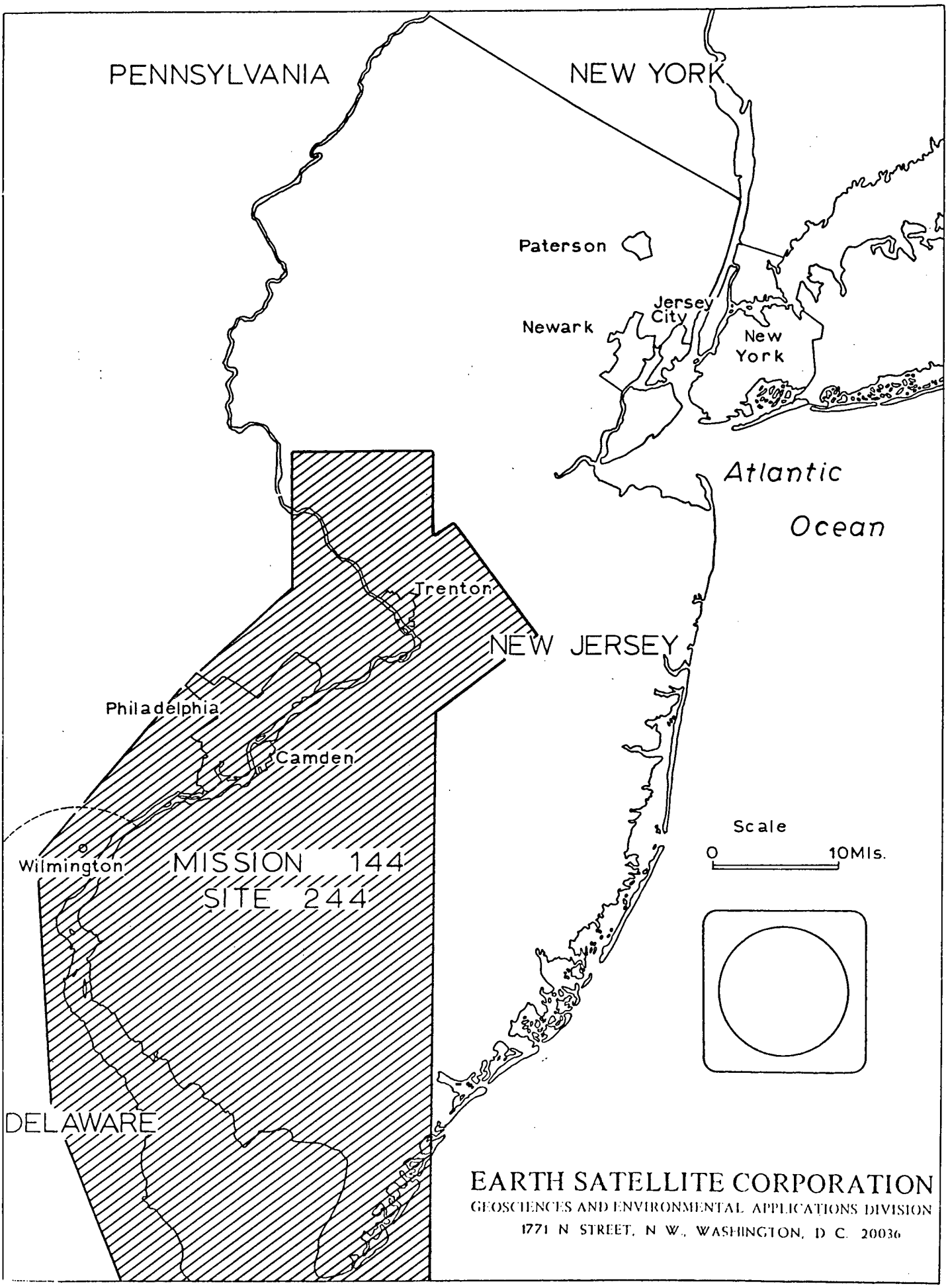
1771 N STREET, N.W., WASHINGTON, D.C. 20036

NEW JERSEY IMAGERY

SOURCE	:	NASA Screening and Index Report, Mission 144 NASA-MSC, Houston, Texas
MISSION #	:	144
SITE #	:	244
DATE	:	Sept. 22-29, 1970
AIRCRAFT	:	RB-57F
ALTITUDE	:	60,000 feet
SENSORS	:	RC-8 - Color, Color Infrared Zeiss - Color, Color Infrared Hasselblad - Color, Color Infrared, Black and White, Black and White Infrared
SCALE	:	1:120,000
CLOUD COVER	:	0
OVERALL QUALITY	:	Very Good
GEOGRAPHICAL AREA:		Southwestern New Jersey (Trenton, southward)
COMMENTS	:	Only a small portion of the southern New Jersey shore (Cape May area) was photographed; however, useful information can be extracted for further analysis of circulation patterns and coastal erosion.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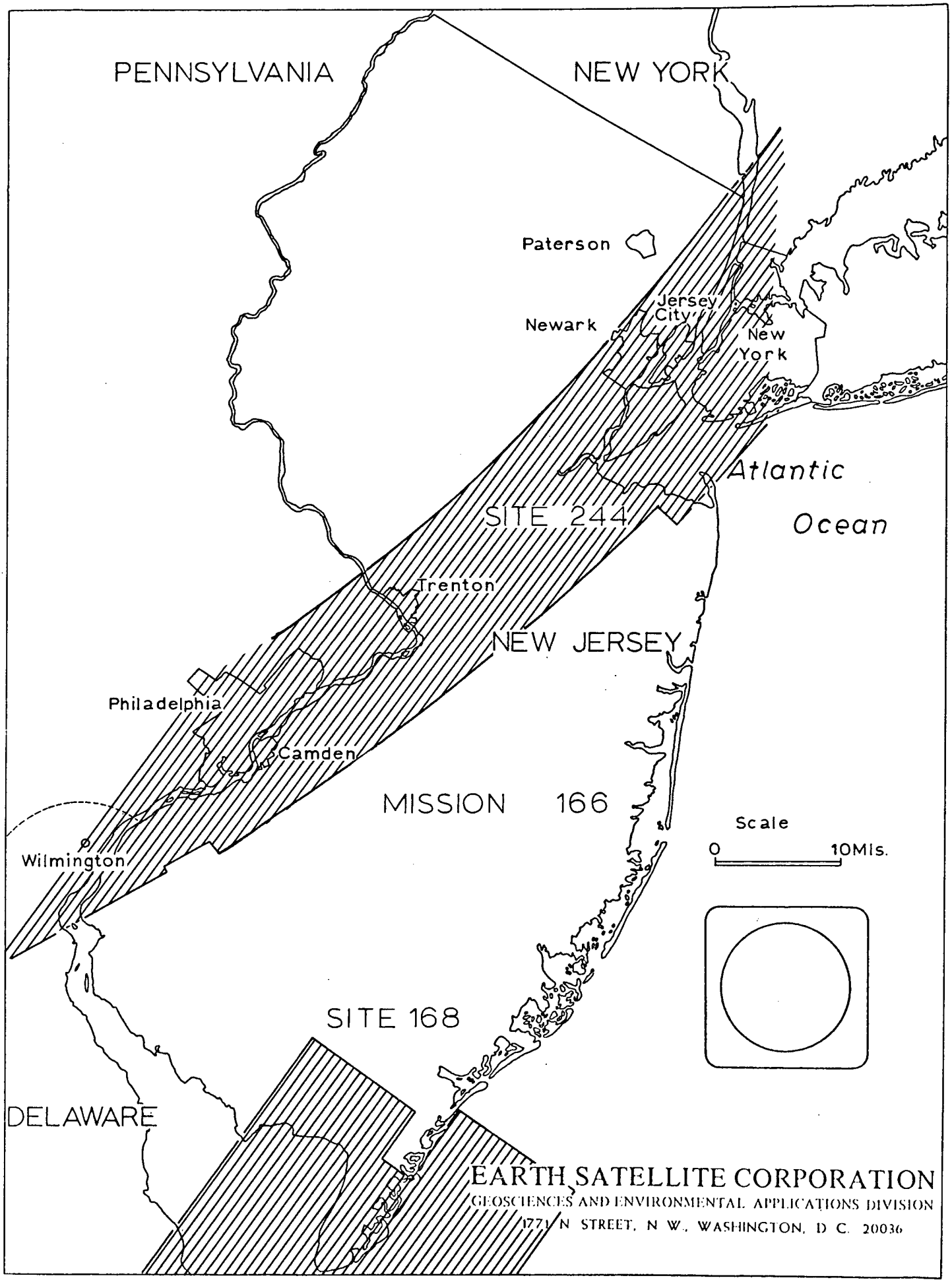
Trenton
NEW JERSEY
Philadelphia
Camden
Wilmington
MISSION 144
SITE 244
DELAWARE
Scale
0
10Mls.
EARTH SATELLITE CORPORATION
GEOSCIENCES AND ENVIRONMENTAL APPLICATIONS DIVISION
1771 N STREET, N W., WASHINGTON, D C. 20036

NEW JERSEY IMAGERY

SOURCE	:	NASA Screening and Index Report, Mission 166 NASA-MSC, Houston, Texas
MISSION #	:	166
SITE #	:	168, 244
DATE	:	May 18-19, 1971
AIRCRAFT	:	RB-57F
ALTITUDE	:	58,000 - 60,000 feet
SENSORS	:	RC-8 - Color, Color Infrared Zeiss - Color Infrared Hasselblad - Color IR, Black and white, Black and White Infrared RS-7 - Thermal Infrared
SCALES	:	1:116,000 - 1:120,000
CLOUD COVER	:	0 - 25%
OVERALL QUALITY	:	Very Good
GEOGRAPHICAL AREA:		168 - From Woodbine, New Jersey, southward 244 - From Norfolk, Virginia to north of New York City (Air Pollution Study)
COMMENTS	:	Only a small portion of the southern New Jersey shore (Cape May area) was photographed; however, useful information can be extracted for further analysis of circulation patterns and coastal erosion.


PENNSYLVANIA
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Jersey City
New York
Atlantic Ocean
SITE 244
Trenton
NEW JERSEY
Philadelphia
Camden
MISSION 166
Wilmington
Scale
0
10Mls.
SITE 168
DELAWARE
EARTH SATELLITE CORPORATION
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APPENDIX C

BRIEFING PACKAGE

LIMITED QUANTITIES AVAILABLE FROM DEP.

THE APPLICATION OF ERTS DATA TO COASTAL ENVIRONMENTAL PROTECTION IN NEW JERSEY

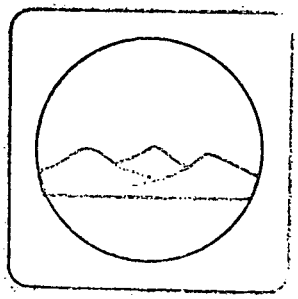
BACKGROUND MATERIAL PREPARED FOR PARTICIPANTS FROM THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

PREPARED BY:

Dr. Frank J. Wobber
EARTH SATELLITE CORPORATION

IN CONSULTATION WITH:

Edward B. Feinberg
Roland S. Yunghans
DEPARTMENT OF ENVIRONMENTAL PROTECTION



EARTH SATELLITE CORPORATION
Geosciences and Environmental Applications Division
1771 H Street, N.W., Washington, D.C. 20036/ (202) 785-1123

EARTH SATELLITE CORPORATION
(EarthSat)

1771 N STREET, N.W., WASHINGTON, D.C. 20036 / (202) 785-1123

Gentlemen:

The Earth Resources Technology Satellite ERTS-1 is an experimental space platform which is gathering data on the Earth's resources. It is the first in a series of experimental satellites which are the precursors of operational satellites which will be launched later in this decade. The weather satellite program developed following a similar period of experimentation and testing before operational satellite systems were launched.

The ERTS-1 experiments may be generally divided into two categories: (a) those which are primarily research aimed at advancing the technology of earth observations from satellites, and (b) those which seek to demonstrate applications of satellite data.

The New Jersey Department of Environmental Protection's experiment falls into the second category. I am convinced that it is this group of experiments that will largely determine the future of the earth observation program and provide near-term benefits to the public. ERTS-1 is providing vast amounts of data which can be refined into useful information for environmental protection. The purpose of the New Jersey ERTS experiment is to determine whether these data are useful for coastal environmental protection and management.

The success of New Jersey's experiment depends upon the joint efforts of Department personnel and the EarthSat staff, and what can be anticipated as a close, interactive working association.

This booklet outlines the experiment, and provides other background data of potential value to State personnel.

It is the first step towards an essential mechanism to ensure experiment success -- mutual communication.

I would like to take this opportunity to invite each participant and his family to visit EarthSat's Washington, D.C. offices, and view firsthand the procedures and equipment used to analyze ERTS imagery.

Dr. Frank J. Wobber, Director
Geosciences and Environmental
Applications Division
Earth Satellite Corporation

APPENDIX D

FINAL REPORT OUTLINE

NEW JERSEY ERTS FINAL REPORT OUTLINE

I. INTRODUCTION

A. Justification and Need for the Experiment

1. Coastal environment is extremely dynamic and its management may benefit from repetitive, near synotic data.
2. More data for routine State decision-making in coastal areas are needed.
3. Integrated ERTS and aircraft remote sensing data can provide basic information needed for decision-making.

B. General Objectives

1. To demonstrate that useful information products derived from ERTS-1 imagery can be applied by NJDEP to the protection of New Jersey's Atlantic coastal shoreline and estuarine-areas.

C. Specific Objectives

1. To study the dynamic characteristics of coastal and estuarine current systems.
2. To locate areas of serious coastal erosion in relation to coastal current systems.
3. To locate navigation channels in relation to coastal current systems.
4. To monitor the environmental impact of dredging, filling, and dumping of dredge spoil in the coastal zone.

5. To locate ocean outfalls in relation to coastal current systems.

6. To determine gross pollution capacities of estuaries by measuring tidal flushing volumes.

II. BACKGROUND

A. NJDEP and EarthSat Involvement

- Wetland studies using remote sensing
- Increasing NJDEP need for data of value for comprehensive coastal zone management.

B. Small Scale Image Studies Have Established: (for Coastal areas)

- what can be seen in imagery
- which bands are of greatest utility
- that synoptic, repetitive coverage has advantages
- that certain tasks are more reasonably conducted at small scales.

C. ERTS-1 Proposal Preparation and Implementation

III. METHODS AND APPROACH

A. Review of Relevant State Laws, Regulations, and Procedures

B. Interview State Personnel to Determine Coastal Problems and Information Necessary to Solve Some

- Marine Current Circulation Patterns
- Movement of Sewage and Dredge Spoil Dumps
- Existing Ocean Outfalls Dispersion
- Estuarine Flushing Rates
- Beach Erosion and Accretion

C. Collect and Organize Collateral Data

1. Catalog Existing Aircraft Data
2. Gather Ground Truth Data
   - Climatology
   - Bathymetry
3. Gather Technical Literature Related to Coastal management, coastal engineering and environmental protection.

D. Conduct Preliminary Analysis of ERTS-1 Imagery

1. Preparation of Photo Mosaics
2. Photomap Overlays of Various Coastal Features and Phenomena.
3. Photomaps Preparation
4. Line Map Preparation
5. Enhancement Techniques
   a. Addcol Viewing
   b. Digicol Viewing
   c. Photographic Enhancement
   d. IBM Image Processing

E. Preparation of Preliminary Information Products for NJDEP

1. Photomaps
2. Mosaics
3. Line-maps
4. Overlays
5. Sketches/Cross Sections/Block Diagrams
6. Annotated Enhanced Images
7. Tabular Listings

F. Conduct A Coordinated ERTS, Aircraft, and Ground Truth Survey for Test Area

1. Reconnaissance survey of test site area
   - Select instrumentation sites
   - Conduct preliminary ground truth measurements
2. Prepare aircraft and ground truth plans
3. Instrument test area
4. Analyze data collected

G. Continue Analysis of ERTS-1 Imagery Reflecting Changes Determined During Ground Survey

H. Finalize Information Products Package (Products with scope and in a format cost useful to NJDEP)

I. Routine Preparation and Distribution of Final Information Products

J. Cost Benefits Analysis

K. Final Report Preparation

IV. RESULTS

A. Final Report Documenting the Utility of ERTS Data For Environmental Management of New Jersey's Coastal Zone
   - summary of the utility of integrated ERTS, aircraft, and ground truth derived products to NJDEP
   - utility of repetitive, synoptic ERTS-1 coverage

B. Varying Categories of Information

1. Photomaps, overlays, or line-map products showing gross coastal circulation (as seen every 18 days).
2. Coastal map products as a function of various environmental parameters.
   - wind rose overlays for varying wind direction and speeds
   - overlaying histograms of rainfall
3. Coastal map products showing areas of significant erosional or accretional change. (or tabulations)
4. Coastal map or tabular products differentiating stable versus unstable shore areas.
5. Coastal map products showing environmentally-endangered areas due to:
   - Extreme erosion
   - Consistent polluted drift material
6. Map products or tabular listings of estuarine flushing estimates.
7. Maps of unusual features such as:
   - Unexplained Sediment Plumes
   - Previously unidentified discharges
   - Possible oil spill or ship bilge discharges
8. Map products showing dredge and sewage spoil dumping, net movement, and dumping outside designated areas.
9. Map summary showing possible drift of spoils in relation to surface current.

10. Map product of forecasted ocean outfall positions in relation to various surface currents.
11. Relate forecasted outfall size (gallons/day) to existing outfalls and prepare map.
12. Map listing possible areas for outfall location
    - Estimates of Seaward and Shoreward Drift
    - Areas of Consistent Seaward or Shoreward Drift
13. Map products showing physical changes in estuarine areas.
14. Bathymetric map products
    - offshore bathymetry in relation to circulation
    - changes in offshore depth (assuming good historical depth records exist).
15. Map products overlaying circulation and bottom types.
    - possible sand deposits for beach replinishment
16. Maps of environmentally productive and undesirable shoreline land use.
17. Maps of wave approach, reflection, and coastline impingment at inlets or various test sites.
18. Tabulations of environmentally degrading coastal engineering structures.

C. Benefits From Use of ERTS-Derived Products

1. Cost Savings

2. Time Savings

   Public Land Savings

3. Savings in Environmental Protection

   - improved (cleaner) beaches.
   - more sanitary coastal water conditions
   - elimination of unsightly groins
   - pinpointing environmentally degraded coastal (shoreline) areas
   - pinpointing zones of serious coastal erosion
   - pinpointing areas worthy of preservation

V. SUMMARY AND CONCLUSIONS

A. Usefulness of ERTS Data for Coastal Zone Management to NJDEP

B. Summary of Impact and Practical Results to NJDEP

C. Significance of Results to ERTS Program (NASA)

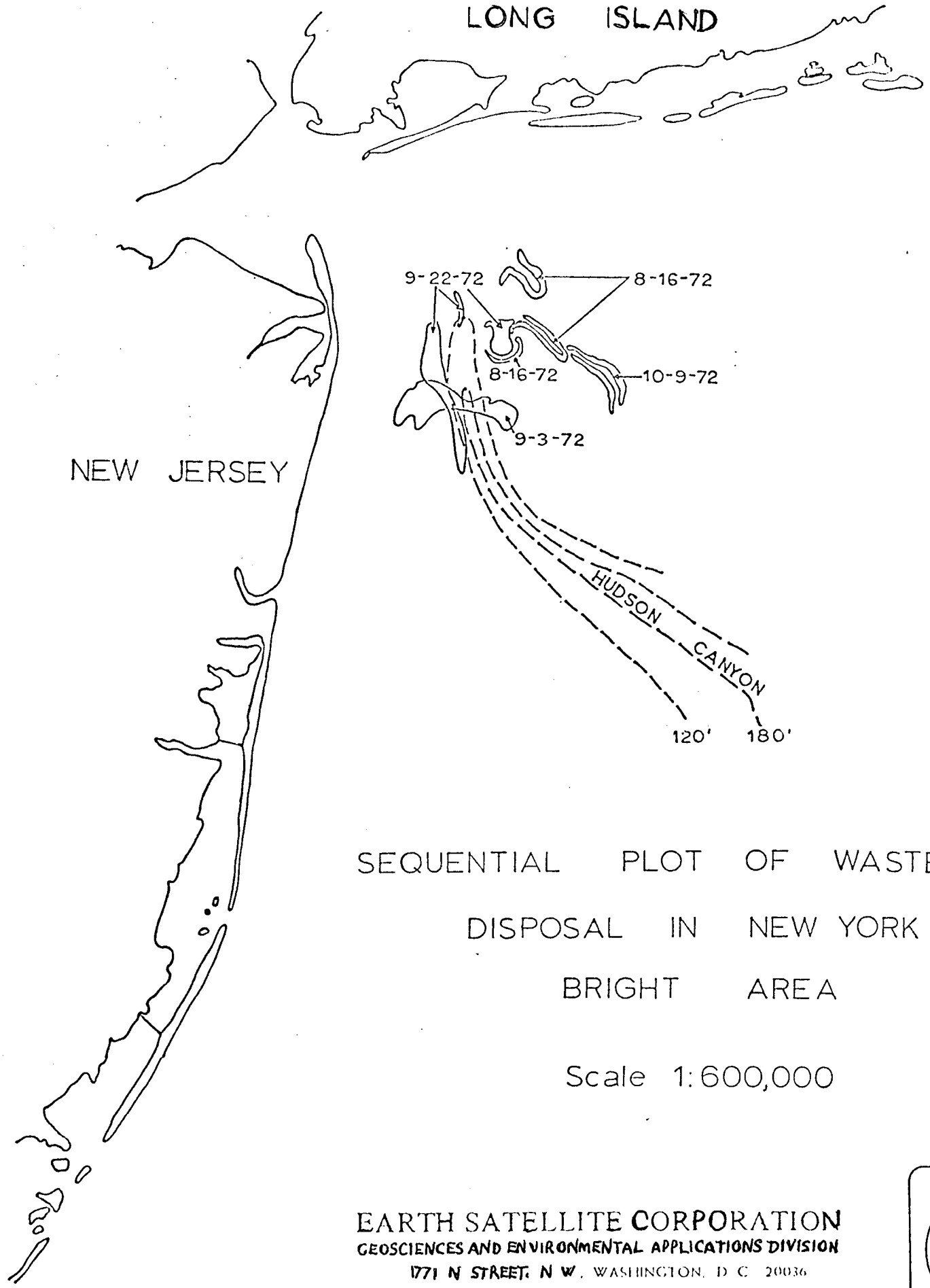
D. Recommended Applications to Other Regions and Problems

E. Statement of Continuing Project Needs

ACKNOWLEDGEMENTS

REFERENCES

APPENDICES



SEQUENTIAL PLOT OF WASTE DISPOSAL IN NEW YORK BRIGHT AREA

Scale 1:600,000

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1771 N STREET, N.W., WASHINGTON, D.C. 20036

APPENDIX F

CHANGE OF REQUEST FORM

STANDING ORDER FORM

ERTS 1 STANDING ORDER FORM

NDPF USE ONLY
D
N
ID
AA
REP
TM
TM A--

DATE December 18, 1972

USER ID NUMBER SA 29

PRINCIPAL INVESTIGATOR Dr. Frank Wobber ☐NEW

TELEPHONE NO (202) 785-1173 ☐NEW

SHIP TO Dr. Frank J. Wobber (NAME)

Earth Satellite Corporation (AGENCY)

1771 N Street, N.W. (STREET)

Washington, D.C. 20036 (CITY) (STATE) (ZIP)

☐NEW
☐CHANGE
☐DELETION
☐NEW ADDRESS

CATALOGS DESIRED

STANDARD ☐ U.S. ☐ NON-U.S.

DCS ☐

MICROFILM ☐ U.S. ☐ NON-U.S.

AREA NUMBER	GEOGRAPHIC POINTS LATITUDE	GEOGRAPHIC POINTS LONGITUDE	CLOUD COVER %	QUALITY	COVERAGE PERIOD START DATE	COVERAGE PERIOD STOP DATE	PROD TYPE	PROD FORMAT	TICK MARK	QUANTITY	RBV BANDS 1 2 3	MSS BANDS 1 2 3 4	DELETE
	40°33'N	74°21'W	8	6	111372	283073	S			2	✓ ✓ ✓	✓ ✓ ✓ ✓	
	40°33'N	73°23'W					M			2	✓ ✓ ✓	✓ ✓ ✓ ✓	
	38°47'N	73°57'W					P			2	✓ ✓ ✓	✓ ✓ ✓ ✓	
	38°47'N	75°05'W					T			2	✓ ✓ ✓	✓ ✓ ✓ ✓	

Four Corner Points of Area Over North America

Up To 30% Cloud Cover

Coverage From 4/15/72 To 10/01/72

Good Images Only

All Bands Desired

Copies

Figure 4.2 Standing Order Form

APPENDIX G

POSSIBLE NEW JERSEY ERTS INFORMATION PRODUCTS

POSSIBLE PRODUCTS & APPLICATIONS FOR NEW JERSEY ERTS DATA

1. Photomaps, overlays, or line-maps showing gross coastal circulation (as seen every 18 days).
2. Coastal maps as a function of various environmental parameters
   - wind rose overlays for varying wind direction and speeds
   - overlaying histograms of rainfall
3. Coastal maps showing areas of significant erosional or accretional change.
4. Coastal maps differentiating stable versus unstable shore areas.
5. Maps showing endangered areas due to:
   - extreme erosion
   - consistent polluted drift material
6. Maps or listings of estuarine flushing estimates.
7. Maps of unusual features such as:
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   - discharges that should not be there.
   - possible oil spill or ship bilge discharge
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9. Maps showing possible drift of spoils in relation to surface current.
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12. Map listing possible areas for outfall location
    - estimates of seaward and shoreward drift
    - areas of consistent seaward or shoreward drift
13. Possible maps of physical changes in estuarine areas.
14. Photomaps showing offshore bathymetry in relation to circulation
15. Photomaps showing changes in offshore depth (assuming good historical depth records exist).
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    - possible sand deposits for beach replinishment
17. Maps of desirable and undersirable shoreline land use.
18. Maps of wave approach, refraction, and coastal impingement at inlets and various test sites.