COASTAL MAPPING PROGRAM

PROJECT AK-9806
COMPLETION REPORT

ALASKA
YAKUTAT BAY

A Photogrammetric Survey based on 1998 Aerial Photographs

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
National Geodetic Survey
Remote Sensing Division

Agency Archive Copy

REMOTE SENSING DIVISION
COASTAL MAPPING PROGRAM

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COMPLETION REPORT

ALASKA
YAKUTAT BAY

Clearance

This report summarizes the photogrammetric operations related to project completion and is submitted for approval. The project data and this report meet the requirements and standards of the Remote Sensing Division's Coastal Mapping Program.

Submitted by,

Timothy Blackford

Timothy P. Blackford
Applications Branch

Approved:

Robert W. Rodkey, Jr.
Chief, Applications Branch
Remote Sensing Division

6/22/05
Date

Robert W. Rodkey, Jr.

Jonathan W. Bailey
Chief, Remote Sensing Division
National Geodetic Survey

6/23/05
Date

COASTAL MAPPING PROGRAM

PROJECT AK9806
COMPLETION REPORT

ALASKA
YAKUTAT BAY

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COASTAL MAPPING PROGRAM

PROJECT AK9806 SUMMARY

Introduction

Project AK9806 provides a highly accurate database of new digital shoreline data of Yakutat Bay, Alaska. The project covers an area from Phipps Peninsula at the mouth of Yakutat Bay to Disenchantment Bay in the north, as well as both Russell and Nunatak Fiords. Refer to the project diagram located in Appendix C.

The project database consists of information measured and extracted from aerial photographs and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using analytical photogrammetry and associated cartographic practices. Project survey data is referenced to the North American Datum 1983 (NAD 83).

Planning

The Requirements Branch of the Silver Spring Office formulated mission instructions for the data acquisition phase of this project as supplements to the Photo Mission Standard Operating Procedure Version II (7/1/93) and to the GPS Controlled Photogrammetry Field Operations Manual (1/2/96). These instructions discussed the project purpose, coverage, scope, and priority; photographic requirements; flight line priority; tide coordination; GPS data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact and communication information. A copy of these instructions are included in Appendix A. The Requirements Branch also furnished a project layout diagram, flight maps, waypoint files for the aircraft's flight management system, lists of geodetic control at base airports, and tide window predictions to the photo mission. A briefing was held to review the mission instructions, and distribute the data to the field personnel.

Field Operations

Kinematic GPS operations were used to acquire precise camera positions and to establish the control network necessary for aerotriangulation. For further information regarding the collection and processing of GPS data for this project refer to the GPS Processing Report in Appendix B. Aerial photographic survey operations for acquiring the color and infrared emulsions were conducted between July and August of 1998. The color photographs were taken using a Wild RC-30 camera with the NOS "A" lens cone, while the infrared photographs were taken using a Wild RC-10 with the NOS "Z" cone. The infrared photographs were acquired to assist in the interpretation of the shoreline during compilation phase. All the photographs were acquired at the nominal scale of 1:40,000.

Aerotriangulation

The aerotriangulation phase of this project was accomplished using the Integrated Digital Photogrammetry Facility (IDPF), which is a configuration of PWS analytical stereoplotters, computer hardware and software components, and other associated peripheral devices. Analytical aerotriangulation methods were applied to establish the network of precise GPS camera positions and other control for mapping and to provide model parameter and orientation elements required for analytical compilation. This work was achieved by the RSD Applications Branch and was completed in December of 1999. Ten digital cartographic feature files (DCFF) were defined in the project data base to provide for the data collection and management during the compilation phase. Refer to the Aerotriangulation Report in Appendix C for further discussion pertaining to this phase of operation. This report describes the overall operations that were performed during this phase, indicates the source photographs that were bridged, and includes an accuracy statement reflecting the maximum scale at which the compiled data may be plotted while maintaining a stated map accuracy. Further, the report includes diagrams that show the geographic coverage and layout of the photographic flight lines used in the project, a diagram depicting the horizontal error ellipses computed from the analytical solution, and the layout of the geographic cells which define the limits of the cartographic feature files.

Compilation

Office instructions to begin the project were issued through a memo by the Branch Chief in September of 1998. Since hydrographic surveying operations in Disenchantment Bay and the entrance to Russell Fiord were being scheduled for the summer of 1999, that portion of the project was given high priority for compilation. The instructions indicated a requirement for new shoreline in the rest of the project area due to reports of shifting from earthquake activity.

Due to time constraints, the compilation phase was initiated for the priority area in February 1999, before aerotriangulation was completed for the photo strips covering Russell and Nunatak Fiords. After compilation of the priority area, consisting of geographic cells 10443 and 10444, was completed in April 1999 it was forwarded to the Hydrographic Surveys Division (HSD) as a preliminary dataset. The project was then set back to the aerotriangulation phase for the addition of the remaining photo strips. Upon completion of this second aerotriangulation phase, compilation of the remainder of the project was resumed in December 1999 and completed in March of 2000.

Digital mapping was accomplished using the Integrated Digital Photogrammetry Facility (IDPF), which is a configuration of PWS analytical stereoplotters, computer hardware and software components, and other associated peripheral devices. Feature identification and the assignment of cartographic codes were based on the interpretation of 1:40,000 scale natural color photographs and supplemental infrared photographs. Nomenclature was assigned to cartographic features that needed further descriptions.

The source photographs used to compile the DCFF files are included in Appendix D.

Final Review

The final review was initiated in March of 2000. The digital cartographic feature files and Landmarks and Aids to Navigation listing were evaluated for completeness and meet the established NOS accuracy standards. Refer to the Aerotriangulation Report in Appendix C for additional information on the overall positional accuracy assessment with this project. Cartographic feature codes conform with the Nautical Charting Division's Standard Digital Data Exchange Format (SDDEF), version number 1, dated April 1, 1985.

Data review consisted of an on-line and off-line evaluation of digital compilation and hard copy products. The on-line review comprised of reviewing stereo models on the analytical stereoplotter for cartographic feature codes selection, positional accuracies of features and nomenclature. The offline evaluation compared hard copy plots with the largest scale nautical charts of the project area. and with color and black and white infrared photographs.

The charts used for this comparison were the NOS nautical chart 16761, Yakutat Bay, 1:80,000 scale, 14th ed., as well as the 1:10,000 scale inset. The Landmarks and Aids to Navigation listing was compared with the USCG Light List Publication of 1998 and the nautical charts, and the format file was reviewed for any apparent inconsistencies. The results of these comparisons can be examined by reviewing the Chart Maintenance Print (CMP).

Project Final Data And Products

Agency Archives:

Original Project Completion Report
Project Folder - containing: project database and aerotriangulation printouts, tide data, memos, field reports, etc.

Remote Sensing Division Electronic Data Library:

Project Database
Digital Cartographic Feature Files (DCFF): GC-10440 thru GC-10449
Copies of DCFFs in NCD-SDDEF format

Marine Charting Division Nautical Data Branch:

Copies of DCFFs in NCD-SDDEF format
Annotated Chart Maintenance Print

APPENDIX A

May 26, 1998

AK-9806
DISENCHANTMENT BAY,
AND
YAKUTAT HARBOR,
STATE OF ALASKA

General Information/Instructions - Aerial Imagery Survey

1.0. **General:** These instructions supplement the Photo Mission Standard Operating Procedure Version II, July 1, 1993.

1.1 **Introduction:** Aerial survey AK9806 is a survey to provide high resolution controlled photographic coverage of the shoreline of northern Disenchantment Bay and Yakutat Harbor. The survey is being conducted in cooperation with the Office of Coast Survey in partial completion of their Hydrographic Surveys project.

1.2. **Coverage:** These instruction cover the initial photographic flights of the designated survey area. Repeat flights are not anticipated.

1.3. **Scope:** 7 flight lines at 1:40,000 scale are required to provide adequate photographic coverage for determination and compilation of the contemporary location of the foot of each glacier and for compilation of new structures within Yakutat Harbor. Control for aerotriangulation will be provided by kinematic GPS data and photoidentification of image points should it prove necessary. Both color negative and black & white infrared emulsions are planned.

1.4. **Flight Line Numering:** Flight lines for this survey have been sequentially numbered from survey AK9804 to avoid confusion when loading way point data into the navigation GPS receiver.

2.0 **Photographic Requirements:**

2.1 All exposures will be taken along the flight lines indicated on the accompanying flight maps and way point files.

2.2 Flight lines 40-18 through 40-24 will be flown using the standard NOS color negative emulsion at an altitude that produces a nominal photographic scale of 1:40,000.

2.3. Flight lines 40-22 and 40-23 will also be flown using the standard NOS black & white infra red emulsion at an altitude that produces a nominal photographic scale of 1:40,000.

2.4. Expose all images so that they have a nominal endlap of 60%

2.5. All flight lines will be navigated using the GPS flight management system.

2.6. Flight lines may be patched if flown under GPS navigation and kinematic data are received for both sides of the split flight line.

2.7. Begin the second portion of a patched flight line at least two photographs before where the break was made.

2.8. All imagery shall be taken while the angle of the sun above the horizon is greater than or equal to 30°.

3.0. **Flight Line Priority:**

3.1. Flight lines 40-18 through 40-21 are the first priority of this aerial survey.

3.2. Flight lines 40-22 through 40-24 are the second priority of this aerial survey

3.3. Because of the mapping accuracy requirements for the compilation phase of this project, the mission commander is not afforded the discretion to alter the required photo scales without prior approval from the Requirements Branch.

4.0. **Tide Coordination:**

4.1. Flight Line 45-22 and 40-23 are to be flown to acquire black & white infrared imagery

4.2. The b&w ir photography will be coordinated with the stage of tide such that it is taken within the acceptable range to capture the MLLW indicated on the imagery acquisition tables provided with these instructions, for tide station: Yakutat, Yakutat Bay

4.3. Non-tide coordinated color imagery may be acquired at any time that weather and satellite conditions warrant but do not necessarily coincide with the low water window.

4.4. In the interest of expediency and economy flying the b&w ir in tandem with the color negative, to obtain the MLLW is preferred.

4.5. When flying tandem photography for this survey, the 80% endlap rule, for the slave camera, is not in effect.

5.0. **Photographic Control for Aerotriangulation:**

5.1. Kinematic and pseudorange GPS data requirements:

5.1.1. Kinematic GPS data are required for all natural color imagery acquired. It is especially important to acquire adequate kinematic GPS data for flight lines 40-18 through 40-21 as no photoidentification of image points will be possible in the northern area of Disenchantment Bay.

5.2. All flight lines may be flown without a bank angle restriction. However caution must be observed when banking so that all satellites being tracked remain locked. (See GPS SOP Section X. for further operational instructions.)

5.3. No support from the NGS Field Operations Branch is required for this aerial survey.

6.0. **GPS Reference Receivers:**

6.1. Primary Reference Receiver: Establish a GPS primary reference receiver station at the airport you choose as your base of operations.

6.1.1. Control is available at the following airports within the operating area of the aerial survey:

6.1.2. Yakutat Airport

6.1.3. Juneau International Airport

6.2. If preexisting control is not of first order or better, or conveniently located; set a PK nail in a convenient spot.

6.3. Observe 2 static GPS surveys over the PK nail, following standard GPS procedures, according to the following schedule:

6.3.1. If the nearest Continuously Operated Reference Station (CORS) is less than 50 Km away, observe 2 static surveys of 2 hours duration each.

6.3.2. If the nearest CORS is greater than 50 Km away, observe 2 static surveys of 4 hours duration each.

6.4. Secondary Reference Receivers: There is no requirement for secondary reference receivers for this aerial survey.

7.0. **Project Schedule/Priority:**

7.1. This survey is scheduled to be accomplished in May through August, 1998.

7.2. During the time on station in the survey area this survey has priority over all other aerial photographic/remote sensing activities. The Mission Commander may, with the prior approval of the Requirements Branch, temporarily move the mission to another aerial survey location dependent on weather and tidal conditions.

7.3. The Chief, Remote Sensing Division may alter or eliminate this priority.

8.0. **Data Recording/ Handling:**

8.1. Record GPS data, both in the aircraft and at the reference receiver at one (1) second epochs.

8.2. Download all data daily

8.3. Make a back-up copy of the GPS raw data and a copy of the GPS observation logs.

8.4. Send one (1) copy of the kinematic GPS data from the aircraft and static data and station logs from the reference receiver to Mr. Tim Blackford of the Applications Branch weekly, unless otherwise requested.

8.4.1. You will be notified when further in-house copies of the data have been made, at which time you may eliminate your copy.

8.5. Send EDI files to Mr. Brian Thornton of the Systems and Quality Assurance Branch in the exposed roll of film that correlates to the file when the film roll is sent to the photo lab for processing.

8.6. FAX a copy of the photographer's flight report for each roll of exposed film to the Requirements Branch when the film and the original report are sent to the contract photo laboratory for processing.

9.0. **General Guidelines for Aircraft GPS Operations:**

9.1. Download GPS satellite ephemeris and health data from the Arinc web site daily to ensure that the satellite constellation is adequate for kinematic operations. Their URL is: WWW.ARINC.COM\PRODUCTS_SERVICES\GPSSTAT.HTML Download the three files that pertain to the daily and monthly ephemeris and satellite health data. These will all run under the same SEM program that has been previously used.

9.2. Run satellite visibility plots and PDOP predictions daily.

9.3. Base daily operations on the most current satellite ephemeris.

9.4. Standard aircraft GPS initialization and survey close-out procedures apply.

9.5. Photographic operations will be conducted from one of the airports listed in Section 6.

10.0. **Satellite Lock:**

10.1. Receiver lock on a minimum of 4 satellites is required at all times during photographic operations for this project.

10.2. Receiver lock on satellites shall be in accordance with the specifications for kinematic GPS operations contained in the GPS SOP Section X, except as follows:

10.3. If loss of lock occurs while flying lines 40-18 through 40-21 follow the procedures outlined in the GPS SOP Section X. (Reestablish lock and re-fly the entire line where lock was lost.)

11.0. **Contacts/Communications:**

11.1. E-mail, FAX, or phone a project status or move report to the Requirements Branch daily, even if there has been no change in project status or progress. A report of "no progress" or "no change" is preferable to no report at all.

11.2. Check your E-mail box frequently; RS, Requirements Branch personnel will forward any project changes or other pertinent data to E-mail address: **Photo1@Earthlink.net**

11.3. For questions or information regarding the operational aspect of this project contact:

Brian Baldwin (Requirements Branch)
Phone: (W) 301-713-2671
(H) 301-530-5597
(FAX) 301-713-4572
Internet: Brianb@ngs.noaa.gov
Brianbaldwin@erols.com

11.4. For questions or information regarding the operational or theoretical GPS aspect of this project or in the event of total GPS failure contact:

Jon Bailey
Phone: (W) 301-713-1412
(H) 301-424-3630
(FAX) 30-1713-4572
Internet: Jbailey@ngs.noaa.gov

11.5. For questions regarding aerial camera maintenance or repair contact:

Steve Nicklas

Phone: (W) 301-713-2671
(FAX) 301-713-4572
Internet: SNicklas@ngs.noaa.gov

11.6. When communicating with anyone outside the Requirements Branch about any aspect of this project a copy of the communication must be forwarded to the Requirements Branch. This includes notifying the Branch that data have been sent.

12.0. Data Provided with these Instructions:

One copy of the original Project Layout Diagram
One floppy disk containing the files: (See section 14.0)
- AK9806.csv - comma separated version of flight lines
- AK9806.wpt - way point input to flight management system
- AK9806.xls - Microsoft Excel format of flight line input
- AK9806.ovl - Delorme Xmap V2.0 format of flight lines

One copy of tide window predictions for each station in the aerial survey area.
One copy of these instructions
Copies of NOAA Form 76-69 (Airport Survey Control Data) showing the geodetic control at the airports listed.
One copy of the listing of other geodetic control in the area.

13.0. Pilot Debriefing:

Before returning to their assigned duty stations either at the conclusion of photographic operations or at a crew swap, at least one pilot assigned to this aerial survey will report to Remote Sensing Division Headquarters to participate in a debriefing of photographic operations.

14.0. Miscellaneous:

Please note: Changes have been made to these instructions in Section 6. Regarding data handling and preexisting control that differ from previously issued instructions. These changes will hopefully clear up ambiguities in previous instructions and should be applied to all projects.

APPENDIX B

AK9806
Yakutat Bay
Alaska

GPS Processing Report
April 1999

INTRODUCTION

The Global Positioning System (GPS) data referred to in this report was processed to provide precise positions of camera centers, to be used as photogrammetric control in the aerotriangulation phase of the Coastal Mapping Program project AK9806 - Yakutat Bay. The datasets processed and the aerial photography covered by those datasets are listed in the table below:

Dataset	Date	Project(s)	Description / Flight Lines
98ACV211	07/30/98	AK9806	40-18, 40-19, 40-20, 40-21, 40-22, 40-23, 40-24
98JNU242	08/30/98	AK9806	40-A, 40-B, 40-C

DATA COLLECTION

GPS data was collected during two observing sessions in July and August 1998, as detailed in the table above. The procedures followed are described in the GPS Controlled Photogrammetry Field Operations Manual, of Jan. 2, 1996. All data was collected using Trimble 4000SSi geodetic receivers. For the first session a Trimble Compact L1/L2 antenna with Ground Plane was set up on a 2 meter fixed height tripod over station CORD 1992 at Merle K (Mudhole) Smith Airport (CDV) in Cordova, AK. This session was a kinematic survey with the rover receiver in the NOAA Cessna Citation II (N52RF) aircraft. This session was of about 3 hours 50 minutes duration with a measurement interval of 1 second. Seven flight lines were flown, and 98 photo events were recorded. No problems were reported by the field personnel in the observation log, but they did note that the aircraft traveled as far as 180 nautical miles (330 km) from the base station.

The next dataset was another kinematic survey by the NOAA Citation aircraft, this time with the base receiver antenna set up over the station EDDIE 1959 at Juneau International Airport. This session was of about 5 hours 30 minutes duration with a measurement interval of 1 second. Three flight lines and a patch were flown, and 46 photo events were recorded. No problems were reported by the field personnel in the observation log, but they did note that the aircraft traveled as far as 180 nautical miles (330 km) from the base station.

All observed data was downloaded daily from the receivers to a portable computer. At the end of each week the data files were copied to PCMCIA disks and forwarded to headquarters for processing. Upon receipt in the office, the datasets were backed up to optical disk and project folders were created for each

session. As it became available, additional data was downloaded from the network for use in the processing stage. This supplementary data included NGS precise ephemeris files for each session, and FIF files for each film roll.

REFERENCE RECEIVER POSITIONING

Since the reference (base station) receivers for both kinematic surveys occupied existing marks, with known coordinates published in the NGS database, there was no need to process any static GPS data to position the reference receivers. The published geographic coordinates of CORD 1992 and EDDIE 1959 on the NAD-83 datum are listed below:

	CORD 1992	EDDIE 1959
Latitude:	60° 29'37.36100"	58° 21'22.54427"
Longitude:	145° 28'31.52607"	134° 34'09.26188"
Ellipsoidal Height:	28.59 m.	8.95 m.

KINEMATIC PROCESSING

The aerotriangulation phase of this project was done in two stages. The first part was begun in November 1998 and included only those photographs acquired during the first kinematic survey on 7/30/98. The second part was not begun until the compilation phase of the first part was completed in April 1999, and included the photographs acquired during the second kinematic survey on 8/30/98. During this time span the RSD standard software for GPS post processing, the NGS developed program KARS (ver. 3/28/95), was replaced by Trimble GPSurvey (ver. 2.30). So the two datasets for this project were not only processed at different times, but using completely different software as well.

The first dataset (98ACV211) was processed in October 1998 using KARS, and utilizing the NGS computed precise satellite ephemeris, and standard meteorologic data. A continuous kinematic phase solution was obtained. The RMS had a couple spikes up to 5 cm, but generally ranged from 1-3 cm throughout the session. The RDOP value mostly varied between one and two, but had a brief 10-minute period at about 5.5 near the end of the last flight line. The product, RMS x RDOP (which is a reasonable estimate of the mean square positional error), generally remained below 7 cm, except for one brief peak to about 10 cm near the middle of the session. The session folder (AK9806 Day 211) on file in the RSD GPS Archive contains this report, plots of RMS and RDOP, a listing of event positions and times, and the field observation log.

The second dataset (98JNU242) contained a loss of lock at 20:01:41, near the middle of the flight. A KARS solution was attempted in September 1998 but was unsuccessful. Since the photo strips acquired during this flight were not needed immediately, the dataset was set aside for later processing. In April 1999 the dataset was reprocessed using GPSurvey with the precise ephemeris and standard meteorologic data.. The loss of lock could not be processed through in one pass without causing large errors in the solution. Thus two separate attempts were made to find a good solution. One processed the data forward from the beginning to the loss of lock; and one went backward from the end of the data to the loss of lock. Two Iono-free fixed continuous kinematic phase solutions were obtained. The RMS had a one early spike up to 4 cm, but was mostly from 1-3 cm the rest of the time. The RDOP value mostly varied between two and three with no significant spikes. The RMS x RDOP product typically hovered around 2-6 cm, but had a few short periods or spikes in the 9-10 cm range.

APPENDIX C

AK9806
Yakutat Bay and Russell Fiord
Alaska

Aerotriangulation Report
December 1999

AREA COVERED

The project area covers all of Disenchantment Bay, Russell Fiord, and Nunatak Fiord, and most of Yakutat Bay and the ocean side of Phipps Peninsula. The portion of Yakutat Bay which is not covered by this project is the northwest shore (Schooner Beach) between Point Manby and Blizhni Point south of 59°. See the Project Diagram for a depiction of the area covered. This project does not adjoin any other contemporary projects of the Coastal Mapping Program.

PHOTOGRAPHY

The photography used in the aerotriangulation phase consisted of ten strips of color and three strips of infrared. All strips were acquired at a nominal scale of 1:40,000 and a total of 111 color photographs were bridged. Since the tide stage for the area covered by the infrared photographs was unknown, it was determined that they would only be used in the compilation phase as supplementary source information. Therefore, the infrared strips were not bridged. All of the color photos were acquired using the A-cone, and the infrared photos were acquired using the Z-cone. Strips 40-18 through 40-24 were collected on 7/30/98 between 19:56 and 21:09 UTC. During this time the water level at the Yakutat tide gauge rose from 1.2' to 1.5' above MLLW (near the MLW value of 1.4'). Strips 40-A, 40-B, and 40-C were flown with both color and infrared in tandem on 8/30/98 between 19:20 and 20:32 UTC. The layout of the flight lines is shown in an attached diagram. Photographic coverage, resolution, overlap, and metric quality were adequate for the performance of the aerotriangulation phase.

CONTROL

No horizontal ground control stations (panels) were established prior to the collection of photography. One vertical control point was measured at runway end 29 of Yakutat Airport. All the color photography was controlled using airborne kinematic GPS positioning techniques with sufficient accuracy to control the analytical adjustment. Refer to the AK9806 GPS Processing Report for further information on the techniques used.

METHOD

The Aerotriangulation Phase of the project was completed in two parts. The first part included the photo strips covering Yakutat and Disenchantment Bays and the north half of Russell Fiord. The

second part included strips covering Nunatak Fiord and the south half of Russell Fiord. All photographs were bridged using analytical aerotriangulation methods to establish the network of photogrammetric control required for the compilation phase. Measurements were made utilizing an analytical stereoplotter, and the associated software and hardware configuration designated as the Integrated Digital Photogrammetric Facility (IDPF). All photos were measured and adjusted as a block. Analytical adjustments were effected using the General Integrated Analytical Triangulation (GIANT) program.

The Visual GIANT system was used to aid in the evaluation of the adjustment. It provided a graphic display of the horizontal and vertical standard deviations and residuals of measured points in the least squares solution. A plot of the horizontal standard error ellipses is attached.

The predicted circular horizontal accuracy for this project as a whole was computed using the root mean square (RMS) for the standard deviations of the triangulated ground points as calculated in the final execution of GIANT. See the attached listing for the results of this computation.

PROJECT DATABASE

A project database was created under the reference number AK-9806 and includes the following:

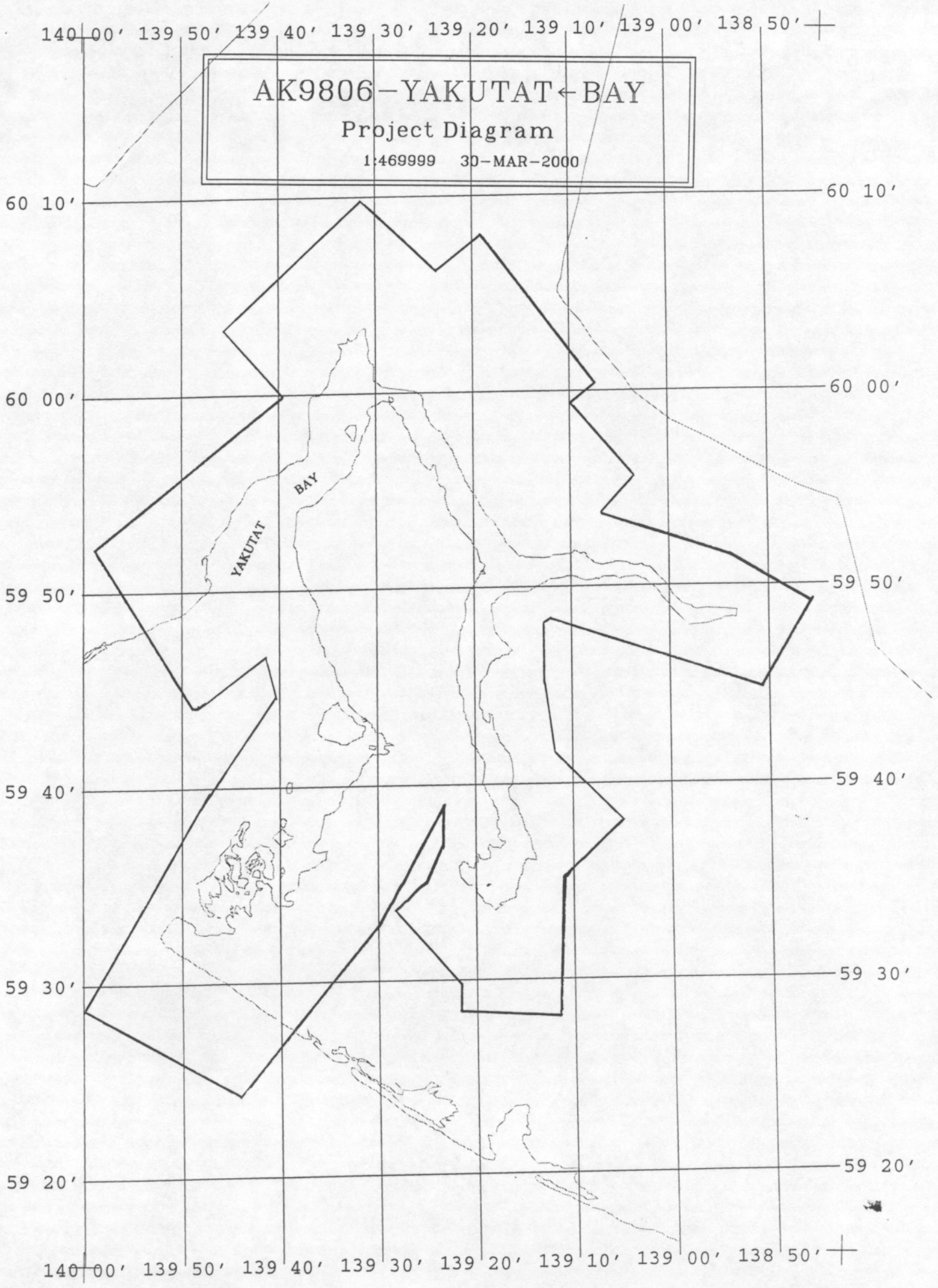
Project Parameters and Options
Coordinate Reference System Definitions
Camera Calibration Data
Initial Estimated Frame Position and Attitude Data
Refined Image Measurements
Ground Control Coordinates (Horizontal and Vertical)
Photo Group Definitions and GPS Antenna Offset Data
Adjusted Frame Position and Attitude Data
Adjusted Ground Point Image Coordinates
Geographic Cell Limiting Coordinates (see attached GC Diagram)

Positional data is based on the North American Datum of 1983, and is referenced to the Alaska 1 (Zone 5001) State Plane Coordinate System which uses an Oblique Mercator projection. Select models were set in the compilation scanning mode to insure the horizontal and vertical integrity of the GIANT solution and to determine the suitability of the database for use in the compilation phase.

Approved and Forwarded:

Robert W. Rodkey
Chief, Applications Branch

5/22/00
Date


AK9806—YAKUTAT←BAY
Project Diagram
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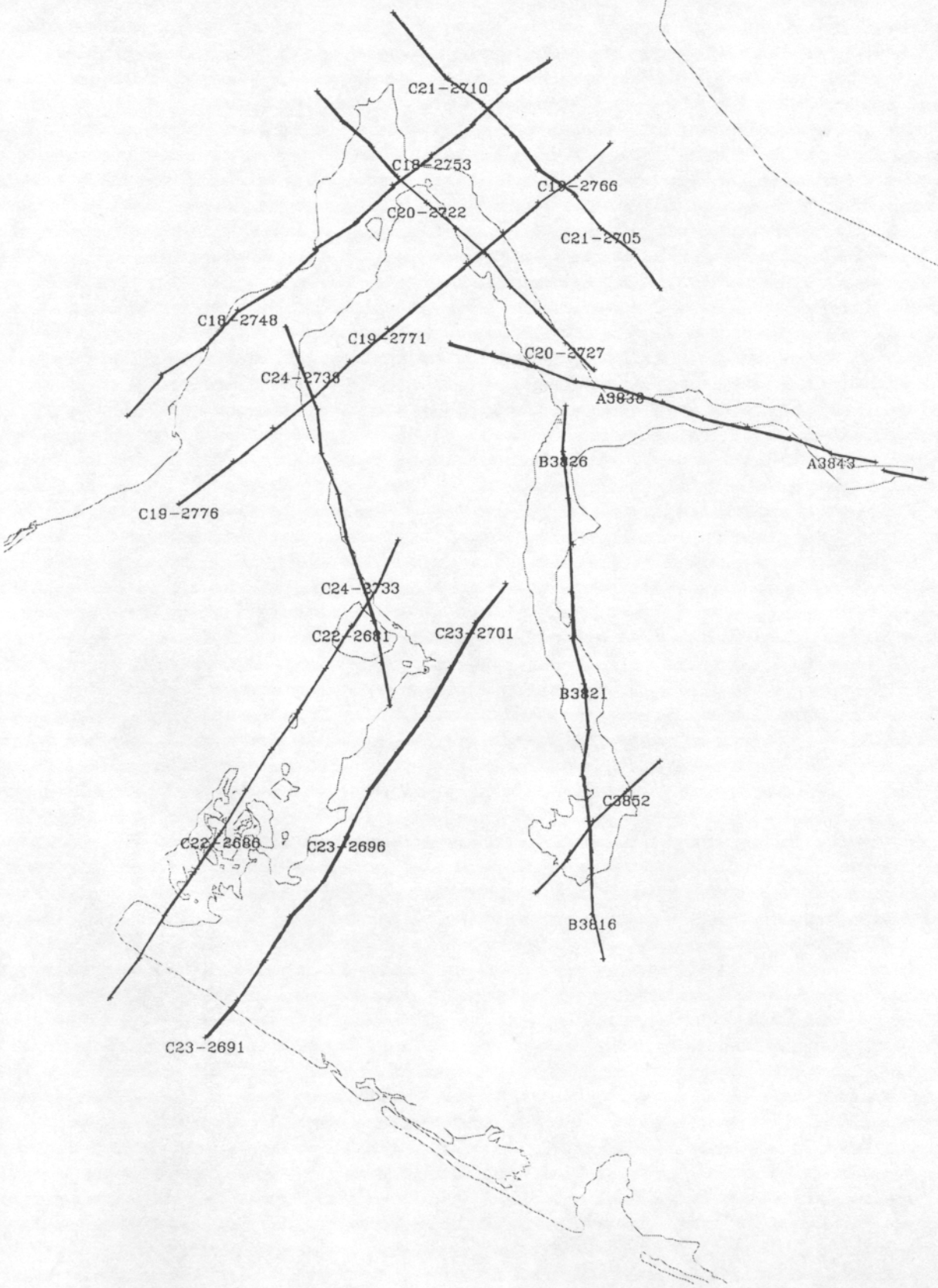
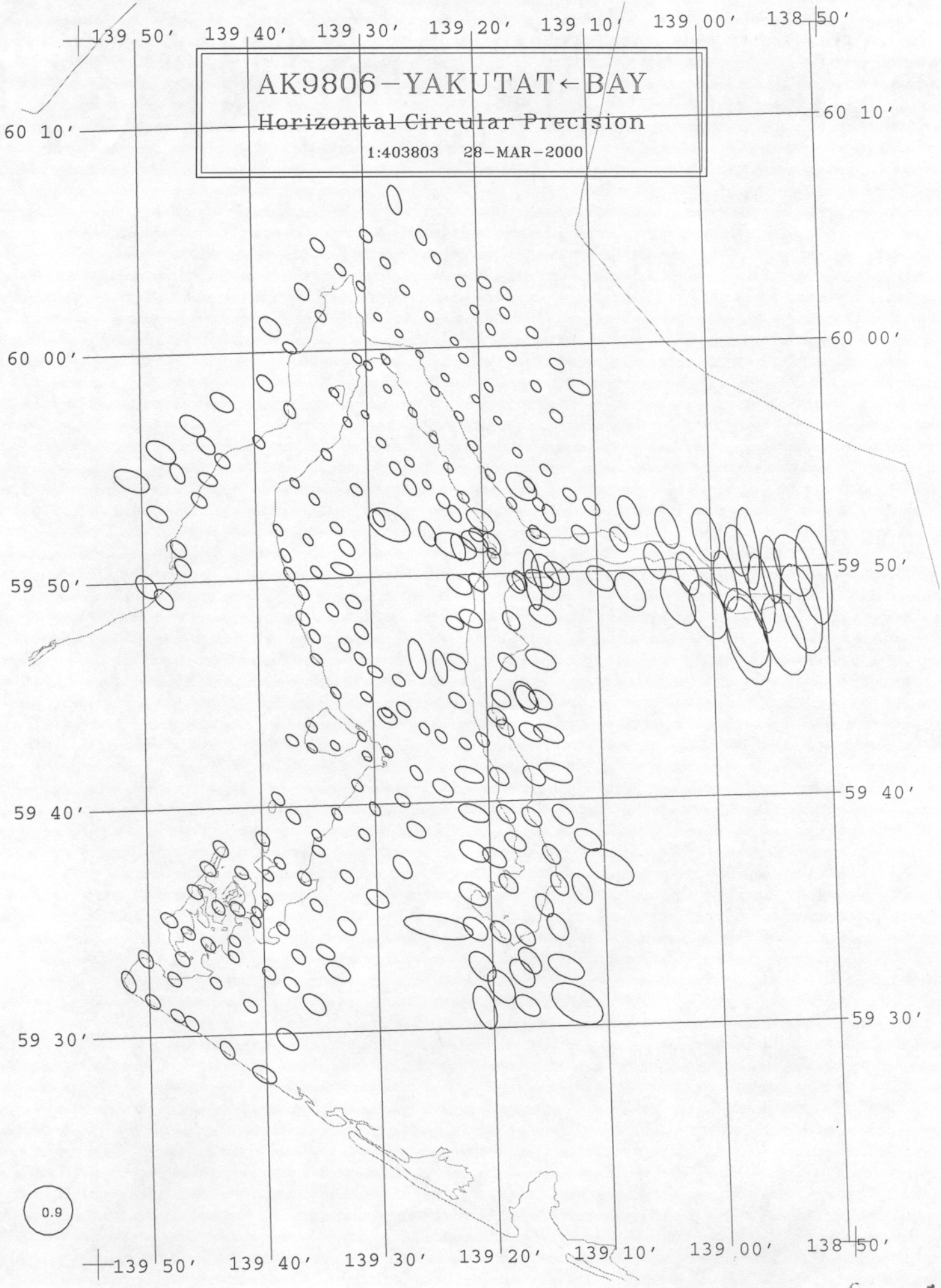
140 00′ 139 50′ 139 40′ 139 30′ 139 20′ 139 10′ 139 00′ 138 50′
60 10′
60 00′
59 50′
59 40′
59 30′
59 20′
YAKUTAT
BAY

AK9806-YAKUTAT←BAY

Flight Line of Color Photographs

1:403803 24-MAR-2000




AK9806-YAKUTAT←BAY
Horizontal Circular Precision
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139 50′
139 40′
139 30′
139 20′
139 10′
139 00′
138 50′
60 10′
60 00′
59 50′
59 40′
59 30′
0.9

PROJECT: AK9806-YAKUTAT_BAY

****

COVERAGE CENTER:
LONGITUDE: -1392223.96
LATITUDE: 594704.75

****

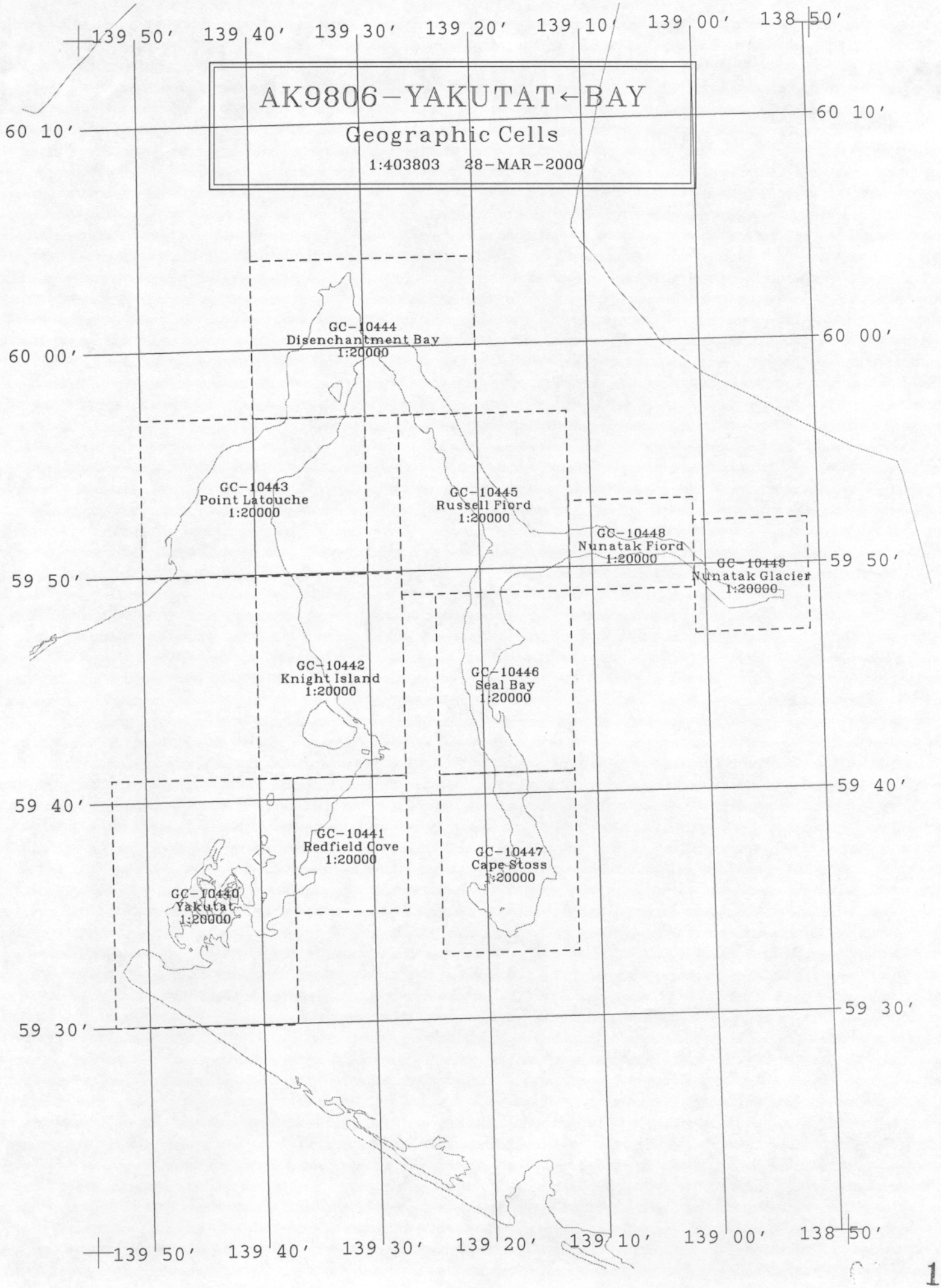
THE RADIUS OF THE 95% CONFIDENCE CIRCLE = 1.0394 METERS

FOR POINTS DETERMINED TO TWICE THE COMPUTED PRECISION
THE RADIUS OF THE 95% CONFIDENCE CIRCLE = 2.079 METERS
2.079 METERS = 0.3MM AT A MAP SCALE OF 1 TO 6929

THE RADIUS OF THE 90% CONFIDENCE CIRCLE = 0.9088 METERS

FOR POINTS DETERMINED TO TWICE THE COMPUTED PRECISION
THE RADIUS OF THE 90% CONFIDENCE CIRCLE = 1.818 METERS
1.818 METERS = 0.3MM AT A MAP SCALE OF 1 TO 6059

Listing A


AK9806–YAKUTAT←BAY
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60 10′
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59 40′
59 30′
GC–10444
Disenchantment Bay
1:20000
GC–10443
Point Latouche
1:20000
GC–10445
Russell Fiord
1:20000
GC–10448
Nunatak Fiord
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Nunatak Glacier
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Knight Island
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GC–10446
Seal Bay
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GC–10441
Redfield Cove
1:20000
GC–10447
Cape Stoss
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GC–10440
Yakutat
1:20000

APPENDIX D

DATA COMPILATION SOURCES

PROJECT: AK9806

PHOTOGRAPHY

DATE	TIME (UTC)	ROLL #	PHOTO #	SCALE	TIDE LEVEL
7-30-98	1957-2000	98ACN10	2682-2689	1:40,000	1.2 ft
7-30-98	2005-2008	98ACN10	2691-2699	1:40,000	1.2 ft
7-30-98	2025-2028	98ACN10	2719-2727	1:40,000	1.2 ft
7-30-98	2035-2038	98ACN10	2730-2739	1:40,000	1.3 ft
7-30-98	2053-2056	98ACN10	2745-2753	1:40,000	1.3 ft
7-30-98	2106-2109	98ACN10	2770-2776	1:40,000	1.5 ft
8-30-98	1921-1926	98ACN13	3817-3827	1:40,000	Unknown
8-30-98	1940-1944	98ACN13	3836-3844	1:40,000	Unknown
8-30-98	2030-2030	98ACN14	3855-3856	1:40,000	Unknown

TIDE LEVEL represents the verified NOS Six Minute Water Level Heights in feet above MLLW at the Yakutat tide station (#9453220) on the indicated dates and times.

APPENDIX E

LANDMARKS AND AIDS TO NAVIGATION
Cartographic Features of Nautical Charting Interest
31-MAY-00

Photogrammetric Project AK9806

HORIZONTAL DATUM: NAD 1983

GENERAL: Features indicated have been identified and measured from aerial photography using analytical photogrammetry. Consult the Nautical Charting Division Standard Digital Exchange Format (Version I) documentation for clarification of attributes; e.g., quality code (QC) and cartographic code (CC).

DATE / SOURCE	NCD QC	GEOGRAPHICAL POSITION LATITUDE	LONGITUDE	NCD CC	FEATURE DESCRIPTION
211/98	4	593224.851	-1395134.299	993	Tank
211/98	4	593228.298	-1395137.997	993	Tank

APPENDIX F

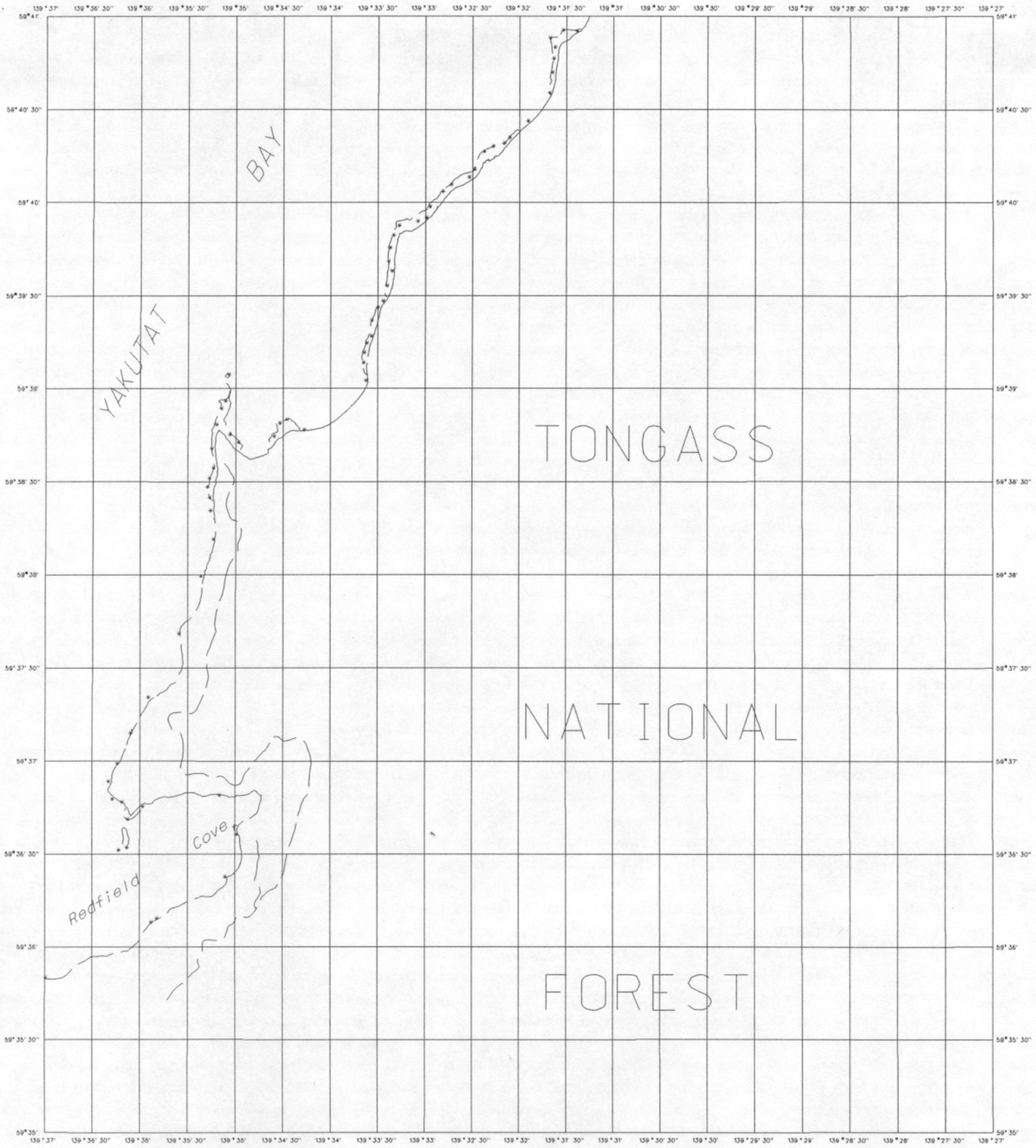
Date of Photography: July 1998

North American Datum 1983

AK9806

YAKUTAT BAY, AK

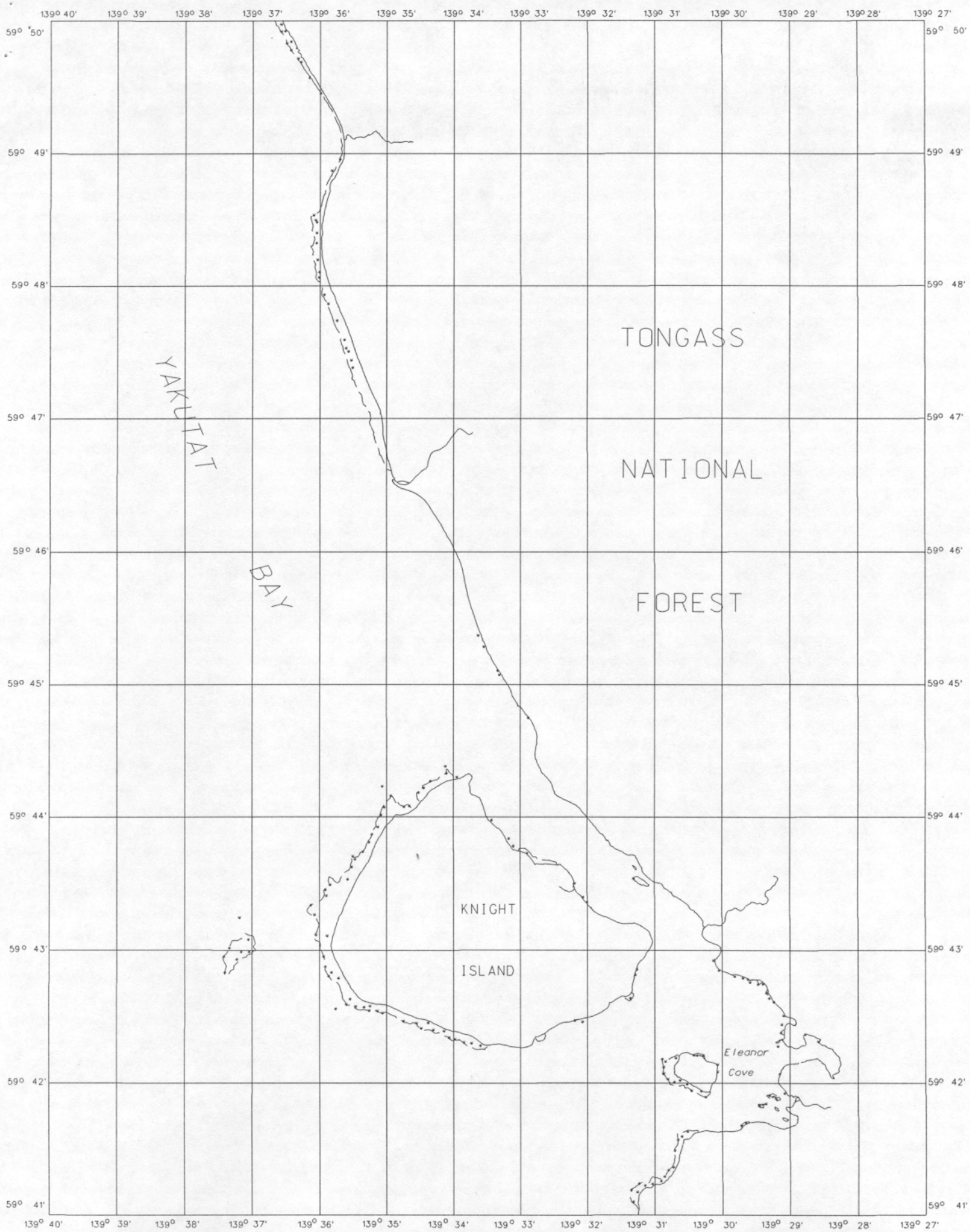
GC-10440



Date of Photography: July 1998

North American Datum 1983

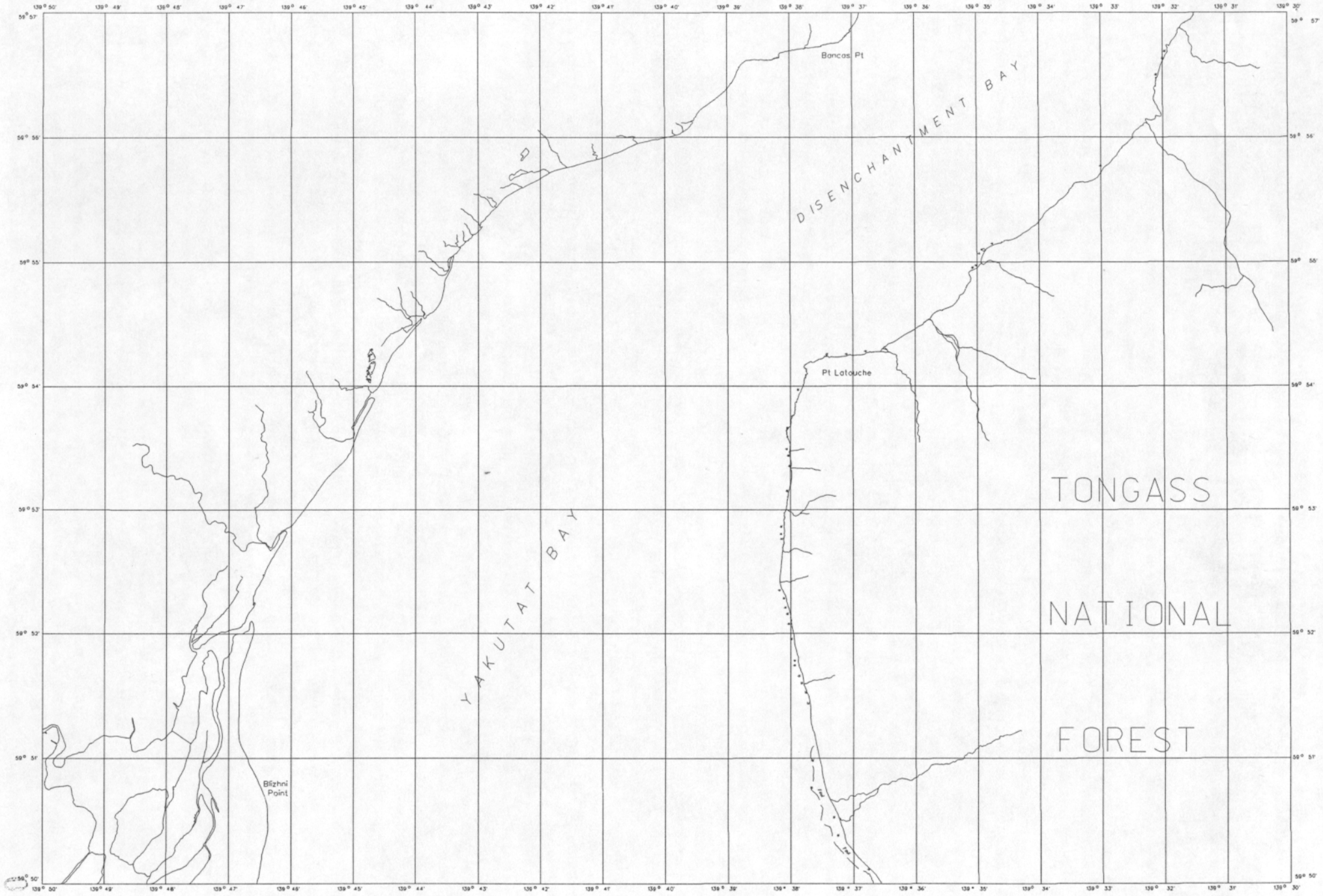
AK9806
YAKUTAT BAY, AK
GC-10441



Date of Photography: July 1998

North American Datum 1983

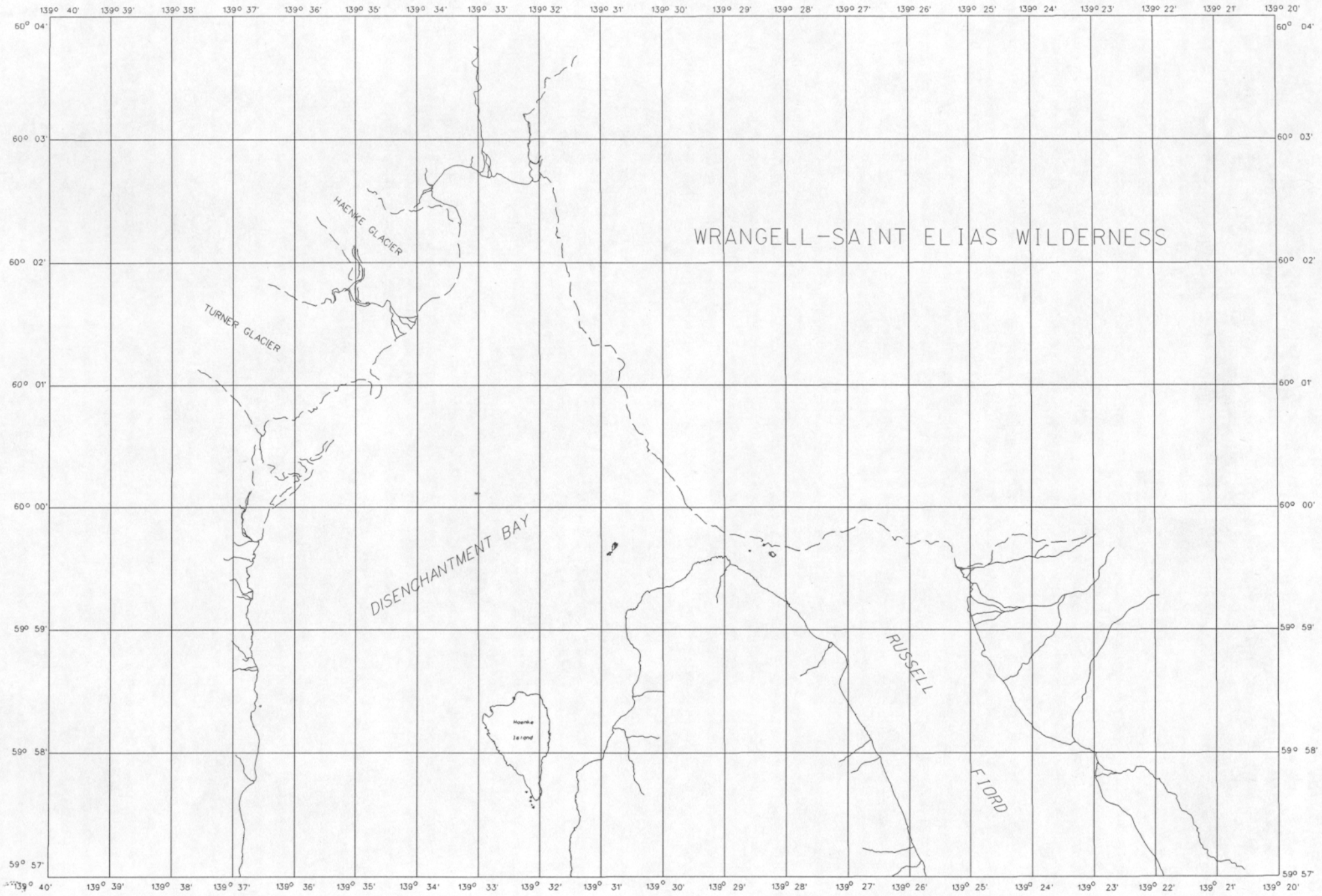
AK9806
Yakutat Bay, AK
GC-10442



DATE OF PHOTOGRAPHY: JULY 1998

North American Datum 1983

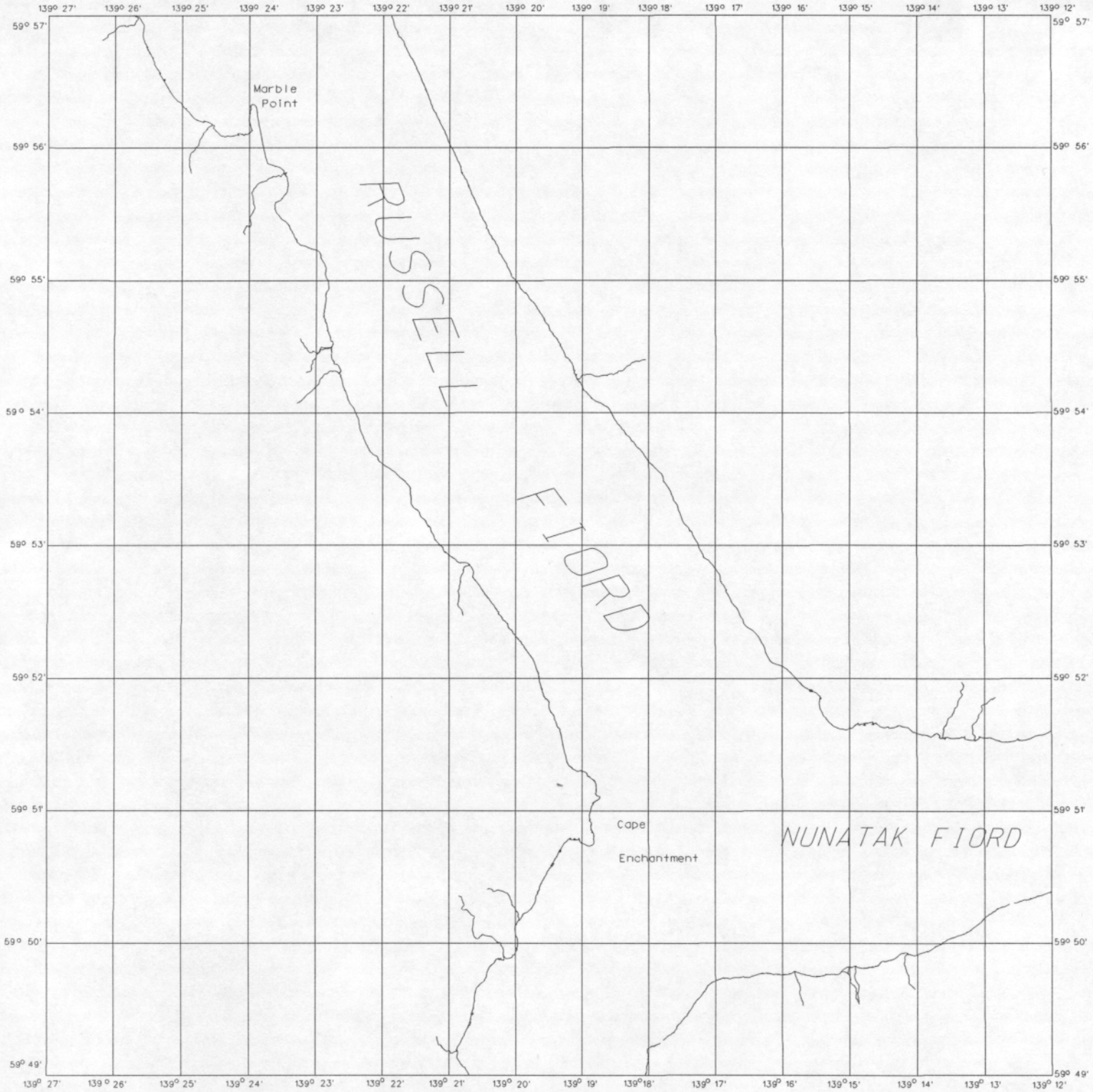
AK9806
Yakutat Bay, AK
GC-10443



Date of Photography: July 1998

North American Datum 1983

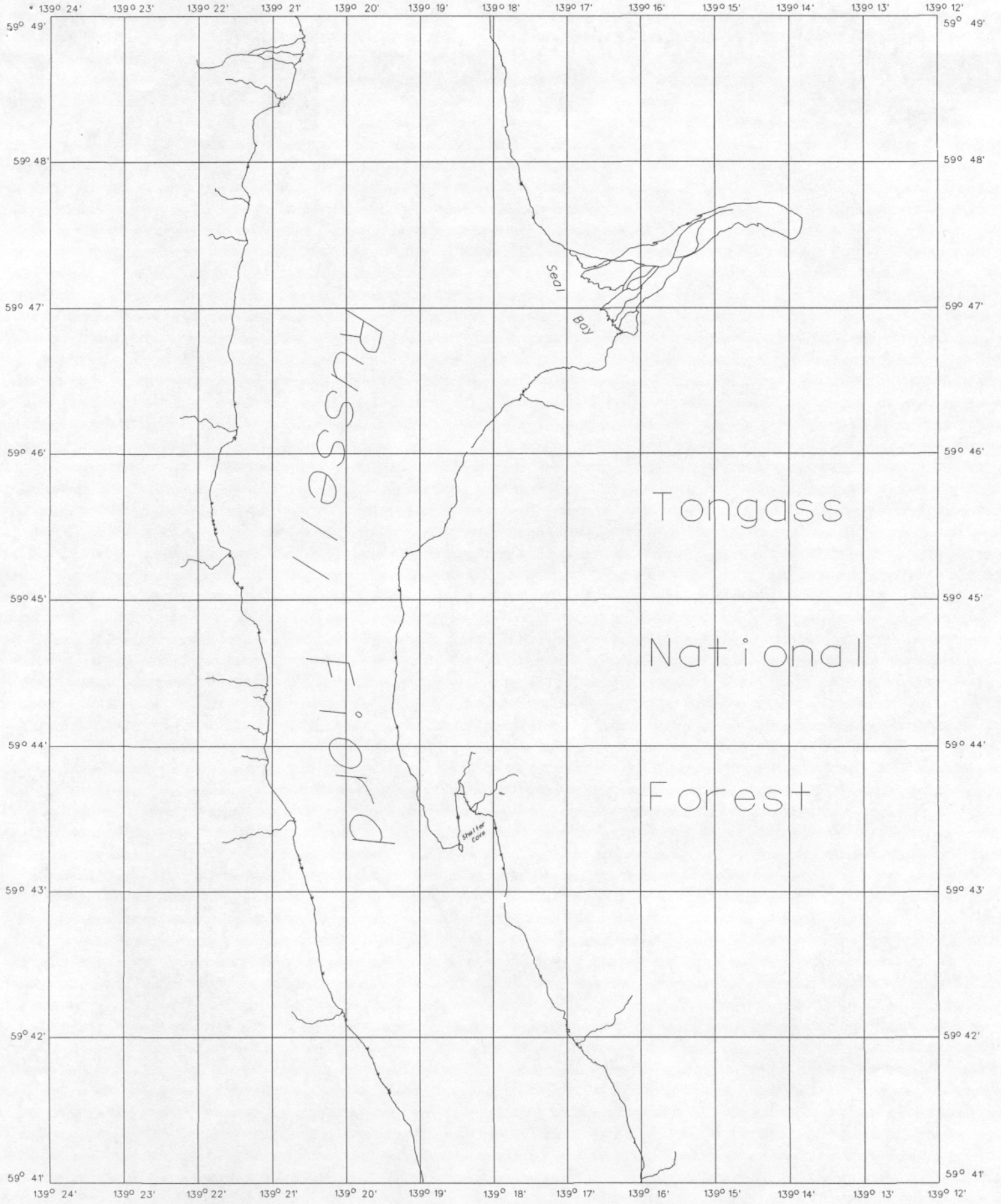
AK9806
Yakutat Bay, AK
GC-10444



Date of Photography: July-August 1998

North American Datum 1983

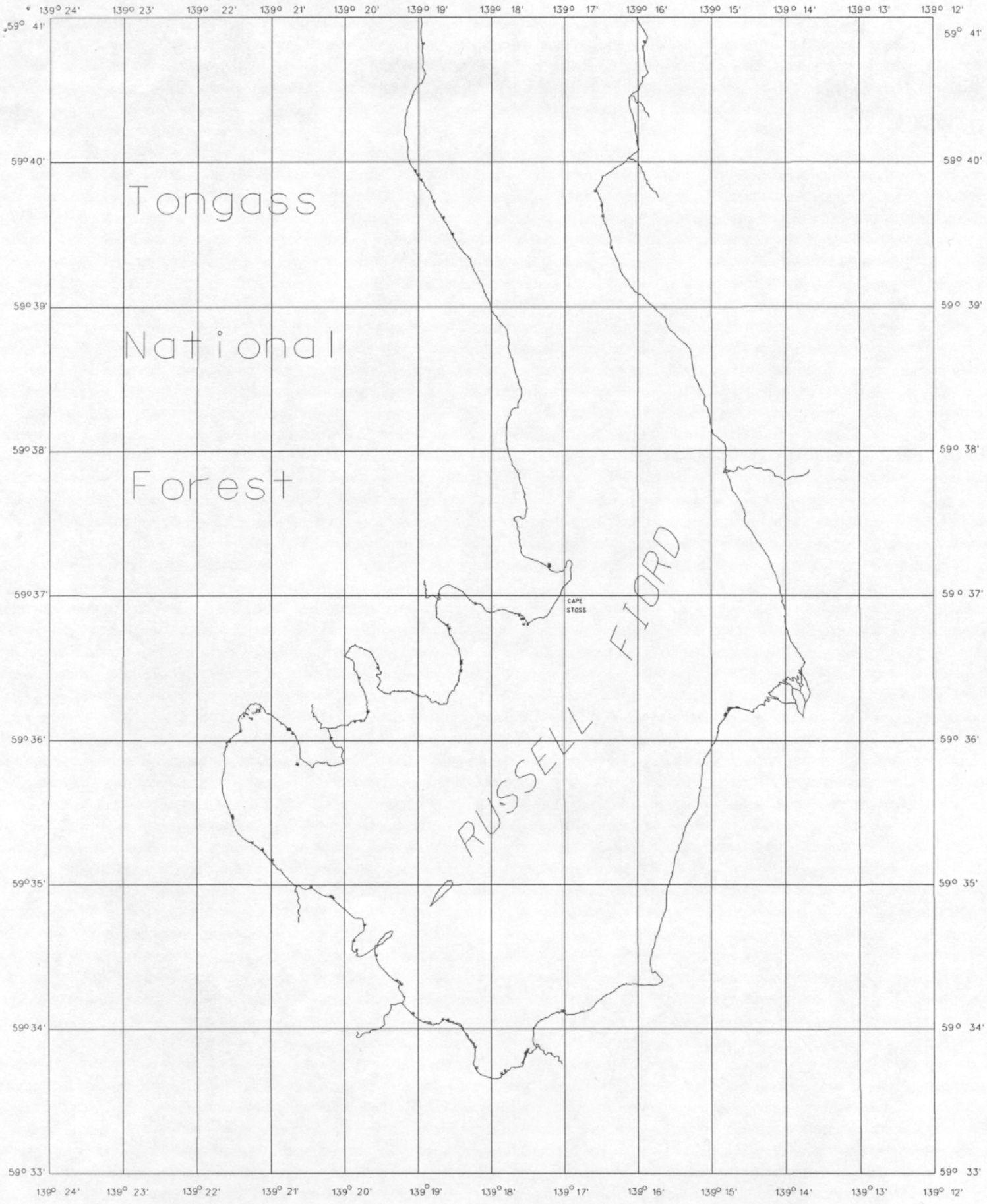
AK9806
Yakutat Bay, AK
GC-10445



Date of Photography: August 1998

North American Datum 1983

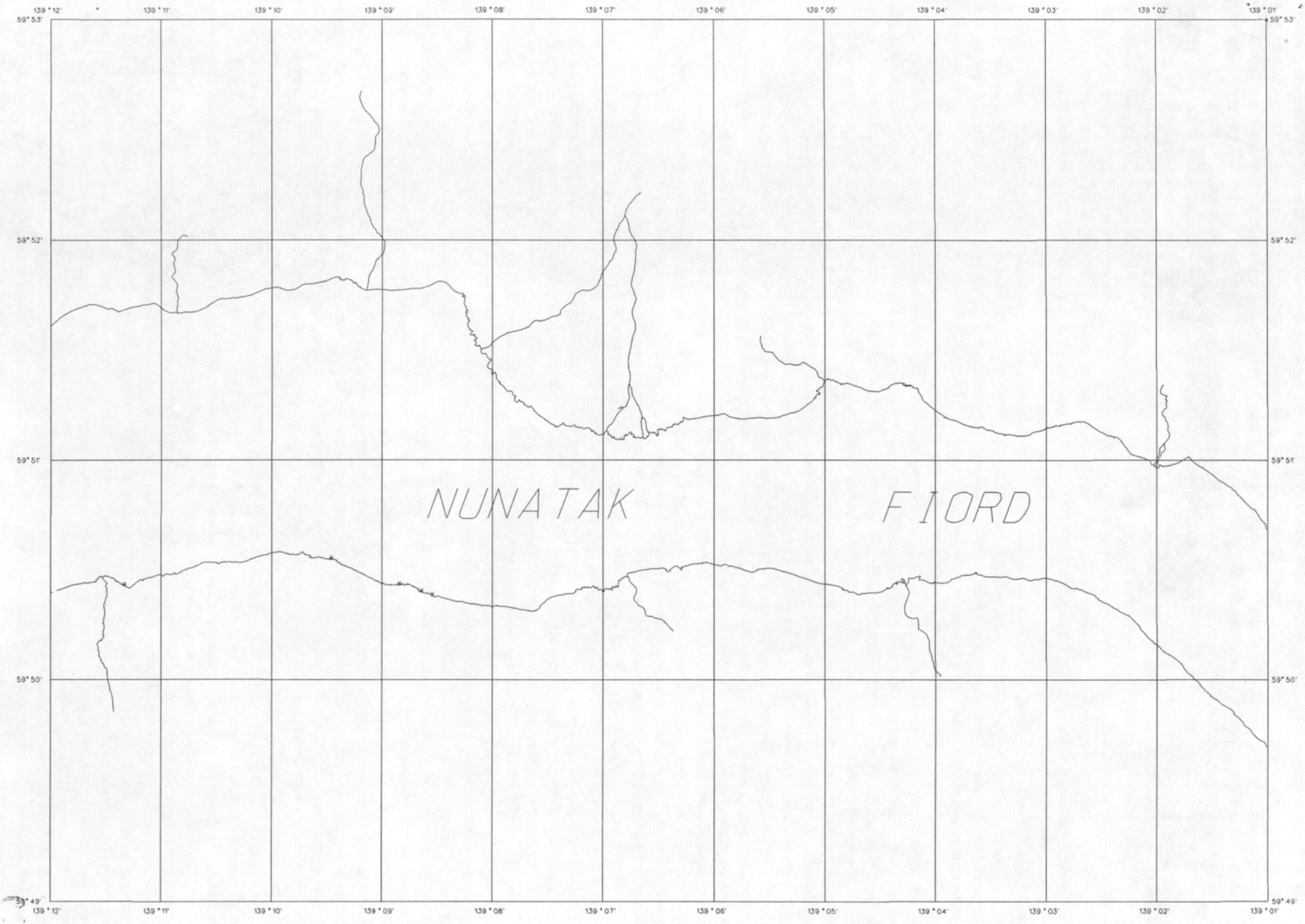
AK9806
Yakutat Bay, AK
GC-10446



Date of Photography: August 1998

North American Datum 1983

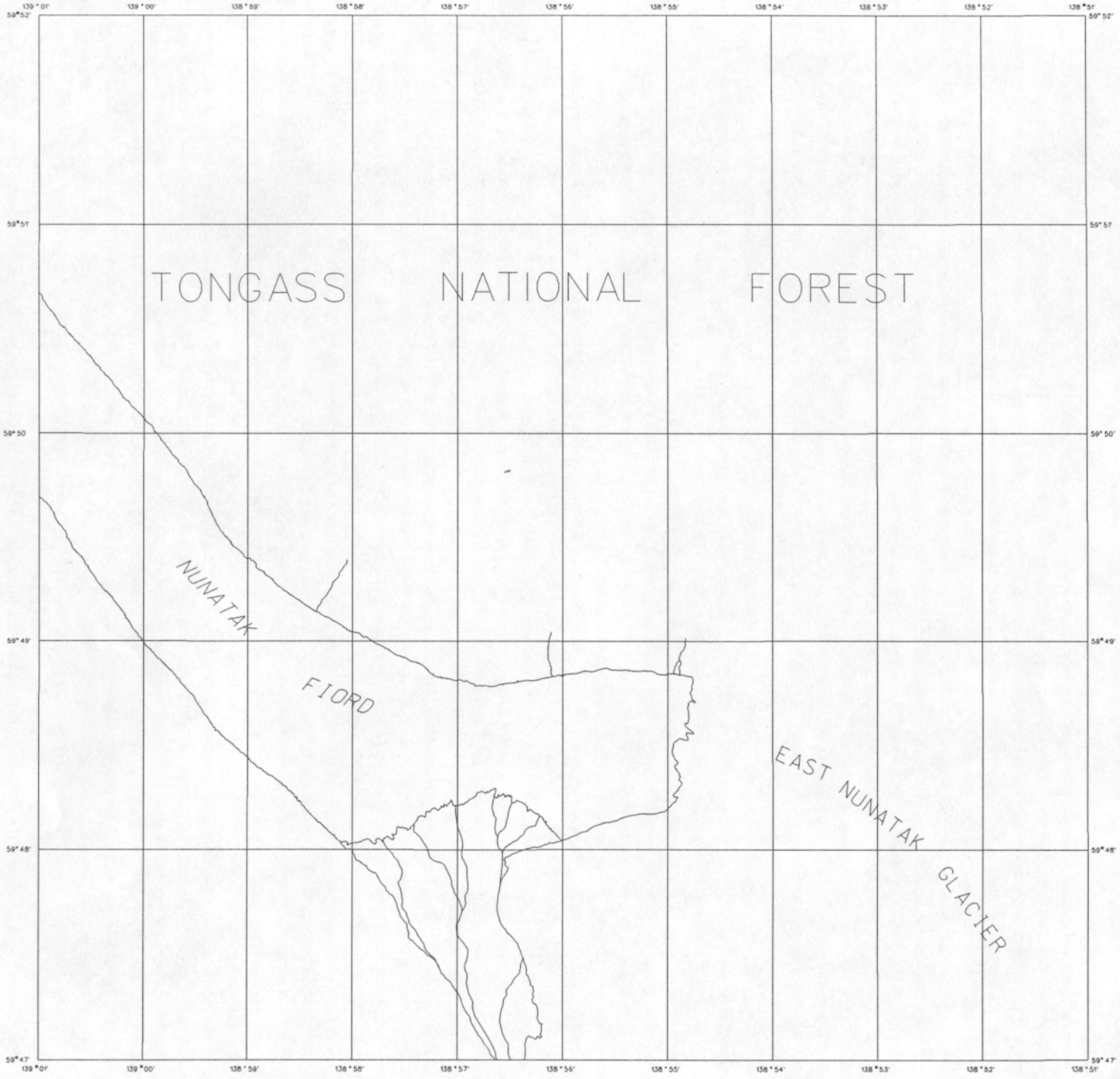
AK9806
Yakutat Bay, AK
GC-10447



Date of Photography: August 1998

North American Datum 1983

AK9806
Yakutat Bay, AK
GC-10448



Date of Photography: August 1998

North American Datum 1983

AK9806
Yakutat Bay, AK
GC-10449