

H11235

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

DESCRIPTIVE REPORT

Type of Survey HYDROGRAPHIC

Field No. N/A

Registry No. H11235

LOCALITY

State Oregon

General Locality North Pacific Ocean

Sublocality Approaches and Entrance to Tillamook Bay

2003

CHIEF OF PARTY

Mark Sinclair

LIBRARY & ARCHIVES

DATE

HYDROGRAPHIC TITLE SHEET

H11235

INSTRUCTIONS The hydrographic sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the office.

FIELD NO.

N/A

State Oregon

General Locality North Pacific Ocean

Sublocality Approaches and Entrance to Tillamook Bay

Scale 1:5,000

Date of Survey 6/19/2003 - 6/21/2003

Instructions Date 6/18/2003

Project No. S-N910-KRL-03

Vessel Tenix LADS Aircraft, VH-LCL

Chief of Party M. J. Sinclair, G. K. Stringfellow

Surveyed by Tenix LADS Inc.

Soundings taken by echo sounder, hand lead, pole Laser Airborne Depth Sounder

Graphic record scaled by N/A

Graphic record checked by N/A

Evaluation by G. Nelson

Automated plot by HP Designjet 800PS

Verification by G. Nelson

Soundings in Feet

at

MLLW

REMARKS: All times are recorded in UTC

Revisions and annotations appearing as endnotes were

generated during office processing.

All seperates are filed with the hydrographic data

As a result, page numbering may be interrupted or non-sequential

**DESCRIPTIVE REPORT TO ACCOMPANY HYDROGRAPHIC
SURVEY H-11235, 1:5000 IN 2003 BY TENIX LADS INC., LEAD
HYDROGRAPHER MARK SINCLAIR**

PURPOSE

A high-resolution hydrographic survey of the Approaches and Entrance to Tillamook Bay, Oregon has been conducted by Tenix LADS Incorporated using Airborne Laser Bathymetry technology. The National Oceanographic and Atmospheric Administration (NOAA) contracted Tenix LADS Incorporated to conduct this work using the LADS Mk II (Laser Airborne Depth Sounder) system.

The purpose of the survey was to provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area. The project objective is to obtain reconnaissance data to determine the current locations and depths on shoal features within the project area.

A. AREA SURVEYED

The LADS Mk II aircraft operated out of Boeing Field Airport, Seattle from June 18 to June 22, 2003. During this period two survey sorties were flown in the following survey area:

- Tillamook Bay Entrance Channel
- Reconnaissance lines Cape Flattery

A.1. TILLAMOOK BAY ENTRANCE CHANNEL

The contracted limits of the Tillamook Bay Entrance Channel survey area extend from the MHW line to at least the 20 meter contour (MLLW) or to the limit of capability based on water clarity. The following NAD 83 geographical coordinates provided by NOAA bound the limits of the survey area:

Latitude (N)	Longitude (W)
45°.55942796	123°.96546397
45°.55942798	123°.98277801
45°.57425700	123°.98277699
45°.57425700	123°.96548102
45°.57081498	123°.96548100
45°.56834902	123°.94235500
45°.56402001	123°.93645998
45°.56738305	123°.96548096

This comprises a surveyed area of 0.9 sq nm.

The data collected extends beyond these limits and is bounded by the following NAD 83 geographical coordinates:

Latitude (N)	Longitude (W)
45°.58116618	123°.99981549
45°.58170911	123°.93573366
45°.55470963	123°.93528543
45°.55416721	123°.99933657

The survey data for Tillamook Bay Entrance Channel is provided on 1 separate 1:5000 sheet with the following sheet limits:

NAD 83 Position			
	Degrees Latitude (N)	Degrees Longitude (W)	
<i>Sheet 1</i>	NW corner	45°.584247	123°.984532
	SE corner	45°.549638	123°.935271

The survey location and the required survey area and smooth sheet layout are provided below.

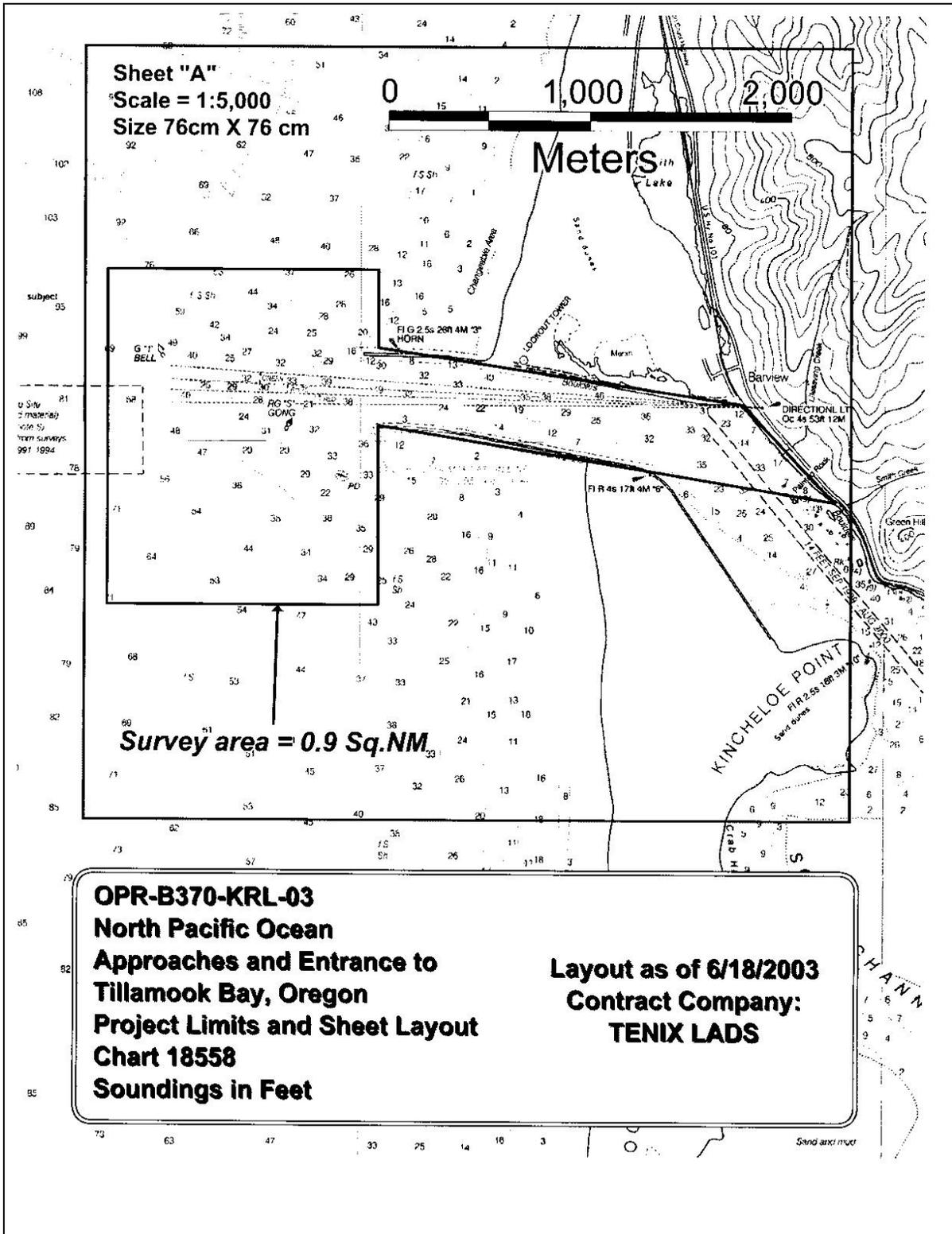


Figure 1- Tillamook Bay Entrance Channel smooth sheet layout

B. DATA ACQUISITION AND PROCESSING

Refer to the Data Acquisition and Processing Report¹ for a detailed description of the equipment, processing and quality control procedures. A general description and items specific to this survey are discussed in the following sections.

B.1. EQUIPMENT

Data collection was conducted using the LADS Mk II Airborne System, data processing using the LADS Mk II Ground System and data visualization and quality control using Caris HIPS 5.3 and Micro Station version 8 was used for the final product.

B.1.1. Airborne System

The LADS Mk II Airborne System (AS) consists of a Dash 8-200 series aircraft which has a transit speed of 250 knots at altitudes of up to 25 000 feet and an endurance of up to eight hours. Survey operations are conducted from heights between 1200 and 1800 feet at ground speeds between 140 and 175 knots. The aircraft is fitted with a Nd: YAG laser which is eye safe in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers. The laser operates at 900 Hertz to provide 5x5 or 4x4 meter laser spot spacing in the main line sounding mode of operation, and is mounted on a stabilized platform. These modes require an aircraft speed of 175 or 140 knots over the ground, and operate across a laser swath width of 240 or 192 meters. The electro-mechanical scanner also provides examination modes of sounding with laser spot spacings of 3x3 and 2x2 meters and swath widths of 100 and 50 meters respectively.

Green laser pulses are scanned beneath the aircraft in a rectilinear pattern. The pulses are reflected from the land, sea surface, within the water column and from the seabed. The green returned laser energy is captured by the green receiver and then digitized and logged onto digital linear tape. An infra-red laser is also directed vertically beneath the aircraft. The height of the aircraft is determined by the received infra-red laser reflection, which is supplemented by an Attitude and Heading Reference System inertial height reference and GPS height. The LADS Mk II system can operate by day and night, and operations at night are enhanced by removing a daylight filter from the receiving optics. Real-time positioning is obtained by either an Ashtech GG24 GPS receiver combined with Wide Area DGPS provided by Thales Geosolutions or an Ashtech GG24 providing stand-alone GPS. Ashtech Z12 GPS receivers are also provided as part of the Ground System to log KGPS data at a locally established reference station.

B.1.2. Ground System

A portable Ground System ‘Hobbit’ was deployed in the aircraft from the Cold Bay, Alaska site office to Seattle for the Tillamook Bay project. The LADS Mk II Portable Ground System Hobbit, consists of a Digital Alpha Workstation 500AU single processor server with 256MB ram, up to 140GB disk space, DLT drives, DAT drives and networked to a series of personal computers to provide the user interface to the hydrographic surveyor, HP 750c

DesignJet plotter, printers and QC workstations. Data validation was conducted in Seattle on Hobbit to provide the client with preliminary data.

Survey data was checked in the Cold Bay, Alaska site office on the LADS Mk II Ground System 'Gandalf'. Ground System Gandalf, consists of a Compaq Alpha ES40 3 processor server with 1 GB EEC RAM, 764 GB disk space, DLT drives and magazines, DAT drive, CD ROM drive and is networked to 12 Compaq 1.5 GHz PCs to provide the user interface to the hydrographic surveyor.

Quality control checks and editing was conducted on Ground System Hobbes, comprising a four CPU Compaq (DEC) Alpha Series 4100 multi-processor server with 256MB RAM, up to 750GB disk space, digital linear tape (DLT) drives, digital audio tape (DAT) drives and networked to a series of X-term or personal computer operator consoles, HP 750c DesignJet plotter, printers and QC workstations.

Final data approval and deliverables were performed on Ground System Frodo, comprising a three 833 MHz CPU HP (Compaq) ES40 Alpha Server with 1 GB RAM, 600 GB disk space, digital linear tape (DLT) drives, digital audio tape (DAT) drives and networked to a series of X-term or personal computer operator consoles, HP plotter, printers and QC workstations.

The GS supports survey planning, data processing, quality control and data export. The GS component also includes a KGPS base station which provides independent post-processed position and height data. A comprehensive description of the GS is provided in the Data Acquisition and Processing Report.

B.2. QUALITY

B.2.1. Data Density

The survey area was sounded at 3x3 and 4x4 meter laser spot spacing with 40 and 80 meter line spacing. The channel centerline was also surveyed using a 5x5 meter laser spot spacing to improve coverage and to achieve the maximum swath width across the entrance channel and between the breakwaters.

At the sea surface the footprint of the laser beam is approximately 2.5 meters in diameter. As the beam passes through the water column it slowly diverges due to scattering. It should be noted that at 4x4 meter laser spot spacing there is a gap of between 1 to 1.5 meters between the illuminated area of adjacent soundings at the sea surface. There is a possibility that small objects in shallow water along the coastline may fall between consecutive soundings and not be detected.²

B.2.2. Water Clarity

The water clarity was fair for laser survey with high turbidity around the breakwaters. Survey operations were programmed around high water. The best conditions for laser survey were experienced just after high water when the start of the ebb stream prevented the turbid longshore drift from sweeping around the head of the northern breakwater and into the channel. The maximum lidar depths measured during the survey exceeded 15 meters, which

has allowed the entrance bar to be defined along with the breakwaters and banks on either side of the channel.³

B.2.3. Data Acquisition

Survey operations were conducted around high water for Tillamook Bay on the 19 and 21 June, 2003. The first Sortie on the 19 June was conducted on a flooding tide. Localized turbidity was encountered around the breakwaters, however, it was observed that the data quality improved at and just after slack high water. Favorable sea states prevailed over several days prior to our arrival on site and continued between the first and second sortie. Favorable sea conditions and targeting the slack high water tide on the 21 June improved data quality and coverage on the second sortie.

B.2.4. Sea Conditions - Sea State, Waves, Swell, White Water

The sea state, which ranged from 1-2 meters throughout the survey, was suitable for airborne laser survey. White water along the coast on either side of the breakwaters walls was still significant. Some noise was detected in the surf zone from breaking waves and general mechanical action of the surf zone in less than one meter of water.

Long period swell created some datum errors in the data and due to redundant coverage this data has been deleted.⁴

B.2.5. Datums

On completion of both flights the GPS data logged on the aircraft and at the base station is processed to determine the KGPS position and height of the aircraft. This data is used in the calculation of the sea surface datum.

B.2.6. Wind

Maximum wind strengths did not exceed 10 knots during the survey. In general the wind strength was around 7 knots from the northwest.

B.2.7. Cloud

Low cloud and high ground was a significant factor during survey operations. Survey operations were conducted at 1800 feet in the northern extent of the survey area due to high ground. During the second sortie survey operations were conducted at 1200 feet to avoid low cloud and a delay of 30 minutes was experienced due to reduced visibility from a heavy rain shower.

B.2.8. Data Processing

The data was processed at the temporary office site in Silver Cloud Inn University Village in Seattle on return from each sortie. Final validation of the data was conducted at this site. Checking was conducted at the Tenix LADS Incorporated site office in Cold Bay, Alaska, and the data was approved at the depot in Adelaide, Australia.

B.2.9. Interim Data

Interim lidar data was provided to NOAA for Tillamook Bay Entrance Channel on June 27 prior to departing from Seattle. The interim data supplied as a Dangers to Navigation report (DTON) on 27 June 2003 are provided in Part D.⁵ Data was also provided in Caris readable format on CD.

In addition, Interim Data was also provided to confirm the format for the final deliverables, as follows:

- a. 10th September 2003 Descriptive Report, smooth sheet and Microstation files.
- b. 7th October 2003 smooth sheet and digital data files.

B.2.10. Final Data

Final data for Tillamook Bay Entrance Channel was dispatched on 24th October 2003.⁶

B.3. DIGITAL DATA FORMATS

Refer to DARPA Appendices I and II.

B.4. CROSSLINES

A single cross line was planned over the Entrance Channel Bar after the majority of main lines had been completed.

The cross line was sounded at 4x4 meter laser spot spacing, producing a total of 11438 comparisons on individual depths as follows:

- Line 125.0.1 365 cross line comparisons.
- Line 129.0.1 571 cross line comparisons.
- Line 130.0.2 280 cross line comparisons.
- Line 131.0.2 751 cross line comparisons.
- Line 132.0.5 472 cross line comparisons.
- Line 133.0.1 165 cross line comparisons.
- Line 133.0.2 1110 cross line comparisons.
- Line 133.0.3 984 cross line comparisons.
- Line 134.0.3 796 cross line comparisons.
- Line 135.0.2 326 cross line comparisons.
- Line 135.0.4 1440 cross line comparisons.
- Line 136.0.1 1447 cross line comparisons.
- Line 136.0.3 292 cross line comparisons.
- Line 137.0.2 837 cross line comparisons.
- Line 137.0.3 796 cross line comparisons.
- Line 139.0.2 662 cross line comparisons.
- Line 140.0.2 144 cross line comparisons.

B.4.1. Mean Depth Differences (MDD) and Standard Deviation (SD)

The averages of the mean depth differences and standard deviation for the crossline are as follows:

B.4.2. Tillamook Bay Entrance Channel

Run No.	Comparisons	Mean Confidence	Average MDD	Average SD
11.0.3	11438	5.4	0.01 +/- 0.09	0.26 +/- 0.04

Crossline comparison details are provided in the Section D of the Separates Report.

These results are consistent with IHO Order-1 depth accuracy for all depths.⁷

B.5. ANALYSIS OF RESULTS

PLOT SOUNDINGS HISTOGRAM

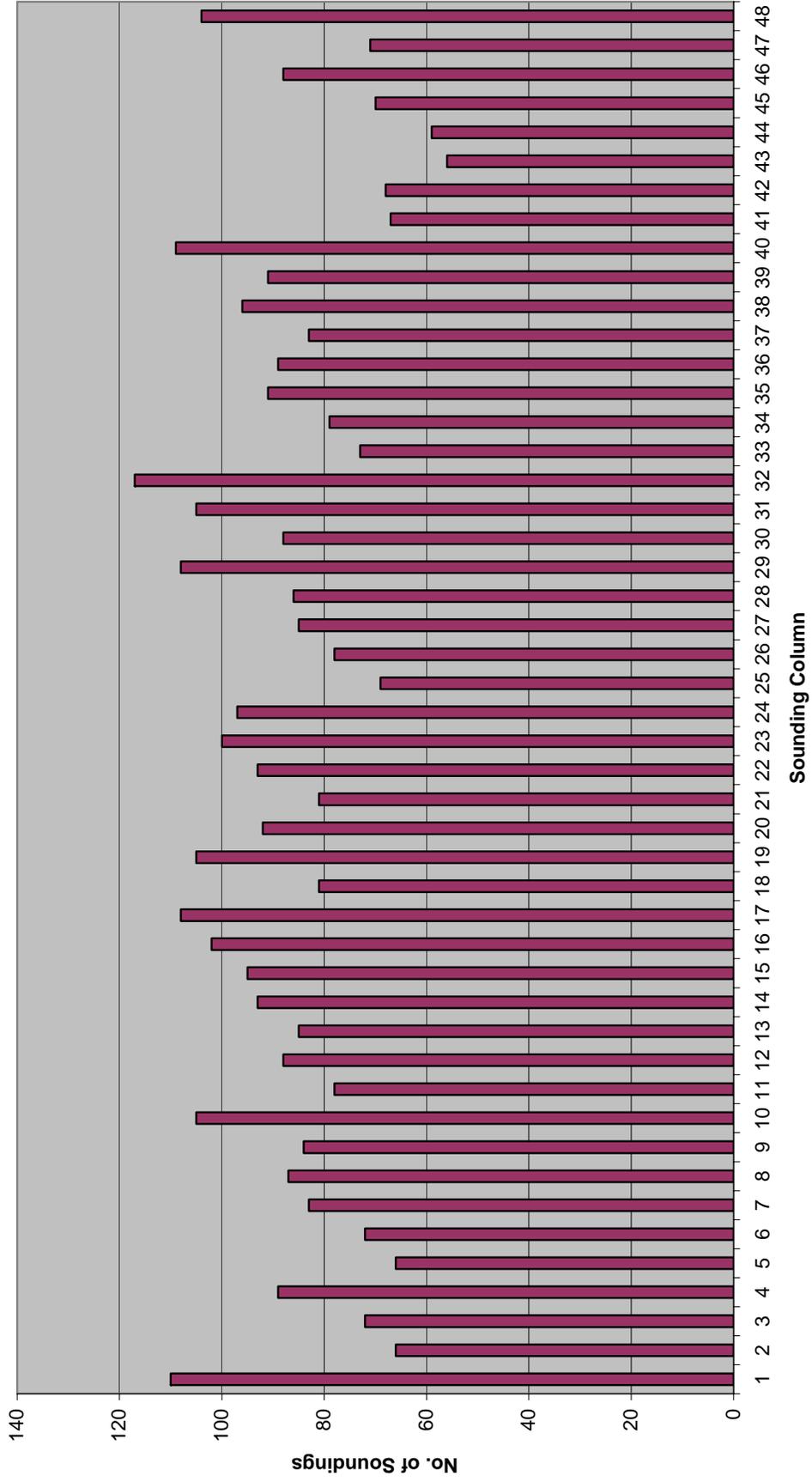


Figure 2 – Plot Soundings Histogram

B.6. POSITION CHECKS

Two independent positioning systems were used during the survey. Real-time positions were determined by stand alone GPS for the first sortie and the Thales WADGPS station in Vancouver for the second sortie. A KGPS position was also determined relative to a local GPS base station which was established on the rooftop of the survey site office located at the Silver Cloud Inn University Village in Seattle. The KGPS position and height were applied to soundings during post-processing.

Position checks were conducted prior to, during and following data collection, as follows:

- a. DGPS Site Confirmation. A 24-hour certification was conducted in 2001 for the local GPS base station established at the survey office site. A local survey company was contracted to verify these coordinates.
- b. Static Position Check. Prior to commencing data collection the coordinates of the aircraft GPS antenna were determined relative to a single mark that was surveyed on the tarmac at Boeing Field Airport in Seattle. Data was then logged by the LADS Mk II positioning system (WADGPS) and the KGPS system, enabling the position to be checked against the known surveyed point. The accuracy of the WADGPS during the static position check was 3.62 meters (95% confidence), the accuracy of the KGPS (PNAV C/A code + carrier phase) during the static position check was 0.38 meters (95% confidence). The results and details of the static position check are enclosed in Vertical and Horizontal Control Report.⁸
- c. Dynamic Position Check. During each sortie GPS data was logged on the aircraft and at the local GPS base station. This provided a check between the real-time GPS and post-processed positions. The mean difference between the real-time and post-processed position for sortie 4-stand alone GPS was 3.232 meters and for sortie 5-WADGPS was 1.613 meters, with a mean standard deviation of +/- 0.159 and +/- 0.184 meters. Details are provided in the Vertical and Horizontal Control Report.
- d. Position Confidence. The position quality was also monitored by checking a post-processed position confidence (C3), which is determined from the AS platform error, GPS error and residual errors between the actual GPS positions and aircraft position as determined from the line of best fit. No position anomalies were detected.

The position checks conducted prior to, during and following data collection provided results that were within the expected tolerances and showed that the positioning systems were functioning as expected.

B.7. CORRECTIONS TO SOUNDINGS

Refer to the Data Acquisition and Processing Report for a description of corrections to its soundings, which demonstrates that corrections to the soundings were being applied correctly.⁹

C. VERTICAL AND HORIZONTAL CONTROL

Refer to the Vertical and Horizontal Control Report¹⁰ for a detailed description of the vertical and horizontal control used during this survey. A summary of vertical and horizontal control for the survey follows.

C.1. VERTICAL CONTROL

Vertical control for the survey was based on the Mean Lower Low Water tidal datum (MLLW). MLLW is the average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch.

Tide data was supplied in UTC and in meters.

C.2. TIDE STATIONS

Only one tide station at Astoria, Washington was used for the duration of the survey. This tide station is one of the 175 tide stations that forms NOAA's National Water Level Observation Network (NWLON) and this tide gauge recorded continuously for the entire survey.

These gauges average over 180 readings per cycle to eliminate wave variations. The NWLON control stations with limited zoning have an accuracy of 0.23 meter and data was recorded at a 6-minute interval

Station details are as follows:

Gauge	Location	GS No.	WGS84	
			Latitude	Longitude
9439040	Astoria US Coast Guard Pier	TS1	46° 12.5' N	123° 46.0' W

C.3. ZONING

For final processing, tidal zoning correctors were applied to “verified” observed data obtained from the CO-OPS web site. The time and height correctors listed below were used for processing the data for tides. Minor changes were made to the zoning scheme provided by NOAA by moving TP 9 and TP 10 to the correct positions of the ends of the breakwaters, which were determined during this survey. The changes are described in Section A of the Vertical and Horizontal Control Report.

<u>Zone</u>	<u>Time Corrector (mins)</u>	<u>Range Ratio</u>	<u>Reference Station</u>
PAC204	-84	0.92	9439040
PAC205	-78	0.94	9439040
PAC600	-72	0.93	9439040
PAC601	-60	0.92	9439040

C.4. HORIZONTAL CONTROL

Data collection and processing were conducted on the Airborne and Ground Systems in World Geodetic System 1984 (WGS 84) on Universal Transverse Mercator (Northern Hemisphere) projection (UTM N) in Zone 10, Central Meridian 123° West. All units are in meters. This data was post processed and all soundings are relative to the North American Datum 1983 (NAD 83).

C.4.1. LADS Local GPS Base Station – Seattle

A local GPS Base Station had previously been coordinated on the roof of the Silver Cloud Inn, University Village, Seattle on 16 April 2001 by Mr John Oswald, LCMF Inc. Geodetic Manager. Tenix LADS Inc. personnel then established a DGPS Base Station on this site.

The base station recovery points were located on return to the base station site on 18 June 2003. Tenix LADS Inc. personnel then re-established a DGPS reference station on this site. To confirm the previous base station coordinates, surveyors Minister & Glaeser were used. In addition, Minister & Glaeser surveyed a single point on the tarmac at the Boeing Field Airport in Seattle. The point was surveyed by static GPS techniques and marked by pink colored paint. The point was used for the static position check. The reference station and static position checkpoint were coordinated on 21 June 2003.

The derived NAD 83 coordinates for the LADS Differential GPS reference station are:

Latitude	47° 39' 56.7260" N
Longitude	122° 18' 00.8060" W
Spheroidal Height	2.68 meters

The LCMF Incorporated and Minister & Glaeser reports on the coordination of the differential GPS reference station at the Silver Cloud Inn, University Village, are presented in the Vertical and Horizontal Control Report.

During the lidar survey operations, real-time positions were determined using an Ashtech GG24 GPS receiver with WADGPS Thales LandStar corrections. The Thales system delivered the differential corrections via the West NAM Satellite spot beam and the corrections were derived from the reference station in Vancouver.

The DGPS positions were determined off-line using data logged at the base station and on the aircraft. This data was processed through Ashtech PNAV software to calculate both a DGPS and Coarse Acquisition (C/A) code + carrier phase smoothed position solution. The C/A code + carrier phase smoothed positions were then imported into the GS and were applied to all soundings. This provided increased sounding position accuracy and horizontal redundancy.

D. RESULTS AND RECOMMENDATIONS¹¹

D.1. CHART COMPARISON

The survey was compared with chart 18558, 37th Edition (Feb, 2002, Scale 1:20,000 and Plan, Scale 1:5,000) Tillamook Bay.

D.1.1. Comparison of Soundings

The bar at the entrance to Tillamook Bay was surveyed by LADS Mk II lidar. This feature was found to consist of two large sandwaves of crescent shape, which form an inner and outer bar. The data collected confirms the general position and depths on the outer bar as shown on the chart. The inner bar is more extensive than depicted on chart 18558. The width of the inner bar is approximately 150 meters across at the centre (on the entrance lead) and tapers towards the breakwater heads.

D.1.2. Automated Wreck and Observation Information system

No AWOIS items were assigned under this project. Chart 18558 displays a wreck symbol on the east side of the outer bar with a Position Doubtful annotation. This feature was not examined in detail during the survey and the coverage over this area is incomplete due to high levels of turbidity.¹²

D.1.3. Danger to Navigation Report

A Danger To Navigation (DTON) Report was compiled from interim data prior to departure from Seattle. The Report was forwarded on Thursday 26 June 2003 (DTON_LADS_2003_1_ch1.doc). This information is provided in Appendix i.¹³

The subsequent checking, quality control and approval processes resulted in two of the data points on the Inner Bar listed in the Dangers to Navigation being removed from the final data set. The data points removed from the final data set are as follows:

Inner Bar

Chart Number	Edition		Surveyed Depth	Horizontal Datum	Surveyed	Position
	No.	Date			Latitude	Longitude
18558	37	2/23/02	26 ft	NAD 83	45° 34' 13.01" N	123° 58' 11.56" W
18558	37	2/23/02	26 ft	NAD 83	45° 34' 04.98" N	123° 58' 15.34" W

These soundings were deleted due to high levels of noise on the raw laser waveforms. The soundings occur in areas of greater than 100% coverage of the seabed and have been replaced on the smooth sheet by sounding of the same depths.¹⁴

D.2. ADDITIONAL RESULTS

D.2.1. Shoreline Verification

The survey covers both the high water and low water lines and includes topographic coverage to approximately 10 meters

D.2.2. Aids to Navigation¹⁵

No checks on aids to navigation were carried out in the survey area, however two buoys were detected in the channel entrance into Tillamook Bay. Both buoys were detected by the LADS MkII system as drying soundings. These were confirmed as returns from the buoys by examining the downward looking video. Buoy 1 was detected on 6 occasions; the positions of the returns were within 6 meters of each other. Buoy 2 was detected on 5 occasions; the positions of the returns were within 4 meters of each other. In the final accepted data set the drying sounding from the buoys were retained. These soundings were replaced by buoy symbols in Microstation for display on the preliminary smooth sheet.

Buoy 1	45° 34' 13.15" N	123° 58' 46.45" W
Buoy 2	45° 34' 01.73" N	123° 58' 16.79" W

The following characteristics of the buoys were determined from the published lights list.

Buoy 1 is a green can located at the entrance of the channel and is a Bell Buoy and is not lighted.

Buoy 2 has a red and green band and is located at the entrance junction and is a Gong Buoy and also is not lighted.

Both buoys are considered to serve their intended purpose.

D.2.3. Comparison with Prior Surveys

Comparison with prior surveys was not required under this task order.¹⁶ See Section D1 for comparison to the nautical chart.

D.2.4. Doubtful Soundings

The following sounding was obtained by LADS and was not able to be properly classified as real or noise during the data review process. The sounding is located on the port side of the inner channel and the details are as follows:

Point	Depth	Line No.	F/R/C	Easting	Northing	Remarks
1	-0.4	147.0.1	79/8/26	426 664	5 046 119	Possible shoal/rock

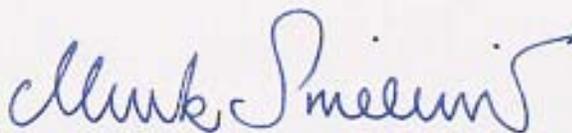
The sounding has been retained in the data set.

It is recommended that no further action is required as the sounding appears amongst the surveyed rocks inside the entrance channel on the eastern extent of the survey area.¹⁷

E. APPROVAL SHEET**LETTER OF APPROVAL**

This report and the accompanying smooth sheets are respectfully submitted.

Field operations contributing to the accomplishment of this survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and the accompanying smooth sheets have been closely reviewed and are considered complete and adequate as per the Statement of Work.



Mark Sinclair
Hydrographer
Tenix LADS Incorporated

Date 24 Oct 03

Revisions Compiled During Office Processing and Certification

¹ Filed with the Project Records.

² Concur

³ Concur

⁴ Concur with clarification. A PHB review of the data in CARIS showed no “artifacts” in the cleaned dataset.

⁵ Concur with clarification. Seven Dangers to Navigation were reported to MCD and are attached to this report.

⁶ Concur

⁷ Concur

⁸ Filed with the Project Records

⁹ Concur

¹⁰ Filed with the project records

¹¹ This survey was conducted using LIDAR technology. Depths meet IHO Order 1 requirements. However, object detection does not meet IHO Order 1 requirements. The evaluator recommends that no shoaler charted depths be superseded by data from survey H11235. More contemporary surveys have been conducted by the Army Corp. of Engineers within the survey area of H11235. The evaluator recommends using data from this survey only in areas that have less contemporary information.

¹² Concur. Retain as charted.

¹³ Concur with clarification. See endnote 11.

¹⁴ Concur

¹⁵ Concur with hydrographer’s comments below. Chart aids to navigation from the most recent ATONIS information.

¹⁶ Concur

¹⁷ Concur with clarification. Chart the area with the most current survey information.

APPENDIX I – DANGERS TO NAVIGATION

Our Ref:
File Ref: LNOA3

27 June 2003

LT E J Van Den Aamele, NOAA
National Ocean Service, NOAA
Office of Coast Survey
Pacific Hydrographic Branch
7600 Sand Point Way NE
Seattle WA 98115-6349



Tenix LADS Inc.
2548 Beach Boulevard
Suite 200
Biloxi MS 39531
USA

Telephone: 228 594 6800
Facsimile: 228 594 6887

Dear EJ,

H-11235 Approaches and Entrance to Tillamook Bay – Interim data

A LADS Mk II reconnaissance survey of Tillamook Bay was conducted on Thursday 19 and Saturday 21 June 2003 under Project Number S-N910-KRL-03. This data has been processed at a temporary processing facility established at the Silver Cloud Inn, University.

The data has been validated and reviewed in Caris HIPS. Checking, quality control and approval of the data, tides and geodetics have yet to be conducted and the survey will be reported in accordance with NOAA Technical Specifications and the SOW.

A DTON covering the depths on the inner bar and the positions of the ends of the breakwaters was provided on Thursday 26 June (DTON_LADS_2003_1_ch1.doc).

Interim data of the survey is provided in Caris readable format on the attached CD.

Regards,

Mark Sinclair
Project Director
Tenix LADS Inc

Attachment: CD containing Interim LADS Data – Tillamook Bay

Danger to Navigation Report

REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H-11235

State: Oregon

General Locality: North Pacific Ocean

Sublocality: Approaches and Entrance to Tillamook Bay, Oregon

Project Number: S-N910-KRL-03

The following item was found during hydrographic survey operations:

Object Discovered: Shoaling on bar off the entrance to Tillamook Bay

The bar at the entrance to Tillamook Bay was surveyed by LADS Mk II lidar. This feature was found to consist of two large sandwaves of crescent shape which form an inner and outer bar. The data collected confirms the general position and depths on the outer bar as shown on the chart. The inner bar is more extensive than depicted on chart 18558. The width of the inner bar is approximately 150 meters across at the centre (on the entrance lead) and tapers towards the breakwater heads. Soundings have been reduced to Mean Lower Low Water using preliminary observed tides from Astoria from the NOAA web site; reducers have been corrected using the zoning in the Scope of Work. The following list of significant depths on the inner bar has been compiled from the preliminary data. The surveyed positions of the western ends of the breakwaters are also provided.

Inner Bar

Chart Number	Edition		Surveyed Depth	Horizontal Datum	Surveyed	Position
	No.	Date			Latitude	Longitude
18558	37	2/23/02	8 ft	NAD 83	45° 34' 14.65" N	123° 57' 57.56" W
18558	37	2/23/02	8 ft	NAD 83	45° 34' 12.81" N	123° 57' 57.48" W
18558	37	2/23/02	17 ft	NAD 83	45° 34' 13.90" N	123° 58' 01.98" W
18558	37	2/23/02	26 ft	NAD 83	45° 34' 13.01" N	123° 58' 11.56" W
18558	37	2/23/02	25 ft	NAD 83	45° 34' 11.79" N	123° 58' 14.30" W
18558	37	2/23/02	25 ft	NAD 83	45° 34' 10.15" N	123° 58' 16.81" W
18558	37	2/23/02	25 ft	NAD 83	45° 34' 07.54" N	123° 58' 18.61" W
18558	37	2/23/02	26 ft	NAD 83	45° 34' 04.98" N	123° 58' 15.34" W
18558	37	2/23/02	27 ft	NAD 83	45° 34' 03.44" N	123° 58' 09.50" W
18558	37	2/23/02	28 ft	NAD 83	45° 34' 03.77" N	123° 58' 05.12" W

Breakwaters

Chart Number	Edition		Feature	Horizontal Datum	Surveyed	Position
	No.	Date			Latitude	Longitude
18558	37	2/23/02	W end of N breakwater	NAD 83	45° 34' 13.94" N	123° 57' 53.58" W
18558	37	2/23/02	W end of S breakwater	NAD 83	45° 34' 02.10" N	123° 57' 47.66" W

APPENDIX II – LIST OF GEOGRAPHIC NAMES.

Geographical names were not checked during the survey, and no amendments are proposed.

APPENDIX III – PROGRESS SHEET

No progress sheet is forwarded as the survey is being rendered in its entirety.

APPENDIX IV – TIDES AND WATER LEVELS

Abstract of Times of Hydrography for Application of Tides

Project Name: Tillamook Bay Entrance Channel
 Registry Number: H-11235
 Contractor Name: Tenix LADS Incorporated
 Datum Used: MLLW
 Field Tide Note: Real time data from <http://co-ops.nos.noaa.gov>
 Final Tide Note: Verified data available from the same website as the Field Tide Note data on a weekly basis.

2003	Date Flown (UTC)	Julian Day	Start Time (UTC)	End Time (UTC)
Sortie 4	19 June 2003	170	22:11	02:42
Sortie 5	21 June 2003	172	22:55	03:35

See Correspondence in Separates Report.

APPENDIX V – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE**TILLAMOOK BAY ENTRANCE CHANNEL Digital Data and Plots***Transmittal Note*

See correspondence in Separates Report.

APPROVAL SHEET
H11235

Initial Approvals:

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, and verification or disproof of charted data. The survey records and digital data comply with NOS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.


_____ Date: 3/24/06

Russ Davies
Cartographic Team
Pacific Hydrographic Branch

I have reviewed the smooth sheet, accompanying data, and reports. This survey and accompanying digital data meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.


_____ Date: 27 MARCH 2006

Donald W. Haines
CDR, NOAA
Chief, Pacific Hydrographic Branch