1995. Settlement and squat correctors were computed in accordance with Hydrographic Manual Section 4.9.4.2, using FPM Fig. 2.3, and are included with project data for OPR-O324-RA-97. The data for vessels 2121, 2122, and 2123 were collected in Shilshole Bay, Washington in March 1997. The data for 2124 and 2126 were collected in 1996. The data for vessel 2125 were collected in Young Bay, Alaska in March 1997. All offset tables contain offsets for the GPS antenna, as well as static draft measurements, and settlement and squat data. Offset tables 1-6 correspond to the last digit of the vessel number. The offset tables are included with project data for OPR-O324-RA-97. The launches are not equipped with heave, roll and pitch sensors.

The Coastal and Estuarine Oceanography Branch (N/OES334) through N/CS31 provided predicted tides for the project on diskette for the Juneau, Alaska reference station (945-2210). HDAPS listings of the data used in generating tide corrector tables are included in Appendix V of this report. Tidal correctors as provided in the project instructions for H-10742 are listed in the survey information summary (attached to report).

Juneau, Alaska (945-2210), and Ketchikan, Alaska (945-0460), are the primary control stations for datum determination at all subordinate stations. RAINIER personnel installed a Sutron 8200 tide gage at Taku Harbor (945-2123) on April 21, 1997, which was removed on June 19, 1997. RAINIER personnel installed a Sutron 8200 tide gage at Speel River (945-2081) on April 16, 1997, and removed it June 19, 1997. Crib Point tide gage (945-2082) was installed June 4, 1997 and removed June 19, 1997. Refer to the Field Tide Notes and supporting data in Appendix V for individual gage performance and level closure information. This information and the boundaries of the survey have been forwarded to N/OES212. A request for approved tides was forwarded to N/OES23 in accordance with FPM 4.2.3. Approved Tide Note dated Nov. 1st, 1997 is attached.

Use of Taku Harbor tide gage data is recommended for final tide correctors.

Final approved tides are from Juneau.

H. CONTROL STATIONS  See Eval Rpt, Section IV.

The horizontal datum for this project is NAD 83. The control stations used for this survey are listed in Appendix III. See the OPR-O324-RA-97 Horizontal Control Report for more information.

I. HYDROGRAPHIC POSITION CONTROL  See Eval Rpt, Section V.

All soundings were positioned using differential GPS. Primary control was TWIN, the VHF differential reference station installed by RAINIER. The US Coast Guard Beacon at GUSTAVUS was used when not using the VHF station. Launch-to-launch DGPS performance checks were performed in accordance with Section 3.4.4 of the FPM. Two observations of position were made from two different DGPS base stations, TWIN and GUSTAVUS, while the launches were rafted together with their GPS antennae within 2-3 meters of each other. RAINIER also used SHIPDIM, version 2.2R (April 1996) with a Trimble Centurion P-code receiver and an Ashtech sensor (both differentially-corrected) to monitor the performance of the USCG Beacon. TWIN was compared to GUSTAVUS during 8-hour daily comparisons and occasional performance checks. Some outliers were noted, but none indicated systematic or continuous errors. The SHIPDIM OUTLIER.SUM results are included on a floppy in the project data for OPR-O324-RA.

Problems with GPS control were encountered in Limestone Inlet due in large part to mountains obstructing satellite signals. Data were rejected and rerun until standards of Field Procedures Manual were met.

* Filed with the hydrographic data.
** Copy attached to this report.
G. CORRECTIONS TO ECHO SOUNDINGS

Sound Velocity Correctors:

A sound velocity cast was acquired with SBE SEACAT Profiler (S/N 219), calibrated January 27, 1998. Velocity correctors were computed using the PC programs SEACAT and VELOCITY, version 3.1 (1997), in accordance with Field Procedures Manual (FPM) section 2.1.2. and Hydrographic Survey Guideline (HSG) No.69. Sound velocity correctors were applied to the raw sounding data in HPS during post acquisition processing. Printouts of the sound velocity profile, data, and correctors used in field processing are included with this letter.

Vessel Offset Correctors

The following table shows when the vessel offset correctors used for this survey were last measured:

<table>
<thead>
<tr>
<th>Vessel No.</th>
<th>Date of static draft and transducer offset measurements</th>
<th>Method of Settlement and Squat Measurement</th>
<th>Date of Settlement and Squat Measurement</th>
<th>Location of Settlement and Squat Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2124</td>
<td>March 26, 1998</td>
<td>Rod leveling</td>
<td>June 11, 1998</td>
<td>Shakan Strait, AK</td>
</tr>
<tr>
<td>2125</td>
<td>March 26, 1998</td>
<td>Rod leveling</td>
<td>June 21, 1998</td>
<td>Chilkat Inlet, AK</td>
</tr>
</tbody>
</table>

Settlement and squat correctors were computed in accordance with Hydrographic Manual Section 4.9.4.2, using FPM Fig. 2.4. All offset tables contain offsets for the GPS antenna, as well as static draft measurements, and settlement and squat data. Offset tables #1-6 correspond to the last digit of the vessel number and were applied to the raw sounding data in HPS during post-acquisition processing. The launches are not equipped with heave, roll and pitch sensors.

Predicted Tidal Correctors:

The tidal correctors were downloaded from Tides & Currents Pro for Windows, version 2.5b Copyright 1993-1997 by Nautical Software Inc. for the Juneau, Alaska reference station (945-2210). The predicted tides at Juneau were entered into HPS and were applied to soundings without adjusting for zoning. Tidal correctors as provided in the project instructions for FE-00432 are listed below.

<table>
<thead>
<tr>
<th>Zone Station</th>
<th>Time Corrector (min)</th>
<th>Range Ratio</th>
<th>HPS Tide Table No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEA8</td>
<td>000 hr 24 min</td>
<td>x1.03</td>
<td>Table No. 1</td>
</tr>
</tbody>
</table>

Real Tidal Correctors:

The operating tide station at Juneau, AK (945-2210) served as control for datum determination. NOS verified six minute water level heights were used as correctors for this investigation. Data are in meters above MLLW and times are on UTC (GMT). A Next Generation Water Level Measurement System (NGWLMS) Aquatrak is the only sensor at this station. Consequently, RAINIER was not required to inspect or perform leveling of these stations.

A Sutron 8200 Bubbler tide station was established for this project in order to provide information on zoning, tidal datums (reducers), and harmonic constants for predictions. Due to the time limitations of the investigation, the tide gauge was operational for 1.5 days.

* Filed with the hydrographic data.
Refer to the Field Tide Notes, included with this letter, for individual gauge performance and level information. Raw waterlevel data from this gauge has been forwarded to N/CS41 on 11/12/98 in accordance with HSG 50 and FPM 4.7 where it will be processed into final approved (smooth) tides. The Pacific Hydrographic Branch will apply final approved (smooth) tides to the survey data during final processing. A request for delivery of final approved (smooth) tides to the Pacific Hydrographic Branch has been forwarded to N/CS41 in accordance with FPM 4.8. Approved Tide Note dated April 15, 1998 is attached.

H. HYDROGRAPHIC POSITION CONTROL ✓

The horizontal datum for this project is NAD 83. Horizontal control was used to verify and establish local geodetic control for this survey in 1997.

All soundings were positioned using differential GPS (DGPS). The USCG beacon, located at Gustavus, AK, was used for this survey.

I. SHORELINE ✓

The shoreline manuscript from Coastal Mapping Survey CM-8809 was supplied by N/CS341 in Standard Digital Data Exchange Format (SDDEF). The digital files from DM-10304 and DM-10305 were projected to the survey grid with OPR-O324-RA-97 geodetic parameters using program Shore version 2.0, provided by N/C32.

Shoreline manuscript and field features were compared to an enlargement of Chart 17314 11th Ed. There was general agreement between the charted and manuscript shoreline and what the hydrographer found on this survey.

J. CROSSLINES ✓

Due to the time constraints of this investigation, no crosslines were run.

K. JUNCTIONS ✓

Not Applicable.

L. COMPARISON WITH PRIOR SURVEYS ✓

See Item Investigation Reports.