Pipeline Route

Basic information
Area covered by pipeline system — 16.3 sq. mi.
Elevations, highest
  Atigun Pass — 4,739 ft. (crest, pipeline MP 166.6)
  Isabel Pass — 3,420 ft.
  Thompson Pass — 2,812 ft.
Diameter — 48"
Grade, maximum, and location — 145% (55°) Thompson Pass
Length — 800.302 mi.; 1,288 km. (406.56 ft. added to length in MP 200 reroute, Apr. 22, 1985)
Mountain ranges crossed, north to south
  Brooks Range
  Alaska Range
  Chugach Range
Ambient temperature, along route — -80°F to 95°F
Right-of-way width
  Federal lands
    Buried pipeline — 54 ft.
    Elevated pipeline — 64 ft.
  State lands — 100 ft.
  Private lands — 54 ft. to 300 ft.
River and stream crossings — 34 major, nearly 500 others
Workpad, length — 790 mi.
### Throughput, actual average per day

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<th>Year</th>
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<th>Days</th>
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### Throughput, total per year

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Alyeska
Organization

Corporate Name
Alyeska Pipeline Service Company (Alyeska is an Aleut word meaning mainland).

Corporate Responsibilities
Design, construct, operate, and maintain the Trans Alaska Pipeline System.

Date of Incorporation
August 14, 1970.

Early History
Originally TAPS, for Trans Alaska Pipeline System, (initially “Trans Alaskan Pipeline Project”) a joint venture of Atlantic Pipe Line Company (now Phillips Transportation Alaska, Inc.), Humble Pipe Line Company (now ExxonMobile Pipeline Company), and BP Oil Corporation (now BP Pipelines (Alaska) Inc.) formed to develop a plan for construction of a pipeline for Prudhoe Bay oil.

Personnel (April 15, 2003)
Number of employees — approx. 895
   Anchorage — 237
   Fairbanks — 341
   Valdez — 317
Alaska residents — approx. 97.3%

The number of personnel working at pump stations varies throughout the year and is captured in the statistics for Anchorage, Fairbanks or Valdez.

Note: Approximately 2500 TAPS employees are required to operate and maintain the Trans Alaska Pipeline System, including Alyeska and contractor employees.
Employee Safety Statistics

<table>
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<th>Recordable Injuries</th>
<th>Lost Time Accidents</th>
<th>Frequency Rate</th>
<th>Manhours Worked</th>
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1 Frequency calculated:

\[
\text{number of cases or days} \times 200,000 \text{ hours} \\
\text{number of employee hours worked during year}
\]
Alyeska Offices & Contact Information

**Anchorage** (company headquarters)
Alyeska Pipeline Service Company
P.O. Box 196660
Anchorage, AK 99519-6660
(907) 787-8700

**Fairbanks**
Alyeska Pipeline Service Company
701 Bidwell
Fairbanks, AK 99701

**Valdez**
Alyeska Pipeline Service Company
P.O. Box 300
Valdez, AK 99686

SERVS
(Ship Escort/Response Vessel System)

P.O. Box 109
Valdez, AK 99686

**Washington, D.C.**
Alyeska Pipeline Service Company
1667 K St., NW, Suite 1230
Washington, DC 20006
(202) 466-3866

**Internet Address**
http://www.alyeska-pipe.com
The Valdez Terminal Office (VTO) building was constructed during 2001 and 2002. The building commemoration on August 1, 2002 coincided with the 25th Anniversary celebration of the first tanker (ARCO Juneau) to depart Valdez with oil from Alaska’s North Slope.
1968

Mar 13, Atlantic Richfield Company (ARCO) and Humble Oil and Refining Company (now Exxon Company, U.S.A.) announce Prudhoe Bay discovery well.

Jun 25, Confirmation well announced by ARCO and Humble.

Jul 29, Pipeline field study team arrives in Alaska under authority of a transportation subcommittee of an ARCO-Humble North Slope Coordinating Committee.

Oct 28, Atlantic Pipeline Company (a subsidiary of Atlantic Richfield), Humble Pipe Line Company (a subsidiary of Humble Oil and Refining Company) and BP Exploration U.S.A., Inc. (a subsidiary of British Petroleum Company, Ltd.) enter into an “agreement for a planning study and for engineering design and construction of the Trans-Alaska Pipeline Project.” Construction was to proceed if the Owner Companies approved the plans developed under this agreement.

1969

Feb 7, Atlantic Pipe Line, Humble Pipe Line and BP Oil Corporation (formerly BP Exploration U.S.A., Inc.) approve an amendment to their original agreement, electing to proceed with design and construction, and changing the name of the project to “Trans Alaska Pipeline System.” The acronym “TAPS” was first applied in usage.

Feb 10, Atlantic Pipe Line, Humble Pipe Line and BP Pipe Line Corporation (a subsidiary of BP Oil Corporation) announce plans to build an 800-mile trans-Alaska pipeline.
Jun 6, TAPS files for federal right-of-way permits over public lands.

Sep 13, First 48-inch pipe arrives in Valdez from Japan.


1970

April, Suits filed by environmental groups and others to block pipeline construction.


Aug 27, TAPS Owner Companies that established the TAPS System Agreement formed Alyeska Pipeline Service Company, a separate corporation and common carrier pipeline company.

Aug 27, Agreement made to design and construct the trans-Alaska pipeline. Alyeska Pipeline Service Company appointed as contractor and agent of the construction project.

1971

Jan 1, Atlantic Pipeline Company (TAPS Owner) stock reissued to ARCO Pipe Line Company.

1973

1974
Home Pipe Line Company (TAPS Owner) stock reissued to six other oil pipe line companies.

Jan 3, Federal right-of-way grant issued.

Apr 29, Prudhoe Bay to Yukon River road construction begins.

May 3, State right-of-way lease issued.

Sep 29, Prudhoe Bay to Yukon River road completed.

Dec 19, Humble Pipe Line Company (TAPS Owner) stock reissued to Exxon Pipeline Company.

1975

Mar 27, First pipe laid at Tonsina River.

Oct 11, Yukon River Bridge completed.

Oct 26, Pipeline project 50% complete.

1977

May 20, Operating Agreement established between Alyeska Pipeline Service Company (as agent) to operate and maintain TAPS on behalf of TAPS Owners (Amerada Hess Pipeline Corporation, ARCO Pipe Line Company, BP Pipelines Inc., Exxon Pipeline Company, Mobil Alaska Pipeline Company, Phillips Petroleum Company, and Sohio Pipe Line Company).

May 31, Final pipeline weld near Pump Station 3.

Jun 20, First oil flows from Pump Station 1.

(10:06 a.m. (AST) — pig in trap)
(10:27 a.m. (AST) — pig depart signal)

Jun 24, Oil front at PS 3 (12:56 p.m.)

Jun 25, Oil front at PS 4 (7:50 a.m.)

Jun 28, Oil front at PS 5 (6:23 a.m.)

Jul 1, Oil front at PS 6 (6:30 p.m.)

Jul 4, Nitrogen leak detected ahead of oil front, MP 489.12 (near PS 8 north block valve). Oil flow stopped.

Jul 7, Pipe repair, MP 489.12. Pipe and elbow cracked
from injection of super-cooled nitrogen. Pipe replaced.

**Jul 7**, Oil front at PS 8. (9:24 p.m.)

**Jul 8**, PS 8 pump building destroyed by explosion and fire; 1 fatality, oil loss — 300 bbl.

**Jul 19**, Oil leak (heavy equipment accident) CV 7, 1,800 bbl.

**Jul 20**, Oil front at PS 9. (10:37 a.m.)

**Jul 22**, Oil front at PS 10. (4:46 a.m.)

**Jul 26**, Oil front at PS 12. (3:48 a.m.)

**Jul 28**, Oil reaches Marine Terminal. (11:02 p.m.)

**Aug 1**, *ARCO Juneau* departs Valdez with first oil.

**1978**

**Feb 15**, Oil spill (sabotage), Steele Creek, MP 457.53, 16,000 bbl.

**Feb 16**, Pipe repair MP 457.53.

**Mar 7**, PS 8 recommissioned. (11:05 a.m.)

**1979**

**Jun 10**, Oil leak, MP 166.43, Atigun Pass, 1,500 bbl., pipe settlement.

**Jun 13**, *ARCO Heritage*, 1,000th tanker to load.

**Jun 15**, Oil leak, MP 734.16, 4,000 bbl., pipe settlement.

**June**, Pipe repair, MP 734.16.

**Jul 1**, First commercial injection of DRA into pipeline at PS 1.

**Aug 18**, Curvature pig (Super Pig) stuck in line at CV 29.

**Sep 25**, CV 29 opened, curvature pig removed; stopple and by-pass installed.

**Oct 2**, PS 2 commissioned.

**October**, Yukon River Bridge opened.

**1980**

**Jan 22**, 1 billionth barrel arrives Valdez.

**Feb 11**, Oil leak, Terminal, east tank farm, leaking valve, 3,200 bbl.
May 12, Oil leak, relief tank valve, 238 bbl.
Sep 20, Monument to pipeline construction workers dedicated at Marine Terminal.
Dec 1, PS 7 commissioned.
Dec 29, Thompson Pass, 2,000th tanker to load.
1981
Jan 1, Oil leak, CV 23, 1,500 bbl., drain connection failure.
Nov 10, 2 billionth barrel arrives Valdez.
Dec 15, First Kuparuk field oil delivered to PS 1.
1982
Jun 19, Philadelphia, 3,000th tanker to load.
Jun 7, RGV 121A, uncommanded closure.
1983
Jul 21, 3 billionth barrel arrives Valdez.
Nov 8, Tonsina, 4,000th tanker to load.
1984
Mar 20, Removal of stuck scraper pig at CV 4 and relocation of pig trap from PS 5 to PS 4.
November, Removal of stuck pig at PS 10.
1985
Jan 11, Overseas Boston, 5,000th tanker to load.
Mar 11, 4 billionth barrel arrives Valdez.
Apr 22, MP 200 final tie-in of 48-inch permanent reroute (404.7 ft. added to total pipeline length); reroute due to pipe settlement.
Nov 2, Milne Point field start-up.
Nov 9, Two primary generators damaged by fire in generator room at PS 1.
1986
Mar 5, ARCO Sag River, 6,000th tanker to load.
Apr 18, Union Oil Pipeline Company (TAPS Owner) becomes Unocal Pipeline Company.
Sep 15, 5 billionth barrel arrives in Valdez.
Nov 18, “Tee” damaged by scraper pig at PS 10; “Tee” replaced.
Dec 15, Lisburne field start-up.
Dec 24, Sohio Pipeline Company (TAPS Owner) becomes Sohio Alaska Pipeline Company.

1987
Apr 1, First IPEL Corrosion Pig run.
Apr 19, Atigun Pass, 7,000th tanker to load.
Jun 19, 10th Anniversary celebration of the Prudhoe Bay field and trans-Alaska pipeline.
Sep 29, Buckled pipe replaced, Atigun Pass MP 166.4.
Oct 3, Endicott field start-up.

1988
Jan 1, BP Pipelines, Inc. (TAPS Owner) merged into Sohio Alaska Pipeline Company (TAPS Owner).
Jan 14, highest daily throughput — 2,145,297 bbl.
Feb 16, 6 billionth barrel arrives Valdez.
May 2, Chevron Mississippi, 8,000th tanker to load.
September, PS 2 pump manifold pipe replacement project complete.
October, Atigun Pass Releveling Project, MP 167, pipe settled due to erosion of ground below.

1989
Jan 3, Oil spill, Thompson Pass, 1,700 bbl., crack in vessel's hull.
Mar 1, Sohio Alaska Pipeline Company (TAPS Owner) becomes BP Pipelines (Alaska) Inc.
Mar 24, Oil spill, Exxon Valdez, 260,000 bbl., vessel ran aground at Bligh Reef. Alyeska provided initial oil spill response.
May 27, Texaco Florida, 9,000th tanker to load.
Jun 1, First NKK corrosion pig run.
Jun 30, 7 billionth barrel arrives Valdez.

August, Feasibility study for Atigun Floodplain Pipe Replacement Project was done to replace 8.5 miles of mainline pipe between MP 157 and 165.5.

1990

Feb 8, Alyeska/Regional Citizens Advisory Council (RCAC) contract signed.

June, Construction complete on Incinerator Repair Project, Valdez Marine Terminal.

Jun 12, Deadleg repair/replacement, PS 1.

Jul 31, Exxon New Orleans, 10,000 tanker to load.

September, PS 3 corrosion repair, station temporarily bypassed.

September, Construction begins on 8.5 mile Atigun Floodplain Pipe Replacement Project.

Sep 15, Project to inspect, recoat, and reinsulate 1,600 ft. of insulated buried mainline pipe between MP 167.3 and 167.5 completed.

December, First shipment of pipe for Atigun Floodplain Pipe Replacement Project arrives in Valdez.

1991

Jan 1, 8 billionth barrel arrives Valdez.

Feb 28, ARCO Pipe Line Company (TAPS Owner) becomes ARCO Transportation Alaska, Inc.

March, Concrete Biological Treatment Tanks (BTT) placed in service at Valdez Marine Terminal.

Oct 2, Overseas Boston, 11,000 tanker to load.

September, Atigun Floodplain Pipe Replacement Project completed (MP 157-165.5).
1992

11 storage tanks were internally inspected.

**January**, Floor of crude oil storage tank #5 (VMT) replaced and cathodic protection installed.

**Apr–May**, Corrosion repairs to 2.5 mile section of pipe in the Chandalar Shelf.

**Jun 20**, 15-year Anniversary of TAPS operations.

**Jul 7**, 9 billionth barrel transported through line.

**Jul 30**, First full-scale aerial dispersant test in Prince William Sound.

**Aug 7**, RGV 73 uncommanded closure, over-pressuring the pipeline.

**Aug 25**, Ombudsman appointed.

**September**, PS 1 Tank 111 returned to service after bottom replacement project completed.

**October**, Recoating of superstructure for Berths 3 and 4 at Valdez Marine Terminal completed.

**December**, Completion of new roof for 40,000 sq. ft. Dissolved Air Flotation (DAF) building at Valdez Marine Terminal.

**Dec 10**, Fuel gas line (north of the Brooks Range) releveling project complete.

**Dec 28**, *ARCO California*, 12,000 tanker to load.

1993

**Jan 1**, 3,000 SERVS escorts.

**Jan 20**, Petro Star Refinery on-line.

**March**, Construction of new tug dock at Valdez Marine Terminal completed.

**June**, PS 10, desalter for pretreating Topping Unit Crude Feed put in service.

**June**, PS 9, Mainline Pump #3 converted to half-head operation.
**September**, Recoating of Berth 5 superstructure at Valdez Marine Terminal completed.

**October**, Inspection, repair and recoating of 10 storage tanks at Valdez Marine Terminal completed. This completes the initial inspection of all the major storage tanks at VMT.

**Dec 10**, Install fuel gas line pig launcher, MP 34.

**1994**

**March**, Tank 209 at PS 10 leaks 3,500 gallons of residual oil in tank farm.

**Mar 5**, 10 billionth barrel arrives Valdez.

**May 13**, *ARCO Texas*, 13,000th tanker to load.

**Jul 5**, Alyeska selects method of tanker vapor control at Valdez Marine Terminal.

**Sep 26**, TAPS Owners Assessment of pipeline operations complete.

**1995**

**Mar 9**, Valdez Emergency Operations Center/Escort Response Base opened.

**Mar 30**, Alyeska employees worked 1 million consecutive hours without a lost time accident.

**April**, Alyeska completes major electrical improvement project (ANSC), line-wide.

**May 24**, PS 8 topping unit shut down.


**Oct 26**, PS 7 idled for maintenance, three months.

**December**, Alyeska completes construction on new Otter Rehabilitation Facility.

**Dec 12**, 11 billionth barrel arrives Valdez.

**Dec 31**, *ARCO Juneau*, 14,000th tanker to load.
1996

Apr 20, Oil leak at CV 92 discovered.
Apr 25, CV 92 leak repair begins.
Jun 30, PS 8 placed in standby status.
Jul 1, PS 10 placed in standby status.
August, pressure pulsations felt in Thompson Pass, created by slackline condition.
Sep 17, Alyeska investigates pipe vibrations near pipeline MP 776.
Nov 27, Alyeska responds to evidence of hydro-carbons detected by soil probes near MP 776; no spill found.

1997

Exxon Pipeline Company (TAPS Owner) becomes ExxonMobil Pipeline Company.
January, Temporary back pressure installed at VMT to stop pressure pulsations in Thompson Pass.
Jan 1, Phillips Alaska Pipeline Corporation (TAPS Owner) stock reissued to Phillips Transportation Alaska, Inc.
Jun 20, 20th Anniversary of Trans Alaska Pipeline System.
Jul 1, PS 2 placed in standby status.
Aug 8, PS 6 placed in standby status.
Aug 12, Overseas Juneau, 15,000th tanker to load.
Oct 2, Permanent Back Pressure Control System operational.
Dec 1, 12 billionth barrel arrives Valdez.

1998

Mar 19, Tanker Vapor Control System brought in to full operation.
Sep 25-26, Pipeline shutdown, 28 hrs., 40 min., to repair CV 122 and replace RGV 80.
1999

**Jan 27**, *Nanuq*, enhanced tractor tug arrives Valdez to join SERVS fleet.

**May 22**, *Tan’erliq*, enhanced tractor tug arrives Valdez to join SERVS fleet.

**Jun 26**, *Arco Spirit*, 16,000th tanker to load.

**Jul 10**, 10th Anniversary of SERVS.

**Sep 11**, Pipeline shutdown, 25 hrs, 49 minutes to replace RGV 60.

2000

**Feb**, *Alert*, Prevention Response Tug arrives Valdez to join SERVS Fleet.

**April**, pipeline movement at MP 170.

**Apr 27**, 13 billionth barrel arrives Valdez.

**May**, *Attentive*, Prevention Response Tug arrives Valdez to join SERVS fleet.

**Jun**, Scraper pig removed seat ring from CV 74.

**Jun 30**, Mobil Alaska Pipeline Company (TAPS Owner) stock reissued to Williams Alaska Pipeline Company, LLC.

**Jul**, *Aware*, Prevention Response Tug arrives Valdez to join SERVS fleet.

**Aug 1**, ARCO Transportation Pipe Line Company (TAPS Owner) stock reissued to Phillips Transportation Alaska, Inc.

**Summer**, Extensive renewal of Berth 4 at the Valdez Marine Terminal.

**Sep 16**, Pipeline shutdown to replace CV 74 and the M-2 Valve at PS 9.

**Oct 7**, Shutdown to test remaining valves needed to complete the 5-year valve test program of all mainline valves.
2001

**Jul 11,** *Polar Endeavor,* first Millennium class double-hull tanker arrives Valdez Marine Terminal.

**Jul 19,** *S/R Benecia,* 8,000th tanker to load.

**Summer,** Extensive renewal of Berth 5 at the Valdez Marine Terminal.

**Aug 21,** Alyeska SERVS received “Distinguished Achievement” award in recognition of outstanding third-party oil spill response to the *F/V Windy Bay* grounding in Prince William Sound.

**Sep 22,** *Marine Columbia,* 17,000th tanker to load.

**Sep 22,** Pipeline shutdown for mainline valve maintenance and integrity test and performance evaluation of two 48-inch mainline remote gate valves.

**Oct 4,** Bullet hole at MP 400 leaks 258,000 gallons of oil. Over 178,000 gallons recovered and reinjected into the pipeline.


**Nov,** Valdez Marine Terminal Ballast Water Tank 94 raised 2 feet, 250-foot diameter.

**Nov 2,** First oil from Northstar field received at PS 1.

**Nov 9,** *Chevron Mississippi,* final tanker load after 30 years of service and 1002 sailings, all ports. (432 from VMT)

2002

**June,** Commemoration of Current Buster™ technology used in nearshore oil spill response.

**Jun 20,** 25th Anniversary of pipeline operations.

**Jul 25,** Pipeline shutdown to replace RGV 39.

**Aug 1,** Valdez Terminal Office Building dedication.

**Oct 10,** Laden *T/V Kenai* assisted by escort vessels when mechanical problems developed at Hinchinbrook Entrance.
Oct 30, Valdez Marine Terminal main fire water distribution line re-lined.

November, Valdez Marine Terminal Ballast Water Tank 93 raised 2 feet, 250-foot diameter.

Nov 3, 7.9 earthquake at MP 588, damaged shoes and VSM crossbeams repaired or replaced.

Nov 26, State of Alaska renews pipeline right-of-way for 30 years.
Design, route survey and selection

Archaeological survey
  Contractors — University of Alaska, Alaska Methodist University.
  Cost, total — $2.2 million approx.
  Sites excavated, total — 330 approx.

Soils survey
  Bore holes — 3,500 approx.
  Soil samples — 15,000 approx.

Time devoted to preconstruction effort — 6 years approx.

Government oversight

Permits required, number
  Federal — 515.
  State — 832.

Notices to Proceed required, number
  Federal — 465.
  State — 403.

James B. Dalton Highway

Bridges, number
  20 permanent.

Construction dates
  Started — Apr. 29, 1974.

Construction time
  154 days.
  Labor hours — 3 million.
Construction Contractors, by road segment

Segments 1-5 (total miles: 221) — Green/Associated Pipeline.
Segment 6 south (34 miles) — Morrison-Knudsen.
Segment 6 north (48 miles) — General Alaska Stewart.
Segment 7 (54 miles) — Burgess.

Ownership and control transferred to state Oct. 1978.

Cost — $125 million approx.

Dimensions

Length — 358 mi. (Yukon River to Prudhoe Bay)
Width — 28 ft.

Grade — 12% max.

Gravel, total used
32 million cu. yds.

Thickness — 3 ft. to 8 ft.

Present name
James B. Dalton Highway: name applied by state in 1981 to 415 miles of roadway, including the North Slope Haul Road (former name), and the 57 mile\(^1\) road from the Yukon River to Livengood constructed by Alyeska in the winter of 1969-70.

*James B. Dalton—Native-born Alaskan, graduate mining engineer, supervised construction Distant Early Warning (DEW) Line in Alaska, expert in Arctic engineering and logistics, served as consultant in early oil exploration in northern Alaska, pioneering winter trails for heavy equipment transport.*
Pipeline, pump stations, road, terminal, construction

Time required to complete — 3 years, 2 months. (Apr. 29, 1974 to June 20, 1977)

Construction Contractors, by pipeline segment
   Section 1 (145 miles) Valdez to Gulkana River — Morrison-Knudsen-Rivers.
   Section 2 (157 miles) Gulkana River to Salcha River — Perini Arctic Associates.
   Section 3 (144 miles) Salcha River to Yukon River — H.C. Price.
   Section 4 (127 miles) Yukon River to Midnight Dome — Associated Green.
   Section 5 (98 miles) Midnight Dome to Kuparuk River — Arctic Constructors.
   Section 6 (125 miles) Kuparuk River to Pump Station 1 — Arctic Constructors.

Contractors and subcontractors, total number — 2,000 approx.
Cost, construction — $8 billion.

Ditching, dimensions
   Below-ground ditches — 8 ft. wide, 8 ft. deep approx., but variable for overburden depth.
   Below-ground pipeline overburden — 3 ft. to 35 ft.

Temporary facilities
   Airfields — seven, 2,500 ft. to 3,000 ft. long; seven, 5,000 ft. long (two continue to be used for TAPS purposes; Galbraith Lake and Prospect).

Construction camps
   Total number 1974 to 1977 — 29.
   Largest camp — Marine Terminal, 3,480 beds.
   Largest pipeline camp — Isabel Pass, 1,652 beds.
   Smallest pipeline camp — Sourdough, 112 beds.
Materials
Shipped to Alaska, total weight — 3 million tons approx.
Gravel used for entire project, total — 73 million cu. yds.
Gravel used for workpad — 32 million cu. yds.
Largest piece shipped — floating tanker berth. (3,250 tons)
Testing, hydrostatic pressure
Maximum, equivalent to 96% of specified minimum yield strength.
Minimum, 125% of operating pressure or 750 psi, whichever was greater.

Welding
Double joints ², number — 42,000.
Field girth welds, number — 66,000.
Passes for field girth welds, number
.562 in. pipe — 7.
.462 in. pipe — 6.

Workforce
Peak — 28,072, Oct. 1975. (includes Alyeska employees and contractors)
Peak, contractors only — 21,600.
Total over life of construction project (1969-1977) — 70,000 approx.
Minority hire, percentage — ranged from 14% to 19%.
Women, percentage — ranged from 5% to 10%.
Lives lost — 31, in incidents directly related to construction. (includes Alyeska, contractors and subcontractors; excludes common carriers)

Pipeline Construction footnotes

² 56 mi. originally; 57 mi. after realignment by state at Livengood in 1981.
² Double joint—two pipe sections (joints) welded into a single length before transport to the field for placement in the line.
<table>
<thead>
<tr>
<th>Construction Camps, Names and Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS 1</td>
</tr>
<tr>
<td>Franklin Bluffs</td>
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<tr>
<td>Happy Valley</td>
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<tr>
<td>PS 3</td>
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<tr>
<td>Toolik</td>
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<tr>
<td>Galbraith Lake</td>
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<tr>
<td>PS 4</td>
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<tr>
<td>Atigun</td>
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<tr>
<td>Chandalar</td>
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<tr>
<td>Dietrich</td>
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<tr>
<td>Coldfoot</td>
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<tr>
<td>PS 5</td>
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<tr>
<td>Prospect</td>
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<tr>
<td>Old Man</td>
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<tr>
<td>Five Mile</td>
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<tr>
<td>PS 6</td>
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<tr>
<td>Hess Creek</td>
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<tr>
<td>Livengood</td>
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<tr>
<td>Ft. Wainwright</td>
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<tr>
<td>PS 8</td>
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<tr>
<td>Delta</td>
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<td>PS 9</td>
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<td>PS 10</td>
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<td>PS 12</td>
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<td>Sourdough</td>
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<td>Glennallen</td>
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<tr>
<td>Tonsina</td>
</tr>
<tr>
<td>Sheep Creek</td>
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<tr>
<td>Terminal</td>
</tr>
</tbody>
</table>
Atigun Construction Camp was one of 30 camps operating during pipeline construction. The buildings were removed and the site was revegetated in 1978.
Pipeline Operations

Basic information
Maximum daily throughput
2.136 million bbl., avg. (with 11 pump stations operating). Rates exceeding 1,440,000 bbl./day assume drag reduction agent (DRA) injection.

Maximum daily throughput (2002)
1 million bbl., avg. (with 7 pump stations operating). Rates exceeding 1,000,000 bbl./day assume DRA injection.

Fuel required for all operations (fuel oil equivalent)
210,000 gal/day (see also “Fuel requirements” under Pump Stations and Valdez Marine Terminal).

Pressure
Design, maximum — 1,180 psi.
Operating, maximum — 1,180 psi.

Pump Station facilities planned in original design
12 pump stations with 4 pumps each.

Pump Stations operating, Nov. 1, 1998 — 7
PS 1, 3, 4, 5, 7, 9, 12; PS 5 is a relief station only. PS 11 was not built, but has maintenance facilities. PS 8 placed in standby June 30, 1996. PS 10 placed in standby July 1, 1996. PS 2 placed in standby July 1, 1997. PS 6 placed in standby August 8, 1997.

Communications
Control Systems
Primary: microwave.
Backup: satellite.
Components: backbone communication system, remote gate valve, ARCS — alternate route communication
system.
Control systems are provided for supervisory control and telemetering, seismic monitoring, and remote gate valve status monitoring and control.

Enterprise Data Services
Primary: fiber optics.
Backup: satellite.
Components: voice, data, video, cable TV Enterprise data services are provided for business systems.

ARCS
Alternate Route Communications System: a private radio network that is used by technicians across TAPS.

Control system
Provides instantaneous monitoring, control of all significant aspects of operation and pipeline leak detection. Operators in the Operations Control Center (OCC) at the Marine Terminal monitor the system 24 hours a day and control oil movement through the pipeline and loading of tankers.

Computer type — Data General MV/20000 and various PCs.
Location — Computer hardware and controllers’ consoles are located in the Operations Control Center at the Marine Terminal.

Points monitored
Pipeline — 3,047 Input points. 352 Control points.
Marine Terminal — 1,074 Input points, 461 Control points.

Remote data acquisition units
Pipeline — 14 (each pump station, plus the North Pole Metering facility and Petro Star Refinery)
Marine Terminal — 24; Metering — 14.

Software programming functions
Data acquisition and control,  
Alarm and data processing and display,  
Hydraulic modeling,  
Leak detection,  
Historical archiving and reporting,  
Seismic evaluation.

**Crude Oil**

Basic conversions
1 bbl. = 42 gallons  
bbl. per ton = 7.07

Definition — a fluid made up of various hydrocarbon components, natural gas liquids and fixed gases.

Gravity  
29.9° API at 60° F.

Linefill, total  
9,059,057 bbl.

Recoverable reserves, at discovery (estimated)
- Sadlerochit — 9.6 billion bbl. (largest Prudhoe Bay pool)
- Kuparuk — 2.2 billion bbl.
- Lisburne — 300 million bbl.
- Milne Point — 200 million bbl.
- Endicott — 350 million bbl.
- Pt. McIntrye — 300 million bbl.
- Niakuk — 75 million bbl.
- Badami — 120 million bbl.
- Alpine — 400 million bbl.
- Northstar — 130 million bbl.

Temperature — (2002)
- At Pump Station 1 — 114° F at injection into pipeline.
- At Terminal — 65° F approx.

Total travel time, PS 1 to Valdez — 9 days.
Velocity — 3.7 mph.

Weight — 310.9 lb./bbl.

32Throughput, average (2002) — 1 million bbl./day or 41,705
Drag Reduction Agent (DRA)
A long chain hydrocarbon polymer injected into the oil to reduce the energy loss due to turbulence in the oil.

**DRA Chronology**

**1979**

*Apr 1*, First test of DRA in TAPS at PS 1.

*Jul 1*, (6 p.m.) Injection initiated at PS 1.


*Oct 22*, Discontinued at PS 1. (PS 2 online)

*Nov 1*, Initiated at PS 10.

**1980, Nov 5**, Discontinued at PS 6. (PS 7 online)

**1985, Jan 6**, Initiated at MP 203. (in support of MP 200 Reroute Project)

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<table>
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<th>FROM</th>
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<th>MILES</th>
<th>LINEFILL</th>
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<td>57.76</td>
<td>653,862</td>
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<td>12.65</td>
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217.65  800.32  9,059,879
1987, Sep 11, Initiated at PS 1 and PS 7.
1990, Dec 18, Installed at PS 8.
1991, Oct 3, Demobed MP 203. (declining throughput)
1992, Oct 1, Decommissioned at PS 7. (declining throughput)
1993, Jun, Test run at PS 6.
1995, Nov 1, Initiated at PS 6. (PS 7 shutdown for maintenance, three months)
1996
  Jun 15, Installed at PS 7 and PS 9.
  Jul 1, Initiated at PS 7 and PS 9. (PS 8 and PS 10 placed in standby)
1997, Summer, Installed and initiated at PS 1 and MP 238. (PS 2 and PS 6 placed in standby)
2002, Sep - Dec, Used to bypass PS 12.
  DRA Test Beds installed south of PS 9 at MP 554.74, MP 568.82, MP 602.66, MP 649.4, MP 709.48.

Fuel Gas Line

Dimensions
  Diameter — 10 in. (34 mi.) from PS 1 to MP 34; 8 in. (115 mi.) from MP 34 to PS 4
  Length — 149 mi.
Function
  Carries natural gas from North Slope fields to fuel pump stations north of the Brooks Range. (Stations south of the Brooks Range are fueled by liquid turbine fuel.)
Gas temperature
  30° F max. (leaving PS 1)
Location
Generally parallels mainline crude oil pipeline, from Prudhoe Bay to PS 4.

Pig launching/receiving facilities
PS 1, MP 34, PS 4

Compressors
Two 1200 hp gas turbine compressors at PS 1 boost gas pressure from approx. 600 psi to 1100 psi.

Pressure
Current operating — 1,090 psi max.
Design — 1,335 psi.
Basic information
Number of stations in original design — 12.
Number of stations operating as of Dec 2002 — 7.
  Pump Stations 1, 3, 4, 5, 7, 9 and 12.
  PS 5 is a relief station; PS 11 never built, maintenance facility.
  PS 8 placed in standby June 30, 1996.
  PS 10 placed in standby July 1, 1996.
  PS 2 placed in standby July 1, 1997.
  PS 6 placed in standby August 8, 1997.
There were 8 stations operating at start up (PS 1, 3, 4, 6, 8, 9, 10 and 12). PS 8 pump building was destroyed by an explosion and fire July 8, 1977, during the start up process; the station was recommissioned Mar. 7, 1978.
  PS 2 was commissioned Oct. 2, 1979; PS 7 was commissioned Dec. 1, 1980.
Number of stations at maximum throughput — 11.

Crew size
Varies per station, 10-25 Alyeska employees.

Crew shifts
  1 week on/1 week off or 2 weeks on/2 weeks off depending on station; 12 hour work day.

Crude oil holding capacity
  PS 1 — 420,000 bbl.
  PS 5 — 150,000 bbl.
  All others — 55,000 bbl.

Fire systems, types
  Halon, water and foam, dry chemical, wet chemical, carbon dioxide.
Fire trucks
1 per station — Pump stations associated with airports have designated airfield fire fighting trucks.

Fire Response Team
Pump station personnel.

Fire training
Annual live fire training and monthly fire response training; airfield rescue fire training provided at stations associated with airports.

Fire training facilities
Each station has fire extinguisher training props.

Fuel requirements, per station, avg. (fuel oil equivalent)
30,000 to 60,000 gallons per day total.

Permanent living quarters, where provided
At 9 stations: PS 1, 2*, 3, 4, 5, 6*, 7, 10* and 12.
Personnel at PS 9 live in nearby communities.
*Removed from service when Pump Station placed in standby.

Power
Size of power plants — ranges from 1.3 megawatts at PS 12 to 4.7 megawatts at PS 6, depending on availability of commercial power, presence of topping unit and/or vapor recovery system.
Stations generating electrical power — All stations.
Stations also purchasing commercial power — PS 8, 9 and 12.

Pumps
Number — at .999 million bbl./day: two operating at PS 1, 3 & 9. PS 4, 7 & 12 have one unit operating. PS 5 is a
relief station.

Pumps, definition

Full head pump — a two-stage pump with both impellers in series. It has one inlet and one outlet.
Half head pump — a two stage pump with both impellers in parallel. It has two inlets and two outlets. It can handle twice the flow of the full head but only produces half the (head) pressure rise.

Capacity of mainline pumps
Half head configuration — 60,000 gpm each.
Full head configuration — 20,000 gpm each.

Pumps, configuration
Half head configuration — PS 2 and 7.
Full head configuration — all other pump stations.
PS 12 is configured to operate with either two full head or one half head pump.

Booster pumps — All pump stations have booster pumps to move oil from the storage tanks to the mainline. (PS 1 has three mainline booster pumps to boost oil pressure.) PS 5 also has injection pumps.

Refrigerated foundations, stations with — 5.
PS 1, 2, 3, 5 and 6.

Topping units
Definition — mini-refinery that produces turbine fuel.
All topping units are in standby.
Production capacity — 2,400 avg. bbl./day of low sulphur turbine fuel.

Turbines, fuel requirements
Gas fired units — 4.3 mcf/unit/day avg.
Liquid fired units — 30,000 gal./unit/day avg. (half head configura-
tion) 24,000 gal./unit/day avg. (full head configuration)

**Power ratings** (sea level, 59° F)

Avon gas generator — 24,600 exhaust gas horsepower.

Reaction turbine

- 18,700 brake horsepower (half head configuration).
- 15,300 brake horsepower (full head configuration).

### Pipeline mileages from/to Prudhoe Bay/Fairbanks/Valdez, and elevations of pump stations

<table>
<thead>
<tr>
<th>PS</th>
<th>Fm. Prudhoe</th>
<th>To Fairbanks*</th>
<th>To Valdez</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>510</td>
<td>800.32</td>
<td>39 ft.</td>
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<tr>
<td>2</td>
<td>57.76</td>
<td>444</td>
<td>742.56</td>
<td>602 ft.</td>
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<td>3</td>
<td>104.27</td>
<td>398</td>
<td>696.05</td>
<td>1,383 ft.</td>
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<tr>
<td>4</td>
<td>144.05</td>
<td>356</td>
<td>656.27</td>
<td>2,763 ft.</td>
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<td>5</td>
<td>274.82</td>
<td>222</td>
<td>525.50</td>
<td>1,066 ft.</td>
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<tr>
<td>6</td>
<td>355.00</td>
<td>139</td>
<td>445.32</td>
<td>881 ft.</td>
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<tr>
<td>7</td>
<td>414.18</td>
<td>55</td>
<td>386.14</td>
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<td>8</td>
<td>489.28</td>
<td>40</td>
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<td>9</td>
<td>548.74</td>
<td>105</td>
<td>251.58</td>
<td>1,509 ft.</td>
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<td>10</td>
<td>585.83</td>
<td>145</td>
<td>214.49</td>
<td>2,392 ft.</td>
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<td>11</td>
<td>685.99</td>
<td>254</td>
<td>114.33</td>
<td>1,302 ft.</td>
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<tr>
<td>12</td>
<td>735.10</td>
<td>300</td>
<td>65.22</td>
<td>1,821 ft.</td>
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<tr>
<td>Terminal</td>
<td>800.32</td>
<td>368</td>
<td>0</td>
<td>142 ft.</td>
</tr>
</tbody>
</table>

*Road miles: PS 1 to PS 7, Dalton & Elliot Highways.
PS 8 to Terminal, Glenn & Richardson Highways.
Pump Station 1.
Typical Pump Station Configuration.
Valdez
Marine Terminal

Basic information
Total area — 1,000 acres.
Cost to build — $1.4 billion.
Elevation — sea level to 660 ft. All facilities except berths
15 ft. or higher.
Holding capacity in crude oil tanks — 9.18 million bbl.

Ballast water treatment
Average ballast water treated — 270,000 bbl./day.
Capacity of system — 30,000 bbl./hour.
Crude oil recovered from ballast — 800 bbl./day avg.
Purity standards — 1.0 ppm aromatic hydrocarbons.
  (daily max.)
Settling tanks
  Capacity — 430,000 bbl. each.
  Number — 3.
  Dimensions — height, 53 ft. 6 in./diameter, 250 ft.
  Piping from berths to tanks — diameter, 42 in.
Biological Treatment Tanks — concrete, above ground
  Capacity — 5.8 million gal. each.
  Number — 2.
Diffuser line at discharge into Port Valdez
  Depth — 300 ft. (maximum)
  Distance offshore — 700 ft. to 1,050 ft.
  Time required for treatment — 21 hrs. avg.

Berths
  Number — 4.
Types — 1 floating, 3 fixed platform.

Designation
   Fixed platform — Berths 3, 4 and 5.
   Floating — Berth 1. (out of service)

Flotation, floating berth — 13 buoyancy chambers.

Loading arms, number and size, each berth, by berth type
   Fixed platform — Four, 16 in.
   Floating — Four, 12 in.

Loading rate, each berth, by berth type
   Fixed platform — 100,000 bbl./hr.
   Floating — 80,000 bbl./hr.

Operating platform, size, by berth type
   Fixed platform — 122 ft. 6 in. long, 46 ft. wide.
   Floating — 390 ft. long, 96 ft. wide.

Tanker Vapor Recovery — Berths 4 and 5 are fitted with vapor recovery arms to collect vapors released during tanker loading. Tanker Vapor Control System brought on-line Mar. 19, 1998.

Time required to close loading arm emergency shutoff valves — 6 seconds.

Water depths at berths (mean low water)
   Berth 1 — 110 ft.
   Berths 3 and 4 — 90 ft.
   Berth 5 — 80 ft.

Weight, floating berth — 6.5 million lbs.

Fire systems
   Portable extinguishers, water and foam systems, halon, CO₂.

Fire trucks — 4.

Fire boats — 6. (tugs equipped with fire fighting equipment)
Fire training, personnel
All terminal technicians trained to Incipient Level.
Advanced training for Exterior & Interior Level Fire Brigade members.
Annual refresher for all three levels.

Fuel requirements
All Terminal and SERVS operations (fuel oil equivalent) — 500 bbl./day, avg.

Height of stacks
Boiler — 300 ft.
Incinerators (3) — 108 ft.

Holding tanks, crude oil
Capacity — 510,000 bbl. each; or 9.18 million bbl. total.
Number — 18.
Dimensions — height 63.3 ft., diameter 250 ft.
Floor thickness — 1/4 in. steel plate. (on concrete ring wall)
Wall thickness — graduated from 1-1/8 in. steel bottom ring, to 1/2 in. top ring.
Type — Fixed, conical roof.
Roof supports, number and size — 61 columns, diameter 24 in.
“Slosh zone” — 3 ft., 9 in.
Space enclosed by — 1.2 acre each, approx.
Working inventory of, avg. — 85% of max. or 7.8 million bbl. (approx 7.8 days of inventory at .999 mbpd.)

Containment dikes
Number of tanks in each — 2.
Capacity — 110% capacity of both tanks, plus 4 ft. for water and snow accumulation.
Walls of, reinforcing steel in — 52 miles in each, diameter 1/2 in. to 3/8 in.
Power generation
Primary plant facilities
Three steam boilers — output 175,000 lb/hr. at 600 psig at 750° F, steam, each.
Three condensing steam turbine driven generators — capacity 12.5 megawatts at 13.8 kv, each.
Standby systems
Two 12-cylinder diesel generators — capacity 2.8 megawatts, total.
Four uninterruptable power supply systems supplied by a 125 volt battery bank for essential control equipment.

Vapor recovery
Number and type of gas compressors — 5, rotary. 13,500 scfm each. Two compressors dedicated to recovering vapors from storage tanks, two compressors dedicated to recovering vapors from Marine Tanker Berths and one swing compressor that can provide either function.

Workforce
Construction, at peak — 4,300.
Valdez Marine Terminal.
The Valdez Marine Terminal, the southern terminus of the trans-Alaska pipeline, is located on the ice-free Port of Valdez at the northeast end of Prince William Sound. This 1,000-acre terminal can store up to 9.18 million barrels of crude oil and has four tanker loading berths. Two of the berths are fitted with a tanker vapor control system and are the primary berths used for loading crude oil.
Ship Escort
Response Vessel
System (SERVS)

Mission
To prevent oil spills by assisting tankers in safe navigation through Prince William Sound and to protect the environment by providing effective response services to the Valdez Marine Terminal and Alaska Crude Oil Shippers in accordance with oil spill response agreements and plans.

Equipment
Enhanced Tractor Tugs (ETTs) — 2 — Nanuq and Tan’erliq. (Alaska Native words for polar bear and black bear)
Function — designed for tethered tanker escort and oil spill response operations. The vessels enhance the ability to assist a disabled tanker.
Size — approx. 153 ft., 10,192 hp, 70,000 gallons recovered oil storage.
Crew — 7, trained response personnel.
Equipped with
Voith Schneider propulsion system.
2,000 ft. of boom.
DESMI skimmers.
70,000 gallons of recovered oil storage capacity.
Dispersant spray arm systems.
ABS Class 1 Firefighting rating that includes pumps, monitors, foam and vessel spray system.
Prevention/Response Tugs (PRTs) — 3 — Alert, Attentive, and Aware.
Function — specially designed for escorting and response service in Prince William Sound.
Best technology for prevention and response missions by powerful ocean-class tugs, arrival in 2000.
Size — approx. 140 ft., 10,200 hp Z drives.
Crew — 7, trained response personnel.
Equipped with
2,000 ft. of Kepner Sea Curtain Boom.
Two DESMI skimmers.
Two 20-ft Kvichak workboats.
AVS Class 1 Firefighting rating that includes pumps, monitors, foam and vessel spray system.
Additional Vessels — 5, including docking tugs and Endurance, an Emergency Response Vessel.
Response Barges — 6.
Four barges each have three open class major skimming systems mounted aboard. (two ea. TransRec 350 and one GrahamRec Skimmers)
Dedicated nearshore barge — 1, the Responder 500-2.
Lightering barge — 1.
Total storage capacity — in excess of 780,000 bbls.
Skimmers — more than 100.
Total recovery capacity — more than 75,000 bbls/hr.
Skimming capacity — ranges from greater than 3,000 bbls/hr to small systems for operating in shallow water.
Valdez Star oil spill recovery vessel — dynamic inclined plane skimming system.
Skimming capacity — 2,000 bbl/hr. (design)
Size — 123 ft.
Boom — various types.
  Total at SERVS — over 42 miles.
Response Centers — 5.
  Chenega Bay, Cordova, Tatitlek, Valdez, Whittier.
Fishing Vessels on Contract (March 2000)
  Core group — 50.
  Total contracted vessels — 350.
Prestaged Equipment
  Hatcheries and Sensitive Areas — Lake Bay, Cannery Creek, Solomon Gulch, Main Bay, Sawmill Bay, Valdez Duck Flats and 10 Port of Valdez sensitive areas.
  Others — Naked Island, Port Etches, Whittier, Cordova, Chenega Bay and Tatitlek.
Wildlife Hazing
  Capture and rehabilitation plans are in place for spill response support.
Non-Mechanical Response Equipment
  Helitask Airborne Dispersant Systems — 2.
    Treatment potential — 4,200 gals/payload.
  ADDS Pack, airborne dispersant delivery system.
    Packages — 2.
    Treatment potential — 2,600 bbl/payload.
  Spillspray, meter controlled dispersant spray unit — 3.
    Onboard tankage — 3,000 gal concentrate liquid.
  Heli-torch, airborne ignition systems — 2.
Alyeska Tactical Oil Spill Model (ATOM)
  Software package specifically designed for oil spill trajectory modeling used to:
    Forecast path of oil, based on real weather input.
    Show wildlife impact potential and other sensitivities such as recreational sites, commercial fishing areas and shoreline types.
    Show locations of PWS communities and hatcheries.
Outbound laden tanker under escort in Prince William Sound.
Approach routes
Gulf of Alaska to Prince William Sound to Port Valdez, via Hinchinbrook Entrance following dedicated traffic lanes to Valdez Arm, and Valdez Narrows. Hinchinbrook Entrance, clearance at — 6.4 to 6.8 miles.

Port Valdez
Depth — Up to 800 ft.
Dimensions, surface — 12 mi. long, 2 -1/2 mi. wide.
Geological description — natural fjord.

Traffic lanes
Depths along — 600 to 1,000 ft. avg.; 350 ft. min. (in Valdez Narrows)
Distance separating — 1 mi.
Width — 3/4 mi.
Valdez Narrows — one-way traffic.

Aids to navigation and safety
Major light house, light towers, differential GPS coverage, radar reflectors, racons, fog signals, buoys, day markers and strobe beacons.
The U.S. Coast Guard maintains a vessel traffic service which includes radio/telephone communications with vessels, global positioning satellite (GPS) based transponder surveillance system in the Gulf of Alaska approaches and Prince William Sound, two radar sites providing coverage in the Valdez Port, Narrows and Arm.
Vessels escorted through Prince William Sound, ice navigation rules/restrictions, and wind restrictions on tanker operations.
Prince William Sound map shows tanker lanes, hatcheries and duck flats, response centers, pre-staged barge locations that contain response equipment, and weather buoys/stations.
Valdez Narrows, clearance at — 1000 yds., Middle Rock to southeast shore.

Classification
General purpose — up to 25,000 dwt.*
Super tanker — 25,000 to 150,000 dwt.
VLCC — 150,000 to 300,000 dwt.
ULCC — More than 300,000 dwt.

Draft of largest tankers — 85 ft.

Largest berthed and loaded to date — 270,000 dwt.
Number loaded per month — 42 avg. (2002)

Size that can be berthed and loaded (in dwt)
  Berth 1 — 120,000 dwt. (out of service)
  Berth 3 — 250,000 dwt.
  Berths 4 and 5 — 270,000 dwt.

Turnaround time
  Berthing, offloading ballast, loading crude, deberthing
   22:20 hrs. avg.

Natural phenomena affecting tanker movements
High winds — The Valdez Narrows is closed to all tanker traffic if the winds exceed 40 knots.
Cape Hinchinbrook — When the winds exceed 45 knots OR the seas exceed 15 feet, Hinchinbrook Entrance is closed to laden tankers.
Glacier Ice — The U. S. Coast Guard Prince William Sound Vessel Traffic Center may impose ice routing measures as appropriate. These measures may include moveable one-way zones, daylight-only restrictions or closure to tanker traffic.

Columbia Glacier
  Height — 0 to 150 ft. above sea level, approx. at terminus
  Length — 35 mi. approx.
  Location — Northeast corner of Prince William Sound,

*dwt., i.e., deadweight tons (cargo weight) x 7 = bbl. (app.)
at the head of Columbia Bay.
Width — 3 mi. approx. at terminus.
Calving rate — 13 million tons/day approx.
Distance from tanker lanes — 8 to 9 mi.
Frequency large icebergs sighted in tanker lanes — 10 to 15 times/month.
Impact on tankers — When Captain of the Port, Valdez, determines hazardous ice conditions exist in Valdez Arm, the Valdez Narrows ice routing measures are placed into effect in accordance with the Prince William Sound Vessel Escort Response Plan.
Largest icebergs produced by — 30 ft. high, 300 ft. dia., approx.
Water depth at face of — range, 0 ft. to 1,000 ft. approx.

**Tanker Escort**

Outbound laden tankers are escorted by two tugs from the marine terminal to Cape Hinchinbrook, a distance of approximately 70 miles with a standby while the tanker moves 17 miles seaward. One of the tugs is attached to the tanker (tethered) for the first 20 miles to provide immediate assistance if required. Inbound tankers (in ballast) are provided a standby sentinel escort from the Gulf of Alaska to the marine terminal.

Over the past few years, Alyeska has invested more than $75 million dollars in new escort tug technology and tug construction. The cornerstones of the 10 tug escort fleet include the two 10,000 horsepower Voith Schneider tractor tugs and the three 10,000 horsepower Z drive tugs. The tanker escort system in Prince William Sound utilizes complementary best available technology and is unsurpassed anywhere in the world.
Pipeline Oil Spill Contingency Plan

Leak detection system — provides detection and location of oil spills.
Leak alert systems, number — 4.
Leak alert systems, types — Pressure deviation, flow rate deviation, flow rate balance deviation and line volume balance.

Containment sites — 221 designated.
Located along drainages.
Criteria for selection — accessibility, river velocity, river channel configuration, environmental sensitivity.
Equipment storage — varies per site, includes oil spill equipment, concrete anchors, or underflow dam kits.

Equipment
Varies at each station.
Equipment available line wide
  Boom, containment — 46,700 ft.
  Boom, fire — 2,150 ft.
  Store capacity — 22,630 bbl.
  Boats/Rafts — 35.
  Vacuum trucks — 12.

Mutual Aid Agreements — provides additional equipment and resources for oil spill response.

Personnel
Pump station personnel trained in oil spill response.
Each manned pump station has 24-hour oil spill response capabilities.
Drills
Field drills are conducted to evaluate preparedness to react to an oil spill. The drills permit evaluation of the training program, particularly oil spill skills such as reconnaissance, assessment and response.

Training
Training for new employees and a 2-day classroom refresher for existing employees with a minimum of two days field training.

Valdez Terminal Oil Spill Contingency Plan
Includes a comprehensive prevention plan outlining spill prevention measures taken at the Terminal as well as a response section describing land and water response for spills originating from Terminal facilities.

Prevention Programs on the Terminal
Training Programs,
Substance Abuse Programs,
Medical Monitoring,
Security,
Transfer Procedures,
Tank Leak Protection,
Corrosion Control Programs,
Preventive Maintenance,
Inspection and Records.

Oil Spill Response Equipment
Ship-assist tugs — 4.
Work boats — 10.
Tank barges — 4.
  Barge mounted skimmers — 6.
  Equipment storage.
  Recovered oil storage — 217,000 bbl. approx.
Flat deck barge — 1.
  Sensitive area protection boom.
On-water staging location.
Self-propelled skimmers — 4.
JBF 6001 (*Valdez Star*) — 1.
  Recovery rate — 2000 bbl/hr.
  Onboard storage — 1300 bbl.
JBF 3003 — 2.
  Recovery rate — 570 bbl/hr.
MARCO Class VII — 1.
  Recovery rate — 1280 bbl/hr.
Containment boom — over 21,000 feet.
Vacuum trucks — 3.
Vacuum skimmers — 3.
Weir/disc skimmers — 14.
Additional equipment available from SERVS warehouse.

**Personnel**

Oil spill response crews available 24 hours/day.
Trained to conduct land and water response operations.

**Spill Responder**

A spill from a tanker at berth or transiting Port Valdez is covered under the Prince William Sound Tanker Spill Prevention and Response Plan. Although a spill from a tanker is the responsibility of the tanker owner, Alyeska provides initial spill response to those tankers.

**Prince William Sound Tanker Spill Prevention and Response Plan**

Tankers transiting Prince William Sound are required by the state to have oil spill contingency plans. The Prince William Sound Tanker Oil Discharge Prevention and Contingency Plan is a required part of each tanker’s individual contingency plans. APSC/SERV S is the Primary Response Action Contractor responsible for the implementation aspects of the PWS Tanker C Plan. The prevention portion of this plan requires that each laden
tanker transiting Prince William Sound must be escorted by two vessels, one of which must be a specially equipped prevention and response vessel or tug. Laden tankers are tethered to Escort Tugs from the Terminal through the Valdez Narrows and Valdez Arm. Also included in the plan are speed limits for tankers and weather restrictions. The response portion of the plan includes plans for open-water, nearshore and shoreline responses and support operations.
<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Location</th>
<th>No of Barrels</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>Jul. 8</td>
<td>PS 8</td>
<td>300 bbl.</td>
<td>Explosion.</td>
</tr>
<tr>
<td></td>
<td>Jul. 19</td>
<td>CV 7</td>
<td>1,800 bbl.</td>
<td>Const.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>damage.</td>
</tr>
<tr>
<td>1978</td>
<td>Feb. 15</td>
<td>Steele Creek</td>
<td>16,000 bbl.</td>
<td>Sabotage.</td>
</tr>
<tr>
<td></td>
<td>Jun. 15</td>
<td>MP 734</td>
<td>4,000 bbl.</td>
<td>Pipe settlement, hairline crack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tank valve.</td>
</tr>
<tr>
<td></td>
<td>Mar. 24</td>
<td>Exxon Valdez</td>
<td>260,000 bbl.</td>
<td>Vessel ran aground.</td>
</tr>
<tr>
<td>1996</td>
<td>Apr. 20</td>
<td>CV 92</td>
<td>800 bbl.</td>
<td>Loose threaded fitting on buried piping.</td>
</tr>
</tbody>
</table>
### Regulatory Reported Crude Oil Spills*
by year, number and amount

<table>
<thead>
<tr>
<th>Year</th>
<th>No.</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>34</td>
<td>81,181 gal/1,932 bbls</td>
</tr>
<tr>
<td>1978</td>
<td>24</td>
<td>672,576 gal/16,013 bbls</td>
</tr>
<tr>
<td>1979</td>
<td>43</td>
<td>233,800 gal/5,566 bbls</td>
</tr>
<tr>
<td>1980</td>
<td>55</td>
<td>149,495 gal/3,531 bbls</td>
</tr>
<tr>
<td>1981</td>
<td>32</td>
<td>63,371 gal/1,508 bbls</td>
</tr>
<tr>
<td>1982</td>
<td>30</td>
<td>1,653 gal/39 bbls</td>
</tr>
<tr>
<td>1983</td>
<td>17</td>
<td>174 gal/4 bbls</td>
</tr>
<tr>
<td>1984</td>
<td>32</td>
<td>3,301 gal/78 bbls</td>
</tr>
<tr>
<td>1985</td>
<td>31</td>
<td>1,138 gal/27 bbls</td>
</tr>
<tr>
<td>1986</td>
<td>40</td>
<td>1,607 gal/38 bbls</td>
</tr>
<tr>
<td>1987</td>
<td>37</td>
<td>172 gal/4 bbls</td>
</tr>
<tr>
<td>1988</td>
<td>35</td>
<td>600 gal/14 bbls</td>
</tr>
<tr>
<td>1989</td>
<td>26</td>
<td>10,571,907 gal/251,712 bbls</td>
</tr>
<tr>
<td>1990</td>
<td>31</td>
<td>277 gal/6 bbls</td>
</tr>
<tr>
<td>1991</td>
<td>54</td>
<td>460 gal/11 bbls</td>
</tr>
<tr>
<td>1992</td>
<td>55</td>
<td>822 gal/19 bbls</td>
</tr>
<tr>
<td>1993</td>
<td>65</td>
<td>361 gal/8 bbls</td>
</tr>
<tr>
<td>1994</td>
<td>44</td>
<td>13,610 gal/324 bbls</td>
</tr>
<tr>
<td>1995</td>
<td>06</td>
<td>90 gal/2 bbls</td>
</tr>
<tr>
<td>1996</td>
<td>12</td>
<td>34,185 gal/814 bbls</td>
</tr>
<tr>
<td>1997</td>
<td>05</td>
<td>80 gal/2 bbls</td>
</tr>
<tr>
<td>1998</td>
<td>05</td>
<td>22 gal/0.5 bbls</td>
</tr>
<tr>
<td>1999</td>
<td>08</td>
<td>16 gal/.39 bbls</td>
</tr>
<tr>
<td>2000</td>
<td>06</td>
<td>165 gal/4 bbls</td>
</tr>
<tr>
<td>2001</td>
<td>15</td>
<td>287,980 gal/6,856 bbls</td>
</tr>
<tr>
<td>2002</td>
<td>09</td>
<td>16 gal/.39 bbls</td>
</tr>
</tbody>
</table>

*Includes Alyeska spills, shipper vessel spills and contractor spills that occurred in the Trans Alaska Pipeline System.
Regional Citizens Advisory Council (RCAC)
Budget — $2.5 million per year. (provided by Alyeska)
Members — January 1996.
  Alaska State Chamber of Commerce.
  Alaska Wilderness Recreation & Tourism Association.
  Chenega Bay Corporation.
  Chenega Bay IRA Council.
  Chugach Alaska Corporation.
  City of Cordova.
  City of Homer.
  City of Kodiak.
  City of Seldovia.
  City of Seward.
  City of Valdez. (2)
  City of Whittier.
  Cordova District Fishermen United.
  Kenai Peninsula Borough.
  Kodiak Island Borough.
  Kodiak Village Mayors Association.
  Oil Spill Region Environment Coalition.
  Prince William Sound Aquaculture Corporation.
  Tatitlik Corporation.
  Tatitlik Village IRA Council.
Alyeska Pipeline contracts with fishing vessels to assist with response activities in Prince William Sound in the event of an oil spill. The fishing vessel above is deploying boom near Tatitlik during a spill response drill.
**Major Pipeline Repairs**

1977

**Jul 7** — MP 489.12 — approx. 20 ft. south of north block valve at PS 8; damage to 30° elbow and pipe from injection of super cooled nitrogen ahead of oil front during oil-in. Replaced with new elbow and two 6-ft. pups. Pipe reburied.

**Jul 8** — MP 489.24 — pump building at PS 8 destroyed in an explosion and fire; the pipeline was undamaged. The pump building was replaced, and recommissioned on Mar. 7, 1978.

**September** — MP 388.00 — north of Lost Creek; two bullet indentations. Covered with 48-in. dia., 3-ft. welded split sleeve.

1978

**February** — MP 457.53 — Steele Creek; 1-in. dia. hole (sabotage). Covered with 48-in. dia., 22-1/2 in. bolted split sleeve; subsequently covered with welded sleeve.

1979

**June** — MP 166.43 — north side Atigun Pass; hairline crack caused by buckle. Covered with 56-in. dia., 6-ft. welded split sleeve; 19 steel supports installed. Pipe reburied.

**June** — MP 734.16 — 1 mi. north of PS 12; hairline crack caused by buckle in pipe. Covered with 56-in. dia., 6.1-ft. welded split sleeve; 7 steel supports installed. Pipe reburied.

**September** — MP 157.62 to MP 157.65 — instrument
pig (“Super Pig”) lodged in line at CV 29. Stopple and bypass installed, valve bonnet lifted, pig removed. Pipe reburied.

**October** — MP 166.41 — north side Atigun Pass; buckled pipe. Covered with 56-in. dia., 6-ft. welded split sleeve. Pipe reburied.

**1980**

**April** — MP 449.96 — indentation, possibly from bullet. Covered with 48-in. dia., 18-in. welded split sleeve.

**May** — MP 159.70 — construction damage from backhoe during monitor rod installation. Covered with 48-in. dia., 3.6-ft. welded split sleeve. Pipe reburied.

**June** — MP 416.00 — approx. 2 mi. south of PS 7; pipe settlement. Approx. 430-ft. excavation; 8 steel supports installed. Pipe not reburied.

**August** — MP 752.00 — flash flood, 900 ft. of overburden washed out; no damage. Pipe reburied.

**November** — MP 720.00 — pipe settlement. Approx. 200-ft. excavation; pipe lifted, concrete slurry added beneath pipe. Pipe reburied.

**1982**

**April** — MP 168.40 — south side Atigun Pass; pipe settlement. Approx. 300-ft. excavation; concrete slurry added beneath pipe. Pipe reburied.

**August** — MP 166.03 — north side Atigun Pass; pipe buckle. Covered with 56-in. dia., 6.5-ft. welded split sleeve. Pipe reburied.

**1983**

**March** — MP 730.29 — pipe settlement. Approx. 102-ft. excavation; 9 concrete river weights removed, concrete slurry added beneath pipe. Pipe reburied.

**April** — MP 200.24 — Dietrich River channel; pipe buckle. River channel redirected temporarily; approx.
125-ft. excavation; 56-in. dia., 6-ft. welded split sleeve installed; 5 specially designed steel supports installed. Pipe reburied.

**October** — MP 45.97 — pipe settlement. Approx. 200-ft. excavation; concrete slurry added beneath pipe. Pipe reburied.

**1984**

**March** — removal of stuck scraper pig at CV 4 and relocation of pig trap from PS 5 to PS 4.

**November** — removal of stuck pig at PS 10.

**1985**

**January** — MP 200 temporary bypass tie-in, pipe settlement.

**April** — MP 200 final tie-in of 48-inch permanent reroute. (404.7 ft. added to total pipeline length in MP 200 reroute, Apr 22, 1985.) Reroute due to pipe settlement.

**1986**

**Oct 10** — Steele Creek; permanent welded sleeve installed over bolted split sleeve.

**Nov 18** — replaced damaged “Tee” at PS 10; “Tee” damaged by stuck scraper pig.

**1987**

**Sep 29** — MP 166.41 to 166.43, Atigun Pass, replaced 234 ft. of buckled pipe.

**Aug 25** — mechanical damage covered with 3 ft. welded sleeve.

**1989**

Total of 30 sleeves installed for corrosion repairs.

**1990**

Total of 86 sleeves installed for corrosion repairs.

**Nov 23** — MP 172.62, dent covered by 6 ft. welded sleeve.

**Dec 3** — mechanical damage covered with bolted clamp,
later covered with a split tee. (part of Atigun Floodplain Pipe Replacement Project)

**1991**

Total of 18 sleeves installed for corrosion repairs.

**Mar 8** — MP 779.47, mechanical damage covered by 4 ft. welded sleeve.

**Apr 6** — MP 756.80, mechanical damage covered by 4 ft. welded sleeve.

**September** — MP 157-165.5. Atigun Floodplain Pipe Replacement Project completed. Permanent reroute of 8.5 miles of mainline pipe due to corrosion.

**1993**

**Jun 6** — MP 775, mechanical damage covered by 3 ft. welded sleeve.

**1994**

**Jul 22** — CV 9 bypass spool replacement and drain line repair.

**Jul 30** — CV 86 bypass and drain line repair.

**Sep 30** — CV 74 drain line repair.

**1995**

**Mar 15** — replace actuator on CV 55.

**Jun 8** — replace actuator on CV 89.

**Jul 14** — RGV stem leak repair.

**Sep 15** — extend Chena Hot Springs Road casing.

**1996**

**Apr 25** — replace bypass line on CV 92.

**1997**

**Feb 8** — install “armadillo” sleeve at Wilbur Creek. Repair due to corrosion.

**Jun 20** — MP 775.75, mechanical damaged covered by 2.5 ft. welded sleeve.

**Oct 9** — MP 799.68, corrosion repair covered by 4.8 ft.
welded sleeve.

1998

**Sep 25** — replaced RGV 80 and repaired CV 122.

**Mar 19** — Tanker Vapor Control System operations began at Valdez Marine Terminal.

1999

**Apr 26** — MP 652, total of 2 sleeves installed for corrosion repair.

**Sep 11** — replaced RGV 60.

2000

**May 26** — MP 170, completed reset and repair of tripped anchors, a result of the collapse of vapor pocket after pipeline restart.

**Jun 1** — MP 710.76, mechanical damage covered by two 2-ft. welded sleeves.

**Sep 16** — PS 9, replaced CV 74 and M-2 valve.

2001

**Sep 22** — pipeline shutdown for mainline valve maintenance and integrity test, and performance evaluation of two 48-inch mainline remote gate valves.

**Oct 4** — MP 400, bullet hole repaired with hydraulic clamp. Clamp later replaced with Thor plug.

2002

**Jul 25** — pipeline shutdown to replace RGV 39.

**November** — MP 588, repaired or replaced damaged shoes and VSM crossbeams from 7.9 earthquake on Nov 3.
Pipeline Shutdowns

1977

Aug 2 — equipment malfunction — 40 min.
Aug 15 — PS 9 sump overflow — 110 hrs., 11 min.
Sep 20 — equipment malfunction — 59 min.
Oct 9 — producer shutdown — 4 hrs., 14 min.

1978

Jan 5 — equipment malfunction — 1 hr.
Jan 10 — equipment malfunction — 4 hrs.
Jan 16 — equipment malfunction — 4 hrs., 22 min.
Jan 17 — equipment malfunction — 3 hrs., 41 min.
Feb 15 — sabotage, Steele Creek — 21 hrs., 31 min.
May 6 — equipment malfunction — 7 hrs., 18 min.
May 30 — equipment malfunction — 2 hrs., 22 min.
Sep 4 — equipment malfunction — 3 hrs.
Dec 17 — equipment malfunction — 2 hrs., 8 min.

1979

Jun 10 — Atigun Pass leak — 53 hrs., 37 min.

1980

May 12 — PS 10 crude tank valve leak — 3 hrs., 37 min.
Oct 17 — scheduled maintenance — 5 hrs., 16 min.

1981

Jan 1 — CV 23 leak — 15 hrs., 38 min.
Feb 8 — equipment malfunction — 3 hrs., 54 min.

1982

Jun 7 — equipment malfunction — 2 hrs., 48 min.
Dec 22 — equipment malfunction — 12 hrs.
1983
0 hrs. (no shutdowns)

1984
Mar 20 — Scraper pig stuck at CV 4 — 18 hrs./PS 4 Trap relocation — 57 hrs., 40 min.
Jun 17 — equipment malfunction — 1 hr., 7 min.
Oct 5 — producer maintenance — 5 hrs.

1985
Jan 21 — MP 200 bypass tie-in — 66 hrs.
Apr 22 — MP 200 final reroute tie-in of 48-in. pipe — 20 hrs., 40 min. (404.7 ft. added to total pipeline length in MP 200 reroute, Apr. 22, 1985).
Jun 26 — equipment malfunction — 42 min.
October — removed stuck pig at PS 10.
Nov 9 — PS 1 explosion and fire — 10 hrs., 15 min.

1986
Sep 26 — removed scraper pig at PS 10 — 31 hrs., 50 min.
Nov 18 — replaced “Tee” at PS 10 — 16 hrs., 54 min.

1987
Sep 29 — Atigun Pass pipe replacement — 24 hrs., 6 min.

1988
0 hrs. (no shutdowns)

1989
Feb 26 — total power failure at PS 1 — 1 hr., 31 min.; PS 1 block line — 32 min.
Oct 20 — repair corroded pipe at MP 144.2 — 5 hr., 16 min.

1990
Mar 21 — PS 3, broken nipple valve 320 — 4 hr., 10 min.
Jun 12 — PS 1, valve D2 pipe replacement — 12 hr., 39 min.
Jun 12 — PS 9 isolated station, valve M2 leak — 1 hr., 34 min.
Nov 20 — corrosion repair, welding at MP 157.87 — 3 hr., 17 min.
Dec 15 — high inventory and power failure at Valdez Terminal — 1 hr., 42 min.

1991
0 hrs. (no shutdowns)

1992
Aug 7 — uncommanded closure of RGV 73, electric short — 1 hr., 49 min.
Oct 7 — segment 11 RGV intransit indication — 35 min.
Oct 16 — segment 11 RGV intransit indication — 7 min.

1993
May 20 — PS 3 isolated gas building, broken fitting — 9 min.
Jun 22 — RGV 98A false intransit indication, MLR2 project work — 38 min.
Oct 29 — loss of communication with segment 12 RGV's — 20 min.

1994
Jan 24 — isolate station at PS 10 caused by leaking nipple on 26 in. yard check valve — 1 hr., 26 min.
Feb 14 — isolate gas building at PS 1 faulty gas detector — 24 min.
Apr 15 — replace 002 valve at Valdez and troubleshoot segment 4 RGVs — 24 hrs., 28 min.
Apr 18 — work on PS 4 Systronics Master Panel — 7 hrs., 57 min.
Jun 8 — communications failure with RGV 73, failed power converter — 1 hr.
Jun 12 — communications failure with RGV 69, battery failure — 36 min.
Oct 15 — communications failure with RGV 40 — 2 hrs., 20 min.
1995

Feb 22 — PS 9 shutdown by high pressure shutdown switch — 19 min.

Jun 16 — communications failure to Segment 4 RGVs, RGVs 31-35 closed — 2 hrs., 25 min.

Jul 10 — RGV 118 intransit indication — 1 hr., 41 min.

Jul 10 — communications failure to Segment 10, RGV 95 — 29 min.

Jul 11 — communications failure with RGV 95 — 1 hr., 30 min.

Sep 11 — scheduled maintenance — 15 hrs., 45 min.

Sep 12 — completion of scheduled PS 2 maintenance — 4 hrs., 51 min.

Sep 18 — communications failure with RGV 37 — 1 hr., 42 min.

Nov 7 — fire alarm in PS 10 pump house building — 12 min.

1996

Feb 17 — communications failure with RGV 113 — 2 hrs., 7 min.

May 6 — scheduled maintenance — 21 hrs. 45 min.

May 7 — PS 8 valve seal repair, repair leaking PS 4 M2 valve body drain valve — 7 hrs., 17 min.

Jul 12 — scheduled maintenance, preparations for PS 8 and PS 10 standby — 10 hrs., 25 min.

Aug 1 — scheduled maintenance as part of ramping down PS 8 and PS 10 — 8 hrs., 40 min.

Aug 6 — scheduled maintenance as part of ramping down PS 8 and PS 10 — 11 hrs., 2 min.

1997

Jan 12 — communications failure with RGV 124 — 3 hrs., 24 min.

Jan 13 — communications failure at RGV 62, 65, & 67 — 13 min.
Jun 1 — false RGV indication at RGV 32-44, Segment 4 — 2 hrs., 9 min.

Jun 26 — communications failure with RGVs in segment 12 — 5 hrs., 44 min.

Jul 1 — communications failure with RGV 31-33 — 1 hr., 45 min.

Aug 1 — scheduled maintenance for PS 2 & PS 6 ramp-down preparation — 17 hrs., 49 min.

Aug 8 — placed PS 6 in standby — 19 hrs., 29 min.

Aug 12 — false transit indication, PS 11, M-1 valve — 25 min.

Sep 19 — false transit indication, RGV 103 — 14 min.

Nov 8 — communications failure, RGV 45 — 1 hr., 17 min.

1998

May 18 — PS 1 in-rush vapor test and vibration test of VMT incoming relief piping — 5 hrs., 9 min.

Aug 5 — segment 10 RGVs in invalid status — 24 min.

Aug 14 — communications failure, segment 10 — 5 hrs., 4 min.

Sep 25 — valve maintenance, replaced RGV 80 and repaired CV 122 — 28 hrs., 40 min.

Nov 15 — communications failure to Segment 4 RGVs, relay failure — 3 hrs., 23 min.

1999

Feb 15 — communications failure at RGV 60 — 15 mins.

Feb 17 — communications failure at RGV 105 — 1 hr., 25 mins.

Feb 23 — communications failure at RGV 32, battery failure — 2 hrs., 12 mins.

Mar 20 — communications failure at RGV 80 — 1 hr., 07 mins.

Mar 25 — communications failure at RGV 102 — 1 hr.,
57 mins.
**Apr 3** — communications failure at RGV 91 — 26 mins.
**Apr 11** — communications failure at RGV 69 — 56 mins.
**Jun 8** — communications failure with all Segment 4 RGVs — 1 hr., 13 mins.
**Jun 17** — communications failure at RGV 91 — 34 mins.
**Jul 5** — communications failure at RGV 43 — 34 mins.
**Jul 5** — maintenance at Tea Lake, repeater loss of communication to segment 4 RGVs — 1 hr., 52 mins.
**Sep 11** — valve maintenance, replaced RGV 60, tested 46 mainline valves and completed 165 other maintenance tasks — 25 hrs., 49 mins.
**Oct 16** — communications failure at RGV 67 — 1 hr., 10 mins.
**Nov 9** — communications failure at RGV 53 — 26 mins.
**Nov 13** — planned maintenance and autologic testing — 8 hrs., 6 mins.
**Dec 8** — false fire alarm in PS 1 booster pump building — 2 hrs., 34 mins.
**Dec 23** — communications failure with RGVs 62 & 67 — 36 mins.
**Dec 25** — communications failure at RGV 121 — 4 hrs., 16 mins.

**2000**
**Feb 10** — communications failure at RGV 42 — 1 hr., 24 mins.
**Apr 17** — PS 4 unintended stop flow/close RGV initiated due to invalid state transmitted from RGV 35A while troubleshooting power failure — 1 hr., 26 mins.
**Apr 22** — Loss of visibility of PS 11 M-1 — 43 mins.
**Aug 28** — communications failure at RGV 121A, battery failure — 1 hr., 39 mins.
**Sep 16** — Planned line-wide maintenance shutdown — 29 hr., 39 mins.
**Oct 7** — Planned line-wide shutdown for valve leak tests
2001

Feb 26 — PS 5 false fire alarm — 1 hr., 24 mins.

Apr 3 — communications failure at RGV 32 — 2 hrs., 59 mins.

Apr 18 — work on PS 4 Systronics Master Panel — 6 hrs., 38 mins.

Jun 25 — automatic controls activated during planned failover of Scada Host Computer — 1 hr., 10 mins.

Aug 16 — communications failure at RGV 60 — 1 hr., 30 mins.

Aug 26 — communications failure at RGV 123 — 58 mins.

Sep 5 — communications failure at RGV 124 — 2 hrs, 59 mins.

Sep 22 — planned maintenance shutdown — 21 hrs., 4 mins.

Oct 4 — bullet puncture at MP 400 — 60 hrs., 30 mins.

Oct 18 — PS 4 false fire indicator — 1 hr., 57 mins.

Oct 28 — backbone communication system disruption — 4 hrs., 5 mins.

Nov 1 — communications failure at RGV 44 — 2 hrs., 48 mins.

Dec 20 — communications failure at RGV 44 — 2 hrs., 30 mins.

2002

Jan 5 — segment 10 to 11 RGVs closed due to Copper Valley Electric Association power failure — 2 hrs., 6 mins.

May 9 — communications failure at RGV 108 — 1 hrs., 10 mins.

Jun 11 — communications failure at RGV 97 — 2 hrs.

Jul 27 — planned maintenance shutdown — 29 hrs., 57 mins.

Sep 16 — seismic system testing — 35 mins.

Oct 12 — planned maintenance at PS 4 — 3 hrs., 20 mins.

Nov 3 — 7.9 earthquake at MP 588 — 66 hrs., 33 mins.

Nov 27 — communications failure in segment 4 — 1 hr., 49 mins.
Regulatory Oversight

State and Federal Agencies
Alaska Department of Environmental Conservation*
Alaska Department of Fish and Game*
Alaska Department of Labor*
Alaska Department of Natural Resources*
Alaska Department of Public Safety
Alaska Department of Transportation and Public Facilities
Alaska State Fire Marshall
Regulatory Commission of Alaska
Federal Aviation Administration
Federal Energy Regulatory Commission
Federal Maritime Commission
Interstate Commerce Commission
Local Boroughs and Municipal Governments
U.S. Coast Guard
U.S. Corps of Engineers
U.S. Department of Commerce, National Oceanic & Atmospheric Administration
U.S. Department of Interior, Bureau of Land Management*
U.S. Department of Labor, Occupational Safety & Health Administration
U.S. Department of Transportation/Office of Pipeline Safety*
U.S. Environmental Protection Agency*
U.S. Fish & Wildlife Service*
U.S. National Transportation Safety Board

* denotes member of the Joint Pipeline Office
Cost — Approximately $8 billion for construction of entire system, including Marine Terminal and pump stations, at conclusion of initial construction period in 1977. Does not include interest on capital investment, or capital construction after 1977.

Concrete weights
Pipe coating, river crossings — 75,000 lbs. per 40-ft. section.
Saddles, flood plains — 18,500 lbs. each.

Mainline crossings
Animal, elevated, minimum height — 10 ft.
Animal, elevated, number — 554.
Animal, buried, number — 23.
Animal, buried, refrigerated, location — MP 645 and MP 649.
Bridges, Pipeline, types and number
Orthotropic box girder — 1.
Plate girder — 9.
Suspension — 2.
Tied arch — 1.
Total — 13.
Road, number
North of Yukon — 21.
South of Yukon — 23.
Road crossings, refrigerated — Glenn Highway at Glennallen.
Design modes

Selection — Soil sampling and other means were used to determine soil types along the route. Where thaw-stable soils were found, the pipeline was buried in the conventional manner. In areas of thaw-unstable soils, and where heat from the pipeline might cause thawing and consequent loss of soil foundation stability, the pipeline was insulated and elevated above ground by means of a unique support system.

Basic types and miles of each
Above-ground — 420 mi.
Conventional below-ground — 376 mi.
Refrigerated below-ground — 4 mi.

Description
Above-ground — Specially designed vertical supports were placed in drilled holes or driven into the ground. In warm permafrost (See Permafrost) and other areas where heat might cause undesirable thawing, the supports contain two each, 2-inch pipes called “heat pipes,” containing anhydrous ammonia, which vaporizes below ground, rises and condenses above-ground, removing ground heat whenever the ground temperature exceeds the temperature of the air. Heat is transferred through the walls of the heat pipes to aluminum radiators atop the pipes.

Conventional below-ground — The pipe is underlain with a layer of fine bedding material and covered with prepared gravel padding and soil fill material, in a ditch from 8 ft. to 16 ft. deep in most locations, but up to 49 ft. deep at one location. Zinc ribbons, which serve as sacrificial anodes to inhibit corrosion of the pipe, are buried alongside the pipeline. The Atigun pipe replacement section, 8.5 miles in length, has four
magnesium ribbon sacrificial anodes installed. Electrical currents in the earth’s surface, called “telluric currents” and caused by the same phenomenon that generates the Northern Lights, can be picked up by the pipeline and zinc/magnesium anodes. The zinc/magnesium anodes act like grounding rods to safely return these currents back to the earth, reducing the risk of damage to the pipeline.

Special burial, non-refrigerated — In areas of thaw-unstable soils calling for elevated pipeline construction, but where the pipeline had to be buried for highway, animal crossings, or avoidance of rockslides and avalanches, the line was insulated, to protect the permafrost from the heat of the pipeline,

*Refrigerated Burial of Pipe*
and buried.
Special burial, refrigerated — In some areas the line was insulated and buried in a refrigerated ditch. Refrigeration plants at each of these points circulate chilled brine through loops of 6-inch diameter pipe to maintain the soil in a stable frozen condition.

**Insulation**
- Elevated pipeline, thickness — 3.75 in.
- Refrigerated below-ground pipeline, thickness — 3.2 in.
- Under gravel workpad or road — 2 in. to 4 in. (limited areas only)

**Gabion & concrete mats**
- Used in Atigun Floodplain Pipe Replacement Project as cover on pipe in shallow burial area for protection from natural erosion and scouring.
- Gabion mats, used 31,750 ft.
- Concrete mats, used 9,525 ft.

**Land ownership**
- Ownership, entire system, by area:
  - Federal government — 6.27 sq. mi. approx.
  - State government — 7.79 sq. mi. approx.
  - Private — 1.41 sq. mi.
  - Owner companies — 2.9 sq. mi.
  - Total area — 18.4 sq. mi.
- Ownership, pipeline only, length
  - Federal government — 376 mi. approx.
  - State government — 344 mi. approx.
  - Private — 80 mi. approx. (including 51 mi., Alaska Native Corp. land)
  - Total — 800 mi.
- Pipeline in municipal jurisdiction, approx.
  - Arctic North Slope Borough — 179.2 mi.
  - Fairbanks North Star Borough — 89.1 mi.
  - City of Delta Junction — 5.5 mi.
City of Valdez — 20.8 mi.

Linefill
Definition — Amount of oil in pipeline from PS 1 to Marine Terminal.
Volume — 9,059,057 bbl.

Permanent facilities
Access roads, dimensions — 120 ft. to 7.5 mi. long; 28 ft. wide, minimum 3 ft. gravel base.
Access roads, number — 225, linking state roads with pipeline, pump stations and airfields.
Airfields, land status and length
   Federal land subject to and operated under state leases
   Galbraith Lake — 5,200 ft.
   Prospect — 5,000 ft.
Pressure Relief Station — 1. (PS 5, reinjects oil drained down for pressure relief, but does not have mainline pumps and does not boost total stream.)
Marine terminal — 1. (Valdez)
Pig launching/receiving facilities — 3. (PS 1, PS 4 and Marine Terminal)
Pipe shoes, number — 39,000 approx.
Pump stations — 11. (10 pump stations, 1 relief station)
Topping units — 3. (PS 6, 8, and 10. PS 8 & 10 topping units placed in standby, summer 1996. PS 6 topping unit placed in standby summer 1997.)

Pipeline Valves, types and number
   Check — 81.
   Gate — 71.
   Block — 24.
   Ball — 1.
   Total — 177.

Thermal expansion
Definition — change in pipe length due to change in crude
oil temperature.
Tie-in temperature — actual pipe temperatures at the time when final welds were made which joined strings of pipe into a continuous line.
Hot position — pipe at maximum oil temperature. (145° F)
Cold position — pipe at minimum steel temperature. (-60° F, pre-startup)
Each 40 ft. length of pipe expands .031 inches with each 10° F rise in temperature and contracts the same distance with each 10° F drop in temperature.
Longitudinal expansion of typical 720 ft. straight above-ground segment from minimum tie-in temperature to maximum operating temperature — 9 inches.
Note: due to anchoring, the pipeline does not expand lengthwise but shifts laterally on the above-ground supports. (See zig-zag configuration below.)
Maximum above-ground lateral movement
  Tie-in to hot position — 8 ft.
  Tie-in to cold position — 4 ft.
Thermal stress — maximum, 25,000 psi, where below ground pipeline is fully restrained by the soil, the maximum longitudinal stress due to change in temperature from pipe temperature at tie-in to maximum oil temperature.

Zig-zag configuration
Above-ground sections of the pipeline are built in a zig-zag configuration to allow for expansion or contraction of the pipe because of temperature changes. The design also allows for pipeline movement caused by an earthquake.

VSMs (Vertical Support Members)
Number — 78,000.
Depth at which embedded — 15 ft. to 70 ft.
Distance between
  Anchor supports — 800 ft. to 1,800 ft.
  Standard supports — 60 ft. approx.
Heat pipes, number fitted with — 61,000. (122,000 individual heat pipes, 2 per VSM, where fitted)

**Vertical Support Member**
Above ground section of the trans-Alaska pipeline as it enters the “Sag” River near pipeline Mile Post 84, approximately 26 miles south of Pump Station 2.
Permafrost

Definition — Any rock or soil material that has remained below 32°F continuously for two or more years. The two-year minimum stipulation is meant to exclude from the definition the overlying ground surface layer which freezes every winter and thaws every summer (called the “active layer” or “seasonal frost”).
By type
Cold permafrost — Remains below 30° F, and which may be as low as 10° F as on the North Slope; tolerates introduction of considerable heat without thawing.
Ice-rich — 20% to 50% visible ice.
Thaw-stable — Permafrost in bedrock, in well drained, coarse-grained sediments such as glacial outwash gravel, and in many sand and gravel mixtures. Subsidence or settlement when thawed is minor, foundation remains essentially sound.
Thaw-unstable — Poorly drained, fine grained soils, especially silts and clays. Such soils generally contain large amounts of ice. The result of thawing can be loss of strength, excessive settlement and soil containing so much moisture that it flows.
Warm permafrost — Remains just below 32° F. The addition of very little additional heat may induce thawing.

Depth along pipeline route
From a few inches to 2,230 ft. approx.

Location, definitions
Continuous Zone — Permafrost is found almost everywhere in the zone, as the name implies. Includes all of the North Slope and most of western Alaska.
Discontinuous Zone — Permafrost is found intermittently. Includes much of the interior of the state.
Sporadic Zone — Permafrost is found in isolated, small masses of permanently frozen ground.

Pipeline, affected areas — Approximately 75% of the line passes through permafrost terrain. The line traverses the continuous zone on the North Slope and through the Brooks Range; it then encounters the discontinuous and sporadic zones and passes through areas of no permafrost in the immediate vicinity of Valdez.
Problems
Frost-heaving — When the active layer freezes, ice forms, pushing the ground surface upward.

Frost-jacking — When heaving occurs as described above, if a structure imbedded in the ground is not properly anchored to resist such movement, the structure will be forced upward along with the ground surface. In most cases, the structure does not return to its original position when the active layer thaws during the following summer. The net upward movement is called “jacking.” This phenomenon can occur whenever there is seasonal freezing and thawing of the active layer, and is not limited to permafrost areas.

Thaw settlement — Structures founded on “thaw-unstable” permafrost may settle if the large amounts of ice in the thaw-unstable permafrost are melted. Melting is typically caused by heat from the structure or changes to the natural thermal conditions.

Design solutions
The pipeline design is based primarily on the soil conditions encountered along the right-of-way. There are three principal design modes.

Above-ground pipeline — Where thaw-unstable permafrost was encountered, problems associated with melting permafrost were avoided by placing the pipeline above ground on an elevated support system. VSMs (pilings) used to support the line were designed to resist frost-jacking forces.

To allow animals to cross, twenty-three sections were conventionally buried line-wide, each about 200 feet long.

Below-ground pipeline, conventional burial — Where either unfrozen or thaw-stable permafrost were
encountered the pipeline was buried in the conventional manner with no special provisions for permafrost. Below-ground pipeline, special burial — Where thaw-unstable permafrost was encountered, but where the pipeline had to be buried for highway, animal crossings, or avoidance of rockslides and avalanches, protection of the permafrost from heat of the pipeline was provided by insulation around the pipeline. Some special burials include ground refrigeration systems along with pipe insulations.

Special burial locations, (about four miles)
MP 645-649 approx. — caribou crossing.
MP 681 approx. — highway crossing. (Glenn Highway)
Two sections (about one mile) in Atigun Pass were buried in insulated boxes to provide protection from rock slides and avalanches.
Earthquakes

Earthquake magnitude pipeline system designed to withstand — 8.5 Richter Scale (maximum); range from 5.5 to 8.5, depending on area.

Faults crossed by pipeline — 3.
Denali, McGinnis Glacier and Donnelly Dome.

Predicted limits of lateral movement for above ground pipeline, general — 2 ft.

Design values for maximum movement at pipeline crossing of major faults
- Denali fault — 20 ft. lateral and 5 ft. vertical displacement
- McGinnis Glacier fault — 8 ft. lateral and 6 ft. vertical displacement.
- Donnelly Dome fault — 3 ft. lateral and 10 ft. vertical displacement.
- Minor potential fault locations — 2 ft. lateral and 2 ft. vertical.

Earthquake Monitoring
Alyeska’s Earthquake Monitoring System (EMS) consists of sensing and processing instruments at all pump stations south of Atigun Pass and at the Valdez Terminal. A central processing unit at the Operations Control Center is linked to the Pipeline and Terminal operator consoles. The EMS is specifically designed to process strong ground motions, to interpolate or extrapolate estimates of earthquake accelerations between the sensing instruments and to prepare a mile-by-mile report comparing the estimated accelerations along the pipeline with the pipeline seismic design.
criteria.

**DSMAs**

The instrumentation at field locations consists of accelerometers mounted on concrete pads which measure strong ground motions in three directions (tri-axial) which are connected to a Digital Strong Motion Accelerograph (DSMA). The DSMA, generally located in the Pump Station control room, processes the signals from the accelerometers in real time and reports alarms and selected data to the central processor at the OCC.

**Tested**

Nov 3, 2002 — The pipeline’s earthquake design withstood a 7.9 earthquake that was centered along the Denali Fault, in the interior of Alaska, approximately 50 miles west of the pipeline. Estimates indicate that the ground along the fault moved 7 feet horizontally and nearly 2.5 feet vertically. The 7.9 quake was the largest on the Denali Fault since at least 1912 and among the strongest earthquakes recorded in North America in the last 100 years.
Pipeline Bridges

Number — total 13.

Types, numbers of each and definition

Orthotropic box girder — 1.

Main supporting members are made up of steel plates welded together to form box beams with the tops of the box beams being an integral part of the driving deck.

Plate girder — 9.

Main supporting members are made up of steel plates welded together to form deep, wide flanges.

Suspension — 2.

Pipe is suspended from large steel cables draped over towers and anchored to massive foundations on opposite banks.

Tied arch — 1.

Supporting element is a steel arch with a horizontal steel member, tying the bases of the arch together to resist the tendency of the bases to move apart.

Yukon River Bridge


Cost — $30 million (Owner’s share, approx. $10 million)


Location in pipeline — MP 353.3.


Name of bridge — Officially named “E.L. Patton Yukon River Bridge” by Alaska Legislature in 1982, after E.L. Patton, President of Alyeska during pipeline construction.


River width — 1,900 ft. (typical)
<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
<th>Length</th>
<th>Milepost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atigun River</td>
<td>Plate girder</td>
<td>537 ft.</td>
<td></td>
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<tr>
<td>Roche Moutonnee</td>
<td>Plate girder</td>
<td>177 ft.</td>
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<tr>
<td>Dietrich River</td>
<td>Plate girder</td>
<td>357 ft.</td>
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<tr>
<td>Middle Fork,</td>
<td>Plate girder</td>
<td>537 ft.</td>
<td></td>
</tr>
<tr>
<td>Koyukuk River</td>
<td>Plate girder</td>
<td>537 ft.</td>
<td></td>
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<tr>
<td>Hammond River</td>
<td>Plate girder</td>
<td>357 ft.</td>
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<tr>
<td>South Fork,</td>
<td>Plate girder</td>
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<td></td>
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<tr>
<td>Koyukuk River</td>
<td>Plate girder</td>
<td>537 ft.</td>
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<tr>
<td>Yukon River</td>
<td>Orthotropic box girder</td>
<td>2,295 ft.</td>
<td>MP 353.3</td>
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<td>Hess Creek</td>
<td>Plate girder</td>
<td>177 ft.</td>
<td></td>
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<tr>
<td>Tatalina River</td>
<td>Plate girder</td>
<td>177 ft.</td>
<td></td>
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<tr>
<td>Shaw Creek</td>
<td>Plate girder</td>
<td>177 ft.</td>
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<tr>
<td>Tanana River</td>
<td>Suspension</td>
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<td>Gulkana River</td>
<td>Tied arch</td>
<td>400 ft.</td>
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<tr>
<td>Tazlina River</td>
<td>Suspension</td>
<td>650 ft.</td>
<td></td>
</tr>
</tbody>
</table>
Dimensions
Diameter, outside — 48 in. (122 cm)
Lengths, standard — 40 ft. and 60 ft.
Thickness, wall — .462 in. and .562 in.

Pieces required for pipeline
over 100,000.

Shiploads
Construction — 120.
Atigun Floodplain Pipe Replacement Project — 6.

Steel grades
x60. (60,000 psi specified minimum yield strength)
x65. (65,000 psi specified minimum yield strength)
x70. (70,000 psi specified minimum yield strength)

Miles, by specification, used in pipeline construction
Grade
x60 — 44 mi.
x65 — 732 mi.
x70 — 24 mi.

Thickness
.462 in. — 466 mi.
.562 in. — 334 mi.

Thickness/grade
x60/.462 in. — 20 mi.
x60/.562 in. — 24 mi.
x65/.462 in. — 446 mi.
x65/.562 in. — 286 mi.
x70/.462 in. — 0 mi.
x70/.562 in. — 24 mi.
Atigun Floodplain Pipe Replacement Project (1991)

Thickness/grade
x70/.562 in — 8.47 mi.

**Pipe, manufactured**
Construction — Japan.
Atigun Floodplain Pipe Replacement Project — Italy.

**Tested to** — Maximum axial force of 2.52 million pounds and lateral deflection force of 459,000 pounds before wrinkling. (typical test sample: 31’5”)

**Volumetric displacement** — 11,366 bbl./mi. (.462”); 11,270 bbl./mi. (.562”)

**Weight** — Per linear ft. — 235 lbs. (.462”); 285 lbs. (.562”)
Total weight shipped — 550,000 tons approx.

**Pig**
Definition — A mechanical device which is pushed through the pipeline by the oil. Several types of pigs are used to improve flow characteristics, inspect for dents and wrinkles, inspect for pipeline corrosion, and measure pipeline curvature.

Types
- **Scraper** — A pig used for cleaning and flow enhancement. Consists of cone-shaped, polyurethane cups on a central body which matches the shape of the interior pipe wall. Bumper nose, urethane construction and light weight prevent damage to check valve clappers.
- **Deformation** — A pig which measures the diameter of the pipe. Defines changes in pipe diameter caused by dents, ovalities, or pipe bending. Changes are recorded and analyzed by engineers.
- **Corrosion** — A pig which detects corrosion or pitting in the pipe wall. These pigs may use different technologies to collect and record corrosion data.
Ultrasonic Corrosion Pig — Measures and records wall thickness of pipeline using ultra sonic transducers. First run in June 1989.

Magnetic Corrosion Pig — Detects metal loss in pipe wall by measuring disturbances in a magnetic field.

Curvature — A pig using an inertial navigation system to determine pipeline location, curvature and pipe wall deformation. First run in 1992.

Operation, frequency — Determined each year as needed.
Launching/Receiving facilities — 3.
PS 1, PS 4 and Marine Terminal.
TAPS employee cleans a scraper pig at the Valdez Marine Terminal. Scraper pigs are pushed through the pipeline by the oil. They are used for pipeline cleaning and oil flow enhancement.
Pipeline Valves
Check — 81.
Gate — 71. (62 remotely operated, 9 manually operated)
Block — 24.
Ball — 1.
Total — 177. (inclusive of valves classified as mainline)

Mainline Valves
Number — 145.
Size — 48-inch.
Design pressure — 1200 psi.

Pump Station and Terminal Valves
Size — 2-inch to 48-inch.
Design pressure — varies to meet process conditions.
(type 150# through class 2500#)
Type — Gate, ball, check, plug, etc.
Number of motor operated valves — approximately 1000.

Definitions
Block valve — when closed, the valve can block oil flow in
either direction. Block valves include manual gate
valves, remote gate valves and station block valves
(suction valves and discharge valves).
Check valve — operates one-way and prevents the reverse
flow of oil. Check valves are designed to be held open
by flowing oil and to drop closed automatically when oil
flow stops or is reversed. To increase operating
efficiency, some check valves are held fully open
mechanically, thus lifting valve clappers entirely free of
the oil stream, reducing turbulence. Actuators fitted to
these valves receive signals from flow or pressure
sensors to drop the valve clappers free. Once the clappers have been released, the actuated check valve functions as a normal check valve to stop flow reversal. Approximately one half of the mainline check valves are fitted with hydraulic actuators; the remainder have manual actuators only.

Manual gate valve — block valves that are operated manually; placed in check valve segments periodically to provide more positive isolation than can be provided by check valves during pipeline maintenance.

Pressure relief valve — a valve designed to open automatically to relieve pressure and keep it below a designated level.

Remote gate valve (RGV) — a remotely controlled block valve for the primary purpose of protecting segments of the line in the event of a catastrophic pipeline break. Valve operating times are either 4 or 8 minutes to fully open or fully close.

Station block valve — a gate valve installed at the inlet (suction) side and the outlet (discharge) side of the pump station or terminal to isolate the facility from the pipeline in the event of an emergency.
Environmental Considerations

Wildlife

Pipeline animal crossings, constructed
579 approx.

Bird species, number identified along route
More than 170.

Fish species, number identified in waters crossed by
pipeline — 34.

Caribou, Population histories

Central Arctic herd
1970 — 3,000
1980 — 9,000
1983 — 12,500
1984 — 13,000
1986 — 16,000
1988 — 15,000 (est.)
1990 — 25,000 (est.)
1992 — 23,400 (est.)
1995 — 18,100
1998 — 38,552
2000 — 27,552

Nelchina herd
1967-68 — 48,000
1972-73 — 10,000
1981 — 20,730, (increasing)
1984 — 25,000
1986 — 29,000
1987 — 30,200
1990 — 37,500 (est.)  
1993 — 40,360 (est.)  
1996 — 50,000  
1999 — 31,000 (est.)  
2000 — 30,000  

Wildlife footnotes

4Ibid. (Heavy harvest cited as cause of decline.)
6R.D. Jakimchuk, 1984: “Relationship Between the Central Arctic Caribou Herd and The Trans Alaska Pipeline.”
7D.R. Carruthers, 1984: “Spring and Fall Movement of The Nelchina Caribou In Relation to The Trans Alaska Pipeline.”
9J. Sexton, 1987 Alaska Dept. of Fish and Game, personal communication.
10Alaska Department of Fish and Game survey.
11Alaska Department of Fish and Game.
13Alaska Department of Fish and Game Nelchina Caribou Management and Hunting Opportunity, 1996-97 flyer.
14Alaska Department of Fish and Game.
15Alaska Hunting Bulletin Vol 5, No. 3, A publication of the Alaska Department of Fish and Game.
Restoration

Area revegetated (through 1997) — Nearly 7,750 acres.

Basic restoration data
  Fertilizer used — 5,500 tons.
  Grass seed used — more than 450 tons.
  Seedlings planted — 83,500.
  Trees transplanted — 24,000.
  Camps, pad restoration — 14.
  Acres — 550 approx.

Soil samples, random, number taken to test for regeneration — 15,000.

Atigun Floodplain Pipe Replacement Project
Restoration
  Fish Wintering Lakes — 3, approx. 4 acres. (1991)
  Reseeding ROW, material sites — 12.5 acres. (1992)
  Willow saplings planted — 4.5 acres. (1992)

Sagavanirktok River Floodplain, Revegetation Research Project. (June 1995)

Deitrick River Floodplain
  Bank Stabilization, MP 218 — 1.4 acres. (1999)
  Revetment, MP 186 — .8 acres. (1999)
  Restoration, MP 190. (2002)


McCallum Creek, Rechannelization, MP 601.5 — 1 acre. (2000)

Tazlina River, Revetment Project, MP 686.8 — 1 acre. (2000)

Oskar’s Eddy, Restoration, MP 178.79. (2001)

Minnie Creek, Restoration, MP 225.76. (2001)

Marion Creek, Restoration, MP 233.25 — 6 acres. (2001)

MP 400 Spill Site, Restoration — 2.5 acres. (2001)

Arthur Creek, Restoration, MP 95.79 — 1 acre. (2002)

Mark Creek, Rechannelization, MP 69.7 — 1 acre. (2002)
Darling Creek, Rechannelization, MP 573.6 — 1 acre. (2002)

**Visual Impact Stipulations**

Access roads, max. allowable grade — 12°.

Buffer strips (undisturbed land)
- Minimum width along streams — 300 ft.
- Width required between state highways and material sites — 500 ft.
- Width required between workpads and parks, refuges, etc. — 1/2 mi.

Right-of-way, maximum straight length permitted visible from highway — 600 ft.
## Pipeline Communities

### Alaska

Area — 586,000 sq. mi.
Coastline, miles of — 33,900.

Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
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<tr>
<td>1980</td>
<td>400,481</td>
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<tr>
<td>1984</td>
<td>523,048</td>
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<td>1986</td>
<td>542,150</td>
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<td>1987</td>
<td>537,800</td>
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<td>1988</td>
<td>531,000</td>
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<tr>
<td>1989</td>
<td>534,400</td>
</tr>
<tr>
<td>1990</td>
<td>550,043</td>
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<tr>
<td>1991</td>
<td>569,575</td>
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<tr>
<td>1992</td>
<td>587,605</td>
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<tr>
<td>1993</td>
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<td>626,932</td>
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<tr>
<td>2001</td>
<td>633,630</td>
</tr>
<tr>
<td>2002</td>
<td>643,786</td>
</tr>
</tbody>
</table>

1. U.S. Bureau of Census
2. Alaska Department of Labor
Anchorage
Population — 269,070² (Borough, 2002), Largest city in Alaska.
Precipitation, per year average — 15.91 inches.
Snowfall, per year average — 69.5 inches.
Temperature range, average — 8.4° F to 65.2° F.
Location — south central Alaska.
Company headquarters
Alyeska Pipeline Service Company
900 E. Benson Blvd.
Anchorage, AK 99508
Telephone: (907) 787-8700
Mailing Address:
Alyeska Pipeline Service Company
P.O. Box 196660
Anchorage, AK 99519-6660

Delta Junction
Precipitation, per year average — 12 inches.
Snowfall, per year average — 37 inches.
Temperature range, average — °11 F to 69° F.
Location — interior Alaska.

Glennallen
Precipitation, per year average — 9 inches.
Snowfall, per year average — 39 inches.
Temperature range, average — °10° F to 56° F.
Location — interior Alaska.
Fairbanks
Population — 84,791\(^2\) (Borough, 2002), Second largest city in Alaska.
Precipitation, per year average — 10.87 inches.
Snowfall, per year average — 65.1 inches.
Temperature range, average — °F to 72.3° F.
Location, interior Alaska
Fairbanks Office
Alyeska Pipeline Service Company
701 Bidwell
Fairbanks, AK 99701
Mailing Address:
Alyeska Pipeline Service Company
P.O. Box 60469
Fairbanks, AK 99706

Valdez
Precipitation, per year average — 64.04 inches.
Snowfall, per year average — 315.7 inches.
Record snowfall (1989-90) — 560.7 inches.
Temperature range, average — ° F to 62.3° F.
Location, Prince William Sound
Depth of Port Valdez — up to 800 ft.
Port dimensions — natural fjord, 12 miles long, 2-1/2 miles wide.
Tidal range in port, 12 to 14 ft.
Valdez Offices
Alyeska Pipeline Service Company
P.O. Box 300
Valdez, AK 99686
SERVS
(Ship Escort/Response Vessel System)
P.O. Box 109
Valdez, AK 99686

\(^2\)Alaska Department of Labor
Visitor Information

Facility access
   Alyeska Pipeline Service Company does not conduct public tours.

Information centers
   Fox Visitor Center, MP 8, Steese Highway.

Information road signs, north to south
   North side of Yukon River — MP 56, James Dalton Hwy.
   Steese Hwy — Approx. 8 mi. north of Fairbanks.
   Tanana River Bridge — MP 275, Richardson Hwy.
   Donnelly Dome — MP 243, Richardson Hwy.
   Denali Fault — MP 214, Richardson Hwy.
   Willow Mountain — MP 88.5, Richardson Hwy.
   PS 12 — MP 65, Richardson Hwy.

Museum displays
   University of Alaska, Fairbanks, Museum; Anchorage Museum of History and Art, Alaska Gallery; Valdez Museum; Prince William Sound Community College.

Pipeline monuments and information signs
   Dr. James A. Maple, P.E., Arctic Pipeline Pioneer — Fox Visitor Center, MP8, Steese Highway.
North Slope

Description
A nearly flat, treeless plain, covering about 88,000 square miles extending from the foothills of the Brooks Mountain range to the Arctic Ocean.
Coastal Plain of ANWR (Arctic National Wildlife Refuge) 90 miles east of Prudhoe Bay.
1.5 million acres-coastal plain.

Prudhoe Bay is a coastal feature of the Beaufort Sea, approximately 250 miles north of the Arctic Circle, and 1,300 miles south of the North Pole. Also used generally to describe a land area of petroleum development of Alaska’s North Slope: 18th largest field in the world. Largest field in North America.

Environment
For 56 days in winter the sun never rises. Winter twilight provides sufficient light for driving without headlights during the day. Winter temperatures drop to ~60° F. Wind chill factor may fall as low as ~135° F. From mid-April to mid-August, there is daylight 24 hours a day. Summer temperatures climb to 70° F and higher.

Oil discovery
Exploratory drilling on the North Slope continued for more than 20 years; many unsuccessful exploratory wells were drilled and many companies gave up the search before the Prudhoe Bay discovery well was drilled by Atlantic Richfield Company and Humble Oil and Refining Company in 1967. A confirmation well the following year proved the discovery of the large oil and gas
reservoir.

**North Slope oil production for all fields and pools received at Pump Station 1 (PS 1)**

2002 — 365.3 million bbl.
Total Cumulative, through 2002 — 13.9 billion bbl.

**PS 1 connections from the North Slope**

Sadlerochit — Representing the major fields of the Prudhoe Bay development.
Startup 1977. (Comprised the Eastern Operating Area (EOA) connection and the Western Operating Area (WOA) connection.) The EOA connection was shutdown in January 2000 and oil from that field now feeds through the connection name now commonly called the Sadlerochit connection.
2002 receipts — 180.9 million bbls.
Average per day — 495,586 bbls. approx.
Total cumulative through 2002 — 10.8 billion bbls.

Kuparuk — Representing the major fields of Kuparuk, Alpine, Milne Point, West Sak, Tabasco and Tarn.
Startup — Dec. 1981
2002 receipts — 131 million bbls.
Average per day — 358,786 bbls. approx.
Total cumulative through 2002 — 2.2 billion bbls.

Lisburne — Representing the major fields of Pt. McIntyre and Niakuk.
Startup — Dec. 1986
2002 receipts — 24.7 million bbls.
Average per day — 67,692 bbls. approx.
Total cumulative through 2002 — 576 million bbls.

Endicott — Representing the major fields of Endicott and Badami.
Startup — Oct. 1987
2002 receipts — 10.9 million bbls.
Average per day — 29,765 bbls. approx.
Total cumulative through 2002 — 444 million bbls.
Northstar — Representing the major field of Northstar.
  Start up — Nov. 2001
  2002 receipts — 17.9 million bbls.
  Average per day — 49,087 bbls. approx.
  Total cumulative through 2002 — 19 million bbls.

**Waterflood and enhanced oil recovery (EOR)**

Methods are enhancing oil production from several North Slope fields, including Prudhoe Bay, Kuparuk, Endicott and Pt. McIntyre.

**Waterflooding**

A system of pumping water into the reservoir behind the produced oil to maintain reservoir pressure and ultimately recover more oil.

**(EOR)**

A miscible gas solvent injected into the reservoir to sweep stranded oil toward product wells.
**Glossary of Terms**

**Block Valve**
When closed, the valve can block oil flow in both directions. Block valves include manual gate valves, remote gate valves and station block valves (suction valves and discharge valves).

**Breakout Tank**
A tank used to relieve surges in a hazardous liquid pipeline system, or to receive and store hazardous liquid transported by a pipeline for re-injection and continued transportation by pipeline.

**Check Valves**
Operates one-way and prevents the reverse flow of oil. Check valves are designed to be held open by flowing oil and to drop closed automatically when oil flow stops or is reversed.

**Discharge Pressure**
Pressure of the oil as it exits a pump station.

**DRA (Drag Reduction Agent)**
A long chain hydrocarbon polymer injected into the oil to reduce the energy loss due to turbulence in the oil.

**dwt**
Deadweight tons, the weight of the cargo; dwt x 7 = bbl. (approx.)

**Linefill**
The amount of oil in the pipeline from PS 1 to the Marine Terminal.

**Manual Gate Valve**
Block valves that are operated manually; placed in check valve segments periodically to provide more positive
isolation than can be provided by check valves.

**Maximum Allowable Operating Pressure**
A rating indicating the maximum pressure at which a pipeline or segment of a pipeline may be operated under the D.O.T. regulations in normal conditions. Also called pressure rating.

**One Barrel**
One Barrel = 42 gallons

**Packline**
Oil flow that completely fills a pipeline.

**Permafrost**
Any rock or soil material that has remained below 32°F continuously for two or more years.

**Pressure Relief Valve**
a valve designed to open automatically to relieve pressure and keep it below a designated level.

**Pressure Spike**
A sudden, brief rise in pressure.

**Pressure Surge**
A pressure spike/excursion moving through the pipeline at sonic velocity, produced by a sudden change in velocity of the moving stream that results from shutting down a pump station or pumping unit, closure of a valve or any other blockage of the moving stream.

**Remote Gate Valve**
A remotely controlled block valve for the primary purpose of protecting segments of the line in the event of a catastrophic pipeline break.

**Slackline**
Oil flow that does not completely fill a pipeline.

**Station Block Valve**
A gate valve installed at the inlet (suction) side and the outlet (discharge) side of the pump station to isolate the
pump station from the pipeline in the event of an emergency.

**Suction Pressure**
Pressure of the oil as it enters a pump station.

**Telluric Currents**
Electrical currents in the earth's surface, caused by the same phenomenon that generates the Northern Lights.

**Thermal Expansion**
Change in pipe length due to a change in crude oil temperature.

**Topping Unit**
A mini-refinery that draws crude off the line and produces turbine fuel to power the station. Three pump stations have topping units: PS 6, 8, 10.

**ULCC**
Ultra-Large Crude Carrier, tanker more than 300,000 dwt.

**Ultimate Strength**
The stress level at which the pipe will fail/rupture or “break.” The ultimate strength of the steel is determined by testing during the manufacture of the pipe.

**VLCC**
Very Large Crude Carrier, tanker 150,000 to 300,000 dwt.

**VSM**
Vertical Support Member.

**Yield Strength**
The stress level above which the pipe will yield/bend/stretch.
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Contingency Plan

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