Marine Navigation Conditions Summary
Technical Memorandum

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Table of Contents

Section **Page**

List of Figures

List of Tables

1.0 Introduction

In support of the Gravina Access Project, this reconnaissance of vessel navigation requirements is intended to identify the characteristics of vessels using Tongass Narrows, their numbers and sizes. This will complement similar efforts to identify aviation requirements, and together these reports will support the process of identifying practical alternatives for improving access from Ketchikan to Gravina Island.

1.1 Brief Description of Tongass Narrows

Tongass Narrows (see Figure 1) is a continuation of Revillagigedo Channel that extends northwest to Guard Islands in Clarence Strait. The Narrows is divided at its lower end by Pennock Island. The channel northeast of the island is called East Channel and the channel southwest of the island, West Channel. Both channels are good for vessels of any draft.

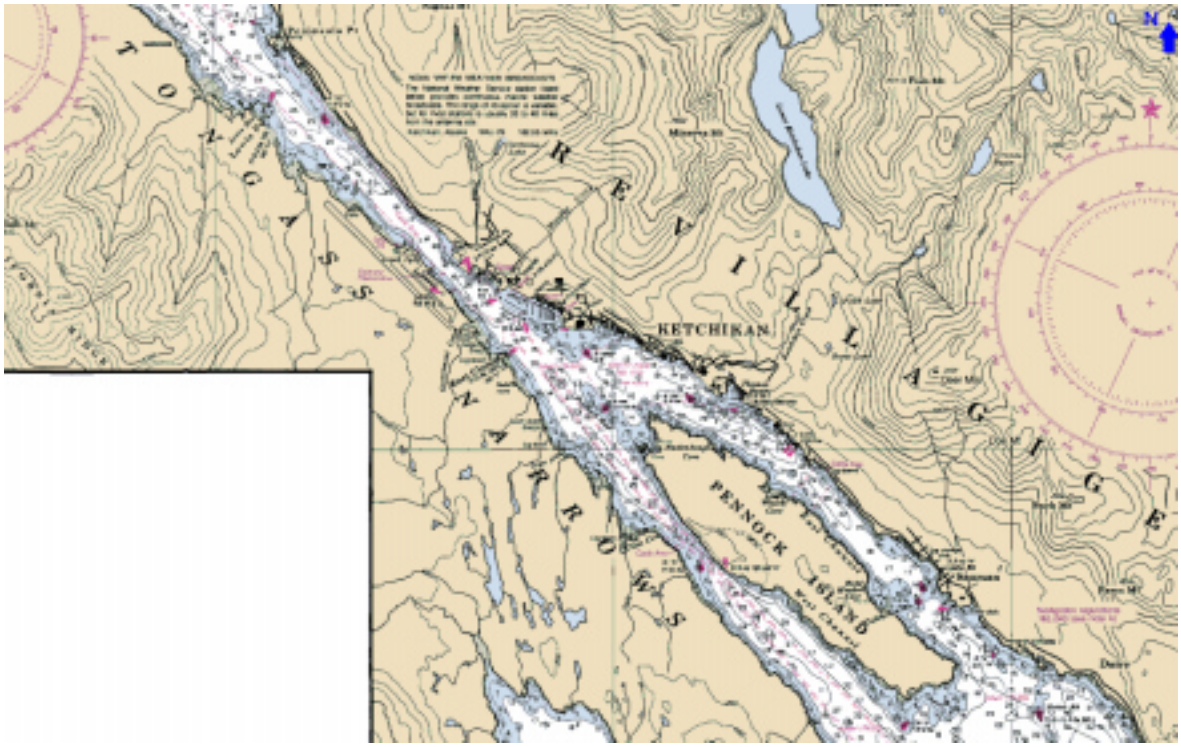

FIGURE 1

Tongass Narrows from Saxman to Peninsula Point

Cruise ships bound for Ketchikan usually make use of East Channel, because it aligns better with the cruise ship docks. Vessels of the Alaska Marine Highway System and barges tend to use West Channel in order to avoid cruise ship traffic and because there is less shoreline development along West Channel, and hence less concern regarding wake.

Vessel operations in Tongass Narrows between Idaho Rock and Charcoal Point are subject to a seven knot speed restriction in accordance with 33 CFR §162.240.

Due to the heavy and diverse character of marine traffic in Tongass Narrows, vessel operations there are currently subject to the voluntary guidelines found in the "Tongass Narrows Voluntary Waterway User Guide" published 18 March 1999.

1.2 Brief Description of Project

The Gravina Access Project will identify practical alternatives for improving access from Ketchikan to Gravina Island. Alternatives to be considered include: no change, bridges, submerged tubes, tunnels and improved ferry service. Various locations and alignments are under consideration for the bridges, tubes and tunnels. As the project progresses an environmental impact statement (EIS) will be developed that identifies a preferred alternative. A final design will follow approval of the EIS.

2.0 Marine Traffic Volumes

This section presents summary data characterizing the traffic volume and salient dimensions of the principal classes of vessels making use of Tongass Narrows. Data are derived from diverse sources and are, in general, complementary.

2.1 Waterborne Commerce Traffic Volumes and Trends

The U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center (WCSC), collects and compiles data regarding vessel movements on navigable waters of the United States. Statistical summaries of these data are published annually under the title "Waterborne Commerce of the United States," and additional data and statistics may be obtained by contacting WCSC directly.

The legal authority for the collection, compilation and publication of waterborne commerce statistics by the Army Corps of Engineers is Section 11 of the Rivers and Harbors Appropriation Act of 1922 (42 Stat. 1043), as amended, and codified in 33 U.S.C. 555 and provides the following:

> "*Owners, agents, masters, and clerks of vessels and other craft plying upon the navigable waters of the United States, and all individuals and corporations engaged in transporting their goods upon the navigable waters of the United States, shall furnish such statements relative to vessels, passengers, freight and tonnage as may be required by the Secretary of the Army: Provided. That this provision shall not apply to those rafting logs, except upon a direct request upon the owner to furnish specific information.*
>
> *Every person or persons offending against the provisions of this section shall, for each and every offense, be liable to a fine of not more than $5,000 or imprisonment not exceeding two months, to be enforced in any district court of the United States within whose territorial jurisdiction such offense may have been committed. In addition, the Secretary may assess a civil penalty of up to $2,500 per violation against any person or entity, that fails to provide timely, accurate statements required to be submitted pursuant to this section by the Secretary.*"

The waterborne commerce traffic movements are reported to the Corps of Engineers by all vessel operators of record on ENG Forms 3925 and 3925b (or equivalent). The reports are generally submitted on the basis of individual vessel movements completed. Cargo moved for the military agencies in commercial vessels is reported as ordinary commercial cargo; military cargo movements in Department of Defense vessels are not collected. All vessels in commercial operation (i.e., carrying either cargo or passengers for hire), and traveling more than three miles, are required to report their movements.

In summarizing the domestic commerce, certain movements are excluded: Cargo carried on general ferries; coal and petroleum products loaded from shore facilities directly into ship's bunkers as vessel fuel; and insignificant amounts of government materials (less than 100 tons) moved on government owned equipment in support of Corps projects.

National Marine Fisheries Service furnished the fish landing data. No domestic fishing vessel trips are included in the data of the Trips and Drafts Section, but Alaska ferry movements are included.

Figure 2 shows the total reported tonnage of waterborne cargo handled through Tongass Narrows (inclusive of Ketchikan harbor). The cargo tonnage shown in Figure 2 includes all cargo, i.e., shipped, received and "through" cargo. The past nine years of data indicate a downward trend of tonnage handled through Tongass Narrows, most likely reflecting the closure of the Ketchikan pulp mill and general regional declines in forest and fishing commerce.

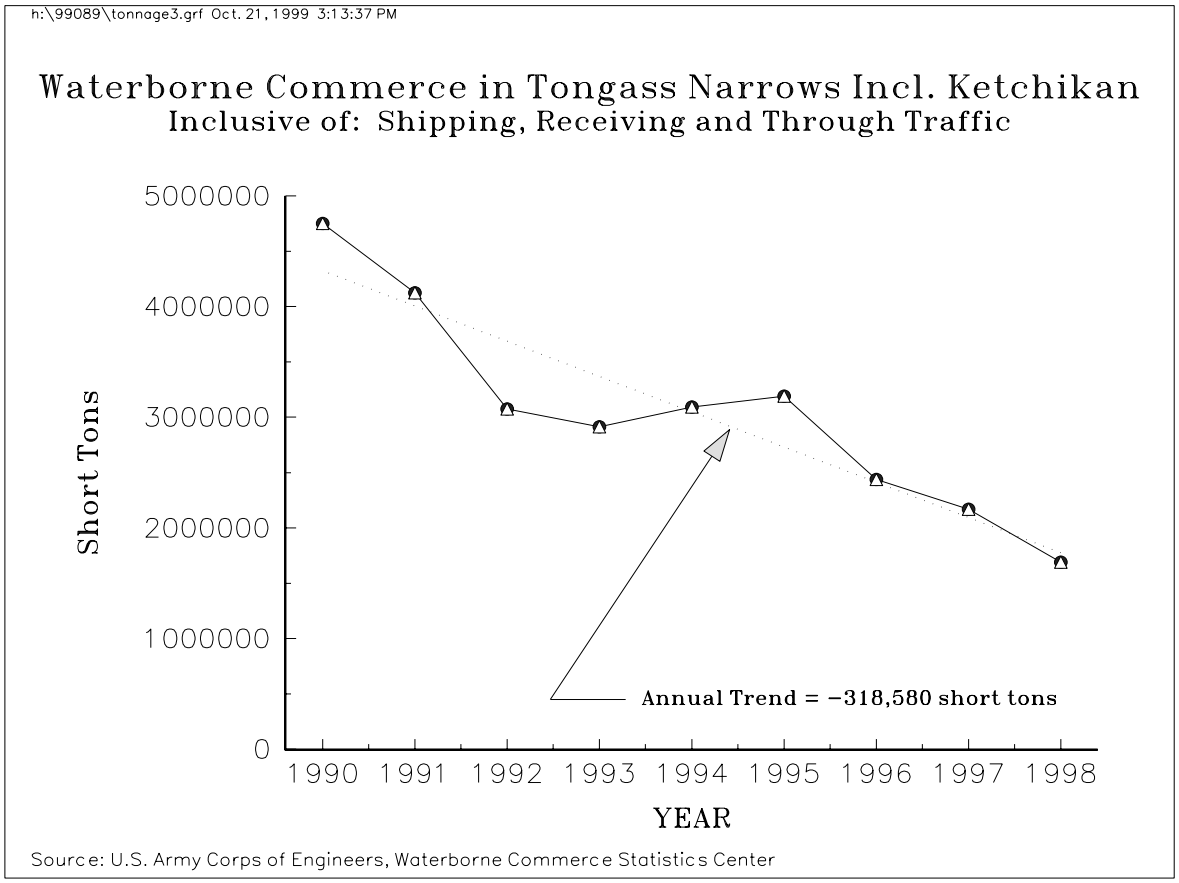

FIGURE 2

Waterborne Commerce in Tongass Narrows

Table 1 indicates the total reported trips in Tongass Narrows (including Ketchikan) by year and statistics describing the distribution of vessel drafts. The "MAX" is the greatest draft for which any trips were reported. The percentile columns indicate the draft below which the specified percent of all trips fall. For example, in the year 1990 98% of all vessel trips reported had a draft equal to or less than 17.36 feet.

TABLE 1

Tongass Narrows (incl. Ketchikan): Total Trips and Drafts by Year

YEAR	Total Trips	Drafts, feet				
		MAX	98th Percentile	95th Percentile	90th Percentile	75th Percentile
1990	9687	28	17.36	16.77	16.32	15.07
1991	6552	34	20.07	17.72	16.77	15.79
1992	6885	35	20.13	18.35	17.43	15.92
1993	7624	28	19.58	18.69	17.71	15.56
1994	10339	36	27.37	24.24	16.47	14.17
1995	10400	35	27.19	24.24	16.30	13.81
1996	10094	37	26.47	23.86	16.37	14.24
1997	9983	36	26.54	23.62	16.34	14.51
Average	8946	33.62	23.09	20.94	16.71	14.88

Source: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center

The average values given in the final row of Table 1 are the averages of the respective columns representing eight years of data.

Table 2 provides for each year the total number of reported trips in Tongass Narrows (including Ketchikan) and the maximum reported draft, for each of five vessel categories. Data include trips and drafts by both domestic and foreign vessels.

TABLE 2

Tongass Narrows (incl. Ketchikan):
Total Trips and Maximum Drafts, by Vessel Type, by Year

YEAR	Self-Propelled Passenger & Dry Cargo		Self-Propelled Tanker		Self-Propelled Tow or Tug		Non-Self-Propelled Dry Cargo		Non-Self-Propelled Tanker		Total	
	Trips	Max Draft	Trips	Max Draft	Trips	Max Draft	Trips	Max Draft	Trips	Max Draft	Trips	Max Draft
1990												
1991	2511	20	18	34	2480	17	1372	15	172	14	6553	34
1992	2755	20	18	35	2129	18	1842	13	143	13	6887	35
1993	2818	20	16	28	2506	20	2243	16	43	13	7626	28
1994	4495	15	27	34	2831	18	2743	15	245	16	10341	34
1995	4288	32	24	35	3102	22	2692	25	295	17	10401	35
1996	4369	37	24	28	2903	16	2369	18	431	20	10096	37
1997	4591	36	5	22	2845	20	2074	25	471	16	9986	36
Maximum	4591	36	24	35	3102	22	2743	25	471	20	10096	37
Average	3690	25.7	19	30.9	2685	18.7	2191	18.1	257	15.6	8841	34.1

Source: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center

The maximum in the next to last row is the greatest value occurring in each respective column and the average appearing in the final row is the average of the respective eight years of data.

2.2 Cruise Ship Traffic

The largest vessels routinely making use of Tongass Narrows are cruise ships that call seasonally at Ketchikan, primarily in the period May through September. As a consequence of the Passenger Services Act[1] most of the large cruise ships operating in Alaska operate from Vancouver, British Columbia. As a result, nearly all of the large cruise ships calling at Ketchikan pass under the Lions Gate Bridge located at the First Narrows at Vancouver, B.C. Vessels taking the inside passage of Vancouver Island must also pass under the Seymour Narrows power cable crossing located north of Campbell River. As described in Section 3 of this report the vertical clearance of the Lions Gate Bridge is 200 feet and the vertical clearance of the Seymour Narrows power cable is currently 180 feet.

[1] The Passenger Services Act imposes restrictions on the operations of foreign built passenger vessels. The Jones Act places similar restrictions on foreign built freight vessels. These are both basic cabotage acts that limit the carriage of passengers and freight between domestic ports to vessels constructed in the United States. To circumvent the Passenger Services Act foreign built cruise ships operate from the foreign port of Vancouver, B.C.

Table 3 provides principal dimensions and other data regarding the large cruise ships that operated in Southeast Alaska during the 1999 summer cruise season.

Table 4 provides principal dimensions and data for large cruise ships currently on order by cruise lines that historically have operated in Southeast Alaska. These cruise lines have significant operations in other parts of the world and therefore some of the new cruise ships are not destined to be assigned to Southeast Alaska operations. In particular, the very largest of the new cruise ships are generally regarded as less well suited to cruising in Southeast Alaska and more suitable for other large markets, such as the Mediterranean, that are currently experiencing rapid growth and that are not inhibited by the restricted waterways characteristic of Southeast Alaska cruising.

The very largest cruise modern cruise ships are designed as destinations in their own right, making the actual ports of call of somewhat reduced significance. The architectural focus of these large ships is inward, whereas the essence of Southeast Alaska cruising is the spectacular scenery external to the vessel and the ports of call. Thus the largest new cruise ships are best suited to "cruises to nowhere" or to large but perhaps less scenic ports of call, the antithesis of Alaska cruising. For these reasons it is not anticipated that the largest of the new cruise ships will engage significantly in Southeast Alaska cruising in the foreseeable future.

Figures 3 through 4 indicate trends in large cruise traffic and passenger volumes to Ketchikan. Figure 3 indicates the number of cruise ship passengers calling at Ketchikan and the indicated mean linear trend over the past decade is an annual increase of 36,084 passengers per year. Figure 4 indicates the number of cruise ships in the Ketchikan trade and the indicated mean linear trend over the past decade is an annual increase of 1.56 ships per year. Figure 5 indicates the number of cruise ship stops in Ketchikan and that the indicated mean linear trend over the past decade is an annual increase of 18.23 stops per year.

Figures 6 through 10 indicate trends in large cruise ship principal dimensions and gross register tonnage. Trends are indicated for the world fleet and also for the subset representative of cruise ships operating in Southeast Alaska. Figure 6 indicates the trend in maximum navigation draft, Figure 7 the trend in maximum beam, and Figure 8 the trend in overall length. Figure 9 shows the trend in gross register tonnage, a measure of the total enclosed volume of the ship. And Figure 10 shows the trend in air draft, including future points representing new vessels under construction by cruise lines that historically have operated in Southeast Alaska.

TABLE 3

Large Cruise Ships Operating in Southeast Alaska During 1999 Cruise Season

Operator	Ship	Passengers	Gross Tonnage	Displacement	LOA (feet)	Register Length (feet)	Beam Max (feet)	Beam Register (feet)	Maximum Draft (feet)	Air Draft (feet)
Carnival	*Jubilee*	1,486	47,262		733			92	25	
Carnival (future)	*Fantasy* Class	2,040	70,367		885			103.4	25.6	175.5
Celebrity	*Mercury*	1,740	77,713		866			105.6	25.5	
	Galaxy	1,740	77,713		866			105.6	25.5	
Crystal Cruises	*Crystal Harmony*	960	48,621		790	676	105.0	97.1	24.6	143.0
Holland America	*Nieuw Amsterdam*	1,214	33,930	22,451	704	596	103.4	89.2	24.3	137.3
	Noordam	1,214	33,930	22,451	704	596	103.4	89.2	24.3	137.3
	Statendam	1,266	55,451	31,338	720	607	111.6	101.1	24.6	159.5
	Ryndam	1,266	55,451	31,338	720	607	111.6	101.1	25.3	159.5
	Veendam	1,266	55,451	31,338	720	607	111.6	101.1	25.3	153.6
	Westerdam	1,494	53,900	33,083	800	723	106.0	95.1	23.6	155.2
Norwegian Cruise Line	*Norwegian Dynasty*	800	34,250		537			74	18	
	Norwegian Wind	2,100 max	50,760		754	624	32	93.5	23	
Japan Cruise Line	*Pacific Venus*	600								

TABLE 3, Continued

Large Cruise Ships Operating in Southeast Alaska During 1999 Cruise Season

Operator	Ship	Passengers	Gross Tonnage	Displacement (metric tons)	LOA (feet)	Register Length (feet)	Beam Max (feet)	Beam Register (feet)	Maximum Draft (feet)	Air Draft (feet)
Princess Cruises	*Crown Princess*	1,590*	69,845		804	670	125.1	105.6	26.5	156.1
	Dawn Princess	1,950*	77,441		857	762	131.2	105.8	26.5	162.0
	Sea Princess	1,950*	77,441		857	762	131.2	105.8	26.5	162.0
	Sky Princess	1,200*	43,087		789	666	97.7	91.2	26.8	163.7
	Sun Princess	1,950*	77,441		857	762	131.2	105.8	26.5	162.0
Royal Caribbean Inc.	*Rhapsody of the Seas*	2,416	78,491	38,917	915			105.6	25.4	171.0
	Vision of the Seas	2,416	78,491	38,880	915			105.6	25.4	171.0
World Explorer Cruises	*Universe Explorer*	737	23,500	22,886	617	570	88.0	84.0	27.3	130.0

* Passenger capacity lower berth

TABLE 4

New Large Cruise Ships on Order (Among Alaska Operators)

Operator	Ship	Passengers	Gross Tonnage	Displacement (metric tons)	LOA (feet)	Register Length	Beam Max @ Bridge (feet)	Beam Register (feet)	Maximum Draft (feet)	Air Draft (feet)	Year Finished
Carnival	*Carnival Victory**	2,758	101,500	50,800	894		141.7	116.5	27.2	208	2000
	Carnival Spirit	2,100	82,000		960		127.3	105.6	26.3	175.5	2000
	Carnival Pride	2,100	84,000		960		127.3	105.6	26.3	175.5	2001
	Unnamed (option)	2,100	84,000		960		127.3	105.6	26.3	175.5	2002
	*Carnival Conquest**	2,758	101,500	50,800	894		141.7	116.5	27.2	208	2002
	*Carnival Glory**	2,758	101,500	50,800	894		141.7	116.5	27.2	208	2003
Celebrity	*Millenium 1*	1,900	85,000								2000
	Millenium 2	1,900	85,000								2001
	Millenium 3	1,900	85,000								2001
	Millenium 4	1,900	85,000								2002
Holland America	*Zaandam*	1,440	63,000	32,500	781	663	112.9	106.0	26.3	153.6	2000
	Amsterdam	1,380	60,000	32,500	781	663	112.9	106.0	26.3	156.2	2000
	Volendam	1,440	63,000	32,000	781		109.6	105.6	26.3	153.6	1999

* Post Panamax

TABLE 4, Continued

New Large Cruise Ships on Order (Among Alaska Operators)

Operator	Ship	Passengers	Gross Tonnage	Displacement	LOA (feet)	Register Length (feet)	Beam Max (feet)	Beam Register (feet)	Maximum Draft	Air Draft	Year Finished
Princess	*Ocean Princess*	1,950	77,441		857	782	131.2	105.8			2001
	Unnamed	2,600	108,806		950	792	158.1	118.2			2002
	Unnamed	2,600	108,806		950	792	158.1	118.2			2002
Royal Caribbean	*Explorer/Seas*	3,100	142,000	64,474	1,021				28.9	190	2000
	Radiance/Seas	2,500	86,000	45,369	963				27.2	174	2001
	Brilliance/Seas	2,500	86,000	45,369	963				27.2	174	2002
	Adventure/Seas	3,100	142,000	64,474	1,021				28.9	191	2003

Operator	Ship	Passengers	Gross Tonnage	Displacement	LOA (feet)	Register Length (feet)	Beam Max (feet)	Beam Register (feet)	Maximum Draft	Air Draft	Year Finished
American Hawaiian Cruises	*Unnamed (two ordered with an option for a third)*	1,900	70,000		840			105.7	26.3	Less than 180ft	2003

Comment: The American Hawaiian vessels under construction at Ingalls Shipyard in Pascagoula, Mississippi, are the first large cruise ships built in the United States in more than 40 years. While designed for Hawaiian service, these vessels are U.S. built and U.S. flagged and thus may embark/disembark passengers on voyages between any U.S. ports.

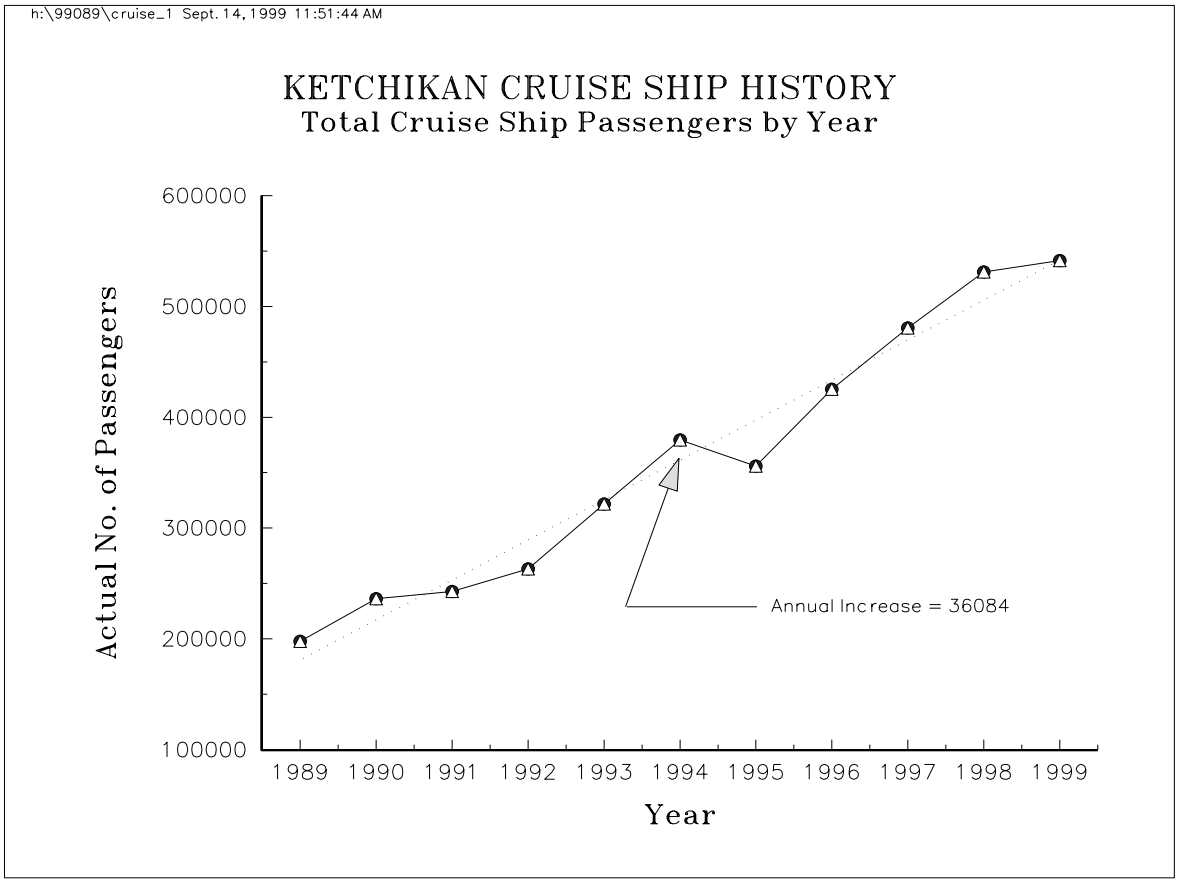

FIGURE 3

Total Cruise Ship Passengers Calling at Ketchikan by Year

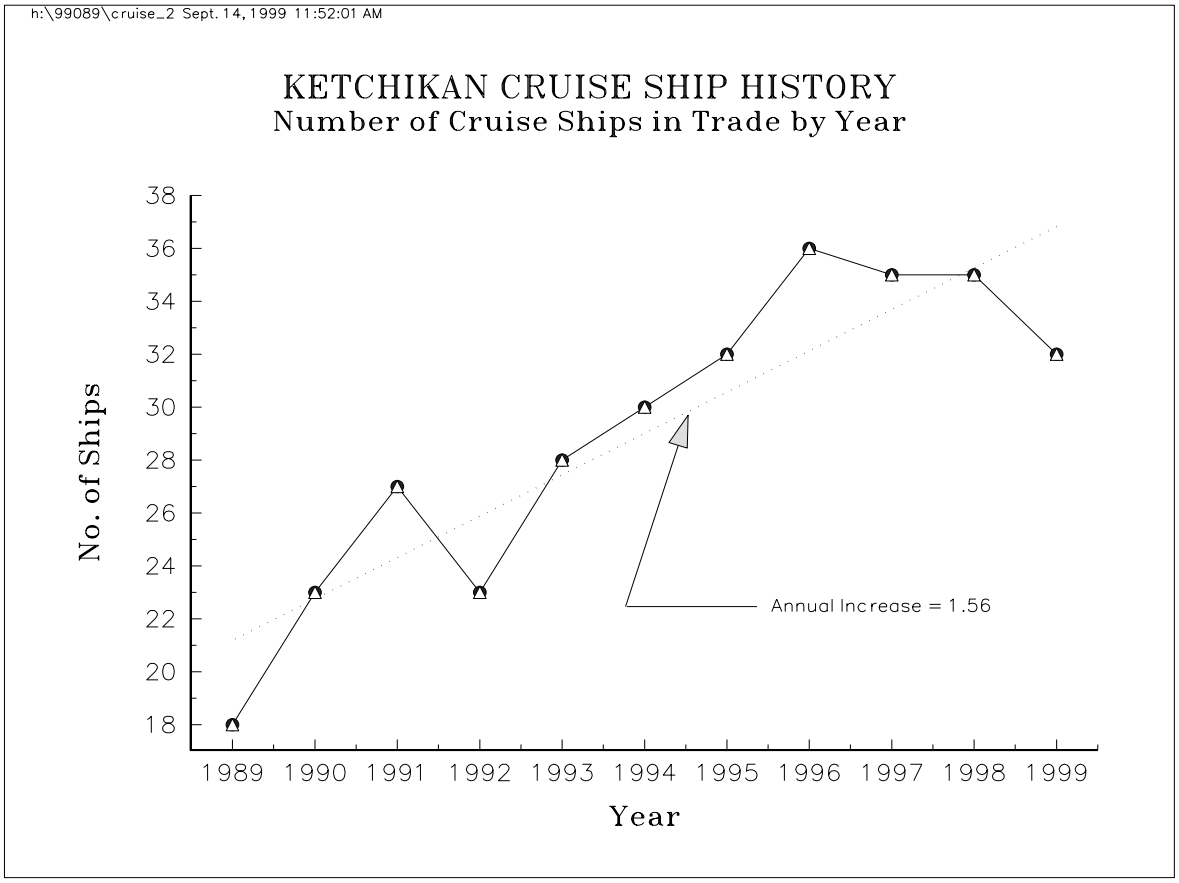

FIGURE 4

Number of Cruise Ships in Trade by Year

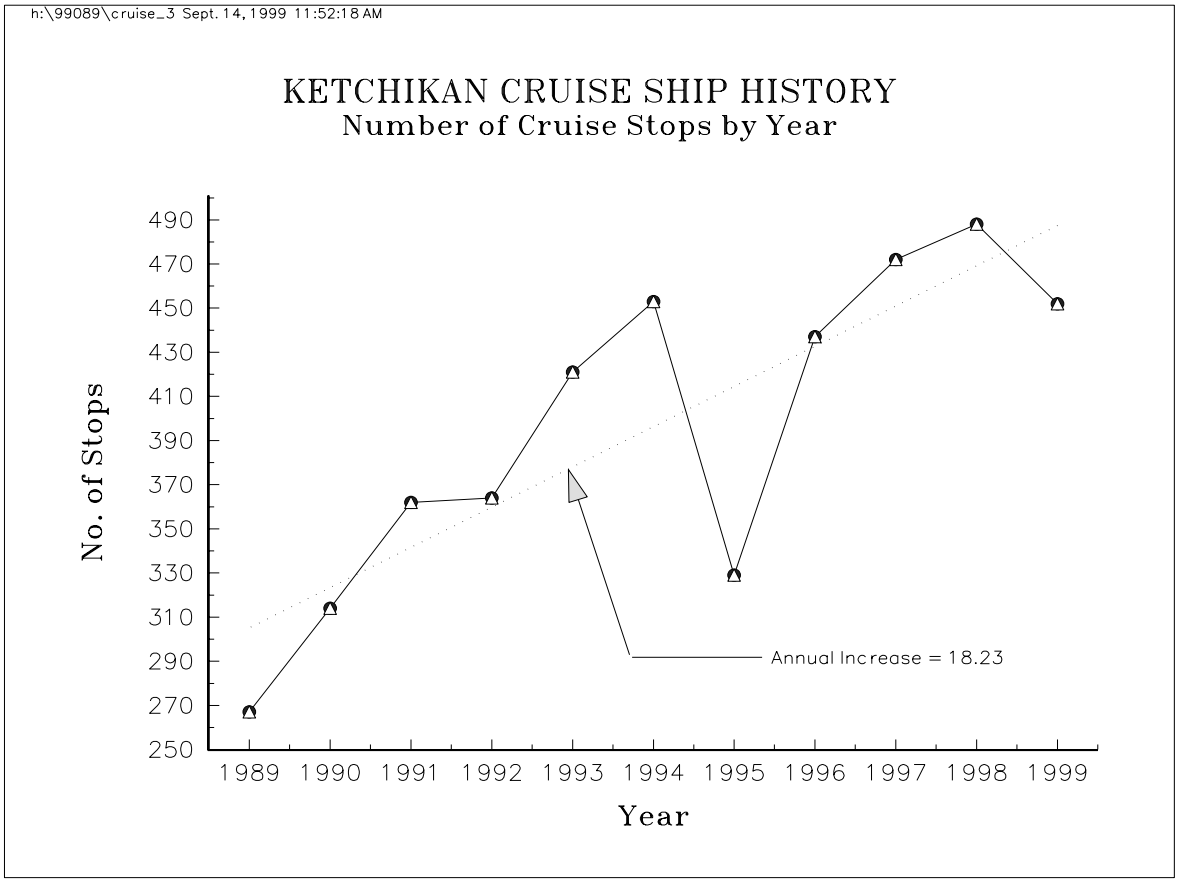

FIGURE 5

Number of Cruise Ship Stops at Ketchikan by Year

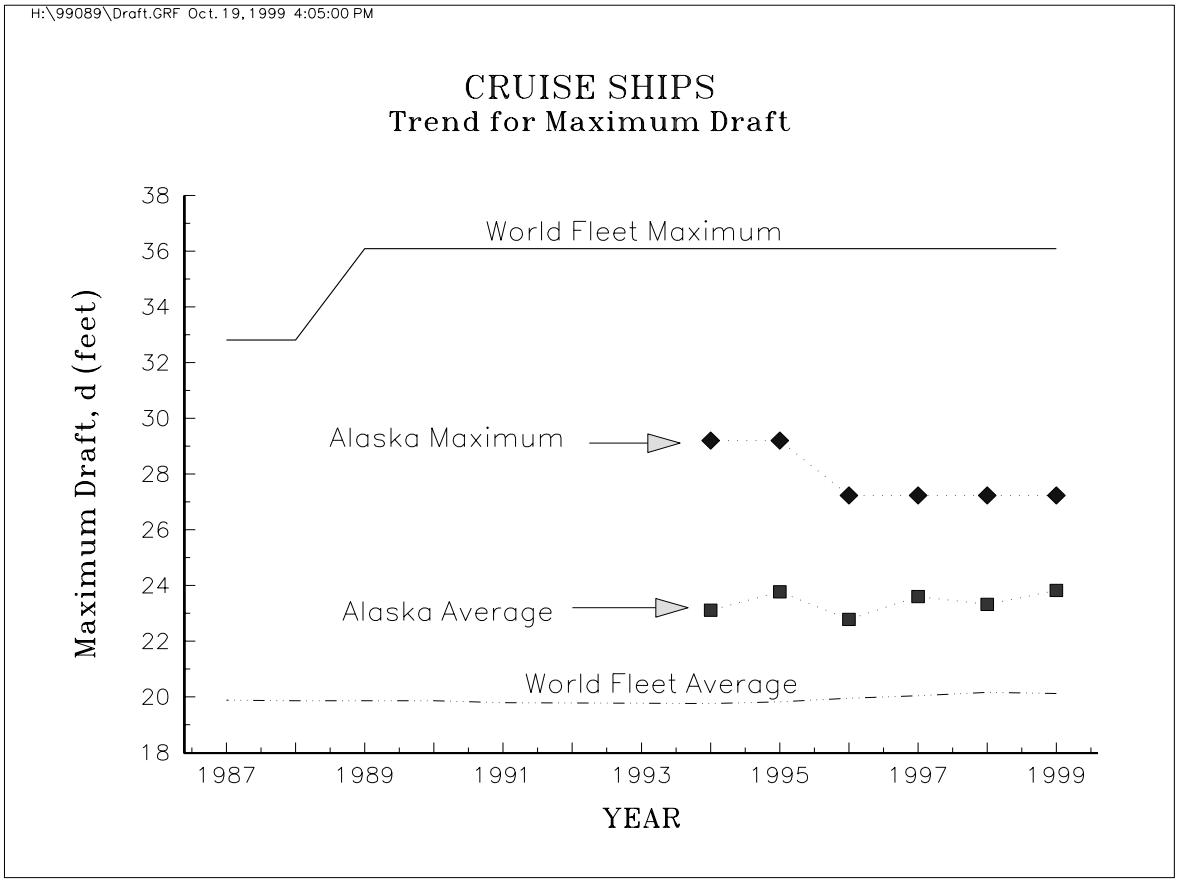

FIGURE 6

Large Cruise Ship Navigation Draft Trends

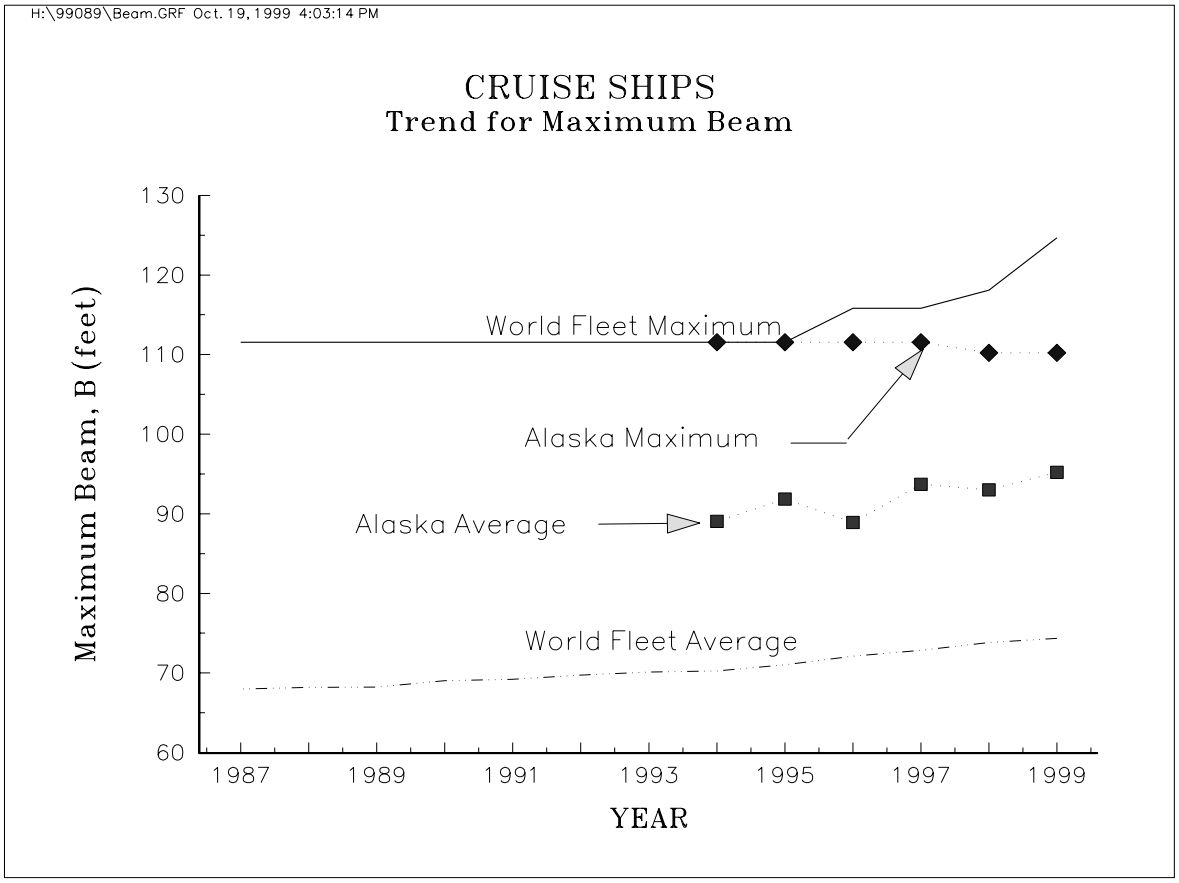

FIGURE 7

Large Cruise Ship Maximum Beam Trends

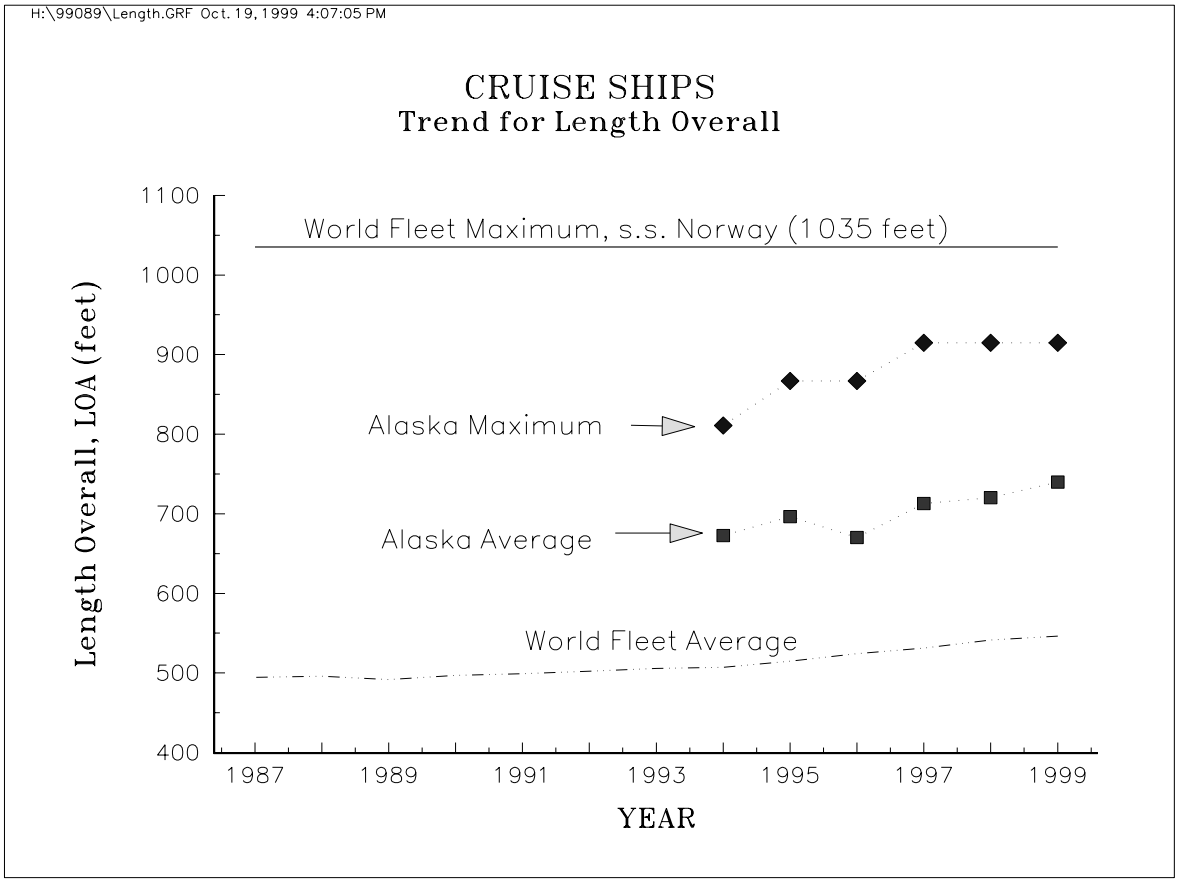

FIGURE 8

Large Cruise Ship Length Overall Trends

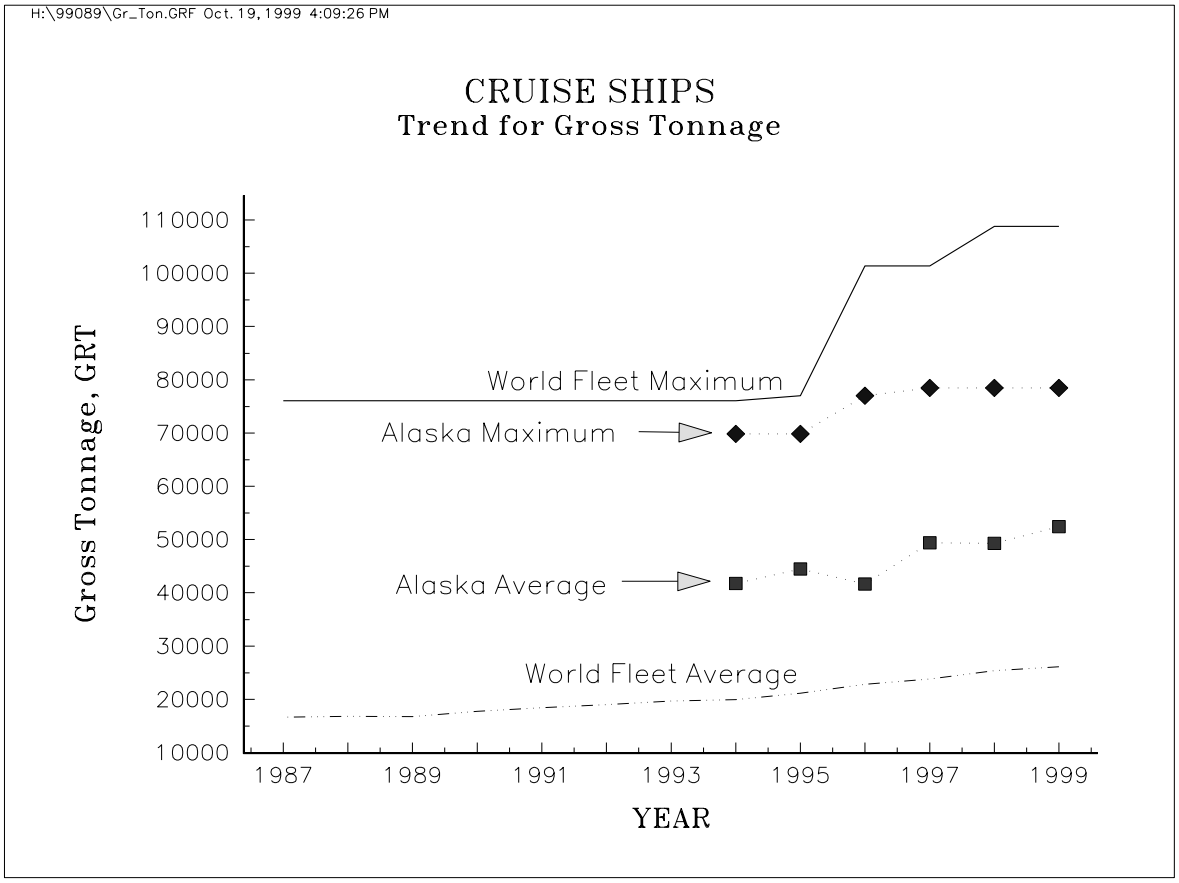

FIGURE 9

Large Cruise Ship Gross Register Tonnage Trends

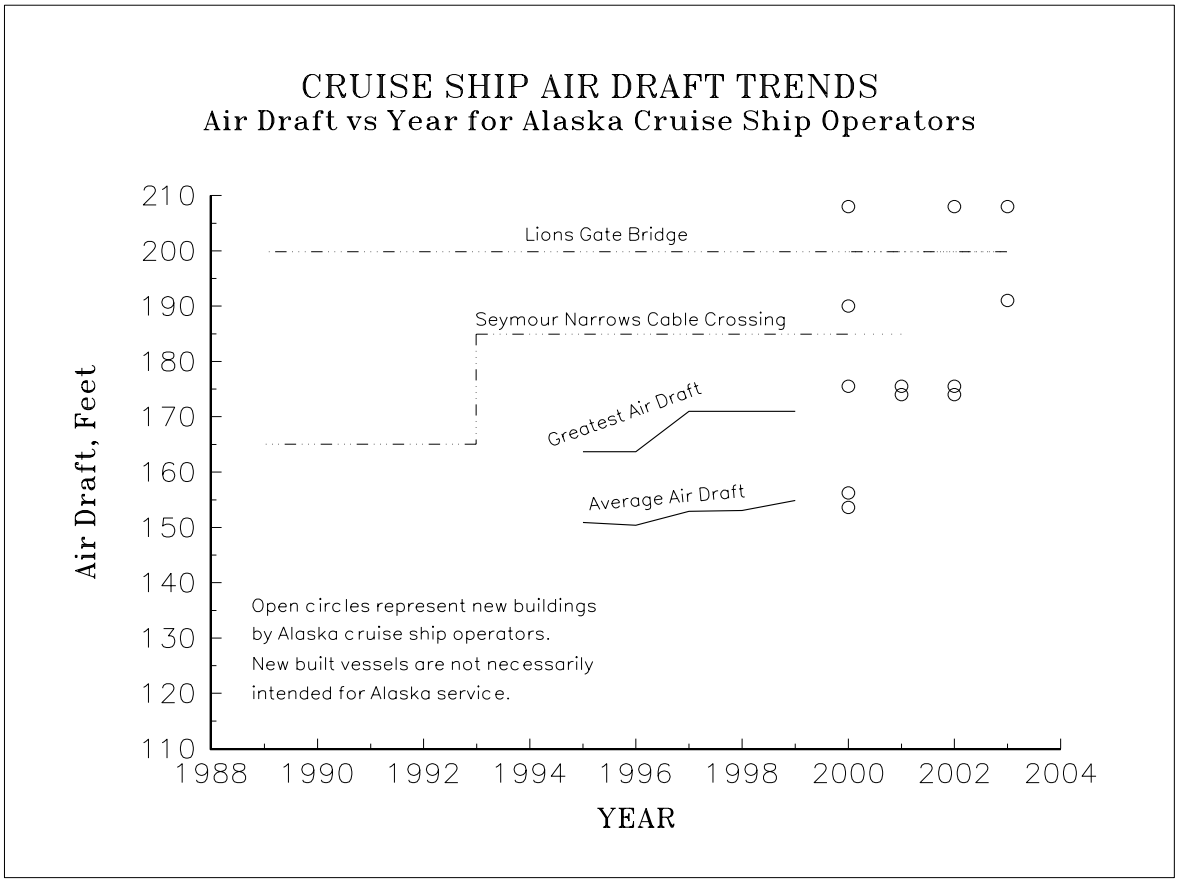

FIGURE 10

Large Cruise Ship Air Draft Trends

2.3 Small Cruise Operators

In addition to the large cruise ships operating in Southeast Alaska and calling at Ketchikan, there are a growing number of small cruise ships offering adventure and/or nature oriented cruising opportunities. Table 5 provides a representative sample of these vessels.

TABLE 5

Small Cruise Vessels
Operating in Southeast Alaska

Operator	Vessel	Passengers	LOA (feet)	Beam (feet)	Draft (feet)	Tonnage
Glacier Bay Tours	*Executive Explorer*	49	98.5	36.75		
	Wilderness Discoverer	88	169	38		95
Clipper Cruise Lines	*Yorktown Clipper*	138	257	43	8	99.5
Lindblad Special Expeditions	*Sea Bird*	70	152	31	8	99.7
	Sea Lion	70	152	31	8	99.7
Cruise West	*Spirit of Discovery*	84	166			94
	Sheltered Seas	90	90			95
	Spirit of Glacier Bay	58	125			97
	Spirit of Alaska	82	143			97
	Spirit of Columbia	78	143			98
	Spirit of '98	101	192			96
	Spirit of Endeavor	102	219			99

2.4 Alaska Marine Highway System

The Alaska Marine Highway System operates five mainline and two feeder vehicle/passenger ferries in Southeast Alaska. The mainline vessels are the *Columbia, Kennicott, Malaspina, Matanuska* and *Taku*. Currently the *Columbia, Kennicott, Matanuska* and *Taku* routinely call at Ketchikan.

The feeder vessels operating in Southeast Alaska are the *Aurora* and *Le Conte*. Under current schedules the *Aurora* routinely calls at Ketchikan.

In March 1999 the Alaska Department of Transportation & Public Facilities (DOT&PF) approved a new regional transportation master plan for Southeast Alaska. Known as the "Southeast Alaska Transportation Plan" (SATP), this new plan will result in significant changes to the way ferry service is delivered in the Southeast Alaska region, and consequently will alter the future character of the AMHS vessels calling at Ketchikan.

2.4.1 Current Operations

Table 6 indicates the principal dimensions of the Alaska Marine Highway System vessels that currently have routine operations in Southeast Alaska. Not shown is the *Bartlett* that operates in Prince William Sound and the *Tustumena* that operates in Prince William Sound and Southwest Alaska (out to Unalaska).

TABLE 6

Dimensions of Alaska Marine Highways Vessels Operating in Southeast Alaska

Vessel	**LOA (feet)**	**Beam (feet)**	**Draft** (feet)	**Air Draft (feet)**
Columbia	418	85	17.5	106+
Malaspina	408	74	16.67	106+
Matanuska	408	74	16.67	106+
Taku	352	74	16.67	90+
Kennicott	382	85	17.5	95
Aurora	235.75	57.33	14	65.33
Le Conte	235.75	57.33	14	65.33

Notes: 1) Drafts are maximum navigation drafts, corresponding variously with the loadline and/or the draft used in ABS scantling determinations.
2) Air drafts followed by a plus sign '+' are measured from the design waterline. The maximum air draft could be greater under some light loading conditions. In general the increase in air draft should be no more than 3 feet.

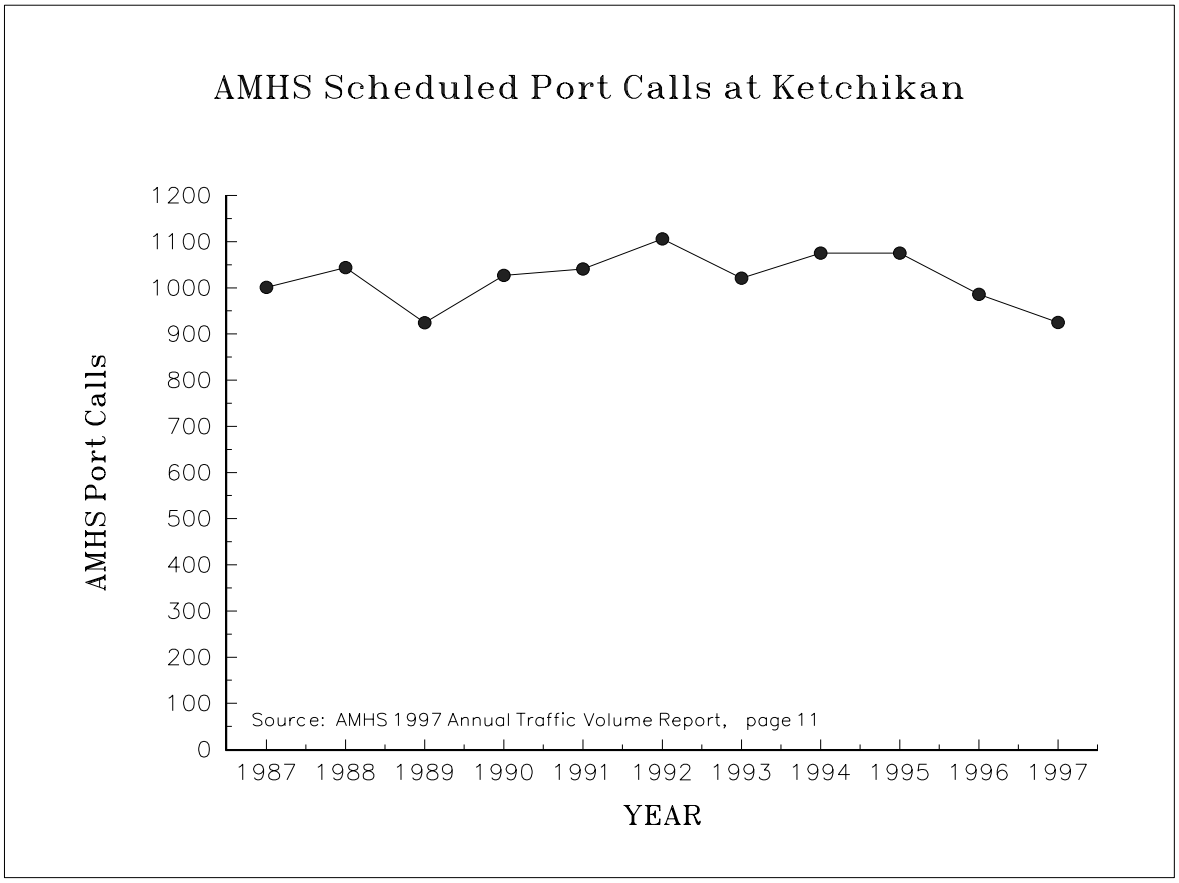

FIGURE 11

AMHS Port Calls at Ketchikan

Figure 11 indicates that AMHS port calls at Ketchikan have been remarkably steady for the past ten years. However, the two most recent reported years show a slight decline in port calls.

TABLE 7

Alaska Marine Highways Vessels Calls at Ketchikan, 1997

	1997
Columbia	62
Malaspina	124
Matanuska	82
Taku	159
Aurora	566
Le Conte	50
Kennicott	---
	1043

Source: Based on data found on page 26 of "AMHS 1997 Annual Traffic Volume Report"

TABLE 8

Alaska Marine Highways Vessels Calls at Ketchikan, July 1999

	July 1999
Columbia	8
Malaspina	0
Matanuska	17
Taku	17
Aurora	68
Le Conte	0
Kennicott	16
	126

Source: AMHS Official Summer 1999 Alaska Marine Highway Schedule

July is the peak traffic month in the annual cycle for AMHS. The 126 Ketchikan port calls by AMHS in July 1999 represent an average of 4.06 port calls per day. According to the 1999 schedule, the peak number of AMHS vessel calls is 7 per day.

2.4.2 Effect of Southeast Alaska Transportation Plan

The Alaska Department of Transportation & Public Facilities "Southeast Alaska Transportation Plan" issued in March 1999 calls for major changes in the way public ferry services are delivered in Southeast Alaska. The SATP planning horizon is the period between the year 2000 and 2020. When implemented the SATP will result in reduced port calls throughout Southeast Alaska by existing large "mainline" vessels such as the *Columbia, Kennicott, Matanuska, Malaspina* and *Taku*; as well as daily service from new smaller vessels providing regional, community or shuttle services as defined in the SATP. These smaller vessels providing the regional, community and shuttle services may comprise either or both conventional and high-speed vessels. Due to their smaller size these new vessels are unlikely to impose governing constraints on any fixed link civil structure crossing Tongass Narrows to improve access to Gravina Island.

2.4.3 Inter-Island Ferry Authority (IFA)

The Inter-Island Ferry Authority (IFA) currently has a new ferry under design. The vessel is a conventional displacement monohull vehicle and passenger ferry, similar to (though somewhat smaller than) the existing AMHS vessels *Aurora* and *Le Conte*. This new vessel will operate, in general, twice daily between Hollis and Ketchikan, docking at or near the existing AMHS ferry terminal in Ketchikan. Preliminary dimensions for the new IFA ferry are:

Length	=	200 feet
Beam	=	54 feet
Draft	=	12 feet
Air Draft	=	71 feet

2.5 Barges

Tug and barge transportation is the principal mode of delivery for both dry and liquid cargoes throughout Southeast Alaska.

The waterborne commerce statistics indicate an average of 219 trips per year by dry cargo barges in Tongass Narrows (including Ketchikan) for years 1990 through 1997, as shown in Table 2. Three major common carriers, providing containerized barge service, make a total of four scheduled calls per week to Ketchikan year-round, for a total of about 408 calls, corresponding to 816 transits, or 20% of the average total reported transits.

Petroleum products are also delivered almost exclusively by barge, there being an average of 257 petroleum barge trips in Tongass Narrows (including Ketchikan) for the reported years, as shown in Table 2. Note that in 1997, the latest reporting year, there is a drop in tanker transits and an increase in petroleum barge transits. This is believed to be a reflection of retirement of old tankers from the trade, so the 1997 figures should better reflect future traffic patterns.

Through traffic by barges is a significant contributor to total annual volume, though not necessarily an issue in peak congested traffic periods. Barge operators that we

spoke with expressed a preference for transiting Tongass Narrows in the stormy winter months, as this route minimizes the exposure time crossing Dixon Entrance. In the summer months, the same operators would more likely head westward across the Gulf at Dixon Entrance, or use the alternative route through Clarence Strait to avoid the congestion in Tongass Narrows.

2.6 U.S. Coast Guard

The U.S. Coast Guard operates from their base located between Ketchikan and Saxman on Revillagigedo Island. Three cutters operate from this base with salient characteristics as shown in Table 9.

TABLE 9

Dimensions of U.S. Coast Guard Cutters Stationed at Ketchikan

Vessel	LOA (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)
Achusnet	213	40.67	13.92	100
(to be identified)	175	38	9	70
Naushon	110	21.92	7.33	60

Source: Phone conversation with Lt. Martin, USCG, Juneau, 15 September 1999.

U.S. Coast Guard buoy tenders will also occasionally call at Ketchikan. The buoy tenders have a length of 225 feet, a beam of 42.67 feet, a draft of 13.5 feet, and an air draft of 90 feet.

The largest vessels operated by the U.S. Coast Guard are their 378 foot Hamilton Class cutters and their ice breakers, *Polar Sea*, *Polar Star* and *Healy*. However, these Coast Guard vessels rarely if ever call at Ketchikan. Table 10 provides additional characteristics of these large cutters.

TABLE 10

Dimensions of Large U.S. Coast Guard Cutters Stationed Elsewhere

Vessel Class	LOA (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)	Stationed At	Primary Operating Areas
Polar Class	399	83.5	28	138	Seattle (2)	Arctic and Antarctic
Healy	420	82	29.25	–	Seattle	Arctic and Antarctic
Hamilton Class	378	42			Note 1	

Source: Internet

Note 1. Twelve ships in class with home ports of Alameda, California (4); San Pedro, California (2); Charleston, South Carolina (2); Seattle, Washington (2); and Honolulu, Hawaii (2)

2.7 U.S. Navy

There are no known significant U.S. Navy operations in Tongass Narrows. However, the U.S. Coast Guard base is designated as an emergency port facility for submarines making use of the Back Island acoustic range on Behm Canal. An inquiry will be addressed to the U.S. Navy to ascertain any concerns they may have.

While U.S. Naval vessels do not routinely operate in Tongass Narrows, it is instructive to consider the principal dimensions of major classes of naval vessels as given in Table 11.

TABLE 11

Characteristic Dimensions of Large U.S. Navy Vessel Classes

Class Designation	Vessel Type	Displacement (feet)	Condition	Length (feet)	Beam (feet)	Draft (feet)	Air Draft (feet)
CVN	Aircraft Carrier	81,600	Standard	1092	134	37	207
CG	Cruiser	9,100	Loaded	563	55	31	201
CGN	Cruiser	11,000	Loaded	585	63	30	190
AOE	Fast Combat Support	53,600	Loaded	793	107	40	---
LHD	Amphibious Assault	40,500	Loaded	844	106	27	---
SSBN	Ballistic Missile Submarine	18,700	Submerged	560	42	36.5	91

Source: Internet and Norman Polmer, *The Ships and Aircraft of US Fleet*, 12th edition, Naval Institute Press, Annapolis, Maryland, 1983.
Note: SSBN 732, USS *Alaska* recently made a courtesy port call at Ketchikan

2.8 Commercial Fishing, Charter Vessels and Small Craft

The Ketchikan area has seven small boat harbors. Their capacities are shown in Table 12 and the distribution of boat types is shown in Table 13

TABLE 12

Ketchikan Harbor Capacities

	<21'	21'-30'	31'-40'	41'-50'	51'-70'	71'-100'	>100'	Total
Bar Harbor North	53	109	61	34	7	2	0	266
Bar Harbor South	110	165	92	30	31	3	0	431
City Float	14	0	0	0	0	0	0	14
Thomas Basin	50	30	55	27	20	0	0	182
Ryus Dock	Transient and Lighterage Moorage Only							
Hole-in-the-Wall	17	9	2	0	0	0	0	28
Knudsen Cove	29	20	0	0	0	0	0	49
TOTAL	273	333	210	91	58	5	0	970

Source: Alaska DOT&PF, Ports & Harbors, Alaska Harbor Management System, Operations Management Report, 1994

TABLE 13

1994 Harbor Census

	Recreational	Fishing Charter	Commercial Fishing	Other	Total
Bar Harbor North	174	24	47	19	264
Bar Harbor South	288	21	97	13	419
City Float	Transient Only				
Thomas Basin	90	12	73	2	177
Ryus Dock	Transient and Lighterage Moorage Only				
Hole-in-the-Wall	25	0	3	0	28
Knudsen Cove	42	1	4	0	47
TOTAL	619	58	224	34	935

Source: Alaska DOT&PF, Ports & Harbors, Alaska Harbor Management System, Operations Management Report, 1994

In 1998 the City of Ketchikan, Port & Harbors Department, recorded the following:

3000 to 4000	Transient Boats
6050	Boat-Days of Transient Moorage
158	One-Month Transient Moorage Permits
528	Three-Month Transient Moorage Permits
62	Charter Boats in Harbors
800	Commercial Fishing Boats in Harbors
844	Reserved Stalls Billed Out in July 1998
1045	Port Calls by 335 Ships

In addition to the recreational small craft, fishing charter boats and commercial fishing boats in harbors, there are three very active boat launching ramps in the Ketchikan area. These are Bar Harbor, Mountain Point and Knudsen Cove. Launching permits issued by the City of Ketchikan, Port & Harbors Department, in 1998 are given in Table 14.

TABLE 14

1998 Ketchikan Boat Launch Permits

Day Permits	
Bar Harbor	354
Mountain Point	537
Knudsen Cove	672
Total Day Permits	1,563

Annual and Semi-Annual Permits	
Commercial Permit	2
Annual Permits	436
Semi-Annual Permits	74
Free Annual Permits to Reserve Moorage Clients (Estimate)	~ 400
Total Annual and Semi-Annual Permits	912

On summer weekends the boat launches are in continuous use for at least twelve hours per day. Estimating that an average launch or retrieval takes approximately 5 minutes, the total number of launches and retrievals on a summer weekend must be on the order of 3x[12*60/5] = 432 for the three launch ramps.

2.8.1 Kayaks

A large number of kayaks operate on the waters of Tongass Narrows. During the summer tourist season several outfitter/guide operations offer kayak excursions originating in Ketchikan. In addition local residents also kayak on the Narrows. Kayaks are not easily observed by sight or on radar, and thence are at risk from other vessels. The "Tongass Narrows Voluntary Waterway User Guide" of 18 March 1998 identifies two kayak operating zones, one (North kayak zone) extending from Hansen Float to the North end of Pennock Island and the second (South kayak zone) extending from Thomas Basin to Pennock Island immediately north of Radenbough Cove.

Appendix One of the 18 March 1999 "Tongass Narrows Voluntary Waterway User Guide" is the "1998 Power Vessel Operator and Kayaker Suggested Guidelines for Safe Operations in Alaska," which addresses specific operating practices intended to enhance the safety of kayak operations.

2.8.2 Personal Watercraft

Personal watercraft include vessels such as jet skis. Many personal watercraft are small and able to achieve high speeds (on the order of 50 knots). The "Tongass Narrows Voluntary Waterway User Guide" (3/18/98) states: *"Although these craft are not restricted in Tongass Narrows, due to the high volume and variety of traffic in Tongass Narrows, mariners wishing to operate personal watercraft should not operate them in Tongass Narrows."* The Ketchikan harbormaster has indicated that few personal watercraft operate there (i.e., "*less than ten*"), but some personal watercraft operate from Knudsen Cove and south of town.

2.9 Gravina Island Ferry

The Gravina Island ferry currently adds to the traffic congestion in Tongass Narrows. Furthermore, it represents crossing traffic. However, once the bridge is completed, presumably the ferry will cease to operate and therefore no longer be a traffic factor.

2.10 Floatplanes

Floatplanes landing and taking off from Tongass Narrows are currently subject to the operational guidelines contained in the "Tongass Narrows Voluntary Waterway User Guide," (3/18/99). That guide identifies two narrow floatplane operating zones, one in front of the Ketchikan waterfront, one hugging the Gravina Island shore and extending northwest from the Ketchikan Airport terminal. A third floatplane operating area is located in the vicinity of Ward Cove. As described in the "Tongass Narrows Voluntary Waterway User Guide," floatplane traffic on Tongass Narrows is seasonally quite heavy, comprising in excess of 500 takeoffs and landings on an average summer day. Aviation is the topic of a separate reconnaissance report which complements this one and which should be consulted for a more thorough examination of aviation issues.

3.0 West Coast Bridges and Aerial Cable Crossings

Existing West Coast bridges and aerial cable crossings present significant constraints to the ultimate size and operations of large shipping. The Lions Gate Bridge, located at the First Narrows in Vancouver, British Columbia, and the Seymour Narrows power cable crossing, located north of Campbell River have recently been acknowledged as design constraints for the new U.S. built cruise ships to be constructed at Ingalls Shipyard in Mississippi for American Classic Voyages (AMCV).

At 180 feet vertical clearance, the current controlling constraint for cruise ship traffic is the Seymour Narrows power cable crossing. Before 1995 the vertical clearance was 165 feet. The cable crossing was raised in 1995 at a cost on the order of $300,000 (U.S.). Officials at B.C. Hydro have indicated that the cable could be raised another 3.0 meters (9.8 feet) at a cost probably not exceeding $100,000 (U.S.). This additional three meters of clearance could be achieved by increasing the tension in the cable and reducing the catenary sag. However, this procedure would have the adverse consequence of increasing the fatigue of the power conductor and thereby would increase the risk of interruptions to the electrical power service.

Officials at B.C. Hydro have also speculated that, for a cost in excess of $1,000,000 (U.S.), the cable could be raised further, to 200 feet, thus achieving a clearance equal to that of the Lions Gate Bridge. Raising the clearance to that extent would entail building new towers and guy arrangements, which accounts for the substantial cost.

Table 15 summarizes the significant bridges and cable crossings on the West Coast of the United States and Canada.

TABLE 15

Existing West Coast Bridges and Cable Crossings

Bridge or Cable Crossing	State or Province	Maximum Vertical Clearance	Reference for Vertical Clearance	Comments
Near Island Bridge	Kodiak, Alaska	101 feet	MHHW	200 feet horizontal clearance
Seymour Narrows Cable Crossing	Campbell River, British Columbia	55 m (180 feet)	MHHW	Most Alaska bound cruise traffic transits Seymour Narrows
Lions Gate Bridge	Vancouver, British Columbia	61 m (200 feet)	MHHW	Most Alaska bound cruise traffic passes under Lions Gate Bridge
Tacoma Narrows Bridge	Tacoma, Washington	180 feet	MHHW	
Astoria highway bridge	Astoria, Oregon	205 feet	MLLW	Access to Swan Island shipyards
Longview highway bridge	Longview, Washington	185 feet	Columbia River Datum	Access to Swan Island shipyards
Saint Johns highway bridge	Portland, Oregon	205 feet	Columbia River Datum	Access to Swan Island shipyards
BN RR Lift Bridge	Portland, Oregon	200 feet	Columbia River Datum	499 feet horizontal clearance Access to Swan Island shipyards
Columbia River Cable Crossings	Various	216 feet	MLLW	Access to Swan Island shipyards
Golden Gate Bridge	San Francisco, California	225 feet	MHHW	
San Francisco – Oakland Bay Bridge	San Francisco, California	204 feet in recommended channel	MHHW	220 feet in some spans with cautions regarding span sag due to traffic live load and temperature
Vincent Thomas Bridge	Los Angeles, California	185 feet	MHHW	Old cruise ship terminal is upstream of bridge but new terminal is downstream of bridge
Coronado Bridge	San Diego, California	195 feet	MHHW	Access to NASSCO shipyard

4.0 Potential Navigation Impacts of Bridges

Submerged tubes or tunnels would presumably have no impact on navigation in Tongass Narrows. Likewise, bridges with horizontal and vertical clearance equal to or exceeding that of the Lions Gate Bridge would have little or no impact on navigation. However, it is recognized that aviation requirements might constrain the height of bridges crossing the Narrows. Bowing to aviation requirements and other factors could lead to consideration of bridges that did impede some vessel traffic. As cruise ships are the largest vessels to routinely ply these waters, they are the vessels most likely to be affected by any such impairment.

These impairments could include:

1) A bridge blocking large vessel traffic north of the cruise ship docks.

2) A bridge blocking both East and West Channels south of the cruise ship docks.

3) A bridge blocking either East Channel or West Channel south of the cruise ship docks, but not both.

The impacts on large vessel traffic of each of these possible impairments will be considered in the following subsections.

4.1 Blocking of Large Vessels North of the Cruise Ship Docks

If Tongass Narrows were to be blocked to large vessels north of the Ketchikan cruise ship docks, then large cruise ships arriving from the south and continuing north would have to proceed southwest through Nichols Passage and round the southern end of Gravina Island to get to Clarence Strait and continue their voyage northward (route shown in blue in Figure 12). And large cruise ships arriving from the north would have to round the southern end of Gravina Island into Nichols Passage and the northeast through Nichols Passage in order to proceed up Tongass Narrows to Ketchikan. These alternative routes join the normal route (the normal route transits the northern portion of Tongass Narrows and is shown in red in Figure 12) at a waypoint located in the center of Clarence Strait west of Caamano Point. The distance along this normal route to this waypoint is 17.7 n.m. as shown in Figure 13 and the distance along the alternate route around the southern end of Gravina Island is 48.2 n.m. Thus the typical increase in route distance that would result from blocking Tongass Narrows north of the Ketchikan cruise ship docks is approximately 30.5 n.m.

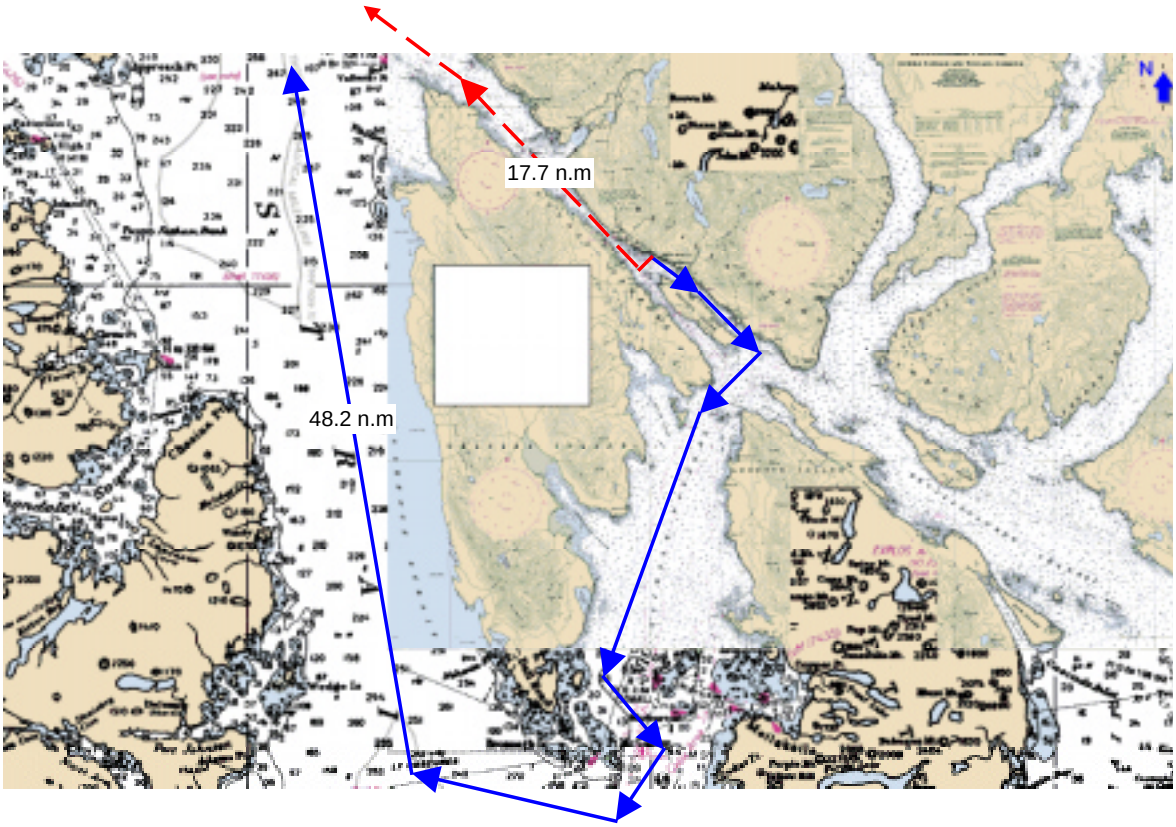

FIGURE 12

Effect of Blocking Tongass Narrows North of Ketchikan Cruise Ship Docks Revised Route (Blue) and Normal Route (Red)

4.2 Blocking of Large Vessels South of the Cruise Ship Docks

If Tongass Narrows were to be blocked to large vessels south of the Ketchikan cruise ship docks, then large cruise ships arriving from the north and continuing south would have to retrace their path through the northern half of Tongass Narrows and round Guard Island onto a southbound course in Clarence Strait in order to continue their southbound voyage (route shown in blue in Figure 13). And large cruise ships arriving from the south would have to proceed up Clarence Strait and round the Guard Islands into Tongass Narrows from the north in order to proceed down the Narrows to Ketchikan. These alternative routes join the normal route (the normal route transits the southern portion of Tongass Narrows and is shown in red in Figure 13) at a waypoint located at the entrance to Malacca Passage near Prince Rupert. The distance along this normal route to this waypoint is 87.4 n.m., as shown in Figure 13 and the distance along the alternate route around the southern end of Gravina Island is 106.8 n.m. Thus the typical increase in route distance that would result from blocking Tongass Narrows north of the Ketchikan cruise ship docks is approximately 19.4 n.m.

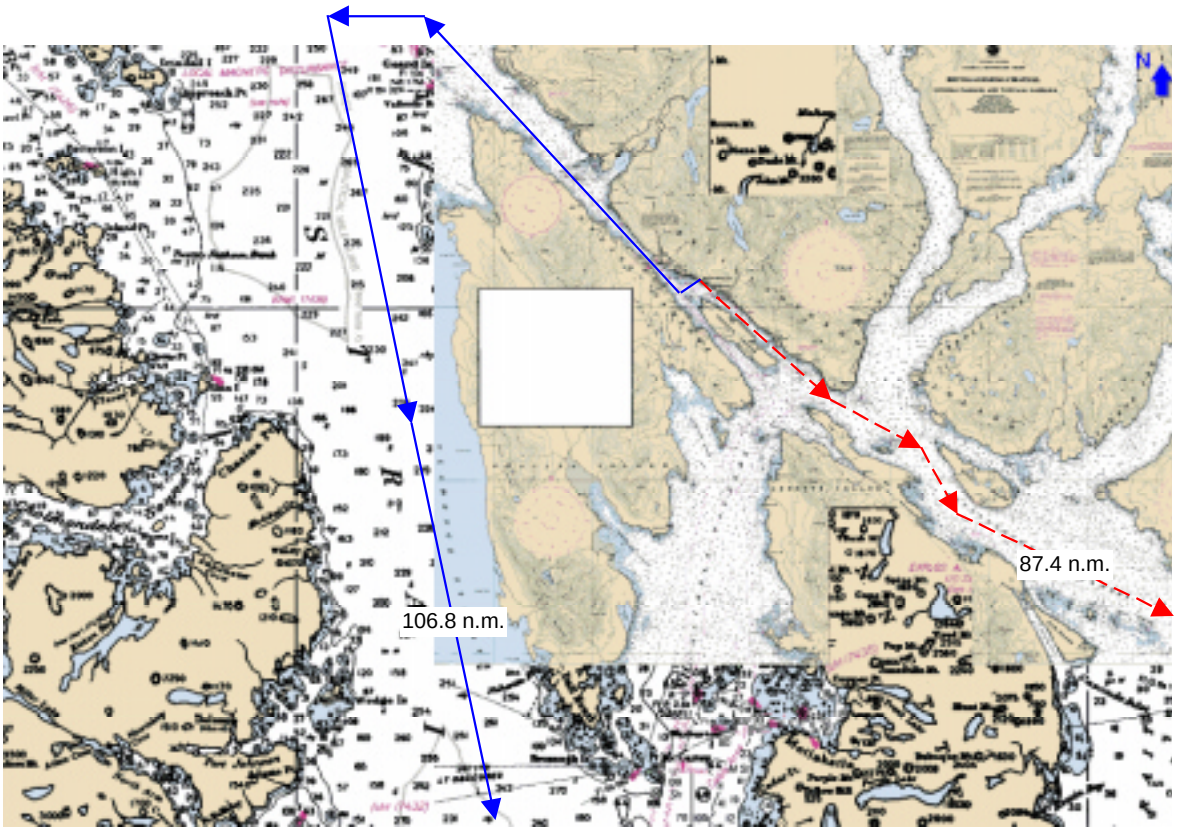

FIGURE 13

Effect of Blocking Tongass Narrows South of Ketchikan Cruise Ship Docks Revised Route (Blue) and Normal Route (Red)

4.3 Blocking of Either East Channel or West Channel but Not Both

If only one of the channels alongside Pennock Island is blocked to large vessels, then there will be no impact on the sailing distances for cruise ships calling at Ketchikan.

4.3.1 Blocking of West Channel to Large Vessels

As cruise ships rarely use West Channel, there would be no impact on cruise ship operations if West Channel were blocked to large vessels – provided that East Channel were open to large vessels. Depending on the nature of the blockage in West Channel, vessels other than cruise ships might likely still be able to use it. For example, if the blockage were an issue of vertical clearance and the vertical clearance of the West Channel bridge were 110 feet, then all of the vessels of the Alaska Marine Highway System and all normal barge traffic could continue to use West Channel as they do today. If, on the other hand, West Channel were blocked for Alaska ferries and barge traffic, then the use of East Channel would be affected by the increased congestion.

4.3.2 Blocking of East Channel to Large Vessels

If East Channel were blocked to large vessels but West Channel were open, there would be no increase in sailing distance for cruise ships, but cruise ship operations would be made more complicated and difficult. Unlike West Channel, East Channel aligns with the Ketchikan cruise ship docks. If cruise ships were forced to use West Channel, they would have to turn within the confines of Ketchikan harbor in order to land at the cruise ship docks. Figure 14 illustrates the maneuvers that would be required. This turning maneuver would add time to the operations and, depending on wind and current, might occasionally require assist tugs for landings where such assistance is currently not required.

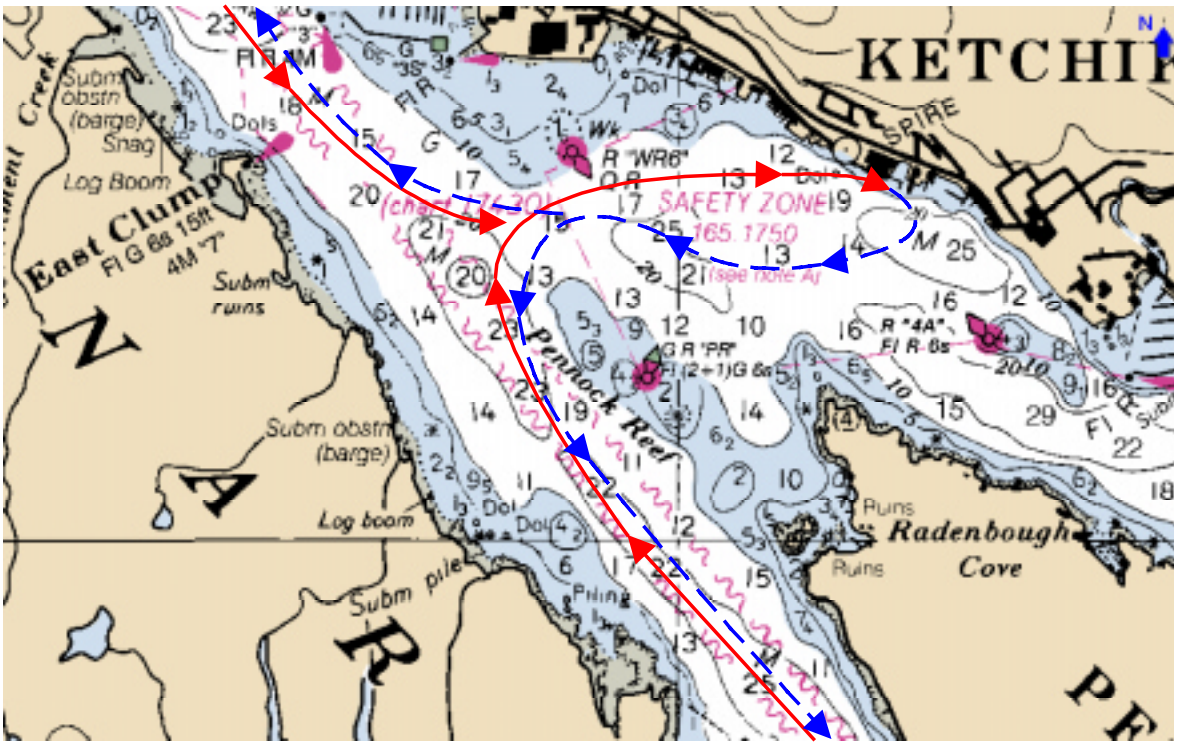

FIGURE 14

Illustration of Cruise Ship Maneuvers in Ketchikan Harbor if East Channel is Blocked

If East Channel were blocked to large vessels but open to medium-sized shipping such as Alaska ferries and barge traffic, then the natural separation of shipping that currently takes place would be adversely modified and crossing traffic patterns would develop within Ketchikan harbor. And if East Channel were blocked to both large and medium-sized shipping, then congestion in West Channel would be exacerbated.

We conclude that blocking of East Channel to large vessels is less desirable than the blocking of West Channel to large vessels. When compared to the blocking of West Channel the blocking East Channel would result in increased operation times, cost and collision risk for cruise ships calling at Ketchikan.

5.0 Other Navigation Issues

The following are specific navigation issues and concerns identified through discussions with ship pilots operating in Ketchikan, and others.

5.1 Navigation Restrictions During Construction

Legitimate concern has been expressed regarding navigation restrictions that may be imposed during bridge (or other civil structure) construction. This question extends to both the nature of the restrictions and their timing. For instance, it would be preferable if the most severe restrictions were limited to the "off" season for the cruise and tourist industry.

5.2 Bridge Structure Effect on Wind

Ship pilots have expressed concern about possible modifications to wind patterns on Tongass Narrows that might result from introduction of a bridge structure.

5.3 Bridge Structure Effect on Current

Ship pilots have expressed concern about possible modifications to current patterns in the waters of Tongass Narrows that might result from introduction of a bridge structure.

5.4 Reflection of Bow Waves by Bridge Piers

Ship pilots have expressed concern regarding the reflection of bow waves off bridge piers that may cause a vessel to shear off course.

5.5 Radar Shadow of Bridges

Ship pilots have expressed concern about the possibility that a major bridge may create a radar shadow that would inhibit the ability to image beyond the bridge.

5.6 Preferred Bridge Alignment

Ship pilots have expressed a preference for bridge alignments that cross at right angles to the shipping channel. Oblique alignments extend the duration of vessel interaction with the bridge, restrict heading as well as lateral position, and are visually disorienting.

5.7 Horizontal Clearance Between Bridge Piers

The magnitude of an acceptable minimum horizontal clearance has not yet been established. The American Pilots Association and Permanent International Association of Navigation Congresses (PIANC) will be contacted to determine if they have any guidelines or recommendations. AASHTO will also be consulted. Ship pilots in Ketchikan were receptive to the use of full mission ship simulators as an aid in establishing a minimum acceptable horizontal clearance.