Draft Design Concept Report

for the

Day Boat ACF

February 25, 2013

For

Alaska Dept. of Transportation and Public Facilities

CWJN 13002

Coastwise Corporation

Naval Architects • Marine Engineers

Anchorage, Alaska

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Introduction

History

On June 28, 2006 the Alaska Department of Transportation and Public Facilities (DOT&PF, or Department) issued a statement of services for a shuttle ferry class of vessel described as "Southeast Shuttle Ferry" with the purpose to:

> "Select Naval Architecture and Marine Engineering Firm to modify a concept ferry boat design to meet Alaska Marine Highway Systems operational and performance requirements for a new class of Southeast Alaska Shuttle Ferries."

The statement of services specified that the vessel design must meet the following criteria:

- Vessel Type: Roll On-Roll Off Passenger Ferry
- Overall Length: 255ft to 305ft
- Passenger Capacity: 450 (interior seating for 300 passengers)
- Vehicle Capacity: 48-60 plus
- Loading Ability: Bow, Stern and Side
- Cruise Speed: 18 knots (20 knot sprint speed)
- Operation: Day boat Operations (12 hours)

This began the process toward building the Alaska Class Ferry (ACF), which would be the first Alaska Marine Highway System (AMHS) stern/bow roll on-roll off (RORO) vessel since the *M/V Bartlett*. The stern/bow RORO would enable the most efficient vehicle loading and unloading capabilities, which in turn allows 12 hour day boat operation on many routes. Day boat operation, utilizing much smaller crews, greatly reduces operating costs. It was estimated in 2006 that the cost to build a vessel that met the above criteria would be approximately $25 to $30 million.

As the concept developed, there were several changes made that differed from the criteria in the statement of services. One of the most important changes was the elimination of a bow door, which decreased the ability of vehicles to roll on and roll off in an efficient manner. Less time in port and more time underway was an important characteristic for a Southeast Alaska Shuttle Ferry, especially for routes that were on the edge of being able to be completed in less than 12 hours. A second major change to the concept design was the inclusion of crew quarters, which conflicted with the "day boat operations" specification in the original statement of services. The vessel was also lengthened to 350 feet during this process. The ACF Design Study Report was completed in 2009 and included these changes to the original vision of the vessel; the cost estimate increased to $120 million.

The 2010 Alaska State Legislature appropriated $60 million of state general funds toward building the first Alaska Class Ferry. The appropriation matched $68 million in Federal Highway Administration funds. Later that year, Governor Parnell "defederalized" the ACF project and the department transferred approximately $1.5 million that had been expended for design to other state transportation projects. Defederalizing the ACF project allowed the state more flexibility to choose where and how the ACF would be designed and constructed. This aligned with the Governor's and legislature's intent that the vessel be built in Alaska to support Alaskan jobs. The federal funds were later redistributed to other transportation projects in Alaska.

In parallel with the ACF development, DOT&PF hired the University of Alaska Fairbanks (UAF) in 2007 to independently analyze the AMHS. The study was published in 2011 and found that there would be no improvement in the overall efficiency of the AMHS by replacing the *M/V Malaspina* in Lynn Canal with a 350-foot ACF. When two ACF's of this size were deployed (with the retirement of the *M/V Taku*) the study found that the average annual AMHS operating subsidy increased by approximately $6.7 million. There would be an improvement in service with deployment of two 350-foot ACF's in Lynn Canal, but at a substantially increased cost that resulted in the highest annual AMHS subsidy of any alternative the UAF study analyzed.

In fall 2012 the conceptual design had reached a point where accurate cost estimates could be provided by both the naval architect and Alaska Ship & Drydock (ASD). These estimates showed the total project cost at between $150-$167 million. The department was now faced with a vessel design that did not meet the original intent of constructing a stern/bow RORO shuttle ferry, a study provided by the University of Alaska that cast doubt on the use of the vessel, and a cost estimate that exceeded the amount available for construction.

Armed with this information the department consulted with the Governor and received direction to reevaluate the direction the project had taken. The vessel design and purpose were reviewed and the department determined that going back to the original concept was the best course of action for service to the public. Governor Parnell announced in December 2012 to revert the design back to a stern/bow RORO concept which will cost less to build and operate, and which will better serve Alaskans.

The Way Forward

With clear direction from the Governor, the Department has begun the process of returning the ACF project back to the original day boat ferry concept. The Department has identified the following plan which will rapidly reformulate the vessel design, and minimize the cost and time to begin construction of the new vessels. Although the ACF project funding and nomenclature remain unchanged, for purposes of clarity between old and new information, the new vessel will be termed the **"*Day Boat ACF*"**.

DESIGN CONCEPT REPORT

The first step is this design concept report (DCR). The purpose of the DCR is to re-examine the mission requirements of the Day Boat ACF and more clearly specify the required vessel and terminal characteristics. The DCR has been prepared for the Department by Coastwise Corporation, a naval architecture firm in Alaska, to provide a perspective independent of the old ACF design process. As soon as it is complete, the DCR will be provided to the AMHS and their design consultant, Elliott Bay Design Group (EBDG), to be used as the basis for concept design. The DCR will be provided to the Marine Transportation Advisory Board (MTAB) and the Joint House and Senate Transportation Committee. Comments and questions in response to the DCR will be addressed during the next phase described below.

DESIGN STUDY REPORT AND CONCEPT DESIGN

Using the DCR as a starting point, the AMHS will create a concept design of the new *Day Boat ACF*. The Concept Design will clearly indicate vessel size and all major design features, including rough speed and power and stability estimates. The basis for design decisions used to create the concept design vessel, and the resulting vessel characteristics, will be succinctly documented in a Design Study Report (DSR). At the end of the Concept Design a new vessel cost estimate will be provided. The DSR will also clearly state those design features needing additional study. The DSR and subsequent design documents will be provided to MTAB for discussion and input.

PRELIMINARY DESIGN

Some elements of the vessel design, for example hull speed and sea keeping analysis, may need additional work prior to the detail design phase. The AMHS and their design consultant will address these design issues during a preliminary design phase. A new expanded set of design drawings will be issued to support vessel preliminary design. A brief Preliminary Design report and appendices will be issued to document design decisions. At the end of the Preliminary Design a vessel cost estimate will be provided.

DETAILED DESIGN

Once the Preliminary Design is approved, AMHS and their design consultant will begin detailed vessel design. Detail design will be monitored using normal AMHS vessel project control milestones and review points. A vessel cost estimate will be provided at 40% and 100% of Detailed Design. Once detailed design has commenced, the AMHS will engage the vessel construction contractor and work out the dates for the involvement of the shipyard in the construction design process. At this point, the date for a final shipyard construction price will be identified.

SCHEDULE

The following is an early tentative project schedule. The project schedule will be updated monthly.

February 25, 2013	Completion of DCR
March 31, 2013	Completion of Concept Design and DSR
May 1, 2013	Completion of Preliminary Design
November 1, 2013	Completion of Detailed Design
January 1, 2014	Keel laying first vessel

Description of Design Concept Report

The purpose of this Design Concept Report (DCR) is to define the mission of the *Day Boat ACF* and determine a specific definition of the vessel and terminal characteristics required for successful vessel operation. In this context, the DCR first examines the components of day boat operation including basic premises such as routes, speed, and mooring/loading times. Using these day boat operational elements, sailing schedules are created to show viable day boat operation. The DCR then uses the results of the day boat analysis to generate day boat mission requirements. The day boat mission requirements are supplemented with the other standard AMHS mission requirements and the cost requirement to fully define the mission. Then the DCR identifies the required vessel and terminal characteristics needed to fulfill the mission. Finally, a “roadmap” vessel will be presented which illustrates one possible *Day Boat ACF* design.

Day Boat Operation

Basic Premise of a Day Boat

The proposed ACF is intended to operate as a day boat. The Day Boat ACF will normally operate no more than 12 hours each day, unless a second crew is used. The 12 hour rule is a USCG requirement to ensure the crew has sufficient rest. This means that normally a vessel must leave and return to its home port such that the crew works no more than 12 hours per day. There are several day boat vehicle ferries currently operating in Alaska: the *Lituya*, the *Prince of Wales*, and the *Fairweather* and *Chenega*.

The 12 hour limitation of a day boat places a strong constraint on vessel operation in Alaska because most ports are a long distance apart. To be effective, day boats can operate only between ports that are no greater than 4.5 to 5.0 hours of sailing time apart (see exceptions in Day Boat Route section below). For a displacement type steel ferry in Southeast Alaska, only a limited number of routes are possible. For a high-speed ferry the operational limitation is less of a restriction, but the vessel pays a large cost penalty due to increased fuel consumption and high engine maintenance.

Where day boat operation is geographically possible, it is an attractive marine transportation option. Most important for the traveling public is that the vessel is operating during daytime hours, instead of late night port calls. Day boat operation provides a profound reduction in operational cost because overnight crew accommodations and services are not required. Based on AMHS information, crewing costs for vessels operating 24 hours a day account for approximately 70 percent of total operational costs. If the *Malaspina* in North Lynn Canal service were replaced with two day boat vessels, the total number of required crew members would be reduced by about 44%[1].

Alternate means of operating a day boat are possible, but not analyzed in detail in this report. A day boat vessel can operate with two 8 hour per day crews to extend the operational day to 16 hours, assuming the vessel route is short enough to return to its home port in 8 hours. This is similar to the Ketchikan Airport ferry operation. Another option is to run to a community 5 to 10 hours from the homeport, overnight the crew there in shore side facilities, with a return voyage on the following day. This is similar to airline operation. In this way a sailing from Juneau to Petersburg or Sitka would be possible. For maximum capacity a second crew could operate the vessel for the second 12 hours of selected days (provided the schedule allows crew to return to the home port), effectively causing the day boat to operate 24 hours per day.

Day Boat ACF Operational Elements

Many elements of day boat vessel operation are the same as traditional AMHS ferry operation. However, to create an effective and efficient day boat, it is important to understand those operational elements that are unique and critical to the success of a day boat. The following discussion describes in detail these important day boat operational elements.

[1] The Malaspina has two crews, 42 members each; the proposed Day Boat ACF is assumed to require two crews of 9 members each, not counting night crew. If there are 3 night crew for the 12 hour Juneau-Haines vessel and 1 night crew on the 8 hour Haines-Skagway vessel, this results in an approximate crew comparison of (2x42) **84** Malaspina crew **vs.** (2x12 Haines vessel) + (2x10 Skagway vessel) = **44** crew. (Minimum crew size is determined by the USCG; if a crew of 10 is required, total crew would be 48.)

SERVICE SPEED

Vessel speed is critical to making the most of a 12 hour operational day. However, vessel speed is the most costly of all non-crew operational elements, because it takes fuel to make speed. This study concentrates on displacement type day boats, because they are the most fuel efficient. For a vessel of average AMHS fleet size, (such as the *Taku*) an efficient hull speed is about 15.5 knots. This is the traditional AMHS vessel service speed and large vessels traveling about 15.5 knots are a well-established physical and environmental presence in the waters of Southeast Alaska.

Displacement vessels of *Taku* size can be made to go at greater speeds but the horsepower required to add this level of speed begins to increase rapidly beyond "hull" speed. For example, to increase the *Taku's* service speed from 15.5 knot to 17.5 knots would require roughly double the horse power and roughly double the fuel. This power also results in a significantly higher energy vessel wake field. So while it is possible to plan for day boat vessel speed above 15.5 knots, it should be considered a last resort.

Since speed has such a significant impact on operational costs and a day boat is limited to only 12 hours of operation per day, it stands to reason that <u>a day boat vessel must spend as much time at sea as possible and greatly minimize time in port</u>. This is not a traditional AMHS operational requirement and will be a new way to conduct business. This new operational system impacts other AMHS vessel and shore side operations including: mooring, loading, ticketing/security, unaccompanied vehicles, vessel cleaning, replenishment, and maintenance.

MOORING

Mooring is one component of a vessel's time in port. Traditional AMHS side mooring is not a fast method to position and secure a vessel. Previous timing studies indicate that it takes on average about 22.4 minutes combined time to moor and unmoor a traditional AMHS vessel. In contrast, other ferry systems can moor and unmoor a vessel in about 7 minutes, using drive straight-in bow capture terminals. This is about a 15 minute difference in time.

Assuming a day boat has at least two mooring cycles per day, even a 30 minute time increase could be important. For example, to make up 30 minutes of time between Auke Bay and Haines requires 2 knots additional vessel speed[2].

The difference in mooring times plays a more critical role as the frequency of vessel trips increases. Some of the proposed future day boat vessel schedules plan for 3 or more vessel round trips in a 12 hour period. In this case, with 6 or more mooring cycles, the time spent mooring the vessel begins to exceed several hours per day and is not viable.

Terminal configuration is obviously the most important component of mooring times. Capturing either the stern or the bow of a vessel is the most effective means to quickly position the vessel. See Figure 1. But other considerations, such as holding the vessel into the pier with propulsion power instead of mooring lines are also important.

[2] See Appendix A, Juneau-Haines 15.5 and 17.5 knot schedules.

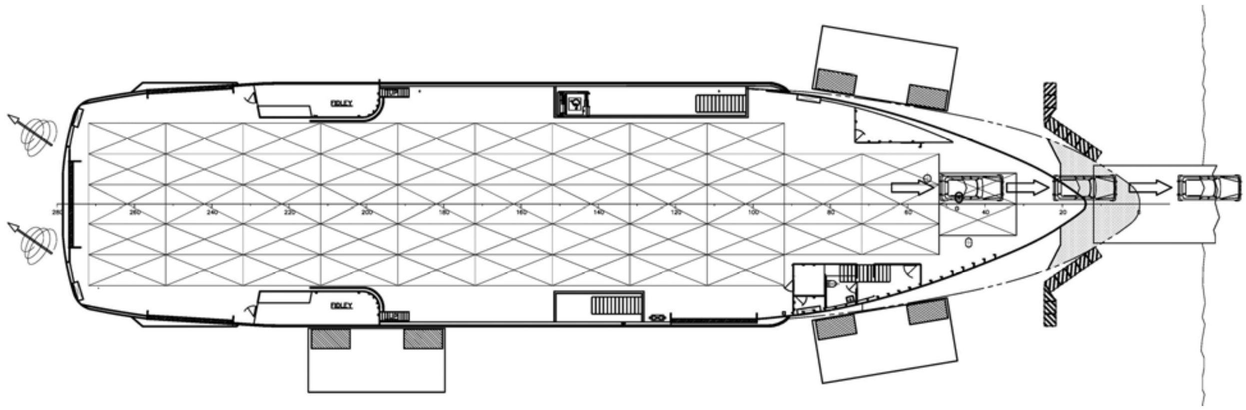

Figure 1 - Bow Capture, Bow Unload Mooring

VEHICLE LOADING/UNLOADING

Vehicle loading/unloading is another component of vessel port time. Many activities are included in this broad category: vehicles maneuvering on the arriving vessel's Car Deck, unloading arriving vehicles, providing tickets to departing vehicles, staging and security clearance of departing vehicles, loading departing vehicles, and maneuvering and securing vehicles on the departing vessel's Car Deck. Traditional AMHS operation is not arranged for fast loading times as fast loading/unloading is not required to meet existing weekly schedules. Generally, AMHS schedules 2 hours for each port call of mainline vessels[3]. In a day boat schedule with 2 or more mooring cycles, spending upwards of 4 or more hours per day loading a vessel is not a viable strategy.

Previous timing studies have indicated that AMHS loads at about 2 cars per minute and that other ferry systems can load vehicles at about 10 cars per minute per lane. The experience of other ferry systems indicate that fast loading/unloading times require mooring schemes that allow vehicles to drive straight on and off of the vessel. Fast loading times also require that vehicles be ticketed, checked for security, and staged prior to vessel arrival. A key component of fast unloading times is that adequate uplands space be available to hold the entire vessel load of vehicles, so that there is no stopping or delay in the traffic moving off the vessel.

One of the key aspects to fast loading times is to have drivers on the Car Deck and in their vehicles prior to docking. While common in other U.S. ferry systems, currently the *Lituya* is the only AMHS vessel that allows this practice. The *Day Boat ACF* needs to be designed to accommodate passengers on the Car Deck while underway.

It is not possible to get fast loading times if unaccompanied vehicles, and especially unaccompanied freight containers, are allowed on the Car Deck. While AMHS has previously allowed unaccompanied vehicles on the Car Deck, this operation is not part of the basic mission of providing a highway. It occurs because doing so does not greatly affect operating costs on existing schedules. In order to have viable day boat schedules, the AMHS will need to revert back to the priority mission of carrying normal highway traffic. On day boat routes all vehicles will have to be self-propelled, the vessel cannot wait for special maneuvering of cars and vans on the Car Deck. Unaccompanied vehicles can still be carried on other AMHS routes and on traditional AMHS vessels.

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[3] AMHS schedules 1 hour or shorter port time for the FVFs, and is starting to schedule 1 hour port time for the *Aurora*/*LeConte* in some ports.

The loading of walk-on passengers will also need special consideration. Terminals and loading ramps should be modified to allow for safe simultaneous loading of passengers and vehicles. Future terminal modification should consider separate walk-on passenger loading systems.

MOORING AND LOADING OPERATIONS (MLOPS)

Given the above description of day boat mooring and loading issues, there are numerous considerations when attempting to configure a day boat ferry system and many of the mooring and loading issues can have a large impact on schedule and operational efficiency. To quantify these issues, a mooring and loading study was developed and is shown in Appendix B. The intent of this study was to examine in detail, the mooring and loading concepts discussed above, and to generate estimates of mooring and loading times for analysis of day boat operation. The results of this study are the Mooring and Loading Operations (MLOPS) tables which provide different sets of mooring and loading times to be used to develop day boat schedules.

NIGHT CLEANING, REPLENISHMENT, AND MAINTENANCE.

Because the vessel's primary crew is fully occupied when operating the vessel on a 12 hour route, they do not have time for replenishment, cleaning, and maintenance. These types of tasks (such as fueling, pumping, oil changes, stores replenishment, and cleaning) need to be accomplished by a night crew. The night crew is also in charge of vessel security and safety.

Day Boat Routes

The Department is on record regarding Southeast Alaska marine transportation improvements. In general, the Department believes that deploying day boat ferries in conjunction with small road segments will greatly improve sailing frequency and lower operational costs. This type of ferry system results in high reliability and redundancy. The vessels will be simple to operate and maintain and will provide widespread crew familiarity. Identical vessels will be able to provide back-up capability during overhaul and breakdown periods. Furthermore the day boat vessels can be efficiently deployed in a wide variety of schedule options which is a powerful feature for future system modifications.

1ST PRIORITY ROUTES – NEW NORTH LYNN CANAL SERVICE

Juneau-Haines-Juneau
Haines-Skagway-Haines

2ND PRIORITY – OTHER AMHS ESTABLISHED ROUTES

Juneau-Angoon-Juneau
Juneau-Gustavus-Juneau
Juneau-Hoonah-Juneau
Juneau-Tenakee-Juneau (Same approximate distance and operational features as Juneau-Angoon)
Metlakatla-Ketchikan-Metlakatla (Identical to current *Lituya operation*)

3RD PRIORITY – JUNEAU ACCESS IMPROVEMENTS (JAI) STATE PREFERRED ROUTES

Haines-Katzehin-Haines
Skagway-Katzehin-Skagway

4TH PRIORITY – OTHER JAI ALTERNATIVES ROUTES

Haines- Sawmill Cove[4]-Haines

[4] Sawmill Cove is labeled Berners Bay (BER) in Appendix A and C.

Juneau-Skagway-Juneau
Skagway-Sawmill Cove-Skagway
Sawmill Cove-William Henry Bay–Sawmill Cove

5TH PRIORITY - OTHER POSSIBLE FUTURE ROUTES

It is hard to forecast the long range growth of the AMHS. Many potential day boat routes exist that could be served by the Day Boat ACF, particularly with small road extension segments. Some of these routes are charted in Appendix A, but no official schedules were developed.

Cascade Point[5]–Haines
Cascade Point-Skagway
Whittier-Valdez-Whittier
Cordova-Valdez-Cordova
Anton Larsen Bay-Ouzinkie-Port Lions. Requires terminal at Anton Larsen Bay
Juneau-Warm Springs Bay (Sitka)-Juneau. Requires one road segment
Whittier-Cordova-Whittier. Requires road extension in Cordova.

6TH PRIORITY – OVERNIGHT ROUTES

While day boat operation was previously defined as a vessel that returns to its home port every night, it is possible to run the vessel to a port, then put the crew in shore side accommodations overnight, then resume sailing the next day. This type of operation greatly extends the range of the vessel, but long day trips can increase the desire for passenger services, such as meals and accommodations for the infirm. Some possible overnight routes are:

Juneau-Haines-Skagway-Haines
Haines-Skagway-Haines-Juneau
Juneau-Sitka-Juneau
Juneau-Petersburg-Juneau
Ketchikan-Petersburg-Ketchikan
Ketchikan-Prince Rupert-Ketchikan. (Vessel would require SOLAS exemption.)

Day Boat Schedules

Based on the day boat routes and operation discussed above, and using an assumed conservative vessel speed, many day boat schedules were created and analyzed. These schedules are important because they determine: 1) if a route is feasible from a day boat standpoint, 2) what kind of speed is required, and 3) what kind of mooring/loading times are required.

SCHEDULE METHODOLOGY

To support schedule calculations, all route geographic information was generated new and analyzed using vessel navigation software. This information was based on recent digital navigational data from AMHS navigation computers. See Appendix A for detailed route information. Of key importance is the length of restricted speed areas, usually adjacent to terminals.

Detailed schedule information and methodology is shown in Appendix C. Basic scheduling assumptions were that a crew day was 12 hours, vessel speed was 15.5 knots, and maneuvering

[5] Cascade Point schedules are calculated the same as Sawmill Cove schedules and labeled as Berners Bay (BER) because these two routes are virtually equidistant.

speed 5.0 knots. Mooring and Loading Operations (MLOPS) were optimized as necessary for each schedule, however if time was available, schedules used the most generous day boat MLOPS time of 30 minutes. Assuming an arbitrary crew arrival start time, the arrival and departure times and the number of round trips were calculated for each port in the route. The effect of current was examined, but not included in the analysis due to limited impact.

Many variations of schedules were examined, however only one set of 1st Priority through 2nd Priority routes schedules are presented.

1ST PRIORITY ROUTES – NEW NORTH LYNN CANAL SERVICE

Juneau - Haines Schedule

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load		7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Haines	12:07	4:37			5:22
Depart		13:07		1:00		6:22
Arrive	Juneau	17:44	4:37			10:59
Unload		18:14		0:30		11:29
Crew End		18:29			0:15	11:44

Schedule Statistics		
Total Underway Time	9:14	
	76.9%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	11:44	
	97.8%	Of Day
Unassigned Time	0:16	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines - Skagway Schedule (Reduced Frequency)[6]

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 2

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		8:40				0:00
Load		8:55			0:15	0:15
Depart	Haines	9:25		0:30		0:45
Arrive	Skagway	10:16	0:51			1:36
Depart		11:16		1:00		2:36
Arrive	Haines	12:07	0:51			3:27
Depart		13:07		1:00		4:27
Arrive	Skagway	13:58	0:51			5:18
Depart		14:58		1:00		6:18
Arrive	Haines	15:49	0:51			7:09
Unload		16:19		0:30		7:39
Crew End		16:34			0:15	7:54

Schedule Statistics		
Total Underway Time	3:24	
	28.3%	Of Day
Total MLOPS time	4:00	
	33.3%	Of Day
Total Operation Hours	7:54	
	65.8%	Of Day
Unassigned Time	4:06	

MLOPS: Maneuvering and Loading Operations. See Appendix B

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6 This schedule shows 2 round trips when 3 round trips are possible, see Appendix C. However, this schedule synchronizes with the arrival of the Juneau-Haines vessel in Haines to reduce the transfer time for Skagway bound vehicles and passengers. The extra time in this schedule can be used for vessel maintenance and cleaning, reducing night crew workload.

2[ND] PRIORITY – OTHER AMHS ESTABLISHED ROUTES

Juneau – Angoon Schedule (Same as Juneau – Tenakee)

Ferry Speed: 15.5 kn MLOPS2a: 15.1 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		7:14				0:00
Load	Juneau	7:14			0:00	0:00
Depart	Juneau	7:30		0:15		0:15
Arrive	Angoon	12:55	5:25			5:40
Depart	Angoon	13:25		0:30		6:10
Arrive	Juneau	18:50	5:25			11:35
Unload		19:05		0:15		11:50
Crew End		19:05			0:00	11:50

Schedule Statistics		
Total Underway Time	10:50	
	90.3%	Of Day
Total MLOPS time	1:00	
	8.4%	Of Day
Total Operation Hours	11:50	
	98.7%	Of Day
Unassigned Time	0:09	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau – Gustavus Schedule

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Juneau	7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Gustavus	11:52	4:22			5:07
Depart	Gustavus	12:52		1:00		6:07
Arrive	Juneau	17:14	4:22			10:29
Unload		17:44		0:30		10:59
Crew End		17:59			0:15	11:14

Schedule Statistics		
Total Underway Time	8:44	
	72.8%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	11:14	
	93.6%	Of Day
Unassigned Time	0:46	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau – Hoonah Schedule

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Juneau	7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Hoonah	11:00	3:30			4:15
Depart	Hoonah	12:00		1:00		5:15
Arrive	Juneau	15:30	3:30			8:45
Unload		16:00		0:30		9:15
Crew End		16:15			0:15	9:30

Schedule Statistics		
Total Underway Time	7:00	
	58.3%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	9:30	
	79.2%	Of Day
Unassigned Time	2:30	

MLOPS: Maneuvering and Loading Operations. See Appendix B

3[RD] PRIORITY – JAI STATE PREFERRED ROUTES

The 3[rd] Priority routes of Haines-Katzehin-Haines and Skagway-Katzehin-Skagway are currently the Department's preferred routes in the Juneau Access Improvements (JAI) project. New day boat schedules were created for these routes using the information in this report and are shown in Appendix C. In a 12 hour day, assuming fast mooring and loading operations, the Haines vessel can make 6 round trips and the Skagway vessel can make 4 round trips. These schedules are similar to those already published by the JAI project.

4TH PRIORITY – OTHER JAI ALTERNATIVES ROUTES

4th Priority schedules can be found in Appendix C.

5TH PRIORITY - OTHER POSSIBLE FUTURE ROUTES & 6TH PRIORTY – OVERNIGHT ROUTES

Not all lower level priority schedules were calculated in this study. Some 5th priority schedules can be found in Appendix C. Some of these routes have been previously analyzed by the Department or AMHS. If these routes become more likely, actual routes and schedules should be developed.

SCHEDULING LESSONS LEARNED

The creation and analysis of day boat schedules provides some interesting results:

- The schedules show that the Day Boat ACF can successfully and efficiently operate: on North Lynn Canal routes, on other AMHS traditional routes, on all of the JAI displacement vessel routes, and on many other future AMHS routes not yet in existence.
- For the Juneau-Haines route, an increase in speed from 15.5 knots to 17.5 knots (which approximately doubles fuel consumption) gains approximately 30 minutes of transit time. Meaning that doubling fuel consumption saves the time equal to one loading or one unloading cycle. This is a clear indication that mooring and loading operations need to be made as fast as possible, prior to increasing vessel speed, as a means to improve day boat schedules. Since it is very difficult to improve on a modern vessel's original fuel consumption and fuel is a large component of operational cost, the decision to determine vessel speed during the design phase can greatly increase vessel operational cost over the vessel's 60 year life span.
- Short route schedules have a cumulative MLOPS time of up to 50% of the 12 hour day. This means that the vessel is mooring and loading more than half of its operational day and again points to the major economic importance of fast loading and terminal operations.
- For Haines-Skagway route, increase in speed from 15.5 knots to 17.5 knots gains 5 minutes for each trip. No additional sailings are gained from increased speed. For short routes, increasing vessel speed does not realistically improve the schedule.
- For the Haines-Skagway route, reducing MLOPS from 30 minutes to 15 minutes (for each load or unload interval) allows for 1 additional round trip. This is a 33% system efficiency increase with no extra operational funding required.
- For the Haines-Katzehin route, reducing MLOPS from 30 minute each to 15 minutes (for each load or unload interval) allows 3 additional round trips. This is a 100% system efficiency increase with no extra operational funding required.
- Long routes at the extreme limit of possible day boat operation, such as Juneau-Angoon and Juneau-Skagway, must substantially minimize MLOPS time to make a round trip in a 12 hour day. An increase in vessel speed to 17.5 knots does not provide a similar result. Even with reduced MLOPS times, these two routes are close to the 12 hour operational limit and may also require shore side or night crew assistance for loading/unloading and vessel startup and shutdown.

The schedule timing information presented in the above tables clearly shows the viability of day boats/shuttles for priority routes and the key importance of fast terminal operations.

Mission Requirements

The day boat analysis has shown the day boat routes, operational elements, schedules, and the key importance of minimizing port time. In this chapter, the preceding day boat analysis is used to identify the mission requirements for successful day boat operation. These requirements are followed by a definition of the normal AMHS vessel mission requirements based on previous vessel design projects. Finally, the cost requirements for the Day Boat ACF project are defined. These three major requirement categories (day boat, AMHS, and cost) form a detailed definition of the Day Boat ACF mission.

Day Boat Mission Requirements

PAYLOAD

Vessels must carry a minimum of 53 Alaska Standard Vehicles (ASV) each, which is based on current Lynn Canal summer traffic[7]. Traffic shall drive straight-on and then drive straight-off the vessel. Passengers shall be able to stay in cars while underway (at the discretion of the Captain). Passenger loading shall be segregated from vehicle loading, to the best extent possible.

SPEED

The need and cost of day boat vessel speed has been discussed in detail in this paper. The results of this analysis are:

- Schedule speed is 15.5 knots
- Service speed should be not less than 16.0 knots
- Main engines sized for 85% MCR at service speed (for sea state and fouling)
- Use previous ACF engine selection data, if applicable

BOW CONFIGURATION

To address the need for short port times with no vehicle backing or turnaround, the most powerful vessel feature is self-propelled bow mooring and bow vehicle unloading. This results in the following mission requirements:

- Vessel mooring straight bow in, holding with ship's power, is required
- Able to open bow door just prior to landing
- Bow door (bulwark gate) is required and shall be simple, strong, reliable
- Bow design shall reduce spray generation during winter operation and shall not have forward side doors.
- Vessel shall not have propulsion on the forward end[8], except for bow thruster.

[7] Traffic analysis is based on accommodating daily traffic 95% of the time. Special events, such as races and fairs, exceed this level of traffic and must be addressed by additional crews or additional vessels.

[8] Significant thought was given to a double-ended vessel design, prior to this concept being rejected. Given that many of the intended day boat routes are long channel routes, there is significant concern about forward propeller damage from logs and deadheads during night/dark operation. Increased installed horsepower, rudder machinery, and limited sea keeping abilities were also considered. The double-ended concept was only beneficial for very fast turnaround times, such as might be required for some of the preferred Juneau Access routes while they are being operated at maximum capacity (number of round trips). This level of system throughput is not envisioned in the next 30 years and can be overcome by extending vessel operation to 16 hours.

STERN CONFIGURATION

If the bow is configured as above, the stern of each vessel must have a stern center door and at least an aft port side door. An aft starboard door could be considered as an option, although this door would see use only at some traditional AMHS berths outside Northern Southeast Alaska.

MANEUVERABILITY

Since a key part of each vessel's mission is to turn and back quickly into a dock multiple times per day, the vessels must be very maneuverable. Excellent visibility astern from the wheelhouse is required. Installing 3 rudders, similar to the *Lituya*, is recommended. Depending on installed main engine horse power, it may be necessary to install a stern thruster.

MANNING

The vessel's USCG required manning level shall be safely minimized using vessel design features:

- Engine room shall be un-manned, similar to *Lituya/Fairweather*
- No galley or hot food service, other than vending machines
- Mooring must not drive up manning requirements; utilize mechanical means rather than line tying if necessary
- Close attention to design of lifesaving and vessel evacuation requirements
- Additional vessel assistance at port (loading, etc.) may come from shore
- No crew overtime shall be built into normal vessel operation

ACCOMMODATIONS

Good accommodations shall be provided for passengers and crew. Passenger spaces shall be broken into multiple single-use rooms, so that passengers have a choice of seating and activities during transit.

- Forward view lounge
- Library (quiet reading, no cell phones)
- Movie lounge
- Computer use tables/booths
- General lounge
- Eating lounge
- Children's area
- Solarium

At least four of these passenger areas (library, computer use, general lounge, eating lounge) shall have lights available during hours of dark operation.

A small separate deck shall be available for crew. Crew accommodations shall provide: officer mess, crew mess, break room, quiet room, lockers and gear storage.

UPLAND AND TERMINAL IMPROVEMENTS

Berths, uplands, terminals, and terminal operations shall be improved to allow for minimum vessel time in port:

- Berth improvement to minimize mooring time
- Improved vehicle and passenger staging areas to optimize traffic flow on and off vessels:
  - Adequate upland lane space to hold entire vessel car capacity while loading and unloading

- Improved ticket taking areas and procedures to eliminate ticket verification at top of ramp
- Improved security procedures, if required
- Better segregation of passengers and vehicles during load and unload operations

PROVISIONS FOR OVERNIGHT MOORING

Terminal shall provide electrical power, fresh water, fuel, sewage and garbage disposal. Provisions shall be made for quick transfer to shore power, without interrupting sensitive electrical equipment. Overnight mooring berths shall be configured to minimize line handling. Night crew shall conduct cleaning and maintenance, if the crew operational day is too long to accomplish this work. Night-crew shall also be able to assist with startup/shutdown if necessary to meet 12 hour crew day limitations.

AMHS Standard Mission Requirements

The resulting AMHS mission requirements are well defined from previous vessel design efforts.

SAFETY

The vessels must be safe in all regional environmental conditions. Vessel survivability in a grounding event shall be at least as good as existing AMHS Taku class, regardless of USCG regulations.

RELIABILITY

Vessel operation shall exceed 99% sailing frequency, or as good as existing AMHS service, whichever is greater.

Vessel construction shall use marine systems that have demonstrated 5 years minimum proven marine technology, capable of being serviced in Ketchikan, Alaska. Steel vessels shall be designed for approximately a 60 year life span, using one main engine replacement and two passenger accommodation area refurbishments.

REGULATORY

Vessels shall be USCG approved, as 46 CFR Subchapter H. Vessels shall be ABS or DnV classified. Vessel classification shall include relevant machinery and electrical certifications. Relevant Federal and State emissions (Tier 3 air emission, vessel general permit) and discharge (sewage) requirements shall be met.

ENVIRONMENTAL CONDITIONS

Vessel shall be designed for operation on the coastal waters of Alaska. For this operation, the AMHS maintains standard environmental criteria that shall be used as minimum design criteria:

- Permanent list of 15 degrees
- Permanent trim of 5 degrees (by bow/stern)
- Roll of 30 degrees (each side) with total rolling period of 12 seconds from horizontal
- Pitch of 10 degrees (bow up/bow down) with total pitching period of 8 seconds
- Ambient air temperature between minus (–) 20°F through plus (+) 85°F
- Seawater temperature between plus (+) 28°F through plus (+) 65°F

SEA KEEPING

Ship Motions (Passenger Comfort). Vessels shall be designed to provide less ship motions (i.e. better comfort) than found on the AMHS LeConte class vessels. This analysis shall be limited to bow and stern seas. The design goal shall be ship motions (comfort) approaching the levels found on the

Taku, without greatly impacting the budget. It is anticipated that this level of comfort can be obtained by a vessel of approximately 280 feet in length, assuming that the vessel does not have forward car doors and associated forward guard sponsons. The closest example of this type and size of vessel hull in the AMHS fleet would be the 295 foot *Tustumena*.

Spray Generation and Forebody Slamming. Vessel shall be designed to minimize spray generation and forebody slamming and shall (to the greatest extent possible) reduce ice formation on vessel safety equipment. Winter spray performance shall be significantly better than the AMHS LeConte class vessels.

Survivability. Assuming operation on all routes in Southeast Alaska, except ocean entrances, vessels shall be able to survive during a once in 50 year storm. (It is not realistic to design a coastal vessel for a once in 50 year open ocean exposure climatology event.)

VEHICLES

An Alaska Standard Vehicle is defined as a block 10' x 20'. During the ACF car deck test conducted in 2010, it was determined that 4 adjacent ASV lanes (40 foot total lane width) can carry 5 passenger vehicles. For the Day Boat ACF, this means that 5 adjacent lanes (4 lanes 8' wide, plus 1 lane 10' wide) would be an acceptable combination.

Car Deck wheel loading shall carry all highway legal vehicles, except double and triple trailer combinations. Limited construction equipment may be carried, if it is not in excess of highway limits. In general, car deck stiffening shall be parallel to direction of traffic. Vessel shall be provided with cargo van electrical hookups.

PASSENGERS AND OTHER CARGO

Vessels must be able to accommodate motorcycles, bicycles, and walk-on passengers. A limited amount of walk-on cargo capacity is normally accommodated by a luggage cart carried by AMHS vessels, but this requirement may be impacted by future day boat routes of short duration.

Vessels shall meet applicable ADA regulations and shall be accessible to the greatest extent possible for marine vessels. A passenger elevator shall be provided for access to all passenger decks.

Capital Cost Requirements

The Department will closely monitor the cost of the new Day Boat ACFs and aggressively seek safe means to reduce the cost of the vessels. The Department will deliver vessels that are safe, simple, and reliable and deliver these vessels at the least reasonable cost. The cost requirement will be met during all phases of the project including: design, procurement, construction, and construction management.

BUDGET

The Department desires that the total constructed price of two Day Boat ACFs not exceed $117.0 million (M) dollars, as there is approximately $117.0M remaining in the existing ACF funding. This total cost includes preliminary engineering (design), the shipyard contract, construction engineering (AMHS oversight during construction) and Indirect Cost Recovery Plan (ICAP) charges. (An ICAP charge is applied to all Department capital projects to recover Department overhead costs.)

The vessel construction package shall consist of the minimum necessary vessel features. If desired by the AMHS, additional vessel features may be added to the construction package as optional change orders, which may be activated if funds are available.

Budget monitoring shall occur periodically throughout the project. The AMHS will create a brief project status report, including a vessel construction cost estimate, at intervals no longer than 3 months. Early stages of vessel construction cost estimates may be calculated using parametric cost models.

The Department acknowledges the Contract Manager/General Contractor (CM/GC) procurement strategy and a general willingness to build the vessels at the state owned Ketchikan shipyard facility. However, cost is a key consideration, and the final vessel construction cost will be determined by the shipyard facility lessee, not the Department. If the Department and the shipyard cannot agree to a construction cost, the Department may elect to put vessel construction out for public bid, with the possible result that construction would occur outside of Alaska.

DESIGN

The design cost of the vessel shall be minimized, using applicable portions of the old ACF design including the public process comments, steering committee comments, and relevant design research. The AMHS will task its design team to seek all realistic and safe cost reduction measures, within the context of meeting the vessel's mission requirements.

PARTIALLY OPEN AFT ROOF

One possible construction cost savings measure may be to include a partially open aft roof. A partially open roof above the aft portion of the vehicle space reduces the cost of the vessel superstructure, the bow door, and other equipment associated with ventilating and heating the car deck. The Department will require the vessel design team to investigate a partially open aft roof, enclosed with bulwark walls high enough to safely shield the Car Deck from sea water including spray.

LIFE CYCLE COSTS

Given a minimum construction cost project mandate, the resulting vessel will (of necessity) be as small as possible to accomplish the mission. In some cases, minimum construction cost is not in the best interest of the State, if for example, it means an increase in operational costs over the anticipated 60 year life of the vessel. The AMHS shall task its design team to be vigilant regarding the long term (life cycle) operational costs of the vessel and minimize these costs where possible. Increased fuel consumption has a very large life cycle cost impact and shall be carefully monitored.

Other design features should be examined with due diligence for long term cost impacts. For example, an increase in vessel length may cause the vessel to be more expensive, but allow for a slight decrease in fuel consumption, a decrease in passenger motions, and make for a more comfortable car deck. In this case, the design team shall investigate these issues and advance them to the Department for analysis and decision.

Vessel Characteristics

Based on the above definition of mission requirements, some of the required vessel characteristics can be determined. A more detailed list of vessel characteristics will be determined during the vessel Design Study Report and Concept Design. However, for purposes of illustration a "Roadmap" vessel sketch is included in this chapter to show a vessel that provides the required characteristics and could be considered a starting point for the Day Boat ACF.

Size

Length: Minimum 256'-9" Length on Waterline (40 feet greater than *LeConte*)
Beam: As necessary to support 42 ft clear traffic lanes and two 8' casings
Depth: Normal AMHS constraint for Wrangell Narrows / Peril Straight
Bow designed to minimize spray, no large guard knuckle sponsons or forward side car doors

Payload

53 cars in four 8' lanes and one 10' center lane
Car deck designed to meet Appendix B
200 passenger seats, certificate for 300 passengers[9]

- Passenger areas segregated by use:
  - Forward Lounge, movie theater, vending area with tables,
  - Computer stations, silent reading room, family room
  - One elevator

Loading

Bow door for vehicle loading/unloading. 14' minimum width (one 10' lane, one 4' pax walkway)
Symmetric P/S aft side car loading openings
One aft stern car loading opening

Speed

Schedule speed = 15.5 knots
Service speed = 16.0 knots at 85% MCR (re-examine after speed power curve known)
Horsepower approximately 3,000 hp per side
Use ACF propulsion study if applicable, likely main engines are EMD 710 12 cylinder.

Tonnage

No restriction. Department will not seek "small passenger vessel" 46 CFR Subchapter K or T regulatory status.

[9] AMHS frequently certifies vessels for more passengers than the number of passenger seats, to account for the infrequent times the vessel must carry high capacity passenger loads. Also, some passengers may prefer to stay in their vehicles on shorter runs. The final number of certified passengers will be determined during later design phases.

“Roadmap” Vessel Design

Figure 2 below shows a “Roadmap” vessel design. The “Roadmap” sketch indicates a vessel that could be considered a starting point for the Day Boat ACF. Subsequent design work will identify a true concept design with more accurate technical details.

Particulars

Length	278’-6”
Beam	62’-6”
Depth	19’-7”
Draft	13-4”
Service speed	16 knots at 85% MCR
Vehicle Capacity	53 (20’ x 8’ min) ASV
Passenger Capacity	300 persons
Passenger Seating	280 interior seats not counting solarium
Main Engines	2 x 3000 hp

Fast Mooring and Loading Operations (MLOPS)

This report has clearly demonstrated the multiple problems and cost penalties a day boat pays for slow MLOPS. Towards the goal of fast MLOPS, the “Roadmap” vessel has a “clam shell” style bow door for fast loading, a stern center door, and is arranged to allow passengers on the Car Deck. The vessel also has no forward side doors and an optimized bow for better sea keeping, and a partially open aft roof enclosed with full (18 foot) height bulwarks. More details and a size comparison of the “Roadmap” vessel can be seen in Appendix D.

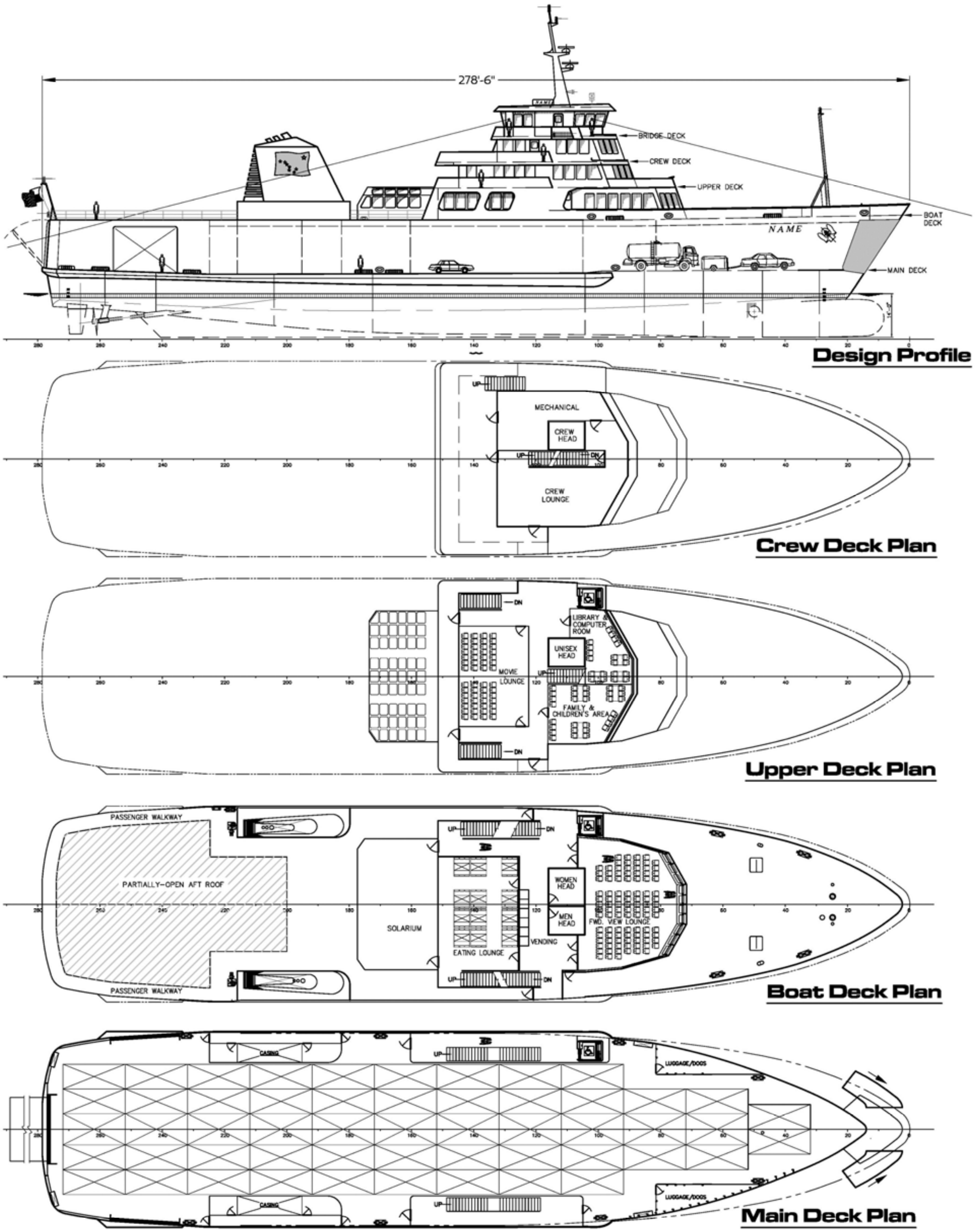


Figure 2 - "Roadmap" Vessel

Cost

An early and approximate vessel construction cost was created for the “Roadmap” vessel, using the Coastwise Parametric Vessel Construction Cost Model (CPVCCM). A parametric cost estimate is similar to getting a price per square foot for a new house; it is only a rule-of-thumb unit cost, times the anticipated number of units. In the case of vessel parametric cost models, the usual comparison unit is price per cubic feet, although the CPVCCM uses several other methods. This produces planning level estimates, with a confidence range of about plus or minus 10 percent, which are used until detailed design plans are available for more specific cost estimating.

The CPVCCM calculates construction cost, which is the cost necessary to pay the contractor for the construction of the vessel, assuming the contractor is provided a reasonably detailed set of vessel construction drawings.

The parametric cost model estimated the first Day Boat ACF construction cost to be between $44.3M and $54.1M dollars (See Appendix E). The second vessel, if constructed by the same shipyard immediately after the first vessel, should experience a cost reduction of between 5 to 15 percent. This accounts for less engineering, planning, and procurement and for the fabrication lessons learned by the shipyard. Using the mid-point of the projected first vessel cost ($49.2M), and a 10% expected cost reduction, the second Day Boat ACF is projected to cost $44.3M. A planning level estimate of the total project costs are as follows:

Preliminary Eng. (PE)	$ 3.2M (6.5% of first vessel: $49.2M)
First vessel contract	$ 49.2M
Second vessel contract	$ 44.3M
Construction Eng. (CE)	$ 5.6M (6% of both vessels: $93.5M)
ICAP	$ 4.9M (4.79% of PE, both vessels, and CE: $102.3M)
Total Project Cost	**$107.2M**

The total estimated project cost based on parametric analysis of the roadmap vessel is $107.2M, which if $117.0M remains in the budget, leaves a contingent sum of $9.8M. On all construction projects with potentially unknown cost elements, a contingency amount is included in the estimate until the design is complete and ready to put out for bid. In the case of vessel construction, the contingency amount should increase as the vessel design becomes more complex and as time increases between the construction of similar vessels. The AMHS recommends a contingency of 10 percent (of estimated construction cost) for the Day Boat ACF. The projected contingency is fairly close to this percentage.

Two factors argue in favor of proceeding with the projected contingency at this time. The first is that the projected second vessel cost savings is conservative based on recent State of Washington information. Secondly, there is reason to believe the parametric cost estimate is conservative. A draft CPVCCM analysis of vessel costs for the 350-foot concept ACF was completed in support of the Southeast Alaska Transportation Plan and the Juneau Access Improvements supplemental EIS. This parametric analysis produced a cost estimate range with a mean cost that was $23M higher than the shipyard estimate. (See Appendix E for more detail.)

As stated earlier, the parametric analysis is an early planning tool and may be off as much as 10 percent. Furthermore, it is based on the “Roadmap” vessel, which is only a planning level example of a vessel that can meet the mission requirements identified. If a more detailed estimate at the DSR stage (or later) indicates total costs may exceed available funding, design changes will be necessary unless additional funding is obtained.

Terminal Characteristics

General

Day boat terminal and berth design is an important factor to reduce day boat mooring and loading operations time. All aspects of existing terminals should be re-examined for this mission requirement.

When possible, new end loading day boat terminals should be installed. These terminals should allow self-propelled mooring and fast unloading. Ideally, passenger traffic would be separated from vehicle traffic at new terminals.

Protected overnight berths are also a key component of a day boat system, because the vessels will usually spend half of the day tied up. A stern berth or berth that allows for the vessel to moor with the bow door down is the preferable overnight berth, so the bow door does not need to stay open. If more than one vessel is moored overnight at the same terminal, there are possible cost savings associated with using a single night crew for both vessels.

Final required terminal characteristics will need to wait until the design of the Day Boat ACF advances to the point of knowing the exact configuration of the stern. Discussion between terminal designers and vessel designers should occur during the design process to determine the optimum arrangement of ramps and doors.

1st Priority – New North Lynn Canal Service

JUNEAU/AUKE BAY

The Day Boat ACF will stern load in Auke Bay. No major modification of terminals is required at Auke Bay. The aft end of the Day Boat ACF fits into both of the side berths at Auke Bay and also into the *Fairweather* stern berth. See Figure 3. AMHS has indicated that they can adjust terminal operation to allow for the *Fairweather* and Day Boat ACF to operate from Auke Bay and also to allow both vessels to safely moor overnight.

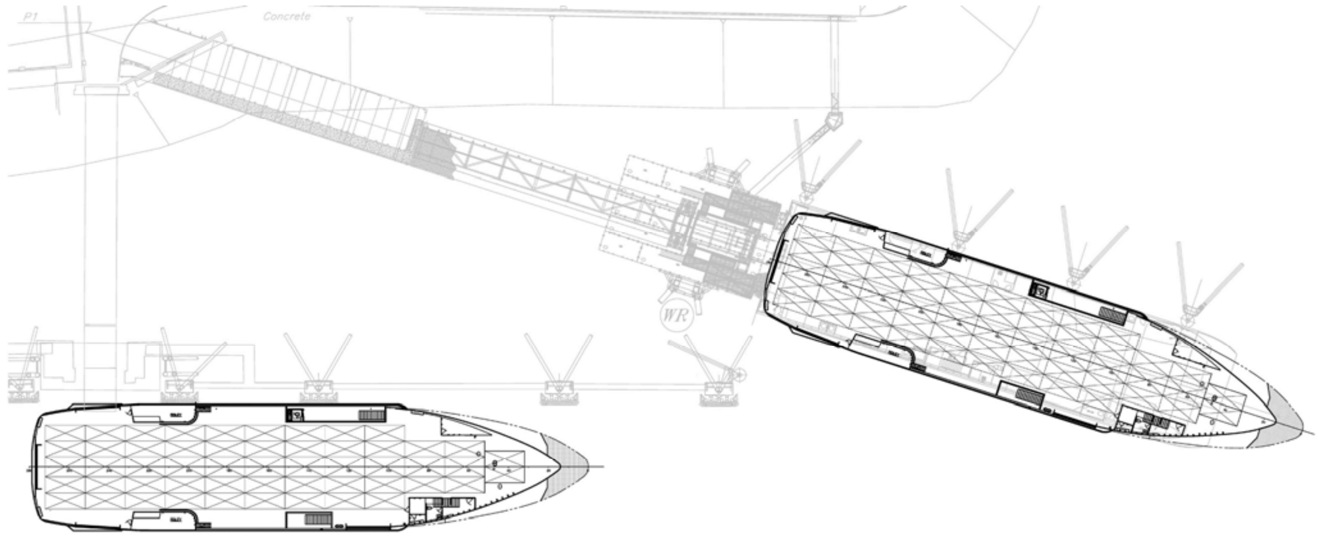


Figure 3 - Auke Bay Terminal

For future use, the advantages of the Auke Bay terminal location for day boat use should be re-examined. Currently, vessels approaching Auke Bay terminal must reduce speed for 2.3 miles. Even beyond this distance, marine traffic and shore side development is advancing to the point that further reductions in vessel speed may be required. If the State does not elect to pursue one of the Juneau Access Improvement alternatives, the Department is on record indicating that it will consider a terminal at Cascade point for North Lynn Canal service[10].

SKAGWAY

No modification of the Skagway terminal is planned for the near future. This means that the aft end of the Day Boat ACF will be required to fit into the side berth at Skagway for the new North Lynn Canal service. See Figure 4. AMHS has indicated that they can adjust terminal operation to allow for the Day Boat ACF and other AMHS vessels operating to Skagway (typically two per week in summer and one in winter) to share the terminal. The less efficient side loading of the vessel will not be a problem in the near term because the level of traffic on the HNS-SGY vessel will normally be well below vessel capacity and the two round trip per day schedule is not time constrained.[11]

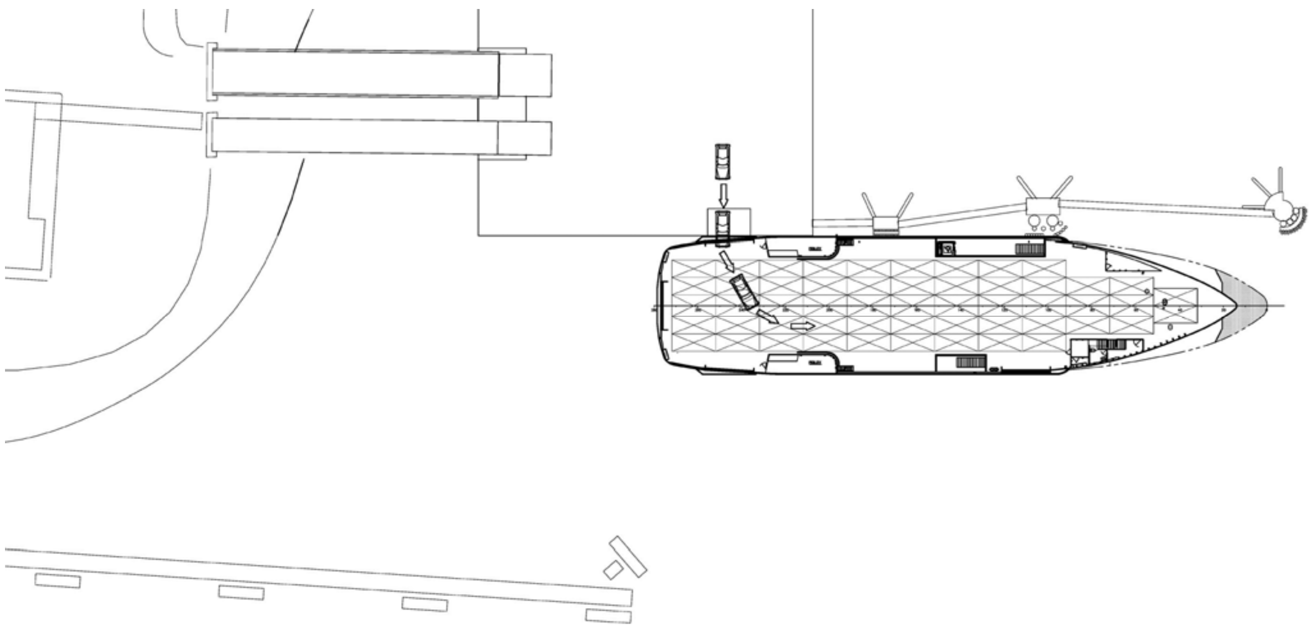


Figure 4 - Skagway Terminal

HAINES

If the Day Boat ACF must load from the stern at both Juneau and Skagway, it follows that both the Juneau-Haines and Haines-Skagway vessels must unload from the bow at Haines. In order to facilitate quick turnaround times in Haines and timely transfer for travelers making a connection to the second vessel, two bow berths will be required. And, if a new facility is going to be built for the Day

[10] To meet system needs, this would be a new stern load terminal, although not likely an overnight mooring berth.

[11] Future modifications to the Skagway terminal, such as might occur for the Juneau Access Improvement project, should consider a dedicated end berth for the Day Boat ACF to increase efficiency.

Boat ACFs, it would be cost effective to design the new berth to safely moor both vessels overnight. A large terminal improvement project at Haines is currently in the planning stages. This project will consider the implementation of new twin bow mooring and loading berths, in conjunction with improving the existing side load berth. One possible concept of this terminal is shown in Figure 5.

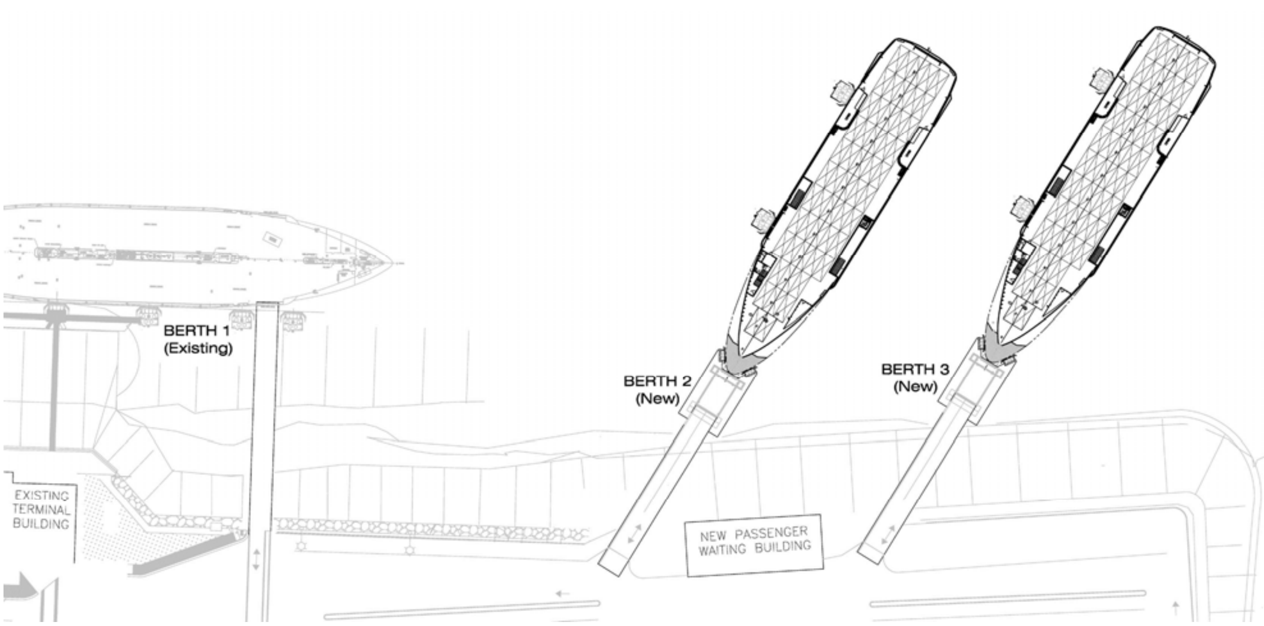


Figure 5 – Conceptual Sketch of Haines Terminal Improvements

2nd Priority – Other AMHS established Routes

By definition, service to other AMHS established routes will call on already constructed terminals, which except for Tenakee, are configured for forward starboard side car doors. The Day Boat ACF will be designed to fit into all existing terminals by mooring port-to, using an aft port side car door. Figure 6 shows the Day Boat ACF at the Hoonah terminal. Since Tenakee is in line for terminal improvements, the Department is considering a new terminal location to support a traditional side door. If a terminal modification does not become a reality, a forward port side hatch could be installed in the Day Boat ACF to handle walk-on and four wheeler traffic at Tenakee.

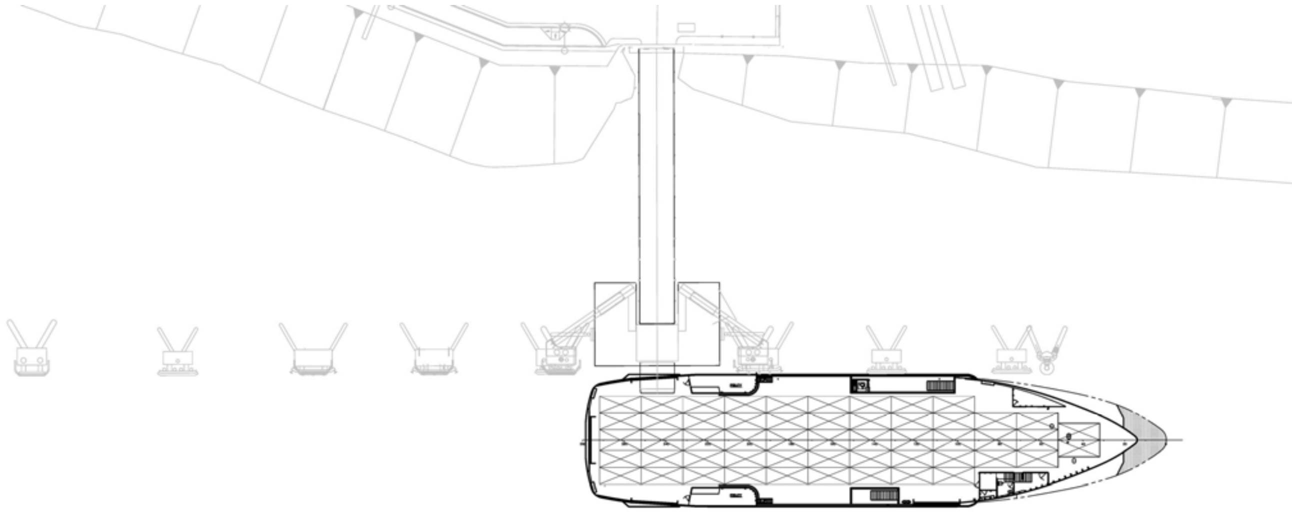


Figure 6 - Hoonah Terminal

3rd Priority – JAI State Preferred Routes & 4th Priority – Other JAI Alternatives Routes

If the Haines terminal is improved in the near future, its new berthing systems would govern the arrangement of any new Juneau Access Improvements terminals. As previously mentioned, Skagway would be improved with the addition of a new dedicated end berth. Katzehin would need to be a stern load berth with no overnight mooring.

Appendix A - Vessel Routes

Table of Contents

Methodology

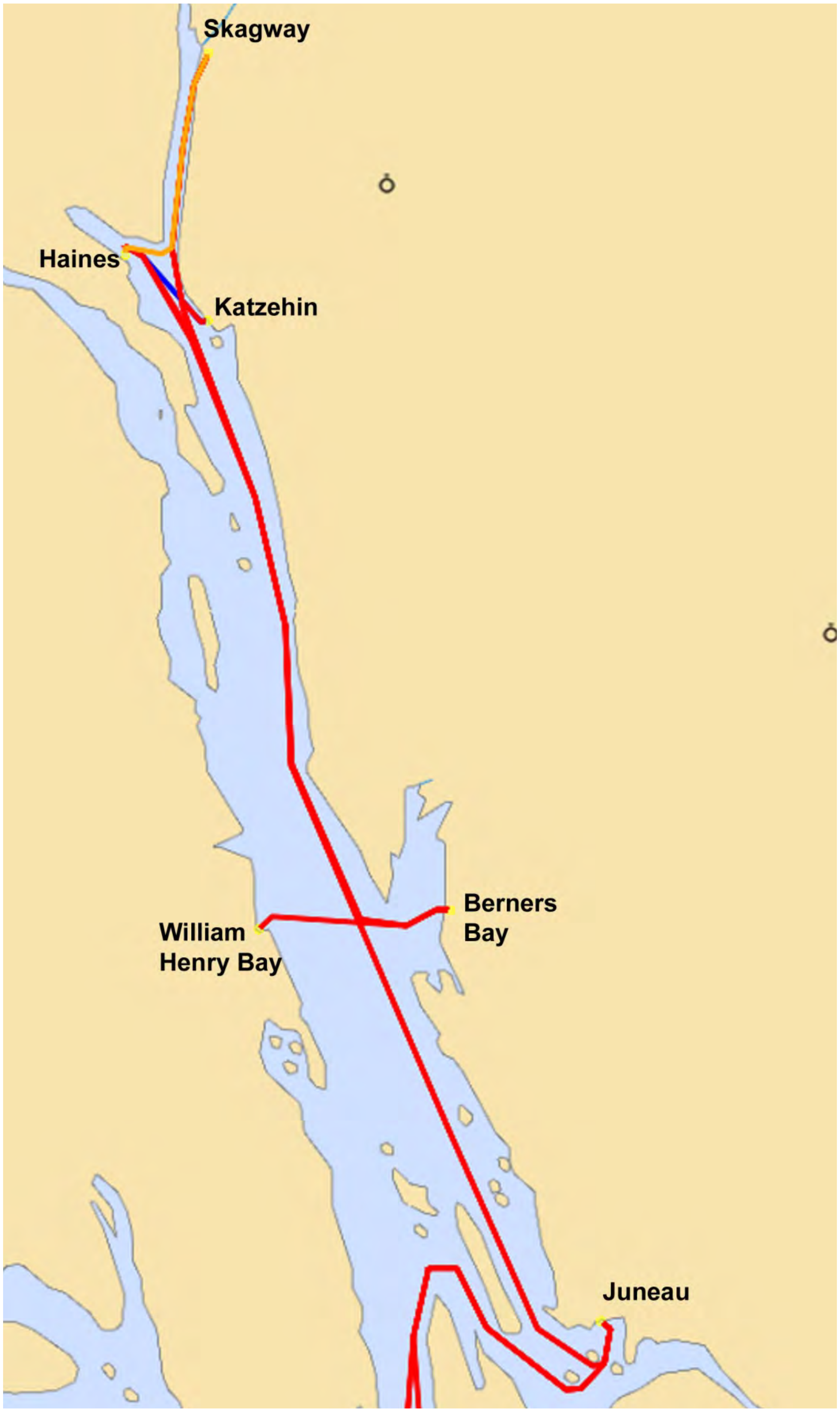
Both the Juneau Access Improvement (JAI) alternative routes and some existing AMHS routes are included in this appendix. The existing AMHS routes are based on actual navigation routes exported from the vessel's electronic charting and navigation systems. JAI routes are sample routes developed from historical JAI documentation.

Commercially available charting software was used to define each route. The path of each route is defined by waypoints (locations where vessel heading is altered). Waypoints in the route tables have been given names of adjacent geographical features for reference where appropriate, and have been identified by numerals where they occur away from prominent geographical features. All distances are measured in nautical miles (NM) and all speeds are measured in nautical miles per hour, or knots (kn).

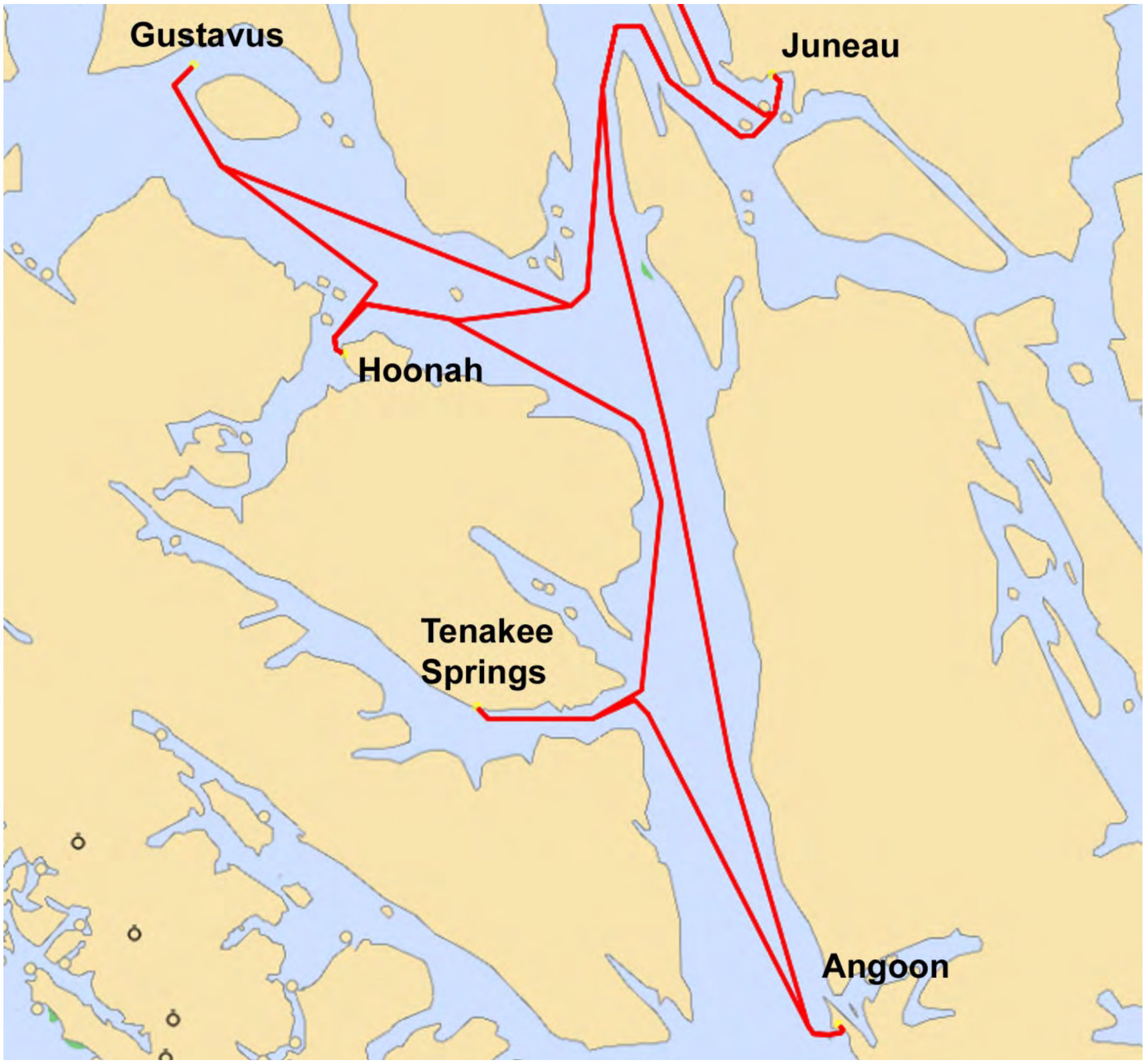
Each route was terminated approximately 0.1 nautical miles from the terminal. The remaining travel distance will be addressed as part of the mooring time (see Appendix B). Vessel speed was assigned to each leg of the route as either the assumed cruising speed 15.5 knots or assumed maneuvering speed of 5.0 knots. Waypoints at which speed changes occur are identified in the route tables.

System Overview

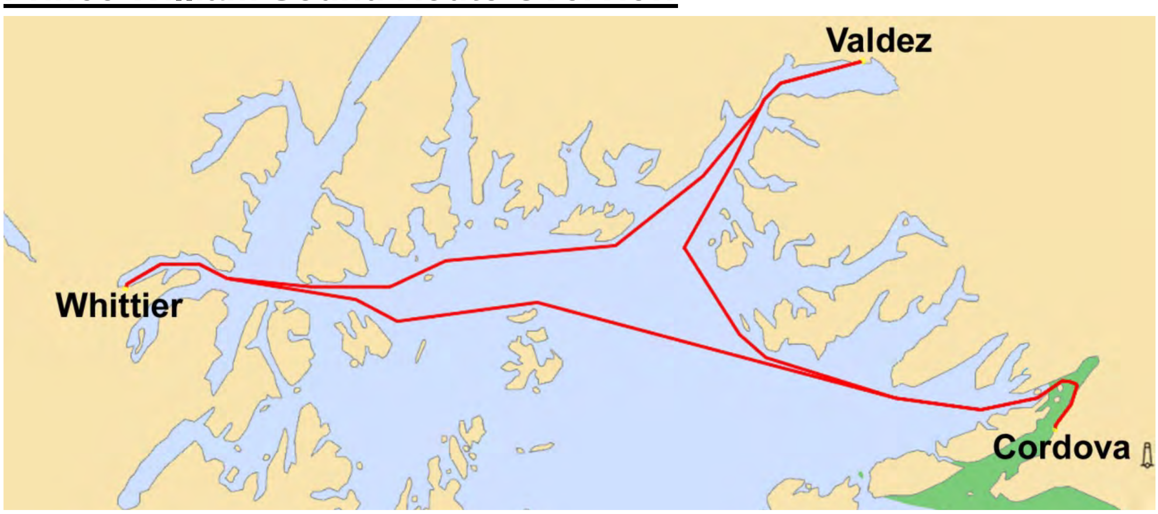
Lynn Canal Route Overview



North Southeast Route Overview



Prince William Sound Route Overview



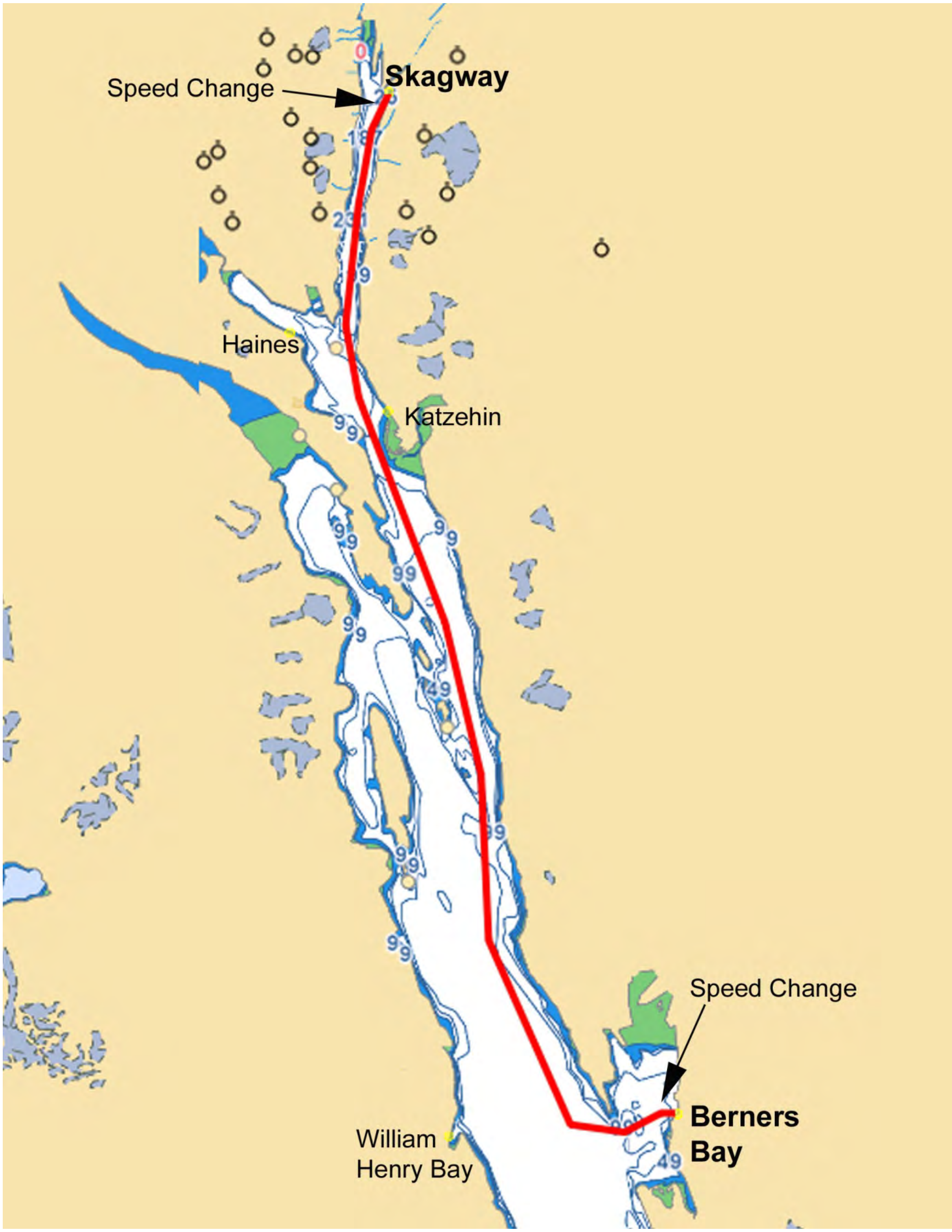
Route Details

Berners Bay to Haines (BER-HNS)

Berners Bay to Haines (BER-HNS) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Berners Bay					
2	0.075 NM	0.075 NM	5.00 kn	0:00:54	0:00:54
Speed Change	0.611 NM	0.536 NM	5.00 kn	0:06:26	0:07:20
Point Saint Mary	2.372 NM	1.761 NM	15.50 kn	0:06:49	0:14:09
5	4.714 NM	2.342 NM	15.50 kn	0:09:04	0:23:13
Point Sherman	13.33 NM	8.614 NM	15.50 kn	0:33:21	0:56:34
Eldred Rock	20.37 NM	7.046 NM	15.50 kn	0:27:16	1:23:50
Talsani Island	27.01 NM	6.638 NM	15.50 kn	0:25:42	1:49:32
Battery Point	35.52 NM	8.509 NM	15.50 kn	0:32:56	2:22:28
Tanani Point	40.46 NM	4.943 NM	15.50 kn	0:19:08	2:41:36
Speed Change	41.50 NM	1.035 NM	15.50 kn	0:04:00	2:45:36
Haines	41.83 NM	0.333 NM	5.00 kn	0:04:00	2:49:36

Berners Bay to Skagway (BER-SGY)



Berners Bay to Skagway (BER-SGY) - Route Segments, Distances & Times

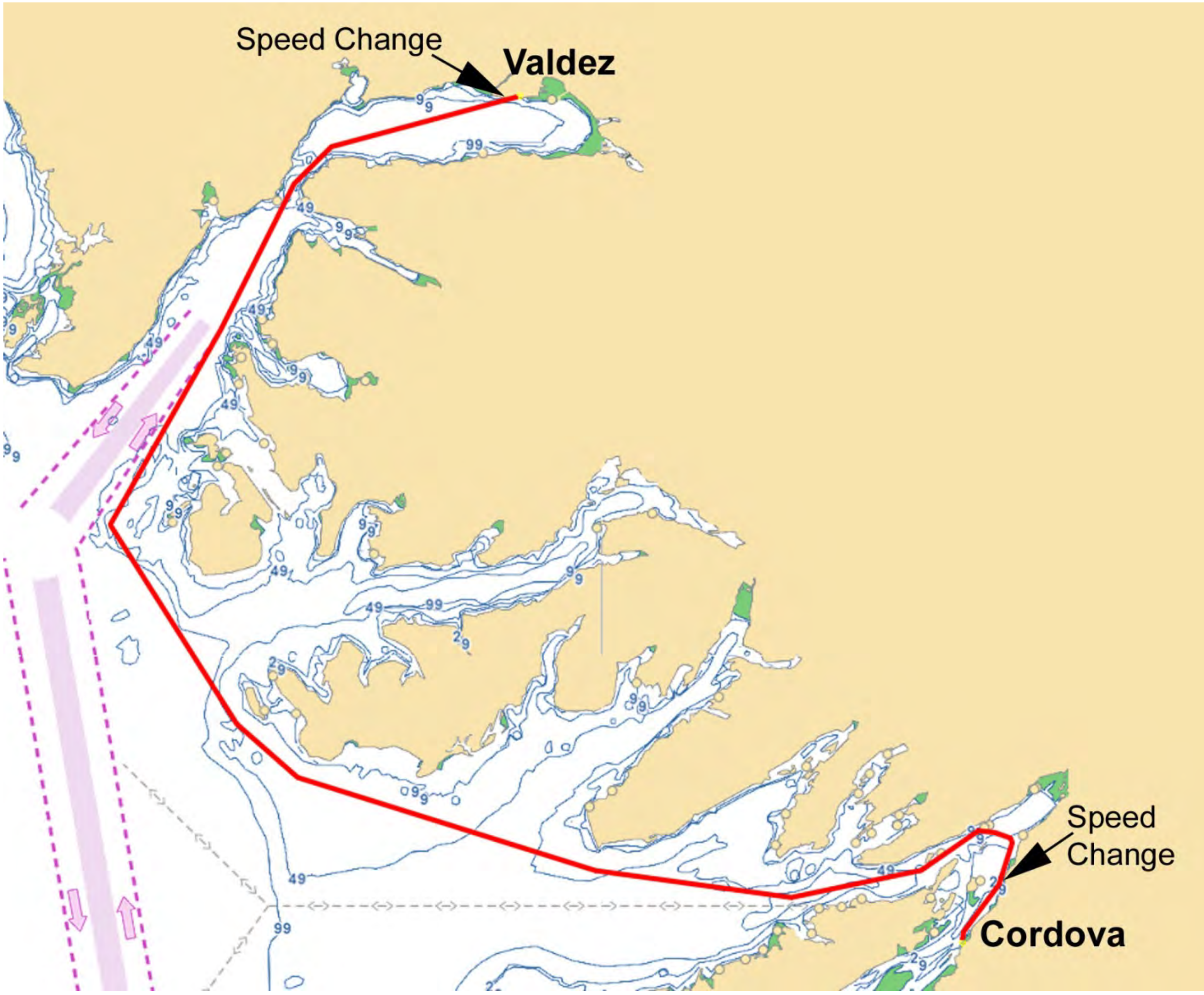
Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Berners Bay					
2	0.075 NM	0.075 NM	5.00 kn	0:00:54	0:00:54
Speed Change	0.611 NM	0.536 NM	5.00 kn	0:06:26	0:07:20
Point Saint Mary	2.370 NM	1.759 NM	15.50 kn	0:06:49	0:14:08
5	4.704 NM	2.333 NM	15.50 kn	0:09:02	0:23:10
Point Sherman	13.31 NM	8.606 NM	15.50 kn	0:33:19	0:56:29
Eldred Rock	20.36 NM	7.046 NM	15.50 kn	0:27:16	1:23:46
Talsani Island	26.99 NM	6.636 NM	15.50 kn	0:25:41	1:49:27
Battery Point	35.50 NM	8.511 NM	15.50 kn	0:32:57	2:22:24
10	37.17 NM	1.671 NM	15.50 kn	0:06:28	2:28:52
Taiya Point	40.26 NM	3.082 NM	15.50 kn	0:11:56	2:40:48
12	45.31 NM	5.056 NM	15.50 kn	0:19:34	3:00:22
13	48.55 NM	3.237 NM	15.50 kn	0:12:32	3:12:54
Speed Change	50.04 NM	1.489 NM	15.50 kn	0:05:46	3:18:40
Skagway	50.17 NM	0.129 NM	5.00 kn	0:01:33	3:20:12

Berners Bay to William Henry Bay (BER-WHB)

Berners Bay to William Henry Bay (BER-WHB) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Berners Bay					
2	0.075 NM	0.075 NM	5.00 kn	0:00:54	0:00:54
Speed Change	0.611 NM	0.536 NM	5.00 kn	0:06:26	0:07:20
Point Saint Mary	2.374 NM	1.763 NM	15.50 kn	0:06:49	0:14:09
Lance Point	9.205 NM	6.831 NM	15.50 kn	0:26:27	0:40:36
Speed Change	9.928 NM	0.723 NM	15.50 kn	0:02:48	0:43:24
William Henry Bay	10.05 NM	0.121 NM	5.00 kn	0:01:27	0:44:51

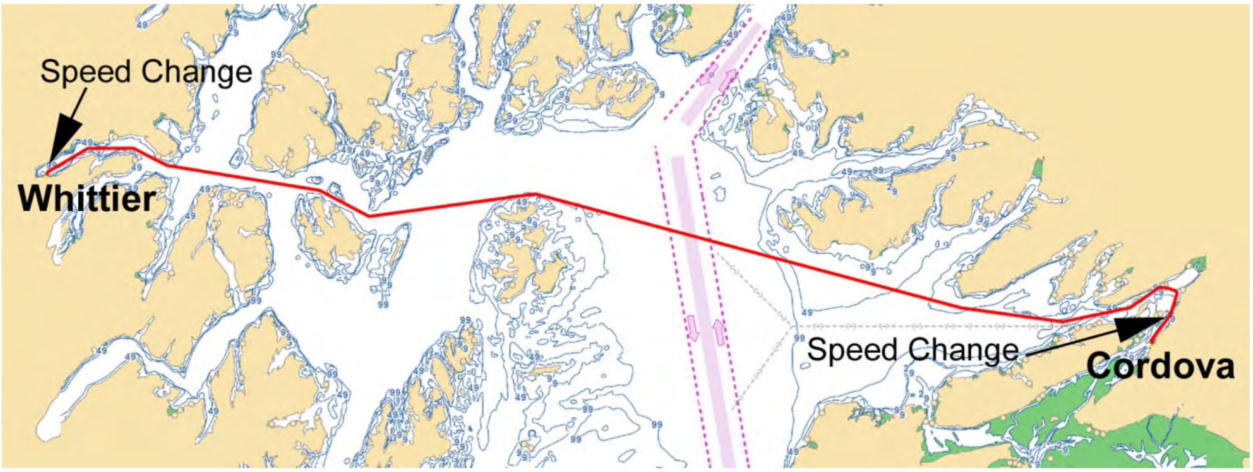
Cordova to Valdez (CDV-VDZ)



Cordova to Valdez (CDV-VDZ) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Cordova					
2	0.342 NM	0.342 NM	5.00 kn	0:04:06	0:04:06
Speed Change	2.729 NM	2.387 NM	5.00 kn	0:28:39	0:32:45
4	4.516 NM	1.787 NM	15.50 kn	0:06:55	0:39:40
Shepard Point	4.717 NM	0.201 NM	15.50 kn	0:00:47	0:40:27
6	5.379 NM	0.662 NM	15.50 kn	0:02:34	0:43:00
7	6.059 NM	0.680 NM	15.50 kn	0:02:38	0:45:38
8	8.879 NM	2.819 NM	15.50 kn	0:10:55	0:56:33
Sheep Point	14.27 NM	5.394 NM	15.50 kn	0:20:53	1:17:26
Gravina Point	22.29 NM	8.019 NM	15.50 kn	0:31:02	1:48:28
Knowles Head	34.94 NM	12.65 NM	15.50 kn	0:48:58	2:37:26
Goose Island	38.21 NM	3.272 NM	15.50 kn	0:12:40	2:50:06
Bligh Reef	47.75 NM	9.534 NM	15.50 kn	0:36:54	3:27:01
Rocky Point	56.78 NM	9.035 NM	15.50 kn	0:34:58	4:01:59
Potato Point	62.40 NM	5.616 NM	15.50 kn	0:21:44	4:23:43
Entrance Point	63.30 NM	0.897 NM	15.50 kn	0:03:28	4:27:12
Entrance Island	65.40 NM	2.105 NM	15.50 kn	0:08:09	4:35:21
Speed Change	72.69 NM	7.284 NM	15.50 kn	0:28:12	5:03:32
Valdez	73.10 NM	0.419 NM	5.00 kn	0:05:02	5:08:34

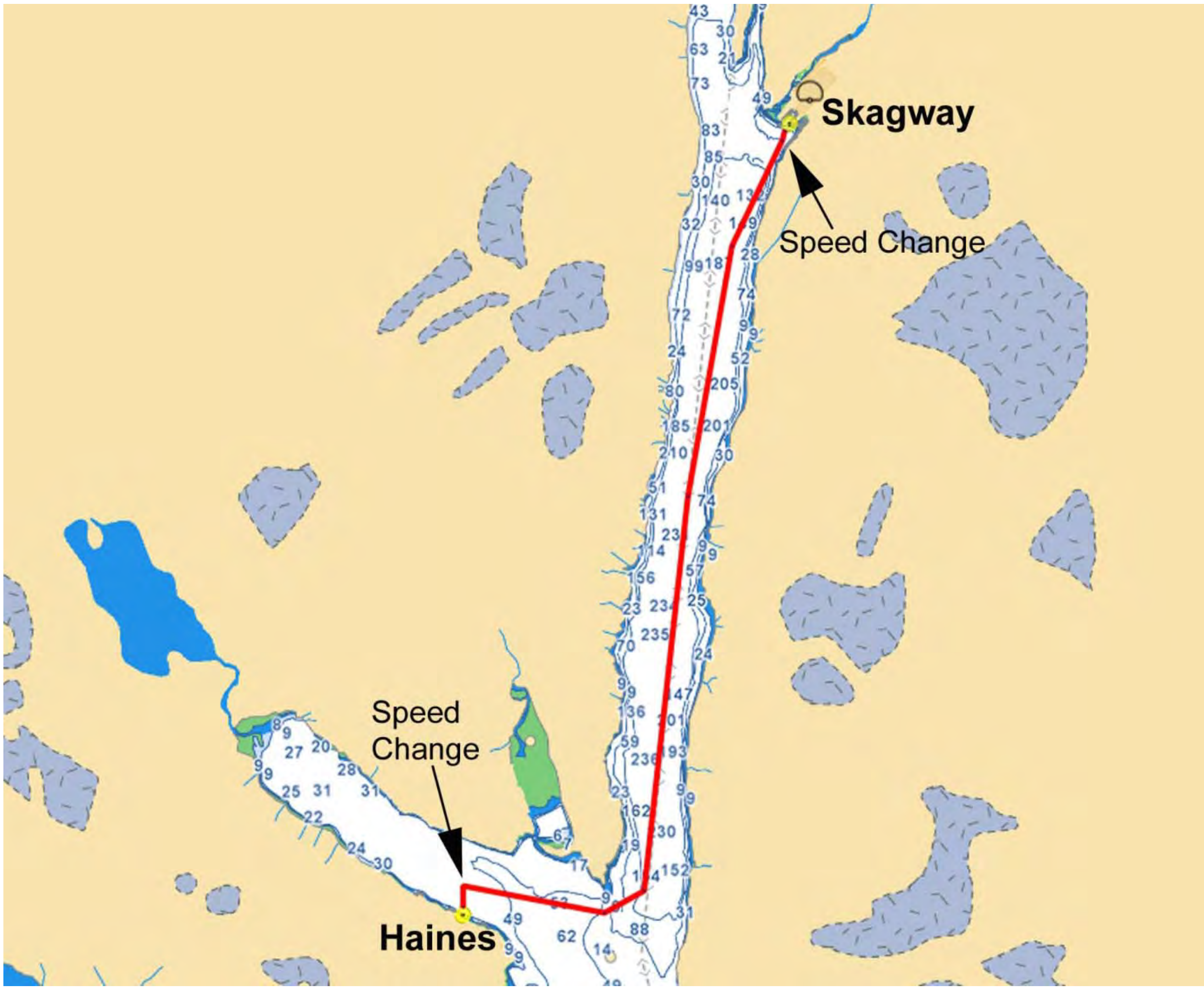
Cordova to Whittier (CDV-WTR)



Cordova to Whittier (CDV-WTR) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Cordova					
2	0.342 NM	0.342 NM	5.00 kn	0:04:06	0:04:06
Speed Change	2.728 NM	2.386 NM	5.00 kn	0:28:38	0:32:44
4	4.516 NM	1.788 NM	15.50 kn	0:06:55	0:39:39
Shepard Point	4.718 NM	0.201 NM	15.50 kn	0:00:47	0:40:26
6	5.380 NM	0.662 NM	15.50 kn	0:02:34	0:43:00
7	6.060 NM	0.680 NM	15.50 kn	0:02:38	0:45:38
8	8.879 NM	2.819 NM	15.50 kn	0:10:55	0:56:33
Sheep Point	14.27 NM	5.393 NM	15.50 kn	0:20:53	1:17:25
Gravina Point	22.29 NM	8.018 NM	15.50 kn	0:31:02	1:48:27
Storey Island	56.78 NM	34.49 NM	15.50 kn	2:13:31	4:01:58
12	69.89 NM	13.11 NM	15.50 kn	0:50:45	4:52:43
Point Perry	74.24 NM	4.350 NM	15.50 kn	0:16:50	5:09:33
Point Pigot	86.32 NM	12.08 NM	15.50 kn	0:46:46	5:56:19
Decision Point	89.27 NM	2.943 NM	15.50 kn	0:11:24	6:07:42
Trinity Point	92.79 NM	3.526 NM	15.50 kn	0:13:39	6:21:21
Speed Change	96.44 NM	3.646 NM	15.50 kn	0:14:07	6:35:28
Whittier	96.71 NM	0.275 NM	5.00 kn	0:03:18	6:38:46

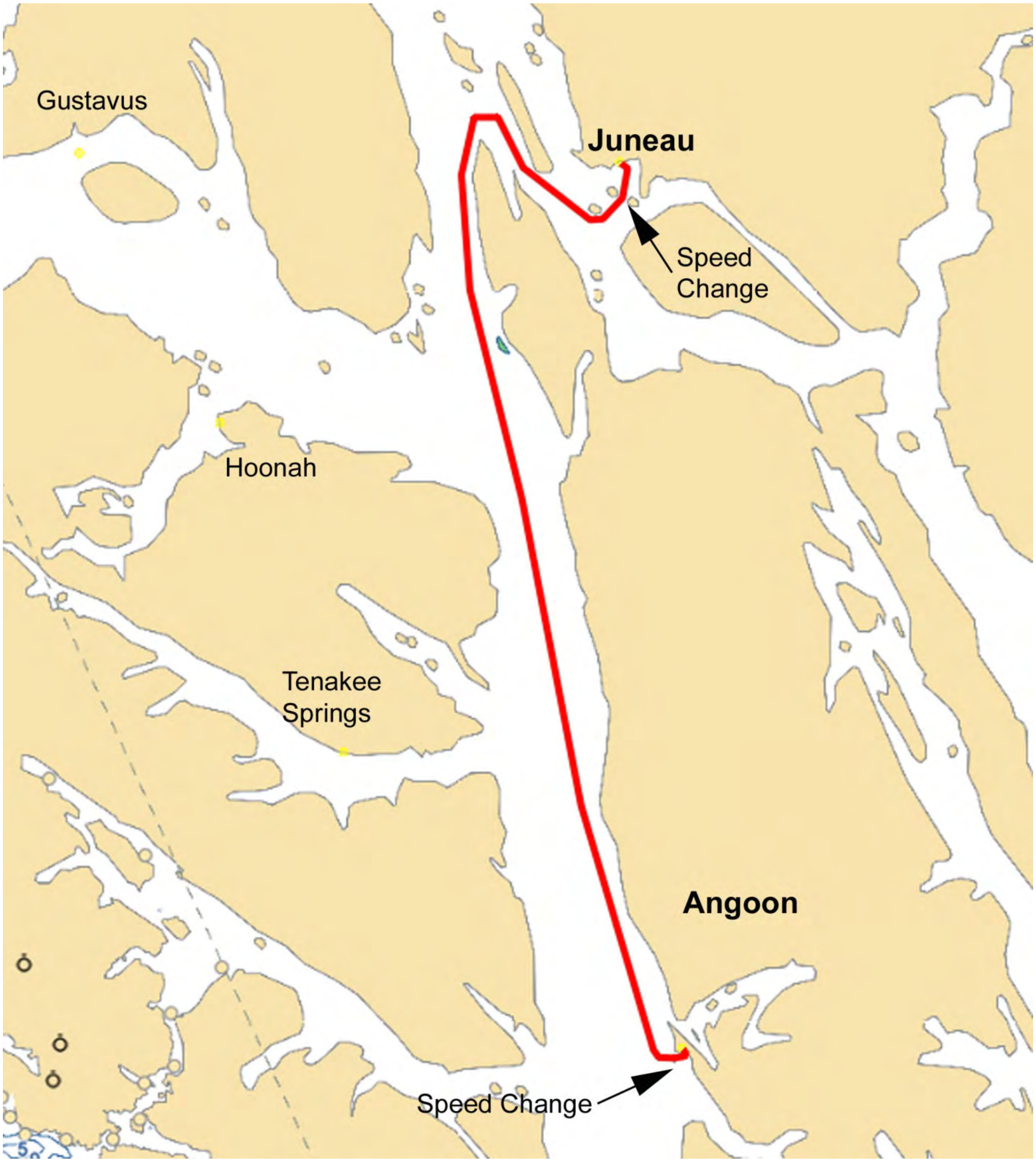
Haines to Skagway (HNS-SGY)



Haines to Skagway (HNS-SGY) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Haines					
Speed Change	0.272 NM	0.272 NM	5.00 kn	0:03:16	0:03:16
Taiya Point	2.110 NM	1.838 NM	15.50 kn	0:07:07	0:10:23
4	2.689 NM	0.579 NM	15.50 kn	0:02:14	0:12:37
5	7.749 NM	5.060 NM	15.50 kn	0:19:35	0:32:12
6	10.99 NM	3.237 NM	15.50 kn	0:12:32	0:44:44
Speed Change	12.48 NM	1.490 NM	15.50 kn	0:05:46	0:50:30
Skagway	12.60 NM	0.129 NM	5.00 kn	0:01:33	0:52:03

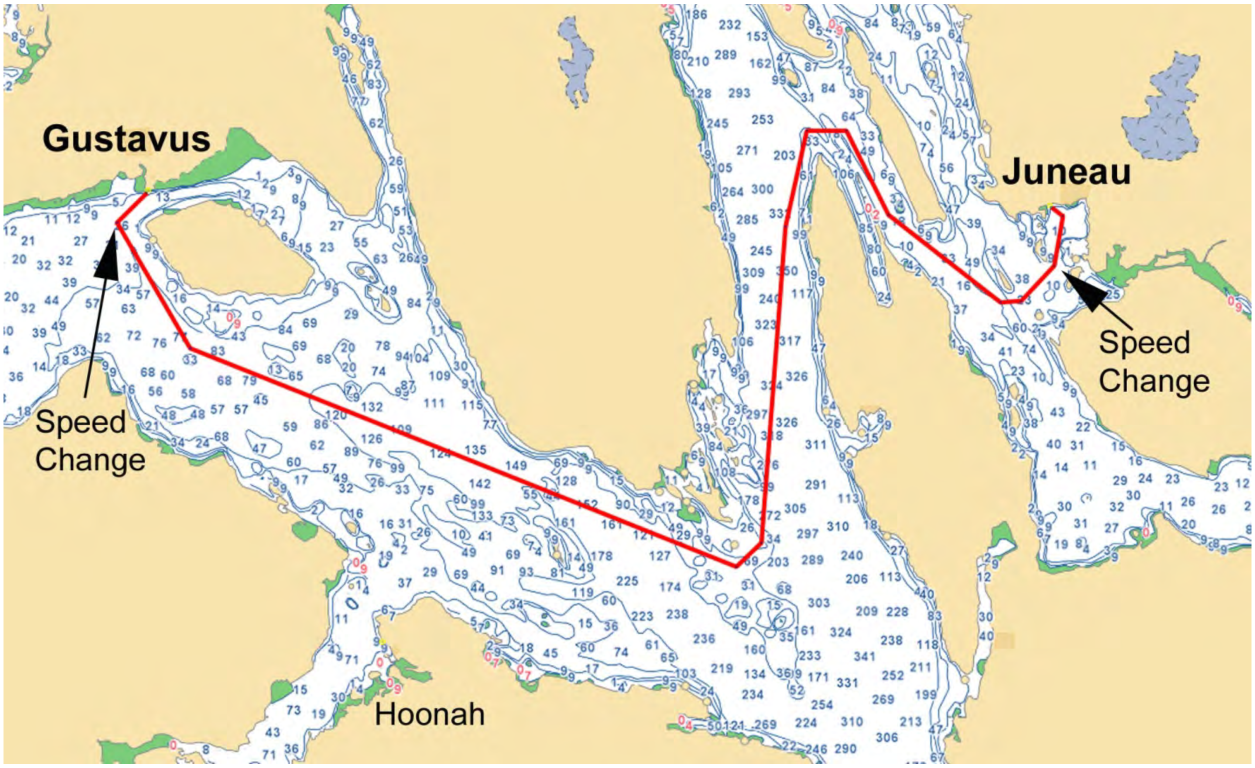
Juneau to Angoon (JNU-ANG)



Juneau to Angoon (JNU-ANG) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Juneau					
2	0.514 NM	0.514 NM	5.00 kn	0:06:10	0:06:10
Speed Change	2.346 NM	1.832 NM	5.00 kn	0:21:59	0:28:09
4	4.106 NM	1.760 NM	15.50 kn	0:06:49	0:34:58
Portland Island	4.866 NM	0.760 NM	15.50 kn	0:02:57	0:37:54
Barlow Point	10.05 NM	5.188 NM	15.50 kn	0:20:05	0:57:59
7	13.48 NM	3.423 NM	15.50 kn	0:13:15	1:11:14
8	14.92 NM	1.445 NM	15.50 kn	0:05:36	1:16:50
False Point Retreat	18.51 NM	3.584 NM	15.50 kn	0:13:52	1:30:42
Funter Bay	25.54 NM	7.039 NM	15.50 kn	0:27:15	1:57:57
Point Marsden	38.70 NM	13.16 NM	15.50 kn	0:50:57	2:48:54
12	58.02 NM	19.32 NM	15.50 kn	1:14:47	4:03:41
Point Samuel	73.90 NM	15.88 NM	15.50 kn	1:01:28	5:05:09
14	74.47 NM	0.573 NM	15.50 kn	0:02:13	5:07:22
Speed Change	75.36 NM	0.891 NM	15.50 kn	0:03:27	5:10:49
16	76.06 NM	0.697 NM	5.00 kn	0:08:22	5:19:11
17	76.29 NM	0.232 NM	5.00 kn	0:02:47	5:21:58
Angoon	76.60 NM	0.311 NM	5.00 kn	0:03:44	5:25:42

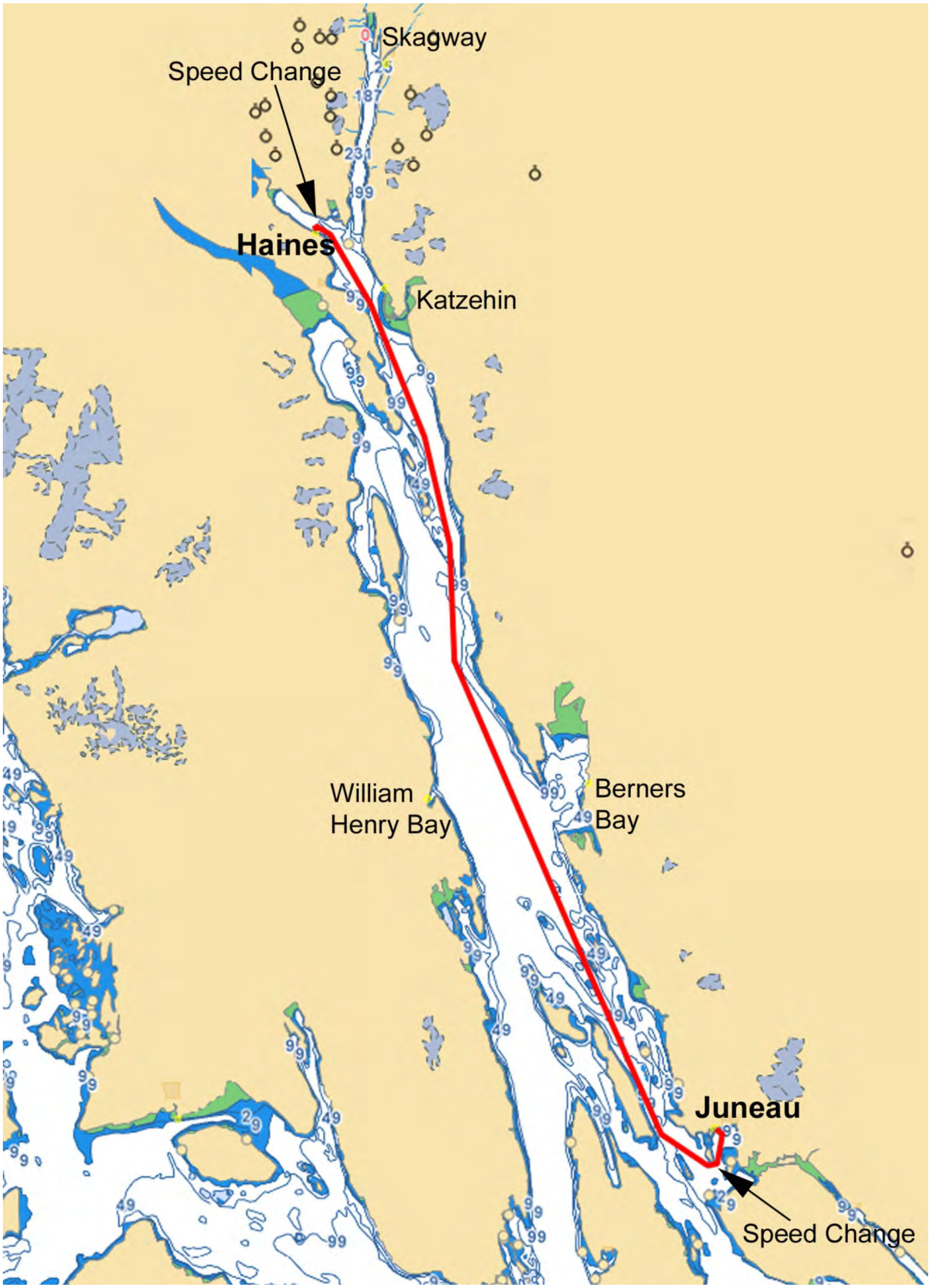
Juneau to Gustavus (JNU-GUS)



Juneau to Gustavus (JNU-GUS) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Juneau					
2	0.513 NM	0.513 NM	5.00 kn	0:06:09	0:06:09
Speed Change	2.342 NM	1.829 NM	5.00 kn	0:21:57	0:28:06
4	4.103 NM	1.761 NM	15.50 kn	0:06:49	0:34:55
Portland Island	4.863 NM	0.760 NM	15.50 kn	0:02:57	0:37:52
Barlow Point	10.05 NM	5.189 NM	15.50 kn	0:20:05	0:57:57
7	13.47 NM	3.422 NM	15.50 kn	0:13:15	1:11:12
8	14.92 NM	1.446 NM	15.50 kn	0:05:36	1:16:48
False Point Retreat	18.50 NM	3.582 NM	15.50 kn	0:13:52	1:30:40
10	30.07 NM	11.57 NM	15.50 kn	0:44:47	2:15:27
Swanson Harbor	31.35 NM	1.274 NM	15.50 kn	0:04:56	2:20:23
Pleasant Island Reef	52.90 NM	21.55 NM	15.50 kn	1:23:25	3:43:48
Speed Change	58.20 NM	5.302 NM	15.50 kn	0:20:31	4:04:19
Gustavus	59.73 NM	1.533 NM	5.00 kn	0:18:24	4:22:43

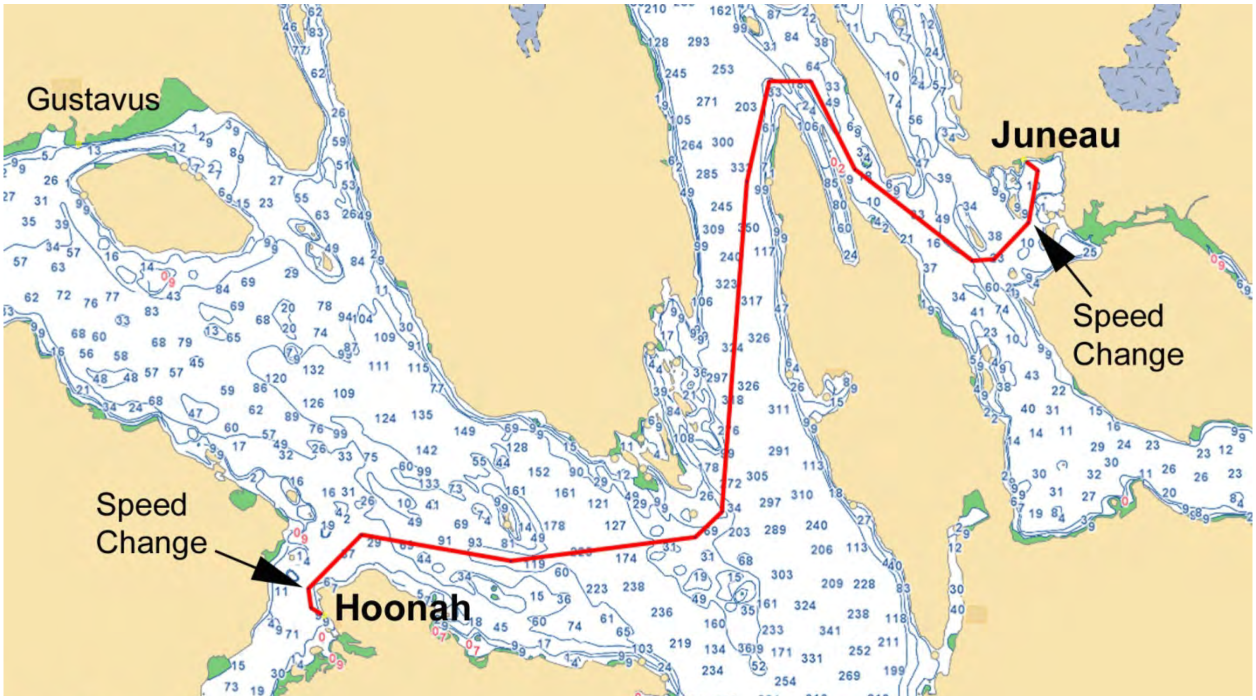
Juneau to Haines (JNU-HNS)



Juneau to Haines (JNU-HNS) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Juneau					
2	0.512 NM	0.512 NM	5.00 kn	0:06:09	0:06:09
Speed Change	2.342 NM	1.830 NM	5.00 kn	0:21:58	0:28:06
4	2.937 NM	0.595 NM	15.50 kn	0:02:18	0:30:24
Point Lena	6.366 NM	3.429 NM	15.50 kn	0:13:16	0:43:41
Sentinel Island	17.58 NM	11.21 NM	15.50 kn	0:43:24	1:27:04
Point Sherman	37.83 NM	20.26 NM	15.50 kn	1:18:26	2:45:30
Eldred Rock	44.88 NM	7.043 NM	15.50 kn	0:27:16	3:12:46
Talsani Island	51.51 NM	6.636 NM	15.50 kn	0:25:41	3:38:27
Battery Point	60.09 NM	8.573 NM	15.50 kn	0:33:11	4:11:38
Tanani Point	64.92 NM	4.835 NM	15.50 kn	0:18:43	4:30:21
Speed Change	65.94 NM	1.017 NM	15.50 kn	0:03:56	4:34:17
Haines	66.24 NM	0.307 NM	5.00 kn	0:03:41	4:37:58

Juneau to Hoonah (JNU-HNH)



Juneau to Hoonah (JNU-HNH) - Route Segments, Distances & Times

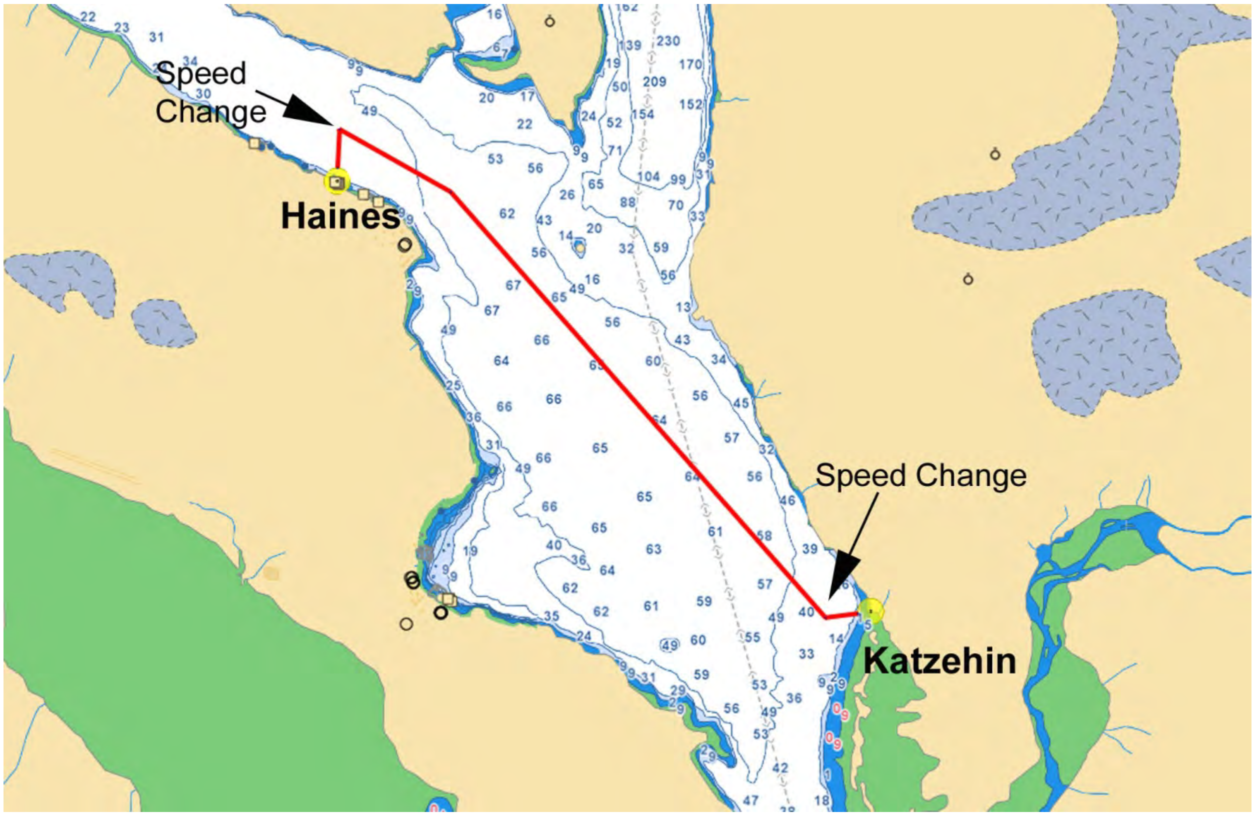
Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Juneau					
2	0.515 NM	0.515 NM	5.00 kn	0:06:11	0:06:11
Speed Change	2.348 NM	1.834 NM	5.00 kn	0:22:00	0:28:11
4	4.110 NM	1.762 NM	15.50 kn	0:06:49	0:35:01
Portland Island	4.871 NM	0.761 NM	15.50 kn	0:02:57	0:37:57
Barlow Point	10.06 NM	5.190 NM	15.50 kn	0:20:05	0:58:03
7	13.48 NM	3.422 NM	15.50 kn	0:13:15	1:11:17
8	14.93 NM	1.445 NM	15.50 kn	0:05:36	1:16:53
False Point Retreat	18.51 NM	3.582 NM	15.50 kn	0:13:52	1:30:45
10	30.08 NM	11.57 NM	15.50 kn	0:44:47	2:15:32
Swanson Harbor	31.36 NM	1.276 NM	15.50 kn	0:04:56	2:20:29
Sisters Reef	37.86 NM	6.506 NM	15.50 kn	0:25:11	2:45:40
Point Sophia	43.19 NM	5.323 NM	15.50 kn	0:20:36	3:06:16
Speed Change	45.84 NM	2.653 NM	15.50 kn	0:10:16	3:16:32
Hoonah Point	46.52 NM	0.681 NM	5.00 kn	0:08:10	3:24:43
Hoonah	46.95 NM	0.433 NM	5.00 kn	0:05:12	3:29:54

Juneau to Skagway (JNU-SGY

Juneau to Skagway (JNU-SGY) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Juneau					
2	0.512 NM	0.512 NM	5.00 kn	0:06:09	0:06:09
Speed Change	2.341 NM	1.829 NM	5.00 kn	0:21:57	0:28:06
4	2.934 NM	0.594 NM	15.50 kn	0:02:18	0:30:23
Point Lena	6.363 NM	3.428 NM	15.50 kn	0:13:16	0:43:40
Sentinal Island	17.57 NM	11.21 NM	15.50 kn	0:43:24	1:27:03
Point Sherman	37.83 NM	20.25 NM	15.50 kn	1:18:23	2:45:27
Eldred Rock	44.87 NM	7.043 NM	15.50 kn	0:27:16	3:12:42
Talsani Island	51.51 NM	6.635 NM	15.50 kn	0:25:41	3:38:23
10	61.69 NM	10.18 NM	15.50 kn	0:39:24	4:17:48
Taiya Point	64.77 NM	3.082 NM	15.50 kn	0:11:56	4:29:44
12	69.82 NM	5.056 NM	15.50 kn	0:19:34	4:49:18
13	73.06 NM	3.237 NM	15.50 kn	0:12:32	5:01:50
Speed Change	74.55 NM	1.490 NM	15.50 kn	0:05:46	5:07:36
Skagway	74.68 NM	0.129 NM	5.00 kn	0:01:33	5:09:09

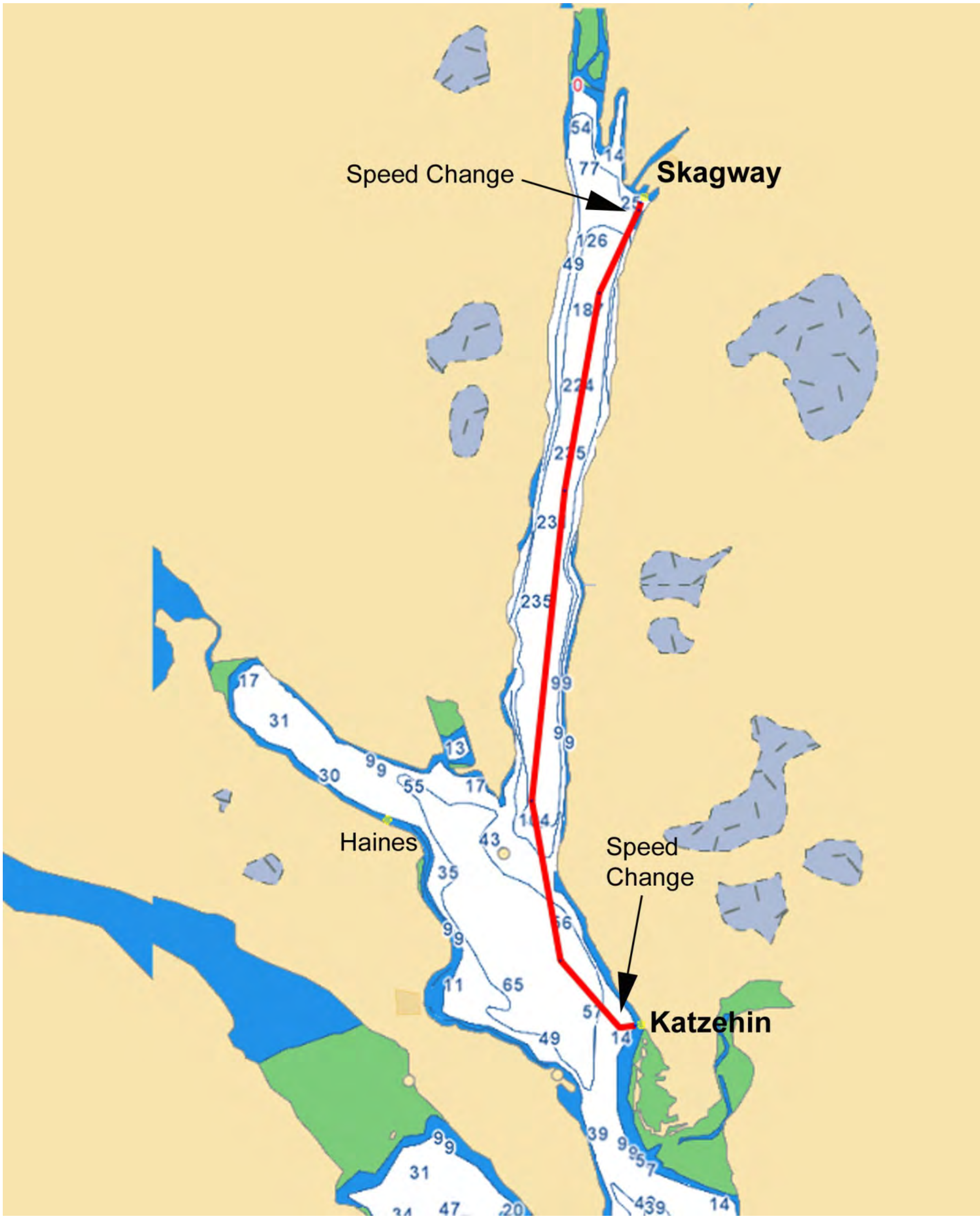
Katzehin to Haines (KTZ-HNS)



Katzehin to Haines (KTZ-HNS) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Katzehin					
Speed Change	0.254 NM	0.254 NM	5.00 kn	0:03:03	0:03:03
Tanani Point	4.638 NM	4.384 NM	15.50 kn	0:16:58	0:20:01
Speed Change	5.620 NM	0.983 NM	15.50 kn	0:03:48	0:23:49
Haines	5.919 NM	0.299 NM	5.00 kn	0:03:35	0:27:25

Katzehin to Skagway (KTZ-SGY)



Katzehin to Skagway (KTZ-SGY) - Route Segments, Distances & Times

Waypoint	Distance (total)	Distance (leg)	Speed (leg)	Leg Time (h:mm:ss)	Total Time (h:mm:ss)
Katzehin					
Speed Change	0.253 NM	0.253 NM	5.00 kn	0:03:02	0:03:02
3	1.708 NM	1.455 NM	15.50 kn	0:05:38	0:08:40
Taiya Point	4.342 NM	2.634 NM	15.50 kn	0:10:12	0:18:52
5	9.398 NM	5.056 NM	15.50 kn	0:19:34	0:38:26
6	12.63 NM	3.237 NM	15.50 kn	0:12:32	0:50:58
Speed Change	14.12 NM	1.489 NM	15.50 kn	0:05:46	0:56:44
Skagway	14.25 NM	0.128 NM	5.00 kn	0:01:32	0:58:16

Appendix B - Mooring and Loading Study

Table of Contents

Methodology

A mooring and loading study was conducted to examine the total time it would take to moor and unload and load a day boat ferry using different terminal configurations. These times, called mooring and loading operations (MLOPS), are instrumental in creating day boat operating schedules.

The development of mooring and loading times is based on measured vessel mooring times for both Alaska Marine Highway System (AMHS) vessels and Washington State Ferry (WSF) vessels. The known mooring and loading times were extrapolated to various vessel configurations and combined in order to develop round trip MLOPS.

Using both the assumed mooring times and the loading times, specific round trip times for mooring and loading operations (MLOPS) can be developed. Each MLOPS is one full round trip between two terminals. To determine an average loading and unloading time for use in the development of schedules, the total MLOPS times are divided by 4.

Mooring

MEASURED MOORING TIMES

Coastwise has previously measured vessel mooring times for some of the AMHS and the WSF vessel/terminal combinations during the development of the Juneau Access Improvements marine segments.

At the time of the previous study, not all of the existing AMHS mooring times were measured. The un-measured mooring times have been estimated to assist in the development of assumed mooring times for the Day Boat ACF. Below is a summary of vessel mooring times based on the results of the previous study.

Current AMHS displacement vessel side mooring
Arrival: 2.9 transition, 10.5 mooring = 13.4 minutes

Departure: 7.0 unmooring, 2.0 transition = 9.0 minutes

Current AMHS Fast Vehicle Ferry stern end mooring
Arrival: 2.1 transition, 6.8 mooring = 9.9 minutes
Departure: Not measured[1], assume 50% faster = 5.0 minutes

Current AMHS Displacement Vessel stern end mooring
Arrival: Not measured[1], assume not more than side load = 13.4 minutes
Departure: Not measured[1], assume = 5.0 minutes

Current WSF double-end displacement vessel (straight in - end moor – hold with propulsion)
Arrival: 2.1 transition, 1.9 mooring = 4.0 minutes
Departure: Not measured, assume 10% faster = 3.0 minutes

[1] The actual vessel mooring times in Whittier (Aurora end mooring) and Juneau (Fairweather) should be measured in order to verify the estimated times.

ASSUMED MOORING TIMES FOR DAY BOATS:

Based on the measured mooring times, the following mooring configurations were developed. The configurations listed below assume a single ended vessel propulsion system. Each configuration is intended to be used as the mooring time at one end terminal of a MLOPS scenario. The assumed arrival and departure times for each mooring configuration are estimated values only.

1) Bow End Moor – This is similar to traditional double-ended ferry mooring configurations. The vessel sails straight in to the berth such that the bow is captured as shown in Figure 1. Vessel position is maintained by the propulsion system, with additional safety lines in place for emergency purposes. The arrival and departure times are increased from WSFS times to account for single ended operation.
Arrival: = 5.0 minutes
Departure: = 4.0 minutes

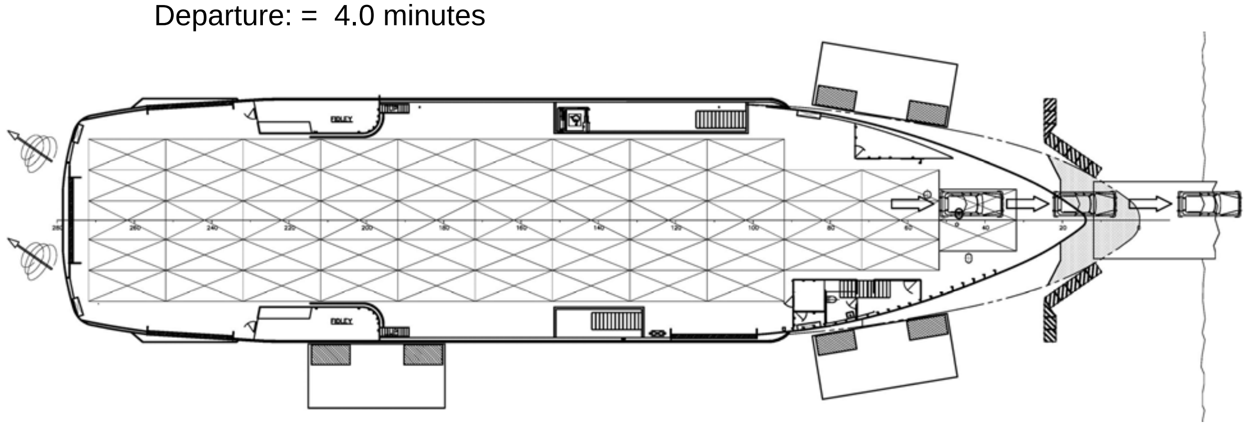


Figure 1: Bow End Moor, Bow Loading

2) Side Moor –This mooring configuration requires the vessel to tie off to a side berth as shown in Figure 2. In order to ensure that the side door is aligned with the terminal ramp, this mooring configuration normally requires multiple tie-off attempts. Arrival and departure times for the Day Boat ACF are assumed to be quicker than the measured AMHS times to account for improved vessel operations for tight schedules.
   Arrival: = 12.0 minutes
   Departure: = 8.0 minutes

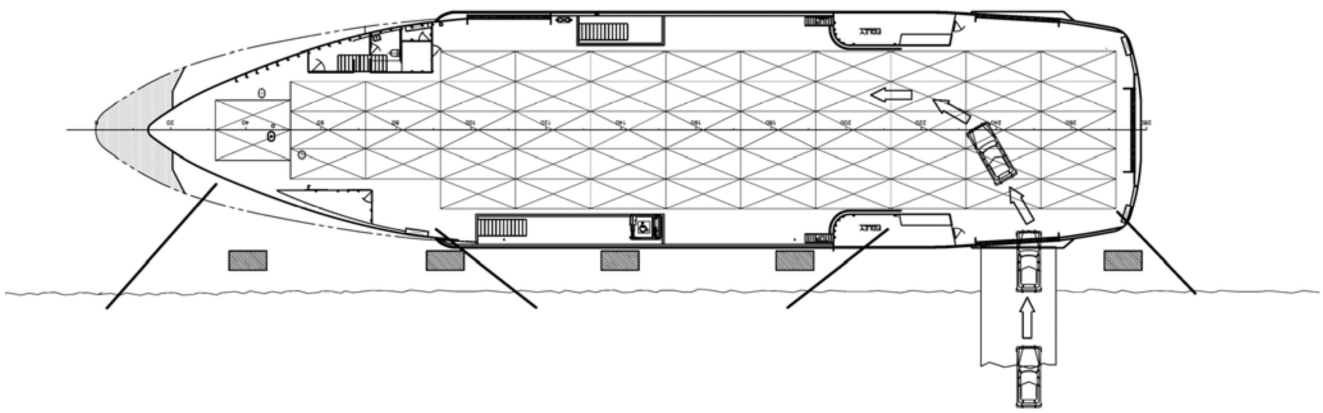


Figure 2: Traditional Side Moor, Side Loading

3) Stern End Moor – This is similar to the current AMHS end mooring configuration as shown in Figure 3. This mooring configuration requires the vessel to turn around just prior to arriving at the berth. The vessel then backs into the berth and ties off using stern lines. Pending actual vessel operation measurements, it is assumed that this style of mooring can be accomplished by the Day Boat ACF in the same time as a side mooring arrangement.
   Arrival: = 12.0 minutes
   Departure: = 4.0 minutes

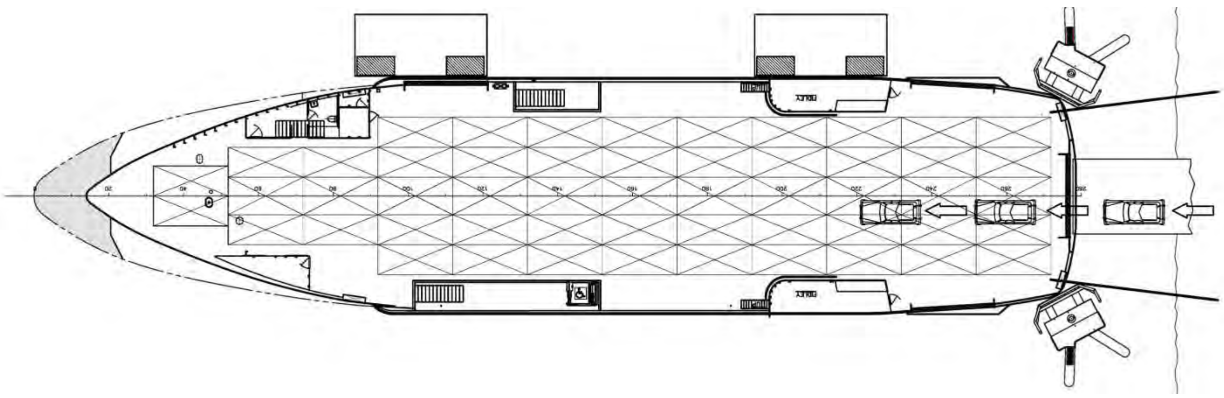


Figure 3: Stern End Moor, Stern Loading

Vehicle Loading

ACTUAL LOADING TIMES:

Coastwise has previously measured vessel loading and unloading times for some of the AMHS and the WSF vessel/terminal combinations during the development of the Juneau Access Improvements marine segments.

At the time of the previous study, not all of the existing AMHS loading times were measured. The un-measured loading times were estimated to assist the development of loading times for the Day Boat ACF. Below is a summary of vessel loading times based on the results of the previous study, with loading rates given in cars per minute (CPM).

Current AMHS (displacement vessel) side loading
Arrival/Unloading: 2.9 minute delay, 2.0 CPM
Departure/Loading: Not measured

Current AMHS Fast Vehicle Ferry (turn around end moor stern) stern loading
Arrival/Unloading: 2.2 minute delay, 4.6 CPM
Departure/Loading: Not measured

Current WSFS DE displacement vessel (straight in - end moor – hold with propulsion)
Arrival/Unloading: 0.0 minute delay, 10 CPM per lane
Departure: Not measured, assume 9 CPM per lane

ASSUMED LOADING TIMES FOR DAY BOATS:

The loading times listed below assume that vehicles drive straight on and off the vessel, requiring no turn around either during loading or unloading operations. In addition, the load times assume vehicles are not required to stop at the top of the ramp for ticket collection; rather, the terminal uplands are adequately sized and configured to stage all of the vehicles to be loaded on to the ferry after the ticketing. The offloading lanes are also assumed to be sized appropriately to prevent any backlog or stopping of vehicles. In order to meet the estimated loading times, no unattended trailers are permitted to be loaded onto the vessel.

The estimated loading times shown below vary from the previously measured AMHS loading times due to improved vehicle traffic patterns. For end load times, due to the vehicle types and sizes typically operated in Alaska, the loading and unloading times are estimated to be slightly greater than similar arrangements for WSF.

1) Side Loading – Loading the vessel from the side can only be accomplished using a side mooring configuration similar to Figure 2. Although this figure shows loading at the stern end of the vessel, side loading can also occur at the forward end of the vessel. In this loading configuration the majority of the vehicles can drive straight into their parking place; however when fully loaded some vehicles will need to back into place at either the bow or the stern.

Side load	= 4.0 CPM	if cars are 10 feet apart = 1.36 MPH average
Side discharge	= 6.0 CPM	if cars are 10 feet apart = 2.05 MPH average

2) End Loading – With an appropriate vessel arrangement, end loading can occur either at the stern of the vessel, as shown in Figure 3, or at the bow, as shown in Figure 1. This style of loading is the most efficient as the vehicles do not need to make any turns on the vehicle deck.

End load	= 6.0 CPM	if cars are 10 feet apart = 2.05 MPH average
End discharge	= 9.0 CPM	if cars are 10 feet apart = 3.07 MPH average

Day Boat Mooring and Loading Operational Scenarios

In order to compare the different MLOPS, each scenario assumes that a full complement of 53 vehicles is loaded and unloaded at each terminal. Since the scenarios are based on the estimated loading times discussed above, the vehicles are assumed to be able to load and unload from the vessel without turning around. This means that vehicles must load from the front end of the vessel at one terminal and at the rear of the vessel at the second terminal.

MLOPS 1 Round Trip: Straight In Bow : Straight In Stern

This MLOPS is for a double ended ferry and was developed for comparison purposes only. A double ended ferry operates without the necessity of turning the vessel around to load at the bow and the stern. This means that a double ended ferry can moor using the bow end mooring configuration described above for both terminals and still be able to load and unload vehicles without requiring them to turn around.

Mooring Terminal A: Bow End Moor
Mooring Terminal B: Bow End Moor
Loading Terminal A: End Load (bow ramp)
Loading Terminal B: End Load (bow ramp

Activity	Mooring (minute)	Delay (minute)	Traffic Rate (cars / Min. avg.)	Traffic Time (minute)	Total Time (minute)
Load 53 cars			6.0	8.8	8.8
Mooring Departure A	4.0				12.8
Mooring Arrival B	5.0				17.8
Unload 53 cars			9.0	5.9	23.7
Security Sweep		3.0			26.7
Load 53 Cars			6.0	8.8	35.6
Mooring Departure B	4.0				39.6
Mooring Arrival A	5.0				44.6
Unload 53 cars			9.0	5.9	50.4
Security Sweep		3.0			53.4
Sum of Time:	18.0	6.0		29.4	53.4

MLOPS = 13.4

MLOPS 2 Round Trip: Back In Stern : Straight In Bow

Mooring Terminal A: Stern End Moor
Mooring Terminal B: Bow End Moor
Loading Terminal A: End Load (stern ramp)
Loading Terminal B: End Load (bow ramp)

Activity	Mooring (minute)	Delay (minute)	Traffic Rate (cars / Min. avg.)	Traffic Time (minute)	Total Time (minute)
Load 53 cars			6.0	8.8	8.8
Mooring Departure A	4.0				12.8
Mooring Arrival B	5.0				17.8
Unload 53 cars			9.0	5.9	23.7
Security Sweep		3.0			26.7
Load 53 Cars			6.0	8.8	35.6
Mooring Departure B	4.0				39.6
Mooring Arrival A	12.0				51.6
Unload 53 cars			9.0	5.9	57.4
Security Sweep		3.0			60.4
Sum of Time:	25.0	6.0		29.4	60.4

MLOPS = 15.4

MLOPS 3 Round Trip: Side Load Aft : Straight In Bow

Mooring Terminal A: Side Moor
Mooring Terminal B: Bow End Moor
Loading Terminal A: Side Load (aft side ramp)
Loading Terminal B: End Load (bow ramp)

Activity	Mooring (minute)	Delay (minute)	Traffic Rate (cars / Min. avg.)	Traffic Time (minute)	Total Time (minute)
Load 53 cars			4.0	13.3	13.3
Mooring Departure A	8.0				21.3
Mooring Arrival B	5.0				26.3
Unload 53 cars			9.0	5.9	32.1
Security Sweep		3.0			35.1
Load 53 Cars			6.0	8.8	44.0
Mooring Departure B	4.0				48.0
Mooring Arrival A	12.0				60.0
Unload 53 cars			6.0	8.8	68.8
Security Sweep		3.0			71.8
Sum of Time:	29.0	6.0		36.8	71.8

MLOPS = 18.0

MLOPS 4 Round Trip: Side Load Fwd : Back in Stern

Although the assumed side loading times are referenced to Figure 2, which shows the ramp on the aft end of the vessel, side loading can also occur at the forward end of the vessel with no impact on the mooring. Forward side loading permits vehicles to drive straight on the stern and straight off the side.

Mooring Terminal A: Side Moor
Mooring Terminal B: Stern End Moor
Loading Terminal A: Side Load (forward side ramp)
Loading Terminal B: End Load (stern ramp)

Activity	Mooring (minute)	Delay (minute)	Traffic Rate (cars / Min. avg.)	Traffic Time (minute)	Total Time (minute)
Load 53 cars			3.0	17.7	17.7
Mooring Departure A	8.0				25.7
Mooring Arrival B	12.0				37.7
Unload 53 cars			9.0	5.9	43.6
Security Sweep		3.0			46.6
Load 53 Cars			6.0	8.8	55.4
Mooring Departure B	4.0				59.4
Mooring Arrival A	12.0				71.4
Unload 53 cars			4.0	13.3	84.6
Security Sweep		3.0			87.6
Sum of Time:	36.0	6.0		45.6	87.6

MLOPS = 21.9

MLOPS 5 Round Trip: Assumed Standard MLOPS

For the purpose of comparing schedules a slightly more generous MLOPS time of 30 minutes (per each loading and unloading cycle) was developed and implemented. This MLOPS 5 time has the benefit of requiring an even hour of port time and more closely aligns with some current AMHS operations. However, if the vessel is carrying a full load of 53 vehicles, this MLOPS 5 time still requires much faster loading and unloading times, compared to current AMHS operation.

Appendix C – Day Boat Schedules

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Methodology

To support schedule calculations, all route navigation information was generated new and analyzed using Nobeltech® navigation software. This information is based on recent digital navigational data from AMHS navigation computers. See Appendix A for detailed route information. Of key importance is the length of maneuvering speed areas and the length of mooring operation areas, usually adjacent to terminals.

For the purpose of calculating schedules, mooring and loading operations (MLOPS) scenarios were developed. Previously measured Alaska Marine Highway System (AMHS) and Washington State Ferries (WSF) mooring and loading times were used as the basis to estimate the mooring and loading times for various day boat configurations. The MLOPS are further detailed in Appendix B.

Using the defined vessel routes and the MLOPS, sample vessel schedules were calculated. Basic scheduling assumptions were that a crew day was 12 hours, vessel speed was 15.5 knots, and maneuvering speed 5.0 knots. Mooring and Loading Operations (MLOPS) were optimized as necessary for each day boat schedule, however if time was available, schedules used the slightly more generous MLOPS 5 time of 30 minutes. Assuming an arbitrary crew start time, the arrival and departure times and the number of round trips were calculated for each port in the route. The effect of current was examined, but not included in the analysis due to limited impact.

Notional Vessels

Based on the MLOPS detailed in Appendix B, the following notional vessel characteristics were developed. These notional vessels are used as input for the calculation of the schedules in order to define the vessel speed, startup time, shutdown time, loading time and unloading time. Not all the notional vessels shown below were used in the schedules.

Since the total MLOPS times developed in Appendix B are for a complete round trip between two terminals, the load and unload times are each assumed to be ¼ of the total round trip MLOPS time shown in Appendix B.

Unless specifically noted, all notional vessels are assumed to have 15 minutes of crew time for vessel startup and 15 minutes for shutdown. The startup and shutdown times were removed from MLOPS 2a in order to be able to make the Juneau-Angoon route within the 12 hour crew day. It is assumes that the night crew can assist in the vessel startup and shutdown.

Notional Vessel	Vessel Type	Speed (knots)	Maneuvering Speed (knots)	Startup (minutes)	MLOPS (load) (minutes)	MLOPS (Unload) (minutes)	Shutdown (minutes)
MLOPS1	Day Boat	15.5	5	15	13.35	13.35	15
MLOPS2	Day Boat	15.5	5	15	15.1	15.1	15
MLOPS2a	Day Boat	15.5	5	0	15.1	15.1	0
MLOPS3	Day Boat	15.5	5	15	17.95	17.95	15
MLOPS4	Day Boat	15.5	5	15	21.9	21.9	15
MLOPS5	Day Boat	15.5	5	15	30	30	15
MLOPS6	Day Boat	17.5	5	15	30	30	15

Speed: Average vessel schedule speed
Maneuvering Speed: Average vessel maneuvering speed.
Startup: Time required to startup vessel at beginning of operating day prior to loading the vessel.
Shutdown: Time required to shutdown vessel at end of operating day after the last unloading of the vessel.
MLOPS (Load): Average time required to load and undock the vessel
MLOPS (Unload): Average time required to dock and unload a vessel

Routes

The Day Boat ACF design concept report identifies the following routes and route priorities.

1ST PRIORITY ROUTES – NEW NORTH LYNN CANAL SERVICE

Juneau-Haines-Juneau
Haines-Skagway-Haines

2ND PRIORITY – OTHER AMHS ESTABLISHED ROUTES

Juneau-Angoon-Juneau
Juneau-Gustavus-Juneau
Juneau-Hoonah-Juneau
Juneau-Tenakee-Juneau (Same approximate distance and operational features as Juneau-Angoon)
Ketchikan-Metlakatla-Ketchikan (Identical to *Lituya*)

3RD PRIORITY – JAI STATE PREFERRED ROUTES

Haines-Katzehin-Haines
Skagway-Katzehin-Skagway

4TH PRIORITY – OTHER JAI ALTERNATIVES ROUTES

Haines-Sawmill Cove[1]-Haines
Juneau-Skagway-Juneau
Skagway-Sawmill Cove-Skagway
Sawmill Cove-William Henry Bay-Sawmill Cove

5TH PRIORITY - OTHER POSSIBLE FUTURE ROUTES

It is hard to forecast the long range growth of the AMHS. Many potential day boat routes exist that could be served by the Day Boat ACF, particularly with small road extension segments. Some of these routes are charted in Appendix A, but no official schedules were developed.

Cascade Point[2]-Haines
Cascade Point-Skagway
Whittier-Valdez-Whittier
Cordova-Valdez-Cordova
Anton Larsen Bay-Ouzinkie-Port Lions. Requires terminal at Anton Larsen Bay
Juneau-Warm Springs Bay (Sitka)-Juneau. Requires one road segment
Whittier-Cordova-Whittier. Requires road extension.

6TH PRIORITY – OVERNIGHT ROUTES

While day boat operation is defined as a vessel that returns to its home port every night, it is possible to run the vessel to a port, then put the crew in shore side accommodations overnight, then resume sailing the next day. This type of operation greatly extends the range of the vessel, but very long day trips can increase the desire for passenger services, such as meals and accommodations for the infirm. Although no official schedules have been created, some possible overnight routes are:

Juneau-Haines-Skagway-Haines
Haines-Skagway-Haines-Juneau
Juneau-Sitka-Juneau
Juneau-Petersburg-Juneau
Ketchikan-Petersburg-Ketchikan
Ketchikan-Prince Rupert-Ketchikan. (Vessel would require SOLAS exemption.)

[1] Sawmill Cove is labeled Berners Bay (BER) for the purpose of route characteristics and schedules.
[2] Cascade Point schedules are calculated the same as Sawmill Cove schedules and labeled as Berners Bay (BER) because these two routes are virtually equidistant.

Route Characteristics

Based on the route details in Appendix A, the following route leg characteristics have been determined. These route leg characteristics are used as input to the calculation of the schedules in order to define the route length at cruising speed and the maneuvering speed. All route legs are shown in one direction only. If traveling in the reverse direction shown, the cruising and maneuvering speed lengths remain the same, with the departure and arrival terminal switched. Some routes shown in the table below are not included in the schedules since they were not listed as Day boat routes in the Day Boat ACF Design Concept Report.

Departure Terminal	Leg Name	Length Total Route	Terminal 1 Name 1	Terminal 1 Manuv Dist 1	Length Cruise	Terminal 2 Name 2	Terminal 2 Manuv Dist 2
Angoon	ANG-TKE	33.75	Angoon	1.24	31.67	Tenakee	0.84
Berners Bay	BER-HNS	41.83	Berners Bay	0.61	40.89	Haines	0.33
Berners Bay	BER-SGY	50.17	Berners Bay	0.61	49.43	Skagway	0.13
Berners Bay	BER-WHB	10.05	Berners Bay	0.61	9.32	William Henry Ba	0.12
Cordova	CDV-VDZ	73.10	Cordova	2.73	69.96	Valdez	0.41
Cordova	CDV-WTR	96.71	Cordova	2.73	93.71	Whittier	0.27
Haines	HNS-SGY	12.60	Haines	0.27	12.21	Skagway	0.12
Hoonah	HNH-GUS	22.99	Hoonah	1.10	20.36	Gustavus	1.53
Juneau	JNU-ANG	76.60	Juneau	2.35	73.01	Angoon	1.24
Juneau	JNU-GUS	59.73	Juneau	2.34	55.86	Gustavus	1.53
Juneau	JNU-HNS	66.24	Juneau	2.34	63.60	Haines	0.30
Juneau	JNU-HNH	46.95	Juneau	2.35	43.49	Hoonah	1.11
Juneau	JNU-SGY	74.68	Juneau	2.34	72.21	Skagway	0.13
Katzehin	KTZ-HNS	5.92	Katzehin	0.25	5.37	Haines	0.30
Katzehin	KTZ-SGY	14.25	Katzehin	0.25	13.87	Skagway	0.13
Tenakee	TKE-HNH	46.76	Tenakee	0.86	44.78	Hoonah	1.12
Valdez	VDZ-WTR	76.19	Valdez	0.42	75.50	Whittier	0.27

Schedules

Using the above described supporting information and methodology day boat schedules have been calculated. In general the schedules are presented in order of the 1st priority through 4th priority established by the Design Concept Report. However additional schedules were calculated and are shown as necessary to investigate the impact of increased vessel speed, decreased MLOPS time, and other changes of interest. Not all calculated schedules are presented in this Appendix.

Juneau - Haines

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Juneau	7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Haines	12:07	4:37			5:22
Depart	Haines	13:07		1:00		6:22
Arrive	Juneau	17:44	4:37			10:59
Unload	Juneau	18:14		0:30		11:29
Crew End		18:29			0:15	11:44

Schedule Statistics		
Total Underway Time	9:14	
	76.9%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	11:44	
	97.8%	Of Day
Unassigned Time	0:16	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau –Haines: Increased Speed

The vessel speed is increased from 15.5 knots to 17.5 knots in order to show the scheduling impact of increased operational speed. When compared to the prior Juneau-Haines schedule, it can be seen that the underway time has been reduced by 28 minutes, however there is no impact to the service frequency.

Ferry Speed: 17.5 kn MLOPS6: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Juneau	7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Haines	11:39	4:09			4:54
Depart	Haines	12:39		1:00		5:54
Arrive	Juneau	16:48	4:09			10:03
Unload	Juneau	17:18		0:30		10:33
Crew End		17:33			0:15	10:48

Schedule Statistics		
Total Underway Time	8:18	
	69.2%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	10:48	
	90.0%	Of Day
Unassigned Time	1:12	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines - Skagway

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 3

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Haines	7:00			0:15	0:15
Depart	Haines	7:30		0:30		0:45
Arrive	Skagway	8:21	0:51			1:36
Depart	Skagway	9:21		1:00		2:36
Arrive	Haines	10:12	0:51			3:27
Depart	Haines	11:12		1:00		4:27
Arrive	Skagway	12:03	0:51			5:18
Depart	Skagway	13:03		1:00		6:18
Arrive	Haines	13:54	0:51			7:09
Depart	Haines	14:54		1:00		8:09
Arrive	Skagway	15:45	0:51			9:00
Depart	Skagway	16:45		1:00		10:00
Arrive	Haines	17:36	0:51			10:51
Unload		18:06		0:30		11:21
Crew End		18:21			0:15	11:36

Schedule Statistics		
Total Underway Time	5:06	
	42.5%	Of Day
Total MLOPS time	6:00	
	50.0%	Of Day
Total Operation Hours	11:36	
	96.7%	Of Day
Unassigned Time	0:24	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines-Skagway: Reduced Frequency

A schedule with reduced service frequency is shown below. This schedule is developed as a sample which matches one of the Haines terminal arrival and departure times to the Juneau-Haines schedule. Although the below schedule can be completed in an 8 hour day, the statistics are still based on a 12 hour day with the additional 4 hours labeled as unassigned.

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 2

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		8:40				0:00
Load	Haines	8:55			0:15	0:15
Depart	Haines	9:25		0:30		0:45
Arrive	Skagway	10:16	0:51			1:36
Depart	Skagway	11:16		1:00		2:36
Arrive	Haines	12:07	0:51			3:27
Depart	Haines	13:07		1:00		4:27
Arrive	Skagway	13:58	0:51			5:18
Depart	Skagway	14:58		1:00		6:18
Arrive	Haines	15:49	0:51			7:09
Unload		16:19		0:30		7:39
Crew End		16:34			0:15	7:54

Schedule Statistics		
Total Underway Time	3:24	
	28.3%	Of Day
Total MLOPS time	4:00	
	33.3%	Of Day
Total Operation Hours	7:54	
	65.8%	Of Day
Unassigned Time	4:06	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines-Skagway: Increased Speed

The vessel speed is increased from 15.5 knots to 17.5 knots in order to show the scheduling impact of increased operational speed. When compared to the initial Haines-Skagway schedule, it can be seen that the underway time has been reduced by 5 minutes, however there is no impact to the overall service frequency.

Ferry Speed: 17.5 kn MLOPS6: 30 minute each, load and unload Number of round trips: 3

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Haines	7:00			0:15	0:15
Depart	Haines	7:30		0:30		0:45
Arrive	Skagway	8:16	0:46			1:31
Depart	Skagway	9:16		1:00		2:31
Arrive	Haines	10:02	0:46			3:17
Depart	Haines	11:02		1:00		4:17
Arrive	Skagway	11:48	0:46			5:03
Depart	Skagway	12:48		1:00		6:03
Arrive	Haines	13:34	0:46			6:49
Depart	Haines	14:34		1:00		7:49
Arrive	Skagway	15:20	0:46			8:35
Depart	Skagway	16:20		1:00		9:35
Arrive	Haines	17:06	0:46			10:21
Unload	Haines	17:36		0:30		10:51
Crew End		17:51			0:15	11:06

Schedule Statistics		
Total Underway Time	4:36	
	38.3%	Of Day
Total MLOPS time	6:00	
	50.0%	Of Day
Total Operation Hours	11:06	
	92.5%	Of Day
Unassigned Time	0:54	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines-Skagway: Decreased MLOPS

The vessel MLOPS is decreased from 30 minutes to 15 minutes for each load or unload interval in order to show the scheduling impact of decreasing the MLOPS time. When compared to the initial Haines-Skagway schedule, it can be seen that the decrease in MLOPS time increases the service frequency from 3 round trips to 4 round trips (a 33% increase). In addition, the percentage of the 12 hour crew day used for MLOPS has decreased.

Ferry Speed: 15.5 kn MLOPS2: 15.1 minute each, load and unload Number of round trips: 4

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:59				0:00
Load	Haines	7:14			0:15	0:15
Depart		7:30		0:15		0:30
Arrive	Skagway	8:21	0:51			1:21
Depart		8:51		0:30		1:51
Arrive	Haines	9:42	0:51			2:42
Depart		10:12		0:30		3:12
Arrive	Skagway	11:03	0:51			4:03
Depart		11:33		0:30		4:33
Arrive	Haines	12:24	0:51			5:24
Depart		12:54		0:30		5:55
Arrive	Skagway	13:45	0:51			6:46
Depart		14:16		0:30		7:16
Arrive	Haines	15:07	0:51			8:07
Depart		15:37		0:30		8:37
Arrive	Skagway	16:28	0:51			9:28
Depart		16:58		0:30		9:58
Arrive	Haines	17:49	0:51			10:49
Unload		18:04		0:15		11:04
Crew End		18:19			0:15	11:19

Schedule Statistics		
Total Underway Time	6:48	
	56.7%	Of Day
Total MLOPS time	4:01	
	33.6%	Of Day
Total Operation Hours	11:19	
	94.4%	Of Day
Unassigned Time	0:40	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau – Angoon

Calculations indicate that the Juneau Angoon route is too long to allow the completion of a round trip within a 12 hour crew day, using the standard MLOPS 5 (30 minutes for each load or unload interval). In order to complete one full round trip, the MLOPS time must be reduced to 15 minutes for each load or unload interval and the startup and shutdown time must be removed. This means that the night crew would be required to perform vessel startup and shutdown.

Ferry Speed: 15.5 kn MLOPS2a: 15.1 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		7:14				0:00
Load	Juneau	7:14			0:00	0:00
Depart		7:30		0:15		0:15
Arrive	Angoon	12:55	5:25			5:40
Depart		13:25		0:30		6:10
Arrive	Juneau	18:50	5:25			11:35
Unload		19:05		0:15		11:50
Crew End		19:05			0:00	11:50

Schedule Statistics		
Total Underway Time	10:50	
	90.3%	Of Day
Total MLOPS time	1:00	
	8.4%	Of Day
Total Operation Hours	11:50	
	98.7%	Of Day
Unassigned Time	0:09	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau – Gustavus

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Juneau	7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Gustavus	11:52	4:22			5:07
Depart	Gustavus	12:52		1:00		6:07
Arrive	Juneau	17:14	4:22			10:29
Unload	Juneau	17:44		0:30		10:59
Crew End		17:59			0:15	11:14

Schedule Statistics		
Total Underway Time	8:44	
	72.8%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	11:14	
	93.6%	Of Day
Unassigned Time	0:46	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau – Hoonah

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Juneau	7:00			0:15	0:15
Depart	Juneau	7:30		0:30		0:45
Arrive	Hoonah	11:00	3:30			4:15
Depart	Hoonah	12:00		1:00		5:15
Arrive	Juneau	15:30	3:30			8:45
Unload	Juneau	16:00		0:30		9:15
Crew End		16:15			0:15	9:30

Schedule Statistics		
Total Underway Time	7:00	
	58.3%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	9:30	
	79.2%	Of Day
Unassigned Time	2:30	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines – Katzehin

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 3

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Haines	7:00			0:15	0:15
Depart	Haines	7:30		0:30		0:45
Arrive	Katzehin	7:57	0:27			1:12
Depart	Katzehin	8:57		1:00		2:12
Arrive	Haines	9:24	0:27			2:39
Depart	Haines	10:24		1:00		3:39
Arrive	Katzehin	10:51	0:27			4:06
Depart	Katzehin	11:51		1:00		5:06
Arrive	Haines	12:18	0:27			5:33
Depart	Haines	13:18		1:00		6:33
Arrive	Katzehin	13:45	0:27			7:00
Depart	Katzehin	14:45		1:00		8:00
Arrive	Haines	15:12	0:27			8:27
Unload	Haines	15:42		0:30		8:57
Crew End		15:57			0:15	9:12

Schedule Statistics		
Total Underway Time	2:42	
	22.5%	Of Day
Total MLOPS time	6:00	
	50.0%	Of Day
Total Operation Hours	9:12	
	76.7%	Of Day
Unassigned Time	2:48	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines – Katzehin: Reduced MLOPS

The vessel MLOPS is decreased to 15 minutes for each load or unload interval, in order to optimize the schedule. When compared to the initial Haines-Katzehin schedule, it can be seen that the decrease in MLOPS time increases the service frequency from 3 round trips to 6 round trips (a 100% increase). In addition to the increased frequency, the amount of unassigned time has been reduced to 3 minutes.

Ferry Speed: 15.5 kn MLOPS2: 15.1 minute each, load and unload Number of round trips: 6

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:59				0:00
Load	Haines	7:14			0:15	0:15
Depart		7:30		0:15		0:30
Arrive	Katzehin	7:57	0:27			0:57
Depart		8:27		0:30		1:27
Arrive	Haines	8:54	0:27			1:54
Depart		9:24		0:30		2:24
Arrive	Katzehin	9:51	0:27			2:51
Depart		10:21		0:30		3:21
Arrive	Haines	10:48	0:27			3:48
Depart		11:18		0:30		4:19
Arrive	Katzehin	11:45	0:27			4:46
Depart		12:16		0:30		5:16
Arrive	Haines	12:43	0:27			5:43
Depart		13:13		0:30		6:13
Arrive	Katzehin	13:40	0:27			6:40
Depart		14:10		0:30		7:10
Arrive	Haines	14:37	0:27			7:37
Depart		15:07		0:30		8:08
Arrive	Katzehin	15:34	0:27			8:35
Depart		16:05		0:30		9:05
Arrive	Haines	16:32	0:27			9:32
Depart		17:02		0:30		10:02
Arrive	Katzehin	17:29	0:27			10:29
Depart		17:59		0:30		10:59
Arrive	Haines	18:26	0:27			11:26
Unload		18:41		0:15		11:41
Crew End		18:56			0:15	11:56

Schedule Statistics		
Total Underway Time	5:24	
	45.0%	Of Day
Total MLOPS time	6:02	
	50.4%	Of Day
Total Operation Hours	11:56	
	99.6%	Of Day
Unassigned Time	0:03	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Skagway – Katzehin

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 2

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Skagway	7:00			0:15	0:15
Depart	Skagway	7:30		0:30		0:45
Arrive	Katzehin	8:28	0:58			1:43
Depart	Katzehin	9:28		1:00		2:43
Arrive	Skagway	10:26	0:58			3:41
Depart	Skagway	11:26		1:00		4:41
Arrive	Katzehin	12:24	0:58			5:39
Depart	Katzehin	13:24		1:00		6:39
Arrive	Skagway	14:22	0:58			7:37
Unload	Skagway	14:52		0:30		8:07
Crew End		15:07			0:15	8:22

Schedule Statistics		
Total Underway Time	3:52	
	32.2%	Of Day
Total MLOPS time	4:00	
	33.3%	Of Day
Total Operation Hours	8:22	
	69.7%	Of Day
Unassigned Time	3:38	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Skagway – Katzehin: Reduced MLOPS

The vessel MLOPS is decreased from 30 minutes to 15 minutes for each load or unload interval, to show the scheduling impact of decreasing the MLOPS time. When compared to the initial Skagway-Katzehin schedule, it can be seen that the decrease in MLOPS time increases the service frequency by one round trip to a total of 3 (a 50% increase). However, the below schedule still has a significant amount of unassigned time.

Ferry Speed: 15.5 kn MLOPS2: 15.1 minute each, load and unload Number of round trips: 3

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:59				0:00
Load	Skagway	7:14			0:15	0:15
Depart	Skagway	7:30		0:15		0:30
Arrive	Katzehin	8:28	0:58			1:28
Depart	Katzehin	8:58		0:30		1:58
Arrive	Skagway	9:56	0:58			2:56
Depart	Skagway	10:26		0:30		3:26
Arrive	Katzehin	11:24	0:58			4:24
Depart	Katzehin	11:54		0:30		4:54
Arrive	Skagway	12:52	0:58			5:52
Depart	Skagway	13:22		0:30		6:23
Arrive	Katzehin	14:20	0:58			7:21
Depart	Katzehin	14:51		0:30		7:51
Arrive	Skagway	15:49	0:58			8:49
Unload	Skagway	16:04		0:15		9:04
Crew End		16:19			0:15	9:19

Schedule Statistics		
Total Underway Time	5:48	
	48.3%	Of Day
Total MLOPS time	3:01	
	25.2%	Of Day
Total Operation Hours	9:19	
	77.7%	Of Day
Unassigned Time	2:40	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Skagway – Katzehin: Optimized

In addition to decreasing vessel MLOPS to 15 minutes for each load or unload interval, the vessel startup and shutdown time were removed in an attempt to optimize the schedule. When compared to the initial Haines-Katzehin schedule, it can be seen that this optimized schedule increases the service frequency from 2 round trips to 4 round trips (a 100% increase). In addition to the increased frequency, the amount of unassigned time has been reduced to 14 minutes.

Ferry Speed: 15.5 kn MLOPS2a: 15.1 minute each, load and unload Number of round trips: 4

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		7:14				0:00
Load	Skagway	7:14			0:00	0:00
Depart		7:30		0:15		0:15
Arrive	Katzehin	8:28	0:58			1:13
Depart		8:58		0:30		1:43
Arrive	Skagway	9:56	0:58			2:41
Depart		10:26		0:30		3:11
Arrive	Katzehin	11:24	0:58			4:09
Depart		11:54		0:30		4:39
Arrive	Skagway	12:52	0:58			5:37
Depart		13:22		0:30		6:08
Arrive	Katzehin	14:20	0:58			7:06
Depart		14:51		0:30		7:36
Arrive	Skagway	15:49	0:58			8:34
Depart		16:19		0:30		9:04
Arrive	Katzehin	17:17	0:58			10:02
Depart		17:47		0:30		10:32
Arrive	Skagway	18:45	0:58			11:30
Unload		19:00		0:15		11:45
Crew End		19:00			0:00	11:45

Schedule Statistics		
Total Underway Time	7:44	
	64.4%	Of Day
Total MLOPS time	4:01	
	33.6%	Of Day
Total Operation Hours	11:45	
	98.0%	Of Day
Unassigned Time	0:14	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Haines – Berners Bay

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Haines	7:00			0:15	0:15
Depart		7:30		0:30		0:45
Arrive	Berners Bay	10:19	2:49			3:34
Depart		11:19		1:00		4:34
Arrive	Haines	14:08	2:49			7:23
Unload		14:38		0:30		7:53
Crew End		14:53			0:15	8:08

Schedule Statistics		
Total Underway Time	5:38	
	46.9%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	8:08	
	67.8%	Of Day
Unassigned Time	3:52	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Juneau – Skagway

Calculations indicate that the Juneau-Skagway route is too long to allow the completion of a round trip within a 12 hour crew day, using the standard MLOPS 5 (30 minutes for each load or unload interval). In order to complete one full round trip, the MLOPS time must be reduced to 15 minutes each, load and unload.

Ferry Speed: 15.5 kn MLOPS2: 15.1 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:59				0:00
Load	Juneau	7:14			0:15	0:15
Depart		7:30		0:15		0:30
Arrive	Skagway	12:39	5:09			5:39
Depart		13:09		0:30		6:09
Arrive	Juneau	18:18	5:09			11:18
Unload		18:33		0:15		11:33
Crew End		18:48			0:15	11:48

Schedule Statistics		
Total Underway Time	10:18	
	85.8%	Of Day
Total MLOPS time	1:00	
	8.4%	Of Day
Total Operation Hours	11:48	
	98.4%	Of Day
Unassigned Time	0:11	

MLOPS: Maneuvering and Loading Operations. See Appendix B

Skagway – Berners Bay

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 1

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Skagway	7:00			0:15	0:15
Depart		7:30		0:30		0:45
Arrive	Berners Bay	10:50	3:20			4:05
Depart		11:50		1:00		5:05
Arrive	Skagway	15:10	3:20			8:25
Unload		15:40		0:30		8:55
Crew End		15:55			0:15	9:10

Schedule Statistics		
Total Underway Time	6:40	
	55.6%	Of Day
Total MLOPS time	2:00	
	16.7%	Of Day
Total Operation Hours	9:10	
	76.4%	Of Day
Unassigned Time	2:50	

MLOPS: Maneuvering and Loadinc Operations. See Appendix B

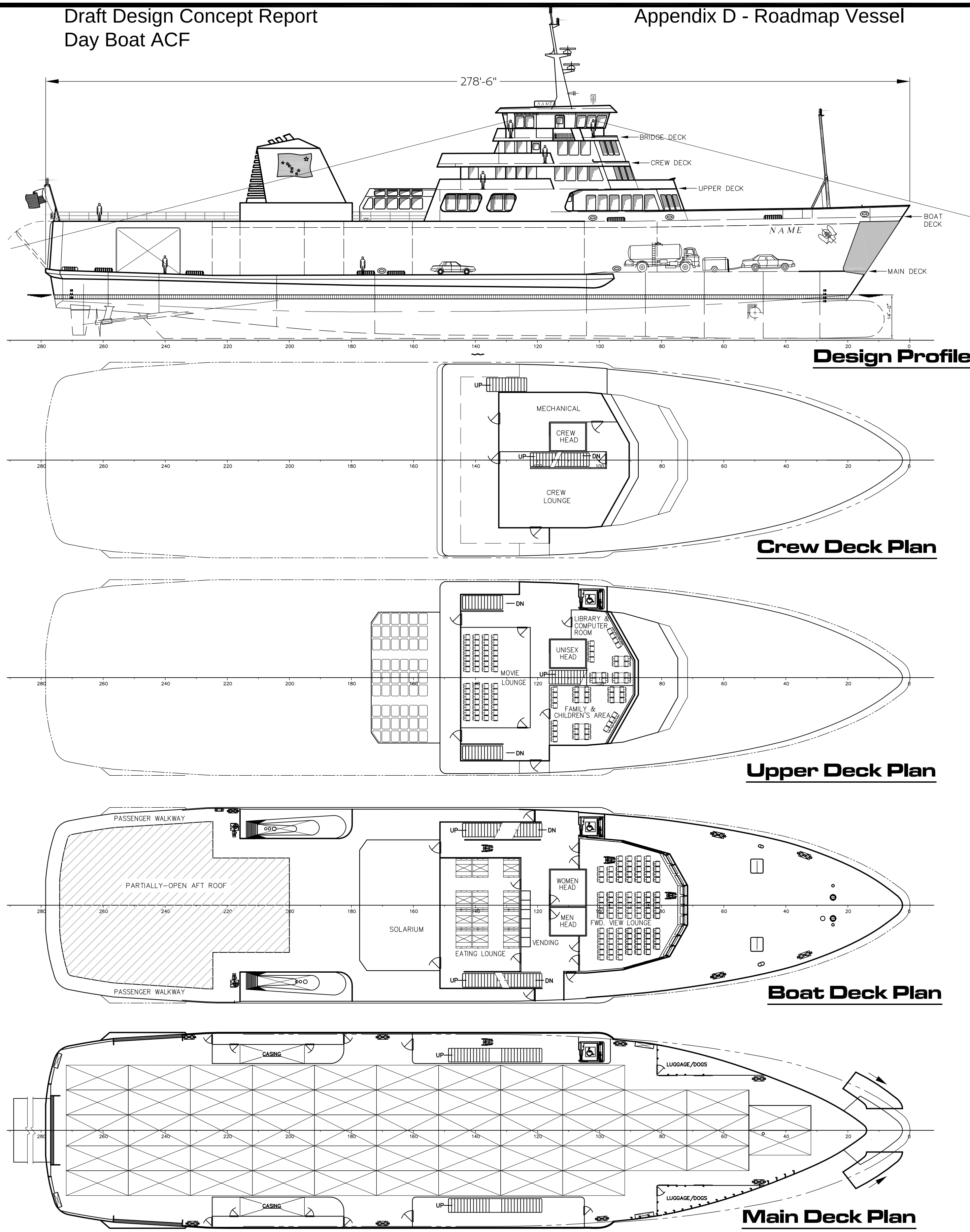
Berners Bay – William Henry Bay

Ferry Speed: 15.5 kn MLOPS5: 30 minute each, load and unload Number of round trips: 3

	Terminal	Time	Underway Time	Load / Unload	Startup / Shutdown	Cumulative Time
Crew Start		6:45				0:00
Load	Berners Bay	7:00			0:15	0:15
Depart	Berners Bay	7:30		0:30		0:45
Arrive	William Henry Bay	8:14	0:44			1:29
Depart	William Henry Bay	9:14		1:00		2:29
Arrive	Berners Bay	9:58	0:44			3:13
Depart	Berners Bay	10:58		1:00		4:13
Arrive	William Henry Bay	11:42	0:44			4:57
Depart	William Henry Bay	12:42		1:00		5:57
Arrive	Berners Bay	13:26	0:44			6:41
Depart	Berners Bay	14:26		1:00		7:41
Arrive	William Henry Bay	15:10	0:44			8:25
Depart	William Henry Bay	16:10		1:00		9:25
Arrive	Berners Bay	16:54	0:44			10:09
Unload	Berners Bay	17:24		0:30		10:39
Crew End		17:39			0:15	10:54

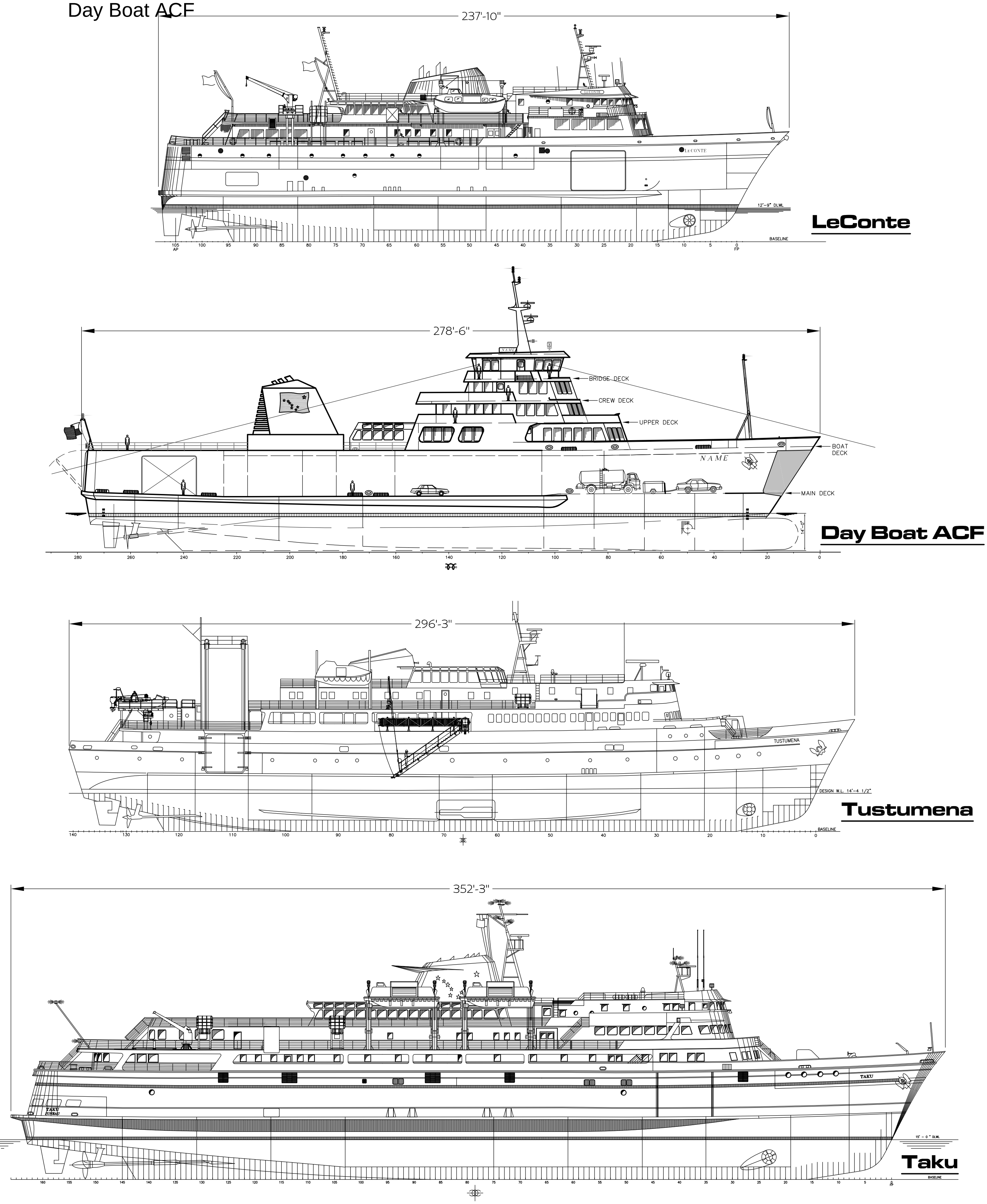
Schedule Statistics		
Total Underway Time	4:24	
	36.7%	Of Day
Total MLOPS time	6:00	
	50.0%	Of Day
Total Operation Hours	10:54	
	90.8%	Of Day
Unassigned Time	1:06	

MLOPS: Maneuvering and Loading Operations. See Appendix B



Coastwise Corporation
Naval Architects - Marine Engineers
Anchorage, Alaska

Title	Concept Roadmap	Dwn OEC	Date 2/14/13	
		Aprvd	Date	
Project	Day Boat ACF Design Concept Report	Dwg. No. 13002-00-01		
Client	DOT&PF	Scale N.T.S.	Sheet 1 of 2	Rev. -



Coastwise Corporation
Naval Architects - Marine Engineers
Anchorage, Alaska

Title	Vessel Size Comparison	Dwn OEC	Date 2/14/13
		Aprvd	Date
Project	Day Boat ACF Design Concept Report	Dwg. No. 13002-00-01	
Client	DOT&PF	Scale N.T.S.	Sheet 2 of 2 / Rev. -

Appendix E – Parametric Vessel Cost Estimates

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Methodology

Preliminary approximate vessel construction cost ranges are generated using the Coastwise Parametric Vessel Construction Cost Model (CPVCCM). A parametric cost estimate is similar to getting a price per square foot for a new house, it is only a rule-of-thumb unit cost, times the anticipated number of units. In the case of vessel parametric cost models, the usual comparison unit is price per cubic feet, although the CPVCCM uses several other methods. This produces planning level estimates, with a confidence range of plus or minus 10 percent, to be used until detailed design plans are available for more specific cost estimating.

The CPVCCM is based on the cost of previously constructed ro/ro ferry vessels delivered to the West Coast of the USA. Most of these costs were based on low-bid public procurement methods and vessel construction occurred at shipyards with significant new vessel construction experience. Unit costs are updated to the present year using relevant Bureau of Labor Statistics indices for labor and other relevant indices for material costs. Parametric cost analysis occurs using a variety of structural and outfitting categories. This version of the CPVCCM is designed to forecast costs for US Coast Guard inspected ro/ro passenger vehicle ferries exclusively.

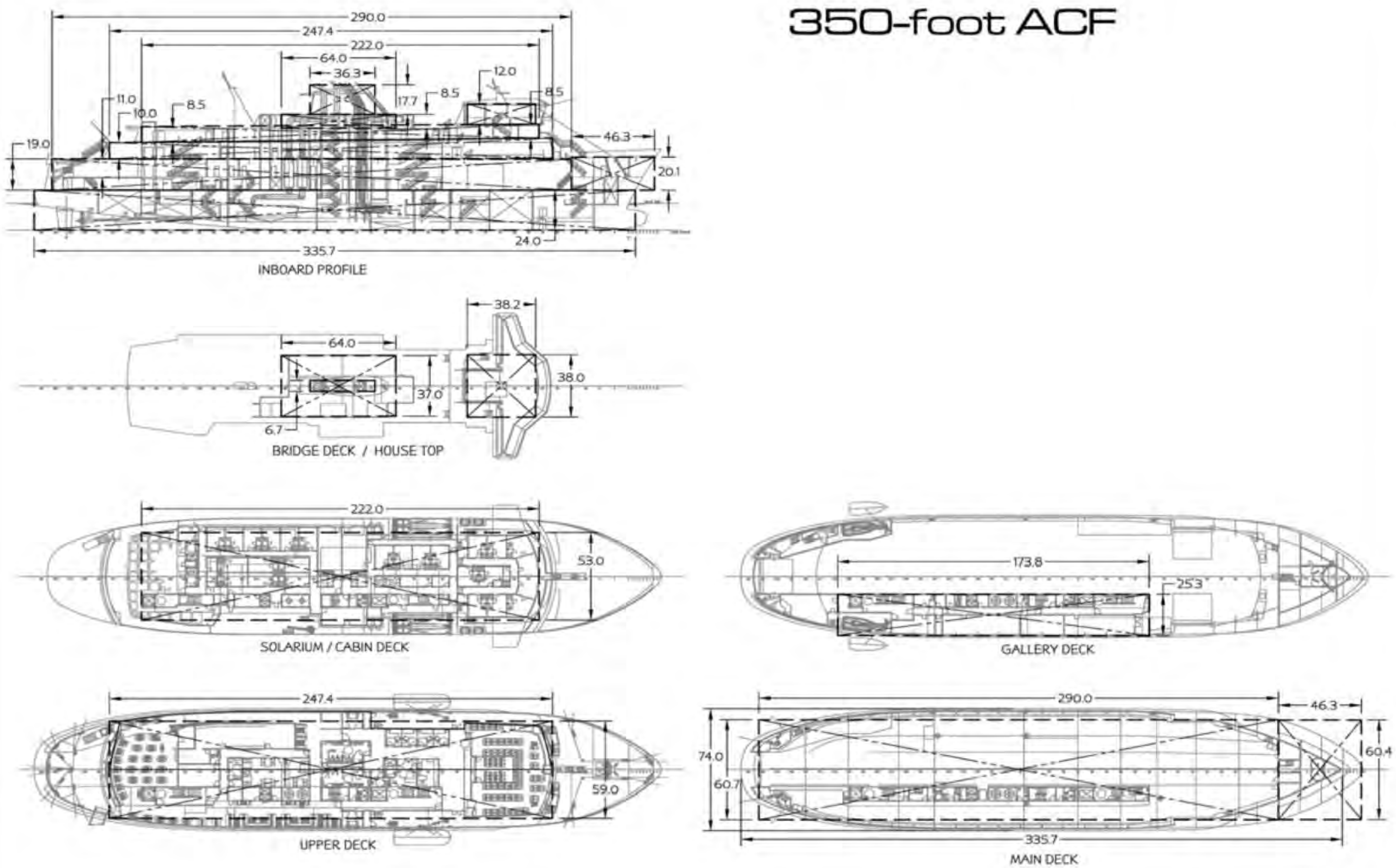
The CPVCCM calculates a construction cost range, which is the cost necessary to pay the contractor for the construction of the vessel, assuming the contractor is provided a reasonably detailed set of vessel construction drawings.

Input Data

A draft CPVCCM analysis of vessel costs for the 350-foot concept ACF was completed in support of the Southeast Alaska Transportation Plan and the Juneau Access Improvements supplemental EIS. Subsequently, the “Roadmap” Day Boat ACF arrangements have been used to estimate the construction cost range for this vessel. The CPVCCM requires input vessel dimensions segregated by area. Below are the input sheets for both the 350-foot ACF and the Day Boat ACF.

350 ft ACF

Capital Cost Model Input Data



All dimensions in feet.

	Length	Breadth	Height	Block Coef.
A) Hull Structure				
1 *i) Hull* (1)	335.7	74.0	24.0	0.500
ii) % Tonnage Framing				
iii) Foclse (2)	46.3	60.4	20.1	0.450
2 ***Hull Crew/Passenger Flats***				
i) Space #1 Gallery Deck	173.8	25.3	11.0	1.00
ii) Space #2				
				# of Decks
B) Superstructure (Above Main Deck)				
1 Superstructure				
i) *Passenger Decks*				
a) Deck #1 Upper Deck	247.4	59.0	10.0	1.00
b) Deck #2 Cabin Deck	222.0	53.0	8.5	1.00
c) Deck #3				
ii) *Wheelhouse*	38.2	38.0	12.0	
iii) *Stack*	36.3	6.7	17.7	
iv) *Misc #1* House Top	64.0	37.0	8.5	
v) *Misc #2*				
2 Enclosed Car Deck				
i) *Main Car Deck*	290.0	60.7	19.0	
ii) *Second Car Deck*				

	% Low Density	% High Density
C) Accommodation Outfit		
i) *Passenger Decks*		
a) Deck #1 Upper Deck	40%	60%
b) Deck #2 Cabin Deck	5%	95%
c) Deck #3		
iii) *Wheelhouse*		100%
iv) *Misc #1* House Top		
v) *Misc #2*		
vi) *Passenger Decks*		
a) Space #1 Gallery Deck	100%	
b) Space #2		

	Length	Breadth	% Outfit
3 Enclosed Car Deck			
i) *Main Car Deck*	*290.0*	60.7	100%
ii) *Second Car Deck*			

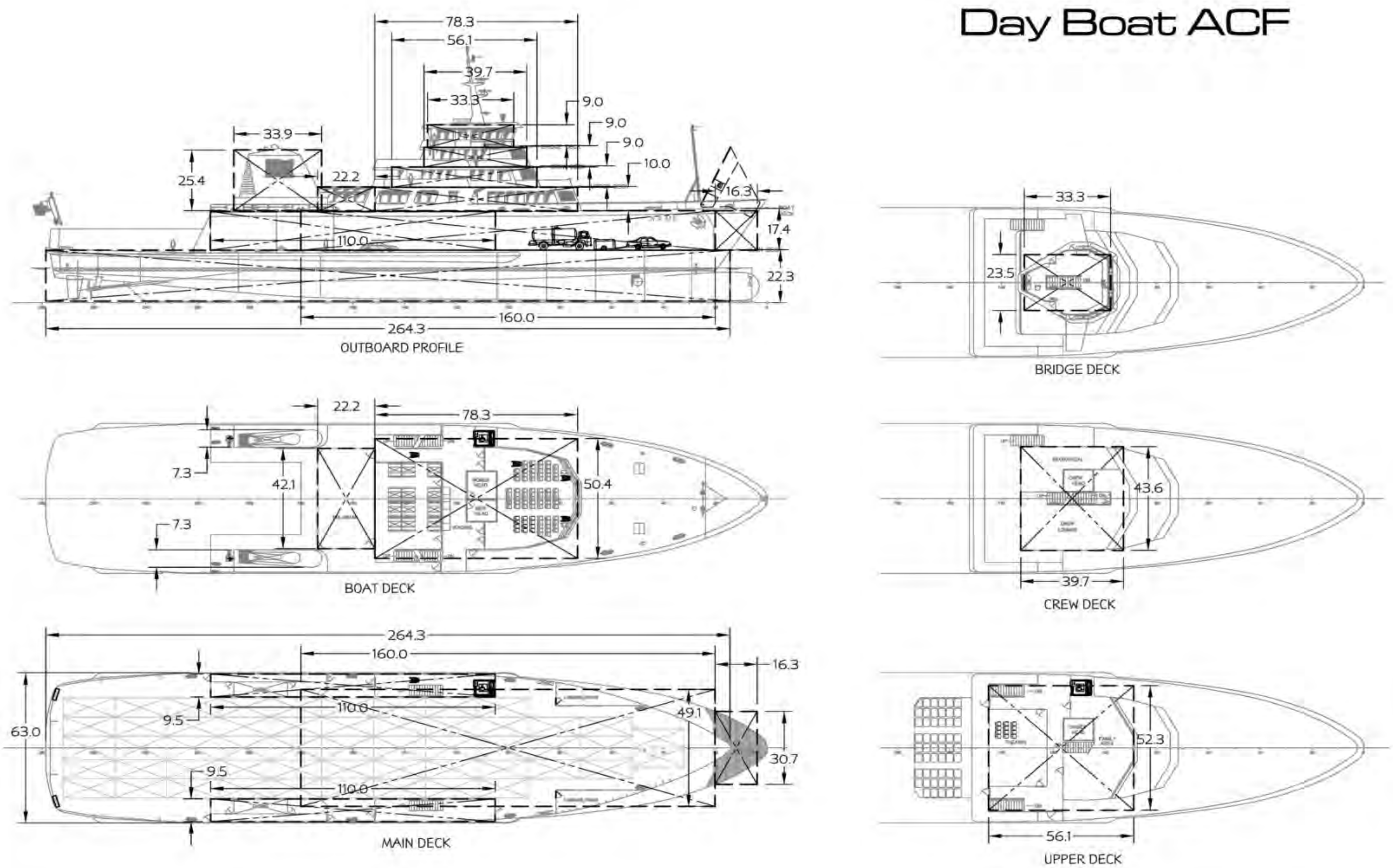
D) Machinery		
1 Engines, propulsion, etc	Installed HP	10,000
	Day Boat Machinery Reduction	
2 Special equipment		
3 Electrical Equipment	Installed KW	1,680
	Day Boat Electrical Reduction	
F) SOLAS	% Increased Cost	10%

Notes:

1) Hull block coefficent estimated
2) Focsle block coefficient estimated

Day Boat ACF

Capital Cost Model Input Data



All dimensions in feet.

	Length	Breadth	Height	Block Coef.
A) Hull Structure				
1 i) Hull (1)	264.3	63.0	22.3	0.447
ii) % Tonnage Framing				
iii) Foclse (2)	16.3	30.7	17.4	0.400
2 Hull Crew/Passenger Flats				
i) Space #1				
ii) Space #2				

	Length	Breadth	Height	# of Decks
B) Superstructure (Above Main Deck)				
1 Superstructure				
i) Passenger Decks				
a) Deck #1 Boat Deck	78.3	50.4	10.0	1.00
b) Deck #2 Upper Deck	56.1	52.3	9.0	1.00
c) Deck #3 Crew Deck	39.7	43.6	9.0	1.00
ii) Wheelhouse	33.3	23.5	9.0	
iii) Stack	33.9	14.6	25.4	
iv) Misc #1 Solarium	22.2	42.1	10.0	
v) Misc #2 Casings	110.0	19.0	17.4	
2 Enclosed Car Deck				
i) Main Car Deck	160.0	49.1	17.4	
ii) Second Car Deck				

		% Low Density	% High Density
C) Accommodation Outfit			
i) Passenger Decks			
a) Deck #1 Boat Deck		90%	10%
b) Deck #2 Upper Deck		90%	10%
c) Deck #3 Crew Deck		90%	10%
iii) Wheelhouse			100%
iv) Misc #1 Solarium			
v) Misc #2 Casings			
vi) Passenger Decks			
a) Space #1			
b) Space #2			

	Length	Breadth	% Outfit
3 Enclosed Car Deck			
i) Main Car Deck	160.0	49.1	100%
ii) Second Car Deck			

D) Machinery		
1 Engines, propulsion, etc	Installed HP	6,000
	Day Boat Machinery Reduction	20%
2 Special equipment		
	Bow door (0.25), stern thruster (0.1)	0.35
3 Electrical Equipment	Installed KW	1,200
	Day Boat Electrical Reduction	20%
F) SOLAS	% Increased Cost	

Notes:
1) Hull block coefficent estimated based on M/V Taku
2) Focsle structure block coefficient estimated, additional bow door costs captured in D)2)

Vessel Construction Cost Summary

	Alaska Class		Day Boat ACF	
A) **Hull Structure (Below Main Deck)**	21.8	M $	10.6	M $
B) **Superstructure (Above Main Deck)**	14.3	M $	6.7	M $
C) **Accommodation Outfit**	65.5	M $	13.0	M $
D) **Machinery**	20.7	M $	14.6	M $
E) **Lofting/Trials&Testing/Insurance**	11.6	M $	4.3	M $
F) **SOLAS**	13.4	M $		
Vessel Construction Cost Range	132.5 - 162.0	M $	44.3 - 54.1	M $