PRINCE WILLIAM SOUND/COPPER RIVER AREA TRANSPORTATION PLAN

Implications of Technological Improvements Technical Memorandum

prepared for the

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INTRODUCTION

The purpose of this memorandum is to identify the potential implications of technological improvements in the Prince William Sound/Copper River (PWS/CR) area. Four separate areas are considered: (1) Global Positioning System (GPS) technology; (2) tiltrotor technology; (3) high-performance marine vessel technology; and (4) air cushion technology. The analyses herein are based on technical data, current environmental assessments, site visits, and personal interviews.

GPS TECHNOLOGY

Global positioning system (GPS) technology represents one of the most important technological advances ever for improving air travel in Alaska. This section describes GPS and how it works, the applications currently being explored by the Federal Aviation Administration (FAA), and the current status of the technology in the PWS/CR area.

The GPS is a worldwide, satellite-based radio navigation system originally developed by the Department of Defense for military applications. A "constellation" of 24 satellites circles the earth in 12-hour orbits that repeat once a day. The constellation ensures that any given user has access to between five and eight satellites from which to triangulate his or her position from any point on the earth at any given time.

Since 1978, the Department of Transportation, the U.S. Coast Guard, and Department of Defense have been jointly planning for different navigation systems for military and civilian needs. Civilian GPS users must have a receiver that converts the satellite signals into position, velocity, and time estimates. Navigation receivers are made for aircraft, ships, ground vehicles, and hand carrying. Civilian users worldwide may access the basic GPS service without charge or restriction. The accuracy of the positioning signal is, however, intentionally degraded by the DOD to only have 100 meter horizontal accuracy, 156 meter vertical accuracy, and 340 nanoseconds time accuracy. Corrections made by the receivers can improve this accuracy to some extent.

FAA AUGMENTATION OF THE BASIC GPS SYSTEM

The FAA is taking significant measures to enhance basic GPS service with improvements (augmentations) to make GPS the primary means of navigation for U.S. airspace from take-off through precision approach and landing. The two types of augmentation systems are called the Wide Area Augmentation System (WAAS) and the Local Area Augmentation System (LAAS). With the basic GPS satellites, augmented by WAAS and LAAS, aircraft outfitted with the proper equipment will be able to use GPS as their primary means of navigation for all phases of flight.

Wide Area Augmentation System

WAAS supplements basic GPS service to improve the accuracy, integrity, and availability of basic GPS signals. WAAS will allow GPS to be used as a primary means of navigation for *en route* travel and non-precision approaches in the U.S., and for Category I[1] approaches at selected airports nationwide. The wide area of coverage for this system includes the entire United States and some outlying areas. Full WAAS implementation is expected by 2001.

WAAS is comprised of a network of approximately 35 ground reference stations around the country. Signals from GPS satellites are received by both aircraft and the ground reference stations. Because the reference stations are precisely surveyed, they can be used to determine and correct the error in the GPS signals received at the station's location. This information is then passed along to a wide area master station, which calculates correction algorithms and assesses system integrity. This corrective information is sent to a ground earth station and transmitted to a communications satellite, where it is forwarded to the receiver on board the aircraft, which refines the plane's positioning information accordingly. The communications satellites also act as navigation satellites for the aircraft, providing additional navigation signals with which to refine the plane's position.

Local Area Augmentation System

Basic GPS and WAAS augmentation will only be suitable for *en route* navigation and Category I approaches at selected airports. To provide for Category I precision approaches at other airports and to provide for Category II & III precision approach capabilities, the FAA is also instituting a Local Area Augmentation System (LAAS). The LAAS takes over where the WAAS leaves off. Because the LAAS is cheaper than conventional instrument landing systems, it can be installed at more airports.

Similar to the WAAS concept, which incorporates communications satellites across the country to transmit corrections to supplement basic GPS, the LAAS will broadcast position correction information from a transmission station at a known geographic point near the airport via a line-of-sight radio link. The LAAS reference station is situated on the ground at an accurately surveyed location in the vicinity of area to be covered. Signals from the basic GPS satellites will be received by aircraft in the local area as well as by this reference station. Since its position is known exactly, the LAAS reference station detects any measurement errors from the satellites in view and transmits a correction message to the aircraft.

Future Air Navigation System

The future air navigation system (FANS), or "free flight" concept relies on existing GPS and satellite communications technologies to greatly increase the user's flexibility in planning flight routes and operating aircraft. Aircraft currently follow directions from ground-based navigation aids, often in zigzag paths that waste time and fuel. Established air routes allow controllers to track planes' locations and to keep them at least three miles apart horizontally and 1,000 feet apart vertically. As such, the FANS will reduce or eliminate the need for aircraft to follow established routes, allowing pilots to choose the routes and altitudes that best suit the destination and flight conditions, which will reduce fuel waste while improving safety.

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[1] The limits of visibility have been set down in general groupings called Categories. Landings can be made in poor visibility if the ILS performs accurately enough to substitute for the loss of vision to make the landing safety. The visibility is measured both in horizontal and vertical directions. When there is not instrumentation, the minimum limits of vision are 16,000 feet horizontal and 1,000 feet vertical. With a normal ILS, the minimums are reduced to 1,800 and 200 feet (Category I) with the same margin of safety. Or, with an ILS which is more accurate than the normal system, the minimums may be reduced to 1,200 and 100 feet (Category II), with the same margin of safety as 16,000 feet and 1,000 feet with no ILS. Category III is when the visibility is zero. (Source: Federal Aviation Administration)

FANS relies on improvements in communications, navigation, surveillance, and onboard safety alert systems. Communications will rely on satellites or digital data links. Navigation will rely on the Flight Management Computer aboard the aircraft, which uses GPS, inertial, air data, and other navigation radios where available. Aircraft surveillance will be accomplished by an air traffic management (ATM) center, which will track the plane's position. FANS is advantageous in that planes can be tracked at all times, even where radar coverage is nonexistent. Moreover, locations are known with greater accuracy. Because planes' locations are known more precisely, and the location is reported continuously through satellite communications, a reduced separation distance between planes is possible while also obtaining a high degree of safety (aircraft currently are separated by about 60 miles when flying ocean routes to avoid collisions due to navigation errors).

GPS APPLICATIONS BY PHASE OF FLIGHT

The FAA has identified potential GPS applications to nearly all phases of flight, including surface operations, arrivals and departures, *en route* operations, and approach and landing.

Surface

Planes on the ground face hazards from the congestion of other planes and vehicles. Where surface traffic at airports is particularly busy, the FAA is exploring ways to use GPS in conjunction with LAAS to help pilots and controllers identify, locate, and track surface vehicles and planes in all types of weather.

Arrivals and Departures

GPS will be used with the augmentation systems to develop new, higher efficiency routes allowing greater navigation accuracy and flexibility, which will ultimately relieve congestion and conserve fuel. The FAA manages traffic areas around airports by designating fixed routes for arriving and departing aircraft. These standard arrival and departure routes are based on the position of ground-based navigation aids, aircraft performance, and flight obstructions for the particular airport. Aircraft arriving into the terminal area use set instructions to lead them to the point at which they begin their final approach. During departures, aircraft also follow set paths to leave the airspace surrounding the terminal area. These standard routes are not necessarily the most direct for all flights and the accuracy of the current navigational equipment leaves little room for route deviation. GPS provides the opportunity for greater navigation flexibility for arriving in and departing the airspace than the current ground-based navigation aids because of its universal coverage and greater accuracy.

En Route

With GPS, exact position information is available anywhere on the planet. This technology eliminates the need for aircraft to fly routes dependent on VFR navigation. Portage Pass is the primary VFR route to the Valdez/Cordova area. If the pass is forecast to be closed, it is a good indication that low clouds exist between Passage Canal and the Valdez and the Cordova area. Currently, the FAA recommends that VFR flights not be attempted below low clouds in this area as there are no landing areas with the exception of Whittier, until one is near Hinchinbrook Island or Valdez. Topographical and climatic conditions in the pass require pilots to travel within specified height and width parameters. The use of GPS for en route navigation may increase the pilot's accuracy in navigation and slightly decrease flight distance parameters. However, the program manager for the Alaska region Flight 2000 program said that it is unlikely that pilots will be allowed to fly the pass in IFR conditions because of the mountainous topography and the lack of emergency landing areas, even though GPS may enhance their navigational abilities.

Approaches and Landings

GPS approach and landing requirements vary depending on the difficulty of the landing, with each level of landing having its own requirements. GPS is currently being used as a supplemental navigation aid for non-precision approaches. The FAA is working with state aviation officials to develop GPS approach procedures for all airports on a priority basis. In the future, GPS will be used with the WAAS as the primary means of navigation for all non-precision approaches. Category I approaches using LAAS can accurately navigate an aircraft to within 200 feet of a runway. The FAA is currently approving LAAS Category I approaches on a case-by-case basis. The WAAS will make Category I approaches possible throughout the U.S. without the use of a LAAS and will be used as a primary means for Category I approaches at all qualified airports. FAA investigations have shown that GPS can also be used to bring aircraft down to the surface of the runway. As such, Category II and III approaches will be possible with the LAAS. GPS also has application for aiding in missed approaches. Currently, an aircraft that aborts its landing after it has started its approach must follow a set route to leave the terminal airspace. GPS provides greater flexibility in routing because of its greater accuracy in determining the plane's location. This flexibility eases congestion and airspace conflicts and provides the pilot greater flexibility in navigating back around for a reapproach.

IMPLICATIONS FOR THE PRINCE WILLIAM SOUND/COPPER RIVER AREA

Following the Flight 2000 initiative, on January 15, 1997 Vice-President Gore stated that up to 49 airports in Alaska would be recommended for Instrument Flight Rules (IFR) upgrade for GPS approaches. However, none of these airports is located within the PWS/CR study area. Nonetheless, there is potential for future GPS upgrades at study area airports. It is likely that the busiest airports will be upgraded first. From this standpoint, Whittier, Chitina, and Seward are less likely to be upgraded. Moreover, in the opinion of the FAA Alaska Region's Flight 2000 Program Manager, the Cordova airport currently utilizes navigational instrumentation that lessens their need for a GPS upgrade.

It should be noted though, that the transition from current navigational systems to GPS technology will eventually require the use of aircraft that can accommodate GPS instrumentation and flight rules. Smaller more conventional aircraft, typically used to reach many Alaskan communities, may not have enough cockpit space to accommodate the instruments required for GPS navigation and may not be adequately equipped to fly in weather conditions allowed by GPS flight.

TILTROTOR TECHNOLOGY

Over the past four decades, the Department of Defense (DOD) and National Aeronautics and Space Administration (NASA) have researched the development and production of aircraft capable of vertical take-off and landing while maintaining fixed-wing flight between destinations. The preferred alternative has become the tiltrotor concept. Tiltrotor aircraft combine conventional fixed-wing airplanes with tilting wing-mounted engine nacelles capable of the vertical takeoffs and landings similar to those of a helicopter. However, their range and speed are comparable to those of fixed-wing airplanes. Tiltrotors offer speed and range advantages over helicopters while requiring substantially less area for landing than conventional passenger aircraft. (The first tiltrotor aircraft was flown in 1955.) The V-22 Osprey is currently under development, and manufacture for the DOD and will continue until late 1999. A commercial tiltrotor aircraft manufactured by BellBoeing/Textron should become available in the year 2000.

In August 1993, the Alaska Department of Transportation and Public Facilities performed the *Alaska Tiltrotor, Vertiport Study.* The objectives of which were to (1) to examine the economic and technical viability of operating tiltrotor aircraft as part of Alaska's air transportation system; (2) to identify appropriate tiltrotor applications and support system configurations; and (3) to forecast the expected impacts on users, operators, and relevant government agencies. A vertiport analysis was also conducted to establish a range of Alaska village vertiport costs for use in assessing the feasibility of establishing tiltrotor service between Bethel and its villages, and between the service segment airports and Southeast Alaska communities.

The study concluded that due to the large capital investment and cost of operations and maintenance required to provide an acceptable level of tiltrotor commuter service from Bethel or in Southeast Alaska, it would be necessary to provide supplemental funding in the range of $4.5 to $10 million per year. Initial capital and operating costs of tiltrotor aircraft far exceed the costs of conventional fixed-wing aircraft. While the study also found that tiltrotor service could be maintained without supplemental funding, the frequency of service was deemed unacceptably low.

The report determined that this cost issue could, however, be resolved via some combination of the following:

- supplemental funding provided by the State of Alaska and/or the federal government;
- increased operating revenues through increased passenger fares, freight tariffs, and/or mail rate subsidies;
- decreasing tiltrotor operating costs.

Increased operating revenues would require an increase in demand, an increase in fares, or a decrease in operation costs. However, because of operating costs, it is unlikely that passenger fares will drop low enough to stimulate the demand necessary to support tiltrotor service. In sum, the report indicated that decreasing tiltrotor operating costs may not be feasible at this time due to high capital and maintenance costs due to the current state of technology.

TILTROTOR COMPARED TO CONVENTIONAL AIRCRAFT

Table 1 summarizes the technical specifications for three types of aircraft: conventional fixed-wing aircraft, helicopters, and the tiltrotor. All three are GPS-compatible. Compared to the Bell Jetranger, the Navajo, and the BellBoeing 609 provide greater passenger capacity, higher ceiling operation, and increased speed and range. Initial cost is the most significant difference between the Navajo and the BellBoeing 609. While the Navajo costs just under $200,000, the BellBoeing costs between $8 and $10 million dollars, with higher operating costs.

Table 1
Tiltrotor Compared to Conventional Aircraft Specifications

	Fixed-Wing	Helicopter	Tiltrotor
	Piper PA-31 Navajo Chieftain	**Bell Model 206 Jetranger**	**BellBoeing 609 Civil Tiltrotor**
Maximum range (miles)	1,226	455	852
Maximum cruise speed	270	140	316
Useful load (lbs.)	1,700	690-1300	5,500
Operational ceiling (ft.)	27,000	13,500	25,000
Navigation	IFR	IFR	IFR
Crew required	1-2	1-2	1-2
Passenger Seating	up to 7	up to 4	up to 9
Pressurized cabin	yes	no	yes
Facility Requirements	min. 2,150 ft. runway	3,600 sq. ft.	22,500 sq. ft. vertiport
Cost	$196,170	$900,000	$8-10 million

Compiled by HDR Alaska, Inc.

IMPLICATIONS FOR THE PRINCE WILLIAM SOUND/COPPER RIVER AREA

Few communities in the Prince William Sound/Copper River area rely solely on commuter air service for transportation. Current transportation demands from the isolated PWS/CR communities could be adequately accommodated with Tiltrotor aircraft, and the potential exists for providing an even higher quality of service than is currently experienced. Tiltrotor aircraft have the advantage of vertical takeoffs and landings. Yet, they are still capable of standard fixed-wing takeoffs and landings and would require minimal or potentially no runway modification. The vertical maneuvers of a tiltrotor aircraft could possibly be accommodated with existing helicopter pads or other designated landing sites with little or no modification.

Though tiltrotor technology could prove advantageous to a few communities in the Prince William Sound/Copper River area, is not likely to become economically feasible over the next

20 years. The initial capital investment ($8 million to $10 million per plane) and operation and maintenance costs for tiltrotor service both greatly exceed current fleet costs. Existing air carriers would not likely select tiltrotor aircraft for service because of the substantial capital investment and prohibitive operation and maintenance costs.

HIGH-PERFORMANCE MARINE CRAFT

Over the past ten years, high-performance marine craft have emerged as a viable transportation mode in markets worldwide. They have done so by demonstrating that they can compete successfully, both as passenger-only transportation elements and in carrying both vehicles and passengers. High-performance marine craft operations in general entail lower initial capital costs, potentially lower labor costs, but higher fuel and maintenance costs than conventional monohulls (Table 2). This combination of cost factors has made high-performance marine craft most suitable for high volume markets where riders will pay a premium for speed. Markets that meet these criteria typically connect large population and economic centers and often have a significant commuter traffic elements. Neither of these characteristics applies to Prince William Sound. For the purposes of this study, high-performance craft can be categorized depending on what they are designed to carry:

- passengers only;
- passengers and automobiles, but not heavy trucks; or
- passengers and all classes of RoRo traffic, including heavy trucks.

Table 2
Advantages and Disadvantages
of High-Performance Marine Craft

Advantages	Disadvantages
1. Fast ferry implementation could allow more terminals to be served by fewer boats under existing service levels.	1. Fast ferries require approximately 3.5 times more fuel than conventional ferries with the same vehicle capacity.
2. Because of their speed, the number of arrivals and departures of fast ferries on a given route typically increases by a factor of two or more, resulting in more frequent service and higher passenger and vehicle carrying capacity.	2. Fast ferry operation requires more intensive management because of the high volume of passengers, the higher level of service provided, the general pace of operations, and the sensitivity of the highly stressed mechanical systems
3. Crewing costs are reduced because of (1) the lack of accommodation services required; and (2) route operation as day boats, which means that crews can go home at the end of the day.	3. Fast ferries, which are comprised principally of aluminum, rather than steel, have service lives about half as long as conventional ferries (30 years compared to 50-60 for conventional ferries).
4. Capital costs are significantly lower for fast ferries. On a per vehicle-space basis, conventional ferries of similar capacity cost at least twice as much to build as fast ferries.	

Regarding advantages 3 and 4 (Table 2), a couple of caveats are in order. Claims regarding fast ferries' lower capital and operating costs must be qualified. While these claims are valid for routes that are too long for day boat service (i.e., >12 hours), when served by conventional displacement monohull vessels, they do not hold true where distances are short enough to operate a conventional vessel as a 'day boat,' in which case both capital and crewing costs are comparable to those of a high-performance vessel. The advantage claimed for high-speed ferries, that the "crew can go home at the end of the work day," is really an advantage of 'day boat' service. As such, that claimed advantage holds true for both conventional and high-performance ferries engaged in 'day boat' service. The true advantage of fast ferries is that they can operate as 'day boats' on longer routes because they can make the round trips faster, and under the 12-hour threshold that delimits the feasibility of such service.

IMPLICATIONS FOR PRINCE WILLIAM SOUND

There are no insurmountable technical, environmental, or financial barriers to the application of many of the current high-performance marine craft concepts on Prince William Sound. With the future opening of the Whittier Tunnel to automotive traffic, a fast marine link between Cordova and Whittier, and perhaps between Valdez and Whittier, could provide attractive vehicular access between those communities and Anchorage. Sea miles between Cordova, Valdez and Whittier are shown in Table 3, while sailing time between Prince William Sound ports as a function of speed is shown in Table 4.

Table 3
Sea Miles between PWS AMHS Ports

	Cordova	Valdez	Whittier
Cordova		74	97
Valdez	74		78
Whittier	97	78	

Table 4
Sailing Time between PWS Ports as a Function of Speed

	Cordova			Valdez			Whittier		
	12 kts	24 kts	36 kts	12 kts	24 kts	36 kts	12 kts	24 kts	36 kts
Cordova				6 h 10 m	3 h 5 m	2 h 4 m	8 h 5 m	4 h 3 m	2 h 42 m
Valdez	6 h 10 m	3 h 5 m	2 h 4 m				6 h 30 m	3 h 15 m	2 h 10 m
Whittier	8 h 5 m	4 h 3 m	2 h 42 m	6 h 30 m	3 h 15 m	2 h 10 m			

Compared to a conventional displacement monohull with a 12-knot service speed, a high-performance vessel that can provide a 36-knot service speed can reduce sailing time by four hours or more between these ports. In the case of a one-way voyage between Cordova and Whittier with an intermediate stop at Valdez, the sailing time saved is over eight hours (Table 5).

Table 5
PWS Sailing Time Savings due to High-Performance Vessels

	Conventional Ferry @ 12 knots	High-Performance Vessel @ 36 knots	Time Saved
Cordova to Valdez leg	6h 10m	2h 4m	4h 6m
Valdez to Whittier leg	6h 30m	2h 10m	4h 20m
TOTAL	12 h 40 m	4 h 14m	8h 26m

Important advantages in vessel staffing and labor costs may accrue if complete round trips (or multiples thereof) can reliably be accomplished in under 12 hours. The most challenging Prince William Sound service would be a round trip from Cordova to Valdez to Whittier and back (return port calls in reverse sequence), which entails a round trip distance of 304 nautical miles. If 10 minutes were allowed for each slow speed maneuvering and the associated docking and undocking evolution, and 25 minutes were allowed in each port for loading and discharge, then a 36-knot vessel could accomplish this round trip in 11 hours and 13 minutes. If maneuvering/docking time could be reduced to 5 minutes and loading/discharge time to 20 minutes, a 36-knot vessel could accomplish the round trip in a little over 10.5 hours (Table 6).

Table 6
Breakdown of Time Required to Make a Round Trip Loop Cordova-Valdez-Whittier via a High-Performance Vessel

	Standard; Slow maneuvering and load/unload time	Faster; Slow maneuvering and load/unload time
Loading in Cordova	25	20
Cordova to Valdez leg	124	124
Slow speed maneuvering and docking at Valdez	10	5
Unloading/loading in Valdez	25	25
Valdez to Whittier leg	130	130
Slow speed maneuvering and docking at Whittier	10	5
Unloading/loading at Whittier	25	20
Whittier to Valdez leg	130	130
Slow speed maneuvering and docking at Valdez	10	5
Unloading at Valdez	25	20
Valdez to Cordova leg	124	124
Slow speed maneuvering and docking at Cordova	10	5
Unloading at Cordova	25	20
TOTAL (minutes)	673	633
Minutes/60	11.22	10.55
Hour-minute conversion	11h 13m	10 h 33m

The expected 25-year extreme significant wave height in central Prince William Sound is 14.4 feet (low Sea State 6), and the annual 99th percentile significant wave height is approximately 9 feet (low Sea State 5). Several types of modern high-performance vessels could operate successfully in this wave environment, including fast monohulls, wave-piercing catamarans and semi-SWATHS. Each of these high-performance vessel types is available three configurations; i.e., 1) passenger-only; 2) passenger and automobiles, but no heavy trucks; and 3) passenger and all classes of RoRo (roll-on/roll-off) vehicles, including heavy trucks. Existing AMHS vessels, using conventional displacement monohull (low speed) technology, offer served for passenger and all classes of RoRo traffic, including heavy trucks.

If high-performance marine service were required to carry passengers and all classes of RoRo traffic, including heavy trucks, then, based on the design examples currently available in the world market, it is anticipated that the fast monohull would be on the order of 100 m in length; a wave-piercing catamaran would be on the order of 70 to 80 m in length; and the semi-SWATH would be on the order of 90 to 100 m length (Table 7).

Table 7
Carrying Capability and Approximate Length of High-Performance Marine Vessels

Carrying Capability	**Fast Monohull**	**Wave-Piercing Catamaran**	**Semi-SWATH**
Passengers and all classes of RoRo traffic, including heavy trucks	100 m	70-80 m	90-100 m
Passengers and autos, but not heavy trucks	60 m	50-60 m	50-70 m
Passengers only	40-50 m	30-40 m	35-45 m

If high-performance marine service were required to carry passengers and automobiles, but not heavy trucks, then, based on the design examples currently available in the world market, it could be anticipated that the fast monohull would be on the order of 60 m in length; a wave-piercing catamaran would be on the order of 50 to 60 m in length; and a semi-swath would be on the order of 50 to 70 m length.

If high-performance marine service were required to carry passengers only, then it could be anticipated that the fast monohull would be on the order of 40-50 m in length; a wave-piercing catamaran would be on the order of 30-40 m in length; and a semi-SWATH would be on the order of 35 to 45 m in length.

Large vessels capable of handing passengers and all classes of RoRo traffic, including heavy trucks, should have 100 percent environmental operability in the Prince William Sound operating area. The mid-sized vessels capable of handling passengers and automobiles, but not large trucks, should have environmental operability approaching 100 percent, while the smaller, passenger-only vessels may have environmental operability on the order of exceeding 99 percent (i.e., less than three days a year canceled due to weather).

Of the three high-performance vessels mentioned above, the semi-SWATH would offer the best seakeeping performance and the most comfortable ride. For passenger comfort, computer-activated ride control systems are recommended for high-speed wave-piercing catamarans or monohulls.

AIR CUSHION VEHICLES

Air cushion vehicle technology, more commonly known as hovercraft, has long been available. In principle, a hovercraft is comprised of a body or hull in which a rotor fan is mounted so that it produces an air cushion between the ground and the vehicle’s bottom surface. This air cushion allows the vehicle to hover and move over a variety of terrain. Forward propulsion, braking, and steering are performed aerodynamically by thrust impulses or lateral propellers, which are usually mounted at the vehicle’s rear. Stability is a major concern. As speed increases, so does dynamic pressure, which tends to break down the supporting air cushion. Speeds may range from 30 to 60 knots (Table 8). Hovercraft can be configured to travel over mud, marshes, ice fields, water, sand, and many other surfaces incapable of supporting a conventional vehicle. Hovercraft are capable of supporting heavy payloads in the form of passengers or cargo.

Table 8
Hovercraft Specifications
British Hovercraft Corporation, AP1-88 Passenger Ferry

Fuel Consumption (gph)	60
Endurance w/maximum fuel	6-8 hrs.
Maximum Speed (MPH)	50
Payload	16,000 lbs.
Navigation	GPS
Required Crew	1
Passenger Seating	80
Operating Noise Level	>50 dB
Operating Cost/hr (no fuel or crew)	$800
Approximate initial Capital Cost	$1.5 million

Source: US DOT. Final United States Postal Service Alaska Hovercraft Demonstration Project EA & FONSI. July 1997.

AIR CUSHION VEHICLE USE IN ALASKA

The United States Postal Service (USPS) is currently conducting a two-year demonstration project in the Yukon Kuskokwim region that provides surface class mail service, on a year-round basis, by hovercraft. This method replaces mail service previously transported by several air carriers. Mail, via the hovercraft, is distributed from the hub city of Bethel to the surrounding villages of Akiachak, Akiak, Atmautluak, Kasigluk, Kwethluk, Napkiak, Napaskiak, and Nunapitchuk. The hovercraft also provides limited passenger and freight service to these villages.

The British AP1-88 hovercraft leased from Alaska Hovercraft Ventures for this two-year demonstration project makes three scheduled runs a week between the villages. Scheduled runs to Napaskiak, Napakiak, Atmauluak, Nunapitchuk, and Kasigluk are conducted on Tuesday, Thursday, and Saturday. Kwethluk, Akiachak, and Akiak receive scheduled service on Monday, Wednesday, and Friday. Charter service is also available.

The July 1997 Final EA and FONSI for the *Alaska Hovercraft Demonstration Project*, reflect resistance to hovercraft on the part of both the general public and state and federal agencies. Concern has been expressed over the potential disturbance of nesting birds and fish due to high noise levels due to hovercraft operation. Disturbance of species and habitat used for subsistence activities is a particular issue. Another area of contention is the potential for increased bank erosion by high-energy wave action resulting from the operation and beaching of the hovercraft.

The use of hovercraft also implies a reduction in the amount of mail distributed by air to many of the communities in the region. Because an important economic component of the aviation system is mail distribution, a shift to distribution via hovercraft could have a significant impact on the demand for aviation services. The Postal Service subsidizes mail delivery via air in rural Alaska through the Bypass Mail system. If mail revenue to air taxis is decreased, ticket prices will likely increase and/or some carriers will leave the market. Higher prices due to decreasing subsidy or decreasing competition would lessen the demand for air travel in the region.

IMPLICATIONS FOR PRINCE WILLIAM SOUND/COPPER RIVER AREA

Air Cushion Vehicles were examined in the draft *King Cove to Cold Bay Transportation Needs Assessment, 1997,* but were dropped from detailed consideration because of high operating costs compared to the level of demand. Conversations with the transportation company involved in the Bethel operation indicate that "if conventional boats can operate, a hovercraft is not economical." An air cushion vehicle with the capacity for 80 passengers would require an initial capital investment of $1.5 million, and maintenance costs are estimated at $1,000 per hour. The transportation company estimates that "the craft would have to operate at capacity six times a day to make the investment economical. Capital costs do not include landside improvements that might be required to accommodate the hovercraft or its passengers or freight."

The advantages to hovercraft use occur when conventional boats cannot be used year-round or where terrain prohibits the use of other conventional craft. Because of their relatively slow speed and high operating costs, hovercraft use is more appropriate for short hauls of heavy loads over terrain inaccessible by conventional craft. Conventional boats can typically reach all of the communities in the Prince William Sound/Copper River area year round (except Chitina, which is connected by a road). Since conventional boats are more stable, cheaper to operate, and faster, widespread applicability for hovercraft use in the Prince William Sound/Copper River area is impractical. In addition, even though seas in Prince William Sound are generally well protected, the relative instability of a hovercraft during operations precludes its use in rough conditions, limiting hovercraft reliability in this area.