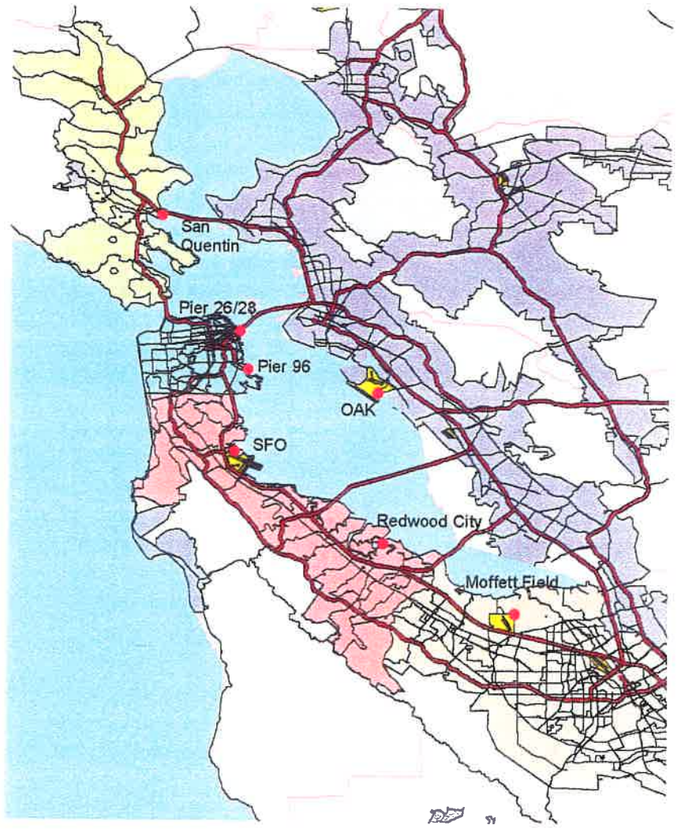
Air Cargo Shuttle Service Study

John B. Loughran & Roger L. Peters



Oakland International Airport

Oakland International Airport
Air Cargo Shuttle Service Study

August 2001

Abstract

This study analyzes the operational and economic opportunities for establishing a cargo hovercraft serving Oakland International Airport (OAK). The initial results show the broadest interest and greatest cargo volumes are between OAK and San Francisco International Airport (SFO). The potential users included in the study are air express companies and aviation suppliers, but the use of the hovercraft is not restricted to these types of firms. Based on the initial conceptual volume commitments of at least three air express companies, and the aircraft maintenance materials of at least one major airline, the conclusion of the consultant team is that the concept of an commercially operated, all-cargo hovercraft operation between OAK and SFO (and potentially other Bay points) is operationally and economically viable.

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Methodology

The airfreight data evaluated in this report has been obtained through interviews with the major air express carriers serving Oakland International Airport. These interviews have been conducted on a confidential basis so as to protect the proprietary business interests of those carriers. All cargo data in this report have been consolidated to safeguard those interests. Interviews with airport and other public government officials regarding control data and permit processes have not been treated with confidentiality.

Description of the Consulting Team

The two principal consultants, John B. Loughran and Roger L. Peters, have extensive local and regional experience in goods movement, airline and waterborne transportation, distribution systems and government relations. Significant contributions to this report, at the concept level in particular, have also been provided by Anthony Bruzzone, Pacific Transit Management.

Airfreight Cargo Analysis

Bay Area Airfreight Market

Table 1 of this report summarizes the Bay Area airfreight market. That table shows the Bay Area's three major commercial airports: San Francisco International Airport (SFO), Oakland International Airport (OAK) and San Jose International Airport (SJC) individually and combined. Since it is common in the industry to use different words for the same products and services, this table uses the following definitions:

- Air Cargo: includes total USPS mail volume, commercial airfreight, air couriers and air express.
- Freight: includes commercial airfreight, air couriers and air express, but not USPS mail.
- USPS: refers to U.S. Postal Service products.
- Freighter: refers to all-cargo dedicated aircraft that do not carry any passengers.
- Belly: refers to lower-deck bin space (below the passenger compartment flooring) for mixed luggage and commercial air cargo.

This study looked at the years 1996-1999. During that period, the Bay Area's air cargo grew between 36,000 tons (2%) and 142,000 tons (10%) per year. In 1999 SFO had a 52% share, OAK a 41% share and SJC an 8% share. All three airports exhibit healthy growth indicators.

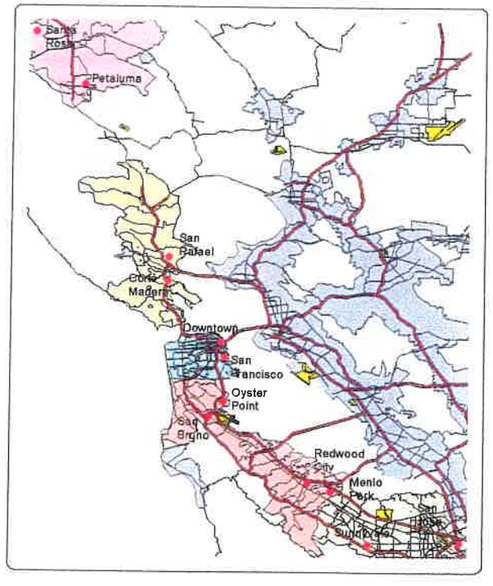
Note: Airborne has no West Coast hub, so all of its "Next Day" volume must travel to or from their main hub in Wilmington, Ohio.

Cargo Catchment Areas

Through the course of repeated and extensive interviews, the air express carriers identified the origins and destinations of cargo carried via Oakland. The following table shows the catchment areas that can serve Oakland by hovercraft. Most simply, the catchment areas represent the urbanized areas of the counties listed below.

Catchment Areas	Geographic Profile
North Bay	Sonoma and Marin Counties
San Francisco	San Francisco County
Peninsula	San Mateo County
South Bay	Santa Clara County

The various expediters serve these catchment areas from local ground service hub facilities, known as "stations" with large line-haul trucks (and aircraft from Sonoma County) to and from Oakland airport. The following map shows the catchment areas, their proxy stations and the local airports. To maintain the overall confidentiality of the expeditors, we have shown the stations in generic locations, (such as the center of a city).



Inbound and Outbound Peak Flows

For the purpose of this report, inbound airfreight is characterized as an AM Flow (the morning delivery cycle) and PM Flows (the afternoon pickup cycle). These AM and PM flows are driven by customer needs (typically the standard eight-hour business day) that, in turn, dictate the primary aircraft arrivals and departures at Oakland, as below.

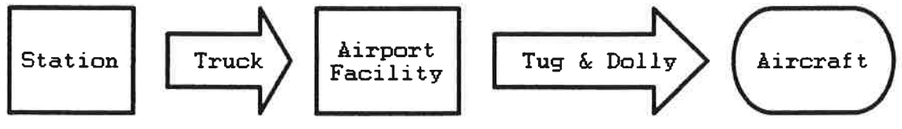
Carrier	Type	Arrivals and Departures	Days
Airborne	AM Flow	5:57 AM	Tue-Sat
FedEx	AM Flow	4:30-5:30 AM	Tue-Sat
UPS	AM Flow	3:30-4:51 AM	Tue-Sat
Airborne	PM Flow	7:15 PM	Mon-Fri
FedEx	PM Flow	7:15-8:00 PM	Mon-Fri
UPS	PM Flow	7:12 PM	Mon-Fri

Note: The Saturday inbound AM arrival shipments, not requiring delivery on Saturday morning, are held at the air express stations for delivery on Monday morning.

Stations and Existing Trucking Operations

Typically, within the various catchment areas, the expeditors use small step vans, panel trucks, bicycles, foot messengers and storefronts to receive and deliver express air cargo to and from customers on a package-by-package basis. As you would expect, the person in the small van or truck that comes to pick up and express envelope or package from your home or office is not taking it directly to the airport after seeing you. Your driver takes all of the local packages to some nearby central location "Station" to consolidate it with the volume collect by other local drivers. Stations are used to load and unload these packages to and from airfreight containers. (Other consolidations and containerizations may occur at different points and hubs on the way to the final destination). Semi-trailers are typically used to move air containers to and from Oakland airport; this is the point where the largest vehicles, loaded with containers, would be most apt to use very crowed roads and bridges. Graphically, the flow of goods from stations to the airport (PM flows) and the flows from the airport to the stations (AM flows) are shown below.

PM Flow



Note: The "non-incident" average flow times shown above do not allow for delays associated with roadway incidents, breakdowns and accidents. In effect, the above times are "non-incident, free-flowing congestion."

Landings and Potential Hovercraft Operations

Hovercraft-landing sites, "landings," serving North Bay, West Bay, South Bay and East Bay catchment areas are shown on the following map.

- In the North Bay, the San Quentin prison site has been identified as a potential ferry site should the State close the prison and develop it as a mixed-use project.

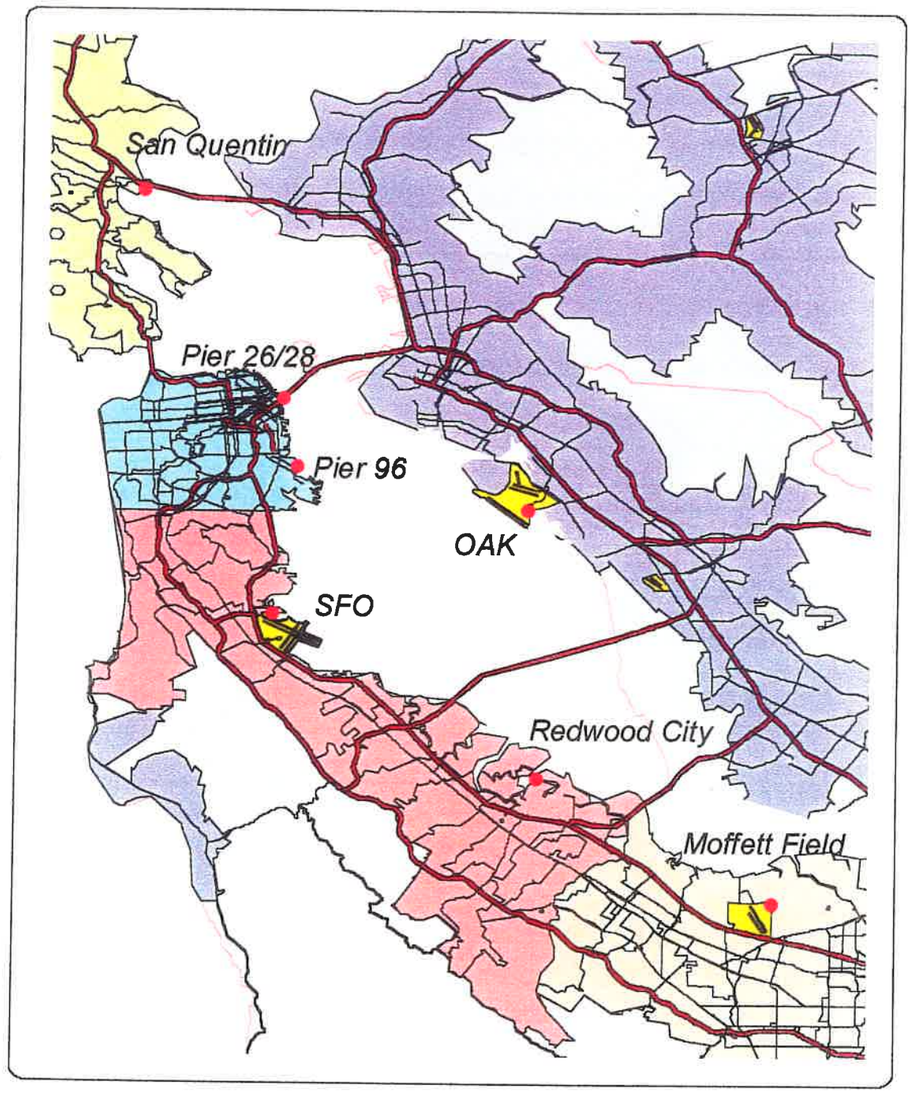
- In the West Bay, San Francisco has two potential sites: Pier 26/28 (serving downtown and the northern parts of the city) and Pier 96 (serving the southern portion of the city).

- Northern San Mateo County has a potential site at SFO's Seaplane Harbor with two alternatives: the Coast Guard Air Station and the old "PanAm" ramp.

- In southern San Mateo County, the Port of Redwood City offers waterborne access and another potential landing site.

- In the South Bay, Moffett Field has water access and is a potential site.

- Oakland airport, also located on the edge of the Bay, offers a potential landing site on the southern end of Terminal Two. The following map shows the location of these possible sites.



As the map above demonstrates, there is a great deal of water between many of the catchment areas/landing points and OAK. The table below indicates the transit time of the cargo hovercraft between these landing points and the landing point at the southern edge of OAK. The hovercraft travels in as close to a straight line as possible at

about 45 miles-per-hour. Just as in the truck times shown above, loading and unloading times are not included -- just transit times.

Hovercraft Miles and Minutes to Oakland

Landings	Miles To/From OAK Airport (Hovercraft)	Minutes To/From OAK Airport (Hovercraft)
Pier 26/28	13	17
Pier 96	11	15
SFO	12	16
OAK	0	0
Moffett Field	22	29
San Quentin	26	35
Redwood City	14	19

This next table blends the data from many of the tables shown before. It takes the direct truck times from each of the stations to OAK, then compares it to a combined time using truck to SFO, loading the hovercraft and water transit to OAK. The table determines what origin and destination catchment station locations are favored for a hovercraft run between SFO and OAK. The savings in time using the hovercraft for various locations is shown in parentheses.

Comparison of Hovercraft and Truck Times to OAK Via SFO

Station	Minutes	Station	Minutes
Santa Rosa	30	Oyster Point	(10)
Petaluma	27	San Bruno	(18)
San Rafael	47	**SFO**	(41)
Corte Madera	39	Redwood City	17
San Quentin	49	**Port RWC**	15
Downtown SF	34	Menlo Park	10
Pier 26/28	36	Sunnyvale	31
San Francisco	26	San Jose	40
Pier 96	27	**Moffett Field**	23

As you would expect, volume from SFO itself to OAK is the most favorable via hovercraft. Additionally, other points in the Upper Peninsula and lower San Francisco are favored via hovercraft. Tables containing the range of average truck speeds of 20-40 miles per hour are contained in Exhibit Tables 5-9.

Air Express Cargo Volumes

We have identified aggregate volumes of air express cargo that are attractive candidates for conversion to hovercraft. The following

table identifies these volumes of truckloads and hovercraft loads of air express cargo that would be available in each catchment area.

Composite Air Cargo Available for Hovercraft Service

Flow	Catchment Area	Filtered Trucks	Hovercraft	Flow	Catchment Area	Filtered Trucks	Hovercraft	Total Hovercraft
AM	North Bay	5	2	PM	North Bay	7	3	5
AM	SF	7	3	PM	SF	6	2	5
AM	Peninsula	9	3	PM	Peninsula	6	2	5
AM	South Bay	11	4	PM	South Bay	5	2	6
	Total	**32**	**12**		**Total**	**24**	**9**	**21**

Airfreight Cargo Capture Rate

The initial hovercraft trips shown in the table above only represent five percent of the air express freighter totals for OAK. This creates a sizable potential for growth in the short run and, as road and bridge conditions worsen over time, a mature hovercraft system should prove a viable alternative to attract significant quantities of additional cargo.

Analysis of Ancillary Cargo Potential

Airline Maintenance Materials

The primary airline maintenance company in the Bay Area is United Airlines (UA) and they have major facilities at both SFO and OAK. Their various patterns of work cause them to shuttle a wide range of company material (COMAT) items between the two airport facilities on a round-the-clock basis. At a minimum, they have two truck runs each shift, three shifts a day, seven days a week throughout the year. Other urgent parts runs are added, as needed. Also, on occasion, they need to move large outsize aircraft sections and/or engine parts across the Bay using expensive special "wide-load" trucking operations during off-peak freeway hours. Conversion of much of this parts activity to the hovercraft will help to broaden its utilization.

USPS Express and Priority Mail

At the end of August 2001, the U.S. Postal Service will begin a shared network (SNET) partnership with Federal Express. USPS will be using FedEx flights to move much of its time-specific mail throughout the USA and the FedEx OAK flight operation is the sole service point in the Bay Area. The requirements for mail transport is in reverse tempo to the usual air express company pattern, since USPS has a more manual pre-routing model than the express companies. Thus the USPS flow, as it develops within the SNET partnership, would be off-peak from the

primary urgent flow of the express companies and help broaden the hovercraft utilization.

Belly Cargoes

As you would expect, not all airlines are equally represented at both SFO and OAK for various reasons; one city might be a hub; one city might offer larger aircraft, or longer-range flights, or different points of service, or not fly to one of the cities at all. Also, a major urgent customer might want a special flight that more exactly meets their needs and it might be on the other side of the Bay. On the OAK side, Southwest Airlines has a major hub and they want to access the large airfreight forwarder community clustered around SFO with inbound and outbound cargo flow. They currently use trucking to accomplish that, but they expressed a great deal of interest in using the hovercraft as a shuttle instead. The hovercraft would appeal to various other carriers for a variety of reasons. Again, this bi-directional cargo flow would help broaden the utilization.

Analysis of Vessel Scheduling and Costs

Peak Flow Operating Schedule

The following table shows a pro forma operating schedule for one hovercraft accommodating the five identified peak flows between OAK and SFO.

AM and PM Peak Flows

Boat "A" Flow	Trip No.	SFO Arrive	SFO Load/ Discharge	SFO Depart	Transit	OAK Arrive	OAK Load/ Discharge	OAK Depart	Transit
AM	1				Idle	6:00	L (:15)	6:15	T (:16)
AM	2	6:31	D (:15)	6:46	T (:16)	7:02	L (:15)	7:17	T (:16)
AM	3	7:33	D (:15)	7:48	T (:16)	8:04	L (:15)	8:19	T (:16)
AM		8:35	D (:15)	Standby					
PM	1	15:55	L (:15)	16:10	T (:16)	16:26	D (:15)	16:41	T (:16)
PM	2	16:57	L (:15)	17:12	T (:16)	17:28	D (:15)	Idle	

Off Peak Flow Operating Schedule

The following table shows a pro forma schedule for one hovercraft accommodating the twenty-four/seven off peak flows between OAK and SFO.

Off Peak Flows

Boat "B"		SFO	SFO	SFO		OAK	OAK	OAK	
			Load and/or				Load or		
Flow	Trip No.	Arrive	Discharge	Depart	Transit	Arrive	Discharge	Depart	Transit
Off Peak	1				Repeat	5:37	D&L (:30)	6:35	T (:16)
Off Peak	2	6:51	D&L (:30)	7:21	T (:16)	7:37	D&L (:30)	8:35	T (:16)
Off Peak	3	8:51	D&L (:30)	9:21	T (:16)	9:37	D&L (:30)	10:35	T (:16)
Off Peak	4	10:51	D&L (:30)	11:21	T (:16)	11:37	D&L (:30)	12:35	T (:16)
Off Peak	5	12:51	D&L (:30)	13:21	T (:16)	13:37	D&L (:30)	14:35	T (:16)
Off Peak	6	14:51	D&L (:30)	15:21	T (:16)	15:37	D&L (:30)	16:35	T (:16)
Off Peak	7	16:51	D&L (:30)	17:21	T (:16)	17:37	D&L (:30)	18:35	T (:16)
Off Peak	8	18:51	D&L (:30)	19:21	T (:16)	19:37	D&L (:30)	20:35	T (:16)
Off Peak	9	20:51	D&L (:30)	21:21	T (:16)	21:37	D&L (:30)	22:35	T (:16)
Off Peak	10	22:51	D&L (:30)	23:21	T (:16)	23:37	D&L (:30)	0:35	T (:16)
Off Peak	11	0:51	D&L (:30)	1:21	T (:16)	1:37	D&L (:30)	2:35	T (:16)
Off Peak	12	2:51	D&L (:30)	3:21	T (:16)	3:37	D&L (:30)	4:35	T (:16)
		4:51	D&L (:30)	5:21	T (:16)	5:37	Repeat		

Operating Costs

The following tables identify the per-unit costs of the hovercraft service for the peak and off-peak operations. It is important to note that these costs only include vessel operating and amortization costs; no landside costs have been included. For this analysis, the following pro forma values are used, namely:

1. Vessel: $5,000,000
2. Useful life: 25 years
3. Crew: $70 per hour
4. Fuel & Maintenance: $330 per operating hour

Peak Flow Costs

Description	Per Year	Per Month	Unit Cost	Unit Cost
Boat "A" AM/PM Flows [1 shift]	**260 days**	**21 days**	**One Way Trip**	**Container**
Amortization	$479,096	$38,696	$230	**$14**
Crew	$145,600	$11,760	$70	**$4**
Fuel and Maintenance	$471,328	$38,069	$363	**$23**
Total	**$1,096,024**	**$88,525**	**$663**	**$41**

Off Peak Flow Costs

Description	Per Day	Per Hour	Unit Cost	Unit Cost
Boat "B" OffPeak Flows [3 shifts]	**24 hrs**	**1 hr**	**Round Trip**	**One Way Trip**
Amortization	$1,313	$55	109	**$55**
Crew	$5,040	$210	420	**$210**
Fuel and Maintenance	$2,020	$330	505	**$252**
Total	**$8,372**	**$595**	**$1,034**	**$517**

Note: Table 11 in the Appendix provides additional financial details.

Estimated Trucking Costs

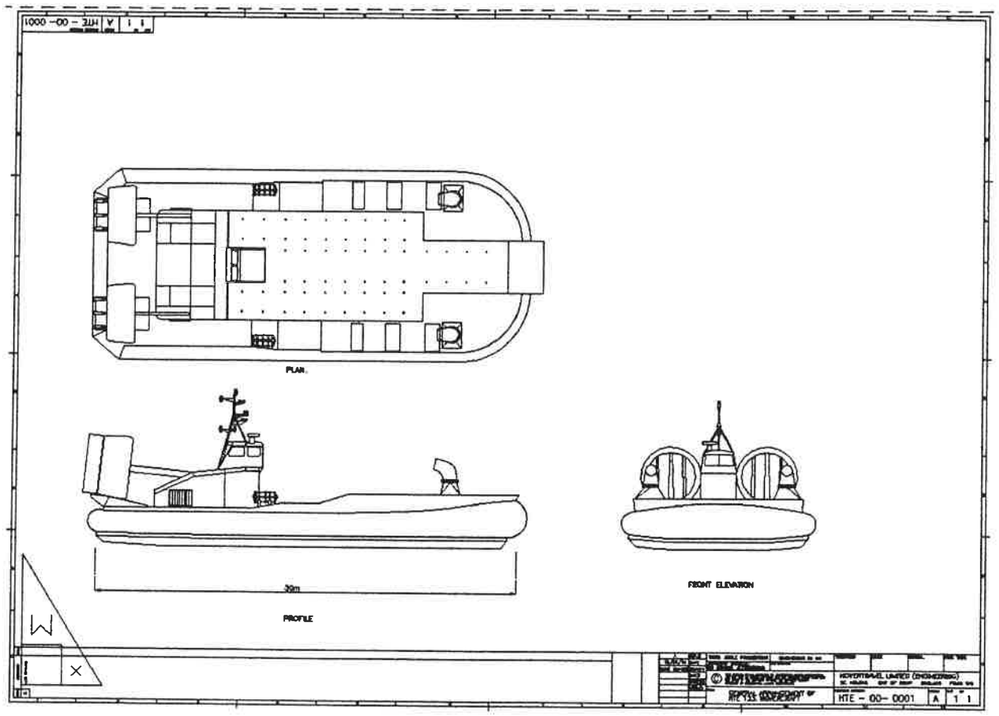
Most of the focus of this report has been time comparisons between hovercraft service and truck service, particularly as they relate to peak roadway traffic hours. Another dimension of the evaluation is to make a rough cost comparison of the two modes, to determine if price at least appears to be a neutral factor. For the express companies, it is very difficult to isolate specific costs for each truck run because each vehicle is used for many functions during each shift. Thus we consulted various air cargo trucking companies to determine the per-trip, or per-mile cost of a truck run between SFO and OAK, for example. Our CalTrans table indicates that the distance between the two airports is 33 miles, and the trucking companies estimate that the "short-haul" contract cost per mile in an urban area is about $3.50 per/mile subject to a per-round-trip minimum of about $350.00 to fully cover the cost of driver, fuel, and equipment. That per mile rate can be considerably higher if traffic slowdowns on the route are a regular and continuous phenomenon. If the $350.00 estimated minimum charge does not apply to a company owned vehicle, then the one-way cost for carrying a full load of five A-2 airline containers either way would be $115.50 @ $3.50 per mile for the full trip over, and $115.50 again to return the truck to its starting point, for a total of $231.00. Given that five containers was the full load, then each container would cost about $46.00 to move from SFO to/from OAK. That price generally coincides with the per-container operating cost estimates of a fully laden hovercraft during peak-period operation. Thus, in a broad sense, it appears that, overall, there is no direct financial penalty or advantage to the use of the hovercraft.

Vessel Capacity and General Arrangement

The following general arrangement shows the current design iteration of the HTE 133 hovercraft. Expected design modifications to the bow will allow two Type A2 airfreight containers to be loaded simultaneously thwartship (sideways) for the length of the entire cargo well. With this modification, it is expected that the cubic capacity of the hovercraft will be sixteen Type "A-2" containers (two rows of eight containers) with a payload capacity of 50,000 pounds.

The vessel well deck should have a ball-mat surface to allow for rapid aircraft-style loading and shifting between rows to quickly adjust the weight, balance and trim of the load. The ball-mat well deck should use some adaptation of aircraft locking devices as well, to insure against load shifts during hovercraft operations. Consideration should also be given to some sort of payload cover, since the

containers are not watertight and have a high percentage of printed matter.



Findings

1. Air express companies with flight operations at OAK are at a time and service advantage using the hovercraft service via SFO to and from southeastern San Francisco and the upper Peninsula during peak congestion periods on Bay Area bridges and freeways.
2. Aviation supply and maintenance companies located on or near SFO and OAK derive service benefits (particularly for urgent odd lots and oversize goods) by using the hovercraft service.
3. A preliminary two-vessel hovercraft fleet is required to provide round-the-clock service and backup operating redundancy.
4. With the projected high capital cost of each hovercraft, vessel utilization readily becomes the key variable to lowering the unit cost of each cargo container or other shipment carried.

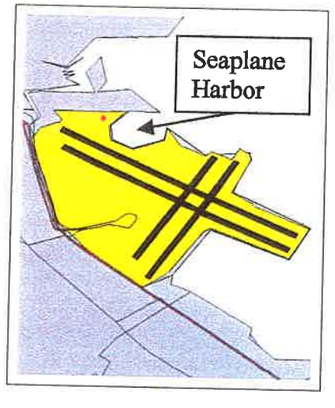
5. Differentiated cost models for peak and off-peak flows, including vessel amortization and operations, support financial feasibility.
6. After the initiation of service, adding other locations (landings) and/or other commodities to the cargo mix will further increase utilization and decrease per-unit costs.
7. Extensive time and distance truck modeling in "rush hour" traffic fully supports the timesavings potential of hovercrafts.
8. Comparisons of operating costs for inter-airport (SFO and OAK) service via truck and via hovercraft are in the same price range, so pricing should be a neutral factor.
9. Hovercraft landing sites should be on the Airport Operations Area (AOA) to facilitate turnover to the on-airport customers and to meet stringent FAA security requirements.
10. The respective airport authorities support initiation of inter-airport hovercraft service.
11. On-airport landing sites should also have means to expeditiously transfer cargo to and from trucks for off-airport customers.
12. Relocating catchment stations to hovercraft landing sites significantly improves temporal performance.

Conclusions

Preferred Preliminary Sites and Routes

Based on the scope and findings of this report, the landings considered for initiation of hovercraft service include SFO and OAK, as shown below.

San Francisco



Oakland

San Francisco Airport (SFO) >> to/from << Oakland Airport (OAK)

Next Steps

The overall purpose of this study was to determine if a cargo hovercraft operation was potentially economically feasible. During the initial contacts with each of the express companies, the promise was made by the study consultants that all air express volumes would be shown in the aggregate to maintain customer confidentiality. Potential hovercraft operators, of course, would have to evaluate the business opportunity themselves in depth. At a minimum, the following initial steps would have to be taken by the potential operator(s), as follows:

1. **COSTS:** All of the hovercraft costs used in this study were best judgment estimates based on other hovercraft operations by one of the leading builders and operators. With a unique all-cargo design and a unique application in a new setting, all of the costs should be fully examined.
2. **LOCATION:** Given that the shuttle between SFO & OAK looks to be the best initial service pattern, the potential operator should re-contact the airports and conduct a full facility evaluation, including the full cost of its operation.
3. **CUSTOMERS:** The potential primary customers that the consultants interviewed extensively should be contacted again, to insure that there have not been, or will not be shortly, shifts in flight patterns, truck patterns, or customer base requirements that would affect the volume contract commitments necessary to start service.

Process to Secure Airport Facilities & Landing Rights

Interviews with senior airport personnel at both SFO & OAK revealed the following:

1. Various airports' cargo and maintenance tenants (and potential hovercraft customers) could operate the landing facilities at each airport as a consortium of some sort, allowing it to function as an extension of the carriers' leases.
2. The landings sites could also be treated as airport common-use facilities, jointly used by all on a volume assessment basis.
3. Environmental facility review (CEQA) will probably be provided by the respective airport or covered by their existing permits. Vessel environmental review will probably be the responsibility of the potential hovercraft operator.
4. A Bay Conservation and development Commission (BCDC) permit would be required.
5. The entire design and approval process could take 18-24 months.

Process to Secure Contracts with Shippers

The purpose of this report is to analyze composite air cargo volumes and to assess hovercraft market feasibility. In interviews with prospective air express carriers, these prospective customers saw a strong potential in the use of hovercrafts. Their concerns continue to be to maintain or improve transit times between catchment areas and the airport ramp and to do this while enjoying competitive hovercraft pricing. Prospective hovercraft operators will need to prepare more thorough business and operating plans that can be reviewed by air carriers before contracts of carriage can be negotiated.

Process to Secure Contracts with Hovercraft Owner-Operator(s)

Oakland and San Francisco have both indicated that they do not intend to operate or chose an operator of the prospective hovercraft service. Rather, they are looking for potential operators who are able to:

- o Arrange for business planning and analysis,
- o Secure access to hovercraft manufacture and finance,
- o Obtain contracts of carriage with airlines, and
- o Realize the necessary environmental entitlements.

Exhibits

The following tables support the findings contained in this report.

Table 1: Bay Area Airfreight Summaries

TOTAL ALL CARGO

Airport	Year	Air Cargo Total	Air Cargo Inbound	Air Cargo Outbound	Air Cargo International	Air Cargo Domestic
SFO	1999	842,215	446,613	395,602	409,055	433,160
SFO	1998	771,920	404,750	387,170	380,498	391,422
SFO	1997	780,029	397,166	382,863	393,086	386,943
SFO	1996	711,871	349,884	361,987	361,072	350,799
OAK	1999	684,740	348,851	335,889	17,776	666,964
OAK	1998	712,674	354,023	358,651	13,760	698,914
OAK	1997	677,957	338,718	339,239	0	677,957
OAK	1996	615,076	301,460	313,616	0	615,076
SJC	1999	130,112	57,557	72,556	3,823	126,289
SJC	1998	120,968	54,537	66,430	7,917	113,050
SJC	1997	111,343	47,387	63,956	533	110,809
SJC	1996	100,386	40,221	60,166	237	100,148
Bay Area	1999	1,657,067	853,021	804,047	430,654	1,226,413
Bay Area	1998	1,605,562	813,310	812,251	402,175	1,203,386
Bay Area	1997	1,569,329	783,271	786,058	393,619	1,175,709
Bay Area	1996	1,427,333	691,565	735,769	361,309	1,066,023

USPS

Airport	Year	US Mail Total	US Mail International	US mail Domestic	US Mail Inbound Total	US Mail Inbound International	US Mail Inbound Domestic	US Mail Outbound Total	US Mail Outbound International	US Mail Outbound Domestic
SFO	1999	186,802	23,457	163,345	89,019	10,152	78,867	97,790	13,309	84,482
SFO	1998	173,065	26,660	146,405	87,033	12,889	74,144	86,032	13,771	72,261
SFO	1997	160,386	23,003	137,383	80,442	9,559	70,883	79,944	13,444	66,500
SFO	1996	147,585	22,678	124,907	74,200	9,438	64,762	73,385	13,240	60,145
OAK	1999	35,730	0	35,730	17,032	0	17,032	18,698	0	18,698
OAK	1998	38,148	0	38,148	17,996	0	17,996	20,152	0	20,152
OAK	1997	36,800	0	36,800	18,173	0	18,173	18,627	0	18,627
OAK	1996	31,115	0	31,115	15,002	0	15,002	16,113	0	16,113
SJC	1999	6,243	0	6,243	3,327	0	3,327	2,916	0	2,916
SJC	1998	7,102	0	7,102	3,629	0	3,629	3,472	0	3,472
SJC	1997	7,353	0	7,353	3,122	0	3,122	4,231	0	4,231
SJC	1996	6,334	0	6,334	2,086	0	2,086	4,248	0	4,248
Bay Area	1999	222,532	23,457	199,075	106,051	10,152	95,899	116,488	13,309	103,180
Bay Area	1998	211,213	26,660	184,553	105,029	12,889	92,140	106,184	13,771	92,413
Bay Area	1997	197,186	23,003	174,183	98,615	9,559	89,056	98,571	13,444	85,127
Bay Area	1996	178,700	22,678	156,022	89,202	9,438	79,764	89,498	13,240	76,258

FREIGHT (Not USPS)

Airport	Year	Freight Total	Freight International	Freight Domestic	Freight Inbound Total	Freight Inbound International	Freight Inbound Domestic	Freight Outbound Total	Freight Outbound International	Freight Outbound Domestic
SFO	1999	655,405	385,594	269,811	363,037	228,176	134,861	292,368	157,418	134,950
SFO	1998	598,855	353,838	245,017	317,717	201,649	116,068	281,138	152,189	128,949
SFO	1997	619,643	370,083	249,560	316,724	199,061	117,663	302,919	171,022	131,897
SFO	1996	564,286	338,394	225,892	275,684	171,131	104,553	288,602	167,263	121,339
OAK	1999	649,010	17,776	631,234	331,819	14,787	317,032	317,191	2,989	314,202
OAK	1998	674,526	13,760	660,766	336,027	10,536	325,491	338,499	3,224	335,275
OAK	1997	641,157	0	641,157	320,545	0	320,545	320,612	0	320,612
OAK	1996	583,961	0	583,961	286,458	0	286,458	297,503	0	297,503
SJC	1999	123,869	3,823	120,046	54,230	2,683	51,546	69,640	1,140	68,500
SJC	1998	113,866	7,917	105,949	50,908	4,994	41,914	62,958	2,923	60,035
SJC	1997	103,990	533	103,456	44,265	524	42,477	59,725	9	59,715
SJC	1996	94,052	237	93,814	38,135	221	38,589	55,918	16	55,902
Bay Area	1999	1,428,284	407,193	1,021,091	749,086	245,646	503,439	679,199	161,547	517,652
Bay Area	1998	1,336,474	375,515	1,011,732	704,652	217,179	483,473	682,595	158,336	524,259
Bay Area	1997	1,364,790	370,616	994,173	681,534	199,585	480,685	683,256	171,031	512,224
Bay Area	1996	1,242,299	338,631	903,667	600,277	171,352	429,600	642,023	167,279	474,744

FREIGHTER (Not USPS)

Airport	Year	Freighter Total	Freighter International	Freighter Domestic	Freighter Inbound Total	Freighter Inbound International	Freighter Inbound Domestic	Freighter Outbound Total	Freighter Outbound International	Freighter Outbound Domestic
SFO	1999	194,372	113,919	80,453	91,536	57,995	33,541	102,836	55,924	46,912
SFO	1998	145,225	71,475	73,750	69,262	43,959	25,303	71,971	**38,960**	33,011
SFO	1997	136,276	63,654	72,622	60,494	38,021	22,474	70,580	39,848	30,732
SFO	1996	92,787	41,284	51,503	38,871	24,129	14,742	53,391	30,944	22,448
OAK	1999	**642,139**	17,442	**624,697**	**328,527**	14,584	**313,943**	**313,612**	2,858	**310,754**
OAK	1998	666,322	12,527	653,795	332,112	9,832	322,280	334,210	2,695	331,515
OAK	1997	634,745	0	634,745	317,340	0	317,340	317,406	0	317,406
OAK	1996	578,121	0	578,121	283,593	0	283,593	294,528	0	294,528
SJC	1999	108,549	1,656	106,894	47,061	1,535	45,526	61,488	**121**	61,368
SJC	1998	99,719	1,418	98,301	44,575	1,281	43,295	55,144	137	55,007
SJC	1997	88,629	0	88,629	37,720	0	37,720	50,909	0	50,909
SJC	1996	80,309	0	80,309	32,016	0	32,016	48,293	0	48,293
Bay Area	1999	945,060	133,017	**812,044**	467,124	74,114	393,010	477,936	58,903	419,034
Bay Area	1998	911,266	85,420	825,846	445,949	55,072	390,878	461,325	41,792	419,533
Bay Area	1997	859,651	63,654	795,996	415,554	38,021	377,533	438,895	39,848	399,047
Bay Area	1996	751,218	41,284	709,934	354,481	24,129	330,351	396,212	30,944	365,269

BELLY (Not USPS)

Airport	Year	Belly Total	Belly International	Belly Domestic	Belly Inbound Total	Belly Inbound International	Belly Inbound Domestic	Belly Outbound Total	Belly Outbound International	Belly Outbound Domestic
SFO	1999	461,033	271,675	189,358	252,615	159,129	93,486	208,418	112,546	95,872
SFO	1998	**453,630**	**282,363**	**171,267**	**248,455**	**157,690**	**90,765**	**209,167**	**113,229**	**95,938**
SFO	1997	483,367	306,429	176,938	256,230	161,040	95,189	**232,339**	**131,174**	101,165
SFO	1996	471,499	297,110	174,389	236,813	147,002	89,811	235,211	136,319	98,891
OAK	1999	**7,003**	**369**	**6,634**	**3,389**	**204**	**3,185**	**3,614**	**165**	**3,449**
OAK	1998	8,194	1,223	6,971	3,916	705	3,211	4,288	528	3,760
OAK	1997	6,412	0	6,412	3,205	0	3,205	3,206	0	3,206
OAK	1996	5,840	0	5,840	2,865	0	2,865	2,975	0	2,975
SJC	1999	57,742	**2,168**	55,574	46,674	**1,148**	45,526	11,068	1,019	10,048
SJC	1998	**21,249**	6,500	**14,749**	9,962	3,714	**6,249**	**11,287**	2,786	**8,501**
SJC	1997	22,714	0	22,714	9,667	0	9,667	13,047	0	13,047
SJC	1996	20,077	0	20,077	8,205	0	8,205	11,873	0	11,873
Bay Area	1999	525,778	274,212	251,566	302,678	**160,481**	142,197	223,100	113,730	109,369
Bay Area	1998	**476,276**	**290,086**	**192,987**	**262,333**	162,109	**100,225**	**224,742**	**116,543**	**108,199**
Bay Area	1997	512,492	306,429	206,064	269,102	161,040	108,062	**248,592**	**131,174**	117,418
Bay Area	1996	497,415	297,110	200,305	247,882	147,002	100,881	250,059	136,319	113,739

Notes:
All values in metric tons of 2,204.159 lbs.
Air Cargo includes total US Mail (USPS), and commercial air freight, air courier and air express.
Freight includes commercial air freight, air courier and air express, not US Mail (USPS).
Freighter means a dedicated aircraft that does not carry passengers.
Belly means air freight carried in conjunction with passengers.
Reduction from prior year.

Table 2: Stations—Truck Distances and Time

Catchment Area	Stations	Truck Miles To/From OAK Airport	Truck Miles To/From SFO Airport	Truck Miles To/From SF P26/28	Truck Miles To/From SF P96	Truck Miles To/From San Quentin	Truck Miles To/From Redwood City	Truck Miles To/From Moffett
Upper North Bay	Santa Rosa	75	67	61	64	46	89	107
Upper North Bay	Petaluma	62	53	49	52	35	77	99
Lower North Bay	San Rafael	29	30	20	23	4	60	82
Lower North Bay	Corte Madera	31	27	14	17	4	57	79
Lower North Bay	**San Quentin**	27	28	17	20	0	44	58
San Francisco	Downtown SF	18	12	1	3	19	28	42
San Francisco	**Pier 26/28**	18	13	0	4	20	28	42
San Francisco	San Francisco	20	10	3	2	23	26	40
San Francisco	**Pier 96**	22	12	4	0	25	26	41
Upper Peninsula	Oyster Point	32	4	11	9	29	20	34
Upper Peninsula	San Bruno	34	2	13	12	32	17	31
Upper Peninsula	**SFO**	33	0	13	12	28	17	32
Lower Peninsula	Redwood City	32	17	28	26	46	2	15
Lower Peninsula	**Port RWC**	33	17	28	26	44	0	17
Lower Peninsula	Menlo Park	38	20	31	29	49	6	12
South Bay	Sunnyvale	39	31	41	39	59	17	8
South Bay	San Jose	35	32	48	46	66	23	12
South Bay	**Moffett**	44	32	42	41	58	17	0

Catchment Area	Stations	Truck Minutes To/From OAK Airport	Truck Minutes To/From SFO Airport	Truck Minutes To/From SF P26/28	Truck Minutes To/From SF P96	Truck Minutes To/From San Quentin	Truck Minutes To/From Redwood City	Truck Minutes To/From Moffett
Upper North Bay	Santa Rosa	150	134	122	128	92	178	214
Upper North Bay	Petaluma	125	106	98	104	70	154	198
Lower North Bay	San Rafael	59	60	40	46	8	120	164
Lower North Bay	Corte Madera	61	54	28	34	8	114	158
Lower North Bay	**San Quentin**	53	56	34	40	0	88	116
San Francisco	Downtown SF	36	24	2	6	38	56	84
San Francisco	**Pier 26/28**	36	26	0	8	40	56	84
San Francisco	San Francisco	40	20	6	4	46	52	80
San Francisco	**Pier 96**	43	24	8	0	50	52	82
Upper Peninsula	Oyster Point	64	8	22	18	58	40	68
Upper Peninsula	San Bruno	68	4	26	24	64	34	62
Upper Peninsula	**SFO**	67	0	26	24	56	34	64
Lower Peninsula	Redwood City	63	34	56	52	92	4	30
Lower Peninsula	**Port RWC**	65	34	56	52	88	0	34
Lower Peninsula	Menlo Park	76	40	62	58	98	12	24
South Bay	Sunnyvale	77	62	82	78	118	34	16
South Bay	San Jose	70	64	96	92	132	46	24
South Bay	**Moffett**	87	64	84	82	116	34	0

Inputs

MPH and MPM	30	0.50

Table 3: Trucking Times

To Oakland By Truck

Catchment Area	Station	Truck Loading	Truck Transit	Unload Trucks	T&D Transit	Available Aircraft
Upper North Bay	Santa Rosa	10	150	10	10	180
Upper North Bay	Petaluma	10	125	10	10	155
Lower North Bay	San Rafael	10	59	10	10	89
Lower North Bay	Corte Madera	10	61	10	10	91
Lower North Bay	**San Quentin**	10	53	10	10	83
San Francisco	Downtown SF	10	36	10	10	66
San Francisco	**Pier 26/28**	10	36	10	10	66
San Francisco	San Francisco	10	40	10	10	70
San Francisco	**Pier 96**	10	43	10	10	73
Upper Peninsula	Oyster Point	10	64	10	10	94
Upper Peninsula	San Bruno	10	68	10	10	98
Upper Peninsula	**SFO**	10	67	10	10	97
Lower Peninsula	Redwood City	10	63	10	10	93
Lower Peninsula	**Port RWC**	10	65	10	10	95
Lower Peninsula	Menlo Park	10	76	10	10	106
South Bay	Sunnyvale	10	77	10	10	107
South Bay	San Jose	10	70	10	10	100
South Bay	**Moffett Field**	10	87	10	10	117

Constants and Notes	Minutes
Truck Loadinig	10
Unload Trucks	10
Load Hovercraft	15
Unload Hovercraft	15
T&D Transit	10

Bold Stations are Landings

Table 4: Landings—Hovercraft Distances and Times

Landings	Miles To/From OAK Airport Hovercraft	Miles To/From SFO Airport Hovercraft	Miles To/From SF P26/28 Hovercraft	Miles To/From SF P96 Hovercraft	Miles To/From San Quentin Hovercraft	Miles To/From Redwood City Hovercraft	Miles To/From Moffett Hovercraft
Pier 26/28	13	14	0	5	13	23	32
Pier 96	11	10	5	0	16	20	30
SFO	12	0	14	10	24	15	24
OAK	0	12	14	11	26	14	22
Moffett Field	22	24	32	30	44	12	0
San Quentin	26	24	13	16	0	34	44
Redwood City	14	15	23	20	34	0	12

Landings	Minutes To/From OAK Airport Hovercraft	Minutes To/From SFO Airport Hovercraft	Minutes To/From SF P26/28 Hovercraft	Minutes To/From SF P96 Hovercraft	Minutes To/From San Quentin Hovercraft	Minutes To/From Redwood City Hovercraft	Minutes To/From Moffett Hovercraft
Pier 26/28	17	19	0	7	17	31	43
Pier 96	15	13	7	0	21	27	40
SFO	16	0	19	13	32	20	32
OAK	0	16	19	15	35	19	29
Moffett Field	29	32	43	40	59	16	0
San Quentin	35	32	17	21	0	45	59
Redwood City	19	20	31	27	45	0	16

Inputs	MPH	MPM
Speed	45	0.75

Table 5: Time Comparison—Hovercraft v. Trucks @ 20 MPH

Catchment		Hovercraft v. Trucking Time Variance					
Area	Station	SFO	SQ	P26-28	P96	RWC	Moffett
Upper North Bay	Santa Rosa	22	(41)	4	13	88	142
Upper North Bay	Petaluma	18	(36)	6	15	90	156
Lower North Bay	San Rafael	48	(30)	18	27	138	204
Lower North Bay	Corte Madera	35	(34)	(4)	5	125	191
Lower North Bay	**San Quentin**	50	(54)	17	26	98	140
San Francisco	Downtown SF	27	48	(6)	0	75	117
San Francisco	**Pier 26/28**	31	52	(28)	4	76	118
San Francisco	San Francisco	16	55	(5)	(8)	64	106
San Francisco	**Pier 96**	17	56	(7)	(39)	59	104
Upper Peninsula	Oyster Point	(38)	37	(17)	(23)	10	52
Upper Peninsula	San Bruno	(50)	40	(17)	(20)	(5)	37
Upper Peninsula	**SFO**	(74)	30	(15)	(18)	(3)	42
Lower Peninsula	Redwood City	2	89	35	29	(43)	(4)
Lower Peninsula	**Port RWC**	(1)	81	33	27	(72)	(1)
Lower Peninsula	Menlo Park	(8)	79	25	19	(50)	(32)
South Bay	Sunnyvale	23	107	53	47	(19)	(46)
South Bay	San Jose	37	139	85	79	10	(23)
South Bay	**Moffett Field**	11	89	41	38	(34)	(135)

Table 6: Time Comparison—Hovercraft v. Trucks @ 25 MPH

Catchment	Hovercraft v. Trucking Time Variance						
Area	Station	SFO	SQ	P26-28	P96	RWC	Moffett
Upper North Bay	Santa Rosa	27	(24)	12	20	80	123
Upper North Bay	Petaluma	23	(20)	14	21	81	134
Lower North Bay	San Rafael	47	(15)	23	31	119	172
Lower North Bay	Corte Madera	37	(18)	6	13	109	162
Lower North Bay	**San Quentin**	49	(38)	23	30	88	121
San Francisco	Downtown SF	31	48	5	10	70	103
San Francisco	**Pier 26/28**	34	51	(17)	12	70	104
San Francisco	San Francisco	22	53	5	3	60	94
San Francisco	**Pier 96**	23	54	4	(26)	57	93
Upper Peninsula	Oyster Point	(21)	39	(4)	(9)	17	51
Upper Peninsula	San Bruno	(31)	41	(4)	(7)	5	39
Upper Peninsula	**SFO**	(54)	33	(3)	(5)	7	43
Lower Peninsula	Redwood City	11	80	37	32	(25)	6
Lower Peninsula	**Port RWC**	9	74	35	30	(52)	9
Lower Peninsula	Menlo Park	3	72	29	24	(31)	(17)
South Bay	Sunnyvale	28	95	52	47	(5)	(27)
South Bay	San Jose	39	121	77	73	17	(9)
South Bay	**Moffett Field**	18	81	42	40	(13)	(79)

Table 7: Time Comparison—Hovercraft v. Trucks @ 30 MPH

Catchment	Hovercraft v. Trucking Time Variance						
Area	Station	SFO	SQ	P26-28	P96	RWC	Moffett
Upper North Bay	Santa Rosa	30	(12)	18	24	74	110
Upper North Bay	Petaluma	27	(9)	19	25	75	119
Lower North Bay	San Rafael	47	(5)	27	33	107	151
Lower North Bay	Corte Madera	39	(7)	13	19	99	143
Lower North Bay	**San Quentin**	49	(27)	27	33	81	109
San Francisco	Downtown SF	34	48	12	16	66	94
San Francisco	**Pier 26/28**	36	50	(10)	18	66	94
San Francisco	San Francisco	26	52	12	10	58	86
San Francisco	**Pier 96**	27	53	11	(7)	55	85
Upper Peninsula	Oyster Point	(10)	40	4	0	22	50
Upper Peninsula	San Bruno	(18)	42	4	2	12	40
Upper Peninsula	**SFO**	(41)	35	5	3	13	43
Lower Peninsula	Redwood City	17	75	39	35	(13)	13
Lower Peninsula	**Port RWC**	15	69	37	33	(39)	15
Lower Peninsula	Menlo Park	10	68	32	28	(16)	(6)
South Bay	Sunnyvale	31	87	51	47	3	(15)
South Bay	San Jose	40	108	72	68	22	0
South Bay	**Moffett Field**	23	75	43	41	(7)	(51)

Table 8: Time Comparison—Hovercraft v. Trucks @ 35 MPH

Catchment	Hovercraft v. Trucking Time Variance						
Area	Station	SFO	SQ	P26-28	P96	RWC	Moffett
Upper North Bay	Santa Rosa	32	(4)	22	27	70	101
Upper North Bay	Petaluma	30	(1)	23	28	71	109
Lower North Bay	San Rafael	47	2	30	35	98	136
Lower North Bay	Corte Madera	40	0	17	23	91	129
Lower North Bay	**San Quentin**	48	(20)	29	35	76	100
San Francisco	Downtown SF	35	47	17	20	63	87
San Francisco	**Pier 26/28**	37	49	(5)	22	63	87
San Francisco	San Francisco	29	51	17	15	56	80
San Francisco	**Pier 96**	30	52	16	(11)	54	79
Upper Peninsula	Oyster Point	(2)	41	10	7	25	49
Upper Peninsula	San Bruno	(9)	43	10	8	17	41
Upper Peninsula	**SFO**	(31)	37	11	9	18	44
Lower Peninsula	Redwood City	21	71	40	36	(5)	17
Lower Peninsula	**Port RWC**	19	66	38	35	(30)	19
Lower Peninsula	Menlo Park	15	65	34	30	(9)	1
South Bay	Sunnyvale	33	81	50	47	9	(6)
South Bay	San Jose	41	99	68	65	26	7
South Bay	**Moffett Field**	26	71	43	42	0	(43)

Table 9: Time Comparison—Hovercraft v. Trucks @ 40 MPH

Catchment	Hovercraft v. Trucking Time Variance						
Area	Station	SFO	SQ	P26-28	P96	RWC	Moffett
Upper North Bay	Santa Rosa	34	3	25	30	67	94
Upper North Bay	Petaluma	32	5	26	30	68	101
Lower North Bay	San Rafael	47	8	32	36	92	125
Lower North Bay	Corte Madera	40	6	21	25	85	118
Lower North Bay	**San Quentin**	48	(14)	31	36	72	93
San Francisco	Downtown SF	37	47	20	23	61	82
San Francisco	**Pier 26/28**	39	49	(1)	25	61	82
San Francisco	San Francisco	31	51	21	19	55	76
San Francisco	**Pier 96**	32	51	20	(6)	53	75
Upper Peninsula	Oyster Point	4	42	15	12	28	49
Upper Peninsula	San Bruno	(2)	43	15	13	21	42
Upper Peninsula	**SFO**	(24)	38	15	14	21	44
Lower Peninsula	Redwood City	24	67	40	37	1	21
Lower Peninsula	**Port RWC**	23	63	39	36	(23)	23
Lower Peninsula	Menlo Park	19	62	35	32	(2)	7
South Bay	Sunnyvale	35	77	50	47	14	0
South Bay	San Jose	42	93	66	63	28	12
South Bay	**Moffett Field**	29	68	44	42	6	(39)

Table 10: Hovercraft Operations Sample Schedule

Boat "A"		SFO	SFO Load/	SFO		OAK	OAK Load/	OAK	
Flow	Trip No.	Arrive	Discharge	Depart	Transit	Arrive	Discharge	Depart	Transit
AM	1				Idle	6:00	L (:15)	6:15	T (:16)
AM	2	6:31	D (:15)	6:46	T (:16)	7:02	L (:15)	7:17	T (:16)
AM	3	7:33	D (:15)	7:48	T (:16)	8:04	L (:15)	8:19	T (:16)
AM		8:35	D (:15)	Standby					
PM	1	15:55	L (:15)	16:10	T (:16)	16:26	D (:15)	16:41	T (:16)
PM	2	16:57	L (:15)	17:12	T (:16)	17:28	D (:15)	Idle	

Boat "B"		SFO	SFO Load and/or	SFO		OAK	OAK Load or	OAK	
Flow	Trip No.	Arrive	Discharge	Depart	Transit	Arrive	Discharge	Depart	Transit
Off Peak	1				Repeat	5:37	D&L (:30)	6:35	T (:16)
Off Peak	2	6:51	D&L (:30)	7:21	T (:16)	7:37	D&L (:30)	8:35	T (:16)
Off Peak	3	8:51	D&L (:30)	9:21	T (:16)	9:37	D&L (:30)	10:35	T (:16)
Off Peak	4	10:51	D&L (:30)	11:21	T (:16)	11:37	D&L (:30)	12:35	T (:16)
Off Peak	5	12:51	D&L (:30)	13:21	T (:16)	13:37	D&L (:30)	14:35	T (:16)
Off Peak	6	14:51	D&L (:30)	15:21	T (:16)	15:37	D&L (:30)	16:35	T (:16)
Off Peak	7	16:51	D&L (:30)	17:21	T (:16)	17:37	D&L (:30)	18:35	T (:16)
Off Peak	8	18:51	D&L (:30)	19:21	T (:16)	19:37	D&L (:30)	20:35	T (:16)
Off Peak	9	20:51	D&L (:30)	21:21	T (:16)	21:37	D&L (:30)	22:35	T (:16)
Off Peak	10	22:51	D&L (:30)	23:21	T (:16)	23:37	D&L (:30)	0:35	T (:16)
Off Peak	11	0:51	D&L (:30)	1:21	T (:16)	1:37	D&L (:30)	2:35	T (:16)
Off Peak	12	2:51	D&L (:30)	3:21	T (:16)	3:37	D&L (:30)	4:35	T (:16)
		4:51	D&L (:30)	5:21	T (:16)	5:37	Repeat		

Notes	Min.
Load (L)	0:15
Discharge (D)	0:15
Discharge and Load (D&L)	0:30
Transit	0:16
	Trips
AM Flow HC Trips [OW]	3
PM Flow HC Trips [OW]	2
Off Peak HC Trips [RT]	12