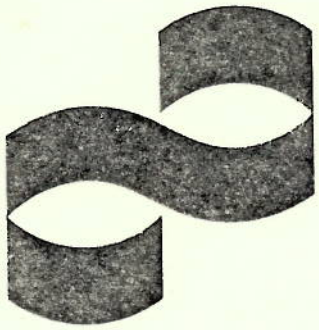


GOLDEN GATE FERRY

January 1979

GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT
P.O. Box 9000, Presidio Station San Francisco, California 94129

Foreword

From the time of the early American settlers in San Francisco, ferry service has existed on San Francisco Bay. First with sail, then with steam, and finally with diesel powered vessels that reigned supreme until completion of the Bay's two great bridges brought about their retirement (see Photo 1).

In the late 1930's, the Golden Gate Bridge and the San Francisco-Oakland Bay Bridge were opened to traffic, and the glorious days of ferry service became numbered. By the end of 1940, the only ferries operating out of San Francisco's famous Ferry Building were those of the Southern Pacific Company which traveled to the Oakland Mole, the terminus for transcontinental and northwest rail travel. Then, by 1956 these vessels, too, were gone.

It then appeared that the day of the San Francisco ferries was ended. Or was it? In this report the story of the resurgence of ferry service on the Bay is told. It has been prepared to respond to the many, and continuing requests for information about development of the innovative Golden Gate Ferry System. We hope that you will find it to be of interest.

S.M.Kowleski
Manager, Ferry Transit Division

Table of Contents

Foreword 3
List of Tables 5
List of Illustrations 5
List of Photographs 5

THE GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT 6

THE FIRST STEP INTO PUBLIC TRANSIT 7

THE TRANSIT EXPANSION PROGRAM 9

DEVELOPMENT OF THE NEW GOLDEN GATE FERRIES 10
- Designing to Meet Special Needs 10
- Waterjet Propulsion System 11
- Amenity Factor Important 12

THE FERRY TERMINALS 13
- The Larkspur Ferry Terminal 13
- Innovative Docking System 14
- Docking Requires Minimum Shoreside Personnel 15
- The San Francisco Ferry Terminal 15
- The Sausalito Ferry Terminal 16

THE FERRY SERVICE IN OPERATION 17

Appendix 18
- Tables 19
- Illustrations 21
- Photographs 23

List of Tables

1. Principal Characteristics of Vessels 19
2. Ferry Transit Operating Budget 20

List of Illustrations

1. Turbine Ferry After Section 21
2. Cutaway View of Turbine Ferry Engine Room 22

List of Photographs

1. San Francisco—1930's—Before the Bridges 23
2. San Francisco—1970's—with the Bridges 24
3. M.V. Golden Gate 25
4. G.T. San Francisco 26
5. Interior of Turbine Ferry 27
6. Interior of Turbine Ferry 28
7. Interior of Turbine Ferry 29
8. Interior of Turbine Ferry 30
9. Sun Deck on Turbine Ferry 31
10. Pilothouse on Turbine Ferry 32
11. Pilothouse on Turbine Ferry 33
12. Engine Room on Turbine Ferry 34
13. Larkspur Ferry Terminal 35
14. Larkspur Ferry Terminal 36
15. Larkspur Ferry Terminal 37
16. San Francisco Ferry Terminal 38
17. San Francisco Ferry Terminal 39

THE GOLDEN GATE BRIDGE, HIGHWAY AND TRANSPORTATION DISTRICT

The "Golden Gate Bridge and Highway District" was originally incorporated in 1928 for the purpose of building the Golden Gate Bridge to provide a highway connection between the city of San Francisco and suburban Marin County to the north. The word,"Transportation", was added to the title in 1969 when the District became an operator of a public transportation system (buses and ferries), as well as the operator of the Golden Gate Bridge, in order to deal with the growing traffic congestion in the Golden Gate Corridor.

The Golden Gate Bridge was opened in 1937. The $35 million construction cost was covered by sale of a series of bond issues. These bonds were secured by the real property of the residents of the city of San Francisco, and the more rural counties to the north of the Golden Gate straits, which are Marin, Sonoma, Napa, Mendocino and Del Norte Counties. Both the principal and the interest to retire the bonds came from toll revenues on the bridge.

On July 1, 1971 the final payment was made on the bonded indebtedness. From that moment on, the District's ability to impose taxes to support its activities was ended. At the time of the last payment, some $22.8 million remained in the treasury to enable the District to respond to the State Legislature's charge to develop transit within the corridor.

The Legislature's broadening of the District's responsibilities was an outgrowth of the realization that something had to be done about the increasing number of automobiles funneling onto the Golden Gate Bridge and into San Francisco every weekday morning. The populations of Marin and Sonoma Counties were continuing to grow and the number of commuters grew accordingly. By 1969 the Bridge was operating at theoretical capacity during the morning commute period, and even a minor accident could delay thousands of people on their way to work.

THE FIRST STEP INTO PUBLIC TRANSIT

As early as 1967 the Board of Supervisors of the City and County of San Francisco had been urging the District to institute a ferry service to and from Marin County. There was recognition of the continuing increase in commuter automobiles crossing the Golden Gate Bridge into San Francisco and their adverse impact upon the City, not to mention the contribution to air pollution being caused by some 20,000 commuter auto exhausts each morning and each evening.

In 1969, Marin and San Francisco jointly sponsored a study of water transport potential between the two counties. Arthur D. Little, Inc., the consultant for the study, reported that a ferry system could greatly reduce dependence upon the auto for commuting, and materially reduce traffic congestion on the Bridge and streets of San Francisco (see Photo 2).

There were resolutions from the San Francisco Board of Supervisors urging prompt action on the development of a ferry system. In response, the District initiated its first ferry service between San Francisco and Sausalito, which was Marin's major ferry terminus before the Golden Gate Bridge was built.

The vessel placed in that service was the M.V. Point Loma, re-christened the M.V. Golden Gate (see Photo 3), a two-engine, diesel-powered, reconditioned ship originally built in San Diego.

The inaugural run was in August of 1970, and the 575-passenger vessel has been operating seven days a week ever since, pausing only for annual trips to drydock for inspection and maintenance. In each year since the start of service the M.V. Golden Gate has carried more than one million passengers.

The success of this vessel gave further impetus toward the implementation of expanded ferry service. It was the District's first step into public transit.

In response to the State Legislature's request, a study of transit options was undertaken which proposed a number of potential solutions to future commuter growth. These included tunnels for "fixed guideway" vehicles under the Bay from Marin County to San Francisco, private right-of-ways for buses or fixed guideways in Marin County, a transit deck on the Golden Gate Bridge, and other options, all of which would be tremendously expensive. The 1970 under-the-Bay plan, for example, was priced at $987 million. A plan for buses using private right-of-ways and a second deck on the Golden Gate Bridge, was proposed to cost $495 million, and was the least expensive option.

The plans were taken to the public in a lengthy series of hearings. To put it mildly, the public was unenthusiastic. There was a consensus that no systems should be implemented that would speed the rate of population growth in Marin and Sonoma Counties. San Franciscans were almost universally against any new tunneling in the City, having already spent years of inconvenience during BART'S construction.

Literally no one spoke favorably about adding a second deck on the Golden Gate Bridge.

In sum, the District was urged to proceed with a system of buses and ferries, involving a relatively low capital expenditure, to meet the transportation needs of the future.

The Urban Mass Transportation Administration was expected to look favorably upon the need for transit facilities as well as the District's ability to match federal grants from the funds in its treasury. Also, it had become a universally accepted fact that public transit could no longer pay its own way from fare box revenues. Public transit operates at a deficit, and the District's capability of applying bridge auto tolls to meet transit deficits was a plus-factor in obtaining the needed Federal capital grants.

The alternative to no transit was another bridge across the Golden Gate, this time at a cost of hundreds of millions of dollars, and a dozen or more new freeway lanes through Marin County costing many millions more. The autos which would use these arteries would, of course, be funneled into the streets of San Francisco where they would no doubt come to a complete halt. That alternative, therefore, was not an alternative. Transit could provide the only solution.

THE TRANSIT EXPANSION PROGRAM

Early in 1971 the District submitted its report to the State Legislature indicating intention to move ahead with a two-mode transit system of buses and ferries. At the same time, application was made to the Urban Mass Transportation Administration (UMTA) for capital funding for the program.

Public hearings on the applications for the federal grants were overwhelmingly supportive, with testimony or letters from each board of supervisors in the region, from numerous cities, and many labor, civic and conservationist organizations.

The application for funds for the two-mode transit system was based upon a ferry transportation plan developed by Philip F. Spaulding and Associates (now Nickum & Spaulding), naval architects and marine engineers of Seattle, Washington and a bus transportation plan, developed by Marin County Transit District.

The bus system was the easiest and, therefore, the first to be implemented. In January 1972 the District replaced the failing Greyhound Lines in providing commuter bus service between Sonoma County, Marin County, and San Francisco. The bus fleet was to grow to 248 buses, with three permanent bus maintenance facilities. Commuter bus patronage grew within three years from the 4,000 people Greyhound was carrying to 8,800 people daily. Bus service is also provided *within* Marin County with the costs, over the amount collected from fares, subsidized by the Marin County Transit District, which obtains funds from a modest property tax levy.

The ferry system was to come next. Philip Spaulding originally proposed a fleet of six new ferries. This was scaled back to three new vessels in a revised funding application to UMTA. Another public hearing was held on the revised plan, and again there was strong endorsement by the public to move ahead with the ferry system. The Mayor of San Francisco appeared at the hearing to stress that the City had "agreed to entry of the District's buses into San Francisco only upon the express condition that the District officially commit itself to the ferry component as well."

UMTA had approved two-thirds capital funding for the District's transit programs and later agreed to pay up to 80 per cent of some of the costs. When fully implemented, the federal government will have contributed in excess of $26 million of the $38 million for the ferry capital improvement program.

DEVELOPMENT OF THE NEW GOLDEN GATE FERRIES

After considerable study it was decided that the main terminal for Marin-San Francisco ferry operations was to be located at Larkspur in Marin County (see Photo 2). The property selected is on the Bay adjacent to U.S. 101, the main highway artery, and to Sir Francis Drake Boulevard, the major east/west county arterial. The 25-acre ferry terminal site was purchased for $1.25 million.

Once determination had been made that Larkspur was to be the northern terminal, the principal parameter in the design of the optimum vessel for the service could be determined, i.e., vessel speed. The water distance from Larkspur to the Ferry Building in San Francisco is approximately 11 nautical miles. Travel time by automobile from the area to downtown San Francisco ranges from 40 to 50 minutes during commute hours. It was obvious that in order for a ferry system to even begin to be attractive to the auto commuter, the vessels within the system had to be time-competitive with the automobile. Applying the results of time and distance profiles for various vessel speeds, it was determined that, in the range of 10-12 nautical miles, a vessel with a speed of 25 knots could make the crossing from Larkspur to San Francisco in 33 minutes. Had the terminal been located farther north, advanced systems craft, such as air cushion vehicles or hydrofoils, might have been required because of their higher speed capability.

With the speed of 25 knots as a design objective, Spaulding was authorized to proceed with the final design of the optimum vessel which was to be classifed under American Bureau of Shipping rules and certificated by the U.S. Coast Guard. After extensive model testing and detailed analysis of the results, the decision was made to proceed with a semi-planing hull form in order to obtain the desired speed with maximum passenger capacity.

In order to get the best possible performance from the hull design, it was decided early in the project to use aluminum construction throughout. Aluminum, while of considerably higher initial cost, is only one-third of the nominal weight of steel. The selection of a light-weight marine aluminum alloy would enable the vessel to attain greater speeds with a given power plant. Aluminum is also easy to handle during construction, and has a high resistance to salt water corrosion which minimizes long-term maintenance cost. After sizing the market and projecting schedules, it was decided to proceed with three craft capable of carrying 750 passengers each, and to require that the vessels be less than 100 gross tons. This would permit their classification as "Small Passenger Vessels" with all of the attendant vessel construction and operating economies.

Designing to Meet Special Needs

With the tonnage, speed, displacement and passenger capacity as major guidelines, the vessel dimensions settled down to 165' LOA, 32' beam, mean draft of 6' and loaded displacement of approximately 280 long tons (see Table 1). Model testing

had shown that the hull form chosen would require approximately 2,900 effective horsepower to make the required 25 knots. Assuming a propulsive efficiency of 46%, plus 10% for other losses, the minimum installed power requirements of about 6,900 SHP was determined. Because of the vessel's comparatively small size and large passenger complement, the choice of propulsion machinery was quickly narrowed to the gas turbine engine as the most compact, lightweight, and virtually vibration-free commercial power package available. The Avco/Lycoming TF-35 gas turbine was selected as appropriate for the task, since it produces 2800 SHP at 60°F, weighs 1100 pounds, and measures only 4½'x 3'x 2½' (see Photo 12). In order to provide sufficient power, and to preserve prime passenger spaces, three such engines generating 8400 total SHP were to be installed in the stern section of the vessel (see Illustration 2).

By comparison, a high-performance diesel providing similar power would measure 21'L x 14' H x 11'W and weigh about 67 long tons. Installation of such a plant within the same hull would submerge the vessel by about 9", reduce the passenger capacity dramatically, and cut the speed to less than 21 knots (the three Golden Gate ferries have approached 30 knots at top speed). Additionally, the modular design of the Lycoming engine enables change out of any module, or even an entire engine, overnight. Schedule integrity is a must in the transportation business, so maintenance of engines cannot be allowed to interfere with a vessel's daily passenger operation. The vessels have unmanned engine rooms with sophisticated electronic display panels located on the bridge (see Photos 10 and 11) to alert the operator to any mechanical abnormalties. Each engine operates independently of the others, and the vessels are only about one-half hour from port under any condition. Through radio communication, shoreside maintenance personnel can advise vessel operators of appropriate action to take when mechanical problems arise during operations.

Two smaller Solar gas turbine "Titan" series engines are used in the ship's generating system. Each 135 HP Solar drives a 90 KW Kato generator, one of which provides for all necessary power requirements. The second Solar generating unit is on standby and programmed to provide automatic back-up within 30 seconds of failure of the working generator.

Waterjet Propulsion System

Waterjet propulsion was selected for the vessels. Waterjets mate naturally with gas turbine engines because the jet itself is a single-shaft, mixed flow pump which turns in the same direction as the engine. This system also offers the advantages of no underwater appendages, (such as propellers) reduced draft, and high maneuverability without the need for clutching mechanisms (see Illustration 1).

The waterjet pump produces thrust by means of applying a momentum change to the water passing through it. Essentially, the pump operates by drawing water through an inlet in the vessel's bottom, and an impeller accelerates the flow rate and then expels it astern. Each of the three pumps is capable of handling 65,000 gallons

of water per minute and producing 15,000 pounds of thrust at 25 knots. Steering of the vessel is accomplished by horizontal deflection of the jet stream, 35° each side of amidships. Reversing is effected rapidly by simply dropping a hinged reverse gate over the jet nozzle to deflect the flow of water in a forward direction beneath the ship's hull.

The arrangement of three gas turbine engines driving waterjet propulsors provides a large selectivity of vessel speed ranges. Since a gas turbine becomes less efficient when throttled back, speeds are adjusted for different schedule requirements by completely shutting down appropriate engines. Three engines comfortably provide speeds in excess of 28 knots (depending upon the power settings), two engines provide 21 knots, and one engine about 17 knots. The vessels are also highly maneuverable, and can easily turn within their own length.

Amenity Factor Important

It is a basic tenet in the transit industry that the speed of the vehicle, the frequency of service, the dependability of service, and the fare structure imposed upon the system, are the principal factors which affect patronage. However, in today's transit market, another important key to public acceptability, whether it be a bus, train, or ferry, is the amenity factor. The amenities relate to the attractiveness and comfort of the vehicle and to a large extent can determine the success of the system.

Realizing this, every effort was made to coordinate interior and exterior design and color schemes for each vessel. Extensive use of carpeting, individual conversation areas with comfortable first class seating, colored vinyl bulkhead covering, historical graphic displays, large viewing windows, sundeck solarium, three passenger decks, cocktail lounges on two decks and other amenities easily make the new Golden Gate Ferries the most attractive public transit vehicles in the world (see Photos 5 through 9).

THE FERRY TERMINALS

The Larkspur Ferry Terminal

The home port for the ferry fleet is the Larkspur Ferry Terminal which is located on a 25 acre site at the mouth of Corte Madera Creek in the City of Larkspur in central Marin County (see Photos 13 through 15). Early studies had indicated that approximately 50% of the total number of Marin County commuters reside within a radius of five miles of this location.

The terminal project included dredging a two mile navigation channel, construction of pile supported structures and vessel docking facilities, erection of a 16,000 square foot terminal space frame, development of a 1000 space parking lot, and restoration of a 125 acre tidal marsh. Construction of this $13.7 million project began in the fall of 1974, and all phases of the construction effort were completed in the summer of 1977, with the exception of an ongoing five-year marsh restoration program.

The Larkspur Terminal site is filled marshland, formerly within the tidal zone of San Francisco Bay. Ferry access required dreging a two mile approach channel, turning basin and berthing areas. The 250 foot width of the channel provides adequate clearance for vessels approaching from opposite directions. The channel depth is 13 feet at Mean Lower Low Water (MLLW), to accommodate the six-foot vessel draft, while providing an adequate shoaling allowance. In addition, a nine-foot minimum depth channel, 50 feet wide, was constructed south of and contiguous to the ferry channel, to provide a separate lane for the numerous small craft in the Corte Madera Creek area. Navigation aids, consisting of pile-supported lighted markers and radar reflectors, were provided at the channel entrance, and at appropriate intervals on each side of the ferry channel and small boat channels.

Dredging of the approach channel, turning basin, and berthing areas, required the removal of 1.7 million cubic yards of material.

Dredging of the downstream or east half of the channel, adjacent to the relatively deep bay water, was accomplished by the clamshell method. This excavated material was transported in bottom dump barges and deposited in San Francisco Bay, off Alcatraz Island, within a public dumping grounds designated by the U.S. Army Corps of Engineers.

Dredging of the upstream or west half of the channel, and the turning basin and berthing areas, was accomplished by the hydraulic suction method. This excavated material, considered to be polluted with heavy metals, was transported 3,000 feet by floating pipeline to a diked land-disposal site.

The California Environmental Quality Act requires that an Environmental Impact Report discuss measures to mitigate any adverse impact of a proposed project. The prime mitigation measure discussed in the Larkspur Ferry Terminal EIR for dredging

the approach channel was for restoration of a tidal marsh of 125 acres of previously diked land near the proposed terminal. The upper portion of the diked land, which comprised more than 600 acres, was the disposal site for approximately 650,000 yards of dredged material from the channel which was transported by the hydraulic suction method. The bayside of the site was developed to ensure that the finished grades and slopes were acceptable for the type of marsh vegetation to be reintroduced. Breaching of the old dikes in the summer of 1976, and the subsequent enlargement of the waters of San Francisco Bay, was heralded as an historic event. Through 1981, a restoration program involving the seeding and planting of marsh vegetation, will be monitored to produce a tidal marsh which is to be dedicated as public open space.

The unique and dominant architectural feature of the Larkspur Ferry Terminal is the 16,000 square foot triangular space frame which spans the terminal deck and passenger waiting and service areas. The space frame is an equilateral triangle 192 feet on a side at the roof line, and tapering down to three point supports 120 feet apart at the terminal deck level. Each base plate is located at the top of a four-foot deep concrete pyramid supported by three foundation piles.

Innovative Docking System

An innovative feature of the District's new ferry terminals is the vessel docking system constructed at each of the two primary berthing areas, and which was developed to satisfy the requirements of a high-speed commuter system.

Each docking system consists of two major elements: berthing facilities for the vessels and boarding facilities for the passengers.

Each berthing facility consists of two steel framed, floating camel fender sections, with each section secured into position by two 48-inch diameter steel pipe guide piles. An energy absorbing rubber fender system is provided on the outboard face to resist the ferry impact force, and to provide a configuration conforming to the ferry hull so as to securely nest the vessel during passenger handling operations. Independent bow and stern mooring dolphins provide the means for anchoring mooring lines to secure the ferry against the fender system. Pontoon flotation units for the camel fenders are shop-fabricated, epoxy-coated expanded polystyrene. Service platforms are constructed on the camel fender sections to provide access to the vessel fuel, fresh water, sanitary sewer, bilge and electrical connections, as well as for general maintenance operations.

The passenger boarding facility consists of a boarding ramp and three gangways. The boarding ramp is adjusted automatically to the proper elevation by two hydraulic cylinders, which are activated by tidal variations as the ferry docks. The steel framed, hydraulically operated, three-section, telescoping gangways are hinged to the outboard end of the boarding ramp, and physically engage the ferry browplate at the vessel's upper deck side ports. The gangways have the capability

of telescoping in excess of seven feet.

When either of the two 10-foot wide passenger gangways, or the single 5-foot wide bicycle gangway, are secured to the vessel, the gangway assumes a "free wheeling" condition. This means that the gangway will accommodate the surge, heave or rolling action of the ship during passenger handling operations.

Docking Requires Minimum Shoreside Personnel

In docking, a vessel approaching the float maneuvers with the engines to enable the deckhand stationed at the after mooring station to pick up a fixed-length stern line which is suspended on a spring-loaded boom. The boom is positioned so that it enables the deckhand to reach the eye of the suspended line from the deck of the vessel. The line is passed through a roller chock and the eye dropped over an adjacent mooring bitt. To facilitate handling this line, the bulwark is slotted vertically from the handrail to the chock, enabling the line to be dropped vertically through the bulwark to the chock with a minimum of effort. This linehandling feature is unique to the Golden Gate Ferry System, but it is expected to be adopted by others in due course.

In the near future the after mooring line boom will also have an electrical umbilical cord suspended from it. The umbilical cord, when plugged into its vessel connection, immediately provides shipboard crew control over dock lights, a bow mooring winch, and the automatic gangways of the docking system. When this installation is incorporated into the docking system, no shoreside personnel will be required for passenger handling.

The vessel then proceeds ahead slowly, and the fixed length of the stern line properly positions the passenger side ports on the vessel's upper deck in line with the gangways on the docking system. The deckhand located at the forward mooring station then pulls a boom-suspended bow-breast line through the slotted bow bulwark and secures it to the adjacent bitts. By pushing a control button located at the forward station, the deckhand activates a tensioning winch located ashore which automatically takes a pre-set strain on the line and holds it. The stern line and bow breast are the only two lines used when the vessel is operating in passenger service. The passenger side port doors are then opened and, through the umbilical system, the gangways can be brought aboard. The entire mooring and gangway system is easily handled with a minimum number of shipboard personnel.

The San Francisco Ferry Terminal

The San Francisco Ferry Terminal is behind the historic Ferry Building at the foot of Market Street and is located on and adjacent to an existing three-acre concrete platform constructed in the early '70's by the San Francisco Bay Area Rapid Transit District (BART)to protect the ventilation shaft of the transbay subaquaeous tube.

The terminal is a short walk from BART's Embarcadero Station from which trains serve the Eastbay as well as downtown San Francisco and northern San Mateo County. Also, Muni bus service is available from nearby the terminal to all of San Francisco.

A terminal plaza area of 30,000 square feet includes a one-story open concrete frame, with landscaped waiting areas, ticketing and service facilities, and administrative offices, partially covered by a 9,000 square foot roof system of open web structural steel trusses and decking. This terminal contains the same docking and mooring line handling facillities as the Larkspur Terminal.

Construction of this $2.9 million project began in early 1977 and was completed in the summer of 1978 (see Photos 16 and 17).

The Sausalito Ferry Terminal

The Sausalito Ferry terminal, which accommodates the M.V. Golden Gate is located in downtown Sausalito at the foot of Anchor Street, and adjacent to a large parking lot. The facility is a minimal one, consisting of a passenger ramp, extending down from a pier which remains from the days of the old auto ferries. A steel boarding float is held in position by pilings.

THE FERRY SERVICE IN OPERATION

The first of the new gas turbine ferries was put into operation between Larkspur and San Francisco on December 11, 1976. A second vessel was added to the daily operating schedule on March 7, 1977. A three-vessel schedule is planned for the future. However, all three vessels are presently being used in service on a rotational basis.

Passengers arrive at the Larkspur terminal either by private auto (there are nearly 1,000 parking spaces) or by ferry feeder buses. A system of eight feeder bus routes provide direct service from Marin County residential areas to the Larkspur Terminal. Buses are scheduled to meet the arrival and departure of commute-period ferries. Limited feeder service is also provided during mid-day periods.

Present commute period departures from Larkspur are at 6:05 am, 7:05 am, 7:35 am, and 8:35 am. Commute period departures from San Francisco are at 3:50 pm, 4:45 pm, 5:20 pm, 6:15 pm, 6:55 pm and 7:55 pm. During mid-day there are four additional roundtrips between the Larkspur Terminal and the San Francisco Terminal.

On Saturdays, Sundays and holidays there are four roundtrips from Larkspur, beginning at 10:50 am and concluding at 4:50 pm.

On weekdays the Sausalito ferry begins operating with a 7:15 am departure to San Francisco. There are nine roundtrips during the day. On weekends and holidays there are eight roundtrips beginning at 9:20 am and concluding at 7:40 pm.

The Golden Gate Ferries are presently carrying approximately 2.5 million passengers each year. The proposed budget (see Table 2) for fiscal year 1978-79 calls for a three vessel operation (one from Sausalito, and two from Larkspur).

Appendix
Tables 19
Illustrations 21
Photographs 23

Table 1. Principal Characteristics of Gas Turbine Vessels

The G.T. San Francisco, G.T. Marin, and G.T. Sonoma are identical in design as follows:

Length overall, molded	164'-4"
Length on subdivision water line	150'-0"
Length on operating water line	149'-1"
Breadth, extreme over guards	33;-4"
Breadth, molded on DLWL	29'-2"
Depth, molded, to Main Deck at side amidship	10'-4"
Draft OWL molded keel amidship	5'-8 ½"
Draft, subdivision	7'-0"
Design Load Waterline	6'-3"
Full displacement at Design Load Draft	281 LT
Service speed	25.0 knots
Trial speed	26.5 knots
Capacity, persons (Certified)	750
Fuel oil capacity storage at 95%	11,200 gallons
Fuel oil day tank	150 gallons
Potable water capacity	1,668 gallons

Main Propulsion Machinery
- 3 Avco-Lycoming model TF35 gas turbines, 2800 SHP each
- 3 Sier-Bath reduction gearboxes
- 3 Jacuzzi model 36YJ marine jet propulsion units

Ships Service Generators
- 2 Solar model T62T-32 gas turbines
- 2 Kato 90 KW, 450 V, 3 phase, 60 Hertz

Table 2. Ferry Transit Operating Budget

	Current Budget FY 1977-78	Proposed Budget FY 1978-79 (3 Ferry System)
OPERATING REVENUE		
Fares	2,300,000	2,541,000
Concession	258,400	250,000
TOTAL OPERATING REVENUE	**$ 2,558,400**	**$ 2,791,000**
OPERATIONS EXPENSE		
Vessel Expense		
Salaries - Crew	1,167,000	1,202,300
Fringe Benefits - Crew	247,000	256,000
Fuel	1,070,000	1,076,000
Marine Insurance	210,000	224,000
Depreciation	138,800	135,600
Operating Supplies	60,000	40,000
Bridge Craft Labor	25,000	30,000
Other	4,000	4,000
Total Vessel Expense	**$ 2,921,800**	**$ 2,967,900**
Terminal Expense		
Salaries - Administration		217,500
Fringe Benefits - Administration	570,000	44,500
Salaries - Terminal Operators		322,800
Fringe Benefits - Terminal Operators	130,000	64,600
Rents and Leases	55,000	33,000
Utilities	45,000	60,000
Telephones	24,000	20,000
Insurance	35,000	144,800
Depreciation	164,600	164,100
Janitorial	15,000	8,000
Security	25,000	30,000
Operating Supplies	60,000	75,000
Bridge Craft Labor	48,000	51,500
Other	15,000	15,000
Total Terminal Expense	**$ 1,186,600**	**$ 1,250,800**
Ferry Feeder Bus	**$ 613,000**	**$ 455,000**
Maintenance Expense		
Salaries - Administration		118,000
Fringe Benefits - Administration	400,000	26,000
Salaries - Mechanics		440,000
Fringe Benefits - Mechanics	100,000	97,000
R&M Propulsion Machinery	159,000	208,000
R&M Hull	25,000	25,000
R&M Other Vessel Systems	30,000	20,000
Drydocking	50,000	65,000
R&M Terminal Equipment	10,000	5,000
R&M Floats, Gangways, Ramps	30,000	30,000
R&M Terminal, Other	20,000	25,000
R&M Communication Equipment	5,000	5,000
Operating Supplies	20,000	20,000
Other	2,000	2,000
Total Maintenance Expense	**$ 851,000**	**$ 1,087,000**
Administrative Expense		
Salaries - Administration	78,400	83,500
Fringes - Administration	18,900	19,500
Promotional	151,000	100,000
Legal	110,000	120,000
Legislative		10,500
Audit		2,400
Operating Supplies	2,000	3,000
Other	7,000	11,000
District Division Transfer	542,000	592,000
Total Administrative Expense	**$ 909,500**	**$ 941,900**
TOTAL EXPENSE	**$ 6,481,900**	**$ 6,702,600**
OPERATING DEFICIT	**$ 3,923,500**	**$ 3,911,600**
OTHER REVENUE		
State TDA Funds	431,100	533,600
Federal Operating Assistance	248,500	227,100
TOTAL OTHER REVENUE	**$ 679,600**	**$ 760,700**
TOTAL DEFICIT	**$ 3,243,900**	**$ 3,150,900**
Passengers	2,500,000	2,535,000
Revenue per Passenger	$ 0.92	$ 1.00
Concession per Passenger	$ 0.10	$ 0.10

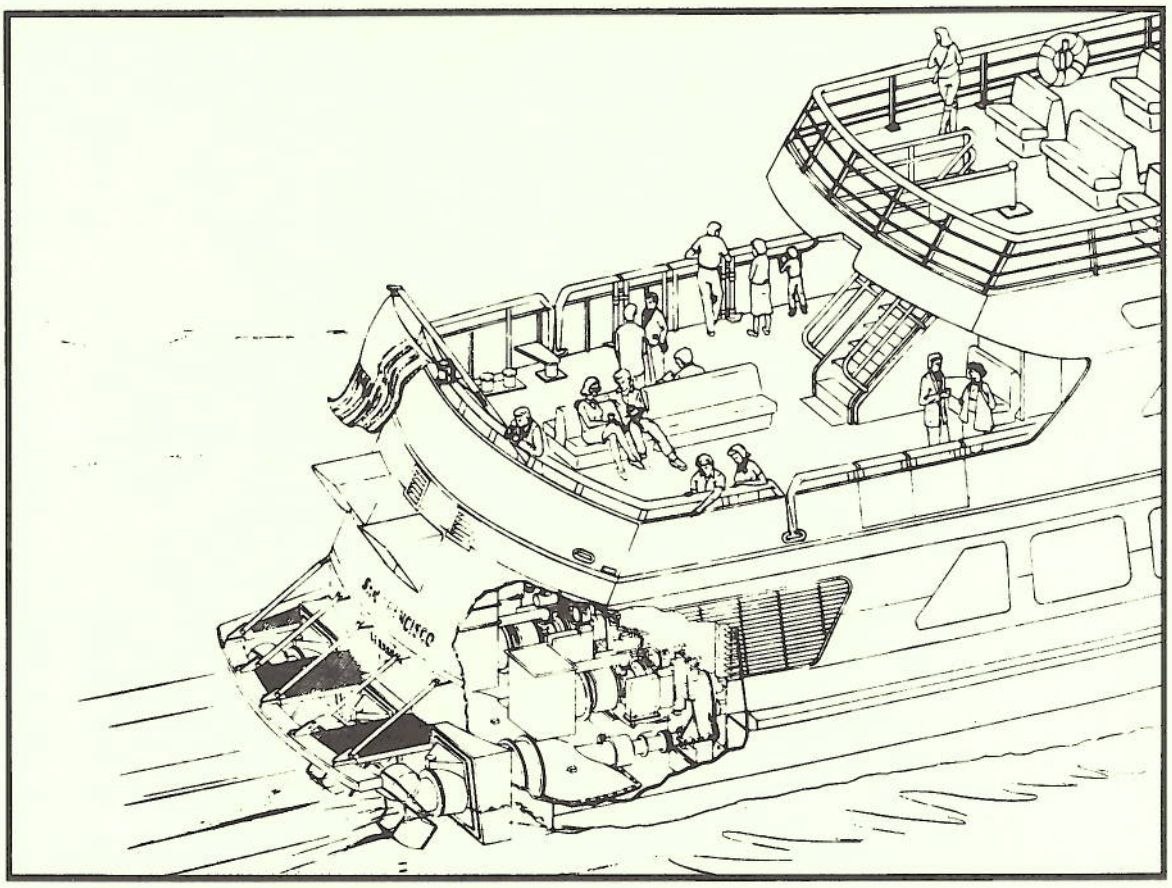


Illustration 1. Turbine Ferry After Section

After section view showing relationship of propulsion machinery to passenger space.

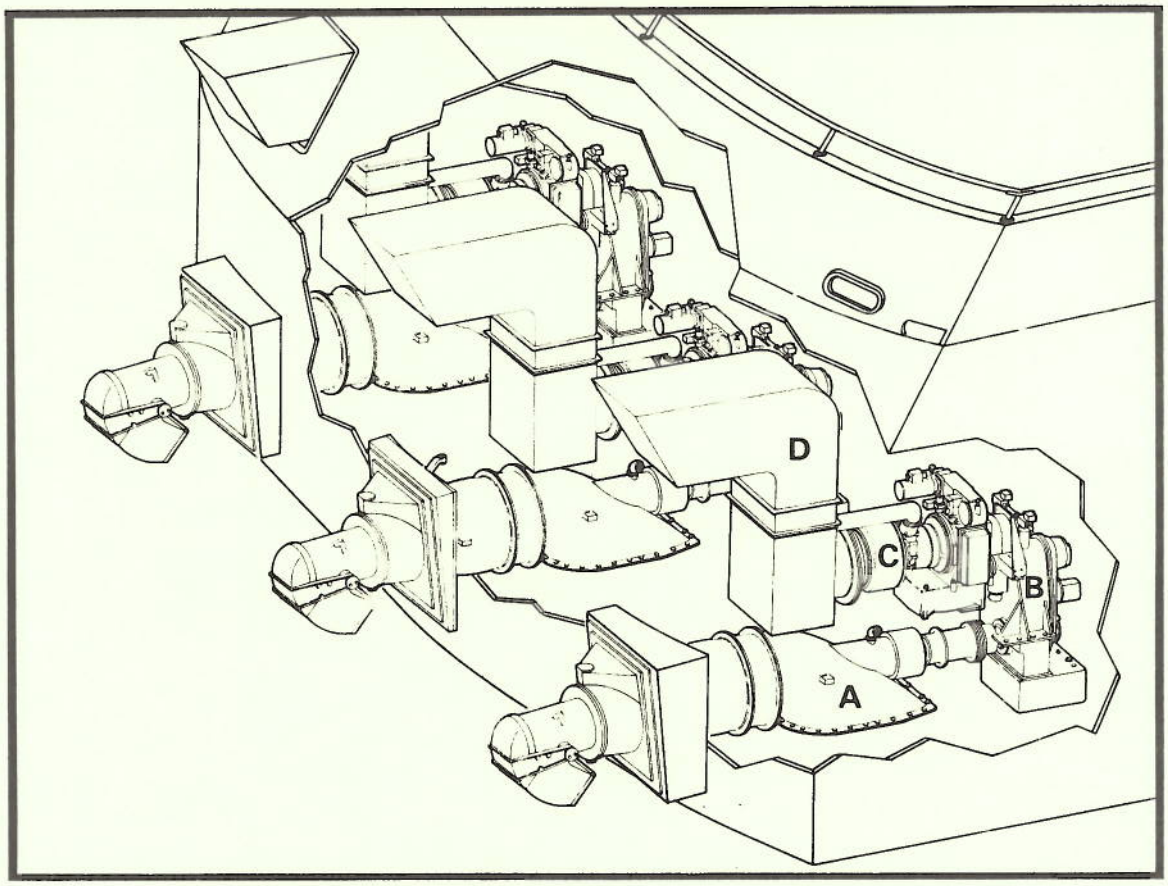
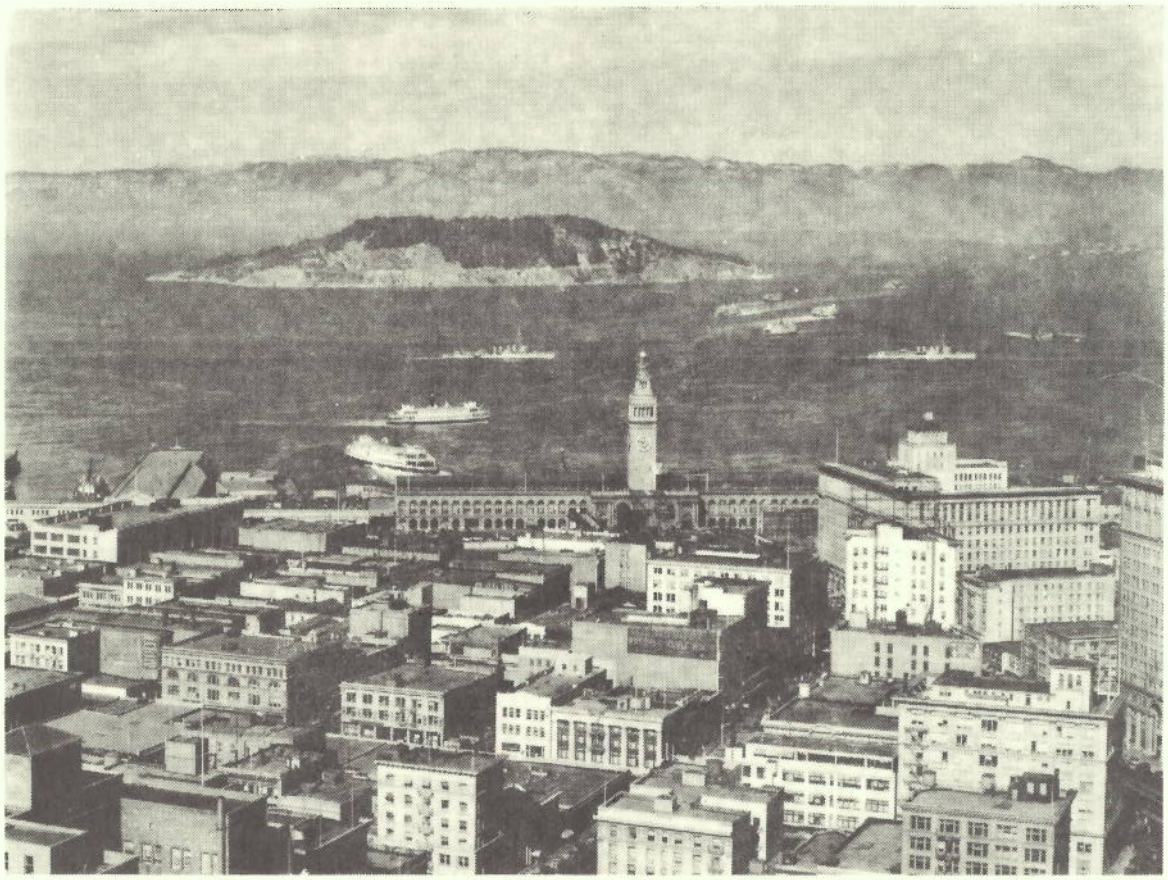


Illustration 2. Cutaway View of Turbine Ferry Engine Room

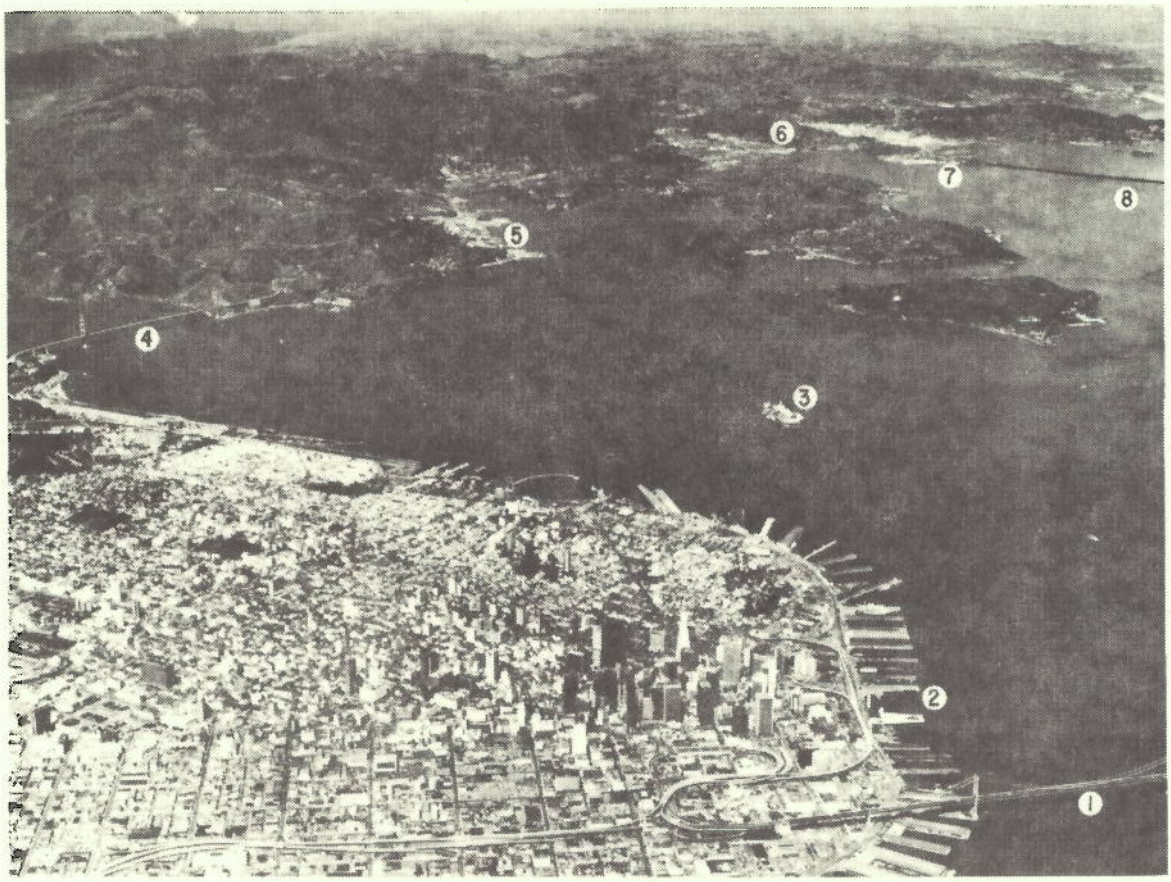
Cutaway view of engine room space on gas turbine vessel showing waterjet pump (A), reduction gear (B), gas turbine engine(C), and exhaust ducting (D).



Photograph 1. San Francisco—1930's—Before the Bridges

San Francisco Bay with the Ferry Building in the center, Yerba Buena Island beyond, and the Oakland-Berkeley hills in the distance. This photograph was taken during the early stages of construction of the San Francisco-Oakland Bay Bridge which was opened to traffic in 1937. At least ten ferries are visible in this scene.

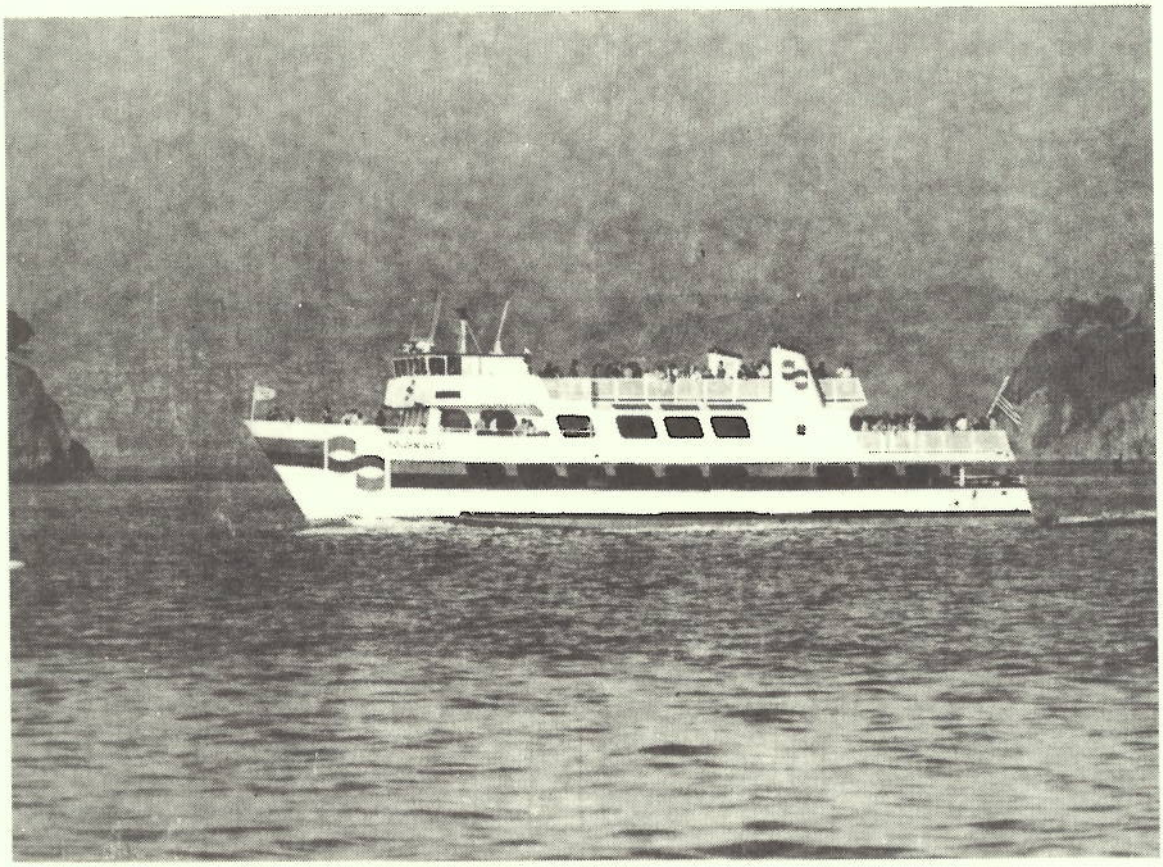
Photo: Moulin Studios, San Francisco



Photograph 2. San Francisco—1970's—with the Bridges

Aerial view of the City of San Francisco with Marin County in the upper portion of the photo and San Francisco Bay in the center. The numerals reference the following items:

1. San Francisco-Oakland Bay Bridge
2. San Francisco Ferry Building and Golden Gate Ferry Terminal
3. Alcatraz Island
4. Golden Gate Bridge
5. Sausalito Ferry Terminal
6. Larkspur Ferry Terminal
7. Point San Quentin
8. Richmond-San Rafael Bridge

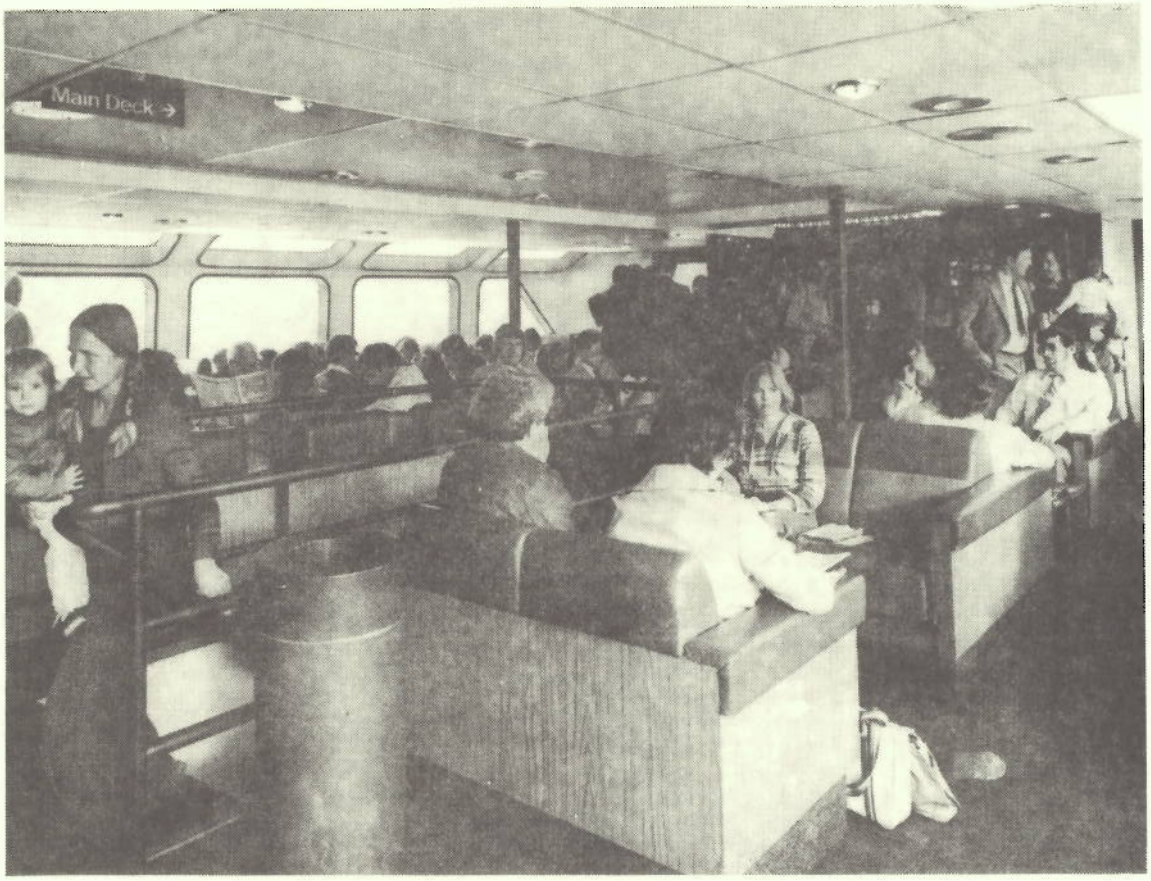


Photograph 3. M.V. Golden Gate

The M.V. Golden Gate operates daily between the San Francisco Ferry Building and central Sausalito in Marin County.

Photograph 4. G.T. San Francisco

The G.T. San Francisco during sea trials. The vessel is traveling at approximately 28 knots on three engines.



Photograph 5. Interior of Turbine Ferry

Upper deck lounge and bar area of the G.T. Marin.

Photograph 6. Interior of Turbine Ferry

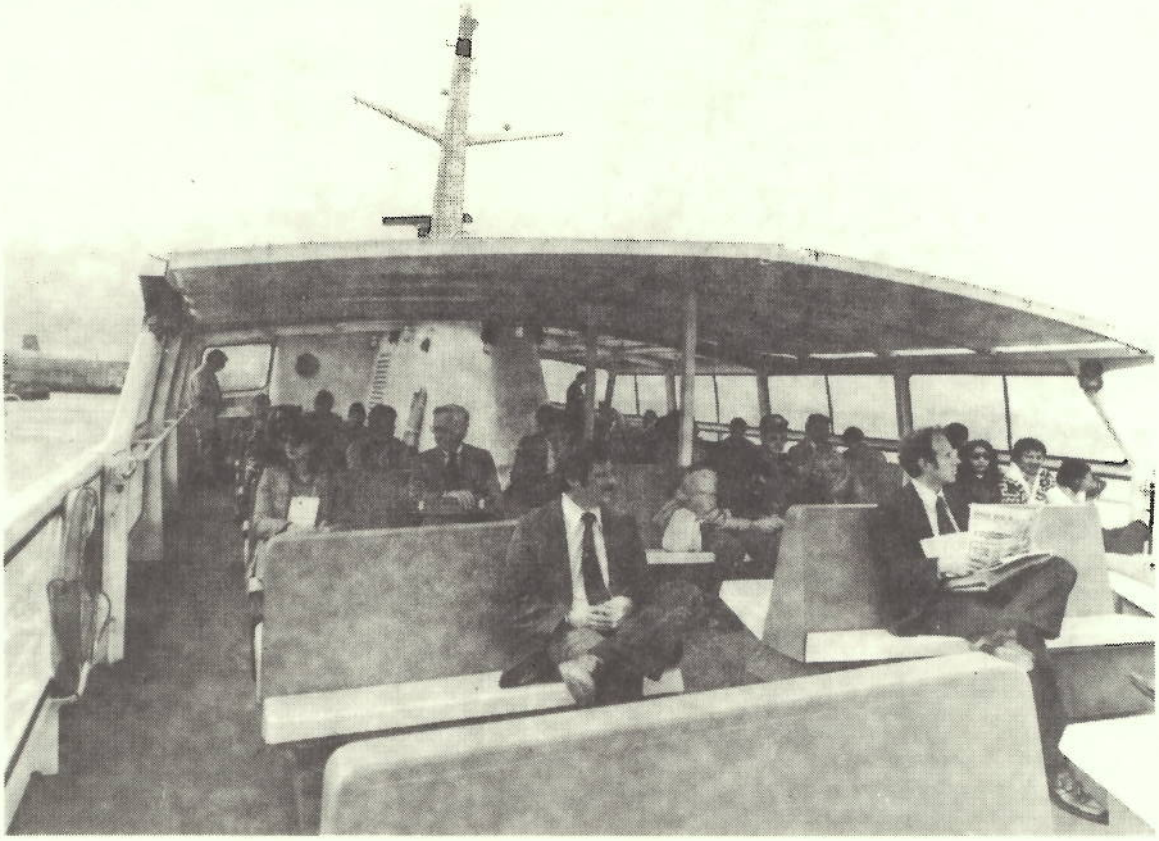
Upper deck, forward observation lounge area of the G.T. Marin.

Photograph 7. Interior of Turbine Ferry

Main deck lounge and bar area of G.T. Marin.

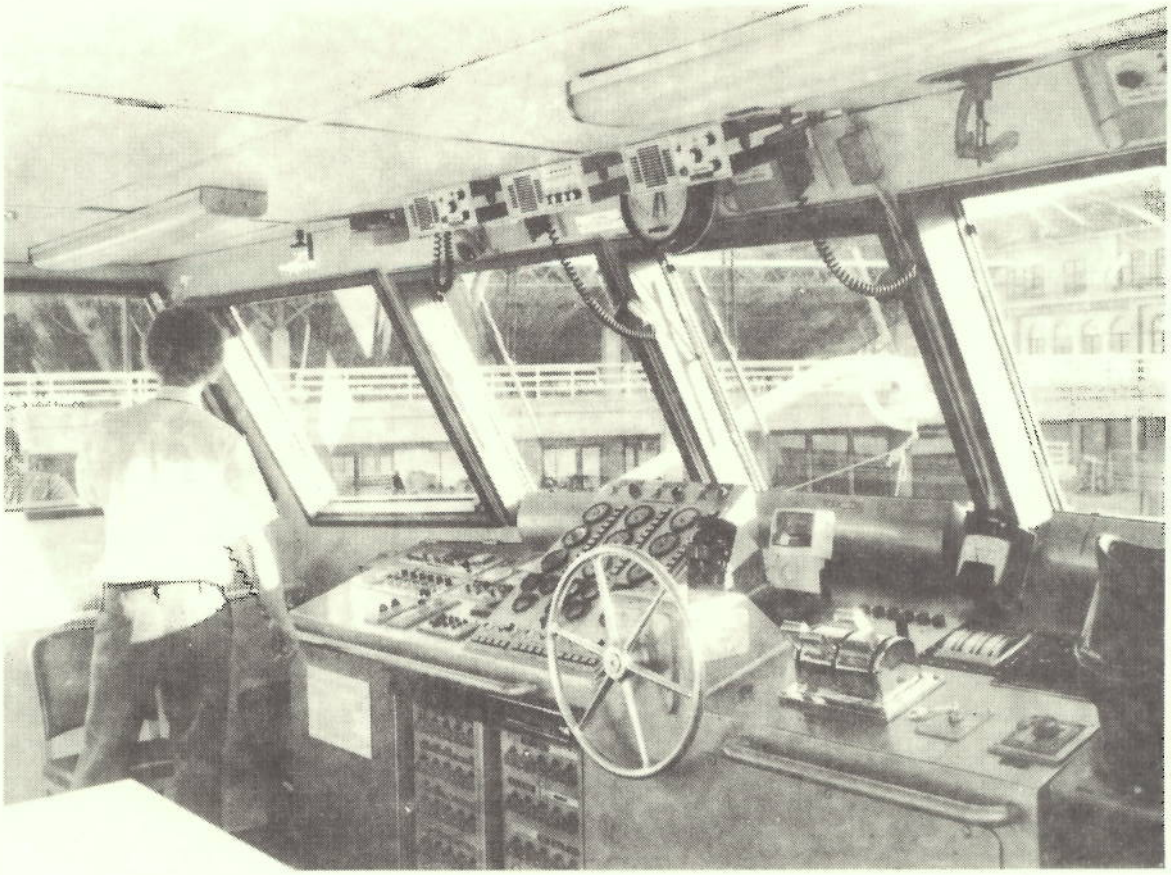
Photograph 8. Interior of Turbine Ferry

Main deck seating arrangement, looking aft, on G.T. Marin.



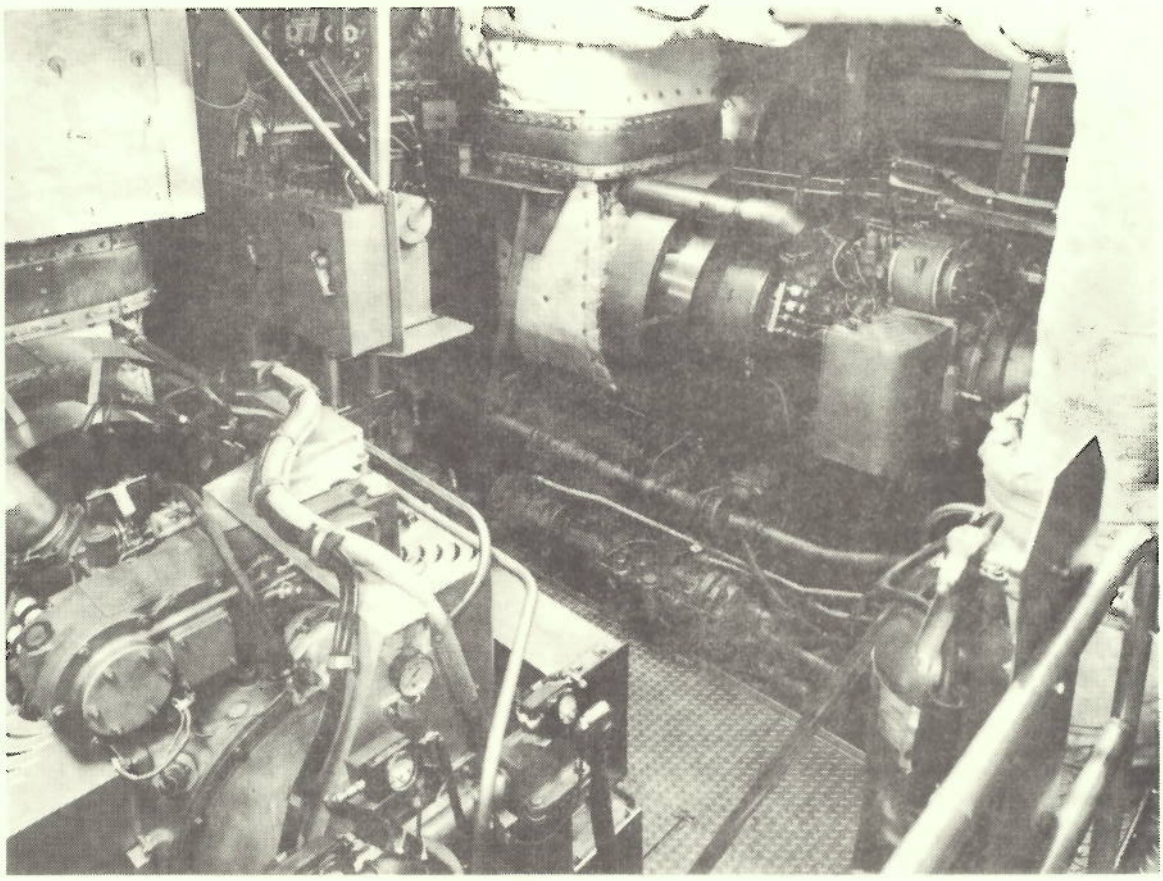
Photograph 9. Sun Deck on Turbine Ferry

Sun deck area on G.T. Marin.



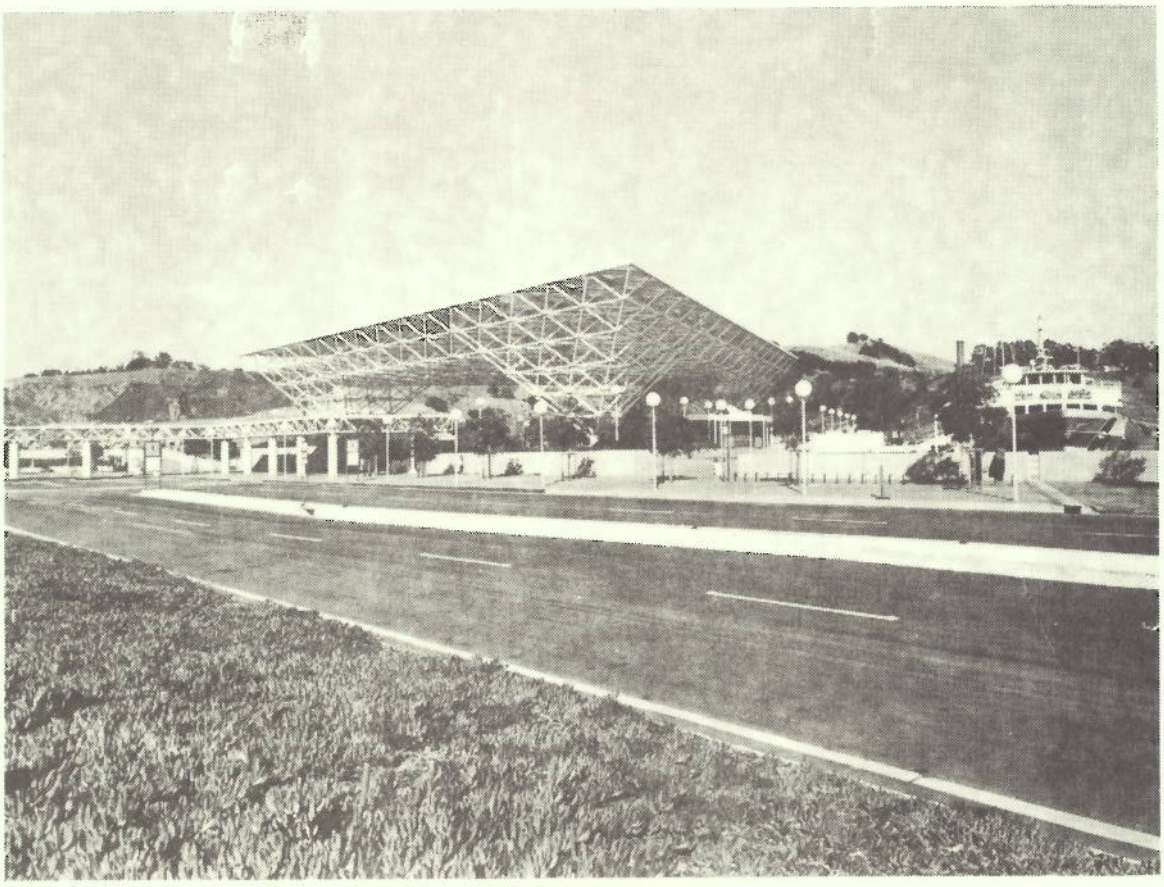
Photograph 10. Pilothouse on Turbine Ferry

Throttle controls, display and alarm panels, and wheel in pilothouse on the G.T. Sonoma.



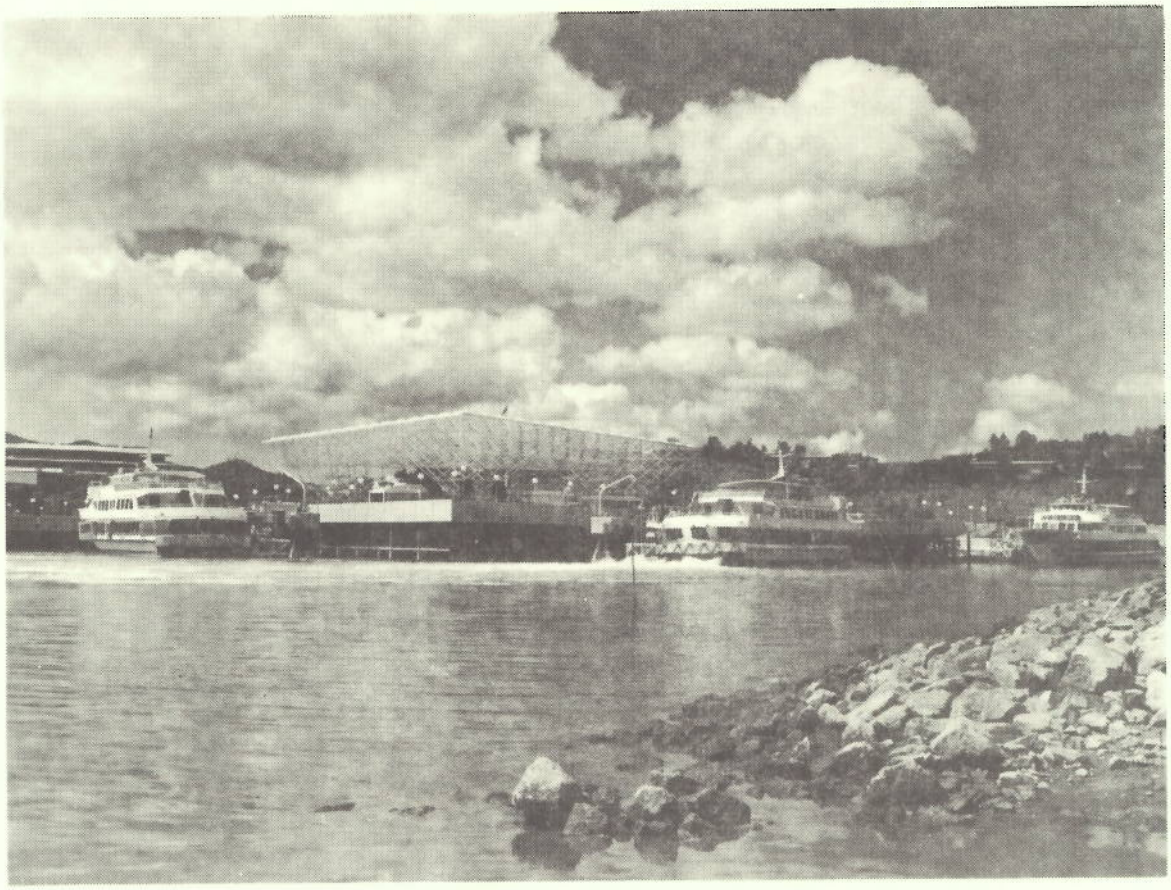
Photograph 12. Engine Room on Turbine Ferry

Engine room on the G.T. Sonoma. The view is looking aft and towards the port quarter. The port main gas turbine engine and waterjet pump are visible just right of the center of the photo. The reduction gear box for the centerline engine system is visible in the left foreground of the photo. The starboard engine system is off the picture to the left.



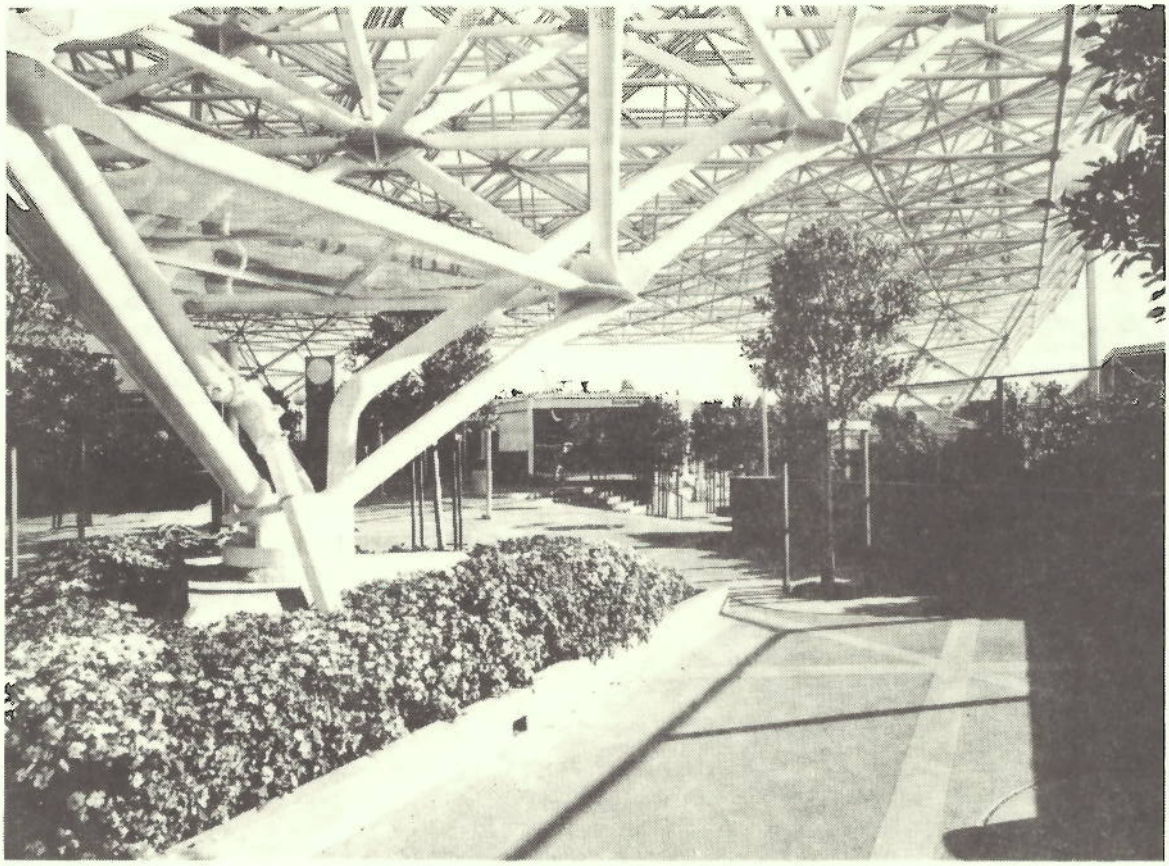
Photograph 13. Larkspur Ferry Terminal

The Larkspur Ferry Terminal structure shown from the land side. Ticketing and passenger waiting areas are under the spaceframe structure. The structure is an equilateral triangle in plan view, with ferries docking on two of the sides and passengers accessing the terminal from the third side. Passengers board feeder buses at the area in the left center of the photo or they park their cars in the 1000-car parking lot which is off the photo to the left.



Photograph 14. Larkspur Ferry Terminal

The Larkspur Ferry Terminal structure from the water side. All three turbine ferries are in port in the photo. Two vessels are at the docking facilities directly associated with the space frame structure, and the third vessel (at the right in the photo) is at the lay-up berth which can also be used for the boarding of passengers.



Photograph 15. Larkspur Ferry Terminal

Under the space frame. One of the three support points of the space frame is visible in the left center of the photo. The structural load at each of the three support points is approximately 100 tons.

Photograph 16. San Francisco Ferry Terminal

The Ferry Terminal with the clock tower of the San Francisco Ferry Building and downtown San Francisco in the background. The photo is taken from the outer-docking facility with the inner docking facility at the center of the photo. The G.T. Marin is at the inner docking facility in the process of taking on passengers.

Photograph 17. San Francisco Ferry Terminal

The Terminal with the Bay and the San Francisco-Oakland Bay Bridge in the background. The photo is taken from the top of the Ferry Building and is looking towards the southeast. Both docking facilities can be seen with the G.T. San Francisco at the inner docking facility and the M.V. Golden Gate departing from the outer one. The subaquaeous transbay tube of the BART system is directly underneath the Ferry Terminal.