

MARITIME HERITAGE OF THE UNITED STATES NHL THEME STUDY--LARGE VESSELS

FERRY BERKELEY

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United States Department of the Interior, National Park Service
National Register of Historic Places Registration Form

1. NAME OF PROPERTY

Historic Name: Berkeley

Other Name/Site Number: Ferry Berkeley

2. LOCATION

Street & Number: B Street Pier

Not for publication:

City/Town: San Diego

Vicinity:

State: CA County: San Diego

Code: 073 Zip Code: 92101

3. CLASSIFICATION

Ownership of Property
Private: X
Public-local:
Public-State:
Public-Federal:

Category of Property
Building(s):
District:
Site:
Structure: X
Object:

Number of Resources within Property
Contributing

 1

 1

Noncontributing

 buildings
 sites
 structures
 objects
 Total

Number of Contributing Resources Previously Listed in the National Register: 0

Name of related multiple property listing: _____

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6. FUNCTION OR USE

Historic: Transportation	Sub: Water-related
Current: Recreation and Culture	Sub: Museum

7. DESCRIPTION

Architectural Classification:	Materials:
<u>N/A</u>	Foundation: Wood
	Walls: Wood
	Roof: Wood
	Other Description: N/A

Describe Present and Historic Physical Appearance.

The former San Francisco Bay ferry Berkeley is now a museum vessel owned by the San Diego Maritime Museum. Moored on the San Diego waterfront near B Street Pier on North San Diego Bay, Berkeley is a historic vessel that also serves as a floating repository for the museum's collections. The ferry's passenger deck is occasionally leased for group functions.

BERKELEY AS BUILT AND MODIFIED

The double-ended, steam-powered, screw-propelled ferry Berkeley is built with a double-riveted, inner-and-outer strake steel hull with Z-bar frames and intercostal floors. The decks are wood laid over steel beams, and the hull is surmounted by a wooden superstructure. Berkeley is 289 feet long overall, with a 260-foot length at the waterline, a 40-foot moulded beam, 64-foot beam over the guards, and a 16-foot, six-inch depth of hold. Berkeley is registered at 1,883 gross tons, 1,245 net tons, and displaces 1,945 tons. The ferry was built with seating capacity for 1,750 passengers. [1]

Berkeley's double-ended hull accommodates a single screw and rudder at each end of the boat. The solid cast bronze propellers are 8 feet in diameter with a 14-foot pitch. Each screw has four blades and an expanded area of 30 and 6/10ths square feet. The direction in which the ferry headed determined the bow, and the

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forward rudder was then locked in place, dead-center, until the boat docked at the ferry terminal. The rudder was then unlocked, and the opposite rudder locked, for the ferry's return trip. Berkeley is divided by four watertight, unpierced bulkheads that extend from the keel to the main deck. These bulkheads, as well as others pierced by watertight doors, create several compartments in the steel hull, including the men's toilet (so termed on ferries as opposed to the traditional term "head" for oceangoing vessels), bar, restaurant, boiler flat, engineroom, crew berths, and athwartship coal bunkers that abut two of the solid bulkheads. The shaft, connected to a single engine, runs from one end to another along the line of the keel. Berkeley's hull does not possess an external keel, making her flatbottomed amidships. [2]

The main, or car deck extends beyond the steel hull and is supported by sponsons. Both ends of the wooden deck are open for approximately 20 feet with the exception of solid steel bulwarks and gates that close off the ends. Davits for the ferry's lifeboats are located at each end; Berkeley carried four wooden lifeboats. The car deck is divided longitudinally by a narrow steel trunk that encloses the engine hatch, boiler hatch, steering engines, and stairways that lead below to the restaurant, bar room, and men's toilet. Stairways at either end fore and aft on the centerline lead below to the crew's quarters and the locker. Two narrow teamways for wagons and automobiles line each side of the trunk. The ladies' toilet is located at what is now the starboard side adjacent to main deck passenger seating.

The second deck is taken up entirely by passenger seating; teak and perforated laminated wood benches spaced at 20-inch centers occupy the majority of the space in three rows. A small steel trunk rises through the deck near the forward end and encloses the stack. The wooden superstructure is taken up by clear glass windows at this deck. A narrow band of stained glass surmounting the deck forms a clerestory. Ornamental carvings and trusses support the arched roof. The original linoleum, with a black, red and white geometric pattern between the benches, covers the deck. Carved wood paneling, plate glass mirrors, and polished brass decorate this space. At each end the stairways from the main deck to the upper deck are also decorative; they were described in 1898 as "built of teak wood, with brass fittings,

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has ample width for a crowd, and altogether has rather an ornamental appearance." [3]

A unique engineering feature of Berkeley, namely the ventilation of the passenger deck, was described in 1899:

The columns at the sides and at the ends of the seats are all made of gas pipe, with a register at the upper end in the ornamental work, while the lower end connects with the air trunks made of steel. They pass underneath the upper deck and thus serve the double purpose of air trunks and supports to the upper deck. Below in the engineroom there is placed a ventilating fan, run by an independent compound engine, which takes its suction from the outside, delivering fresh air throughout the boat, the supply being controlled by registers. In the winter time, in wet weather, or when it is cold, this fresh air is passed over a coil of steam pipe, and heated to any degree that may be required, before it is discharged into the cabin. [4]

As indicated in the description of the ventilating system, the pipes form a "sufficient number of small stanchions to prevent vibration of the arched roof." [5] The arched roof forms the third deck. This open deck is surmounted by the pilothouses, one at each end, and is enclosed by an open pipe railing. The single stack rises above the deck near midships, slightly closer to the forward end. Beneath each pilothouse on the main deck is a three-cylinder steam steering gear that connects the wheel shaft with the rudders.

Berkeley was powered by a single inverted triple-expansion marine steam engine, manufactured by the Union Iron Works, with 22-inch, 34-inch, and 56-inch cylinders with a 36-inch stroke. At 125 revolutions the engine developed 1,450 indicated horsepower that drove Berkeley at 12-and-a-quarter knots on her trials. [6] The engine was equipped with steam reversing gear, box guides for the crossheads, and a horseshoe thrust-bearing at each end. The condenser was cast in the back columns, with an independent air pump and circulating pump. The reciprocating air, or condensate pump was manufactured by the Union Iron Works. The main seawater circulating pump is a centrifugal pump also manufactured by the Union Iron Works. Another product of the Union Iron Works is the main boiler feed pump, which is a piston-driven positive

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reciprocal pump, and a single valve compound engine, date-marked 1897, which drives the ventilating system. The engineroom also mounts five Worthington Duplex Pumps, manufactured by that Harrison, New Jersey, corporation in 1897-1898, if not earlier--a fresh water pump; bilge pump; scavenger lubricating oil pump; an auxiliary boiler feed pump; and an auxiliary seawater circulating pump, also used for firefighting. The boat used 600 weight lubricating oil. All pipe in the engineroom is hand-hammered copper.

Berkeley was built with two Scotch marine boilers, described in 1898 as 10-feet, 10-inches in diameter and 19 feet long, "double-ended, with two 36-inch corrugated furnaces at each end, carrying a pressure of 165 pounds (per square inch) of steam. There are 304 plain and 136 stay tubes 2-1/2 inches by 7 feet long." [7] The boilers were provided with two independent sets of blowers, designed and built by the Union Iron Works, that forced air to the furnaces. "The double set of blowers have been provided because of the hard service on this route, so that at no time could the boat be crippled for lack of draft." [8] The ferry was reboilered in 1907 with Babcock and Wilcox coal-fired boilers, and in 1924 the boilers were again replaced, this time with four Babcock and Wilcox oil-fired water tube boilers. At this time the coal bunkers were modified to accept four riveted-steel tanks for Bunker C fuel oil. The boilers were fed the oil through two Worthington Duplex fuel oil pumps, which passed the oil through fuel oil steam heaters.

Electrical power was provided to the ferry by two independent plants. A single, compound vertical engine with seven-and-a-half-inch by 13-and-a-half-inch cylinders and a six-inch stroke powered a "400 light 16-candle-power machine." The other was an auxiliary "lighting plant of 100 lights, placed for day service, or at any time when only a few lights are required." [9] The electrical system, powered through a Curtis steam turbine, runs a General Electric-manufactured, 25-kilowatt, 125-volt, direct current generator.

BERKELEY'S PRESENT APPEARANCE

Upon her retirement in 1958, Berkeley was maintained in good condition, and following her 1973 arrival at San Diego and a general refurbishing, painting, and cleaning was brought up to excellent, operable condition. Steam no longer powers the boat's

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machinery, all of which is now hydraulically driven by compressed air. Every piece of equipment, from the engine to the smallest pump, operates in this unique working museum of late 19th-century marine steam technology. The engineroom retains its original gauges and valves, and the revolution counter mounted on the forward bulkhead stands at 965,904 revolutions. All ship's equipment remains aboard, including the steam steering gear, the ventilating system, and the dynamos.

Other than the 1924 reboiling and the addition of fuel oil tanks inside the coal bunkers, the only other modifications to Berkeley are the installation of museum exhibits on the main deck and the restaurant and bar room compartments below deck, and the removal of a few center row benches and the installation of a wet bar and a small wooden dance floor for social functions at the offshore, or aft end of the passenger deck. The forward propeller and rudder have been unshipped and removed to the dock, where they are displayed at the entry to the museum. The after pilothouse equipment has been removed, and it now serves as an office. Other than these minor modifications, Berkeley retains outstanding integrity. The ferry was recently described as being "in virtually like new condition. From the ornate Victorian cabin on the second deck...and the steam buff's paradise in the engineroom, she is a fine sight to behold." [10]

ENDNOTES

1. Annual List of Merchant Vessels of the United States.... (Washington, D.C.: Government Printing Office, 1900), n.p. Also see "Propeller Ferryboat Berkeley in Service in San Francisco Bay," Marine Engineering, IV (2), August 1899, p. 52. Hereafter cited as "Ferryboat Berkeley."
2. "Ferryboat Berkeley," and Plans for Berkeley, Union Iron Works Collection, J. Porter Shaw Library, San Francisco Maritime National Historical Park.
3. "Ferryboat Berkeley," p. 52.
4. Ibid.
5. Ibid.
6. Ibid.

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7. Ibid.
8. Ibid.
9. Ibid., p. 56.
10. Thomas G. Rhodes and Harley E. Scott, Steamboats Today: A Pictorial Directory of North American Vessels (New York: Cayuga Creek Historical Press, 1986), p. 91.

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8. STATEMENT OF SIGNIFICANCE

Certifying official has considered the significance of this property in relation to other properties: Nationally: X Statewide: ___ Locally: ___

Applicable National Register Criteria: A X B ___ C X D ___

Criteria Considerations (Exceptions): A ___ B ___ C ___ D ___ E ___ F ___ G ___

NHL Criteria: NHL 1, 4

Areas of Significance:	Period(s) of Significance	Significant Dates
Maritime History	1898-1939	1898
Transportation	1898-1939	1898
Architecture (Naval)	1898-1939	1898
Engineering	1898-1939	1898

NHL Theme(s): XII-L: Business:
Shipping and Transportation

XIV-B: Transportation:
Ships, Boats, Lighthouses, and Other Structures

Significant Person(s): N/A

Cultural Affiliation: N/A

Architect/Builder: Union Iron Works, San Francisco, California

State Significance of Property, and Justify Criteria, Criteria Considerations, and Areas and Periods of Significance Noted Above.

The 1898 ferry Berkeley is the oldest essentially unmodified passenger and car ferry in the United States, and is the best example of three surviving propeller-driven ferries of the double-ended type, the best known American ferry type. The other two double-ended propeller ferries are the modified Maj. Gen. William H. Hart in New York, the subject of a separate study, and the dilapidated, derelict ferry San Mateo in Seattle.

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San Francisco Bay is one of the nation's largest inland bodies of water. Beginning in the 1850s, vessels regularly transported people and horses, and later carried wagons, trains, and finally automobiles across the bay to form the United States' second largest ferry system, after that of New York Harbor. The 1898-built ferry Berkeley was the second built propeller ferry on the Pacific Coast and the first to be put into service on San Francisco Bay. In her 60-year career, Berkeley survived basically unaltered and unmodified, hard worked in a rough service. She, along with the sidewheel ferry Eureka, a National Historic Landmark vessel, exemplify ferry service at the nationally-significant port of San Francisco. Berkeley alone of all American ferries retains her original 19th-century steam plant without modification and in working order, from the triple-expansion engine to the smallest fuel oil feed pumps, all the product, as was the hull, of the nationally important shipbuilding and engine manufacturing Union Iron Works of San Francisco, which in its time built a large number of vessels, including the National Landmark cruiser Olympia. Like Olympia, Berkeley's power plant is an engineering landmark of now obsolete marine steam technology.

The preceding statement of significance is based on the more detailed statements that follow.

THE DEVELOPMENT OF THE AMERICAN STEAM FERRY

Ferries have been used to carry people, horses, and vehicles across narrow bodies of water since antiquity. In addition to a variety of hull designs, a succession of means of propulsion were used for ferries, ranging from pulling and sails to oars and paddles. The first ferry known to operate in America plied the Charles River between Chelsea and Charlestown, Massachusetts, in 1631. [1] Ferries remained little more than scarcely powered barges until the late 18th century, when two technological developments were introduced in the United States to produce the direct ancestor of later ferries. The first was the adoption on American rivers of a broad, shallow draft, scow-formed hull with loading ramps. These hulls, developed in the Netherlands, proved capacious, and because of the ramps at each end, easy to load and unload. Along with the development of these "double-end" ferries, Americans experimented with mechanical propulsion, including "horse ferries," vessels with horses below decks that turned gears to power paddlewheels. The development of marine

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steam technology provided the final element to produce the standard ferry in the United States. [2]

In 1809, Robert Fulton patented the double-ended steam ferry and built several for service across New York's Hudson and East Rivers. A grateful New York named the Manhattan Boulevard joining the two ferry landings "Fulton Street" in his honor, a harbinger of the approbation accorded the new vessels, which spread throughout the country. [3] In time, four basic ferry types were developed in the United States: 1) the double-ended type; 2) the Western River, sternwheel and sidewheel shoal draft type; 3) car transfer ferries; and 4) the Great Lakes car ferry. The double-enders, the most common type, were employed on most harbor routes. Essentially American in design and development, "it is mainly of New York and San Francisco; it has evolved inevitably to meet the problems of the rapid transport of people and vehicles between congested areas separated by water." [4] Efficient "because it permits...unloading the maximum quantity of transportable matter in a minimum of time and...take on board the same maximum quantity for a return trip without any preparations other than the reversal of the main engines..." the double-ended ferry was "a floating bridge." [5] Not surprisingly, of the ten historic ferries greater than 50 years of age left in the United States, eight are double-ended ferries from New York or San Francisco. The other two are Great Lakes car ferries, ship-formed screw propelled ships with flat sterns for loading and entirely enclosed because of the ice and cold of winter and the vast expanses of open water on the inland seas in summer. [6]

The double-ended ferries, while conforming to a general design, did incorporate regional variations:

New York ferries provide seating accommodations, lavatories and wash places only. Norfolk ferries provide in some cases restaurant facilities....Ferries on the Chesapeake...have restaurants and staterooms on three passenger decks. These ships make very long runs. Some San Francisco ferries have restaurants and well fitted rest rooms. In a general way, it may be noted that West Coast ferries--particularly those operating in Puget Sound--have a bigger 'tween deck height and a more square ended superstructure than the Eastern ferries. [7]

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The majority of the ferries, regardless of where they served, were sidewheelers through the late 19th century. The screw propeller was developed by a number of inventors during the 1840s, but debate over its merits continued until the 1880s, when screw-propelled ferries began to appear on the east coast. The first propeller-driven ferry on the west coast was Silver Gate, built at Coronado on San Diego Bay in 1887-1888 and used for only a month because she was unmanageable. [8]

The experiment in screw propulsion on the Pacific's shores was not repeated until the 1898 launch of Berkeley, which became the first propeller ferry to operate on the coast. She remained an anomaly for many years, however, for as late as 1920 the economy and power of screws was debated on the Pacific coast and most ferries were built as sidewheelers until the 1920s. Berkeley in part contributed to the debate, as she was unmanageable while docking. The ferry rammed the dock so frequently that she came to be known as the "pile-driver's friend." On the east coast, however, propellers were increasingly employed, "the paddlewheel being a rapidly disappearing survival of the past." [9] Later variations of the ferry included the adoption of diesel-electric and direct diesel drive, the introduction of more commodious, lighter superstructures over the vehicle decks, and all-steel construction in conformity with Coast Guard regulations seeking to avoid fire hazards. Ferries continue to be built in the United States, though their numbers are in decline. The development of bridges and subterranean tubes, as well as mass transit systems, ended the heyday of ferries on many waterways, notably San Francisco Bay, where the late 1930s construction of the Golden Gate and Bay bridges was the beginning of the end for the bay's fleet of ferries.

CONSTRUCTION AND CAREER OF BERKELEY

The ferry Berkeley was the product of San Francisco's Union Iron Works. Established in 1849, the firm was the first machine shop and foundry on the Pacific coast, as well as the first to fabricate and build iron and steel ships. Notable products of the yard, in addition to many merchant vessels, were some of the first "modern" capital ships of the U.S. Navy, including the battleships Oregon and Wisconsin and the armored cruisers Olympia, South Dakota, and California. [10] Berkeley was the first Union Iron Works ferry. After 1898, Union Iron Works (Bethlehem Steel Corporation's Bethlehem Union Yard after 1905)

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produced more ferries than any other Pacific coast yard in the ensuing years. The last of its 14 ferryboats was Mendocino in 1927. [11]

Built by Union Iron Works under contract to the Southern Pacific Railroad, largest operator of ferries on San Francisco Bay, Berkeley's keel was laid at the iron works' San Francisco yard on January 25, 1898. The boat was launched on October 16, 1898, and was completed and ready for service on November 6, 1898. [12] Berkeley entered service on the Oakland-San Francisco run, carrying passengers across the bay in a 20-minute ride that connected San Francisco with the terminus of the transcontinental railroad at the Oakland Mole. The first propeller driven ferry on San Francisco Bay, Berkeley was also the first built with electric lighting. The boat was also the first in the Southern Pacific fleet to be powered with a more modern triple-expansion marine steam engine, replacing the older, standard walking beam engines of earlier ferries. [13] Berkeley operated on this route from 1898 to 1939, with occasional side trips to Alameda or to Sausalito as a replacement for SPRR's Eureka, assigned to that run. Berkeley achieved considerable note in the aftermath of the San Francisco earthquake and fire in April 1906. For three days, the boat incessantly shuttled between San Francisco and Oakland, ferrying thousands of refugees from the burning city. According to one account, Berkeley ran without relief; "they loaded and left on no particular schedule, and the Berkeley made some sort of record for carrying evacuees." [14]

The completion of the Bay Bridge in 1939 made the operation of commuter ferries on the bay illegal, though Berkeley continued in service as a "train boat," ferrying passengers from San Francisco to Oakland for the transcontinental railroad and meeting passengers disembarking from Southern Pacific trains at Oakland and carrying them to San Francisco. As such, she became one of the last ferries to operate on San Francisco Bay. The 1950s saw the increased retirement of the boats, until San Leandro, the regular train boat, and Berkeley, the spare, were left. The two ferries ceased operation on July 29, 1958, when train service to the Oakland Mole also stopped, "thus ended the oldest ferry route on San Francisco Bay, the one with the most boats and by far the most passengers." [15]

Berkeley was sold to the Golden Gate Fishing Company for conversion into a floating reduction plant on the Oakland

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Estuary, but was rescued by Sausalito merchant Luther W. Conover, who berthed the ferry at the Northwest Pacific Railroad ferry slip in Sausalito in September 1959. Conover operated the ferry without major modification as the Trade Fair, a floating gift shop, from 1960 until 1973. In April, Conover, pressed by the financially draining maintenance of the boat, sold Berkeley to the San Diego Maritime Museum for \$100,000, ending the museum's search for a large vessel, preferably a ferry, to augment its display of the 1863 square-rigged bark Star of India and serve as floating museum for their collection of models, paintings, and artifacts. [16] Boarded up, Berkeley was towed 455 miles south to San Diego in June 1973, where she was refurbished, painted, cleaned, and exhibits installed. Berkeley has served well as a museum and historic attraction for the San Diego Maritime Museum since then.

ENDNOTES

1. K. Jack Bauer, A Maritime History of the United States: The Role of America's Seas and Waterways (Columbia: University of South Carolina Press, 1988), pp. 29, 70.
2. Jean Baptiste Marestier, Memoir on Steamboats of the United States, trans. Sidney Withington (Mystic, Connecticut: The Marine Historical Association, 1957) pp. 22-24.
3. James Thomas Flexner, Steamboats Come True (Boston: Little, Brown and Company, 1978) p. 337.
4. A.C. Hardy, American Ship Types: A Review of the Work, Characteristics, and Construction of Ship Types Peculiar to the Waters of the North American Continent (New York: D. Van Nostrand Company, Inc., 1927) p. 114.
5. Ibid.
6. James P. Delgado, ed. Inventory of Large Preserved Historic Vessels in the United States (Washington, D.C.: National Park Service, 1990); also see Hardy, American Ship Types, p. 140.
7. Hardy, op.cit, p. 122.

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8. Jerry MacMullen, They Came By Sea: A Pictorial History of San Diego Bay (San Diego: Ward Ritchie Press, 1969) pp. 43, 90.
9. Hardy, op.cit, p. 125.
10. See Richard H. Dillon, Iron Men: California's Industrial Pioneers Peter, James, and Michael Donohue (Point Richmond, California: Candela Press, 1984)
11. George H. Harlan, San Francisco Bay Ferryboats (Berkeley: Howell-North Books, 1967) p. 73.
12. "Propeller Ferryboat Berkeley in Service in San Francisco Bay," Marine Engineering IV (2) August 1899, p. 52.
13. Harlan, op.cit, p. 83.
14. As cited in Louise Teather, "The Berkeley Takes New Orders," Marin This Month, March 1960, pp. 10-11.
15. Harlan, op.cit, p. 121.
16. Pat Angle, "One Last Voyage Will End A Colorful Ferry Career," Marin Daily Independent Journal (San Rafael, California), April 19, 1973, section three, p. 19, and Jerry MacMullen, "The Museum That's Coming," The San Diego Union, May 27, 1973, p. C.8.

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9. MAJOR BIBLIOGRAPHICAL REFERENCES

See Endnotes in text.

Previous documentation on file (NPS):

- Preliminary Determination of Individual Listing (36 CFR 67) has been requested.
- Previously Listed in the National Register.
- Previously Determined Eligible by the National Register.
- Designated a National Historic Landmark.
- Recorded by Historic American Buildings Survey: # _____
- Recorded by Historic American Engineering Record: # _____

Primary Location of Additional Data:

- State Historic Preservation Office
- Other State Agency
- Federal Agency
- Local Government
- University
- Other:

Specify Repository: San Francisco Maritime National Historic Park

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10. GEOGRAPHICAL DATA

Acreage of Property: Less than one (1) acre

UTM References: Zone Easting Northing Zone Easting Northing

A 11 3619920 483820

Verbal Boundary Description:

All that area enclosed within the extreme length and breadth of the vessel.

Boundary Justification:

The boundary includes the entire area of the vessel as she floats at her berth.

11. FORM PREPARED BY

Name/Title: James P. Delgado, Maritime Historian

Organization: National Park Service (418) Date: April 18, 1990

Street & Number: P.O. Box 37127 Telephone: (202) 343-9528

City or Town: Washington State: DC ZIP: 20013-7127