MINUTE ITEM

27

12/23/80
W 23816
Lands

APPROVAL OF SALVAGE PERMIT

Calendar Item 27, attached, was pulled from the agenda prior to the meeting.

Attachment: Calendar Item 27.

CALENDAR PAGE
MINUTE PAGE 4089

CALENDAR ITEM
27

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12/23/86
W 23816
Lane

APPROVAL OF SALVAGE PERMIT

APPLICANT: Robert F. Marx
dba Phoenician South Seas
Treasures, Ltd.
330 Thyme Street
Satellite Beach, Florida 32937

AREA, TYPE LAND AND LOCATION
A 20.0 acre parcel of ungranted tide and submerged land, located in the Pacific Ocean, Drake's Bay, Marin County.

LAND USE: Retrieval and salvage of a sunken vessel and the contents thereof.

TERMS OF PROPOSED PERMIT:
Initial period: One year beginning January 1, 1987.

Renewal options: One successive period of one year.

Public liability insurance: Combined single limit coverage of $1,000,000.

CONSIDERATION: $500 land rental; and 25 percent of the net salvage value of $25,000 or less, and 50 percent of the net salvage value in excess of $25,000; said sum shall be due on the first of the month following the sale and bear 18 percent interest per annum, if not paid within 15 days of the due date.

BASIS FOR CONSIDERATION:
Pursuant to 2 Cal. Adm. Code 2083.

PREREQUISITE CONDITIONS, FEES AND EXPENSES:

Filing fee and environmental costs have been received.

STATUTORY AND OTHER REFERENCES:

A. P.R.C.: Div. 6, Parts 1 and 2; Div. 13

B. Cal. Adm. Code: Title 2, Div. 3; Title 14, Div. 6.

AB 884: 04/28/87.

OTHER PERTINENT INFORMATION:

1. This project involves the potential retrieval and salvage of the remains and contents of the "San Augustin", a Manilla Galleon purportly sunk in Drake's Bay in 1595.

   The applicant is a well known underwater archaeologist who has many scientific underwater explorations and recoveries to his credit. His specialization is Naval and Maritime history with an emphasis on the Spanish Colonial period in the Caribbean and Spanish Maritime trade between 1500-1800.

   Terms of Permit require the applicant to provide the Commission with an acceptable archaeological recovery plan prior to recovery of any items. The plan must furnish a detailed description of recovery information and specific methods for conservation.

   All items removed from the site will be inspected and appraised by competent appraisers. Whether the items will be sold or retained by the permittee, the State will be compensated according to terms of the Salvage Permit. For any items retained by the State, the Permittee will be credited against percentage rentals otherwise due th State.

2. Pursuant to the Commission's delegation of authority and the State CEQA Guidelines (14 Cal. Adm. Code 15025), the staff has prepared a Proposed Negative Declaration identified as EIR ND 411, State Clearinghouse No. 861104410. Such Proposed Negative Declaration was prepared and circulated for public review pursuant to the provisions of CEQA.

   Based upon the Initial Study, the Proposed Negative Declaration, and the comments received in response thereto, there is no substantial evidence that the project will have a significant effect on the environment. (14 Cal. Adm. Code 15074(b))

3. This activity involves lands identified as possessing significant environmental values pursuant to P.R.C. 6370, et seq. project, as proposed, is consistent with its use classification.

FURTHER APPROVALS REQUIRED:
National Marine Fisheries Service.

EXHIBITS:
A. Location Map.
B. Negative Declaration.

IT IS RECOMMENDED THAT THE COMMISSION:

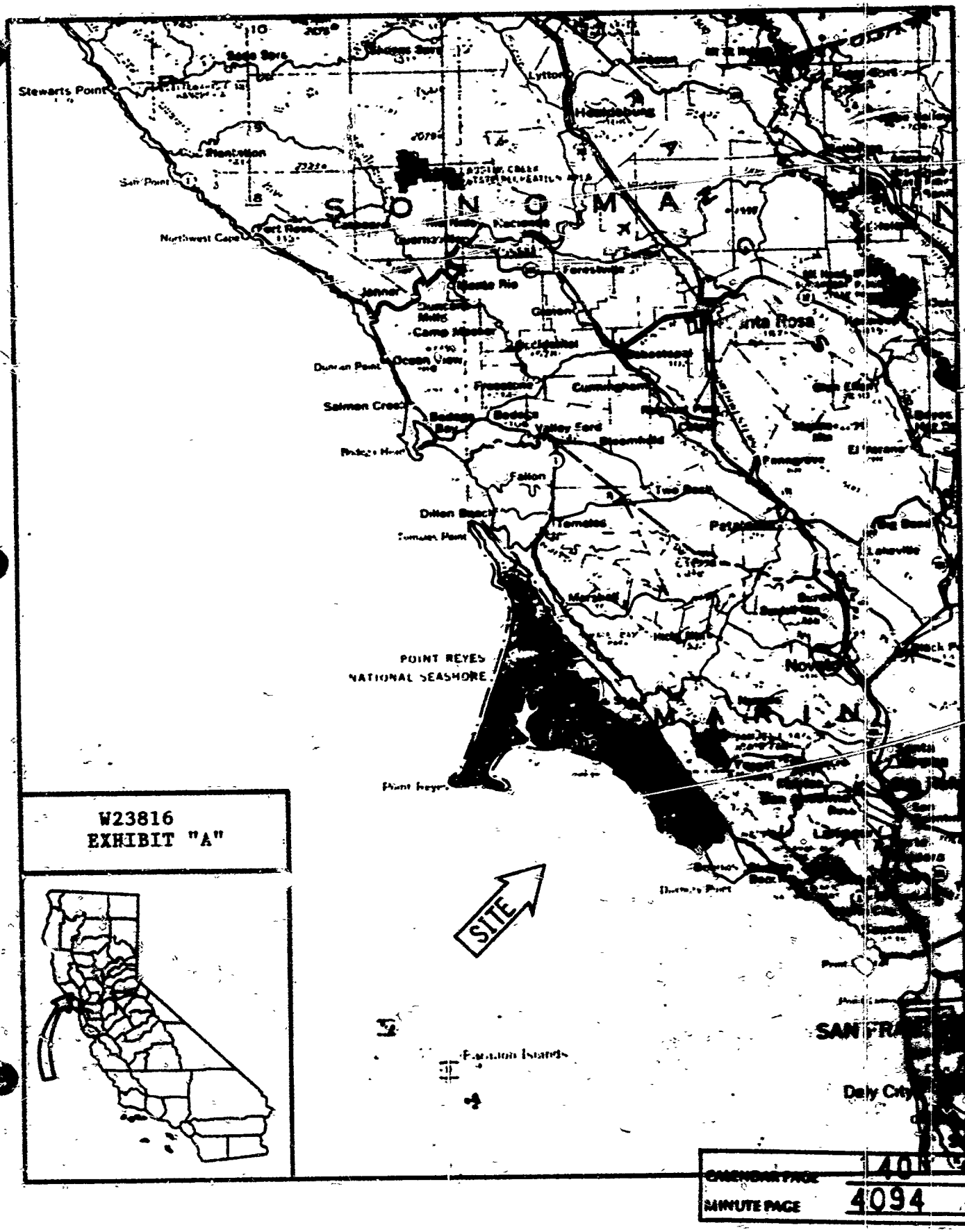
1. CERTIFY THAT A NEGATIVE DECLARATION, EIR ND 411, STATE CLEARINGHOUSE NO. 861104410, WAS PREPARED FOR THIS PROJECT PURSUANT TO THE PROVISIONS OF THE CEQA AND THAT THE COMMISSION HAS REVIEWED AND CONSIDERED THE INFORMATION CONTAINED THEREIN.

2. DETERMINE THAT THE PROJECT, AS APPROVED, WILL NOT HAVE A SIGNIFICANT EFFECT ON THE ENVIRONMENT.

3. FIND THAT THIS ACTIVITY IS CONSISTENT WITH THE USE CLASSIFICATION DESIGNATED FOR THE LAND PURSUANT TO P.R.C. 6370, ET SEQ.

CALENDAR ITEM NO. 27 (CONT'D)

4. AUTHORIZE ISSUANCE TO ROBERT F. MARX DBA PHOENICIAN SOUTH SEAS TREASURES, LTD OF A ONE-YEAR SALVAGE PERMIT, AS ON FILE IN THE MAIN OFFICE OF THE STATE LANDS COMMISSION, BEGINNING JANUARY 1, 1987; WITH AN OPTION OF ONE ADDITIONAL YEAR EXTENSION AT THE DISCRETION OF THE STATE LANDS COMMISSION AND UPON SUCH REASONABLE TERMS AND CONDITIONS AS MAY BE IMPOSED BY THE COMMISSION, IN CONSIDERATION OF $500 LAND RENTAL AND 25 PERCENT OF THE NET SALVAGE VALUE OF $25,000 OR LESS, AND 50 PERCENT OF THE NET SALVAGE VALUE IN EXCESS OF $25,000; SAID SUM TO BE DUE ON THE FIRST OF THE MONTH FOLLOWING THE SALE AND BEAR 18 PERCENT INTEREST PER ANNUM IF NOT PAID WITHIN 15 DAYS OF THE DUE DATE; PROVISION OF PUBLIC LIABILITY INSURANCE FOR COMBINED SINGLE LIMIT COVERAGE OF $1,000,000; FOR RETRIEVAL OF AN ABANDONED VESSEL AND THE CONTENTS THEREOF ON LAND AS DESCRIBED AND ON FILE IN THE OFFICES OF THE COMMISSION.



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STATE OF CALIFORNIA--STATE LANDS COMMISSION GEORGE DEUKMEJIAN, Governor

STATE LANDS COMMISSION
1807 13TH STREET
SACRAMENTO, CALIFORNIA 95814

PROPOSED NEGATIVE DECLARATION

KIR NO 411
File Ref.: 23816
SCH#: 861104410

Project Title: Salvage Permits for Remains of the "San Agustin"

Project Proponent: Mr. Robert Marx and Phoenician Explorations, Inc.

Project Location: In Drakes Bay, off the coast of Marin County

Project Description: Mr. Marx will attempt to determine the precise location and condition of the remains of the galleon "San Agustin," and will attempt a salvage of the vessel and her contents if feasible.

Contact Person: Goodyear K. Walker Telephone: (916) 322-0530

This document is prepared pursuant to the requirements of the California Environmental Quality Act (Section 21000 et seq., Public Resources Code), the State CEQA Guidelines (Section 15000 et seq., Title 14, California Administrative Code), and the State Lands Commission regulations (Section 2901 et seq., Title 2, California Administrative Code).

Based upon the attached Initial Study, it has been found that:

☐ the project will not have a significant effect on the environment.

☒ mitigation measures included in the project will avoid potentially significant effects.

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Form 13.13 (10/86)

INTRODUCTION

Over 70 percent of the earth's surface is covered by water. Only recently has man begun to plumb the depths of his watery planet, and countless traces of the past await the underwater archaeologist. Like the artifacts painstakingly unearthed from land sites, shipwrecks furnish clues to help archaeologists and historians reconstruct our past.

Underwater archaeology is a relatively new discipline, but one of the fastest growing around the world. Underwater sites are generally far less disturbed than those on land. With the exceptions of a few sites such as Pompeii, Herculaneum and Thera, entombed in a fiery flood of lava, land sites typically present stratum after stratum of occupation. One site often spans thousands of years and frequently artifacts from one period become mixed in with those of another period when the site is disturbed, making it difficult for the archaeologist to assign precise dates to the findings.

A sunken ship, however, is often an encapsulated unit. At the moment when disaster struck, time stood still: The vessel sank to the bottom and lies there, representing a single unpolluted moment of a bygone era. There are exceptions: Ships which sunk in port areas where other vessels sank on top of them, wrecks littered by trash from ships anchored above them, and shipwrecks on which salvors have left traces of a later time.

From a shipwreck the underwater archaeologist can recover virtually every artifact that might be found on a land site of the same era. And sometimes he finds objects never seen before. Everything from the smallest coin to marble columns weighing several tons have been found, even such seemingly perishable items as foodstuffs, cloth and paper. A shipwreck can be a time capsule from which the archaeologist gains important information about construction, rigging and armament.

A shipwreck can sometimes be the only source for revealing historical data on a particular type of ship and period of navigation. Such is the case with the famed Manila Galleons. In 1945, the United States was forced to bomb a section of Manila where the Japanese were entrenched and in so doing, totally obliterated the National Archives of the Philippines. Unfortunately, this archives contained three centuries of documents relevant to just about every aspect of the Manila Galleons from the manner in which they were constructed to the actual logbooks compiled during the

voyages. The documentation concerning Manila Galleons which can be found today in the Spanish and Mexican archives is just a drop in the bucket of what was lost in the Manila archives. Thus, in order to learn more about the history of these fabulous ships we must resort to underwater archaeology!

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THE MANILA GALLEONS

The first of the fabled Manila Galleons crossed the Pacific in 1565. The last one put into port in 1815. When the line began, Philip the Second was king of all the Spains and his enemy, Elizabeth Tudor, was queen of England. Hernan Cortes, conqueror of Mexico, had been dead but eighteen years. The same year Pedro Menendez de Aviles laid the foundations of St. Augustine in Florida. When the last Manila galleon sailed it was already five years since Miguel Hidalgo had begun the revolt against Spain which was to create the Republic of Mexico. The United States had been a nation for forty years and Andrew Jackson had just won the battle of New Orleans.

Yearly, for the two and a half centuries that lay between, the galleons made the long and lonely voyage between Manila in the Philippines and Acapulco in Mexico. No other line of ships has ever endured so long. No other regular navigation has been so trying and dangerous as this, for in its two hundred and fifty years the sea claimed dozens of ships, thousands of men and many millions in treasure. As the richest ships in all the oceans, they were the most coveted prize of pirate and privateer. The English took four of them, - the "Santa Ana" in 1587, the "Encarnacion" in 1709, the "Covadonga" in 1743, and the "Satisima Trinidad," largest ship of her time, in 1762.

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To the peoples of Spanish America, they were the China Ships or Manila Galleons that brought them cargoes of silks and spices and other precious merchandise of the East. To those of the Orient, they were silver argosies, laden with the Mexican and Peruvian pesos that were to become the standard of value along its coasts. To California, they furnished the first occasion and motive for the exploration of its coast. To Spain, they were the link that bound the Philippines - and, for a time, the Moluccas - to her, and it was the comings and goings that gave some substance of reality to the Spanish dream of empire over the Pacific.

The Manila Galleons were the largest ships the Spanish used. In the sixteenth century they averaged about 700 tons; in the seventeenth century the average was 1,500 tons; and in the eighteenth century they were between 1,700 and 2,000 tons. Three or four of these ships sailed annually in each direction until 1593, when a law was passed keeping the number of sailings of down to two a year in each direction.

The voyage from Acapulco to Manila was usually pleasant enough, with only an occassional stor unsettling the routine sailing from eight to ten weeks. On the other hand, the voyage from Manila to Acapulco was known as the most treacherous navigation in the world. Because the winds in the Philippine latitudes are from the east, the Manila Galleons had to beat their way as far north as Japan before reaching the belt of westerly winds which would carry them across the Pacific until they made landfall on the coast of California and then worked their way down to Acapulco.

This voyage took from four to eight months, depending on luck. Counting the crews, from 300 to 600 persons sailed on each galleon with an average of from 100 to 150 of them perishing enroute from epidemics, scurvy, thirst, starvation, or the cold. On one of two Manila Galleons sailing jointly in 1657, all 450 persons aboard succumbed to a smallpox epidemic. About half the 400 aboard the other galleon also died.

Notwithstanding the great risks to life, ships, and property involved in this navigation, the financial gain accruing to those involved in the Manila galleon trade and to the Royal Crown seemed well worth the hardships. The cargoes carried from Acapulco to Manila were basically the same as those carried on the flotas between Spain and the Indies ports, except that silver specie and bullion were also carried on these galleons, coming from the mines of Peru and Mexico to pay for the cargoes sent to Manila. The Crown restricted the amount to be sent to Manila at 500,000 pesos a year, but like many other laws, this was almost always disregarded so that an average of 3 to 5 million pesos were sent to Manila annually. In 1597, the fantastic amount of 12 million pesos reached the Asian port.

The cargoes plying the route from Manila to Acapulco were of a more exotic and diversified nature. The main item was silk from China and Japan of varied types. There were crepes, velvets, gauzes, taffetas, damasks, and grosgrains. Packed in chests were silks in every stage of manufacture from lengths of raw silk to finished apparel - robes, kimonos, skirts and stockings. Finely embroidered Chinese religious vestments, silken tapestries and bedcoverings were also shipped. Fine cottons from the Mogul Empire of India comprised a good part of the cargoes during the latter part of the trade as were Persian carpets, imported into the Philippines via India.

In addition, the Manila Galleons carried exquisite jewelry including pendants, earrings, bracelets and rings. There were gem studded sword hilts, rugs, fans, combs and a

wide range of precious spices and drugs (including rhubarb which was much sought after in Europe). The ships carried a great deal of beautiful Chinese porcelainware, objects carved of ivory and sandalwood, gold bells, copper cuspidors and exquisite and unusual devotional pieces such as crucifixes, reliquaries, rosaries and religious sculptures in wood, ivory and gold, crafted in the Orient for Roman Catholics.

Considerable gold in the form of bullion or manufactured articles was exported to Mexico. Though there was legal ban on the importation of jewelry from the Orient, in a large consignment confiscated at Acapulco in 1767 there are enumerated hundreds of rings, many of which were set with diamonds and rubies, bracelets, pendants, earrings and necklaces and a number of gold religious articles including a cross set with eight diamonds. On the same occasion officials also seized "a golden bird from China," some jewel-studded sword hilts, and several alligator teeth capped with gold. Many unset or uncut gems were also carried to Mexico by the Manila galleon. Henry Hawks, an English merchant who spent five years in Mexico in the sixteenth century wrote: "There was a mariner that brought a pearl as big as a doves eggs from thence, and a stone for which the Viceroy would have given 3000 duckets."

When the richly laden Manila Galleons reached Acapulco, merchants arrived from as far away as Peru and a fair was held at which the bulk of the goods were sold. Peruvian merchants would carry their newly acquired merchandise down to Panama City and sail home later in the year on the ships of the Armada of the South Seas. Mexican merchants had their goods carried over the mountains by mules. The agents who represented the merchants in far off Seville also used mules and travelled all the way to Veracruz to board the New Spain Flota back to Spain.

More than 90 percent of all the Manila Galleons lost over the centuries went down in Philippine waters. Ships sailing for Mexico foundered on treacherous reefs or fell victim to typhoons before they were far from Manila and even though the Acapulco-Manila route was less hazardous overall than the route east to the New World, once the heavily laden galleons entered the waters around the Philippines they were in dangerous territory.

Dozens of Manila Galleons lie beneath the seas around the Philippines. Unlike so many of the treasure galleons lost in the New World, none has ever been found or salvaged. They sunk in deep water, beyond the reach of Spanish Colonial salvors but well within the reach of modern salvage efforts.

DRAKE'S BAY MANILA GALLEON

Drake's Bay, located approximately 24 nautical miles west-northwest of the entrance to San Francisco Bay, is so named because it is believed that Sir Francis Drake stopped there to careen his ships during his renowned circumnavigation of the world in 1578. He dubbed the surrounding coastline Nova Albion and took possession for England - a move that infuriated the Spanish who resented intrusion into their territory.

On July 5, 1595, four Manila Galleons were dispatched from Manila enroute to Acapulco, their crowded holds crammed with treasures. The smallest ship of the fleet was the San Agustin, commanded by Captain Sebastian Rodriguez Cermeno. And, although she was only 200 tons, she carried 130 tons in valuable oriental cargo - silks, spices, porcelain and some chests of gold, silver, ivory, jade and ebony objects, in addition to an undetermined amount of precious stones.

Unlike the three larger ships which were to proceed directly to Acapulco, the San Agustin had orders to stop along the coast of California for purposes of exploration. The main objective was to locate one or more safe havens where Manila Galleons could stop to make necessary repairs and take on fresh water and firewood before continuing on to Acapulco.

On November 6, 1595, after a difficult crossing, the ship anchored in Drake's Bay. While most of the crew and passengers were ashore, a sudden storm struck causing the ship to sink. Very little of her cargo was saved. However, the ship's launch was spared and the majority of people managed to reach the port of Chacala, Mexico after a hazardous voyage of more than two months.

Most of the information concerning the loss of the San Agustin comes from Cermenos own account, which was translated by Henry Wagner in 1924 and published in the California Historical Quarterly.

The following is from the original account of Sebastian Rodrguez Cermeno and is signed by him.

> ... As the weather was severe we kept getting near the land, and having reached it, a morro was discovered, which makes a high land and seemed like the Punta del Brazil of Tercera. Running along a musket-shot from the land, we saw a point which bore northwest, and entering by this we say that there was a large bay. Here I went on casting the lead,

with the bow headed north a quarter northeast, with the bottom of the sea of sand, and went on to seven fathoms, where I anchored. The point on the west side bore southwest quarter west, and the one on the east, south-southeast. The bay is very large and shaped like a horseshoe, and a river runs into it, and on the bar at high tide there are three fathoms of water, and from the bar outside to the entrance of the anchorage there is a distance of two shots of an arquebus. Having anchored in this bay, we saw in the middle of it three small islands which bore south-south-west, and to the south a small island of half a league in size. The islands trended northwest-southeast. The land is bare. The river above referred to enters into the land three leagues and has a narrow mouth, while above in some parts it is a league in width, and in others a half a league. On the west side it has two branches of half a league each, and on the east side one, the entrance of which is a matter of a quarter of a league from the bar ...(Wagner 1924)

... The land seems fertile as far as three leagues inland, according to what I saw and what the other Spaniards saw whom I took with me to seek food, of which there was need on account of the loss of the ship ... (Ibid)

... On Friday morning the 8th of December, we left the bay and port of San Francisco--or as its other name is, Bahia Grande--where we were shipwrecked. This bay is in the 38 2/3° and the islands which are in the mouth (of the bay) are in 38 1/2°, and from one point of the bay to the other there may be a distance of twenty-five leagues ... (Ibid)

The following is from a Declaration made by Cermeno on November 30, after he and the expedition survivors arrived in Chacala.

In the port and bay of the new discovery of Cape Mendocino in the camp of Santa Fe, the 30th of November, 1595, before me, Pedro de Lugo, escribano of the King our master, Captain Sebastian Rodriguez Sermeno, chief pilot of the said discovery, said that the reason of having lost, while at anchor in the port, the ship San Agustin which he brought and which Captain Pedro Sarmiento had offered to the King in Manila, without being able to save any of the supplies and other property which was on board, ...

Lastly, the Balanos-Ascension Derrotero, which was translated by Wagner (1926), but which we have taken from Aker (1965), states:

> ... It is called "La Punta de los Reyes" and is a steep morro. On its northeast side this furnishes a very good shelter, making it a good port for all ships. It is in the latitude of 38 1/2°. Note that in anchoring in this port, called "San Francisco," for shelter from the south and southeast winds, you have to do so at the end of the beach in the corner on the west-southwest side ...
>
> ... Here it was that the ship San Agustin was lost in 1595, coming on a voyage of exploration. The loss was caused more by the man commanding her than by the force of the wind ...

The only additional piece of information that is available in a primary source is a comment in the Declaracion of Cermeno before Pedro de Lugo, Scrivener of the King. Although most of the relevant text is repetition of his "account" quoted above, one significant comment is added: "The ship anchored in the bay and port about a quarter of a league from shore" (Aker 1695 as taken from Wagner 1926).

As can be seen, these accounts give only a brief mention of the actual sinking. This may be due to a separate declaration having been taken to cover the loss of the ship. Such a document has never shown up, but it is likely to have been considered a "State secret," both because of the value of the ship and the comment above that the loss was "...caused more by the man commanding her...," and it will most likely never be found.

The approximate location of the San Agustin, within several hundred yards, has been known by scholars for years. Since 1940, more than 800 artifacts, primarily porcelain sherds, have washed ashore on the beach adjacent to the wreck site. Among the artifacts are other ceramic objects, iron nails and spikes, pieces of ships rigging and a brass mortar. An amateur diver reportedly recovered a small bronze cannon, several harquebuses and a few pieces of intact porcelainware.

Due to the fact that the San Agustin is not only the oldest, but possibly the richest shipwreck lost on the west coast of North America, it has been the subject of a great number of scholarly reports and popular articles.

PRIOR ATTEMPTS TO LOCATE THE SAN AGUSTIN

The area of Point Reyes and Drake's Bay are strategically located and offer safe haven from northerly storms and has been used by mariners for many centuries. The San Agustin is believed to be the first ship to have been lost in this area, but at least 72 others over the centuries have met a like fate.

Raymond Aker, a maritime historian associated with the Drake Navigator's Guild, has produced a comprehensive analysis of the portions of the Wagner translation that relate directly to the location of the wreck, and has settled on a probable site just seaward of the present mouth of Drake's Estero. He was assuming that, in 1595, the actual cut through Limantour Spit was located east of its present location.

The step-by-step rationale that Aker develops to justify his conclusion is well-thought-out and unfortunately may be proven correct. It would be unfortunate because it would place the vessel within or very near the existing breaker zone at the mouth of the estero. This area would be extremely difficult to survey adequately, and next to impossible to excavate for the purpose of ground-truthing any remote sensing anomalies. Analysis of this data by the National Park Service, however, put the wreck as much as 1.5 miles west of Aker's projections, and out of the present breaker zone. The logic for this conclusion is based on some very slight differences of interpretation of the documentary evidence. Other analysis have produced still other locations, but these two appear to be the best grounded in the few murky facts available.

In December 1963, discussions were held between John Huston of San Francisco (one of the founders of the Council of Underwater Archaeology), Adan Treganza of San Franciso State Unviersity, and Paul Schumacher who was then the National Park Service Regional Archaeologist, about the need for an underwater archaeological survey of Drake's Bay. Two years later in March 1965, a survey was undertaken using a rubidium magnetometer owned by Varian Associates of Palo Alto and supervised by John Huston. Their main objective was to locate the remains of the San Agustin. Huston reported obtaining a number of "strong anomalies" in the area where the San Agustin was presumed lost but no excavations were ever undertaken to identify the targets. Huston was known to have carried out a great deal of historical research on the San Agustin but failed to write a report on his work before his death in 1968.

In 1982, between August 23 and September 5, and October 4 to 14, the National Park Service conducted a survey of Drake's Bay using remote sensing instruments. A magnetometer was ued to cover an area of 2.5 square miles and they obtained 686 anomalies. These anomalies were analyzed, and 49 clusters of anomalies were indicated for priority test excavation. The majority of these no doubt were from modern-day wreckage and debris. Side scan sonar was also used covering an area of 10 square miles in Drake's Bay to locate any targets which were protruding above the sea floor. A sub-bottom profiler sonar unit was also used covering 30 linear miles to obtain an accurate picture of the bay geology. It was learned that the depth of sediment in the bay ranged from a few inches to seven meters in some areas. The NPS produced an excellent report on their work in this bay but unfortunately were unable to follow up with excavations. Some of their magnetometers anomalies were in the area where the San Agustin was presumed lost and they may have located some sections of this shipwreck.

There have been numerous reports of sports divers and treasure hunters conducting unauthorized searches in Drake's Bay and there are unconfirmed reports that both airlifts and blasters have been used in some cases. There are also reports of divers finding two bronze cannons, numerous intact pieces of porcelain, several muskets and a brass mortar - similar to the one located on land by archaeologists.

ANALYSIS

Over the years a great deal has been written about the loss of the San Agustin in Drake's Bay and the explorations in this area undertaken by Cermeno and his men. Some accounts state that the ship was anchored in five fathoms and others state the depth as seven fathoms. All agree that the location was a quarter league offshore but few authors agree on the exact measurements of a league. My own research indicates that a league was three and a half nautical miles during this period. This would put the anchorage at .875 nautical miles offshore. However, there is geological evidence pointing to the fact that the shoreline has receded over the years and this would put the anchorage even further offshore today.

We know that a storm arose while most of the crew of the ship was ashore and "the ship was lost." Some authors assert that the ship was driven ashore and went to pieces but historical information does not confirm this fact. No doubt her masts and rigging, as well as a part of her superstructure went ashore, but the main section of her hull and all of her armament, ballast, cargo probably remains further offshore. The fact that the survivors were not able to recover any of her cargo and very little of her stores substantiates this fact.

One of the main differences in analysis of the wreck's location is to what degree the ship was blown from her mooring location before sinking. The Park Service analysis combines an ocean swell from west-northwest and a southeast wind to push the San Agustin directly onshore from her anchorage. Aker argues against the southeast wind, believing that under such conditions the crew could have tacked out to safety. But with the captain and the bulk of the crew ashore, and an incompetent (?) in charge, the logic of very little eastward drift could be valid. Information from the Spanish Archives, however, would indicate that the ship actually sunk at her moorings, and didn't drift at all.

The Drake Navigators Guild published a report entitled, The Cermeno Expedition at Drake's Bay by Raymond Aker in 1965 and he has the following to say on page 12: "Cermano's own account, of which there are two original copies not in his handwriting but signed by him, also omits a deposition on the loss of the ship. The reason for not including information concerning the loss of the San Agustin can only be conjecture, but the most compelling apparent reason was that the wreck represented salvage potential. The possibility that this was the case is suggested in Father de la Ascension's account of

the Viscaino expedition in which he wrote that Viscaino had put into Drake's Bay to see if he could find any trace of the San Agustin and a quantity of wax and silks that had been left on shore. In this light there may have been deliberate intent on the part of the persons having a vested interest in the ship and goods to keep the true nature of the loss from becoming known to others who might attempt to salvage the wreck."

The fact is that if the ship had totally broken up and gone ashore as some historians and authors believed, there would not have been any possibility of future salvage operations and everything would have been scattered over a wide area and covered over by shifting sands. Likewise, Cermeno and his people would have been able to obtain baldy needed food supplies and some of her valuable cargo - which did not occur. Recently obtained historical documents from the Spanish Archives indicate that the ship sank in the general vicinity of her anchorage and only some of her upper-works and deck cargo (Such as the wax and silks) were cast upon the shore.

This analysis, then, assumes that the main section of the San Agustin sank at her mooring, or close to it, and lays in waters under the jurisdiction of the State of California and not in the zone closer to shore controlled by the National Park Service.

FUNDING, PERSONNEL AND EXPEDITION RESEARCH VESSEL

Phoenician Exploration Limited

There is still a great deal of preliminary work to be done before the total cost of this project can be determined, but it is expected to cost somewhere between one and three million dollars to first locate and then carry out a proper underwater archaeological excavation of the San Agustin. If wooden remains are located, which is one of the main objectives of this project, additional funds will also have to be spent on the proper treatment and preservation of these wooden remains. We could have another "Mary Rose" on our hands with the San Agustin and this could result in the construction of a major museum to display the ship's hull and her cargo.

Phoenician Exploration, which is a Canadian limited partnership, has been conducting underwater archaeological work for the past eight years, under the direction of Robert F. Marx. They have worked in Nova Scotia, Florida, the Bahamas, Brazil, Mauritius Island in the Indian Ocean and in other areas. Recently, this group has formed another limited partnership named Phoenician South Seas for the purpose of locating and excavating Manila Galleons in the Philippines and, hopefully, in Drake's Bay. One of the main objectives of this group is to obtain enough data to enable them to reconstruct an authentic replica of a Manila Galleon and then undertake a voyage in the replica between Manila and Acapulco, with stops along the coast of California, as part of the 1992 celebration of Columbus's 500 year anniversary of the discovery of the New World. Phoenician South Seas will provide all of the necessary fundings for this project. Attached as Appendix A here is a list of the limited partners of Phoenician Exploration, who are also the General Parnters of Phoenician South Seas, as well as a brief resume of some of those involved.

It is anticipated that a large number of people will be involved in this project. We plan to invite archaeologists and divers from the National Park Service to participate, as well as other scholars from California and elsewhere. Hopefully, John Foster and one or more assistants will be assigned to the project by the Division of Parks and Recreation. The research phase which is underway at this time is being undertaken by Dr. Nicholas Cushner and Robert F. Marx. After the shipwreck has been located Dr. Maria-Lusia de Brito Pinheiro Blot will also join the team as both a historian, draftsperson and diver. The search phase will be conducted by Robert F. Marx

with the assistance of Dr. Harold E. Edgerton of M.I.T. and also personnel of various seismigraphic firms. The overall excavation will be conducted under the direction of Robert F. Marx. Dr. Ian D. Spooner and Dr. Jean-Yves Blot will serve as assistant archaeologists to Robert F. Marx. Ms. Jenifer G. Marx will serve as artifacts officer. Mr. Marc H. Wulf and Mr. James E. Hill, Jr. will serve as chief of diving operations. Additional divers and qualified experts in cleaning and preservation of the artifacts recovered will also be hired as needed.

During the search phase of the project, a suitable vessel will be chartered from the local area. After the shipwreck has been located, the research vessel Rio Grande, which is owned by Phoenician Explorations, will be utilized. See attached description and photograph of the Rio Grande.

KEY PERSONNEL

Detailed resumes of the principal investigators in this proposal are included as Appendix B.

Robert F. Marx

Mr. Marx has been managing marine archeological recoveries since 1957, including work on the U.S.S. Monitor the galleon Nuestra Senora de los Milagros, the submerged Roman cities of Cartega and Bolonia, the French Soleil Royal, and Greek and Phoencian vessels from the 5th and 4th century B.C.. An accomplished diver, Mr. Marx is well equiped to lead an expedition such as this one.

Dr. Jean-Yves Blot

Dr. Blot has his Doctorate in underwater archeology from the Sorbonne in Paris in addition to a Masters degree in anthropology. He has over 15 years experience as a diver on archeological sites all over the world. He is currently employed as an archeologist for the museum of Archeology in Belem, Portugal.

Dr. Maria-Luisa de Brito Pinheiro Blot

Dr. Blot has her doctorate in history from the University of Coimbra, Portugal. She is an accomplished researcher, with many years of experience checking out wrecks in Europe, India, and Indonesia and the United States. She also dives and is an expert underwater photographer.

Jenifer G. Marx

A diver and writer of many years, Ms. Marx is the author or co-author of several books and articles on history and marine archeology.

Ian D. Spooner

A diver with full archeological training, Mr. Spooner obtained a post graduate diploma with distinction in Maritime Archeology. He is on committees for maritime archeology in Britain and Australia, and has published several findings.

Mark H. Wolf

Over 12 years experience diving in marine construction and salvage, beginning as a diver aboard a submarine tender. Mr. Wolf recently performed as a contract diver for NASA on the Challenger shuttle recovery team.

James E. Hill, Jr.

Mr. Hill has been a diver and diving supervisor for many years. His experience includes work at up to 1,000 foot depths, pipelaying and maintenance work, and drilling support, as well as archeological div[illegible] since 1983.

DESCRIPTION OF THE RESEARCH VESSEL — RIO GRANDE

The Rio Grande is a well equipped research vessel for accomplishing shipwreck search and recovery operations. The Rio Grande is valued at U.S. $2,000,000 and her replacement cost is much greater. The vessel has an overall length of 100 feet, weights 61 net tons, has an all aluminum hull and is ocean-going certified by the U.S. Coast Guard. She has four water tight bulkheads, making her nearly unsinkable. The vessel is powered by three large General Motors Detroit diesel engines, carries 7,500 gallons of fuel (and can also carry portable bladder fuel tanks for long ocean crossings) and cruises at 22 knots. She is fully hydraulic powered throughout the vessel, has two large electrical generators and is completely air conditioned for maximum living comfort. At sea, the Rio Grande is totally self-sufficient with two salt water to fresh water conversion units which produce 1,000 gallons of fresh water daily. Her large storage areas, two large deep freezers and refrigerator enable crews to stay at sea for months at a time. The vessel accommodates ten persons comfortably, but has the capacity to berth twice that number.

The Rio Grande's navigation electronics and other equipment has been duplicated to prevent breakdowns from hindering any operation at sea. Among the electronic equipment in the pilot house are:

- a Sperry autopilot
- Ritchie compass
- Furano radar with perimeter defense scanner
- two Furano satellite navigators
- Micrologic Loran C position indicators
- Texas Instrument Loran C position indicators
- Alden Marinefax weather data receiver
- RDI Radar Watch MOD Mark II
- seven marine radio-telephones (including two single sideband units)
- three fathometers

A hydraulic crane on the aft deck can lift up to five tons, and all anchors are powered by hydraulic winches. There is a helicopter landing pad over the aft deck. Two rubber Zodiac boats in addition to a 20 foot fiberglass Aquasport skiff are carried on deck. The Rio Grande can operate anywhere in the world, is totally self-contained, seaworthy and strong enough to weather almost any kind of adverse sea conditions. With her own machine shop and duplicated stock of most

equipment and spare parts, the Rio Grande can stay at sea or on a site for up to three months, a vital factor to be considered when involved in offshore operations.

All types of diving equipment are carried on board the Rio Grande, from standard Scuba gear to the more sophisticated Kirby-Morgan gear used for deep diving. Both high and low pressure compressors are aboard for shallow and deep diving. The vessel is outfitted with two large "blasters" or "prop-washes," the primary tool used in excavating shipwrecks. "Airlift" and "water jets," which are also used in excavations, are also carried on board. Even more important is the fact that Mr. Marx has recently developed and produced a portable underwater "blaster" which is hand-held and controlled on the bottom by a diver. This will enable the Joint Venture to excavate at much deeper depths than the conventional "blasters" which require the vessel to be directly over the shipwreck, and which can operate only up to depths of approximately 75 feet. With this new system, the Joint Venture can operate and excavate a site at all diving depths and also in very shallow water such as around dangerous reefs where the Rio Grande cannot maneuver.

SEARCH PHASE OF THE PROJECT

During the last and present centuries thousands of vessels of all sizes have used Drake's Bay as an anchorage. During storms when anchors are dragged and even in lowering and lifting anchors it is a well established fact that the remains of old sunken ships are disturbed and in some cases destroyed. Hopefully, the San Agustin is buried in one of the deeper areas of the bay where there is substantially sand covering the site to protect her. Yet there is the possibility that she has been damaged or destroyed by the dragging anchors or by a later shipwreck ran aground over her remains. Thus, this is another valid reason why the San Agustin, which is without a doubt the most important shipwreck in California waters, should be located and excavated at this time.

One of the most difficult aspects of underwater archaeological work is the actual detection and locating of a shipwreck site. A good recent example is the 1622 Spanish galleon ATOCHA which took fifteen years and $16,000,000 to locate. Over the years I have worked closely with many scientists and organizations trying to overcome this major problem.

Problems in Underwater Shipwreck Detection

The basic tool used in the location of shipwrecks in the Western Hemisphere is the magnetometer which has its limitations. The magnetometer will only detect the presence of ferrous materials such as iron or steel. In certain instances it will not even locate materials made of these metals. In some cases where large bodies of ferrous metals are in close proximity the different individuals objects may null out the magentic properties of one another. It has also been found that some individual large ferrous objects give no magnetic anomalies; when cannon or anchors were cast and the metal cooled on a particular polar axis something causes the object not to show magnetic properties if this object lays on the sea bottom within a 15 degree axis either east or west of the original position the object when cast. Consequently, cast iron objects have one chance in twelve of not exhibiting any magnetic properties which can be detected by magnetometer.

Contrary to popular belief most ships did not sink, but rather were wrecked on a lee shore or hit upon a reef or shoal in relatively shallow water. During the age of sail probably less than two percent of the ships were lost in deep water;

usually as a result of fires aboard or sea battles. In most cases, even when a ship capsized at sea, it would drift into shallow water before breaking up. Deep water shipwrecks (over 100 feet deep) generally have all of their armament and cargo situated in a relatively small area unless they exploded before sinking. However, rarely are these ships sought as potential targets by archeologists or salvors because their locations are generally very vague in contemporary historical documents and their are a great deal more costly to locate and salvage. A good example is the Spanish galleon San Jose which blew up in 1708 and sank in 800 to 2,000 feet of water off Cartegena, Colombia during a sea battle with the British. To date, various oceanographic and treasure hunting firms have spent over $25 million in the search for this rich target with negative results.

In most cases the ships struck a shoal or reef and was scattered over a wide area, sometimes even over miles. Usually the bottom of the ship containing the ship's ballast would stay in the area of the initial impact while the seas and currents would carry the remaining part of the ship to other areas. In some cases, only a large hole would result from the initial impact and the ship would keep moving with no only its ballast falling out but also a great deal of its cargo. I have seen this latter event result in a 1733 spanish galleon scattering its remains along a six mile stretch from its original impact area to its final resting place, resulting in its contents being so badly scattered that most of it was impossible to locate either by contemporary or modern day salvors. Hurricanes which occurred even years after a ship was wrecked could cause a ship's contents to be widely scattered.

So now we must go back to the magnetometer and what it can accomplish. On old sailing ships a sounding lead was always used at least once an hour so the mariners on those old ships gonerally knew when they were getting into shallow water even if land could not be seen because of darkness or a storm. If unable to bear away from shoal water the captain would order anchors dropped and sails taken in to avert a disaster. In many cases, countless anchors were dropped and when they ran out of anchors as the anchor cables sanpped in storms or were cut on reefs, cannon were even used as anchors. Thus, in many cases, the final resting place of a shipwreck might not have a single anchor left on it and when anchors are located in the general area of a shipwreck they can be miles from the ships location. Naturally, finding a lost anchor doesn't always signify a ship was lost in the area as the ship which lost the anchor may have managed to escape disaster.

So this leaves us with the only remaining target which can be located by a magnetmeter - the cannon. Generally, the important ships used bronze cannon and these cannot be found with a magnetometer, so if the shipwreck does not have any of her anchors still on or near her, she will go undetected unless the cannon can be located visually, or some other part of her. A good example is Mel Fisher's 1622 Spanish galleon Atocha. Six of her bronze cannon were located when a salvage boats anchor was snagged on the bottom and a diver went down to free the anchor and spotted the old guns. Just two weeks ago, eight years after the first six bronze cannon were found on this wreck, Fisher located still another bronze cannon over two miles from the location of the first six. This was accomplished by conducting a visual search from a small plane and videotaping the sea floor from an elevation of 500 feet. The Atocha is a very good example of the difficulties modern salvors face in trying to salvage an old shipwreck which has been widely scattered over a large area and in which most of her cargo is buried under deep sand. Despite the wide amount of publicity that Fisher has received since 1970 when he found a part of the Atocha, to date he has not found the main part of the wreck or the treasures she carried. To date he claims to have spent somewhere between six and ten million dollars in this search, sometimes using as many a six search vessels using the best equipment available.

This still leaves us with iron cannon as potential magnetic targets. When ships were dashed to pieces on a lee shore during a hurricane, such as occurred with some of the 1715 ships lost on Florida's East Coast, the iron guns generally were deposited in the vicinity of the remainder of the wreck - but not always. On one of the wrecks the ship struck bottom about three miles offshore and her top deck and superstructure broke off and drifted right on shore in the breakers, whereas her main hull and cargo are located somewhere in between. On some of the 1715 wrecks the ships and cargoes also went into shore in the breaker zone and although the cannon can be easily found (if iron) her cargo can be spread up and down the coast for several miles. The remains of the Capitana of this fleet are spread along the shore for four miles to the north and one and a half miles to the south of where most of her guns lay. During the past two decades modern day salvors first worked the area where the cannon lay and, after exhausting the area, worked up and down the coastline in hopes of finding more treasures from this wreck. Objects coming ashore in recent hurricanes generally give a vague location of other parts of the wreck hidden under the deep sands.

The same problem occurs when ships are wrecked far from shore. The topsides of the ship, with the cannon and anchors, if any remain, are generally swept far away from the main part of the wreck, making it very difficult to find the smaller non-ferrous items which are usually buried under sand, mud or reef or a combination of them all.

Added to the problem is the fact that on many shipwrecks, the cannon and anchors which are the signpost of a shipwreck, no longer exists. They were salvaged by contemporary or modern salvors. During World War II for example, when there was a great demand for all kinds of metals, many salvage companies scoured the sea floors up and down the U.S. East Coast and throughout the Bahamas and Carribean, recovering everything which could be found. In recent years, this has also been done, and the most recent example on a big scale took place on the Little Bahama Bank where a Bahamian Government bouy tender was employed for months to pick up all cannon and anchors visable. The reason it was done, according to government spokesman, was to prevent their being pirated by unauthorized divers and salvors. The fact is that many of these sites will be lost forever unless some other method is developed to find the smaller objects still on these buried sites.

Before going further I will cover sonar. There are two types: side scan and sub-bottom profilers. Side Scan Sonar can be useful in locating deep water wrecks in which some part of the wreck, such as a ballast pile, is sticking above the surrounding sea floor. However, few wrecks fit into this catagory in this hemisphere. Sub-bottom profilers give a picture of what is buried directly below the boat and only cover a narrow area of the sub-bottom. They are only useful after a shipwreck has been located by another method to try and pin-point objects hidden under the sea floor. In theory they should solve the problem of finding the non-ferrous smaller objects on a shipwreck but such is not the case. In mud or silt, generally only in harbors or near river mouths, they can be useful. However, in sand, where the majority of shallow water wrecks lay, this type of sonar has very limited penetration - generally less than two meters. Also as mentioned above, you have to be almost directly over the buried object to locate it and this is very difficult when many square miles of sea floor have to be searched.

So lets now assume that a shallow water shipwreck has been located and its remains are scattered over a large area. A magentometer can be placed right on the bottom and either dragged slowly or hand carried by a diver to locate smaller ferrous objects such as cannon balls or ships fittings. Unless

these objects are laying in a big mass or are very close to the surface of the sea floor and only a few feet from the magentometer head sensor, no anomalies can be detected, which is the case in most instances. A hand-held metal detector will locate metals of all types but again the objects must be very close to the detector or no reading will be obtained. If a large anchor or cannon (bronze or iron) is more than six feet deep in the bottom sediment, no readings will be obtained. On smaller objects such as hand weapons, tools or coins, the detection range is usually less than a foot. This is fine if the site is only covered by a foot of sand, mud or coral, but this only occurs in very few instances. The average shallow water shipwreck has six to eight feet of sand over it and some, especially in the Bahamas or California, have as much as 15 feet of sand covering them. In one case, we recently found a site with over 30 feet of sand covering it and were never able to identify it because we could not dig deeper with either the prop-washes or airlifts.

The previous three pages all lead up to the most difficult problem we face in location of shipwreck remains - that of finding the smaller items on each site. It is too expensive and time consuming to try and dig up several square miles of ocean bottom and at the moment, with what equipment is presently available, that would be the only solution.

I should also mention at this time that in Florida, the Bahamas, Bermuda and some parts of the Caribbean the magentometers and metal detectors work well because they are being used in areas of sedimentary rock. However, elsewhere they are more difficult to get proper readings, or in some cases any readings, because of the magentic properties of non-sedimentary rocks.

We plan to first utilize the standard equipment for locating the remains of the San Agustin - magnetometers, sub-bottom profiling sonar, metal detectors and visual search. There is little likelihood that any of her remains will be above the sea floor so we will exclude the use of side-scan sonar - especially since this was already undertaken by the NPS in 1982.

After the visual and electronic survey is completed, we will then make small test holes on each target using a small airlift to determine the identity of each one. If we fail to locate the main remains of the San Agustin by using the above mentioned methods, I will then use a very special instrument which is being developed by SRI International in Menlo Park. See attached letter in Appendix C written by

Dr. Lambert Dolphin. This instrument is capable of locating very small objects under 20 to 25 feet of sand. Phoenician South Seas has agreed to provide the funding for the development and construction of this instrument and the initial work on this instrument will commence in the very near future.

EXCAVATION OF THE SAN AGUSTIN

Until the remains of the San Agustin are actually located it is very difficult to determine the exact methods which will be used in properly excavating the site. One thing is certain; the best archaeological techniques and equipment will be used on this project and the maximum effort will be utilized in collecting all pertinent archaeological data. Likewise, the operation will be conducted in a manner which protects the gathering of the archaeological data and protection of the artifacts and wooden remains - if any remain - of the ship's hull. The staff and equipment of Phoenician Explorations, Limited, are as well prepared as anyone in the world today to do as professional a job as can be done on wrecks of this vintage.

There are two different possibilities to consider. One that the ship remains and cargo are scattered over a wide area, which would make the project more difficult and expensive to undertake. However, I do not contemplate this being the case with the San Agustin. The other that the shipwreck is more or less confined to a small area. If this is indeed the case, which I believe it to be, the "blasters" on the Rio Grande will only be used to remove the overburden. Then a grid system will be erected on the bottom over the site and the actual digging will be done by the use of airlifts and hand-fanning in conjunction with the gathering of the archaeological data - i.e. measurements, drawings, photographs, etc.

Detailed archaeological recovery plans cannot be provided until the completion of the search phase; however, staff of Phonecian Explorations will draw up full plans at such time as the remains of the San Agustin are located and identified. These plans will be shared with qualified archeological staff from the National Park Service, the California State Historical Preservation Office, the State Lands Commission and other agencies having a legitimate interest in the recovery and preservation of such a prize. Actual techniques for such a salvage must maximize the data recovery phase to be acceptable to the partners of Phoenician Exploration, and we fully realize the value of this search to the people of California.

Once the methods and degree of salvage are agreed to, we can discuss and draw up plans for the proper conservation and display of the recovered materials. Again, it would be premature to draw up such plans until we know what we have to work with, but it is conceivable that an on-site museum could

be built, as part of the National Seashore, or that institutions in the San Francisco area could share funding of the conservation effort in exchange for displaying them. As we prepare the excavation plans, and before major excavation begins, we will consult with State and Federal experts and present our detailed proposals to archeologists from these agencies for approval.

If we find that the remains of the shipwreck lay in an area of heavy sea swells, making the excavation difficult, we may have to resort to building a cofferdam around the shipwreck and working inside it, such as they are presently doing on one of the Revolutionary War shipwrecks of Yorktown, Virginia. Underwater visibility is another problem in Drake's Bay and this too may be solved with the use of a cofferdam. It is also known that Drake's Bay is the breeding grounds for the White Sharks and the cofferdam might also eliminate the dangers from these predators. If a cofferdam is not required, we will probably have to erect nets around the site to keep the sharks out of the area.

No work will commence on the site until a proper place has been established for the storage and conservation of the artifacts. A laboratory will have to be set up with qualified personnel to operate it.

I also plan to establish a group of advisors who will supervise the overall excavation of the site. Some of these will come from the State of California, the National Park Service as available, and others will be people knowledgeable in different aspects of the history of the site such as Raymond Aker and Edward P. Von Der Porten.

At this time it is impossible to determine the amount of time that this project will take but I think we should count on a minimum of three years and it could take as much as twice that amount of time. Weather and working conditions will be the main factors that will decide this issue.

ENVIRONMENTAL CONSIDERATIONS

Environmental Setting

Drake's Bay is located on the southern edge of the Point Reyes peninsula, approximately 24 nautical miles west-northwest from the entrance to San Francisco Bay.

The Point Reyes peninsula is roughly triangular in shape, with the longest side lying on the east, along the San Andreas Fault Zone. The angle opposite juts out into the Pacific Ocean, forming Point Reyes and its associated headlands. The most prominent feature of the area is the Inverness Ridge, a forested line of hills reaching a maximum elevation of about 1,400 feet above sea level. This ridge drops steeply on its eastern face, to the San Andreas Fault Zone, which is expressed here by Tomales Bay, Olema Valley, and Bolinas Lagoon. The western slopes of the ridge are gentle, and drained by many streams cut into canyons.

The curve of Drake's Bay itself is sheltered by Point Reyes, and is generally a gently shelving sandy beach. Drake's Estero projects north from the Bay into the center of the Paninsula. It is separated from Drake's Bay by a long sand spit, Limantour spit, which has a variable entrance to the ocean.

Geology

Certainly the most prominent geologic feature in the Point Reyes area is the San Andreas Fault. This fault and its rift zone can be traced for hundreds of miles from the Mendocino County coast north of Point Reyes to the desert regions north and east of Los Angeles. The northward movement of the Pacific plate, of which Point Reyes is a part, was graphically illustrated during the 1906 San Francisco earthquake. During that event, Tomales Point, the northernmost point within the Point Reyes Peninsula, moved approximately 20 feet northward in relationship to the adjacent continental land mass on the east side of the fault. Even the present shape of Point Reyes seems to illustrate the north-northwest direction of movement, for it seems to be bent by forces from the northwest, contorting the peninsula into the hook that forms Drake's Bay.

The backbone of the Point Reyes Peninsula is formed by a core of igneous (granitic) rock, which gives structure and definition to Inverness Ridge. This core is overlain by a

series of metamorphic and sedimentary strata. The stratigraphy of these rocks is generally uniform and extends laterally from Inverness Ridge toward the south, west and northwest. At the Point Reyes headlands, the granitic core or basement rock of the peninsula is again exposed. Here the igneous rock is overlain by a consolidated conglomerate of well-cemented sand, gravel, cobble and boulder-sized materials. The hard and resistant nature of the granite and conglomerate along this uplifting fault has created a very impressive and dramatic series of headland cliffs.

Between the headlands and Inverness Ridge, the various sedimentary rocks, marine shales, sandstones, siltstones, and claystone form a shallow dish with its centerline running northwest-southwest through the western part of Drake's Estero. These sedimentary rocks end abruptly at Drake's Bay, forming a series of cliffs. On the more exposed side of the peninsula (Point Reyes Beach) a long, narrow, and uniform beach with hind dunes has been formed. The shore of Drake's Bay has a narrow beach, and a sand spit that lies between Drake's Estero (a flooded stream valley) and the bay also helps define Limantour Estero, which lies behind the spit. Both esteros drain through a break in the spit, whose location shifts continuously east and west due to seasonal storms.

The cliffs facing Drake's Bay are claystones and siltstones of the Drake's Bay Formation, and sandy shales of the Monterey Shale Formation. These formations are generally poorly cemented and erode rapidly; in some places the cliffs faces are receding at a rate of 12 inches or more a year.

Within Drake's Bay, the immediate marine substrata are believed to be the Monterey Shale formation and the lower sections of the Drake's Bay Formation. Overlying these substrata is a layer of unconsolidated marine sands of varying and unknown thickness.

Oceanography

The continental shelf in the project area extends farther seaward than it does along any other portion of the west coast. This area of the continental shelf, known as the Gulf of the Farallons, reaches a width of 26 nautical miles (48 km). The gulf contains two major currents that represent significant components of the northeast Pacific Ocean's circulation system. One current flows southward (the California Current), the other (Davidson Current) flows northward, and there are a number of localized eddy current systems. The California Current has a broad southerly flow, at

generally close to the coast, and supplies water which is cooler and less saline than the waters farther offshore. This current normally flows along the coast from August or September through mid-November.

Toward mid-November, dominant northwest winds decline sharply. With this change in wind pattern, the cold surface water sinks and is replaced at the surface by a thin layer of warmer water. The warmer waters belong to the normally deeper Davidson Current, which runs counter to the California Current. Once it surfaces, the Davidson Current forms a wedge between the California Current and the mainland coast. The inshore, northward, and downwelling movement of the Davidson Current usually lasts well into the winter, bringing with it relatively high surface temperatures. However, by mid-February, prevailing winds shift from the south to the northwest, thus diminishing or reversing the northward flow of surface water. As a result, the California Current flows southward, carrying surface water offshore, and deeper water that is cold and dense rises up to replace it.

During each of the seasons, local geography and topography influence local current patterns. The dominant influences of the California Current and the prevailing northwest winds have an effect on the movement of sediment in the survey area that is the reverse of what would be expected. As it flows past the Point Reyes headlands, the California Current sets up an eddying effect within Drake's Bay, and onshore waves, driven by prevailing northwest winds, meet the headlands and deflect, bending east and northward into Drake's Bay. The overall effect is a localized south and east to north and west transportation system for sediment.

The movement of sediment along the Point Reyes Beach (Pacific coast area) is altogether different. While the south-flowing California Current is the dominating element, the eddying effect caused by the Bodega headlands seems to be an effective trap for most of the sediment from the north. In comparison to the California Current, the prevailing northwest winds have a much greater effect on nearshore sediment movement. However, because of the north-northeast to south-southwest orientation of the Point Reyes Beach and the prevailing surface north-northwest winds, there seems to be no significant movement of sediment. And what sediment transport there is results in material being moved past the western extent of the Point Reyes headlands where it is increasingly influenced by the California Current and ultimately carried into deeper water off the headlands. Overall, little sediment is carried to the Drake's Bay area from the north, the sands here are derived from local and southern sources.

Climate and Weather

The climate of the Point Reyes Peninsula and its immediate environs is characterized by cool, dry, foggy summers and cool, rainy winters. Because there are upwellings of colder waters during the summer, cool temperatures and fog are very common along the coast and seaward. The reverse is generally the case during the winter months, with clear but cool weather that is occasionally interrupted by storms from the southwest. High winds are common in this area, which is generally considered to be both the foggiest and windiest location of the Pacific coast. Winds of more that 100 mph are occasionally recorded. This extreme is due in part to the topography of the Point Reyes headlands. However, gale force winds along the Point Reyes Beach are also common. These high winds are most characteristic of late and early winter, and generally occur out of the north and northwest. Winter storms with accompanying winds usually confront the coast from the southeast, and as the storm system moves inland, the winds move to the northwest. End-of-storm winds out of the northwest are usually the most violent. Drake's Bay provides ships a safe refuge during the strong northwest winds, but this area has the potential for unexpected changes in wind direction due to eddying conditions.

Ocean temperatures generally show little annual variation. For example, the mean monthly surface water temperatures at the Golden Gate Bridge (Fort Point, San Francisco) and at North Farallon Island range from 50.9°F to 60.2°F and 52.2°F to 56.2°F respectively, from January to December (1926-1950).

Marine Biology

The area proposed for this permit lies within the Point Reyes/Farallon Islands Marine Sanctuary, and has had its biology studied extensively.

One of the most spectacular components of the area's wildlife is the concentration of nesting seabirds, with a population exceeding 100,000 pairs. The largest concentration of these pairs exist in the Farralon Islands, far removed from the project site, but the Point Reyes headlands, Drake's Estero, and Estero de Limantour are also important nesting areas.

The Point Reyes headlands provides nesting locations for the Common Murre, Brandt's Cormorant, Pelagic Cormorant, Pigeon Guillemot, Western Gull, and the Black Oystercatcher. The

population of all these species has been increasing over the recent past and they are not threatened by the proposed project.

Drake's Estero and the Estero de Limantour provide estaurine areas for various diving birds, especially the Black Brant.

Within sight of the project area twenty three species of marine mammals have been sighted, including five pinniped species, 17 cetaceans, and one fissiped (the Sea Otter). Most of the pinnipeds (seals and sea lions) are year-round inhabitants. Again, the most important part of the sanctuary for these species is the Farallon Islands, where major breeding, pupping, and haul-out areas have been established. Within Drake's Bay, only the Harbor Seal has established haul-out areas, mostly along Limantour Spit.

In contrast, the cetacean (whale) species are all migratory through this area, especially the California Grey Whale which are usually observed each year from late November through June or July. None of the cetacean species noted with the Sanctuary spends time in the shallow waters proposed for this project.

Fish resources are abundant over a wide portion of the Point Reyes and Farallon Islands areas. The area has many factors which make it vital to the health and existence of many species.

The area has many diverse habitats, but as this project is restricted to the nearshore part of Drake's Bay, this study focuses on this particular environment. Several studies describing the fish resources of the entire area can be found in the "Final Environmental Impactment Statement on the Proposed Point Reyes-Farallon Islands Marine Sanctuary" put out by the Federal Office of Coastal Zone Management in 1980.

Drake's Bay is important as a feeding spawning, and nursery area for many fin-fish. In addition, Drake's Estero and the Estero de Limantour provide nurseries for Pacific Herring, smelt, Starry Flounder, Surfperch and Silver Salmon. Various bottom fish, such as California Halibut, Rex Sole, adult Starry Flounder and occasionally other soles migrate to the Bay at different times of the year. Sharks and rays use the Bay as a feeding ground throughout the year.

Kelp beds, an important marine community, are established within Drake's Bay. The dominent species near the project area is the Bull Kelp (Nerocystis luetkeana), which is an annual

spec[illegible]. Its Winter beds represent only one to five percent of its summer extent. It does not provide the dense substructure or canopy that its better known counterpart, the Giant Kelp, does.

The benthic fauna differs greatly according to habitat type. The project site and surrounding area is smooth, featurless, sandy bottom, with little or no relief. Depending on the severity of the Winter storms, the effect of wave surge can often be felt to the bottom. As a result there is little benthic activity, with burrowing animals predominant. Sand dollars and sea urchins have been noted in the area, but not in the numbers that exist in deeper water.

Transportation and Use

Drake's Bay is outside of the main shipping lanes for San Francisco, but is a sheltered anchorage for many smaller vessels transiting the area. There is also considerable traffic from boats visiting the National Seashore.

While there is little commercial fishing done within the Bay, there is extensive use of the area by party boat anglers and private fisherpersons. The area is included in the Farallon - Point Reyes Marine Sanctuary.

ENVIRONMENTAL EFFECTS

This project will have no significant environmental effects on the area, and will, if successful, have a beneficial effect (Class IV) on the cultural artifacts.

During the initial search phase small boats using non-destructive instruments will cross the area. Since many private or party boats are already in the area this will not be a significant disturbance to either seabirds or marine mammals in the area. If this search gives good indications small test holes will be made, using small airlifts. While this will disturb benthic invertebrates at the actual site of the holes, the small diameter (6-18 inches) in the relation to the whole of Drake's Bay makes this effect insignificant.

If the ship is found and identified, major excavation could begin. A detailed plan will be filed with the permitting agencies when the site details are known well enough to make such planning meaningful; however, analysis of similar projects indicate that there is no danger of environmental effects.

The first step would be to remove the sand overburden from the main body of the wreck, using directed propellor wash. This will disturb the benthic environment over a few hundred square meters at most, including areas effected by the removed sand. Experience in other areas indicates that the invertebrate fauna will reestablish itself within 6 to 9 months following the end of the project. Under certain conditions, it may be advisable to establish a cofferdam around the site before starting work. This would ensure that no fin-fish or marine mammals would inadvertantly enter the site while work was in progress, and would further limit potential damage to the benthos.

The proposed project location is not within any of the kelp beds in Drake's Bay.

The maximum work force would include one major recovery vessel (100 feet long), up to two small skiffs, and possibly a barge. Most of this equipment would be anchored the majority of the time. all are fully self-contained. There will be no discharges to disrupt the water quality of the site. No onshore activity is proposed at this time which could disturb either seabirds or the Harbor Seals.

The remaining issue is the protection and conservation of the San Agustin herself; if she is found. The funding and staff proposed for this project are unquestioably

professionally able to extract the maximum amount of archeological data from the site with a minimum amount of damage. By requiring detailed plans for professional review once the site is precisely located, we are protecting the public trust. The people of California and the nation deserve to have a site of this importance professionally evaluated.

The final phase of this proposal, conservation, is probably the most important. Again, the applicant has agreed to remove nothing from the site until specific provisions for conservation and display or storage are agreed to by the permitting agencies. It is very rare that we are presented with an application with the funding and expertise to provide for a full preservation effort. Staff believes that, if the wreck is found in good condition, a permanent display can be established that meets the needs of State and Federal agencies, and returns a priceless part of California's heritage to public view.

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APPENDIX A

MAJOR OCCUPATIONS AND DIRECTORSHIPS OF CERTAIN OF THE PARTNERS IN PHOENICIAN EXPLORATIONS INC.

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APPENDIX B

ROBERT F. MARX

Date of Birth: 8 December 1936, Pittsburgh, Pennsylvania USA

Present Address: 330 Thyme Street
Satellite Beach, Florida 32937

Telephone: 305-777-2061

EDUCATION

Los Angeles City College, June 1951 - September 1953; September 1956-February 1957 (evening classes).
University of Maryland estension courses (during military service) December 1953 - June 1956 with 90 undergraduate credit hours in total.
Major: Anthropology and Archaeology

FIELDS OF SPECIALIZATION

Marine Archaeology, with particular reference to the Spanish colonial period in the Caribbean.
Naval & Maritime history, with particular reference to Spanish maritime trade - 1500 - 1800.

MILITARY SERVICE

US Marine Corps 1953-56

- In charge of USMC marine salvage operations, East Coast, U.S. 1953-55.
- Director of USMC Diving School, Vieques, Puerto Rico, 1955-56 (training of over 5,000 marines in use of scuba diving and its use in amphibious warfare).
- Honorable Discharge September 1956; USMC Reserves (inactive) 1953-62.

ARCHAEOLOGICAL EXPLORATIONS & RECOVERIES

1. Location of several Civil War blockade runners and recovery of artifacts, under auspices of North Carolina Development Board, 1953-54.
2. Location of Civil War ironclad, USS Monitor, Cape Hatteras, N.C., 1955.
3. Location of a number of Spanish and English wreck sites from period 1650-1800, Puerto Rico and Virgin Islands, 1955-56.

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4. Discovery of a number of previously unknown Mayan temple sites, cenotes, zacbes (ceremonial causeways), and cave tombs in British Honduras, Quintana Roo, Isla Cozmel, Mexico; mapping of Tulum, Coba, Xelha, and other little known Mayan cities on the east coast of Quintana Roo, Isla Cozumel and Isla Mujeres, in cooperation with the Mexican Department of Anthropology and History; first exploration and recovery of artifacts from Mayan cenote at Dzibilchaltun, under direction of Tulane University Department of Archaeology; Assistant Professor John Goggin, University of Florida, in excavation of Spanish colonial sites, Yucatan: February 1957 - September 1959.

5. Discovery of remains of Spanish galleon, Nuestra Senora de los Milagros (sunk in 1741); organization of three series of excavations on the site, the last sponsored by the official Mexican underwater exploration society (CEDAM), which resulted in the recovery of over 200,000 artifacts, Quintana Roo, Mexico, 1957 - 1959.

6. Discovery and identification of early Spanish wreck sites: La Nicolasa, supply ship of Hernan Cortes' expedition (sunk in 1526); and two ships burned and scuttled by Francisco de Montejo (1526), Quintana Roo, 1957.

7. Exploration of Caribbean waters off coasts of Central and South America, Leeward and Windward Islands and the Bahamas, with location of Spanish French, English, Dutch and Portuguese wreck sites from period 1550-1800, 1960.

8. Underwater survey of submerged Roman cities of Carteya and Bolonia (southern Spain); location and exploration of wreck sites in Cadiz harbour and off Tarifa, Zahara, and Sanlucar de Barrameda, under auspices of the Museo Provincial de Cadiz, Spain, 1960-62.

9. Participation in archaeological excavation, sponsored by the Smithsonian Institution, of 16th century Spanish wreck site, Bermuda, August 1963.

10. Organization and direction of exploratory expeditions to Serrana, Seranilla, Roncador and Quitasueno Banks Isla Providencia (western Caribbean), which resulted in the location of a number of important Spanish colonial wreck sites and exploration of four of the principal sites, June-July, 1963 and May-November, 1965.

11. Direction of program of mapping and excavation of the sunken city of Port Royal, undertaken by the Institute of Jamaica, November 1965 - June 1968.

12. Discovery of two shipwrecks of Christopher Columbus which were lost in St. Anne's Bay, Jamaica, in 1504. Plans are underway to excavate these two shipwrecks in the near future. February 1968.

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13. Director of Research and Salvage operations for the Real Eight Co. Inc. of Melbourne, Florida. Summer months spent excavating various shipwrecks of a fleet which was lost in 1715 off the coast of Florida. The remainder of each year spent locating and salvaging ancient shipwrecks in the Bahamas, Mexico and Columbia. June 1968 - January 1971.

14. Archaeological survey on some ancient sunken walls and buildings off Bimini and Andros Island in the Bahamas. August 1969, July 1971 and December 1976.

15. Excavation of three Civil War blockade runners off Charleston and Sullivan Island, South Carolina. January - February 1970.

16. Archaeological explorations on land and underwater at various sites in the Yucatan Peninsula under the auspices of CEDAM of Mexico. January, April and May 1971 and February - March 1976.

17. Exploration for marine archaeological sites around nine different Caribbean Islands in the Windward and Leeward Island group under the auspices of the Minnesota Historical Society. February 1971.

18. Archaeological survey in Lake Toluca, Mexico for pre-Columbian artifacts under the auspices of CEDAM of Mexico. June 1971.

19. Underwater exploration for marine archaeological sites on both sides of the Isthmus of Panama under the auspices of the Panama Institute of Tourism. December 1971 - January 1972, April 1973 and March 1975.

20. Participation in exploration aboard the ALCOA SEAPROBE for ancient deep water wrecks off the coast of Florida. March and November 1972.

21. Exploration for an early 17th century Spanish shipwreck in 1800-2000 feet of water south of the Dry Tortuga Islands in the Gulf of Mexico using sonar and a TVSS (television search and salvage system). November 1972.

22. Exploration of the Little Bahama Bank using visual, sonar and magnetometer methods in which a total of 21 shipwrecks were discovered, including the Nuestra Senora de la Maravilla, a Spanish galleon which sank in 1656. June - October 1972.

23. Exploration of the ancient Phoenician seaports of Byblos, Tyre and Sidon in Lebanon at the invitation of the Lebanese Dept. of Antiquities, during which survey for Phoenician shipwrecks dating from the 5th and 4th centuries B.C. (one with a cargo of terracotta figurines), two Greek shipwrecks from the 3rd and 2nd centuries B.C., two Roman shipwrecks from the 1st century B.C., and a Byzantine shipwreck from the 6th century A.D. were all discovered. Samplings of all cargoes of all the sites were collected for the Department of Antiquities. January and February 1973 and July 1974.

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24. Exploration around the Turks and Caicos Islands at the invitation of the Turks and Caicos Historical Society, to determine if one of these islands was the original landing place of Columbus on his first voyage. Eleven shipwrecks were also discovered, dating from the early 17th to the middle of the 19th century. November 1971, March 1973 and March 1977.

25. Exploration of waters surrounding Ascension Island in the South Atlantic at the invitation of the British Government in which four shipwrecks dating from the middle of the 16th century to the beginning of the 18th century were discovered and investigated. March 1973.

26. Magnetometer and visual search covering a 20 square mile area in the Florida Keys in which nine shipwrecks were discovered, explored and identified. May - October 1973.

27. Exploration of waters surrounding Grand Cayman Island at the invitation of the local government in which a number of shipwrecks were discovered. November 1973 and February 1978.

28. Exploration of a sunken city which was submerged in 1687 off Orangstaad, St. Eustatius Island in the Caribbean under the auspices of the Dutch Government. In addition to locating and mapping the visual submerged structures of the site, a number of old shipwrecks were also discovered and investigated. December 1973.

29. Participation in underwater archaeological surveys and excavations made along the northern coast of Israel under the direction of Dr. Elisha Linder of the University of Haifa. Most of the excavations were concentrated in the area of Acre on harbour works and a Crusader shipwreck. In this area and also at Athlit and Shavei Zion four Phoenician and several Hellenistic and Roman shipwrecks were located by a team lead by myself. September - October 1975 and May 1976.

30. Exploration of both the Atlantic and Pacific coasts of Panama under the auspices of the Panama Government. Very extensive visual and magnetometer searches were made around the Peral Islands on the Pacific side of the Isthmus and on the Atlantic side around the mouth of the Chagres River, Porto Bello, Nombre de Dios and in the San Blas Islands. A total of 44 old shipwrecks pre dating 1800 were discovered. Test hole excavations were made on a number of the sites. June - November 1976 and February - July 1977.

31. Underwater exploration made in the waters off the Central American country of Belize. Seven virgin wreck sites were discovered and two proved to be 17th century Spanish Merchantmen. April 1976.

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32. At the invitation of the Australian Government, I explored four 17th and 18th century Dutch shipwrecks, plus others of other date periods and nationalities off the west coast of Australia. August-September 1977.

33. Underwater archaeological survey made at the invitation of the Dutch Antilles Government around the islands of St. Martin's, Saba and St. Eustatius. Wreck sites were discovered off each island and recommendations for their eventual excavation were made to the government. October - November 1977.

34. Search and excavation of numerous wrecks located in the Florida Keys between Marathon and Key Largo. Among the most important sites worked were three of the 1733 galleons, a 1622 merchantman and a French merchantman 1750. March - July 1978.

35. Extensive magnetometer and visual survay made off Cape Canaveral and surrounding waters. A number of shipwrecks were discovered but poor working conditions prevented them from being excavated. July - September 1978.

36. Aerial, visual and magnetometer of the Little Bahama Bank, covering some 40 square miles in which a total of 28 shipwrecks were located dating from the mid sixteenth to late 19th century. October 1978 and July - September 1979.

37. Working under the auspices of UNESCO and the Dept. of Education of the Mauritius Government, I conducted an extensive aerial and visual survey of the reefs surrounding this island, locating a total of 18 old shipwrecks which predate 1800; including four Portuguese East Indiamen of the 16th century and seven other East Indiamen (French, Dutch and English) of the 17th and 18th centuries. During this same expedition, I was a consultant to the team excavating the French merchant vessel St. Geran which was lost in 1744. A vast number of artifacts were recovered and after preservation, were placed on display in the island's Maritime Museum. February-April 1979.

38. Under the direction of the Naval Museum of Rio de Janeiro, I conducted an underwater visual survey in the waters surrounding Salvador (Bahia) and located 13 shipwrecks from the 17th, 18th and 19th centuries, including the flagship of the Dutch privateer, Piet Heyn, lost during his attack on that place in 1627. May 1979.

39. One Greek and two Roman amphorae-carrying galleys were discovered in waters surrounding the port of Palma de Mallorca, Spain. In other areas, five large lead Roman anchors were discovered, which were not associated with a shipwreck. June 1979.

40. Underwater archaeological survey along the southern coast of Portugal in search of Classical period shipwrecks. In the harbour of Portimão, a Punic and a Roman shipwreck were discovered. October - November 1979.

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41. Underwater archaeological survey made in the Azores around the Islands of Sao Miguel and Santa Maria. Twelve different 16th to 18th century shipwrecks were surveyed. December 1979.

42. Extensive magnetometer and visual survey made along a thirty mile area of the southern and eastern shores of Cape Breton Island (Nova Scotia), Canada. More than 40 shipwrecks dateing from the 17th to 20th century were discovered; amongst the most important were the British HMS Tilbury (1749) and an unknown section of the French warship Chameau (1725). Test excavations were made on the above two and several other 18th century shipwrecks. June - October 1980.

43. Under the direction of the Naval Museum of Rio de Janeiro, Brazil, two 17th century Dutch warships were partly excavated; the flagship of Piet Heyn (Hollandia) lost during his attack on the place in 1627 and the Utrecht lost in 1648. Both sites were located near the harbour of Salvador in the Bay of All Saints. The Portuguese East Indiaman, Santa Clara, lost in 1573 was also discovered 30 miles north of this Bay. November 1980 - March 1981.

44. Underwater archaeological survey made along the eastern and southern coast of Santiago Island in the Cape Verde Islands and seven 15th to 18th century shipwrecks were discovered; the two most important being two Portuguese merchantmen dating from the mid-16th century off the fishing village of Cidade Velha. On a beach on the Island of Sal remains of a Phoenician shipwreck dating from the 5th century B.C. was also discovered. May 1981.

45. Extensive magnetometer and visual survey made, covering an area of 150 square miles on the Great Bahama Bank, Bahamas with more than 50 shipwrecks dating from the 16th to 19th centuries being located. June - November 1981, April - October 1983, August - October 1984.

46. Aerial, sonar, magnetometer and visual search conducted along the coast, harbours and river mouths of the State of Pernambuco, Brazil, under the auspices of the Naval Museum of Rio de Janeiro, Brazil. Eighteen 16th to 19th century shipwrecks were discovered (Portuguese, Spanish, Dutch and French); the majority of which were 17th century ships lost during the Dutch occupation of this area. Two Dutch East Indiamen were also located. February - April 1982.

47. Under the auspices of the Musee de Marine (Paris) a sonar and magnetometer survey was conducted off the coast of Brittany, France, and nine 16th to 18th century shipwrecks were discovered, including three French warships from the famous Battle of Quiberon Bay (1759). Also participated in the excavation of the French warship Soleil Royal (1759) off Le Croisic. June - July 1982.

A.M.

48. Underwater archaeological survey conducted in Baia de Guanabara (Rio de Janeiro), Brazil under the auspices of the Naval Museum of Rio de Janeiro, on what is believed to be a possible Roman amphora carrier from the 2nd century B.C. Three other shipwrecks were found and surveyed on this site (16th, 17th and 20th centuries). September 1982 - February 1983.

49. Magnetometer and side-scan sonar survey and visual search conducted along the East Coast of Florida between Vero Beach and Cape Canaveral during which a number of shipwrecks from the 17th and 19th centuries were located. Several new sections of the flagship of the 1715 fleet, known as the "CABIN SITE" were located and excavated during the summer of 1985.

HISTORICAL RESEARCH

History of Spanish fleets and galleons, 1504-1776; European rivalry in the Caribbean, 1550-1825; Naval warfare, 1500-1825; shipwrecks from Cape Hatteras to Rio de la Plata, 1492-1825; pre-Columbian voyages to America; early history of diving and salvage.

a. September 1959 - February 1960: Library of Congress, Academy of Franciscan History, Washington, D.C.; Hispanic Foundation, N.Y.

b. February 1961 - July 1962: Archivo de la Indias, Seville; Archivo de los Duques de Medina-Sidonia, Sanlucar de Barrameda; Museo Naval, Real Academia de la Historia, and Biblioteca Nacional, Madrid; Archivo Historico de la Marina, Viso del Marques; Museo Naval, Barcelona; Vatican Archives, Vatican Library and Jesuit Historical Institute, Rome.

c. September 1963 - March 1964: Museo Naval, Madrid; Archivo de Simancas, Simancas; Arquivo Historico de Ultramar; Arquivo Nacional da Torre do Tombo, Lisbon; Museu da Marinha, Belem; Library of the University of Coimbra, Coimbra; Osterreichische Nationalbibliothek, Vienna; Bibliotheque Nationale and Musee de la Marine, Paris.

d. May 1964 - April 1965, June 1981 and March 1982: British Museum, Lloyd's of London, Public Record Office, London; National Maritime Museum, Greenwich; Nederlandisch Historisch Scheepvart Museum, Amsterdam; Netherlands Royal Archives, The Hague.

e. August - September 1968: British Museum; National Maritime Museum; Museo Naval, Madrid.

f. July 1969: Archivo de Simancas, Simancas, Spain.

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g. August - Ocotber 1971: British Museum, Lloyd's of London, London; Museo Naval Biblioteca Nacional, Madrid; Archivo de las Indias, Seville.

h. May - June 1975, April 1981 and December 1981: Archivo de las Indias, Seville; British Museum, London; Public Records Office, London.

i. September - October 1977, November 1978 and January 1979: Archivo de las Indias, Seville.

j. November - December 1978 and August 1982: Biblioteque Nationale, Paris.

k. March - April 1983: Netherlands Royal Archives, The Hague; Public Records Office and the British Library, London.

l. November - December 1983, February - March 1984, November - December 1984 and February - March 1985: Archivo de las Indias, Seville; Museo Naval, Madrid; Musee de la Marine, Paris.

VOYAGES

Co-organizer and navigator, voyage of Nina II, replica of Columbus' caravel, from Palos, Spain to San Salvador, August - December 1962. Was made a Knight Commander in the Order of Isabel the Catholic by the Spanish Government as a result of making this voyage.

Organizer and captain, voyage of replica of 10th century Gokstad Viking ship (projected voyage from Gibraltar to Yucatan to demonstrate possibility of pre-Columbian voyages in open-decked, square-rigged vessels; shakedown cruise, Rijeka, Yugoslavia to Bizerta, Tunisia, where shipwrecked in a storm. March - April 1964.

Organizer and captain, voyage of a replica of 10th century Gokstad Viking ship for the same purpose as previous voyage in 1964. Voyage started in Limerick, Ireland, and ended 4,400 miles later at Gibraltar. April - June 1969.

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OTHER EMPLOYMENT

International Minerals and chemicals Corporation (Skokie, Illinois), Oceanographic Consultant, December 1959 - December 1060.

Saturday Evening Post, Adventure Editor, January - September 1963.

Argosy Magazine, Archaeology Editor, December 1967 - December 1978.

Dive Magazine, Contributing Editor, January 1965 - August 1974.

Real Eight Company Inc., Director of research and salvage, June 1968 - January 1971.

Seafinders, Inc., Vice President, Man 1971 - May 1974.

Ocean Industry Insurers Ltd. (London), Consultant on deep diving systems and submersibles, October 1971.

Scripps Institution of Oceanography, visiting Lecturer in underwater archaeology, January - February 1974.

Sea World Enterprises, Inc., President, August 1974 - June 1976.

Planet Ocean (International Oceanographic Foundation), Consultant, October 1974.

Aquarius Magazine, Contributing Editor, 1972 - 1973.

University of California at San Diego, visiting Lecturer in underwater archaeology , January - March 1974 and February 1975.

L.O.S.T. Inc., Expetition Leader, February - October 1978.

Phoenician Explorations, Director of Operations, January 1979 to present.

PUBLICATIONS

Over 400 scientific reports, popular articles and reports.

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ORGANIZATIONS

Escuela de Estudios Hispano-Americano, Seville, 1962.
Council of Underwater Archaeology, San Francisco, 1963.
Academia Real de la Historia, Madrid, 1963.
Club de Exploraciones Deportivas Acuaticas de Mexico (CEDAM), Mexico City, 1959.
CEDAM International, Washington, D.C. 1963.
Caribbean Research Institute, St. Thomas, Virgin Islands, 1967.
Instituto del Caribe, University of Puerto Rico, 1964.
The International Oceanographic Foundation, Miami, 1964.
American Institute of Nautical Archaeology, Cyprus, 1973.
American Littoral Society, Sandy Hook, New Jersey, 1974.
National Maritime Historical Society, New York, 1971.
Jamaican Historical Society, Kingston, 1965.
Society for Nautical Research, Greenwich, England, 1958.
Explorer's Club, New York, 1959.
Adventurer's Club, Los Angeles, 1972.
American Scandinavian Foundation, New York, 1963.
Underwater Society of America, Philadelphia, 1960.
Society for Historical Archaeology, Washington, D.C. 1971.
Sea Research Society, Mount Pleasant, South Carolina, 1972.
Underwater Exploration Society of Israel, 1975.
Save the Dolphin Foundation, San Francisco, 1975.
The Epigraphic Society (elected as a Fellow in 1982), San Diego.
Groupe Pour Le Recherche et L'Inventaire des Epaves, Paris, 1978.

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BOOKS

Historia de la Isla d. Cozumel, Merida, Yucatan, 1959.
Voyage of the Nina II. World Publications Co. Cleveland-New York 1963.
Following Columbus, World. 1964 (Juvenile).
The Battle of the Armada, 1588, World 1965 (juvenile).
The Battle of Lepanto, 1571, World, 1965 (juvenile).
They Dared the Deep: A History of Diving. World, 1967.
History of the Sunken City of Port Royal, World, 1967.
Always Another Adventure, World, 1967.
Treasure Fleets of the Spanish Main, World, 1968.
Shipwrecks in Florida Waters, Real Eight Co. Inc., ~~1969~~.
Shipwrecks in Mexican Waters, CEDAM, Mexico City, 1971.
Shipwrecks of the Western Hemisphere, World, 1971.
Sea Fever: Famous Underwater Explorers, Doubleday, 1972.
Port Royal Rediscovered, Doubleday, 1973.
The Lure of Sunken Treasure, David McKay, 1973.
Underwater Dig: Manual of Underwater Archaeology. David McKay, 1975.
Shipwrecks of the Western Hemisphere (New Revised Edition), David McKay, 1975.
Secrets Beneath the Sea, Belmont-Tower, 1975.
Capture of the Spanish Plate Fleet: 1628, David McKay, 1976.
Diving for Adventure, David McKay, 1979.
Spanish Treasures in Florida Waters, Mariner Press, Boston, 1978.
Still More Adventures, Mason Charter, 1976.
Buried Treasures of the United States, David McKay, 1978.
Into the Deep: A History of Man's Underwater Explorations. Van Nostrand Reinhold, 1978.
Quest for Treasure (Discovery of the galleon Maravillas). Kam Publishing Co., Dallas, Texas, 1982.

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BOOKS TO BE PUBLISHED

Gold: From the Dawn of Time to the Fall of Rome, with Jenifer Marx.
Gold: From the Fall of the Roman Empire to the Present, with Jenifer Marx.
Buried Treasures of the Spanish Main. David McKay.
Pre-Columbian Voyages to America.
Pirates, Privateers & Bucaneers of the Spanish Main, with Jenifer Marx.

MOVIES

Over a period of some twenty odd years I have been involved in the filming or production end of over 30 documentary films, the majority of which were shown on nationwide television. Among the most important films was "The Adventurous Voyage of the Nina" which was a two hour film on CBS-TV shown in February 1963, "Viking Voyage" shown on NBC-TV as a one hour special in August 1964, and "Treasure Galleon" narrated by Rod Sterling and shown on nationwide television as a two hour movie during 1975 and 1976. Most recent films made were "Indian Ocean Treasure" in 1981 and "The Battle of Quiberon Bay" made for both French and American television in 1982.

LECTURES

I have lectured professionally for more than ten years throughout the United States and in more than ten foreign countries on the subjects of underwater archaeology, maritime history, treasure hunting and travel.

LANGUAGES

Speaking: English and Spanish.
Reading: Spanish (including old Spanish), Italian, Portuguese and French.

DR. JEAN - YVES BLOT

Age: 34

Citizenship: French

Dr. Jean-Yves Blot is a recognized underwater archaeologist and has his doctorate degree in underwater archaeology from the Sorbonne in Paris and also has a masters degree in anthropology. Mr. Blot has been diving on shipwrecks as his main employment since 1970 and has participated in or led underwater archaeological expeditions off Iceland, France, Portugal, Kenya, Madeira, Mauritania, Mauritius Island, the Bahamas and Florida. Among his notable finds are the French East Indiaman Saint Geran, lost in 1744 off Mauritius Island in the Indian Ocean; the Meduse, lost in 1807 off Mauritania; and the Soleil Royal, lost in 1759 off the coast of Quiberon, France. Mr. Blot is the author of two books dealing with his work on shipwrecks, has four major documentary films and has lectured extensively throughout Europe and the United States. Currently he is employeed as an underwater archaeologist for the Museum of Archaeology in Belem, Portugal.

DR. MARIA-LUISA DE BRITO PINHEIRO BLOT

Age: 38

Citizenship: Portuguese

Dr. Maria-Luisa De Brito Pinheiro Blot has her doctorate degree in history from the University of Coimbra in Portugal. She has spent a number of years doing archival research relevant to shipwrecks in all of the major depositories of Europe, the United States, India and Indonesia. In addition to being a historian, she is a diver and underwater archaeologist and has participated in all of the expeditions of her husband, Jean-Yves Blot. She has written many articles and is an expert still photographer. Both she and her husband have worked in numerous countries with Mr. Robert Marx during the past 10 years. Currently she is employed as an underwater archaeologist for the Museum of Archaeology in Belem, Portugal.

CURRICULUM VITAE

Nicholas P. Cushner

Date and Place of Birth: December 6, 1932 New York City

Academic Achievement: Ph.D. University of London, University College, 1968, Latin American History

Teaching Specialization: Social History of Colonial Latin America

Courses taught:

Colonial Latin America
Modern Latin America
Modern Mexico
Literature and Society in Latin America
Western Civilization
Social Effects of Colonization:: Latin America and the Philippines Compared
Land and Society in Colonial Peru (Grad.)
Spanish American Paleography (Grad.)

Research Specialization: Social effects of land tenure patterns in colonial Latin America

Academic Experience:

1968-1970. Asst. Prof. of History, Ateneo de Manila University, Manila, Philippines

1970-1974. Asst. Prof. of History, Canisius College, Buffalo, N.Y.

1974-1975. Visiting Research Scholar (with teaching) in History, State University of New York at Buffalo

1975-1977. Asst. Prof., Empire State College, State University of New York

1977-~~Present~~ 1986. Assoc. Prof., Empire State College (Buffalo); tenured 1980

* 1986- Full Professor SUNY

1979-Present. Adjunct Professor of History, Dept. of History, State University of New York at Buffalo

Other Positions: New York State Education Department, Member of Selection Committee for New York Regents Fellowships for Doctoral Study, 1971-

State University of New York, University Awards Committee, Chairperson for Non-Western History, 1978- Awards/Honors:

1979 Empire State College (SUNY) Faculty Lectureship Award for significant scholarly achievements

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1981-1982. President of the New York State Latin Americanists

1984-1985. Selected and appointed by Chancellor as SUNY Distinguished Lecturer

Membership in Professional Organizations:

Fellow of the Royal Historical Society, elected May 13, 1968

Conference of Latin American History

Latin American Studies Association

New York State Latin Americanists (President, 1981-1982)

Grants Received after 1976:

1978. SUNY, University Awards Program, $2800 for research in Quito, Ecuador

1980. Andrew W. Mellon Foundation Fellowship, $1800 for research in microfilm collection in St. Louis University Vatican Library section

1981. SUNY, University Awards Program, $3000 for research in Lima, Peru

1983. Fulbright Award for Research in Peru

1983. National Endowment for the Humanities Summer Stipend Award, for research in Peru

Publications

BOOKS

Jesuit Ranches and the Agrarian Development of Colonial Argentina, 1650-1767. Albany: SUNY Press, 1983.

Farm and Factory. The Jesuits and the Development of Agrarian Capitalism in Colonial Quito, 1600-1767. Albany: SUNY Press, 1982.

Lords of the Land. Sugar, Wine, and Jesuit Estates of Coastal Peru, 1600-1767. Albany: SUNY Press, 1980.

Landed Estates in the Colonial Philippines. New Haven: Yale Univ. Southeast

Asian Studies, 1976.

Spain in the Philippines. From Conquest to Revolution. Manila: Ateneo de Manila Univ. Press, 1971.

Documents Illustrating the British Conquest of Manila, 1762-1764. London: Royal Historical Society, 1971.

Islas del Poniente, Early Spanish Voyages to the Philippines. Manila 1973

Select Articles

"Slave Mortality and Reproduction on Jesuit Haciendas in Colonial Peru." Hispanic American Historical Review, May, 1976, 177-99.

"Hayzapan: The Formation and Society Effects of a Landed Estate in the Colonial Philippines," Journal of Asian History, July, 1973, 30-53.

"Merchants and Missionaries," Hispanic American Historical Review, August, 1967, 360-69.

Reviews

Since 1971 I have been a regular reviewer for the Hispanic American Historical Review, the Journal of Asian Studies, and reviews of mine have also appeared in the Times Literary Supplement (London), Bulletin of Hispanic Studies, Indice Historico Espanol, and Philippine Studies.

Addresses:

Home - 344 Ashland Ave., Buffalo, New York 14222
(716) 882-1453

Office - 3 Franklin Street (Empire State College)
Buffalo, New York 14202 (716-886-8020)

JENIFER G. MARX

Date of Birth: 1 May 1940

Present Address: 330 Thyme Street,
Satellite Beach, Florida 32937

Telephone: 305-777-2061

Jenifer G. Marx is a historical writer and the wife and associate of Robert Marx in his underwater archaeology projects. A graduate of Mount Holyoke College with a B.A. in 1961, she also studied at the University of Florence in Italy. Mrs. Marx was a member of the first U.S. Peace Corps contingent in the Philippines. She taught in Negros Oriental and also worked at the University of the Philippines in Manila. In 1962, she was appointed volunteer leader and travelled throughout the archipelago as liaison between the Peace Corps and local governments. She was involved in establishing the National Peace Corps Training Center near Zamboanga on Mindanao. Subsequently, Mrs. Marx was associated with the International Labor Organization in Africa, Jamaica and Indonesia. She began diving in the Philippines in 1961 and since 1968 has worked with Mr. Robert Marx as a diver and archival researcher in Jamaica, Mexico, Indonesia, the Bahamas, Florida, Brazil, Panama, France, Portugal, England, Ireland, Canada and the Caribbean. Mrs. Marx is the author of several books and many articles on topics ranging from the history of gold to maritime and colonial history.

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IAN D. SPOONER

Address: Church Cottage, St. Clement
Cornwall, England TR1 1SZ

Citizenship: British

ACADEMIC QUALIFICATIONS

1964 - 1966 Diploma in Estate Management and Surveying.
1968 - 1971 Bachelor's Degree in Architecture.
1980 - 1981 Post-Graduate Diploma in Maritime Archaeology, with distinction.

QUALIFICATIONS RELEVANT TO MARITIME ARCHAEOLOGY

1961 Scuba Diving NQS/CMAS 2 Star.
Australian Cave Diving Federation Class 2.
HSE (British Government) Part 4 (Commercial) Diving Management Certificate.
Re-compression Chamber Operator's Certificate.
Royal Institute Chartered Survey, Royal Institute of British Architecture, professional exemptions.

COURSES ATTENDED

1957 Surrey Archaeological Society.
Archaeological Appreciation and Field Techniques.
1963 Cirencester Summer Archaeological School (six weeks excavation of a Saxon site).
1964 Prehistoric Archaeology Field School, Warminister.
1966 Voluntary Service Overseas Farnham Castle Management for Overseas Professional Appointees.
1977 Young Men's Christian Association of New Zealand Management and Financial Courses.
1978 P.A. New Enterprise Course, OXFAM Resource Management, Personnel Management and Financial Management Courses.

PROFESSIONAL ACTIVITIES IN MARITIME ARCHAEOLOGY

1. Commitee member and Projects Officer for Nautical Archaeology Society of Britain.
2. Commitee member and representative from Victoria, Australia for Australian Institute of Maritime Archaeology.
3. West of England Maritime Museum.

PROFESSIONAL PUBLICATIONS IN MARITIME ARCHAEOLOGY

1. "Some Notes on an Old Topic...Boat and Ship Building Methods of the Far East" Indonesia Journal; Spooner, 1975.
2. "A Report of the 1980 Excavation of 'The Hadda' Wracksite in the Houtman Abrolhos" (Directed by I. Spooner and L. Vickery) Spooner and Vickery; AIMA Bulletin No. 4.
3. "Classical Mediterranean Shipbuilding" Western Australian Museum Publications, 1980.
4. "Field Conservation for Remote Wracksites" Spooner, AIMA Bulletin No. 5.
5. "The William Salthouse - A Preliminary Report" AIMA Bulletin No. 6.
6. "The William Salthouse" (Directed by I. Spooner, State Maritime Archaeologist, Victoria, Australia) Spooner, Staniforth and Vickery; AIMA Bulletin (in preparation).
7. "The Underwater Cultural Heritage", I. Spooner, 1983.

PAPERS PRESENTED AT MARITIME ARCHAEOLOGICAL CONFERENCES

1. University of Western Australia, 1980; Boatbuilding Technology in the Far East and in the European Bronze Age Period: a comparison.
2. Dartington Conference on Maritime Archaeology 1982: A Maritime Museum for the South-West.
3. British Nautical Archaeology Symposium 1982: Latest Developments in Maritime Archaeology in Australia.
4. The Maritime Heritage: OCEANS 1983, Australia (N.A.S. Conference).
5. Nautical Archaeology Society Conference 1984: Government Participation and Support for Maritime Archaeology.

RESEARCH IN MARITIME ARCHAEOLOGY AND MARITIME HISTORY

1. Survey and recording of Thames Barge building yards and barge hulks, Yantlet Creek, Essex. 1957.
2. Restoration of traditional Thames one-design yacht. 1958.
3. Voyages with Tristan Jones (Royal Geographical Society), assistant with his researches into early Celtic Seafaring. 1982.

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4. Study of West African ship and boat building techniques and underwater search for German submarine in the Gambia River. 1966-1968.

5. Study of Indonesian ship and boat building techniques from prehistoric times to the present day including building a traditional Bugis Pinisi and the restoration and recording of an Indonesian Sekoci for the Western Australian Maritime Museum. 1971-1981.

6. Organization with local government authorities and in collaboration with the National Maritime Museum of a program for the recording of sites of archaeological interest in the inter-tidal zone around Britain's coast. 1983-1984.

RESEARCH IN TERRESTRIAL ARCHAEOLOGY

1. Survey and recording of unidentified stone circles in The Gambia. 1966-1968.

2. Expedition to the Tassili and Ahaggar regions of the Sahara for a photographic study of the cave paintings and in the search for the remaining cedar trees (subsequently discovered). 1968.

3. Salamis, Cyprus: Investigation of the remains of the city land site in the shallow wa[illegible] offshore. 1969.

4. Kyrenia, Cyprus: Observation of the excavation of the 400 B.C. shipwreck site. 1969.

5. Investigation of several prehistoric Dongson sites in Eastern Indonesia. Location of several previously unknown Hindu sites in the eastern islands. Collection of ethno-archaeological material and the establishment of a Museum in Timor and a museum collection in the island of Rote. 1971-1982.

DIRECTION OF MARITIME ARCHAEOLOGICAL EXPEDITIONS

1. The Hadda, Houtman Abrolhos. An expedition to locate, excavate and record the remains of a 19th century ship. 1980.

2. The St. Anthony, Cornwall (continuing); survey and excavation of a 1527 wreck of a Portuguese carrach owned by the King of Portugal. 1981.

3. The Schiedam, Cornwall (continuing); survey and excavation of a 1676 ship wreck of a Dutch fly-boat captured by the British at Tangier. 1981.

4. The Cootamundra Shoals Survey, Arafura Sea-Timor. Deputy leader and chief diver of a major expedition to the Timor Sea to investigate prehistoric and geomorphological surveys. British Sub-Aqua Club Expedition Award. Diving to 60 meters. Patron, His Royal Highness, Prince Charles. 1982.

.../4

5. The Loch Ard, Victoria, Australia. Rescue and recording of artifacts from the exposed site of an 1871 wrecksite. 1983.

6. The William Salthouse, Victoria, Australia. A major excavation of the first direct cargo shipment from Canada to Australia, wrecked in 1841. 1983.

7. The t'Vliegenshart, North Sea, Holland (in progress). Excavating the wrecksite of an 18th century outward bound East Indiaman. 1984.

8. Engaged in excavating various wrecks of many nationalities in the Goodwin Sands area of the English Channel. 1984 to present.

MARITIME ARCHAEOLOGICAL CONSULTATION

Devon Education Authority.

Maritime archaeology taught in secondary schools in England, for the years 1984/85/86.

MARK H. WULF

Address: 195 Tyler, Apt. 17
Cape Canaveral, Florida 32920

Date of Birth: July 30, 1953, Bay shore, Long Island, New York USA

EDUCATION

U.S. Navy Engineman Class A, Great Lakes, Illinois 1971.
U.S. Navy Deep Sea Diving School, Key West, Florida 1972.
Correspondence Courses in Oceanography, Advance Salvage and Deep Diving Techniques 1973 - 1974.
RCA Management Seminar November 1979.

PROFESSIONAL EXPERIENCE

1971 - 1975 Spent four years active duty in the United States Navy, honorably discharged. Primary duties as a diver aboard a submarine tender engaged in underwater maintenance and and repairs on nuclear powered submarines; also the operation and maintenance of a 55 foot diving support boat.

1975 - 1976 Worked on various short term jobs such as diving, marine mechanic work and commercial fishing. Company names and locations furnished upon request.

1976 - 1981 RCA Atlantic Undersea Testing and Evaluation Center, Andros Islands, Bahamas. Position was Diving Superintendent in complete charge of eight divers with responsibilities which included equipment inventory, research and planning for all diving operations from start to finish; a recompression chamber with crew available 24 hours; also the setting up of both training and maintenance programs, semi annual employee evaluations, and annual budgeting for materials and operating cost. Diving work consisted of inspection, maintenance, installation, and repair of all underwater equipment - i.e. electronic arrays, offshore towers, cable laying, research and development projects, recompression chamber operations, and maintaining a fleet of range support vessels ranging in size from 30 to 200 feet.

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1981 - 1985 Master diver for Circle Bar Salvage Company, a Florida based firm engaged in the discovery and excavation of old shipwrecks in Florida and the Bahamas. Also experienced in operation of sonar, magnetometers and other detection equipment. I also have a United States Coast Guard 100 ton Ocean Captain's license.

1986 My most recent diving experience has been as a civilian contract diver employed by the National Aeronautics and Space Administration (NASA) of the United States to recover wreckage from the Challenger space shuttle disaster.

SUMMARY

I have twelve years diversified marine construction experience including commercial diving, rigging, welding, cutting and masonary and carpentry work, diesel mechanics, heavy equipment operation and high seas operations as both a seaman and ship captain. During this same period I participated in numerous commercial salvage operations such as raising modern fishing vessels. During the past five years my work has been in the field of underwater archaeology and commerical salvaging.

LETTERS OF COMMENDATION AND APPRECIATION FROM MAJOR COMPANIES AND THE UNITED STATES GOVERNMENT FOR DIVING OPERATIONS AND LIFE SAVING ACTS, FURNISHED UPON REQUEST.

JAMES E. HILL, JR.

Age: 46

James E. Hill, Jr. has been a diving supervisor with the John M. Mecom Company in Florida and the Bahamas since April of 1983. In this capacity, Mr. Hill has worked under the direction of Mr. Robert Marx during 1983 through 1985 searching for specific sunken ships. Prior to his employment with the Mecom Company, Mr. Hill worked for McDermott International as a supervisor on a barge offshore the Brazilian coast laying pipelines. Prior to this, he was the lead diver and supervisor on McDermott Jet Barge II for Ocean Systems Do Brazil out of Rio de Janeiro. In this capacity, he supervised and inspected underwater pipeline construction. Mr. Hill has also been employed supervising bounce and saturation dives of up to 1,000 feet for drilling support. He has a Bachelor of Business Administration degree from the University of Texas. He has also attended the School of Drilling Practices at the University of Southern Louisiana, and taken courses in underwater photography at the Brooks Institute in Santa Barbara, California, and commercial diving at the Commercial Diving Center in Wilmington, California.

Dr. Harold E. Edgerton

In one way or another, the inventions of Dr. Harold E. Edgerton touch our lives daily. His perfection of the stroboscope in 1930 produced ultra-high speed photography; today, the strobe and his other discoveries are indispensable in many areas of science, medicine, and industry.

Since 1936, awards and citations have recognized his unique talents and eagerness to share his discoveries with colleagues and thousands of students at Massachusetts Institute of Technology, where he taught for more than fifty years. Now MIT Professor Emeritus, Dr. Edgerton continues to shape the lives of eager young students.

Childhood interest and experience "on the job" in an electrical plant in his hometown, Aurora, Nebraska, preceded Dr. Edgerton's studies at the University of Nebraska and MIT. His arrival in 1926 as a graduate student presaged a new era in electrical engineering research.

In the 1930s, his strobe was adapted for nighttime reconnaissance by the U.S. Air Force, enabling round-the-clock air photo surveillance of enemy forces in World War II. Later, Dr. Edgerton and his two former students, Kenneth Germeshausen and Herbert E. Grier, developed equipment to film nuclear experiments. This partnership was the forerunner of EG&G.

Dr. Edgerton's pioneering research produced outstanding achievements in the development of underwater cameras, lights, and special sonars. He and Jacques-Yves Cousteau collaborated on unmanned deep-sea cameras which were used in searches for the Loch Ness monster and the battleship *Monitor*, two adventures in which "Doc" was involved. The search for the *Monitor* was the subject of a feature article in the January 1975 issue of *National Geographic*.

While his genius continues to break barriers in research, Dr. Edgerton gathers new friends and colleagues in the diverse fields of oceanography, nautical archaeology, and art.

APPENDIX C

10 September 1985

Mr. Robert Marx, Director
Phoenician Explorations
330 Thyme Street
Satellite Beach, Florida 32937

Dear Bob,

Enclosed is our renewed proposal, as per your request.

The price of this proposal is significantly higher than quoted in our previous proposal. Only a small part of this increase is due to salary changes and other annual cost changes. We all felt we wanted to increase our level of effort in development work and testing to build a much better instrument and do the best possible job we can. Technically what we propose to do is very difficult and we feel we should devote extra effort to the task.

Actual testing on site in the Bahamas has not been included as part of this present proposal; we suggest that you or one of your associates join us here in Menlo Park during our final testing before delivery. We also suggest that a follow-on contract would be appropriate in order to permit two members of our staff to accompany you during your next season's work, to gain experience in the use of this instrument. This will help us to build improved models and to add later refinements increasing the utility and cost-effectiveness of the instrument. We believe this will make it a marketable item others will wish to purchase and use for their own applications.

We greatly appreciate your interest and are anxious to do a good job for you.

Sincerely,

Lambert Dolphin
Assistant Director
Radio Physics Laboratory

pdy

Enclosure

10 September 1985

Phoenician Explorations
330 Thrne Street
Satellite Beach, Florida 32937

Attn: Robert F. Marx, Director

Re: SRI International Proposal for Research No. ESC 8[illegible]-175
"SENSITIVE METAL DETECTOR FOR LOCATING DEEPLY BURIED ARTIFACTS"

Dear Mr. Marx:

In December of 1983 you explained to me in a telephone conversation the practical problems frequently encountered in galleon salvage operations in the Bahamas. You indicated that wrecks were frequently scattered over large areas, and that sand depth over the sites could be as much as 20 to 25 ft. We discussed various metal-locator schemes and their limitations at that time and agreed on the various equipment now available. Your letter of reminder of 10 July 1984 stimulated us to look at both current and innovative equipment design to see if we could make a major improvement in locating underwater small, nonmagnetic metal objects (bars, silver, bronze, and the like).

In my letter of 17 July 1984, I mentioned that Bill Edson and Roger Vickers, both of our Laboratory, recommended a large horizontal loop to increase the depth of detection capability of a metal detector. As you know, most metal detectors are intended for coin-shooting on land or in shallow water. The market is competitive: the price must be kept down and the units need to be light weight and easy to use. The search coil diameter is usually 8 to 12 in., and the power output is a few watts. A few "large coil (approximately 3-ft diameter), deep search" detectors have been manufactured, but as you pointed in our first telephone conversation, no one has been able to achieve more than 6 to 8 ft of useful penetration. (For example, the "Gemini II Deep-Search" metal detector by Fisher Research Laboratory has an advertised sensitivity of 3 ft for a jar of coins, 5 ft for a one-inch diameter pipe, 10 ft for a large metal chest, and 20 ft for a "mineral deposit.") The sensitivity of a loop-type metal detector decreases inversely as the sixth power of the distance from the coil; this means that doubling the distance from the coil decreases the instrument sensitivity by a factor of 64. Increasing the transmitted power in a given system is thus not nearly as

helpful as increasing the loop diameter, and this is why we suggests coil size of 25 to 30 ft in diameter. No matter how much we increase the power or are clever with our use of circuitry, we shall not in practice succeed in locating small objects buried 20 to 25 ft in sea without a large coil.

As we explained in our proposal, SRI Proposal ESC 84-197, to you last year, a good survey analysis of metal detectors, radars, seismic sounders, magnetometers, resistivity methods, and electromagnetic detectors has been written by J. Jeffrey van Ee of the Advanced Monitoring Systems Division, Environmental Monitoring Systems Laboratory, Las Vegas, Nevada, as part of their 1983 government study "Geophysical Techniques for Sensing Buried Wastes and Waste Migration." Their recent study of the limitations of metal-detectors as well as other methods is in substantial agreement with our own experience, and yours.

My colleagues Bill Edson, Roger Vickers, and I have had several good discussions to complement the mathematical analysis Joseph Moeni did for us a year ago recommending coil configurations and calculatin the sensitivity of a large, horizontal-loop metal detector. One advantage in working in sea water is that noise signals from the surf will not be detected by the system, and thus a very sensitive receive may be used. A large loop also covers much area per pass, lessening time required to search a large wreck site. Though very large, the l can be lightweight and designed for ease of towing from a hydrodynami point of view. We also suggested and still recommend equipping the system with a small bottom-finding sonar so that the detector unit ca be "flown" a few feet above the sea floor.

Our calculations indicate that we can expect a detector with a 20-ft coil diameter to be capable of detecting a single gold bar at a depth of 20 to 25 ft. Originally, we thought in terms of one transmitting coil and a large number of receiving coils, but further analysis has shown us that we can do just as well with a few coils. Solid-state components now allow us to build a very sensitive and very small receiver, and we suggest a moderately high-powered transmitter (several kilowatts), which is also now readily available.

We would like to hereby renew last year's proposal in response to your phone call on 28 August. Our basic technical approach has not substantially changed since last year's proposal, so we feel we stand good chance of being able to deliver a working large-scale very sensitive metal detector in time for your summer 1986 diving season, provided we can start work in the next 30 to 60 days. As before, we propose to build a developmental model of the detector for ocean testi (locally) for design optimization. After testing, we would then be prepared to build a more rugged, durable version, incorporating changes that prove to be desirable as a result of the testing. Because the instrument will follow an entirely new design, our research program will be kept proprietary.

We propose on a best-effort basis to design and construct a working model of the new detector system eight (8) months after the start of work. The system would include the following:

(1) Towable, hydrodynamically designed coil package, pressure designed and waterproof, equipped with built-in sonar depth finder and guide fins. Approximate diameter 25 ft.

(2) Supporting electronics and power supply including generator, transmitter, receiver and display unit with both real-time and recorded data collection. (Various data collection schemes are possible.)

(3) All necessary cable, hardware, and the like.

(4) Detailed operating manual.

The objective would be to produce sensitivity which would allow detection of a metal object presenting a cross-section of approximately ten (10) square inches at depths of 20 to 25 ft.

Actual testing on site in the Bahamas has not been included as part of this present effort; we suggest that you or one of your associates join us here in Menlo Park during our final testing before delivery.

Total cost of the work as outlined will be $195,000. Our development and building of the proposed detecting system will require an immediate expenditure of funds, and it is our policy on this type of commercial contract to receive an advance payment before commencing work and a letter of credit for the balance. A down payment of $100,000 (plus a letter of credit for the balance) accompanying one copy of the enclosed signed agreement is all we need to commence work on this project. The second copy of the agreement is for your record.

Because of the experimental nature of this development work, SRI cannot guarantee that we will be successful in producing a detector that will meet your specifications. Therefore, we will only do the work on a best efforts basis.

To discuss technical matters, specifications, and test and delivery schedules, please contact me at (415) 859-4868. Questions concerning contractual matters may be addressed to Barbara Camph at (415) 859-4328. This proposal as priced remains in effect until 31 December 1985. Please contact me should you wish an extension.