PRELIMINARY REPORT

on the
Australian National Maritime Museum's participation in the Rhode Island Marine Archaeology Project's search for HMB *Endeavour* August 2002

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Fig 1: ANMM Diver recording a feature on GAMMA wreck site located off Newport Photo Paul Hundley

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Illustrations and Images

1.0 Executive Summary

1: Historical research undertaken by American maritime archaeologist Dr Abbass indicates that the *Lord Sandwich* ex Captain Cook's HMB *Endeavour* was one of thirteen vessels scuttled in August 1778 at the Battle of Newport during the American War of Independence.

2: HMB *Endeavour* is a vessel of great archaeological, historical and social significance to Australia.

3: In May 1999, Paul Hundley, Curator of the Australian National Maritime Museum's (ANMM) USA Gallery met with Dr Abbass to discuss the archaeological significance of the wreck and to develop a scientific methodology which would enable the *Lord Sandwich* to be identified from among the twelve other vessels.

4: In August 1999 an underwater survey was carried out by a joint Rhode Island Marine Archaeology Project (RIMAP) / ANMM team on the Hospital Cannon Site (Primary Target A) which archival information indicated could be the *Lord Sandwich*. Detailed analysis of the hull remains, along with analyses of the stone, coal, timber and sediment samples, indicated that the Hospital Cannon Site was **not** HMB *Endeavour*.

5: With the research methodology established and field tested the ANMM / RIMAP team continued the hunt for HMB *Endeavour* by carrying out a remote sensing survey of Newport Harbour.

6: In July / August 2000 using side scan sonar the team located a number of anomalies which required investigation.

7: One of these anomalies - code named GAMMA - was investigated further in August 2001 and a number of constructional details were discovered which appear to be similar to those recorded during a survey of HMB *Endeavour* at Deptford Dockyard shortly after the vessel was purchased in 1768.

8: In August 2002 a more detailed survey and excavation of GAMMA occurred.

9: GAMMA shares many characteristics with *Lord Sandwich ex* HMB *Endeavour*. It appears to be of the same age, size and tonnage, is built of similar material and was constructed using similar methods.

10: According to Dr. Abbass's own research only one other of the twelve Transports reported lost in August 1778 was of similar size, construction and tonnage to the Lord Sandwich. This vessel was the American built ship *Britannia*.

11: Gamma site is either the *Lord Sandwich* or *Britannia*

2.0 Background to Project

2.1 Rhode Island Geographical Information

The State of Rhode Island and Providence Plantations is located on the eastern seaboard of the United States of America (Longitude 71° 8'W to 71° 53'W; Latitude: 41° 18'N to 42° 1'N). The State is bordered by the State of Massachusetts to the north and east, by the State of Connecticut to the west and by the Atlantic Ocean to the South. Rhode Island is 40 miles long and 30 miles wide with a area of approximately 1,545 square miles (1,045 square miles land, 500 square miles sea), making it the smallest of the 50 states of the United States of America. (www.infoplease.com/ce6/us/A0860721.html)

The dominant physiographic feature of the state is the Narragansett basin, a shallow lowland area of Carboniferous sediments, extending into SE Massachusetts and, in Rhode Island, partly submerged as Narragansett Bay.

Much of Rhode Island is woodland; lowlands in the south and rolling hills in the north and the west. The state can be divided into two geographic regions; the Coastal Lowland in the south and east, and the Eastern New England Upland in the northwest. (Swanson & Stanford, 2001)

The Coastal Lowland of Rhode Island is part of the larger Coastal Lowland Region that covers the entire New England coast. These lowlands cover more than half of the mainland and the islands of Narragansett Bay. West of Point Judith are sandy beaches, lagoons, and salt ponds. To the east of Narragansett Bay, the landscape is characterized by low, rounded slopes with few trees. To the west of Narragansett Bay, the Rhode Island slopes are more rugged and support more forested woodlands.

The Eastern New England Upland covers the northwestern corner of Rhode Island; about 33% of the state. Sometimes called the Western Rocky Upland, this region of Rhode Island is marked by rolling hills and higher elevations. The land rises from about 200 feet above sea level in the east to over 800 feet above sea level in the northwest. The highest point in Rhode Island, Jerimoth Hill, lies in the northwest corner of Rhode Island. Many small lakes and ponds nestle among the hills of the Eastern New England Upland. (Warburton, E, 1988)

2.2 Narragansett Bay

Narragansett Bay, an arm of the Atlantic Ocean, 30 miles (48 km) long and from 3 to 12 miles (4.8–19 km) wide, deeply indents the state of Rhode Island. Its many inlets provided harbors that were advantageous to colonial trade and later to resort development. At the head of the bay is Providence, the State's capital; at the SE corner of the northern bay portion is Newport and its Harbour.

Narragansett Bay has three entrances, from west to east, the West Passage, the East Passage and the Sakonnet River. The East Passage is the one most favoured by deep water vessels, but the West Passage can be used by shipping drawing 8 meters or so. The Sakonnet River (not a real river but a sea passage) provides access to Mount Hope Bay.

Within the Bay are three large islands: including Rhode Island (or Aquidneck), the largest (and the site of Newport); Conanicut Island, (which separates the East and West Passage) and the site of Jamestown; and Prudence Island. (Swanson & Stanford, 2001) There are also more than twenty smaller islands and rocky outcrops.

Shoreline topography is varied with rocky headlands and boulder covered shores common along the lower Bay near the entrances, whilst sand and gravel bluffs are common inland.

Most of the bedrock shoreline consists of conglomerate sandstone and black shale deposited more than 280 million years ago (Hale, 1998). These shale deposits include extensive areas of coal deposits at Portsmouth and Bristol and graphite at Cranston. Outcrops of earlier igneous and metamorphic rocks such as granites and schists can be found along the shores of the southern part of the Bay including Newport.

The Rhode Island shoreline is presently undergoing a steady process of erosion and is submerging because of the slow rise in the level of the sea relative to the land. According to Hale in *Narragansett Bay: A Friends Perspective* (University of Rhode Island, 1998) the rate of submergence is approximately 330mm per one hundred years. Using Hale's calculations - based on tidal records - the depth of water in Newport Harbour has increased approximately 800mm since the loss of the British Transports in 1778.

Narragansett Bay is generally quite shallow with the bottom tapering gradually from Rhode Island Sound in the South to the head of the Bay. Average depths are about 24.5 feet at mean low water in both the West Passage and the Sakonnet River, although there is one 85 foot deep spot in the passage near Dutch Island. In the East Passage, near Castle Hill Light, the water depth is 188 feet and depths of 100 feet plus are found all the way north to Prudence Island almost half way up the Bay. (Hale, 1998)

2.3 Tides

Tidal movement in the Bay is minimal. According to Hale (URI, 1998) it can take between 42 and 59 days for the Bay to flush itself of water. While water movement is slow the twice-daily tides do set up powerful currents in the constricted channels between the islands.

2.4 Winds

On open areas of the Bay, prevailing winds from the North or South can build up substantial seas in the upper Bay between Conimicut Point and Prudence Island. Strong winds can also make the entire West Passage and parts of the Sakonnet River very rough on occasions.

The prevailing winds of the Bay blow from the northwest in the winter and from the southwest in the summer. The summer breezes, when the air temperature is high, are often light and variable in the morning increasing as the day progresses to a steady or

brisk seabreeze from the south or southwest in the afternoon and then dying off to a flat calm in the evening.

When the days are exceptionally hot and substantial amounts of moist air are pulled in the sky, striking cloud formations including thunderheads can occur. These sudden summer storms can unleash rain squalls and 40 to 50 knot winds that move opposite to the prevailing wind conditions. Usually these squalls last no more than a few minutes but they can make all boating and diving operations uncomfortable and some cases dangerous. On a number of occasions, over the last four years of fieldwork, in Narragansett Bay all diving operations have been cancelled because of the high probability of these storms occurring.

Although Hurricanes are uncommon they can hit with incredible force as the Bay acts as a giant funnel, constricting and mounding up the hurricane surge. Between 1635 and 1938, nine severe tropical storms stroke the Bay region. One such hurricane in 1815 increased the level of the Bay at Providence by 12 to 14 feet above normal. Thirty five vessels including four ships, nine brigs, seven schooners and fifteen sloops were wrecked and over 500 buildings destroyed.

2.5 Water Temperature

Summer water surface temperatures range from highs of 74 degree F to lows of 64 degree F at the mouth of the Bay. Bottom temperatures are progressively cooler, as much as six to eight degrees 15 feet below the surface. Winter water temperatures reach a low of between 36 degree and 38 degrees F in February and in 1976 parts of the Bay froze over.

2.6 Salinity

Narragansett Bay is quite brackish in its upper region where the Blackstone, Woonasquatucket and Moshassuck Rivers at Providence, the Palmer River at Barrington, the Taunton River at the head of Mount Hope Bay, the Pawtuxet River at Cranston and the Potowomut River at North Kingston providing a freshwater influx.

At the Bay's three entrances and for a considerable distance northwards, the Bay has an average salt content of 30 to 32 parts thousand. Bottom waters are generally more salty than the water at the surface. The East Passage has the highest concentrations of salt in the entire Bay region.

2.9 Biota

A combination of forces including the tides, river inflow, water and land temperatures and the migratory nature of pelagic fish (non-bottom dwellers) have given the Bay a varied marine life.

Because of the Bay's location it contains both northern, cold-water forms and southern forms of marine life, such as the cold water form soft-shell clam (steamers) and the warmer water hard-shell clams (quahaugs).

The mouth of the Bay is also only 150 miles from the warm water Gulf Stream which not only affects the weather but also allows exotic warm water fish to enter the Bay including tarpon, sand launce, crevalle, threadfish, dollarfish, lookdowns, tripletail, triggerfish, filefish, seahorses, barracuda, puffer and flying fish.

Native marine life includes various types of lobster, crabs, winter flounder (blackback), summer flounder (fluke), tautog (blackfish), sea bass, cunners, bluefish, menhaden, mackerel, herring, hake, butterfish, striped bass, sand shark, dusky shark, smooth and spiny dogfish and the squeteague.

Various shellfish including the Quahaugs (which thrive in sand, mud, clay, shells and small rocks found on the floor of the Bay), razor clam, ribbed and blue mussels, mud snails, oyster drills, oysters, bay scallops and limpets are also found in the silt and sediment of the Bay. (Hale, 1998)

2.8 Water Quality

With a watershed encompassing over 1600 square miles the Bay ecosystem includes most of the State of Rhode Island and extends well into Massachusetts. With over 2 million people living in its watershed, the Bay is one of the most densely populated estuaries in the United States. (Narragansett Bay Project Executive Committee (NBPEC), 1992)

The high population and extensive heavy industry including ship-building and repair has had a dramatic effect on the waters, silts and biota of the Bay.

Nutrient loadings in the Bay, caused by land clearing, erosion and agriculture, are at historically high levels, causing fish kills and low concentrations of dissolved oxygen. Over 40% of the Bay is closed on either a permanent or conditional basis to shellfishing because of high concentrations of bacteria. High concentrations of industrial heavy metals including arsenic, copper, zinc, iron, manganese, nickel, mercury, chromium, lead, cadmium and silver along with concentrations of organic compounds such as PCB's, PHC's and DDT are also found in the Bay's sediments. (NBPEC, 1992)

2.1 Newport

Newport is a city in the State of Rhode Island, about 40 kilometres southeast of Providence the State Capital. Newport is situated near the mouth of Narragansett Bay, in the southwest corner of the island of Aquidneck or Rhode Island and overlooks the East Passage into the Bay.

Newport's harbour is sheltered from the south and east by Newport Neck, from the north by Rhode Island and Coasters Harbor and from the east by Rose Island, Goat Island and Fort Adams.

Founded in 1639 by settlers fleeing the religious restrictions of the Massachusetts Bay colony, the settlements maintained a tradition of religious tolerance welcoming many different religious groups.

The town flourished on shipbuilding and trade with the middle and southern colonies, the West Indies, and Europe, initially in wool and foods but later molassess, rum and slaves. By the 1750s Newport rivaled Boston, Philadelphia and New York as one of the chief commercial and cultural centres on the eastern seaboard of the United States.

By the mid 1700s relations between the Rhode Island Assembly and the British Crown began to sour and Newporters began to look at Fort George on Goat Island - which controlled access to Newport Harbor - with unease and suspicion.

Occupied by the British and later the French during the American War of Independence, Newport's commercial influence declined until the American Civil War in the 1860s when the Naval Academy was evacuated from Annapolis to Newport.

A Naval Torpedo Station was subsequently established at Goat Island in 1869, the U.S. Naval Training Station (Naval Education and Training Center) was built at Coasters Harbor in 1883, the Naval War College in 1884 and the US Naval Hospital in 1886.

The US Navy also built a large coaling station at Melville on Aquidneck Island in 1901 and the Naval Torpedo Factory on Goat Island in 1906. These were followed by the Quonset Point Naval Air Station, the Davisville Naval Base, the Officer Indoctrination School, the Chaplin School, the Surface Warfare Officer School and the Naval Undersea Warfare Center (NUWC).

The increase in population (by 1944 over 162,000 naval personnel were based in and around Newport), naval spending and the growth of supporting infrastructure led to increased prosperity for the town. Newport gained a reputation for being the playground for the well to do of New York and Boston - a reputation it still has today.

2.2 RIMAP

The Rhode Island Marine Archaeology Project (RIMAP) was founded in 1992 with the aim of documenting vessels wrecked in the waters of the State of Rhode Island. A secondary objective was to provide an educational agency through which the diving and non-diving public would appreciated the importance of protecting and researching the State's Underwater Cultural Heritage. (Abbass, 1998)

Working in conjunction with the Rhode Island Historical Preservation Commission (the State Government authority responsible for the management of historic sites) along with the National Maritime Heritage Program, the National Parks Service, the U.S. Navy and hundreds of volunteers, RIMAP a not-for profit organisation has carried out a number of educational programs, surveys, contract site assessments and excavations in Rhode Island.

Under the direction of qualified archaeologists such as Dr. Kathy Abbass (RIMAP); Dr. Rod Mather (University of Rhode Island); Jonathan Faucher (Texas A & M) and Kerry Lynch (University of Massachusetts), RIMAP has investigated

Inundated Native American Sites
HMS *Lark* (1778)
HMS *Orpheus* (1778)
HMS *Cerberus* (1778)
SS *Empire State* (1887);
The Goat Island Marine Railways (1930s);
The Barrington Brickyard Barge (1900) and
The fleet of British Transports lost during the Battle of Newport in August 1788.

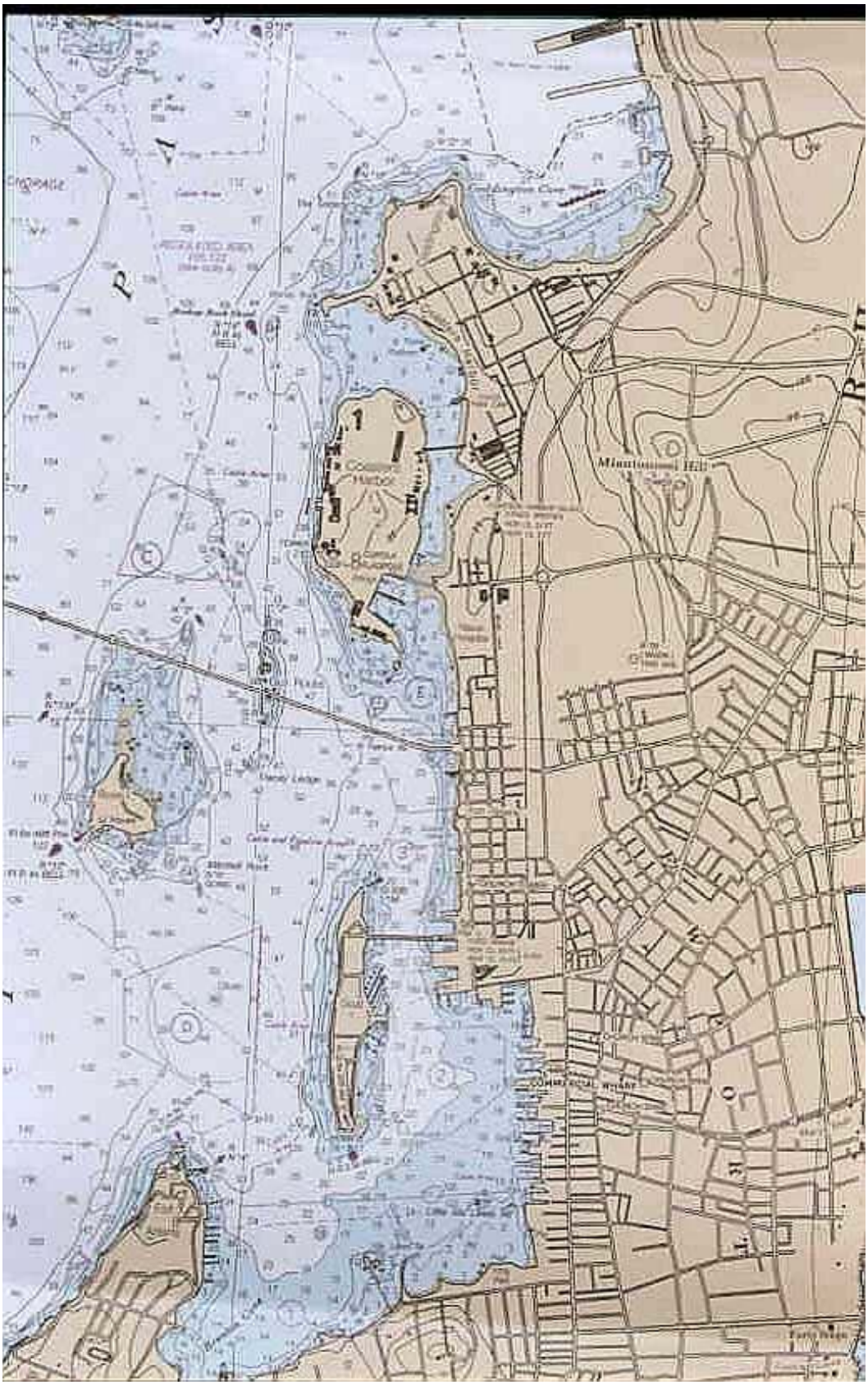

Fig 2: Extract from NOAA Chart 13223 showing Newport Harbor and the location of the Hospital Cannon and GAMMA site. Photo: A Frolow.

2.3 RIMAP and HMB *Endeavour*

In January 1999 Dr Kathy Abbass, announced that she had uncovered information at the Public Records Office in London that suggested that the remains of Captain James Cook's bark HMB *Endeavour* lay in Narraganestt Bay, off Newport, Rhode Island.

Dr Abbass, leader of the Rhode Island Marine Archaeology Project (RIMAP) was investigating a number of British naval vessels and charted troopships - including the *Lord Sandwich* - which were sunk off Newport in 1778 during the American Revolutionary War.

Abbass had gone to England acting on advice from Antonia Macarthur, Director of the Endeavour Foundation, following a lead published by Sydney maritime historians Mike Connell and Des Liddy in the Australian Association of Maritime History's journal *The Great Circle* (1997, 40-49). These two historians, prompted by a proposed donation to the Australian National Maritime Museum, had carried out research that suggested HMB *Endeavour* had been sold out of service and renamed *Lord Sandwich*.

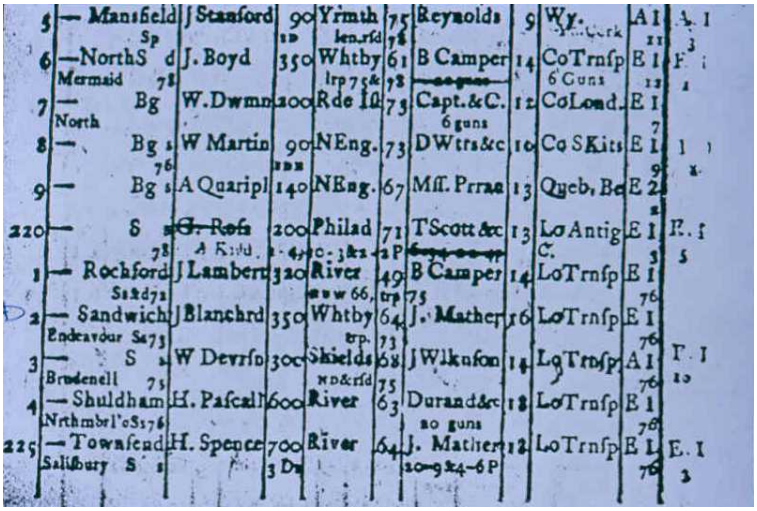

Fig 3: Extract from *Lloyds' Register of Ship* (1777) showing the renaming of HMB *Endeavour* to *Lord Sandwich*. Photo. A. Frolows.

In London Abbass located records that proved that the *Lord Sandwich* was Cook's bark *Endeavour*, that it had served as a troop transport to North America, had served as a prison ship in Newport Harbor and then had been intentionally sunk in Newport Harbor in 1778. (Mellefont, 1999)

2.4 The *Lord Sandwich* ex HMB *Endeavour*

In the 1770s the political situation in the North American colonies had deteriorated, and the British Government decided to send additional troops to the colonies. It is now known that *Endeavour* – now called the *Lord Sandwich* - was offered to the transport service in response to this need. On 6 December 1775, the Deptford Yard reported to The Navy Board that the vessel had failed survey. The name change from *Endeavour* to *Lord Sandwich* is given in a list of vessels offered as transports:

> 'Lord Sandwich *2d: unfit for Service She was Sold out of…service Called* Endeavour *Bark refused before'*
>
> (cited in Abbass, 1999)

Although at first refused for service, the *Lord Sandwich* ex *Endeavour* had some "Material Repairs" and a second survey, so that by February 1776, the *Lord Sandwich* was accepted for the transport service.

This survey report identifies the vessel as the former HMB *Endeavour* in that the tonnage and between deck measurements are exactly the same as those of the *Earl of Pembroke* when it was taken into Royal Navy service as HMB *Endeavour* in 1768.

2.5 *Lord Sandwich* in Newport

The Transports taken into service at the beginning of 1776 carried Hessian troops to New York. An eyewitness account names a number of these ships that were damaged on the voyage, including a *Lord Sandwich,* and others that were lost later in Newport.

The British used ships as prisons in many North American ports, not only because of increased security, but also because of the lack of available buildings ashore. Boston and New London had prison ships, as did New York. After the *Lord Sandwich* arrived in Newport it was also converted into a prison ship.

Following the French – American Treaty signed in the spring of 1778 France sent a fleet to support the American efforts. The French fleet arrived off the mouth of Narragansett Bay, close to Newport, causing the officer in charge of Newport to order that ten transports be sunk in the town's outer harbour to protect Newport and to keep the French ships from coming too close to shore.

On August 3 1778 the officer reported:

> '*this morning I caused five Transports to be sunk in the passage between Goat Island and the Blue Rocks, to prevent the Approach of the Enemy too near the North Battery, so as to attack it with Advantage. And Five more Transports are proceeding out, in order to be sunk between Goat Island and Rose Island for the same Purpose'* (Abbass, 1999, p 15)

A further three Transports, four Royal Navy frigates and a number of smaller vessels were sunk over subsequent days.

When the news arrived back in England that the transports had been scuttled during the Siege, the owners expected to be reimbursed for their loss. This was because the transports were charted to, and not owned by, the Government. The valuations listed (along with nine other Transports) the *Lord Sandwich,* of 368 71/94 tons, that entered into paid service on February 7, 1776.

Transports Lost in Newport August 1778

Name	Tonnage	Where built	Master
Betty	234 5/94	Non known	Thos. Long
Britannia	374 82/97	America	J. Trousdale
Earl of Oxford	231 71/94	America	Jas. Johnson
Good Intent (ex / alt *Intent*)	241 17/94	Scarborough England	Jn. Harrison
Grand Duke of Russia	671 84/94	East Indiaman poss England	Jn. Holman
Lord Sandwich	368 71/94	Whitby	Jn. Blanchard
Malaga	205 91/94	America	Wm. Chien
Rachel and Mary	320 7/94	Hull	Fran. Rowbotham
Susanna	254 20/95	Bristol	Thos. Spencer
Union	261 66/94	America	Bryson.

Source: Abbass, 1999 compiled from ADM 106/3404 and ADM 49/127

Based on the Public Records Office documents, there can be no doubt that this is the same *Lord Sandwich* that had been HMB *Endeavour* (of 368 71/94 tons), and that it was one of the transports sunk in Newport's outer harbour in 1778.

2.6 United States Shipwreck Legislation

The *Abandoned Shipwreck Act* of 1987 established United States government control over the majority of shipwrecks located in the waters of the United States of America and its Territories and created a framework within which shipwrecks are managed. Proclaimed in 1988, the *Act* affirms the authority of State Governments, such as The State of Rhode Island, to claim and manage abandoned shipwrecks covered under the *Act* and asserts that shipwrecks are multi-use resources. (Delgado, 1998)

Under the *Act*, the US Government asserts title to three classes of abandoned shipwrecks located within three nautical miles of the United States coastline and in the internal navigable waters of the United States, such as Newport Harbor.

The *Act* covers abandoned shipwrecks that are embedded in submerged lands, abandoned shipwrecks that are embedded in coralline formations protected by a State and abandoned shipwrecks that are on submerged lands and included in or determined eligible for inclusion in the National Register of Historic Places. Upon ascertaining

title to these shipwrecks, the US Government transferred its title to the government entity that owns the submerged lands containing the shipwrecks.

As a result State Governments, such as The State of Rhode Island, have title to shipwrecks located on submerged State lands. However the US Government continues to hold title to sunken US warships and other shipwrecks entitled to sovereign Immunity.

One of the *Acts* most important provisions specifies that the laws of salvage and finds do not apply to abandoned shipwrecks claimed by the government under the Act.

As required under the *Act*, the National Parks Service, US Department of Interior, prepared guidelines to assist State and Federal agencies in carrying out their responsibilities under the *Act*. The guidelines provide advice on establishing and funding shipwrecks management programs and technical guidance or surveying, identifying, documenting and evaluating shipwrecks.

The *Abandoned Shipwreck Act* applies in the fifty states of the United States, the District of Columbia, Puerto Rico, Guam, the US Virgin Islands, America Samoa and the northern Mariana Islands. Under the *Act* a shipwreck is defined to include the vessel or wreck, its cargo, and other contents. The term embedded means firmly affixed in submerged lands or coralline formations such that excavation tools are required to move bottom sediments to gain access to the wreck.

In Rhode Island shipwrecks are administered through the Maritime Archaeologist, at the Rhode Island Historical Preservation Commission. All work carried out on shipwrecks in Rhode Island must abide by the *Abandoned Shipwreck Act*, The National Parks Service Guidelines and Rhode Island State Preservation law.

Although the *Abandoned Shipwreck Act* should protect shipwreck for their historical and archaeological significance in the United States the *Act* has been challenged on a number of occasions by shipwreck salvors and treasure hunters. The opponents to the *Act* have stated that the law of finds, law of salvage and Admiralty Law should take precedent over the recently enacted federal law. (Delgado, 1998)

In April 1999, the State of Rhode Island took steps to protect the Royal Navy warships and transports sunk during the Battle of Newport in 1778. The Rhode Island Attorney General used Rhode Island State Preservation laws, the Federal *Abandoned Shipwreck Act*, the law of finds and the law of salvage to ask the federal court to award custody to the State of Rhode Island of all non-motorised wooden vessels in Newport Harbor. In December 2000 the federal judge awarded title to the state.

The custody and title reside with the Rhode Island Historical Preservation Commission, and the Rhode Island Marine Archaeology Project have the exclusive contract to conduct work on these vessels. (Abbass, 2001)

3.0 Project Methodology

In May 1999 Dr Kathy Abbass from RIMAP, the RIMAP Board of Directors, Rhode Island State Appointed Archaeologists and Curator Paul Hundley from the Australian

National Maritime Museum developed a strategic approach to guide any future archaeological investigation of wooden, non-motorised shipwrecks in Newport Harbour.

The aim of this approach was to positively identify one of the 13 known 18th century vessels sunk in Newport, Rhode Island during the American War of Independence as the *Lord Sandwich* ex HMB *Endeavour.*

This approach would involve not only additional historical research but also the archaeological survey and possible partial excavation of some of the shipwreck sites.

The Project Team developed a set of criteria, which would be used to identify the vessels.

3.1 Method of Construction

Prior to being purchased by the Royal Navy in 1768, the future HMB *Endeavour* was called the *Earl of Pembroke.* There exists both in Australia and England an extensive archive of documents and ship's plans associated with the *Earl of Pembroke*, HMB *Endeavour* and the vessel's voyage to Australia.

This is due to:

- The detailed survey work carried out on the *Earl of Pembroke* prior to it being purchased by the Royal Navy in 1768;
- The detailed survey work carried out at Deptford prior to the *Lord Sandwich* ex HMB *Endeavour* being taken up by the Board of Transport;
- The meticulous records of the Navy Board;
- The journals of Cook, Banks, Parkinson, Monkhouse and Molyneux;;
- The investigation into and the reconstruction of HMB *Endeavour* in Fremantle, Western Australia and
- The continuing interest in the adventures of Cook and the *Endeavour*.

This archive of documents, ship's plans and artefacts is held at the Australian National Maritime Museum, The State Library of New South Wales, National Library of Australia, the National Maritime Museum, Greenwich and the English Public Records Office.

An examination of these archival items, in conjunction with the careful recording and identification of underwater shipwreck features would be used in the identification of the vessel.

3.2 Construction Materials

Archival information and secondary sources state that HMB *Endeavour* was built predominantly out of English White Oak (for its floors, futtocks, ceilings and outer planking); Elm (for the keel, stem post and possibly the keelson); Baltic Pine (for the bark's masts) and possibly Fir (for the upper decks).

The vessel was timber sheathed, iron and timber fastened, and fitted with iron gudgeons and pintles (hinges for the rudder). The bark had no copper alloy bolts, nails or sheathing used in its construction.

It is also possible that a careful examination of the vessel hull timbers may find traces of South East Asian or Australian timbers used on the vessel – when it was repaired at Endeavour River in June / July 1770 or at Batavia in October 1770.

Careful recording along with the sampling of timbers and fastenings taken from strategic structural components of the wreck would be used in the identification of the vessel.

3.3 Scantlings

By comparing the size of specific structural components – such as the keel, keelson, floors and futtocks - found on any of the wrecked vessels with archival information the Project Team would be able to calculate the tonnage of the vessel. When compared with the known scantlings and tonnage of the *Earl of Pembroke* and HMB *Endeavour* this would be used to identify the vessel.

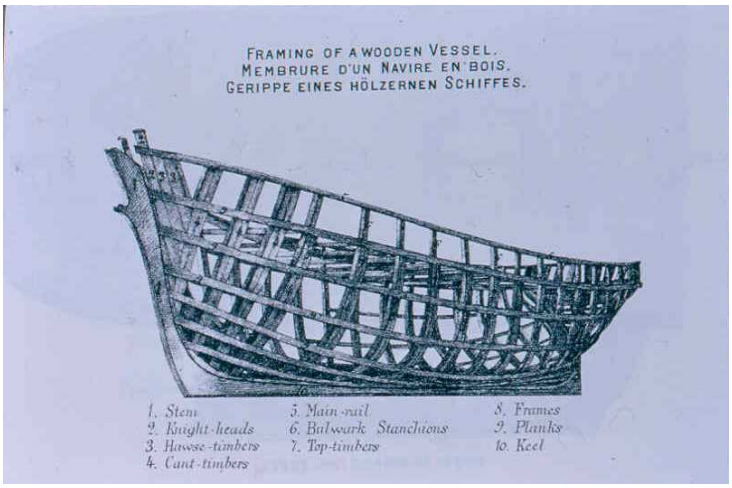

Fig 4: Illustration of typical wooden ship construction showing stem and stern posts, keel, keelson, floors, futtocks and frames. (Paasch, 1885)

3.4 Iron Ballast Analysis

When HMB *Endeavour* became stranded on Endeavour Reef off the coast of Queensland in 1770 the crew jettisoned over fifty tons of material from the vessel. This included iron guns, gun carriages, water casks, provisions and some of the stone and iron ballast that had been stored in the vessel's Bread Room.

In the late 1960s six guns, one of HMB *Endeavour*'s anchors and most of the stone and iron ballast were recovered from the stranding site. In accordance with *The Navigation Act* (1912) these items were handed over to the Department of Transport (Pearson, C, 1972). While the anchor and cannon were sent to various institutions and museums in Australia and around the world (Greenwich, Philadelphia, Auckland,

Cooktown and Kurnell) the Federal Department of Transport passed the custodianship of the remainder of the recovered material to the Australian National Maritime Museum in 1986.

It is highly likely that when HMB *Endeavour* was sold out of service its iron ballast, which was considered permanent and usually chained or fastened to the vessel's hull, was sold along with the vessel. Comparison of the iron ballast found on any of the Newport shipwrecks with that held by the Museum, and known to have come from HMB *Endeavour* could be used in the identification of the vessel.

18th century Royal Navy ballast or 'kentledge' was of a specific size (900mm x 150mm) and weight (300 kilograms) and marked with the 'broad arrow' or government mark.

Pearson in *Restoration of Cannon and other Relics from H.M.B. Endeavour* (1972, p74) noted that the kentledge recovered from *Endeavour* Reef had a specific composition consisting of

Element	**Ballast Iron %**
Total carbon	3.01%
Silicon	0.01%
Manganese	0.25%
Sulphur	0.03%
Phosphorus	1.17%
Titanium	0.005%
Copper	0.02%
Vanadium	0.007%

This analysis is typical of a high-phosphorus white cast iron but with an unusually low silicon content (Pearson, 1972, p74). Pearson goes onto to state that is probably the product of a charcoal fed blast furnace whose founders specifically choose an easy to smelt and cast, cheap and readily available ore that would produce a brittle but ideal iron composition for ballast.

3.5 Stone Ballast Analysis

It is also possible that lying underneath the inner hull planking and between the frames of the *Lord Sandwich* lie fragments of the stone ballast that Cook and his crew obtained during their voyage into the Pacific. Only one other of the 13 known shipwrecks in Newport Harbour journeyed to the South Pacific, the much larger East Indiaman *Grand Duke of Russia*.

Careful sampling of the stone ballast, in particular stone fragments from between the frames, – might reveal stone unique or similar to that found in the South Pacific and in particular to New Zealand and Tahiti from where Cook obtained his ballast. The recovered stone ballast would also be compared with the *Endeavour* ballast held at the ANMM.

3.6 Coal Analysis

Prior to becoming HMB *Endeavour* the vessel was a collier or coal carrier employed out of Whitby, England. It is also reported (Abbass, 1999) that the *Lord Sandwich* carried coal from England to Newport via New York.

A comparison of coal found on the site with known coal sources in England could be used to assist in the identification of the vessel.

3.7 Silt and Sediment Analysis

Because of *Endeavour*'s voyage to the South Pacific and its repairs both in Australia and in Indonesia, its possible that marine organisms, plant fragments and pollen spores unique to these regions may be found in silts and sediments recovered from the bilges of one of the shipwrecks.

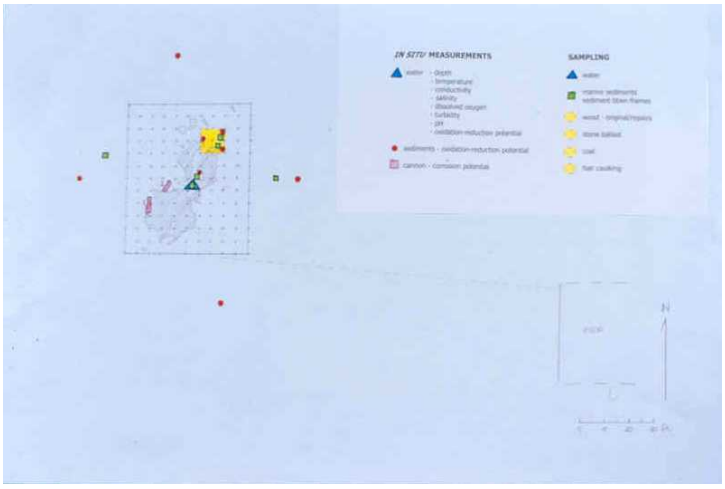

Fig 5: During the 1999 Field season on the Hospital Cannon Site silt, sediment, coal, rock and water samples were collected from all around the site. Photo S. Bassett.

Analysis of these silts and sediments could be used to identify the wreck as *Endeavour* and analytical techniques (such as Lead 210) could be used to date the sediments found in the shipwreck.

3.8 Hair and Timber Treatment Analysis

From the mid 1500s maritime nations have been treating, coating and sheathing their ship's outer hulls with various mixtures, concoctions and substances in an attempt to preserve the hull and protect it from marine borers and growth.

Using archival information including the journal of Lieutenant James Cook the Project Team identified the types of sheathing and protective coatings, which were applied to the hull of HMB *Endeavour*.

Careful sampling and analysis of the outer hull timbers would be able to be used to isolate the various protective coatings allowing them to be compared to those known

to have been used on HMB *Endeavour*. These samples could also be used to aid in dating the shipwreck.

3.9 Material Culture Analysis

Although it is extremely unlikely that any artefactual material associated with Cook's voyage to Australia still remains in the hull of the ship, it may be possible to identify the vessel through artefacts associated with its later use as a troop transport and prison ship.

Historical information indicates that HMB *Endeavour* became the troop transport and prison ship *Lord Sandwich*. Any material associated with the Hessian troops transported out to the Americas on board the *Lord Sandwich* in 1777 or any of the prisoners who are known to have been housed in the ship prior to it sinking would if found, provide very strong evidence that the shipwreck was the *Lord Sandwich* ex HMB *Endeavour*.

4.0 Newport Fieldwork 1999

With the methodology for the fieldwork developed and approved by the Rhode Island State Archaeologists in 1999 a combined RIMAP / ANMM team conducted a limited excavation on a site known as Primary Target A or the Naval Hospital Cannon Site in August 1999.

Fig 6: ANMM team members (1999, 2000) in front of the Hospital Cannon Site and the Newport - Jamestown Bridge. Photo: G. DeAcentis

This site consisted of a stone ballast mound approximately 15 metres long by 10 metres wide and 1 metre high, two iron cannons, some scattered timbers and two small piles of bricks – possibly associated with the ship's galley or kitchen.

The RIMAP / ANMM team excavated a 10 foot by 10 foot (3m x 3m) grid just to the north of the ballast mound and located the ship's keelson – complete with scarf joints, a series of first and second futtocks, frames, outer hull planking, ceiling planking and

the top of the vessel's keel. All these features were carefully recorded, the lines (shape of the hull) taken off and timber, silt, stone and coal samples recovered.

Analysis of the vessel's scantlings and examination and identification of the timber, coal, stone and sediments indicated that whilst this vessel was most likely one of the British vessels sunk in 1778 it was not HMB *Endeavour*. (Bassett et al, 1999)

5.0 Newport Fieldwork 2000

Following the August 1999 Newport Fieldwork - which successfully tested the methodology established by Abbass and Hundley - the project was discussed at the Australian Institute for Maritime Archaeology Conference in Sydney in September 1999 and at the Society for Historical Archaeology Conference in Quebec in January 2000.

As Primary Target A (the Hospital Cannon Site) had proved not to be HMB *Endeavour* the RIMAP / ANMM team proposed at the two conferences that a remote sensing survey of Newport Harbour be carried out and that any sites located be tested using the Abbass / Hundley methodology.

The Rhode Island Historical Preservation Commission approved the program of work and fieldwork commenced in July 2000.

Fig 7: Members of the ANMM / RIMAP team prepare to dive on an anomaly located during the 2000 Fieldwork. Photo P. Hundley

For the first few days Paul Hundley, Sue Bassett and RIMAP Team members carried out additional excavation work on the shipwreck lying off the Newport Navy Hospital Pier. Although the team had previously discounted this site as being *Endeavour* (Bassett, Hundley et al 1999) further work was carried out in the bow and stern areas of the vessel in order to confirm the overall length of the vessel and to assess the site's conservation and archaeological significance.

In early August the team commenced a survey of Newport Harbor using side scan sonar equipment provided by Klein & Co of the United States.

Using a Klein 2000 with an integrated Global Positioning System (GPS) - Joe Zarzynski and Bob Benway from Klein and the RIMAP / ANMM team conducted a series of remote sensing surveys of the seabed. The three areas chosen for the survey were along the west coast of and offshore from Goat Island, between Fort Greene and Rose Island and in an area to the east of Gull Rocks bounded by Coasters Harbor (a small island) and the Naval Hospital.

These areas were selected using archival information, which included eyewitness accounts and two navigational charts of Newport Harbour. An August 1778 chart by a Captain Fage, which showed the approximate position of the scuttled transports between Rose Island and Goat Island, and Goat Island and Blue Rocks.

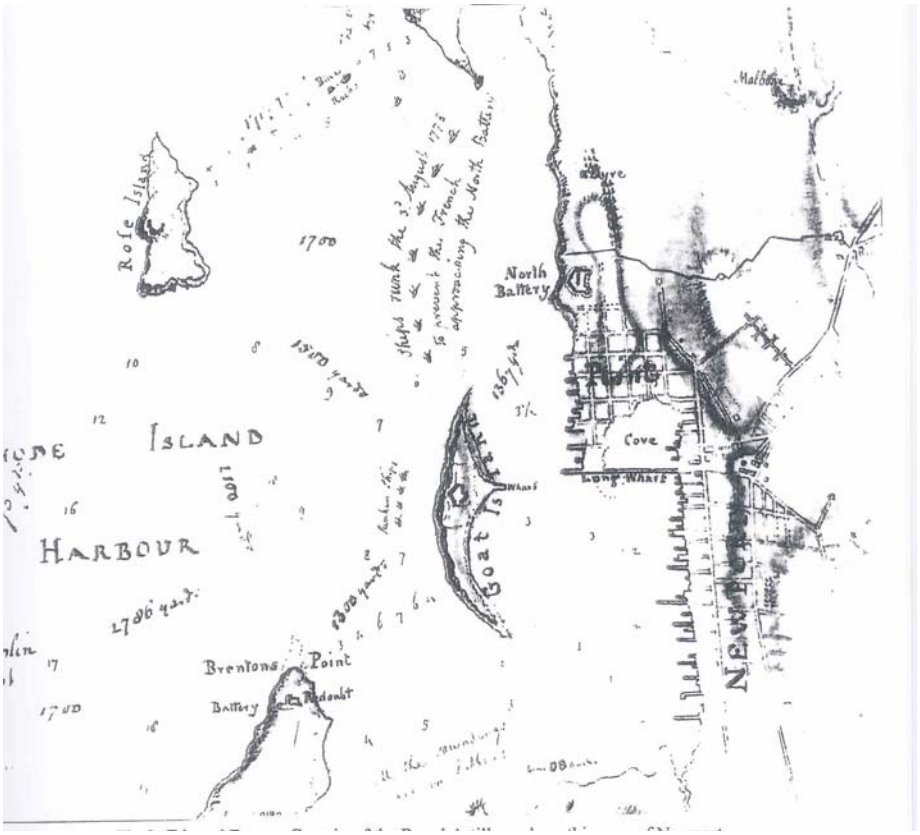

Fig 8: Edward Fage, a Captain of the Royal Artillery, drew this map of Newport Harbor, depicting the location of ships sunk by the British in 1778. (Abbass, 1999)

And a 1779 / 1780 French chart *Plan de la position de l'armée francoise autour de Newport et du mouillage de l'escadre dans la rade de cette ville* which showed a line of sunken British vessels between Goat Island and Blue Rocks and offshore from Dyers Point (Battery Point, Newport)

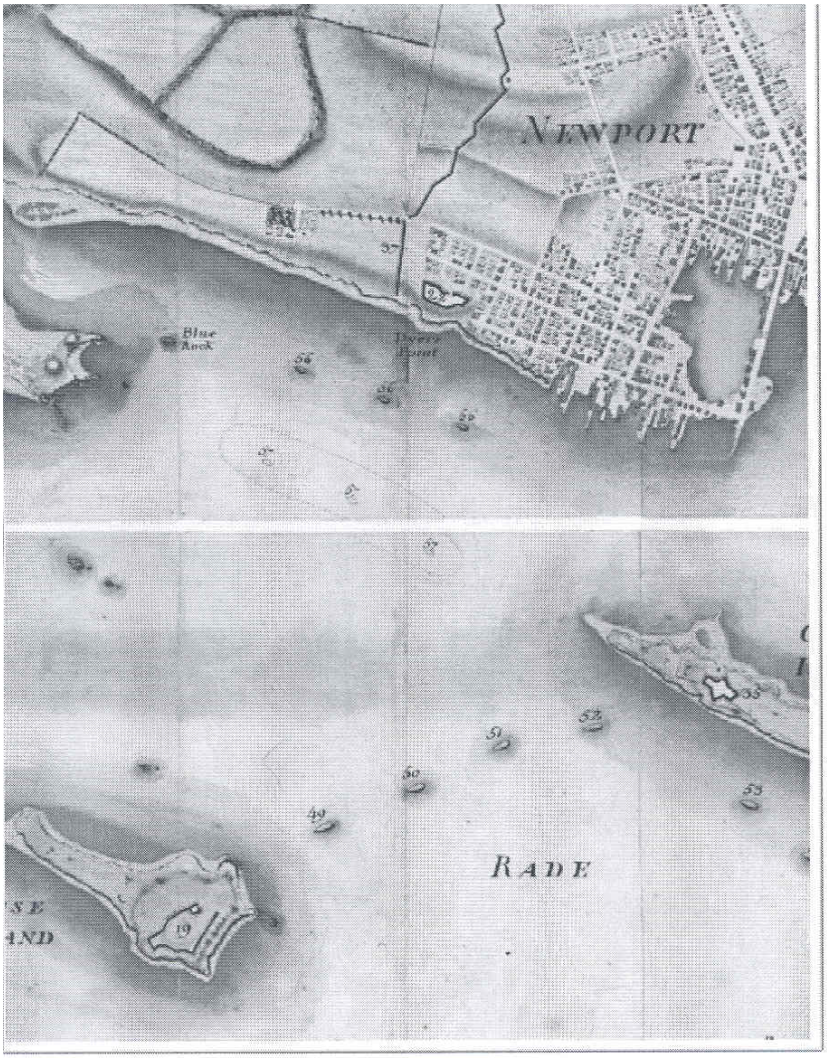

Fig 9: *Plan de la position de l'armée francoise autour de Newport et du mouillage de l'escadre dans la rade de cette ville* (1779)

The team located and buoyed 14 sonar anomalies and then depending upon the state of the tides - dived the potential shipwreck sites in a process called ground truthing.

Sonar Anomalies

Code Name	Location	Date	Anomaly
001	41deg30.181N 071deg 19.741W	2/08/00 14.38	Bridge Material

Sonar Anomalies (cont.)

Code Name	Location	Date	Anomaly
002	41 30.180N 071 19.743W	2/08/00 14.41	Modern debris
003	41 29.995 071 19.704	4/08/00 19.30	Possible Ballast
GAMMA	41 30.149N 071 19.830W	2/08/00 15.16	Barge / Ballast
BARGE 2	41 30.116N 071 19.758W	3/08/00 16.01	Possible Ballast
BOUY 8	41 29.873 071 19.645	3/08/00 18.46	Rising silt / mud
CHECK 1	41 29.778 071 19.580	3/08/00 18.58	Rising silt / mud
004	41 30.000N 071 19.779W	4/08/00	Cracked Rock
005	41 30.000N 071 19.784	4/08/00 19.33	Cracked Rock
006	41 29.981N 071 19.778	4/08/00 19.37	Rock
007	41 29.998N 071 19.784	4/08/00 19.40	Bridge Material
008	41 29.894N 071 19.683	10/08/00 13.21	Sloping silt / mud
009	41 29.964N 071 19.536	10/08/00 13.31	Sloping silt / mud
010	41 30.163N 071 19.787	10/08/00 14.08	Rock

In nine cases the anomalies were discounted as being false echoes caused by local geology, shelving sand or silt, or recently deposited material such as bridge debris. However four substantial anomalies representing possible ballast mounds were located just to the south of the Newport - Jamestown Bridge (opened 1969). The locations of these four potential sites were recorded using GPS, Loran C and shore transits and will be investigated at a later date.

In mid August the team began working on the remains of two shipwrecks lying side by side in 12 - 13 metres (36 - 40 feet) of water just to the north of the Jamestown Bridge. This site, which has been codenamed GAMMA, consisted of a small wooden and iron 20th century barge lying on a north - south axis and a much earlier stone ballast mound, with an associated anchor, lying partly under the barge on an east - west axis.

A base line was established on the northern side of the ballast mound, datum points were surveyed in and a survey grid system placed over the mound. During the survey the team located a number of wooden frames or ribs lying underneath the stone ballast mound on the northern side of the site. As these timbers appeared to be *in situ* and in a good state of preservation the decision was made to excavate a small trench 50cms x 500cms (1.5feet x 15feet) from north to south across the ballast mound in order to take undisturbed timber, silt, coal and stone samples and scantling dimensions. For survey purposes this trench was broken down into five x 100 cms (3feet) sections named A, B, C, D and E.

Trench sections A and B - which were at the northern edge of the ballast mound - proved the most informative with the divers quickly uncovering substantial framing and ceiling planking. These two sections also indicated that the vessel was canted over onto the southern side at such a steep angle that substantial quantities of ballast material would have to be removed in the three other sections (C, D and E) before any ship structure could be exposed.

On the second last day of the expedition an additional small test pit was opened at the western end of the ballast mound. This pit was excavated to see if a substantial longitudinal timber (observed in Sections A & B in the first trench) that appeared to be running from east to west along the site actually continued past the western edge of the ballast mound. This timber was located and additional timber, ballast and silt samples were taken from this area.

As the work on GAMMA was progressing members of the team continued to ground truth anomalies to the north of the barge between Gull Rocks and Coasters Harbor. Historical information indicated that at least one possibly two of the transports had been scuttled in the channel between these two features - possibly to block the northern approaches into Newport Harbor and Fort Greene.

During the last week of the project the RIMAP / ANMM took part in an innovative experiment to publicise the Project work and the work of the team sponsors. Using technology provided by the United States Navy's Undersea Warfare Centre (NUWC) a live weblink was established between ANMM / RIMAP archaeologists working on the seafloor and visitors to the RIMAP / NUWC webpage. The experiment was quite successful with people logging on in America and Australia to observe the divers at work and to ask the archaeologists questions about the project.

6.0 Newport Fieldwork 2001

As the Newport fieldwork report for August 2000 indicated that the GAMMA wrecksite had a one in three chance of being the *Lord Sandwich* ex HMB *Endeavour*

in May 2001 the Australian National Maritime Museum endorsed the return of a Museum team to Newport in 2001.

Like the previous years the 2001 seasons work was jointly led by American archaeologist Dr. Kathy Abbass, Director of the Rhode Island Marine Archaeology Project (RIMAP) and Paul Hundley, ANMM. The works program also included additional excavation work on GAMMA wrecksite at the northern end of Newport Harbor along with an extensive remote sensing survey of Newport Harbor with the Navy Undersea Warfare Center (NUWC).

After a quick reconnaissance, a four point mooring system was established on GAMMA in early August 2001, trail lines were placed around the site and a simple grid system was established around the proposed excavation areas at the bow and stern.

Excavation work commenced on an area at the western end of the ballast mound, which had been briefly explored in August 2000 by Paul Hundley and the former diving conservator at the Australian National Maritime Museum, Sue Bassett. Both Sue and Paul had recorded that just below the surface of the sediment they had come across a large transverse timber - possible a frame or futtock lying directly over what appeared to be the keelson of the ship. As one of the key components of a vessel, if the timber was positively identified as a keelson, it could be used as a major diagnostic feature and help to identify the size and nationality of the vessel.

RIMAP and ANMM diver's quickly uncovered the transverse timber that Paul and Sue had found the previous year. 150 - 200mm (six to eight inches) below the bottom of this timber they came across the upper surface of what was quickly identified as the keelson of the ship.

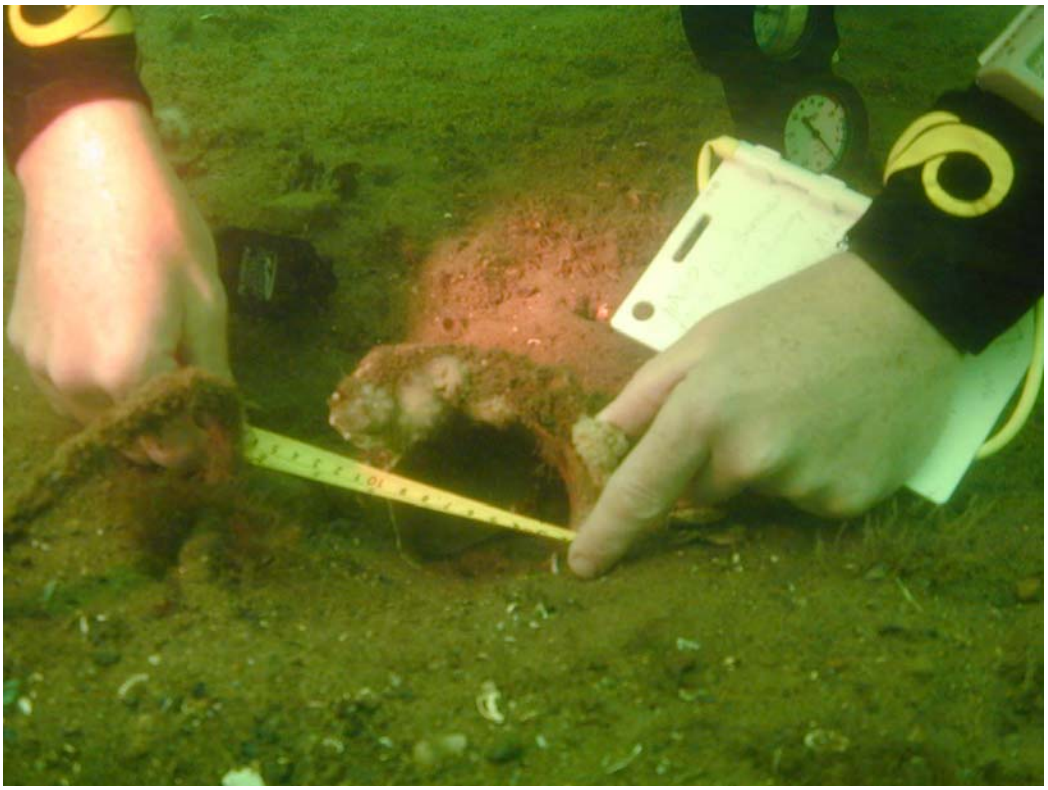

Fig 12 Kieran Hosty records the details of a lead scupper found off the southern side of the ballast mound on GAMMA site. Photo P. Hundley

The team eventually uncovered almost 250 centimeters (8 feet) of keelson before it tapered out at the stem post or bow of the vessel. A second dive confirmed that the team had located the stem post, cant frames along with either the first floor or first futtuck (rib) and the place where the keelson and keel merge into the complex of timber which make up the bow of the ship. Unfortuantaly the timbers were too badly degraded for a sample of the keel to be obtained.

Although the ANMM / RIMAP team had only just started work on the GAMMA site the team broke off excavation work on GAMMA in order to take advantage of the use of staff. sonar and surveying equipment from the Navy Undersea Warfare Center (N.U.W.C.) in Newport.

Fig 13 US Navy Workboat 30 preparing to deploy the Sub-bottom Profiler off the Newport - Jamestown Bridge. Photo K. Hosty.

The first site to be investigated was GAMMA. The dual frequency, E G & G Sub Bottom Profiler quickly picked up a significant layering of material on the site and also indicated that a substantial anomaly lay just to the north of GAMMA - possible the location of another 1778 British Transport.

The team then moved on to the Hospital Cannon Site and repeated the process. This time possible because of the shallowness of the water the system was less affective, failing to detect the small stone ballast mound.

The last run for the day was conducted at Coddington Cove - a small cove on Rhode Island to the north of the Newport Bridge - where the English Royal Navy frigate *Juno* was abandoned and burnt during the Battle of Newport in August 1778. Here the sub-bottom profiler was able to detect a significant anomaly below the sediment of the Cove possible the remains of a vessel, which has not been seen for over two hundred years.

Over the next few days the ANMM, RIMAP and N.U.W.C. Team carried out searches along the western coast of Rhode Island testing the system on the sites of three other Royal Navy frigates - the *Cerberus*, *Orpheus* and *Lark* which were abandoned and burnt at the same time as the *Juno*. Here the Sub-Bottom Profile system proved to be very successful detecting the remains of the three frigates and respective stone ballast mounds.

After locating the frigates the team's attention turned to the area to the south of the Newport Bridge between Goat and Rose Island and along an area known as Tracey Ledge. In August 2000 RIMAP and the ANMM had located a number of potential sites in this area using a side scan sonar - but were unable to locate the sites when the seafloor was searched.

This time using the latitude / longitudes obtained from the side scan sonar's differential global positioning system (DGPS) the area was sweeped using the sub-bottom profiler and a series of anomalies were located. Subsequent research indicates that these anomalies lie in an ark which mimics a drawing produced by an English Artillery Officer called Fage who drew the positions of the sunken Transports shortly after they were sunk. This arc of sunken ships is also apparent on a French Naval Chart drawn up during the French occupation of Newport in 1780.

After a successful surveying operation the Teams' attention moved back to the excavation of GAMMA site.

Whilst some RIMAP diver's were allocated the task of searching the area to the north and east of the barge site where the sub-bottom profiler had indicated an anomaly that may prove to be another 1778 transport other team members re-commenced excavation work on GAMMA.

The water dredge was moved from the bow of the shipwreck on the western side of the site, over the ballast mound to a spot 85 feet away from the stem post - in line with the previously discovered keelson. Once at that spot a small trench 200 centimeters long by 50 centimeters wide (1.5 feet x 6 feet) was cut through the sediment in an attempt to locate the stern section of the vessel. This would allow the team to deduce the site's length and help verify if GAMMA was the *Lord Sandwich* ex HMB *Endeavour*.

After finding a scattering of small ballast and coal at the 85-foot mark the excavation was moved back towards the east in an attempt to pickup the remains of the keelson. At the 55-foot mark (approximately 8 feet from the southeast corner of the barge) the team uncoved more ballast and structural timber and decided to excavate an exploratory trench approximately 50 centimeters wide by 200 centimeters long (2 feet by six feet)

The trench was extended south from the 55-foot mark uncovering additional structural timber including frames and internal or ceiling planking but unfortunately no keelson.

Judging by the size of some of the internal planking the team believed that they were in the vicinity of the turn of the bilge on the portside of the vessel and predicted that if they headed north between ten and fifteen feet they would uncover the elusive keelson.

Over the next few days the trench was extended slowly towards the north from the 55-foot mark and a substantial timber running east to west - which they later identified as being the top of the keelson- was discovered. Its identity was confirmed with the discovery of additional internal planking or ceilings that butted up against it and a series of iron fastenings and treenails (wooden nails 12" to 18" long) that marked the position of floors and futtucks (ribs).

At the 57-foot mark (from the bow) the keelson which was very degraded and worm eaten disappeared. Although unfortunate the disappearance of the keelson at this particular spot coincides with the end of *Endeavour*'s double or sister keelson which is

recorded in the draft body plan of HMB *Endeavour* which had been lent to the Australian National Maritime Museum by the Australasian Pioneers Club.

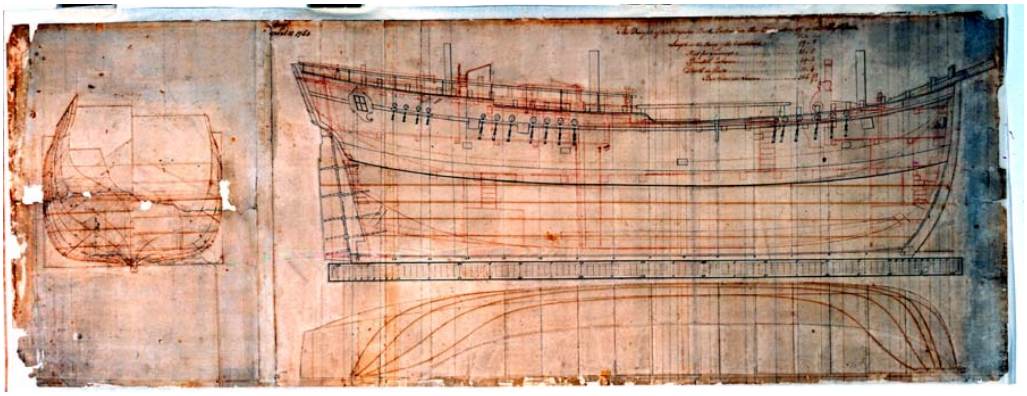

Fig 14 1768 Draft Body Plan of the *Earl of Pembroke* produced at the dockyard at Deptford just after the British Admiralty bought the vessel. Note the double or deadwood keelson. Photo: P. Hundley.

Although commonly found on 19th century wooden vessels, double, sister or deadwood keelsons (Marquardt, 1995) are very unusual on 18th century vessels This feature was not found on the collier *Betsy* sunk at Yorktown in 1780 (Broadwater, 1995) or on the 18th century collier shipwreck at Chubs Head Cut in Bermuda. (Watts and Krivor, 1995).

But research suggests that this doubling of the keelson was a common feature of Whitby built colliers. Double keelsons can be seen on the body plans of HMB *Endeavour*, HMB *Resolution* and on the site of *The General Carleton of Whitby*, which sank of the coast of Poland in 1785. (Babits and Ossowski, 1999)

The excavation proceeded eastwards and downwards in an attempt to pick up the floors, futtocks and hopefully the keel of the ship. Sixty feet east of the bow the team located two floors running north / south across the site and then the first futtocks on both the port and starboard sides of the vessel.

Due to the absence of the keelson the team was able to excavate between the floors and uncovered the top of the vessel's keel, which appeared to terminate up against the western side of one of the floors, 60 feet from the bow of the vessel. The apparent ending of the keel, the shape of the floors and the position and angle of the ceilings seemed at first to indicate to the team that they had almost reached the 'deadwood' timbers at the stern of the ship. If this was the case then the vessels overall length would be in the vicinity of 70 feet - to short to be *Endeavour*.

Unfortunately at this quite exciting stage in the excavation the ANMM team, because of the possibility of getting decompression sickness (bends) if you fly within 24 hours of diving, had to curtail their diving activities and prepare to return to Sydney.

As ships' keels do not terminate at 'floors' but tend to follow through under the 'stern deadwood' and end under the stern post - where the keel is secured to the stern post by

a copper- alloy fish plate or an angled iron plate - the RIMAP team members continued to excavate east along the trench.

Conversations with Dr. Abbass following the return of the ANMM's team members to Australia suggests that although the vessel narrows the keel did not terminate at the floor observed on the ANMM teams last dive. The keel appears to be deeply notched at this spot giving the appearance of terminating and continues on under the silt and sediment getting progressively deeper.

The RIMAP team then dug a series of small test holes along the line of the keel, 65 feet to 85 feet east of the bow. According to Dr. Abbass (Pers. Comms. 14 September 2001) at various spots along keel the RIMAP team uncovered additional ballast stone, coal and unidentified ship's timbers but did not locate any additional *in situ* hull timbers.

6.1 Conclusions of 2000 - 2001 Fieldwork

As reported in the *Preliminary Report on the Australian National Maritime Museum's participation in the Rhode Island Marine Archaeology Project search for HMB Endeavour August 2001* (Hosty *et al*, 2002)

During the excavations that took place in 2000 and 2001 a number of similarities were noted between GAMMA site and the archival information concerning the *Earl of Pembroke* and HMB *Endeavour*.

During the limited excavation that took place in July - August 2000 some similarities were noted between the GAMMA site and the archival information concerning the *Earl of Pembroke* and HMB *Endeavour*.

- Futtocks uncovered in the 50cms by 500cms trench and other futtocks, observed along the northern edge of the ballast mound - although badly wormed, appeared to be similar in size and spacing to those of *Endeavour*.
- It appeared that the GAMMA Site is of a vessel of 300 - 400 tons - a similar tonnage to *Endeavour*.
- Like *Endeavour*, GAMMA Site appeared not to have been fitted with any copper-alloy fastenings, rudder fittings or sheathing. It was also noted that the site contained more iron fastenings than were found on the site investigated in 1999.
- The timber samples recovered from GAMMA Site (analysed by Mr Jugo Ilic of CSIRO Forestry and Forest Products) were identical to those expected to be found on *Endeavour*.

Construction Feature	**Timber Type**	**Likely Origin**
Futtocks	White Oak group (*Quercus sp*)	USA or Europe
Hull planking	White Oak group (*Quercus sp*)	USA or Europe
Internal plank	White Oak group (*Quercus sp*)	USA or Europe

- A comparison of scantlings obtained from the survey report of the *Earl of Pembroke* in 1768 with those obtained from the 50cms by 500cms excavation area

in GAMMA seems to indicate that they belong to a vessel of similar tonnage to HMB *Endeavour*'s 368 tons.

Although badly wormed the four futtocks - appear to be of identical size - 11inches sided - to *Earl of Pembroke.* The room (gap between the timbers) is also similar to that of the *Earl of Pembroke.*

Compared to the list of known lost Transports GAMMA site compares favorably with the American built ship *Britannia* of 374 tons; and the two English built vessels the 320 ton *Rachel and Mary* and the 368 ton *Lord Sandwich*.

Stone and coal Analysis carried out by Emeritus Professor Claus F.K. Diessel, Honorary Research Associate, Department of Geology, University of Newcastle indicated that

- That the nodular flint samples were from either the Cretaceous chalk cliffs of southern England or the Baltic Sea coasts of Denmark and north-eastern Germany. The comparatively high degree of roundness of the samples points to a British origin, since the lower wave energy of the Baltic Sea tends to leave the nodules with fewer shattermarks, more angular and less spherical.

- The limestone was from the Silurian or the Permian Periods and reached their widest distribution during the Carboniferous Period. Deposits of this kind have been extensively quarried in the United Kingdom. A British origin for the samples is thus possible but not certain.

- Orthoquartzite samples found on the site are known from the United Kingdom and Continental Europe from the Devonian (e.g. Old Red Sandstone), Permian and Triassic Periods (e.g. New Red Sandstone). The relatively low degree of induration of the rock suggests a Permian or Triassic age, but it would be difficult to speculate on the place of origin.

- The Calcareous Chert or Siliceous Limestones occur very frequently in the United Kingdom and Continental Europe in the transitional zone between the Carboniferous limestone and Culm facies. A British origin for this sample is highly likely.

- Coal analysis indicated that the coals are of Carboniferous age. Although such coals existed inland on the eastern seaboard of the United States, it is understood that they were not mined until after the American War of Independence. Before 1780 they were mined in England, continental Europe and Nova Scotia.

Fig 10: Kieran Hosty from the ANMM records the details of the 18th century anchor found on GAMMA site. Photo. P. Hundley

- The anchor was a wooden stocked wrought iron Old Pattern Admiralty Longshank style anchor and can be dated to the 18th century. The anchor's dimensions of 12 feet two inches long, breadth of fluke 1' 9" and length of fluke 2' 5.5" are compatible with being the main bower anchor of a vessel of between 350 - 400 tons.

  Of the three lost transports suggested by the scantlings this result favours the *Lord Sandwich* ex *Endeavour* of 368 tons and the American built *Britannia* of 374 tons ahead of the *Rachel* and *Mary* of 320 tons. However it does not definitively exclude the *Rachel and Mary*. (Curryer, 1999)

- The bottle bases located appear to be from traditional blown 'black' glass bottles with no evidence of molding. The dome-shaped push up on the base indicates a date of manufacture between 1750 and 1820. (Boow, 1991)

- The lead ball (lead shot) observed in both the trench and test pit appears to be standard 12mm (half-inch) lead ball. This type of ammunition has a widespread date range (1600s - 1830s) and its presence on GAMMA is consistent with a late 18th century date for the vessel. (Hogg, 1985)

7.0 Newport Fieldwork 2002

Following the analysis of the 2001 field results GAMMA site compared favorably with the American built ship *Britannia* of 374 tons and the two English built ships the 320 ton *Rachel and Mary* and the 368 ton *Lord Sandwich,* ex HMB *Endeavour*.

As GAMMA site had a high probability of being *Lord Sandwich,* in August 2002, following discussions with Dr. Abbass, RIMAP and the Rhode Island State Heritage Protection Office, Kieran Hosty and Paul Hundley from the Australian National Maritime Museum went across to Newport to further investigate GAMMA site.

Upon arrival the ANMM team discussed with Dr. Abbass the works programs for the August fieldwork. The main objective was to carry out further excavation work on GAMMA in an attempt to locate the stern of the vessel, ascertain the length of the ship, confirm the nature of the rudder fittings and to sample the keel timbers. A secondary objective was to assist - along with divers from the Navy Undersea Warfare Center - in a live underwater broadcast from one of the British Royal Navy frigates which were deliberately scuttled during the siege of Newport in 1778.

At the first team meeting Abbass also reported that due to the close proximity of the GAMMA wrecksite to the Newport Navy Base, RIMAP had been unable to return to the site due to the increased security around the Base following the World Trade Center attack in September 2001. Thus the site should be as the ANMM / RIMAP team left it in August 2001 complete with perimeter grids and centerlines. Unfortuantly this also meant that RIMAP had been unable to re establish the mooring system on the site.

Monday 5 August 2002 was planned to be the first day of work on GAMMA site but due to severe thunderstorms over Narragansett Bay with wind gusts exceeding 30 knots all diving operations were cancelled until conditions improved on Wednesday 7 August.

Working out of Brenton Cove, at the south western end of Newport Harbor, the team launched the RIMAP work boat - a former US Army Bridge construction vessel - and motored north through Newport Harbor towards the Newport / Jamestown Bridge and GAMMA.

Paul Hundley and RIMAP member John Hoagland were the first divers into the water. They relocated the site, established a site bouy and then carried out a brief inspection of the site before returning to the work boat. The divers reported that the site appeared little different from last year. A small 20th century iron / steel barge lying across the eastern end of a much older stone ballast mound complete with an 18th century style Admiralty Pattern anchor. The divers also reported that on the northern side of the ballast mound a number of timber frames and floors (ribs) and internal hull planking called 'ceilings' were exposed and that an area of ballast almost 200 cms square (six feet by six feet) appeared to have been disturbed.

Kieran Hosty and Coleman Doyle (James Cook University, Townsville) were the second team of divers to inspect the site. Although Coleman was new to the site, Hosty had worked on GAMMA during the previous two seasons and was very

familiar with that area of the wreck. The divers reported back that an area of the wreck had been recently disturbed. Whilst the areas excavated in and 2001 were quite stable and the silt levels were similar to the surrounding areas part of the northern side of the ballast mound was clean of silt exposing the 200 year old timbers.

Abbass contacted the Rhode Island Historical Preservation and Heritage Commission to report the damage to the site which was protected under the United States *Abandoned Shipwrecks Act.*

Over the next few days the ANMM / RIMAP team worked at re-establishing the mooring system on the site which consisted of four x 500 lbs mushroom anchors and carrying out an assessment of the damage to the site for the Rhode Island Historical Preservation and Heritage Commission.

The damaged area was plotted, drawn and then photographed by the team. They recorded that three floors or futtocks (lower ribs) along with two strakes of ceiling planking had been uncovered exposing them to *teredo.* The eastern most floor appeared to be scarfed to take a first futtock. Above the floors were two substantial ceiling planks (13 inches x 3 inches) which were heavily fastened to the floors by at least one trenail and one iron nail per plank per frame.

On Friday 12 August the team started to prepare the site for excavation. The six foot by 2 foo(180cms x 66 cms) excavation grids were taken down along with photo-scales, survey poles, dogscrews and steel poles.

An area between 57 feet and 70 feet east of the bow was investigated. In 2001 the team noticed a number of interesting structural features including the keelson, floors (bottom ribs) and futtocks (side ribs) which had similar characteristics to those of HMB *Endeavour*. Following discussions with the team Abbass selected an area above the centreline of the vessel between 66 feet and 72 feet east of the bow to be the first area excavated. This area was called Grid Position No. One.

Using the grids - which are split into three x two foot squares (66cms x 66cms) or cells called 'A', 'B' and 'C' - and a small water dredge the first team commenced excavation of Cell 'A'. This cell was directly above the centerline of the ship between 66 and 68 feet east of the bow. After removing 100mm of silt and shell the team started to come across cultural material including timber fragments, small pieces of coal, ballast and fragments of green bottle glass. Working along the grid from Cell 'A' through to Cell 'C' the teams took turns excavating, recording and photographing the artefacts and ship structure.

Once the three cells had been excavated and the material plotted the grid was flipped two feet (66 cms) to the north but still between 66 feet and 72 feet east of the bow - Grid Position No. Two. Almost immediatly the divers uncovered substantial ships timbers - deep 'V' shaped floors - with large iron fastening protruding from there centers. These floors which are found next to the deadwood area in wooden ships, were resting on their starboard side with the upper most port side almost eroded away.

After excavation work had been completed at Grid Position No. Two, the grid area was photographed and features plotted. The grid was then flipped towards the east so

that it was now between 72 feet and 78 feet east of the bow at Grid Position No. Three. The diver's commenced excavation in Cells 'A' and 'B' uncovering loose shell and small ballast stones then a compact layer of shell grit (possible *in-situ* shingle ballast) before uncovering the tops of three more eroded floors (9" - 12" moulded), some outer hull planking and a strange strap like iron concretion.

After discussing the finds the grid was flipped towards the south to Position No. Four (72 feet - 78 east of the bow). As *Endeavour*'s total length of keel was just over 81 feet it was hoped that excavation of this grid position would reveal the start of the stern deadwood and stern post complex. After excavating all three cells the divers uncovered four badly eroded futtocks along with outer hull planking (three inches thick x five and half inches wide). These timbers were all badly eroded appeared to deepening towards the south and did not appear to extend any further than 78 feet east.

Diver's then commenced work on Position No. Five, flipping the grid south over the baseline but still working along a transect between 72 and 78 feet east of the bow. The floor or futtock timbers that were exposed in Grid Position No. Four continued across in to Grid Position No. Five. The timbers continued to run south getting progressevely deeper (from 10"- 18") and were covered in silt, shingle and flint rock.

As there was no sign of the keel or keelson at this grid position the grid was flipped east into Grid Position No. Six between 78 - 84 feet east of the bow and between one foot and three feet south of the baseline. This grid position also proved disappointing with no *insitu* ship structure being uncovered even though the divers were down to 18 inches in Cells 'B' and 'C'.

As the team had not located any substantial structure in Grid Position No. Six the grid was flipped west into Grid Position No. Seven between 72 feet and 78 feet east of the bow and five feet south of the supposed centerline of the ship. Almost immediatly the divers picked up ship structure in the form of a futtock which was attached to some substantial ceiling planking by a number of iron nails and trenails. In Cell 'A' of this grid they also uncovered a number of intact 18th century, black glass, applied lip bottles.

The discovery of ceiling planking this far along the vessel's length was quite confusing. Either the vessel was much longer than we calculated (by the scantlings) or we had overshot the keel and keelson and were now excavating part of the upper port quarter of the vessel rather than lower down near the port deadwood.

The excavated grids and artefacts were plotted and photographed and then the grid was flipped into Position No. Eight between 66 and 72 feet east of the bow and one foot south of the baseline. In Cells 'B' and 'C' the team uncovered *insitu* floors (12" by 12") and first futtocks (10" x 12") with ceiling planks attached by iron and wooden fastenings every frame. Underneath the floors could be seen a single outer hull plank (12" x 3.5 - 4.0"). In this part of the ship the vessel was very heavily fastened with very little room (space) between the floors.

After careful examination it was realised that the iron concretions that had appeared in Grid Position Eight, Cell 'A' and Grid Position Four, Cells 'B' and 'C' lined up and

were most likely iron bolts that at one time had fastened the keelson to the floors of the ship. The keelson had not only disappeared, eroded away by the action of time, currents and the wrecking process, but the line of the keel and keelson was disjointed. The vessel had broken or twisted between 60 and 66 feet east of the bow and the stern of the vessel was lying at an angle north of the baseline.

To confirm the run of the keelson the grid was flipped to Grid Position No. Nine, 60 to 66 feet east of the bow directly over the center line of the vessel. Excavating down through loose silt the keelson was quickly uncovered along with a series of disjointed ceiling planks and a series of notched floors where the keelson use to be. Continuing to excavate towards the east the divers located directly below the break in the keelson and between two of the floors a square hole, which had been cut or punched through the outer hull planking. As 18th century vessels did not have seacocks the only way to deliberatly sink a vessel would have been for the ship's carpenters to make a breech in the ship's hull.

After this discovery the team reassessed the position of the baseline, taking into account the line of iron concretions, which marked the former position of the keelson. The team then sunk a series of small test pits along the line uncovering additional fastenings and notched floors.

At 77 feet east of the bow (just to the east of Grid Position No. Three) they came across a series of large concreted ship's timbers and then at 79 feet the inner and outer stern posts, iron stern post fastenings and the remains of the two lower iron gudgeons.

According to the new baseline the total length of keel for the vessel was now over 79 feet. Allowing for the break in the hull and twisting of the structure the total length of keel would be in the region of 80 to 82 feet.

The area around the stern post was plotted, photographed and recorded and the baseline length checked. The divers confirmed the length of the ship at between 80 - 82 feet, they also uncovered but left *insitu* an additional iron gudgeon along with a cast iron fish plate on the stern post of the ship. Fish plates were special fastenings used to secure the stern post to the keel of the ship.

The 'scuttling hole' was further investigated with the divers excavating down some 32" to locate the remains of the keel and a possible keel scarf joint between 57 - 60 feet east of the bow.

On Wednesday 21 August (the second last day of diving operations for 2002) the team planned to continue excavating in the area around the stern post to obtain additional scantling information and some timber samples from the keel.

Unfortunatly on the morning of the 21 August Dr. Abbass raised a number of concerns about site security, the ANMM website and possible increased media attention on the site. Dr. Abbass requested that the ANMM shutdown the Newport 2002 website and told the team that all work on the site would stop until issues regarding site security and intellectual property rights had been discussed with the Rhode Island Preservation Commission.

Although the ANMM team members were assured that work would continue at the site, a timber samples obtained and the length of keel confirmed, at time of writing (June 2003) no further information has been released by RIMAP.

8.0 Testing the Hypothesis

As outlined in Section 3.0 of this report. In May 1999 Dr Abbass, Paul Hundley, the RIMAP Board of Directors and the Rhode Island State Appointed Archaeologist developed a strategy to guide the archaeological investigation of shipwrecks in Newport Harbor. The primary goal of this strategy was to positively identify the *Lord Sandwich* ex HMB *Endeavour* by examining the remains of all wooden, non-motorised shipwrecks in Newport Harbor using standard criteria.

These criteria included examining the methods used in the construction of the vessel, the construction materials, the scantlings or size of the material, and the sampling, examination and analysis of any stone and iron ballast, coal, silt, sediment, hair or material cultural found on that particular site. The results of this examination would then be compared with the list of Transports (see page 17 this report) known to have been lost in Newport in August 1778.

This strategy was carefully tested and proved during the 1999, 2000 and 2001 Fieldwork Season and were not modified for 2002.

The results of this hypothesis on the GAMMA site are outlined in the rest of this Section.

6.1 Method of Construction:

An extensive archive including plans of the *Earl of Pembroke* (the future HMB *Endeavour*) still exists due to the detailed survey work carried out on the *Earl of Pembroke* prior to it being purchased by the Royal Navy in 1768.

The *Endeavour* was a three masted, strongly built; wooden hulled vessel with very bluff bow. It had a square transom stern, a near vertical stempost and a long box like body with near vertical sides. The vessel also had very flat floors for most of its length, the floors only rising sharply a few feet from each end of the vessel. (Macarthur, 1997, pp 19 – 45)

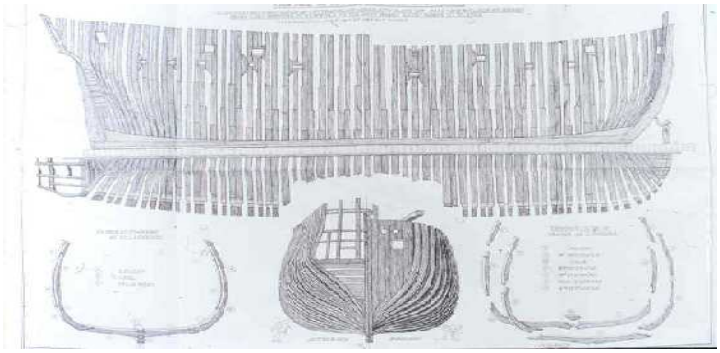

Fig 15: Body plan of HMB *Endeavour* (Parkin, 1997)

According to the plans the vessel had been built along traditional lines with a two piece keel running the full length of the vessel. The keel was almost square at the midships narrowing slightly towards the stem and stern. In order to protect the keel during accidental groundings a substantial false keel had been added to the *Endeavour* during its refit at Deptford.

At either end of the keel were attached the structural timbers associated with the bow and stern – the stem and stern posts, stemson, sternson, breast hooks, hawse timbers, cant frames, dead wood, etc. (Parkin, 1997, Carcass Plan)

Across the keel at regular intervals was placed a series of single and paired frames – the ribs of the ship. Because of the size and shape of the frames they were constructed in sections. The lowermost, or 'floor', was placed across the keel and held in place with iron bolts. Next came the first and second futtocks followed by the third futtock. In the case of paired frames a similar frame was constructed next to the first and then bolted directly to it – to form a single construction. (Lavery, 1991)

According to both McKee in the *Identification of timbers from old ships of north-western European origin* (IJNA, 1976, pp3-12) and Morris, Watts and Franklin in *The Comparative Analysis of 18th Century Vessel Remains in the Archaeological Record* (SHA, 1995, pp125 - 132) the pattern of framing observed on GAMMA site is of the 'middle style double frame type'. This is where the first futtucks are offset from the keel but are joined to the floor of the paired frame by single iron fastenings. Both authors state that this pattern of use was common in England between 1770 and 1818 and appears to be the pattern of framing used in the construction of *Endeavour*.

In 2001 Because of the limited nature of the excavation it was not possible to gauge if the majority of futtocks were paired (like *Endeavour*) or if the vessel had similar lines and hull shape to *Endeavour*.

However in 2002 the divers uncovered substantial *insitu* floor and futtock combinations at Grid Position No. Four (72 - 78 feet east of the bow) and Grid Position No. 8 (66 - 72 feet east of the bow). In Grid Position No. Four the floor / futtock pattern consisted of a single futtock, followed by a paired frame followed by a single futtock. This is typical of 'middle style double frame type' structure found higher up in the hull. In Grid Position No. Eight which was closer to the original position of the keel / keelson all the *insitu* structure appears to consist of closely spaced floors (12" - 14" sided) which crossed over a notched keel.

These methods of construction are identical to those shown in Parkin's body plan of HMB *Endeavour* (Parkin, 1997) and Marquardt's hull structure plan of HMB *Endeavour* (Marquardt. 1995)

Because of the box-like shape of *Endeavour*'s hull, all the 'floors' of the frames were extremely flat for almost the full length of the vessel. These timbers only rising up to form the bow and stern (these special timbers were called cant frames) of the ship when within 10 feet of the bow (or stem post) and 15 feet of the stern post. (Parkin, 1997)

To lock the keel, floors and frames in place another substantial timber called the keelson was placed over the top of the floor timbers, over the keel and then bolted in place. As mentioned in Section 6.0 *Lord Sandwich* ex *Endeavour* was fitted with a double keelson which appears to be a feature at least unique to 18th century colliers and possible unique to those colliers built in Whitby.

Although this feature was not recorded in 2002 it is possible that the break in the keelson (See Section 6 this report) observed on GAMMA site 57 feet east of the bow coincides with end of the double or deadwood keelson. Just east of this area divers discovered a scuttling hole and observed that the after end of the keelson had completely disappeared through the actions of abrasion, worm and the wrecking process. However the position of the keelson could still be recorded because of the concreted remains of the iron fastening which were still holding the surviving cant frames to the keel of the ship.

Divers investigating the scuttling hole also observed that the keel directly below the rabbit appeared to have a vertical keel scarf between 61 and 63 feet east of the bow. **An identical vertical keel scarf is shown in Marquardt's hull structure plan of HMB *Endeavour* (Marquardt. 1995)**

During the excavation work that took place in August 2002 a number of striking similarities were noted between the GAMMA site and the archival information concerning the *Earl of Pembroke* and HMB *Endeavour*.

From these observations it appears the GAMMA Site is a British built vessel of between 350 - 400 tons, a similar tonnage to *Endeavour*.

Compared to the list of known lost Transports GAMMA site may be the *Lord Sandwich* of 368 tons, the *Britannia* of 374 tons or less likely the *Rachel and Mary* of 320 tons.

The site does not appear to be that of the *Betty* 235 tons; *Earl of Oxford* 231 tons; *Good Intent* 241 tons, *Grand Duke of Russia* 671 tons, *Malaga* 205 tons, *Susanna* 254 tons or *Union* 261 tons.

6.2 Construction Materials and Timber Analysis

Archival sources and contemporary documentation have provided detailed information on the types of materials used in the construction of the *Lord Sandwich,* ex *Endeavour*, ex *Earl of Pembroke.*

In 2002 for the first time divers were able to observe the stern structure of GAMMA site and the underneath of the outer hull planking. Like HMB *Endeavour*, GAMMA had not been fitted with any copper-alloy fastenings, rudder fittings or sheathing.

The iron rudder fittings were of particular interest. According to *Industries and Wealth of the Principle Points in Rhode Island, being the City of Providence, Pawtucket, Central Falls, Woonsocket, Newport, Narrangansett Pier, Bristol and Westerly* (A.F. Parsons Publishing Company, 1892) Oziel Wilkinson and Sons of

Pawtucket manufactured the first iron gudgeons cast in the United States in 1780 / 1781.

Prior to that date American built ships had to use either bronze or imported iron rudder fittings. The reason behind this was the British *Iron Act* of 1750. This Act was designed to encourage cost effective iron manufacturing in England. It banned the manufacture of finished iron and steel products in North America and encouraged the exportation of cheaper bar, sow and pig iron to the iron manufacturers of England where the raw material could be finished and then exported back to the Colonies. (*Reasons Against a General Prohibition of the Iron Manufacture in His Majesty's Plantation*, C1850)

If these reference, from the Newport Historical Society and The University of Groningen are correct then either GAMMA site is younger than the Siege of Newport (1778), the vessel is British or European built or was fitted out with expensive imported iron rudder fittings.

The team also observed that the site contained far more iron fastenings than were found on the site investigated in 1999. The patterning of the iron and treenail fastenings observed in the vicinity of the ceiling planking uncovered between 57-foot and 60-foot east and in Grid Positions No. 4 and No. 8 was consistent with that recommended in *Lloyds Register of Shipping* (1857) for a vessel of between 350 and 400 tons.

The major material used in wooden ship construction was timber. The vessel's keel and sternpost, being long and straight tended to be made of European Elm (*Ulmus campestris* or *Ulmus montana*). The English shipwrights preferred English Oak (*Quercus robuir*); European White Oak (*Quercus petraea*) or North American White Oak (*Quercus alba*) for the floors, futtocks, keelson, ceiling and outer planking. The masts would have been most likely constructed out of Spruce (*Picea abies*) or Baltic Pine (*Pinus sylvestris*). (Anon, 1788; Lavery, 1991)

The timber samples recovered from GAMMA Site were analysed by Mr. Jugo Ilic of CSIRO Forestry and Forest Products. The results are summarised below:

Construction Feature	**Timber Type**	**Likely Origin**
Floors	White Oak group (*Quercus sp*)	USA or Europe
Futtocks	White Oak group (*Quercus sp*)	USA or Europe
Hull planking (parallel plank)	White Oak group (*Quercus sp*)	USA or Europe
Keelson (bow)	White Oak group (*Quercus sp*)	USA or Europe
Keel (stern)	inconclusive	

Unfortunately it was not possible to source the specific origin of the oak species more closely than to the Northern Hemisphere. Mr. Ilic was unable to determine the identity of the timber sample obtained from the keel of GAMMA on the very last day of excavation in August 2001.

Unfortunately due to the early shutdown of the site by Dr. Abbass in August 2002 the team was unable to obtain timber samples from the keel. Identification of the keel timber is an essential component of identifying the site.

European Elm was used consistently in British ships built between 1750 and 1804. But the nature of the wood limited its use to portions of the hull below the waterline near the keel. Only the strongest oak could survive constant immersion but Elm was equal to the task if air was excluded. A second advantage to using Elm is that its size allowed keels to be used with a minimum of scarf joints. Because of the easier access to oak and live oak in North America vessels built in the colonies were built predominantly out of oak or pine. (Albion, 1926, pp3 - 39; 231- 281)

If the keel timber is identified as elm it is highly likely the vessel is *Lord Sandwich* ex HMB *Endeavour*. If the keel timber turns out to be white oak it is likely the vessel is the American built ship of similar tonnage *Brittania*.

However the absence of soft wood timbers among the samples and the known preference of English shipwrights to only use hard wood tends to support the premise that GAMMA is an English or European built rather than an American built vessel.

Of the three lost transports in the 300 - 400 ton range this would include the *Lord Sandwich* ex *Endeavour* and the *Rachel and Mary*, but exclude the American built *Britannia*.

6.3 Scantlings

By the 1700s shipwrights had developed a series of unwritten codes relating to the size of structural timbers used in ship construction. These unwritten codes, some of which later developed into *The Lloyd's Rules and Regulations for Wooden Shipbuilding*, specified that vessels of a certain tonnage must use timbers of a certain size in their construction.

A comparison of those scantlings obtained from the survey report of the *Earl of Pembroke* in 1768 with those obtained in 2000, at the bow of the vessel and at the 55-foot mark in 2001 and in the nine excavated grids frames in 2002 seems to indicate that they belong to a vessel of similar tonnage to HMB *Endeavour*'s 368 tons.

	GAMMA	***Endeavour* (1768)**	**Lloyds'**
Keel (sided)	12.5"		12.5"
Keelson (sided)	12.5"		12.5"
Floor (sided)	11" - 14"	14"	11"
Floor and Space	24"	29"	25"
Lower Futtock (sided)	11"	11"	9.5"
Ceilings	10" x 3"	3"	2.75"
Garboard Strake	3"	3"	3"

The team also noted that the thickness of the ceiling planking (from the floorheads to the keel) and that of the lower futtocks appears to be the same as *Lord Sandwich* ex *Endeavour*.

Although no scantlings for the keel and keelson on *Endeavour* are given in the Dockyard Survey Report of the 27 March 1768 the measurements obtained from GAMMA are identical to those obtained from The Table of Minimum Dimensions of Timbers, Keelson, Keel, Planking etc in *Lloyds Register of Shipping Rules and Regulations* (1857, 1864).

Fortunately it is possible to calculate from the 1768 Survey the distance between the bottom of the keel and the Garboard - Strake Rabbet (11.0") and the bottom of the keel to the top of the keel (2' 10.5"). As this area of GAMMA was not excavated in 2001 future work on the site should attempt to examine the lower keel and Garboard-Strake and compare the scantlings with the measurements from the 1768 Survey.

Divers investigating the hole between 61 and 63 feet east of the bow just aft of the break in the keelson noticed that it provided access to the keel. This allowed them to record the depth of keel below rabbit, along with the thickness of the bottom hull planking.

The 'floors' and the 'floor and space' (the distance between the start of one floor and the start of the next) although similar to those required by Lloyds' appeared to be substantially less on GAMMA than on *Endeavour* (1768). This difference could be due to the fact that the 'floor' and 'floor and space' measurement on *Endeavour* were given for one of the 'master frames' in the body (midships) of the vessel rather than towards the end of the vessel where the GAMMA measurements were obtained.

Compared to the list of known lost Transports GAMMA site compares favorably with the American built ship *Britannia* of 374 tons; and the English built vessel the 368 ton *Lord Sandwich* ex HMB *Endeavour*.

6.4 Stone Ballast Analysis

Emeritus Professor Claus F.K. Diessel, Honorary Research Associate, Department of Geology, University of Newcastle carried out an extensive analysis of rock samples recovered from GAMMA Site in 2000. Professor Diessel's full report was attached as Appendix E to Bassett et al (2000)

In brief 18 rock samples including six samples of chert or flint, three of limestone, two of iron / steel slag, one of orthoquartzite, two of quartz, one of calcareous chert of siliceous limestone were recovered from GAMMA Site. 13 of the 15 samples recovered were consistent with coming from the south or south- east coasts of England.

6.5 Coal Analysis

Emeritus Professor Claus F.K. Diessel, Honorary Research Associate, Department of Geology, University of Newcastle carried out an extensive analysis of three coal samples recovered from GAMMA Site in 2000. Professor Diessel's full report was attached as Appendix E to Bassett et al (2000)

In brief Professor Diessel concluded that the coals are of Carboniferous age and although such coals existed inland on the eastern seaboard of the United States, it is understood that they were not mined until after the American War of Independence. Before 1780 they were mined in England, continental Europe and Nova Scotia.

6.6 Sediment Analysis

Unfortunately all sediments samples recovered during the 2000 excavation were intrusive marine sediments and not sediments from the vessel's interior. Therefore no pollen analysis was undertaken.

6.7 Material Culture

Besides the large ballast pile which contained a few samples of coal and the buried ship structure the site also contained a number of *in situ* artefacts including a large iron anchor and a cluster of bottle bases.

Some small shards of ceramic, black glass and lead shot were observed in August 2000. Additional ceramic shards, black glass and lead shot were observed in 2001 along with two wooden pulley sheaves and a small wooden barrel head in the excavation area between 57-foot and 60-foot east. RIMAP divers also noted additional coal between 60-foot and 85-foot east. All artefactual material - except for the two wooden pulley sheaves and barrelhead were left *in situ*.

The anchor was a wooden stocked wrought iron Old Pattern Admiralty Longshank style anchor and can be dated to the 18th century. No evidence of the wooden stock remains.

The anchor's dimensions of 12 feet two inches long, breadth of fluke 1' 9" and length of fluke 2' 5.5" are compatible with being the main bower anchor of a vessel of between 350 - 400 tons. Of the three lost transports suggested by the scantlings this result favours the *Lord Sandwich* ex *Endeavour* of 368 tons and the American built *Britannia* of 374 tons ahead of the *Rachel* and *Mary* of 320 tons. However it does not definitively exclude the *Rachel and Mary*. (Curryer, 1999)

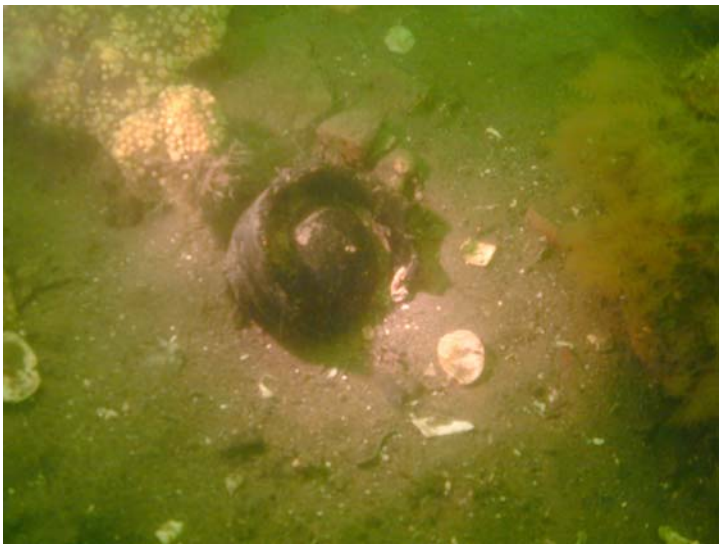

Fig 16: The bottle bases located on GAMMA appear to be from traditional blown 'black' glass bottles with no evidence of molding. The dome-shaped push up on the base indicates a date of between 1750 and 1800. Photo P. Hundley.

The lead ball (lead shot) observed in both the 2000 and 2001 excavations appear to be standard 12mm (half-inch) lead ball. An inert type of ammunition, lead ball was fired from a number of different types of firearms including matchlock and flintlock muskets as well as carbines. This type of ammunition has a widespread date range (1600s - 1830s) and its presence on GAMMA is consistent with a late 18th century date for the vessel. (Hogg, 1985)

Although GAMMA Site contained significant artefactual material associated with an 18th century vessel and is highly likely one of the scuttled vessels - so far no artefact material which can be positively attributed to either HMB *Endeavour* or *Lord Sandwich* has been located on this site.

7.0 Conclusions and Recommendations

Historical research undertaken by Dr Abbass in January 1999 proved that Captain Cook's ship *Endeavour* was one of thirteen vessels scuttled in 1778 during the American Revolutionary War.

In May, Paul Hundley, Curator of the Australian National Maritime Museum's USA Gallery met with Dr Abbass to discuss the archaeological collaboration between the ANMM and the Rhode Island Marine Archaeology Project. The results of these discussions were incorporated into a strategic approach that would guide the investigation of the sites.

In August 1999 a combined RIMAP / ANMM team tested the strategic approach by surveying a wreck site (Primary Target A) that RIMAP had worked on in the past and believed was highly likely to be the remains of HMB *Endeavour*.

Analysis of the construction techniques, the timber scantlings, the timber types along with the coal, stone and sediment analysis indicated that Primary Target A is not *Endeavour*. However the information gained from the examination of this site prove that the research criteria developed in May 1999 work and are capable of identifying *Endeavour* when it is located.

Further discussion between Paul Hundley and RIMAP took place in January 2000 when the findings outlined in the 1999 report were presented at the international Conference on Underwater Archaeology in Quebec, Canada. During this meeting a round table discussion of experts set the research design for the 2000 and 2001 field seasons in Newport.

It was agreed that all future fieldwork would involve an international cooperative effort with Australia playing a significant role. To this end the ANMM representative recommended modifications to the operational plan which would enable the most effective investigation of the remaining shipwrecks.

In 2000 the combined team conducted a remote sensing survey of the areas in and around Newport Harbour where according to the historical documentation the Transports were sunk. A number of anomalies were located, ground truthed using the proscribed method and the sites' archaeological significance, and the likelihood of their being *Endeavour* assessed.
One site, GAMMA, a few hundred metres north of the Jamestown Bridge merited further investigation and a limited test excavation was conducted and additional timber, stone, coal and sediment samples collected.

The 2000 and 2001 seasons indicate that the GAMMA site compares favorably with the American built ship *Britannia* of 374 tons; and the two English built vessels the 320 ton *Rachel and Mary* and the 368 ton *Lord Sandwich*.

Timber species identifications suggests the wreck is less likely to be the American - built *Britannia*, while timber scantlings obtained from GAMMA and the associated anchor suggest the vessel is not the smaller *Rachel and Mary*.

But is GAMMA the *Lord Sandwich* ex HMB *Endeavour*? The size of the keel and keelson, the robustness of the floors, futtocks and ceilings and the numerous iron fastenings and treenails indicates that this was a substantially built vessel. The shape of the floors and futtocks also indicate that this vessel was similar in shape to that of Cook's ship. However the team did not locate the double keelson shown on the plans of HMB *Endeavour*.

When the ANMM team left GAMMA site the size and shape of the excavated timbers and their methods of construction seem to indicate that the team had almost reached the deadwood timbers at the stern of the ship. However additional excavation work carried out by RIMAP in late August early September 2001 seems to indicate the vessel keel continues under the sediment and the vessel may be of a similar length to HMB *Endeavour*.

Although research to date leans favorably towards the wreck being HMB *Endeavour*, this site warrants additional investigation before any firmer conclusions can be drawn.

In 2002 it is proposed that the ANMM and RIMAP further investigate GAMMA Site by carrying out a more detailed survey and excavation of the remains between 57-foot and 85-foot east.

It is also proposed that the joint team (ANMM, RIMAP and the Navy Undersea Warfare Centre) continue their remote sensing survey of the areas in and around Newport Harbour, ground truthing each located site, assessing its significance and the likelihood of it being *Endeavour*.

In 2003 the International Conference on Underwater Archaeology will be held in Providence, Rhode Island, less than 30 minutes from Newport. This presents an opportunity, after the completion of archaeological work, to discuss the broad range of issues relating to *Endeavour*.

The Conference will be used as the forum for planning the long-term disposition and interpretation of the project and will encompass, but not be limited to, the archaeology, history, legal issues of ownership and long term management, interpretation, preservation and display of the remains of one of the great ships of exploration.

The amount of worldwide interest generated by the *Endeavour* project over the last three years has been considerable. There have been over 120 newspaper reports and ten hours of radio and television interviews carried out by ANMM staff related to this work. The reports have been broadcast in Australia, New Zealand, England, France, Canada and the United States. Participation in future work on this project will continue to highlight the profile of the ANMM and the Department within the international community.

The real *Endeavour* still remains to be located in Newport Harbour. Dr Abbass has specifically asked the ANMM to continue its involvement in the project and the Museum is committed to further collaboration with the Rhode Island Marine Archaeology Project in this research, subject to obtaining the necessary funding support.

Appendix A

The Journals of Captain James Cook on his voyage of Discovery

The Voyage of Endeavour 1768 - 1771

Edited by J.C. Beaglehole.

The Boydell Press in association with Hordern House, Sydney.

Date:	**Abridged journal entry**
2nd April 1768	Fitting out *Endeavour* at Deptford,
27th May 1768	Cook hoisted his Pendant and took charge of the ship agreeable to his Commission. Employed crew taking on board stores and provisions.
31st May 1768	Cook to Navy Board (adm 106/1163) 8 tons of iron ballast to be taken on board Bark *Endeavour*. Ballast supplied by Deptford Yard Officers.
30th June 1768	Additional iron ballast requested to bring her down by the stern.
17th – 18th Aug 1768	Caulkers, carpenters and joiners employed in fixing gentlemen's cabins and building a platform over the tiller arm. Powder taken on board and stored in magazine.
19th Aug 1768	Read to the Ship's Company the articles of War and the Act of Parliament. Crew paid two months wages.
26th Aug 1768	Put to sea having on board 94 persons, including Officers, Seamen Gentlemen and their servants, near 18 months provisions, 10 Carriage guns, 12 swivels with good store of Ammunition and stores of all kinds.
14th Sept 1768	Caulkers employed working on ship's sides off Island of Maderia.
28th Oct 1768	This day spent pumping water out of the ground tier of casks and filling the empty casks with salt water to keep the vessel ballasted.

Date:	**Abridged journal entry**
15th – 19th Nov 1768	At Rio de Janeiro – ship's company employed heeling and 'boot topped' the Starboard and larboard sides, forge set up to repair iron work, caulkers employed on hull, 'Boottopping' was the cleaning and greasing of the upper part of the ship's bottom – the 'boothose tops' were the strakes or planks below the water's edge and were generally tallowed when the ship was ordered to cruise –
12th Dec 1768	Caulkers and carpenters employed caulking the quarter deck and waterway seams.
14th Dec 1768	Decks being caulked.
8th – 11th June 1769	Tahiti – ship's company employed on heeling and bootopping the larboard and starboard sides– vessel's hull very fowl, sheathing damaged in places, coated the larboard side with '**pitch and brimstone'**
7th - 9th June 1769	Employed careening both sides of the ship and paying them with pitch and brimstone, bottom in good order, no trace of worm,
3rd – 4th August 1769	Taitea (Society Islands). Cook went ashore to look for a suitable source of stones for ballast and a watering place. Found both very close to anchorage in Rautoanui Bay. Vessel warped in and moored in 28 fathoms. Carpenters employed in stoping leaks in Powder room and fore – sail room. By the evening of the 4th the crew had taken on 20 tons of ballast.
8th Nov 1769	Heeled and scrubbed both sides of the ship.
18th – 19th Dec 1769	Queen Charlotte Sound – Carpenters employed blacking the ships bends, caulking the sides, repair general defects, forge set up to repair tiller braces, Bends were the wales of the ship, broader and thicker than the rest, extended the length of the vessel from bow to stern.
16th 17th Jan 1770	Pelorus Sound ? New Zealand – Careened the ship's hull, payed the starboard side (with Tallow and Venetian Red' (to pay, daub, smear with preparations of

Date:	Abridged journal entry
	tar, oil, tallow, resin, red ochre to protect the planks of the ship from the water, growth, worm etc, - scarped and cleaned the hull. a transom was built for the tiller (it broke throughout the voyage). Hands also employed taken on board stone ballast to be placed at the bottom of the bread room to bring the ship down by the stern. Transoms were cross timbers that held together the stern of the ship – normally the tiller passed inboard over the tiller transom to which the rudder head was attached by band and bracket.
11th June 1770	Vessel struck a rocky reef (later to be called *Endeavour* Reef) -, sounded around ship, three to twelve feet around the vessel (*Endeavour* drew 13' 6"); Started to lighten ship and attempted to kedge off. Started the water casks, threw overboard the six mounted guns, iron and stone ballast, casks, hoops, staves, oil jars, decayed stores, etc. up to 50 tons in weight. Twenty tons of iron and stone ballast. Six carriage guns, buoys fixed to the guns for possible later recovery. Severe leak managed to heave the ships off but concerned at foundering in deeper water. Difference between top of ceiling plank and the top of the outside plank 16" – 18"
17th - 18th June 1770	Vessel run ashore in Endeavour River. As the ship lay fast, got down fore yard, fore topmast booms. Vessel floated and was warped into the harbour, moored alongside a steep beach. Made a stage from the ship to the shore, erected tents for the sick and for officers, provisions, etc. landed empty cask and some provisions.
19th June 1770	Set up Smith's forge, commenced making iron work, landed all provisions, got four remaining guns out of the hold and mounted them on the quarterdeck, got spare anchor and anchor stock from the shore, remaining stores and ballast that were in the hold,
20th June 1770	Got out all the officer's stores, ground tier of water now having nothing in the fore and main hold but the coal and a little stone ballast.

Date:	Abridged journal entry
21st June 1770	Powder, stone ballast, wood (fire wood?) brought out of the ship, coals trimmed aft to get the bow (where the damage occurred) higher out of the water. Water coming in a little abaft the main mast and about 3feet from her keel, had to clear the hold entirely to get at the leak. Had to remove all the coal.
22nd June 1770	Most of the coal out warped the ship a little higher up the harbour – draught of water forward was 7'9", aft 13' 6". Leak was found to be at *Endeavour* Floor Heads – a little before the Starboard fore chains – here the rocks had made their way through four planks and even into the timbers (frames) – wounded three other planks. Planks entirely cut away, scarcely a splinter left. Fortunately the timbers were very close together – otherwise the vessel would have been lost - large pieces of coral rock, fothering, sand and grit had made their way between the frames, stopped the waters from coming in. Part of the sheathing was gone from under the larboard (port) bow) – part of the false keel, remainder much shattered. Fore foot and main keel also damaged. Damage aft could not be seen – Carpenters employed on repairs, forge set up to make bolts and nails (iron) Floor heads were the upper ends of the floor timbers ie: the framing of the floor or bottom of the ship. The chains were the assemblage of the parts whereby the lower shrouds of the mast were secured to the outer hull of the ship. Hence the leak (apart from the widespread damage) was on the bottom of the ship in front of the foremast and on the starboard side – at the turn of the bilge.
23rd June 1770	Carpenters employed shifting the damaged Planks. Starboard side examined at low tide –
24th June 1770	Carpenters finished the starboard side, vessel heeled over, work commenced on larboard side – Went to work repairing the sheathing under the larboard bow – where they found two planks cut through –

Date:	**Abridged journal entry**
25th June 1770	Carpenters busy repairing sheathing and planking under the larboard bow – Whole of larboard side examined – parts of sheathing off abreast the main mast about her floor heads, part of one plank a little damaged –
26th June 1770	Carpenters finished off larboard bow and every other place the tide would permit them to work. Attempted to float off the ship
27th June 1770	Endeavour River – Set up forge to repair iron work, carpenters employed caulking ship, restocking an anchor
6th July 1770	Endeavour River – hardly 4feet of water under ship but could not repair sheathing that was beat off the place being under water. Three strakes of the sheathing gone, 7 – 8 feet long, main plank rubbed**.** Vessel hove off and commenced to reload stores. 8 tons of water stowed in the ground tier after hold.
7th July 1770	Employed taking on board coal, ballast, caulking the ship,
9th July 1770	Carpenters, Smiths and Coopers all at respective employment, seamen employed taking onboard stone ballast.
14th July 1770	Seamen again employed taking on board stone ballast, airing sails etc.
21st July 1770	Carpenters finished repairing pumps. Caulking ship etc.
28th July 1770	Carp's finished caulking the ship.
1st August 1770	Pumps in very poor conditions, wood decayed, one quite useless, water making about 1" per hour,
14th August 1770	As soon as the vessel was outside the reef – found ship was more seriously damaged – leaks increased so that one pump could just keep pace with it.
11th October 177	Anchored in Batavia Road's – Carpenters Report

'*The ship very leaky –makes from twelve to six inches per hour) Occasioned by her main keel being wounded in many places and the scarf of her stem being very open. False keel gone beyond the midships (from forwards and perhaps farther) as I had no opportunity of seeing for the water when hauled ashore for repair)*

Date:	Abridged journal entry
	Wounded on her larboard side under the Main Channel where I imagine the greatest leak is (but could not come at it for the water). One pump on the larboard side useless the others decayed within 1 ½" of the bore. Otherwise Masts, Yards, Boats and Hull in pretty good condition.
	10th Oct 1770 J Seetterly
	Cook had spoken to Officers concerning the leak – vessel now very unsafe – and had to be repaired.
	Cook may have made a mistake in transcribing the damage – for the main leak had been on the starboard side – most of the work at Endeavour River conducted on starboard side – but the Carp could have done a very good job and that leak had been repaired.
	Channel of chain wale was part of the chains and was the thick plank projecting horizontally from the side of the ship where the shrouds were fastened.
12th Oct 1770	At Batavia – Cook had fitted a lightning conductor (an iron chain) carried the electrical matter over the side of the ship – when *Endeavour* was struck by lightning in the roads of Batavia.
18th - ? Oct 1770	'Onrust 'Coopers Island (Batavia) – received on board 3 barrels of tar and one barrel of pitch- proceeded to unload ship, repair rigging, etc for major repairs on hull of *Endeavour*.
29th - 31st Oct 1770	Clearing ship ready for heaving down and careening.
9th Nov 1770	Vessel larboard side of the ship keel out – found the bottom in very poor condition. False keel gone to within 20feet of the stern post – Main keel wounded in several places – great quantity of sheathing off, several planks much damaged especially under the main channel near the keel – where two and half planks near 6feet in length were within 1/8th of an inch of being cut through. Worms had made their ways into the timbers.
10th Nov 1770	Had to caulk and repair upper works as water was coming in when vessel heaved over for careening.

Date:	**Abridged journal entry**
12th Nov 1770	Finished larboard side. Prepared to careen starboard side – very little damage. Repairs completed by the evening of the 13th Nov.
14th Nov 1770	Bottom now repaired – very efficient yard. Vessel's hove down using two masts rather than the English practise of using only one.
16th Nov 1770	Took on coals and ballast. Sent off decayed pump, new one made by yard.
17th – 30th Nov 1770	Employed rigging ship, getting on board stores and water, repairing rigging and sails.
9th Dec 1770	New pump taken on board.
10th Dec 1770	Employed crew painting and scraping hull and upper works.
25th Dec 1770	Completed loading and repairs.
26th Dec 1770	After completing provisioning and taking the surviving gentlemen and crew on board weighed anchor and left port. Have lost seven men to disease and illness with a further 40 sick and the remaining ship's company in a weak condition.
17th Jan 1771	Java Head bore ENE 4 – 5 leagues.
27th Jan 1771	Departed this life Mr Sidney Parkinson, Natural History Painter.
29th Jan 1771	Departed this life Mr Charles Green sent by the Royal Society to observe the Transit of Venus.
31st Jan 1771	In the course of the last thirty six hours have lost another six men to the flux.
12th Feb 1771	Died of the flux after a long and painful illness Mr John Satterly, Carpenter, a man much esteemed by me.
15th March 1771	Arrived off Cape Town. Saluted the castle and took the sick ashore.

Date:	**Abridged journal entry**
16th April 1771	Departed Cape Town,
13th July 1771	Arrived off Portland and anchored in the Downs.

Appendix B

James Cook and the voyage of *Endeavour*

Born in Yorkshire, England in 1728, the future British Royal Navy Captain James Cook went to sea in 1746 and quickly displayed a natural aptitude for mathematics, navigation and maritime skills. He was promoted to First Mate of a merchant vessel by 1752.

By 1755 he had decided that the merchant navy lacked scope for his ambitions and, though he had been offered a merchant command, he declined it and volunteered for the British Royal Navy as an Able Seamen and was drafted to the 60-gun ship *Eagle*.

In 1757 he was appointed Master of HMS *Solebay* and later HMS *Pembroke* and in this vessel he distinguished himself when he successfully surveyed and charted the St Lawrence River allowing the First Rate warships of the Royal Navy to ascend the River and so play a decisive role in the capture of Quebec from the French and the subsequent conquest of Canada.

Following the Seven-Year War, Cook's renown as a navigator and surveyor grew. His observations of an eclipse of the sun at Newfoundland in 1766 drew him to the attention of the Royal Society who subsequently accepted him as one of their official observers for an expedition planned to go to Tahiti in the South Pacific to observe the Transit of Venus across the face of the sun – an event which the Royal Society believed would allow for the easier calculation of longitude. When the Royal Society's own choice of commander Alexander Dalrymple – a civilian – was vetoed by the British Royal Navy, Cook became the obvious appointment.

The scientific expedition became part of a more extensive voyage of discovery with the Admiralty commanding Cook to not only observe the Transit of Venus, but to also sail south to search for the southern continent *Terra Australiis Incognita*. Cook was further commanded to chart the coast of New Zealand – reported by the Dutch explorer Abel Tasman in 1642 – before returning home by either Cape Horn or the Cape of Good Hope.

The expedition vessel chosen by the Admiralty was an ex collier the *Earl of Pembroke* which was subsequently renamed His Majesty's Bark *Endeavour*.

The *Endeavour* left Plymouth on 25 August 1768, calling at Madeira and Rio de Janeiro, rounded Cape Horn and reached Tahiti on 10 April 1769. A temporary observatory was established on shore – called Fort Venus - and the Transit was observed on the 3 June 1769 not only by Cook but also by a number of gentlemen scientists from the Royal Society, including Sir Joseph Banks.

Sailing south from Tahiti as instructed Cook encountered New Zealand and surveyed parts of the East Coast and West Coast before sailing west towards Van Diemen's Land (Tasmania). However, southerly gales forced Cook to sail to the northwards where he encountered the southern coast of Australia in the vicinity of present day Point Hicks. Continuing to survey while following the coast northwards, the *Endeavour* eventually arrived off present day Botany Bay on Sunday 29 April 1770.

For seven days the *Endeavour* and its crew stayed at Botany Bay, with Cook and scientists surveying the coast and parts of the hinterland whilst the crew reprovisioned the vessel with food and water.

Leaving Botany Bay on Sunday 6th May Endeavour sail slowly northwards naming but not entering Port Jackson and Broken Bay?

Sailing further northwards by June 1770 Cook and the *Endeavour* found themselves hemmed in by the converging Great Barrier Reef. On Monday 11 June disaster struck with the *Endeavour* running up onto a coral reef which now bears its name.

For a number of hours the vessel beat on the reef whilst the crew jettisoned over fifty tons of ballast, iron guns, water and provisions in an attempt to lighted the ship. By a combination of good fortune and good seamanship the vessel was eventually freed from the reef and taken into what is now called Endeavour River near the present day town of Cooktown.

For nearly twenty days the *Endeavour* stayed in the river as the crew carried out emergency repairs on its badly damaged hull, replacing the damaged planks and frames (ribs) and recaulking (sealing) the hull.

On the 6 August the vessel left Endeavour River. After negotiating a passage through the reef just north of Lizard Island the vessel made its way north, with Cook landing at Possession Island where he took possession of the entire east coast of Australia – naming it New South Wales, in the name of His Majesty King George III. The vessel then passed through Torres Strait to the Dutch settlement at Batavia (present day Djarkata) where more permanent repairs were carried out on it's hull.

Unfortunately, although a savior to the ship, the town of Batavia was less forgiving to the crew with Malaria and dysentery claiming a number of lives before the vessel was again fit for the long voyage home to England where he arrived in July 1771.

Appendix C

HMB *Endeavour*

Once the British Admiralty and the Royal Society had taken the decision to conduct an expedition to observe the Transit of Venus, The Navy Board (the Royal Navy department responsible for the selection of such vessel) went in search of a suitable vessel for a detached voyage to the South Pacific.

A number of ships, including the colliers *Valentine*, *Earl of Pembroke* and the *Ann and Elizabeth* were subsequently surveyed on the 27 March 1768. The decision was taken shortly afterwards to acquire the cat-built bark *Earl of Pembroke* for 2307 pounds.

This survey information still exists and is currently held in the Public Records office in Kew and the National Maritime Museum in Greenwich and includes two full sets of lines and construction details of the *Earl of Pembroke*. This information was detailed enough to create a full-sized replica of HMB *Endeavour* ex *Earl of Pembroke*.

NB: In 2000 the Australasian Pioneers Club based in Sydney, Australia approached the Australian National Maritime Museum with a third complete set of original *Endeavour* plans dated April 28, 1768. These plans appear to be those used by the shipwrights at Deptford when they fitted out *Endeavour* for Cook's voyage

Although many historians believe it was Cook's decision to have an ex-collier as the expedition vessel, the Navy had already realised that the most suitable vessel for this voyage would be a 'cat-built collier', and purchased the *Earl of Pembroke* on 29 March 1768 prior to the appointment of Cook as Master of the vessel in early April 1768. (Beaglehole,1955, p606 – 607)

Cat-built – sometimes called Scandinavian built – barks were three masted, strongly built, wooden hulled vessels with very bluff bows. They had a square transom stern, a vertical stempost and a long box like body with near vertical sides. This gave the vessel a large deep hold, which was ideal for carrying either coal or months of provisions for a large crew. The vessel also had very flat floors (hull bottom) and a wide beam, which made them slow but steady sailors with the additional advantage of being able to take the ground without suffering any structural damage. (Macarthur, 1997, pp 19 – 45)

Once the *Earl of Pembroke* had been accepted into the Navy it was quickly renamed *Endeavour* and underwent a complete refit at the Royal Navy Yards at Deptford.

A new internal deck was fitted which ran the length of the ship. An additional platform deck - along with a powder magazine, bread and fish rooms, steward room and Captain's Store Room - was built in the hold at the bow and the stern, along with additional cabins to house the Royal Society scientists. Cook also ordered twelve tons of permanent pig iron ballast – called kentledge – to be loaded onto the ship to help trim it. The vessel was then armed with ten, four pound carriage guns along with 12, ½ pound swivel guns. (Knight, 1933, pp 298 - 299)

As the vessel was going to be operating in the warmer tropical waters of the Pacific and would be prone to attack from wood eating marine worms called *Toredo Navalis* the Royal Navy also modified the hull of *Endeavour*.

Whilst at Deptford the vessel's hull was scrapped back, re-caulked and then covered with thick layers of paper rags which were coated with a mixture of horsehair and tar. An additional layer of wooden planking went over the top of this – heavily fastened with large head iron nails. This was then coated with 'White Stuff' a mixture of train oil (whale and fish oil), rosin, turpentine and brimstone. (Macarthur, 1997, pp19 - 45)

Further addaptions and modifications were made to *Endeavour* at Plymouth prior to it leaving England. This included the construction of an additional deck above the tiller arm – steering mechanism - at the stern of the ship.

Following the voyage to the South Seas *Endeavour* returned to England in July 1771. It subsequently sailed to Woolwich where it was sheathed and refitted for further service carrying stores to the Falklands Islands.

The *Endeavour* made at least two voyages to the Falklands before being paid off in September 1773 and laid up. In November 1773 it was ordered to Boston but it was diverted down to the Falklands. It was again paid off at Woolwich in September 1774 and in March 1775 was sold out of the service for 645 pounds. (Knight, 1933, pp299 – 300)

Appendix D

The Historical and Archaeological Significance of HMB *Endeavour*

Captain James Cook and his vessel HMB *Endeavour* have played a highly significant role in the history of Australia.

The voyage of exploration and scientific discovery across the Pacific eventually led to the charting of the east coast of Australia, the European discovery of Botany Bay and Port Jackson and the subsequent claiming of the entire east coast of Australia by the English Government.

According to many noted historians it was the favorable reports not only of Cook but also Sir Joseph Banks and Thomas Matra which eventually led to the European occupation and settlement of the Australian continent in 1788.

Under the Historic Shipwrecks Act (1976) and influenced by the ICOMOS Burra Charter the Commonwealth has provided a series of evaluation criteria which allow archaeologists to assess the archaeological and historical significance of shipwrecks.

The wreck of the *Lord Sandwich* ex HMB E*ndeavour* fulfils the criteria in a number of areas

Criteria One: Historic

> *Significant in the evolution and pattern of history. Important in relation to a figure, event, phase or activity of historic influence.*
>
> HMB *Endeavour* is a highly significant vessel in Australia's history. The vessel is associated with a number of key players in the European occupation of Australia including Captain James Cook and Sir Joseph Banks.

Criteria Two: Technical

> *Significant in possessing or contributing to technical or creative accomplishments. Important in demonstrating a high degree of technical or creative achievement for the period in question.*
>
> HMB *Endeavour* ex *Earl of Pembroke* was specifically chosen by the British Royal Navy as being the ideal vessel to take on a voyage of scientific exploration and discovery to a remote part of the world.
>
> The vessel is associated with the observation of the Transit of Venus and the scientific work of Sir Joseph Banks; the naturalists, Daniel Carl Solander and Herman Diedrich Sporing; the astronomer, Charles Green; the natural history artists, Sydney Parkinson and Alexander Buchan.

These scientists not only recorded some of the earliest encounters with the Aboriginal people of Australia but also recorded many of the countries unique flora and fauna for the first time.

Criteria Three: Social

Significant through association with a community or communities in Australia today for social, cultural or spiritual reasons. Important as a cultural items or places highly valued for reasons of social, cultural, religious, spiritual, aesthetic or educational associations by a community today.

Captain Cook and the crew of HMB *Endeavour* have reached an almost iconographic significance in Australia today. The voyage of Cook and the *Endeavour* is taught at primary school in most States and Territories of Australia and their names appear on the maps of Australia's hinterland along with the charts of the coast.

In 1970 a 50 cent piece and a series of stamps were minted to commemorate Cook's 1770 voyage along the Australian coast. In 1987 - 1994 an $18 million re-construction of the vessel was built in Western Australia. The voyage of Cook and HMB *Endeavour* feature in museums as far apart as Kurnell in New South Wales, Cooktown in Queensland and Whitby – Cook's birthplace – in England.

Criteria Four: Archaeological

Significant for the potential to yield information contributing to an understanding of history, technological accomplishments and social developments. Important for its potential to yield information contributing to a wider understanding of the history of human activity.

Although HMB *Endeavour* was extensively surveyed prior to be purchased by the British government it underwent a number of modification prior to and during its voyage of exploration.

Many of these modifications were carried out in order to make the vessel more efficient or the crew more comfortable. However, as the modifications carried out at Endeavour River in June / July 1770 were to repair a badly damaged vessel. These repairs, possibly using Australian timbers, conducted thousands of miles from home represents a major technological achievement

Criteria Five: Scientific

Significant in the potential to yield information about the composition and history of cultural remains and associated natural phenomena, particular the biota, through examination of physical, chemical and biological processes. Important in the testing of hypotheses concerning

biological processes, the composition of cultural remains, the effects of original use and the effects of other environmental factors.

The work carried out on Primary Target A during August and September 1999 saw the development of a number of innovative underwater testing processes which involved a multidisciplinary approach to the shipwrecks of Newport, Rhode Island.

To assist the ANMM researchers in maritime archaeology and materials science, this investigation has brought together the work of scientists in the fields of:

- Sedimentology and environmental science
- Forestry
- Geology
- Archaeo – botany and palynology
- Forensic science
- Nuclear science.

Criteria Six: Rare

Significant in possessing rare, endangered or uncommon aspects of history. Important in demonstrating a distinctive way of life, custom, process, waterway use, function or design, which is no longer, practise, is in danger of being lost or is of exceptional interest to the community.

HMB *Endeavour* is significant in its potential to demonstrate various aspects of a mid 18th century British Admiralty ship of exploration, troop transport ship and prison vessel. The shipwreck along with its associated artefacts associated with its prisoners, passengers and crew has the potential to demonstrate conditions on board, values, customs as well as ship construction techniques.

Appendix E

Media interviews

Merimbula News Weekly 28 July 1999	(Local)	*Search for Endeavour*
The Age 10 August 1999	(Melbourne)	*In search of the real Endeavour*
National Nine News 10 August 1999	(National)	*In search of Endeavour*
ABC Radio 10 August 1999	(Newcastle)	*In search of Endeavour*
2UE (Mike Carlton) 10 August 1999	(State)	*In search of Endeavour*
The Australian 11 August 1999	(National)	*Voyage of discovery seeks Endeavour*
The Daily Telegraph 11 August 1999	(Sydney)	*$100,000 to solve fate of Endeavour*
The West Australian 11 August 1999	(Perth, W.A.)	*Australia helps to unlock mystery of Endeavour*
Channel Ten (ACT) 12 August 1999		*The Search for HMAS* (sic) *Endeavour*
The Australian 13 August 1999	(National)	Letters to the Editor
The Daily News 13 August 1999	(Newport, R.I.)	*Marine project will search for Endeavour*
The Canberra Times 13 August 1999	(State)	*The Search for Endeavour*
Channel Nine News 14 August 1999	National	*The search for Endeavour*
Channel Ten News 15 August 1999	(Newport, R.I.)	*Search for Endeavour*
BBC Radio 15 August 1999	(National, U.K.)	*Search for Endeavour*

Sky TV 15 August 1999	(National, Aust)	*Search for Endeavour*
Channel Ten 15 August 1999	(National Aust)	*Search for Endeavour*
ABC TV 15 August 1999	(National, Aust)	*Search for Endeavour*
The Daily News 16 August 1999	(Newport, USA)	*Search for Endeavour*
The Bulletin 16 August 1999	National	*Work begins in identifying 'Endeavour' wreck*
The Providence Journal 16 August 1999	(State, R.I.)	*Diver's search harbor muck for remains of long lost ship*
The Newport Daily News 16 August 1999	(State, R.I.)	*Search for Endeavour*
The Hartford Courant 16 August 1999	(State, R.I.)	*Divers are hoping to prove location of Capt. Cook's Ship*
The Australian 17 August 1999	(National)	*Holy grail of the sea*
2BL 17 August 1999	Sydney	*Endeavour* Update
ABC Radio 20 August 1999	Perth	*Endeavour* Update
The Australian 18 August 1999	(National)	*Raider's of the lost bark start search*
The Daily Telegraph 18 August 1999	(Sydney)	*Divers begin Endeavour Search*
Gold Coast Bulletin 18 August 1999	(Local, Qld)	*Hopes high on hunt for history*
The Herald Sun 18 August 1999	(State)	*Sea's promise of Cook's ship*
Daily Telegraph 24 August 1999	(Sydney)	*Fishermen hamper Endeavour mission*

2BL 24 August 1999	Sydney	*Endeavour Update*
5AN News 27 August 1999	(Adelaide)	*A piece of ceramic…*
ABC Radio 28 August 1999	Perth	*Endeavour* Update
The Australian 28 August 1999	(National)	*Endeavour ship in the mud ?*
The Daily Telegraph 28 August 1999	(Sydney)	*Clue to ship's identity*
Sydney Morning Herald 28 August 1999	(Sydney)	*Endeavour Ship in the mud*
2BL 31 August 1999	Sydney	*Endeavour* Update
ABC Radio 3 September 1999	Perth	*Endeavour* Update
2BL 7 September 1999	Sydney	*Endeavour* Update
ABC Radio 10 September 1999	Perth	*Endeavour* Update
The Australian 11 September 1999	(National)	*Cook team sweats on fruitful Endeavour*
Newport Daily News 13 September 1999	(R.I.)	*Ship yields clues, no answers*
3LO 14 September 1999	(Melbourne)	*Is it Endeavour ?*
Whitby Gazette 17 September 1999	(England)	*Endeavour divers fail to come up with new clues on sunken ship's identity*
The Courier Mail 30 September 1999	(State, Qld)	*History's ill winds keep Endeavour from our shores*
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