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Managing an Australian midget: The Imperial Japanese Navy Type A submarine *M24* at Sydney

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Introduction

The discovery in November 2006 of the 'missing' third Japanese midget submarine from the 1942 Sydney raid closed one of Australia's enduring naval mysteries. The vessel was the most successful of the boats used in the audacious attack and its disappearance created a legacy of intrigue. Under command of Sub Lieutenant Katsuhisa Ban (aged 23) and Petty Officer Namori Ashibe (aged 24), *M24* entered the harbour, attacked the visiting United States heavy cruiser USS *Chicago* (CA-29), missed, and sunk a naval depot ship killing 21 men. Importantly *M24* escaped, whereas its sister midgets *Ha-14* and *Ha-21* were destroyed and later recovered. Four submariners were confirmed killed, with the two-man crew aboard *M24* also presumed lost. All were posthumously awarded high Japanese naval honours.

Today the discovery of the midget submarine wreck has led to a reinvestigation of the raid and the final fate of *M24*'s young brave crew. The nationally rare wreck site has become the focus of intense activity by the responsible management authorities and is now beginning to give up its secrets. This paper summarises the management framework established to protect the site, and explores the archaeological clues that provide some insight into the crew's last actions and possible fate.

Discovery

An interesting target was inspected by recreational divers in 54 m of water during November 2006, off Sydney's Northern Beaches. Sydney lies on Australia's east coast in the State of New South Wales (NSW). Upon descending to the seabed, the No Frills Divers club members knew they were seeing something special. Then enshrouded in fishing nets, the small 24-m vessel was different to any other iron or steel shipwreck dotted along the Sydney coastline. It was unmistakably a submarine. Their tentative identification of it being an Imperial Japanese Navy Type A (Ko-Hyoteki) midget submarine proved correct.

Snapshot of the raid

The Japanese midget submarine attack on Sydney Harbour seriously affected the security of one of the major Allied naval arsenals retained in the Southern Hemisphere. In total eight Japanese submarines converged on Sydney with some 500 crew. The fleet included five large ocean going submarines (*I-21, I-27* and *I-29* were of the 'New Junsen Type B1' scouting boats, with *I-22* and *I-24* being 'Junsen Type' C1 boats: see Boyd & Yoshida 1995: 24, 26; Carpenter & Polmar 1986; Stille 2007), *I-22, I-24, I-27* with their three midget submarines, with *I-21* and *I-29* providing aircraft support. A fifth carrier submarine *I-28* was to have been involved but had been sunk en route, whilst a fourth midget had been disabled in a previous gas explosion (Grose 2007:105).

Like the midget attacks at Pearl Habour just six months before (7 December 1941), and the parallel raid at Diego Suarez Habour in Madagascar (30 May 1942), the outcome was mixed. No significant fleet units were damaged at Sydney and all the midget submariners were killed. Midget *Ha-14* deployed from *I-27* became fouled in the partly constructed anti-submarine net at 8.30 pm and partially destroyed when the crew fired the forward demolition charge at 10.30 pm. Midget *Ha-21* from *I-22* was discovered on the surface at 5.00 am the following morning, depth charged, and the crew killed using their service pistol. Midget *M24* escaped the harbour shortly after 2.00 am following its unsuccessful torpedo attack at 12.30 am on 1 June and was never heard from again (Clarke &Yamashita 1966; Reid 2007; Stevens 2005).

The raid did reveal the vulnerability of ports like Sydney to long-range submarine patrols and the need for heightened security. This was the first wave of a significant Japanese submarine offensive along Australia's eastern seaboard that extended into late 1943 and resulted in sixteen Allied vessels sunk in New South Wales' waters alone, and a further ten damaged. The campaign had parallels with the highly successful German U-boat offensive along the United States east coast in 1942.

Many Sydney-siders still recall the moments at night on 31 May 1942 as the harbour lit up with depth charge explosions, torpedo detonations, tracer fire and searchlights. It brought the reality of the 'northern' war home to Sydney's somewhat complacent population. The war was not going well—the British bastion of Singapore had fallen on 15 February, the northern Australian mainland had been bombed at Darwin from 19 February, and the recent dramatic naval engagement known as the battle of the Coral Sea had just occurred north of Australian waters (4–8 May 1942).

The three, 109-m long, midget-carrying submarines and the two aircraft support submarines had left the marshalling point of Chuuk (Truk) Lagoon in the Caroline Islands. Arranging themselves in a semi-circle, centred on the entrance to Sydney Harbour, overall commander Captain Sasaki must have sensed history being made.

International significance—oceans linked by war

Two of the Sydney carrier submarines, *I-22* and *I-24,* had previously launched midget submarines during the Pearl Harbour attack of 1941. This had been the first use of the highly secretive 'Ko-Hyoteki' or 'Target A' weapon. *I-24*

had deployed the ill-fated midget *Ha-19* (Ensign Kazuo Sakamaki and Petty Officer Inagaki Kiyoshi), that famously ran aground near Waimanalo on Oahu Island (Delgado 1988). *I-24* was involved in midget submarine operations beyond the Pearl Harbour and Sydney attacks, deploying midget *Ha-12* near Guadalcanal in November 1942, and *Ha-38* in December that year (http:www.combinedfleet.co/).

Lieutenant Matsuo, commander of midget *Ha-21* at Sydney, had already established a key tactical role with midget operations. He was a spy in Hawai'i before the war and was aboard *I-22* as an observer during the Pearl Harbour mission, in company with operational commander, Captain Sasaki. Matsuo suggested several design modifications for the midgets following observations of their deployment at Pearl Harbour (Carruthers 2006: 57). These design modifications are evident in the three Ko-Hyoteki midgets used in the Sydney Harbour attack - including better protective cages around the forward torpedoes and aft propeller, rudders and hydroplanes, saw-tooth net cutting devices mounted at the bow and conning tower, and an underside crew access hatch to improve transfer at sea from the carrier submarine (known as 'traffic sheaths'). Other improvements included better depth keeping gear, a longer periscope, and external torpedo caps with hydraulic ram releases. The new design was to be known as the Type A Kai 1 – Improved Version 1 (Lenihan 2001). Matsuo was acutely aware of the operational difficulties inherent in the somewhat quarrelsome Type A midget, narrowly escaping drowning during a training incident in Japan. Here his midget crashed to the seafloor following the failing of its electric motor (Teiji Yamaki interview transcript). Matsuo did not survive the Sydney mission, committing suicide at Taylor's Bay.

Confirmation of identity

The discovered wreck north of Sydney could only have been the missing midget deployed from the carrier (or 'mother') submarine *I-24*. As noted, the two other boats had been destroyed inside the harbour (Midget *Ha-14* from *I-27* and Midget *Ha-21* from *I-22*), and recovered shortly after. *M24* had escaped and was never heard from again. The submarine wreck has all characteristic features of the class, including its contra-rotating propellers and twin 18-inch torpedo tubes. Importantly the wreck displays key elements of the design improvements instituted after the 1941 Pearl Harbour deployment, including the distinctive net cutters, despite the removal of many external features by fishing nets. This confirms it to be of the Type A Kai 1 group. As Japanese records indicate only three midgets were ultimately involved in the one-off attack at Sydney, its identification is unchallenged. The wreck is also devoid of its two torpedoes and *M24* was the only Sydney midget to fire successfully. Research by the Heritage Branch also confirms the submarine to be lying on an historical recovery path to a pre-arranged fleet rendezvous location north of Sydney.

***M24* by any other name?**

There is debate over the exact classification or nomenclature of Japanese midget submarines. Where known, they are referred to by their unique number painted on the hull, for example, '14'. Alternatively they can be numbered according to the carrier submarine that bore them, e.g. *M27* (midget 14 deployed from carrier *I-27*). Using this system, the midget would be more properly referred to as '*I-27 tou*'. However, it is noted that the carrier submarine could deploy many different midgets during its service life.

The painted numerals were the proper hull reference and it is clear that Japanese midget submarines had their own numeric designation based on production sequences. The individual series number for two of the Sydney midgets is known: Matsuo's and Chuman's midget submarines were known from visible painted serial numbers on the recovered hulls beneath the conning tower (numbers *21* and *14* respectively). Conservation work at the submarine now on display at the Australian War Memorial, Canberra, Australia (comprising sections of both Matsuo's and Chuman's captured craft), confirmed that the numbers were also 'witness' punched into the hull, so that they could be painted out and re-applied (conning tower section from midget 14 in this instance). This involved chipping the outline of the symbols into the hull plate.

The original designation of Ban and Ashibe's midget has not been confirmed as no paint tracings can now be discerned on the hull, and historic Japanese war records are unclear. The Sydney midgets might have had a variety of other markings painted out during their final mission. *Ha-14*'s conning tower, for instance, had additional witness marks for a Japanese ensign (hinamaru) and possible unit markings (symbols), amongst others (Kemister n.d.).

It is perhaps more accurate to use an 'Ha' prefix before the midget's individual serial number (e.g. *Ha-21* henceforth), a term historically used to denote midget's coastal use classification (Carpenter & Polmar 1986:127; Boyd & Yoshida, 1995: 12).

Management issues and priorities

The submarine wreck site is at risk to all standard factors that affect underwater cultural heritage sites, including environmental and manmade factors. To mitigate risks, the following priorities were established: implementing legislative and active site protective measures, nullifying damage from fishing operations and accidental damage through site visitation, realising the threat of unexploded ordnance, and ensuring the sanctity of any human remains.

Laying down the law

Under existing Australian shipwreck heritage legislation, *M24* was unprotected by the Commonwealth *Historic Shipwrecks Act 1976*, when located, as it was younger than the 75-year automatic inclusion date. This proved problematic, as the finders did not immediately notify the relevant authorities of their 12 November discovery, whilst establishing private media opportunities. Upon disclosure

to the Royal Australian Navy who had become aware of the find, the Federal Minister for the Environment and Heritage, and the State-based Heritage Branch, NSW Department of Planning, were informed.

Within days, the site was declared a provisional Historic Shipwreck under the Commonwealth *Historic Shipwrecks Act 1976* (24 November 2006). A No-Entry exclusion zone of 500-m radius, that included the submarine, was also declared under the Commonwealth Act. State heritage laws could also be applied to the offshore wreck site as it was found to lie just within overlapping New South Wales 'coastal waters'. Under the provisions of the *New South Wales Heritage Act 1977*, penalties of up to $1.2 million dollars came into effect for anyone disturbing the site when the *M24* was gazetted under an interim heritage order (1 December 2006). The site was granted permanent protection with its inscribing on the NSW State Heritage Register on 7 December 2007.

M24 now had the protection of key Federal and State heritage legislation whilst the relevant heritage agencies, the Department for the Environment, Water, Heritage and the Arts (DEWHA), at the Commonwealth level, and the Heritage Branch, NSW Department of Planning (at State level), could inspect the wreck and conduct an independent identification and assessment. This was achieved through the deployment of a remote operated vehicle (ROV *Double Eagle*) from the Royal Australian Navy (RAN) mine hunter HMAS *Yarra* (27 November 2006), a day after the discovery was nationally aired by Australian media.

Hook, line and sinker

When found, the wreck was totally fouled by commercial fish trawl nets which were suspected of removing several key components such as the conning tower and external fittings. It was obvious that contact with the site had been frequent and harsh since its 1942 loss. The majority of nets were of nylon construction suggesting post 1960s hook up events. Mitigating any further contact with the fragile wreck site was determined a critical management priority.

The gazettal of the Protected Zone and interim heritage order was widely promoted, with the coordinates of the centre of the 500-m radius provided. This effectively mitigated any future fishing damage with modern GPS navigation systems. An active program of engaging with the State Department of Primary Industries that regulates commercial trawl operations and the fishing community was established as a priority.

Diving and anchoring

As the *M24* was immediately considered to be of national heritage significance, a proper archaeological survey of the site and surrounding debris field was imperative. Observed cavities in the hull at the aft battery room and control room meant that the internal compartments and possible relic collections were at risk of disturbance. While detailed mapping was initiated, all recreational diver access to the site was banned. This moratorium had the imprimatur of the Japanese Embassy and also eliminated accidental damage to the wreck by visiting boats' anchors. The latter remains a significant threat.

Active surveillance

A sophisticated in-water acoustic and camera surveillance system was installed at the site to manage site access restrictions. This was a joint venture between Australian Federal and NSW State Governments and involved the placement of in-water buoys that allowed for vessel tracking and in-water sound detection within the no-entry zone around the wreck (deployed in early 2007). Operating from permanent (lit) surface buoys, hydrophones trigger an alert at a variety of base stations for action by appropriate authorities such as the NSW Water Police for breaches of the zone. Cameras mounted on the buoys capture 360° photographs of the zone and any illegal vessel presence. The system was augmented in 2008 with a live-feed land-based long range CCTV camera (imaging 3 nautical miles) that provides real-time visual imagery of any transgressions within the perimeter. The in-water buoys mark the area of the protective zone but not the actual position of the submarine. This is the only system of its kind protecting a shipwreck in Australian waters.

Human remains

As the *M24* hull is substantially intact, the hull is likely to contain the remains of its two-man crew. While there has been no visual evidence to confirm the existence of human remains to date, there is corroborative evidence to suggest that the crew did not escape the vessel. A key clue is the retention of the two-step access ladder still resting in its 'up' or stowed position within the remains of the upper crew access shute. The locking lugs on the conning tower hatch, torn off and lying on the sand nearby, also appear to be in the 'locked down' position. It is presently unknown whether the corrosion openings to the hull have compromised the retention or context of human remains. Australian War Graves legislation does not apply at sea although any human remains would constitute archaeological relics under the relevant heritage legislation, providing a level of protection from disturbance. Due to the sensitivities of any contact with the war dead, particularly for the surviving relatives, and in the interests of the Japanese Government, no interference of the internal hull cavities is permitted. Future limited archaeological sampling of the interior sediment deposits to identify the presence and actual location of human remains and internal relics would only be considered with appropriate archaeological permit approvals and the endorsement of relevant parties.

Interests of the Japanese Government and relatives

The Australian Government immediately notified relevant Japanese authorities of the find, including the Japanese Ambassador to Australia and staff, and the Japanese Naval Attaché. An interdepartmental committee (IDC) was formed to oversee the site's protection and ongoing management and included the Department of Prime

Minister and Cabinet, Department of Foreign Affairs and Trade, the Department of Defence (Navy), and Federal and State heritage authorities. This mirrored the consultation between United States authorities and the Japanese Government upon the discovery of the previous midget submarine wreck off Pearl Harbour in 2002 (Wiltshire 2002; Van Tilburg 2006). With the Sydney midget, the Japanese Government confirmed its desire that the *M24* be adequately protected through available Australian heritage legislation, that appropriate archaeological documentation proceed, and that no disturbance of the remains be undertaken, in the first instance. Implicit in these discussions was an initial desire to restrict recreational diving to the site by the general public. The Australian Government was similarly concerned that the remains, particularly of the crew, were uncompromised.

Ownership of the *M24* wreck site has not been a focus of discussions to date, although the Japanese Government officially notified relatives of the crew, following confirmation of its identity by Australian authorities. It is noted that, in the Pearl Harbour case, Japan officially gifted ownership of that wreck to the United States Government for long-term management by relevant US authorities in 2004 (Gorell 2004). Under international maritime law, ownership of naval wrecks is generally retained by the parent State, unless they were surrendered in combat, or transferred (McCarthy 1991; 1998). Regardless of ownership, management of archaeological remains is subject to the heritage laws of the country in whose jurisdiction they lie.

Unexploded ordnance

The Chief of Navy (Australia) and the Heritage Branch (Smith 2006a) confirmed that the wreck would contain two explosive scuttling charges (unexploded ordnance) that may pose a danger. Initially their size, construction and location were unknown. Research by the author has now identified their probable location within the hull, the nature and size of the charges (TNT charges of 60 lb or 27 kg each), and the method of firing (electrical and manual wick). The forward scuttling charge is likely to lie within the central passageway of the forward battery room, close to the internal bulkhead to the torpedo room. The aft charge is probably located in the mirror position in the aft battery room close to the engine room bulkhead. These charges were primarily placed to quickly scuttle the submarine when rendezvousing with the parent or carrier submarine. Being located adjacent to the main joints of the three key hull sections: the forward section (comprising the torpedo room), central section (comprising the forward battry room, control room and aft battery room), and the aft section (engine room), would cause the fastest possible flood.

Research will continue on the likely volatility of these charges, their integrity and probable form of casings. The archaeological surveys have confirmed that the aft charge, at least, is now buried within anaerobic sand deposits, which may have acted to prolong the integrity of the circular steel canister known to contain the charge. Assessment of the charges has confirmed another design change between the Pearl Harbour attack midgets and the improved Sydney type. The Pearl Harbour boats generally had a single charge of 300 lb (136 kg) of TNT mounted aft (some wartime reports say in the aft battery room, others 'under the stern'). The demolition charges must have been 'portable' to allow removal from the midgets during storage, cleaning, and transport. It is known that the Sydney charges were 'lashed to improvised chocks 'and 'very temporarily wired in ordinary twin flex' [electrical wire] (Australian War Memorial, PR89/172).

The existence of unexploded ordnance within the *M24* hull is a significant contra-indication for archaeological recovery of the wreck for conservation and public display. The existence of these explosives is also a significant issue guiding decisions regarding future public access to the wreck, for example through controlled diving activities. This is particularly so as partial access into the aft battery room is possible through corrosion openings.

Access constraints

M24 lies beyond approved recreational SCUBA (air) diving limits (40 m), and normal non-saturation occupational (Commercial) air diving limits (30–50 m). Visitation by recreational divers and Government heritage managers and related professionals is therefore constrained. Because of NSW Occupational Health and Safety Regulations, Australian government maritime archaeologists cannot access the wreck directly (Smith 2006b). This has restricted the ability to undertake archaeological diving inspections. Instead a succession of remote operated vehicle (ROV) surveys has been conducted. Royal Australian Navy Clearance Divers (AUSCDT) were engaged to inspect the site in May 2007 with appropriate clearances. The engagement of commercial dive teams to undertake the archaeological documentation work under supervision has been prohibitive financially. In comparison, the growth of deep wreck recreational diving systems such as mixed gas (e.g. Trimix), and semi to closed circuit re-breathers, means that recreational divers with this training can readily reach the site with prolonged bottom times. However, due to the workplace rules mentioned above, engagement of recreational diving groups to undertake the survey work is not permitted.

Implementing the management strategy

It was implicit that management and survey activities at the site would adhere to the controls of applicable Commonwealth and State heritage legislation, and be in keeping with the UNESCO *Convention on the Protection of the Underwater Cultural Heritage* (2001), which is considered the international benchmark for archaeological investigative activity. Australia is still assessing formal ratification of the convention.

In-situ *preservation*

The Heritage Branch immediately assessed the significance, values, integrity and threats to the site and

determined that *in-situ* preservation would be the guiding management policy (Smith 2006c). This is consistent with the Department's archaeological heritage management approach and that of the *National Historic Shipwrecks Program* under the auspices of the Commonwealth Department for the Environment, Water, Heritage and the Arts (DEWHA). *In situ* retention of archaeological structures is also the cornerstone of international guiding frameworks such as the UNESCO Convention 2001, and the Australasian Institute of Maritime Archaeology (AIMA) Inc.

The complexities of archaeological recovery for conservation and public display were evaluated and the significant technical requirements and costs involved were identified as prohibitive. Fundamental to this decision is the noted existence of unexploded ordnance of unknown form and condition, and the likely existence of human remains within the largely sealed compartments (Smith 2006d). A final successful conservation outcome could not be assured based on current international case studies (e.g. Weaver 2004; Smith 2008b). Cost estimates for the necessary pre-disturbance in-water conservation treatment, wreck recovery, establishment of a shore-based conservation and display facility, and 20–30 years of active stabilisation and interpretation exceeded $AUS50million. Corrosion activity at the junction of the central control room and aft battery room has also created a break in the outer steel hull effectively severing the submarine. This has substantially affected the longitudinal structural integrity of the wreck. The ethical justification for recovery of *M24* was deemed insufficient on pure research grounds, noting the existence of (albeit limited) wartime documentation relative to this class of vessel; the analysis and public museum display of portions of the two sister vessels recovered at the time of the Sydney attack, and other international examples.

The Heritage Branch argued that to have one of the three midget submarines preserved *in situ*, in its original 1942 battle context, would provide a unique management outcome. Retention of the key values of the site would be assured, ongoing in-water conservation analysis would be facilitated, and public education initiatives through available media could be explored. Long-term human visitation to the site as a unique educational and tourism opportunity was identified as one possible long-term option, once a sound understanding of the site and its associated relics collections were understood, and the interests of relevant parties canvassed.

Recovery of human remains for formal repatriation and burial

Upon discovery, the finders voiced an interest in the recovery of human remains as a mark of respect for the brave crews. It must be remembered that in the Japanese psyche, Sub Lieutenant Ban and Petty Officer Ashibe hold special status as 'Hero Gods' for their bravery. Emperor Hirohito bestowed this honour, with their posthumous elevation by two naval ranks conveyed through Admiral Yamamoto (as with the Pearl Harbour crews, except for the captured Ensign Sakamaki). The remains of *M24*'s crew therefore retain special significance to Japan, apart from the personal interests of the families for appropriate private burial. The honours awarded the crew in wartime (*Domei*, Tokyo, 27 March 1942) have created an elevated need for their physical protection, hence the interests of the Japanese Government and Australian authorities regulating public diving interaction with *M24*.

Family descendants voiced their initial interest in recovery of human remains. Mr Itsuo Ashibe (aged 84 at time of discovery), lost his four brothers in the war including Namori Ashibe in *M24*. While noting that few physical reminders might exist, his desire for closure and a final burial for at least one of his brothers was paramount, 'if there was just something, a shoe perhaps, or even if I could have a rusted piece of the sub that I could bury inside my brother's grave, I would be happy'. The surviving brother of Katsuhisa Ban, the commander of *M24*, was more reserved, 'I don't see the point in raising the vessel and disturbing his peaceful sleep' (*Sydney Morning Herald*, 13 December 2006). The complexities of scientific archaeological recovery of human remains and associated personal effects were brought to the attention of the families following a briefing, which included the author, with the Japanese Embassy in Canberra (8 December 2006). It was confirmed that due to the build-up of sand within the hull, the only achievable way to identify the presence of human remains and to identify individual bodies, would be through archaeological excavation of the internal compartments ashore in controlled conditions, similar to that undertaken with the *HL Hunley* (Murphy 1998). This, by default, necessitated the complete recovery and later conservation of the submarine. Recovery of the hull had already been ruled out for the reasons outlined above.

Within a month of the *M24*'s discovery, Mr Ashibe and others acknowledged that retrieval of remains 'was an impossible dream'. His aim now was to sprinkle saké over the sea above the wreck site (*The Japan Times*, 23 December 2006; *Sydney Morning Herald*, 27 December 2006).

By publicly conveying an *in-situ* preservation policy soon after the wreck's discovery, the issue of recovery, including that of human remains, was removed from ongoing public debate. This allowed the relevant management authorities to deal with the archaeological survey and delivery of site protection and surveillance without distraction. Senior naval authorities, including the Chief of Navy of both Japan and Australia officiated at a service memorial over the site aboard the guided missile frigate HMAS *Melbourne* (7 February 2007)—the start of many formal commemorations.

Mr Itsuo Ashibe obtained one of his wishes pouring sake into the water above the resting place of his bother on 6 August 2006 aboard HMAS *Newcastle*. The moving event involved nineteen relatives of the submariners lost in the Sydney attack. Importantly, Ashibe's desire to have a memento of the site for formal internment with his brother's shrine in Japan was also fulfilled. Sand had been deliberately collected at the site during the Heritage Branch-led diving surveys by Australian Navy Clearance

Divers on 21 May 2007. The sand was formally presented to the brothers of *M24*'s crew by the (then) Minister for the Environment, The Hon. Malcolm Turnbull MP. Conservation staff at the Australian National Maritime Museum treated the sand to allow its export under Australian quarantine (AQIS) regulations. The sand was presented in specially crafted Australian hardwood chests organised by DEWHA.

The Japan Maritime Self Defence Force (Japanese Training Squadron) paid their private respects to Ban and Ashibe when a fleet of three visiting JMSDF vessels completed an on deck salute over the wreck on 10 August 2008.

A model gesture

The collection of sand as a symbolic representation of a life lost on a shipwreck site provides a useful model for future remembrance. The gift was highly valued by the families of *M24*'s crew and provided a tangible 'relic' for families to cherish. The recovery did not compromise the archaeological integrity of the archaeological structure, and served as a similar focal point for ongoing remembrance and reflection as a piece of the vessel or artefact would have provided. This is a model that could be used for future ceremonial events linked to crew deaths at sea in wartime (e.g. HMAS *Sydney* II 1941 and *Centaur* 1942).

Heritage and archaeological values

The *M24* is of heritage importance to Australia and Japan and the only Japanese midget submarine wreck located in Australian waters. Only one ocean-going submarine, *I-124*, lies off Darwin. The site is the only *in-situ* identified cultural relic surviving of the attack on Sydney Harbour in 1942 and is important as the vessel that sank the depot ship *Kuttabul*, killing all 21 Allied personnel. The wreck is representative of Japanese submarine operations off Australia's eastern seaboard during the war and a direct physical reminder of the conflict at Sydney. Internationally, it represents one of only a handful of Japanese midget submarine wreck sites located in their unique underwater contexts.

Remains of six Japanese midget submarines are retained as static museum or outdoor display exhibits worldwide:

(1 & 2) *Ha-14* and *Ha-21* composite reconstructed at the Australian War Memorial, Canberra, Australia, with the spare conning tower from *Ha-21* at the Naval Heritage Centre, Garden Island Naval Base, Sydney;

(3) Historic Ship Nautilus and Submarine Force Museum, Groton, Connecticut, United States—possibly *Ha-8* recovered from Guadalcanal;

(4) Admiral Nimitz Museum, Fredericksburg, Texas, United States—*Ha-19* captured at Pearl Harbour in 1941;

(5) Camp Dealy, Guam—identified as a Type C, possibly *Ha-51* recovered off Talofofo, Guam in 1944; and

(6) Eta Jima Naval Academy, Japan—Midget D located near entrance to Pearl Harbour in 1960 and recovered in 1968. Another Type A midget, Midget B, was recovered in 1942 and reburied (twice) in landfill at the Submarine Base, Pearl Harbour and is no longer visible.

Three intact Type A underwater sites have been found since the war at Hawai'I and Papau New Guinea, with another extant wreck ashore at Kiska Harbour in the Aleutian Islands. Another intact Type A midget has been reported by recreational divers in 2008 off the Bonin Islands south of Japan, but details are scarce (Posted on You-Tube, 5 May 2008 <http://www.youtube.com/watch?v=x6qpvDit3Dk>. Fragments of others have been located at Madagascar and offshore from Pearl Harbour. The Sydney archaeological site is therefore of considerable importance in the comparative analysis of midget submarines documented worldwide.

The midget found in 2002 in 400 m of water off Pearl Habour has, despite its depth, seen some of the most thorough archaeological and conservation analysis and is a critical reference site to Sydney's *M24* (Wiltshire 2002; Gorell 2004; Van Tilburg 2006; Wilson, *et al.* 2007). The Heritage Branch has initiated linkages between all site and museum managers responsible for the care of these sites to facilitate greater exchange of data, research sources and management approaches. The *M24* site also has the ability to contribute generally to studies of submarines as a specialised class of archaeological site type (McCarthy 1998, 2007; Smith 1999a, 1999b; Gregory 2000).

An enduring problem in the study of Type A midgets is the paucity of detailed archival information relative to these vessels (e.g. detailed technical documents, plans and photographs), the heavily compromised static display examples—heavily stripped of machinery and fittings, and the lack of detailed studies of most extant examples. The document collections of national Japanese archives are presently unknown, with most records generated of captured vessels prepared by Allied military authorities.

Type A midget submarines: Historical background

The development of Japanese midget submarines has been covered in some detail (Carruthers 1982, 2006; Jenkins 1992; Grose 2007; Lind 1992); however, studies are hampered by the noted lack of records and an equal lack of oral accounts by Japanese instructors and sailors who trained and manned them. Hence the operational characteristics of the craft are only glimpsed in extant interviews with past crew and instructors at naval establishments like the Eta Jima Naval Academy (e.g. Yamaki interview transcript), and some captured operational tactical orders (New Zealand Naval Intelligence Memoranda).

The Japanese Midget Submarine Association has long since been disbanded with the passing and elderly age of its few remaining members, hence eyewitness insights into the operational capacity and environmental conditions inside the boats is now generally lost. Today there are so many questions to be asked regarding the standard operating practices of Type A midgets: What were the tasks

of relative crew? What actions did they take in combat? (e.g. shutting bulkhead doors); How long could they maintain submerged without fresh air? How many times would they come to periscope depth? And, What would the crews do to pass the transit times? Unfortunately the archaeological study of these sites will not answer many of these operational questions.

Kemp identified the Type A 'Ko-Hyoteki', as possibly the most sophisticated and well designed midget submarines used by any of the belligerents in the Second World War (Kemp 1999). Today the few located midget wreck sites, and those retained on land in museum display have become a rare and important record of these craft.

The Sydney Type A design

The Japanese Imperial Navy Type A midget submarines deployed at Sydney were approximately 24 m in length (80.5 ft), of 46 to 47 tons, and carried two 18-inch Type 97 'Special' torpedoes (using pressure enriched air, oxygen, kerosene and seawater mixture), from the Kure Naval Yard. With a two-man crew, contemporary assessments suggested that they could remain submerged for about 12 hours in most normal operating circumstances. After this time the crew would be forced to replenish air and stamina levels. The submarines were of single (pressure) hull design using all welded cold rolled steel plates (MS44 quality – 5/16 in with a normal diving depth of up to 100 m and a collapse depth of 200 m (Kemp 1999: 73). Inspection of the *Ha-21* conning tower section at the Naval Heritage Centre, Garden Island, Sydney, confirmed the hull plating to be 8 mm (5/16 in) in diameter.

Powered by a 600 horsepower electric motor, the boats could not recharge their initial battery capacity and therefore were totally reliant on the careful management of the power reserve, and susceptibilities of any technical breakdowns or events that might impact battery operation. The design achieved an impressive surface speed reportedly up to 24 knots on the surface and 19 knots submerged—far greater than other midget designs of World War Two.

The type was designed in Japan during the 1930s with two experimental boats *Ha-1* and *Ha-2* built as early as 1936. The building program was concentrated from 1938 onwards where some fifty Type A boats were built at Ourazaki and Kure naval yards (Lenihan 2001:Chap. 2), the majority between the main building program of 1938–1942 (number sequence *Ha-3* to *Ha-52*). The class were known by many secret names, such as 'sheaths' and 'flies' to conceal their secret development, the most commonly ascribed being 'Ko-Hyoteki' or 'Target A' (fleet battle targets). Records of production are limited and total production numbers are variously reported, for example, some quoting 59 Type A's produced (Compton-Hall 1985: 135).

The Japanese designed several variants to the Type A midget during the war, including the 'Otsu-Gata' (Type B), the important 'Hei-Gata' (Type C) and the most prolific 'Koryu' (Type D), fitted with generators to allow battery recharge and additional crew.

An enduring mystery – the crew's fate

Ban was the most junior of the three Sydney raid midget commanders, Matsuo and Chuman being Lieutenants. He was not originally assigned to the attack, but part of a relief crew. *I-28* was to be one of the key attack boats but had been sunk by USS *Tautog* on its way to pick up a waiting midget at Chuuk. *I-24* collected that midget but a battery explosion soon after leaving for Sydney killed one of the midget crew, burnt another, and disabled the midget. *I-24* returned to Chuuk and collected the last available midget with the relief crew comprising Ban and Ashibe.

In his farewell letter written immediately before the Sydney attack, Ban commented:

> Nations that fear death will surely be destroyed. It is necessary for the youth of Japan to take notice of this. "Sure-to-die" is the spirit that will bring about the final victory (Jenkins 1992: 204).

These sentiments do not infer that Ban and Ashibe had resolved not to return from their mission. Indeed the evidence below suggests they attempted to effect a recovery as ordered directly by Admiral Yamamato.

One of the enduring legacies of the attack was the final fate and disposition of *M24* after its attack on Sydney Harbour. Where did it go? What condition was it in? and, What were the final actions of its crew? There have been numerous theories for the whereabouts of the vessel, including many false discoveries, hoaxes and area searches. The 2006 discovery of the wreck north of Sydney was an initial surprise as the last tactical order provided to the crew was to rendezvous with the fleet south of Sydney, off the Royal National Park (Recovery Position #2, Telegraphic Order Number 4, 29 May 1942). The author reviewed surviving Japanese battle plans for the attack which showed that, six days before the raid, the preferred recovery position had in fact been north of Sydney, adjacent to Broken Bay (Recovery Position #4, Telegraphic Order Number 3, 26 May 1942). These key collection points, including a number of additional points, were obtained from charts recovered from the midgets captured in the Sydney attack.

When the Heritage Branch overlaid *M24*'s wreck position, it lies almost exactly on the pre-arranged bearing to the northern rendezvous with its 'parent', *I-24*. Ban may have decided not to lead any pursuing forces to the waiting submarine fleet to the south. Perhaps he hoped that the northern zone would be quieter; knowing they would have the southerly set of swell to assist their passage, and where they could have signalled a pick up at a more agreeable time. However *M24* only made it halfway along the track, ending its journey east of Bungan Head, Newport. Research suggests that they would have been in combat for 13–14 hours at this time (perhaps exceeding their suggested 12-hour capability), were perhaps low on air and battery power, or even slightly disabled from the fire-fight they endured inside Sydney Harbour from naval vessels. More importantly, they probably arrived at

their final position as day was breaking on 1 June 1942, and would know that surface and aircraft searches would have been made at first light. This indeed occurred. They would have been forced to sit on the bottom for a further twelve hours till nightfall (Smith 2007a: 55 ff.; 2007b). Perhaps this was an impossible scenario.

Condition of M24

The 2006–8 archaeological surveys of *M24* have not found any evidence of catastrophic damage suggesting an uncontrolled decent to the seabed. Despite the removal of the conning tower, access shute and external fixtures by fishing nets, it can be surmised that the hull was in a closed-down condition at the time. Key evidence is the stowed crew exit ladder at the juncture of the control room roof. It therefore appears that Ban and Ashibe were most likely retained within the hull and either committed suicide, or were overcome by some other mechanical or environmental catastrophe. There is no evidence to suggest that the internal demolition charges had been fired (or successfully fired).

At the present time all archaeological survey activities at the site have been non-disturbance in nature, aimed at obtaining base data on the condition, integrity and environmental setting of the submarine. Only future intrusive surveys of the internal sediment deposits (where achievable) will provide any possible clue to the positioning of human remains within the vessel. The location and orientation of human remains might provide some additional insights into the final actions of the crew, but it is likely that this will remain an enduring uncertainty.

All survey operations since discovery in November 2006 have involved or been led by the State Maritime Archaeologists at the Heritage Branch, NSW Department of Planning. The work has been greatly assisted by the Royal Australian Navy through provision of remote operated vehicles fitted to their mine hunter fleet, and a RAN Clearance Diving Team for an extended survey in May 2007. Several NSW State Government and Commonwealth entities have assisted with provision of vessel and equipment support for dedicated remote surveys (ROV, sidescan sonar); water and sediment analyses, and hydrographic (bathymetry) surveys. These have included the NSW Water Police, NSW Department of Commerce, Sydney Ports Corporation, Defence Maritime Services (DMS), and the Department of Environment and Climate Change (DECC). Commercial survey assistance has also been generously supplied by a number of companies including OceanModules Pty Ltd, Sonartech Atlas Ltd and SeaBotix Inc.

The wreck lies upright on sand following standard observed submarine wrecking patterns, as was predicted by the Heritage Branch. *M24* lies slightly under half buried in surrounding sediments on a gently shelving sand plain. *M24* is largely intact although has sustained damage by commercial fishing trawling operations since its loss 67 years ago. These impacts (of unknown number and frequency), have most probably caused the observed removal of most of the conning tower structure, bow and conning tower net cutting equipment, torpedo and propeller protective cages, and the forward section of the upper torpedo tube. Some removed elements, such as the conning tower access hatch, conning tower net cutting mechanism, and upper torpedo tube are retained in a debris field that surrounds the site. An additional remote operated vehicle survey in November 2008 identified fragments of curved steel plating beneath the sand off the port side of the conning tower. These probably represent some of the missing conning tower 'skin' plating.

A significant amount of corrosion has occurred to the main pressure hull immediately aft of the control room (conning tower), enabling access points into the main hull at the aft battery room. The cause of this damage is presently unconfirmed, but most likely resulted from stress applied to the hull at this point during the attempted recovery (winching) of entrapped fishing nets. Sand levels in the aft battery room are moderate (approximately 2/3 filled; 1.20 m), with the openings into the hull acting to allow water movement and sand scouring. The aft scuttling charge is projected to be located in this aft battery room, immediately forward of the motor room bulkhead (frame 54). No visual trace of the charge has been made, but it is now considered likely to be buried under the accumulated sediment in this compartment. There are no visual access points into the forward section of the submarine to enable an assessment of the condition of the forward battery room, forward scuttling charge, or torpedo room. The removal off site of the crew access chute that once passed through the conning tower has created a circular opening into the main hull at the control room. The control room itself appears to be also approximately 2/3 filled with drift sand.

Future survey activities: Corrosion profiling

Following standard archaeological assessment processes, the Heritage Branch proposes to undertake diver-based corrosion and ultrasonic readings of the hull and major components. These tests could include the recovery of small hull samples for metallurgical and chemical analysis, together with X-Ray diffraction studies on the hull concretion. The data will be used to estimate the average corrosion rate of the external hull and to predict long term survival patterns if left *in situ*. This will assist site managers in identifying the need for any intrusive assistance such as the application of cathodic protection to stabilise corrosion activity and to prolong artefact retention. Similar studies have been initiated at the 400-m deep Pearl Harbour midget with in-water sampling conducted remotely in 2005 (Wilson 2007). Average corrosion rates of that hull have been estimated at 0.014 mm per year (mmpy), corresponding at the time to a 61-year loss of approximately 11% of its original hull thickness (Wilson 2007). This equates to the loss of 0.9 mm of original metal thickness, but retention of 7.1 mm of original metal. This bodes well for the integrity of *M24*,

while noting its location in far shallower and potentially a more oxygenated environment.

The Heritage Branch has completed (May 2008) preliminary water quality and sediment analyses of the *M24* site to evaluate its localised environmental setting, as a precursor to the collection of similar corrosion data, ultrasonic hull thickness data and concretion sampling. Similar studies have been completed at the World War One *J-5* submarine wreck near Melbourne, Australia (Beringer-Pooley 1991; Roach 2007), and at the Australian submarine *AE2* lying in 73 m of water near Gallipoli, Turkey (Smith 2008a; 2008b). Comparable studies have been actioned at other submarine and submersible sites (see: Murphy 1998; Bowyer 1999; Gregory 2000; Barker *et al.* 1997; McCarthy 2007; Weaver 2004), providing useful reference data sets.

Future priorities

The management and protection of *M24* continues to be a high priority for the Heritage Branch as it is recognised as one of the most significant military shipwrecks within Australian territorial waters. Public interest in the site and its story has been high with extensive media coverage of all facets of the survey operations. The wreck has special emotive power for the families of the dead submariner's, with the Japanese and Australian Governments having a close involvement in the development of site management policy. The No Frills Divers who located the site have received many accolades and were presented with Historic Shipwreck Awards signed by the State Minister for Planning, The Hon. Frank Sartor MP, in 2007; personally met the then Australian Federal Minister for Defence, The Hon. Dr Brendan Nelson MP; and, received a 2008 Sydney Harbour Week Award supported by the NSW Maritime Authority, NSW State Government.

All activities have been planned to deliver best-practice site management solutions in keeping with the ethical framework established under the National Historic Shipwrecks Program in Australia.

A critical need is the identification of the volatility of the unexploded demolition charges within the *M24* hull. These explosives have a significant impact on long-term management options for the site. Similar predictive risk modelling assessments have been undertaken for other wartime wreck sites with unexploded ordnance, such as the 1915 *AE2* submarine, Turkey (Smith 2008b). The Heritage Branch has initiated the development of a 3-dimensional model of a Type A midget, including a virtual 'walk-thorough of the sub and wreck site', to aid graphic interpretation, and innovative seabed imaging and rendering of the site. A dedicated web site is under construction to showcase survey and management activities, and follows the production of the initial wreck inspection report (Smith 2007a), and publicly available information fact sheets, a shipwreck poster featuring *M24*, and existing web-based online data available through the Heritage Branch's key web sites. A broad public lecture program has been delivered since the site's discovery. A key strategy of the *M24* public outreach program has been utilisation of the media to provide constant updates on the works program and this has been highly successful. Future debates will centre on whether the site needs in-water stabilisation support through cathodic protection, and whether opening the wreck up to controlled diver visitation by a permit system is appropriate. One long-term protection strategy could include the deployment of a fixed permanent cage around the wreck to limit diver interaction with the historic fabric and internal compartments. The viability of such programs must be considered with the interests of the Japanese Government, families of the crew, relevant Australian authorities, and the localised environment of the site. At present, short-term threats to the site have been mitigated, and medium term strategies to enhance the site's longevity are being developed (e.g. corrosion studies of the hull).

M24 survives as a unique reminder of World War Two's arrival on the doorstep of Sydney, Australia's largest capital city. Protection and interpretation of this fragile site will continue to stir the interests of a country re-connecting with its wartime maritime history, and thrilled at discoveries like *M24*, HMAS *Sydney* II (1941) and the German raider *Kormoran* (1941), off its rugged shores.

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