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Australian rules: Armidales in action

Plain sailing: Australia's Armidales prove fit for task

The Armidale-class patrol boat programme has moved past early design problems with its fuel system and is now proving itself to be a highly capable replacement for the Fremantle-class in patrolling Australia's exclusive economic zone, writes *Julian Kerr*

Two-and-a-half years after the first of the Royal Australian Navy's (RAN's) Armidale-class patrol boats (ACPBs) entered service, the 14-strong fleet is operating at a high tempo off Australia's northern coast with fuel contamination problems apparently a thing of the past.

The first-of-class, HMAS *Armidale*, was commissioned in Darwin in June 2005. The final boat, HMAS *Glenelg*, was completed in November 2007 and is currently completing work up prior to commissioning in February 2008.

Six ACPBs – soon to be seven – are currently tasked to Border Protection Command (BPC), the interagency maritime security organisation led by Customs and Defence that is responsible for operational co-ordination and control of both civil and military maritime security and enforcement activities within Australia's 200 n mile exclusive economic zone (EEZ) and beyond.

Rear Admiral James Goldrick, Commander BPC, told *Jane's* that while the envelope of ACPB capabilities was still being explored, experiences to date were encouraging and the boat was proving an excellent seakeeper.

For Captain Aaron Ingram, Commander Australian Navy Patrol Boat Group, the quantum leap in capability provided by the ACPB over its predecessor Fremantle class is welcome in the face of the increasing belligerence being shown by foreign fishing vessels apprehended in Australian waters.

The ACPB programme had its genesis in 1993 when an initial proposal to replace the 15-strong Fremantle class took the form of a collaborative programme with Malaysia for an offshore patrol combatant/joint patrol vessel.

When this fell through a Life-of-Type Extension was approved for the Fremantles, whose designed life-of-type ended in 1998. High maintenance costs led to the approval

in 2002 of a Fremantle replacement programme known as Project SEA1444.

Although private financing initiatives were originally considered, the Australian Department of Defence (DoD) eventually decided on an innovative direct purchase, performance-based model.

This strategy departed from the traditional DoD practice of procuring a specified number of ships built to highly detailed input specifications, with in-service support being contracted separately.

Instead, the DoD sought a patrol boat system to provide 3,000 days a year of operational availability of specified performance, with the capacity to surge to 3,600 days to meet operational contingencies in any one year. It was left to the tenderer to determine the number of vessels necessary to meet the requirement.

The tender included a range of specific performance parameters, including the ability for the platform to conduct surveil-



Austal: 1294278

The second of the RAN's Armidale-class patrol boats, HMAS *Larrakia*, becomes airborne during sea trials off Henderson, Western Australia.

lance and boarding operations at the top of Sea State 4 (wave heights of 2.5 m) and to maintain surveillance to 1,000 n miles off-shore at the top of Sea State 5 (wave heights of 4 m).

Unusually, the tendering strategy linked a fixed-price build contract with a 15-year fixed-cost in-service support contract taking in all training, logistics and maintenance.

In December 2003, a AUD553 million (USD498 million) contract was awarded to Defence Maritime Services Pty Ltd (DMS), a joint venture between P&O Maritime Services and Serco Asia-Pacific, for the design, construction and in-service support of 12 patrol boats. When the contract was signed the build element was worth about AUD285 million, giving a per unit cost of approximately AUD24 million.

A further two boats were ordered in 2005 specifically to provide the fleet with additional capability to patrol oil and natural gas installations off Australia's North West (NW) shelf and an extra 500 days availability on top of the 3,000 originally contracted for. These were acquired as an extension to the original contract and supported by DMS under the same contractual arrangements, albeit with extended mission durations for ships on deployment to the North West Shelf.

DMS already held the RAN's 10-year, AUD320 million Port Services and Support Craft contract, so the company had considerable experience of efficiently operating more than 400 small craft of different types on behalf of the navy.

Collaboration

All 14 ACPBs have been built by Austal Ships, acting as a principal sub-contractor to DMS, at its Henderson yard near Fremantle in Western Australia. Earlier contracts for eight 38-m Bay-class boats for the Australian Customs Service, 10 37.5-m patrol boats for the Yemen Ministry of Defence, and smaller orders for the Bermuda police and the government of Kuwait, had already cemented the company's reputation as a leading supplier of aluminium-hulled patrol craft.

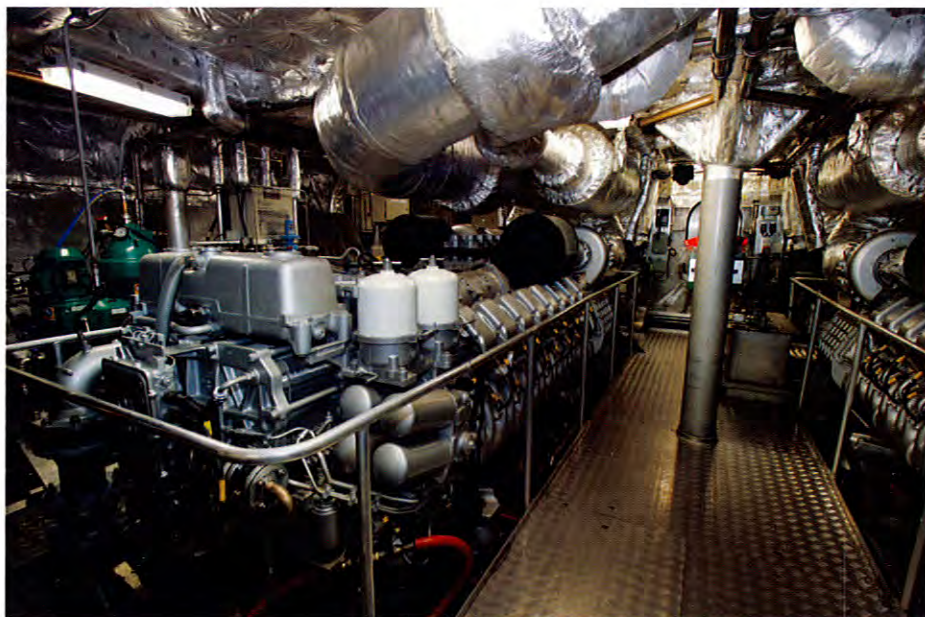
Although the ACPB design drew to some extent on the heritage of the Bay-class vessels, the high-level design was effectively a collaboration between DMS and Austal to meet the performance-based specification provided by the Australian Government's Defence Materiel Organisation (DMO).

The ACPB semi-displacement vee hull is of conventional welded aluminium alloy construction, with a Seastate active ride control system comprising hydraulic stabiliser fins and stern trim tabs.

Departure displacement is 305 tonnes, with a length of 56.8 m, a beam of 10.0 m and a maximum draught of 2.25 m.

The boats are constructed to a combination of commercial standards (Det Norske Veritas Rules for High Speed Light Craft) and specific RAN maritime materiel requirements.

Propulsion is by two MTU 16V M70 4000 series diesel engines driving twin screws through ZF transmissions. These



Twin MTU 16 V M70 diesels give the Armidale-class patrol boat a top speed of 25 kt. The engine room is unmanned.

Austal: 1294279



The ACPB's steering flat.

Austal: 1294280

provide a continuous speed of 25 kt in Sea State 4 and a range of 3,000 n miles, including a fuel reserve of 20 per cent, at a cruise speed of 12 kt.

Although the ACPB is capable of being deployed for longer, the DoD says normal patrol missions last no more than 21 days, depending on the tempo of interception, apprehension, and escort.

The sensor suite includes two surface search radars in S band and X band and the Rafael TOPLITE electro-optical/FLIR day/night observation and targeting system. The BAE Systems Australia PRISM III radar warning system has been fitted to Ships 13 and 14, and will be retrofitted to the earlier deliveries after completing acceptance trials.

The ACPB is also fitted with the fully calibrated and integrated CEA Technologies Warrlock direction-finding system and HF, VHF, UHF and satellite communications (SATCOM) capabilities.

Last year an ACPB successfully received streaming video from a General Atomics Mariner unmanned aerial vehicle (UAV)

taking part in a trial aimed at testing the ability of an unmanned aircraft to perform maritime surveillance of the North West Shelf. Various proposals have been made to fly mini-tactical UAVs from the boats, but none have yet been implemented.

The 25 mm ATK M242 marinised Bushmaster deck cannon is deployed within an Australian-manufactured Rafael Typhoon Mk25 stabilised mount. The mount and cannon, the latter the same as that equipping the Australian Army's ASLAV light armoured vehicles, is interfaced with the TOPLITE system for targeting and is remotely controlled from the bridge. Secondary armament comprises two 12.7 mm machine guns.

Enhanced range

The ACPBs represent a step-change over the Fremantles in all areas. Being some 15 m longer, 85 tonnes heavier and equipped with stabilisers, its improved seakeeping ability and 20 per cent greater range enables more extended patrols

The patrol vessels have a comprehensively equipped workshop.



Austal: 1294281

within the EEZ than was possible with its predecessors.

This includes providing a sustained patrol and response capability around the Christmas and Cocos Islands, something the Fremantle class could not achieve, and as far south as 50° latitude. The boats are also designed to be capable of surviving cyclonic conditions up to Sea State 9.

Habitability and hotel services for the 21-strong crew are among the best in the RAN fleet. The boats, excluding machinery spaces, are fully air-conditioned, and the crew has access to e-mail and satellite television while at sea. Junior sailors are accommodated in four-berth cabins with ensuites rather than the Fremantle-style mess deck of 16 personnel sharing two toilets and showers.

Senior sailors and officers have two-berth accommodation and the commanding officer has his own cabin. The design provides the ability to accommodate female sailors for sea service and separate austere accommodation is available to hold detainees, or to house up to 20 troops.

The contrast with the Fremantle class is stark.

"With the Fremantles we were basically burning our people out with the operating tempo," comments Capt Ingram.

"They'd spend a lot of time at sea in a small, uncomfortable boat with virtually no communication with the outside world, very little recreational space, and a poky little galley that you often couldn't cook in because of rough weather."

RHIBs

Another major enhancement in capability is provided by two Steyr-powered, single waterjet 7.2-m Zodiac Rigid Hull Inflatable Boats (RHIB). These are a development of the RAN's standard RHIB, which is Volvo-powered with a Volvo inboard-outboard stern drive.

Capable of being operated to the top of Sea State 4, the RHIBs are designed to range up to 50 n miles from the ACPB and carry HF and VHF radios as well as their own chart-plotter and GPS electronic navigation package.

The RHIBs are held in a cradle on deck and can be rapidly launched and recovered



Austal: 1294282

Two 7.2 m RHIBs – shown here on board HMAS Armidale – can be launched and recovered while the mothership is under way, and operate at a distance of 50 n miles.

using the Vest davit system, underway if necessary – sea conditions permitting, at speeds of up to 12 kt.

Capt Ingram says the RHIBs have more than doubled the boarding and response capability previously offered by the Fremantle class and for the first time provided RAN patrol boats with an over-the-horizon capability.

"A Fremantle had one small RHIB, which would transport a four-man boarding party very slowly. With the jet RHIBs and the davit we can launch and recover a boat with an eight-strong fully kitted boarding party and two crew without people clambering in and out of the RHIB over the side of the ACPB," he notes.

"And because we have additional accommodation, depending on the mission we can supplement the boarding force with extras."

A further ACPB benefit was uncluttered companionways and a design optimised for the boarding role.

"When boarding stations is piped, the boarding party can proceed in a methodical way through a purpose-built dressing station, be kitted out with lifejackets, webbing and weapons, proceed to a briefing area near the boat deck without tripping over other crew members, and then be deployed on their boats almost instantaneously."

In addition to its role as part of the 25-mm weapon system, Capt Ingram says the TOP-LITE E/O system provides welcome situational awareness in the face of increased belligerence from foreign fishing vessels.

"Operations are becoming more hazardous for our boarding teams – some vessels are deploying steel spikes to stop the teams from boarding and throwing missiles. So with TOPLITE we can check for any passive defences before boarding, and we can then actually see what the boarding teams are doing as well as receiving voice reports from them."

Capt Ingram referred to non-lethal "additions to the tool bag" to halt vessels that refused to stop and be boarded, but declined to give details.

Fast-pace construction

The ACPB construction programme is thought to have been the fastest for vessels of their size in peacetime in Australia. At one stage eight boats were in various stages of construction simultaneously. Three boats were delivered in 2005, six in 2006 and five in 2007.

While the construction process was relatively straightforward and was facilitated by substantial investment by Austal in new facilities, challenges emerged during the build programme in retaining the original concept of the Armidale-class design.

DMS' Chief Executive Officer, Greg Hodge, told *Jane's* the rate of production allowed only a small number of contract change proposals. However, it had been difficult to persuade some elements within the RAN and the DoD not to over-engineer the boats and turn them into full military-specification platforms.

"This is not a destroyer built to military specifications, this is a cost-effective patrol boat based on combined commercial and naval standards that will patrol the EEZ and specifically the northern approaches of Australia," says Hodge.

"It was clear to the DMO Systems Programme Office, it was clear to the RAN Force Element Group, but it was not always clear to other agencies and divisions within the DoD and Navy, and many tried to get a seat at the table to enforce their views, which were often contrary to the contracting philosophy."

For Hodge, progressing the new commercial construct and the new support approach has been facilitated by a clear and unambiguous communication plan with all DoD and navy stakeholders.

Looking ahead, he envisages the challenge will be to continue to drive the pro-



Three generations of RAN patrol craft alongside at Cockle Bay, Sydney (from left): Armidale-class patrol boat HMAS *Armidale*, Fremantle-class patrol ship HMAS *Townsville* and Attack-class patrol boat HMAS *Advance*.

The fourth of the Armidales, HMAS *Albany*, was commissioned in July 2006.



gramme as a commercial arrangement.

“We don’t want to see, over time, the requirements creep and the scope creep and any other enhancements, upgrades and modifications to turn the Armidales into mini-warships.

“[The] navy needed the patrol capability and they’ve actually sought it in a very cost-effective and sensible manner. We must maintain the cost-effectiveness of these vessels and the ease of support”, he states.

To ensure the most efficient use of each boat the RAN has adopted a multi-crewing arrangement. This produces 3,500 sea days from 14 ACPBs, compared to the maximum of 2,660 days of availability provided by the 15 Fremantle-class platforms. Each of the 14 ACPBs is materially supported to provide a minimum of 250 days of operational availability.

An additional 600 days per annum of ‘surge’ availability is created by evaluating maintenance planning regimes and adjusting maintenance planning cycles.

Multi-crewing for the ACPB involves 21 crews rotating through 14 ships. The crews are divided into four divisions, with six crews in three of the divisions and three crews in the fourth division. Crews remain together and are not rotated through divisions other than the one to which they are assigned.

Three of the divisions – Attack, Assail and Aware – are based in Darwin to crew the 10 boats homeported at the Northern Territory capital, while the Ardent division is located in Cairns to support the four boats based there. Up to two of the Darwin-based boats can be forward-based in Dampier, with support staff being flown in by DMS from Darwin and Perth

At any given time, two of the crews in a division are not attached to a boat. During this period – totaling approximately 16 weeks a year per complement – crew will either be on leave, undergoing training, or standing by to act as operational relief for another crew. If necessary, a complete crew handover can be implemented in six hours.

Tangible benefits

Although multi-crewing is in its infancy, the Australian DoD says it is already delivering benefits such as reduced harbour duties, reduced training shortfalls, and improved levels of individual readiness.

The collective training requirement for initial generation of each crew totals approximately three months. Readiness is maintained by a biennial work-up and competencies assessment by the Minor War Vessel Sea Training Unit, together

with a self-generated sea and shore training programme to meet annual continuation training targets.

DMS’ Hodge points out that the ACPB training regime run by DMS under its support contract is different to anything previously experienced by the RAN, and is more aligned to commercial practice.

The assumption was that attendees would be qualified, competent and reasonably experienced sailors.

“For example, we don’t instruct them on how a diesel engine works; that’s done in their own training within the naval system”, says Hodge.

“We teach them about the MTU 16 V M70 and the practices, processes, maintenance regimes and fault-finding issues we may have with this particular system.”

Although some initial difficulties were experienced in ensuring all course attendees had the prerequisite requirements, this has now been resolved within navy posting arrangements.

Hodge acknowledges that the ACPB has experienced some teething problems, but a significant improvement in performance meant that in the 2007 July-September quarter all contractual availability requirements had been exceeded.

This contrasted strongly with figures disclosed in the DoD’s annual report 2006–07, which showed that the ACPB fleet had achieved only 60 per cent availability over the year to 30 June, due to restrictions imposed because of fuel system defects. (The period under review began with three ACPBs in service and this number increased to 10 by year-end).

The boats have twice experienced problems with water contamination in their main engine fuel systems which, in each instance, has led to most of the fleet being temporarily tied up, or the imposition of operating restrictions.

The problem is understood to have been caused by the amount of water in the boats’ fuel tanks fuel overcoming the filtration systems. This caused pressure and cracking in the fuel pumps, leading to significant fuel leakage into machinery spaces.

The defect first appeared in September 2006 when the boats were withdrawn from operational duties for a month. Despite a redesign of engineering controls, the fault resurfaced in January 2007 when an “operational pause” was ordered while the cause was re-investigated and a variety of engineering modifications and procedural changes were put in place.

During this period, according to Capt Ingram, each vessel was managed on a case-by-case basis with priority given to those that were experiencing problems. However, at that time each boat in the fleet had its fuel pump fitted with a shroud to prevent any atomised fuel escaping into machinery spaces.

The problem was attacked by an integrated project team of representatives from Austal, DMO, the Defence Science and Technology Organisation (DSTO), the RAN and DMS. The entire fuel system was redesigned by Austal, including an

improved primary filtration system and the replacement of pipework and the fuel stripping system. DMS amended training regimes appropriately, while the DMO, DSTO and RAN analysed bunkering practices and procedures and the level of rigor in the quality assurance of fuel.

The final five ACPBs were delivered with the fuel treatment and transfer system modifications incorporated into their build, while the nine boats delivered earlier were retrofitted with the redesigned fuel system in 2007.

The exact cause of the defect remains unclear, according to the Chief of Navy, Vice Admiral Russ Shalders, although Capt Ingram disclosed that suspicion had fallen on an element of the filtration system that can, if necessary, be bypassed to ensure clean fuel. As of December 2007, no ACPBs had suffered any further fuel problems and operational tasking was being extended as confidence grew in the revised system and procedures.

An incident in August 2006, in which three sailors inhaled toxic fumes while they prepared for a night in the austere accommodation compartment aboard HMAS *Maitland*, in waters off Darwin, was provisionally attributed by the DoD to improper operation of the boat's sewage treatment plant rather than to a technical fault.

However, use of the compartment as a sleeping space is still banned until techni-

cal feasibility studies into possible design changes in venting and intake facilities are completed and any subsequent configuration changes can be implemented.

Notwithstanding these technical glitches, Rear Adm Goldrick describes the ACPB as admirably suited for playing a presence and deterrence role on the boundaries of the EEZ.

"That requires a lot of time at sea, a lot of time on patrol, and very much the old blockade mode. So the fact that we've got a more capable, more sea-kindly platform which is more comfortable for the crew, reduces fatigue and so on, is very important."

Increased confidence

Rear Adm Goldrick agrees with Capt Ingram that the two RHIBs, rather than the 25 mm deck gun, acted as the main weapons system for much of the work carried out by the ACPB.

"The launching system is extremely well-conceived, the RHIB are big and very capable and the ACPBs have a launch and recovery capacity which is less weather-dependant than the Fremantle class ... the fact that the ACPB carry two is again a leap in capability."

While the fuel contamination problem had affected operational tasking "as we become more confident with the reliability

of the fuel system and with that the boats overall we're happier about sending them further afield. It's a progressive thing. In general I think it's fair to say that their reliability is improving as they settle down", says Rear Adm Goldrick.

He also points to the efficiency of the fallback arrangements that kicked in when the ACPBs were temporarily withdrawn.

"Within an hour of a video conference between the National Surveillance Centre in Canberra and HQ Northern Command the maritime dispositions around the north had been recast to ensure we could meet what we assessed as the threat levels of illegal activity.

"Customs vessels were moving into locations where Armidale class had been, and RAN vessels, which had lesser capability for some tasks, but good capability for others were moving behind the Customs vessels."

Logistics support for the ACPBs is provided from DMS' own warehousing and stores system in Cairns and Darwin, which are both off-base. These carry ready-use spares and stores and some specific long-lead items and deeper-maintenance spares and supplies, part of the essentially-commercial practices used in the maintenance and management of the boats.

With ships' systems living in air-conditioned environments and most of them commercial rather than military specification, repair is generally by replacement.

Maintenance regimes are programmed into the DMS-maintained computer-based Asset Management Planning System (AMPS), which produces daily, weekly or monthly routines. Major dockings are anticipated to take place only three times over the ACPBs' 15-year service life.

DMS relies heavily on small and medium enterprises for specific ACPB maintenance under its direction and overall engineering and maintenance training guidance. In 2006 multiple support orders from the company were received by 98 different enterprises in the Darwin region and 78 companies in Cairns.

Hodge suggests some changes could be made in the phrasing of the availability regime, which is "quite prescriptive".

"It needs to be clear and unambiguous. If you have delivered the capability you'll get a tick; if you haven't you'll get penalised. Some people have too many key performance indicators and therefore the word 'key' is lost."

For Capt Ingram, one lesson learnt to date is the need to ramp up training and facilities in advance of platform delivery, resources permitting. Another is the insight being provided by the multi-crewing concept in terms of possible flexible crewing options for the three air warfare destroyers on order for the RAN. ■

A view of the ACPB's compact bridge.



Austal: 1294285

HMAS *Ararat* was the seventh ACPB to enter service, in October 2006.



Australian DoD: 1294286

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