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# NAVAL MANNING

Naval manpower is the single most important factor in ensuring an efficient and capable navy. Without sufficiently technical and appropriately-numbered personnel, a naval service cannot function effectively, no matter what the sophistication of its vessels or air assets. Yet in the last half of the twentieth century manning levels and the calibre of men within the services often resulted in a somewhat schizophrenic attitude amongst many senior naval officers. Consequently major problems in performance during both training and in wartime conditions were experienced by most navies. This schizophrenia was especially bad at times of national economic hardship, when senior officers saw

manpower as a plentiful source and not one to unduly worry them. In theory at least. On the one hand senior officers were often quoted lecturing new recruits as representing the key cornerstone of their navy, whilst on the other when problems arose with the retention of personnel there was an easy solution in simply recruiting more! Little thought was given to the issues of retaining the already-trained and performing personnel.

In the twenty-first century manning and manpower have been treated differently. This has been a necessary consequence of a series of significant economic, technological, political and social changes since the end of the Cold War. Before the

end of 1989 and the collapse of the Berlin Wall, the navies of much of the world were tasked very differently to today. Moreover their composition differed very markedly from the naval services of the last few decades. For many navies conscription had provided the bulk of their available manpower – and this was almost wholly dominated by male recruits. What female personnel existed normally found themselves in shoreside billets, performing auxiliary tasks. The sea, as it had been for centuries, was very much a male domain. Conscription, the draft or national service as various nations termed it created large manning levels but often of low-performing and technically less capable personnel, usually with little knowledge of the wider world and even less of the importance of naval power. Conscription also varied in duration: from as little as nine months in the case of some navies to as much as six years in others, though the norm was usually two years. Professionalism was correspondingly low, with some navies having less than a fifth of their manpower levels made up of full-time volunteers. Training was rudimentary in many services and the ability of personnel to perform different jobs in a working environment was far from guaranteed. Essentially the civilian was drilled out but only the most basic of maritime skills drilled in. Then again, many navies in the world only performed mundane roles often solely involved with patrolling territorial waters, with day running as standard behaviour and little exposure to the more varied and demanding roles of a large, balanced ocean going fleet.

Even if a naval service belonged to one of the two main coalitions of the Cold War, the situation might not be much better. Although training here was somewhat different and, arguably, far more thorough, much of it was training for a war in the North Atlantic that was considered unrealistic by many and one that neither side could arguably win. Consequently deficiencies persisted. For example, at times only a modicum of interest was paid to training for critical roles, such as ship damage control.<sup>1</sup> The Royal Navy endured this situation during the Falklands War and experienced the repercussions of this failure at first hand. The Boards of Inquiry that were held following the sinking of four of their escorts during the campaign highlighted training as a significant factor and one in need of rectifying.<sup>2</sup> Vigorous improvements were subsequently implemented to the Royal Navy's Flag Officer Sea Training (FOST) command, originally established as far back



The Royal Canadian Navy frigates *Charlottetown* (foreground) and *Montreal* on an anti-submarine exercise in the North Atlantic in the autumn of 2010. Much training by the major navies during the Cold War was focused on North Atlantic scenarios, leading to deficiencies in other areas. (Royal Canadian Navy)

**TABLE 9.1: TRENDS IN FLEET PERSONNEL NUMBERS**

COUNTRY	1990	1995	2005	2015	OBSERVATIONS
Brazil	50,000	47,000	51,000	c. 60,000	Conscription in place throughout. Currently 1 year. Includes c.15k marines.
China	c. 300,000	265,000	250,000	235,000	Conscription in place throughout. Currently 2/3 years.
France	67,000	64,000	43,000	32,000	Conscription ended 2001. Excludes deployed civilian employees.
India	52,000	55,000	57,000	58,000	All volunteer.
Japan	46,000	46,000	46,000	45,000	All volunteer. Excludes civilian employees.
United Kingdom	63,000	51,000	40,000	33,000	All volunteer. Trained personnel in 2015 c. 30,000, including 7,000 RM.
United States - USN	609,000	454,000	366,000	324,000	All volunteer.
United States - USMC	197,000	175,000	178,000	184,000	All volunteer.

**Notes:**

Data drawn from government statistics and supplemented by published data. Due to significant variations in information and statistical processes, data should only be regarded as indicative and figures are also not fully comparable between navies.



Although naval manpower has been declining globally since the end of the Cold War, the trend is less apparent in many emergent navies. There are plenty of sailors evident in this image of China's Type 052B destroyer *Guangzhou*, pictured on a goodwill visit to Portsmouth UK in 2007. (Conrad Waters)

as 1958 but which had previously been more interested in the warfighting aspect of ships than their survival of them. The changes that were made have subsequently paid significant dividends, notably when the ships *Nottingham* and *Endurance* were both saved from sinking due to the training received by their crews.<sup>3</sup> This change has not just benefitted the Royal Navy, as the last decades have seen many other navies receive training from the FOST organisation, the majority returning for further instruction.

The improvement in damage control training is just one example of a number of revolutionary changes over the past twenty-five years that have impacted the ways navies recruit, educate and deploy their manpower. More specifically:

- Manning levels have generally diminished, but with lower numbers of personnel being balanced by these being typically more capable and adaptable than their predecessors.
- This change is reflected in generally heightened education levels amongst sailors as navies pursue a better and longer return from their recruits in comparison to the more limited return achieved from an average conscript of one or two years' service.
- The quota of women within naval services has drastically increased. Moreover, they have become an integral part of the front-line seagoing strength in many fleets around the globe. In some navies, female personnel now make up to a sixth of the overall strength.

Of the changes, the key trend amongst most navies has been a downsizing of personnel strength. For most of the Cold War, cheap and plentiful conscripts fuelled much of the military machinery of East and West, as well as almost all of the non-aligned world. However, since the early 1990s, naval manpower strengths have mostly diminished due to a series of reasons, the most important of which are highlighted below. Whilst the trend has been largely universal, there are a small number of fleets that have bucked it, as evidenced by Table 9.0.1.

### THE IMPACT OF FLEET MODERNISATION

Since the end of the twentieth century, mass modernisation and reconfiguration of navies has taken place around the world. In North America and Western Europe, this rejuvenation has resulted in

**TABLE 9.2: TRENDS IN SHIP COMPLEMENTS**

COUNTRY	SHIP TYPE <sup>1</sup>	1960S–1970S	1980S–1990S	2000–CURRENT
United States	Surface Escort (Destroyer)	<i>Spruance</i> (DD-963) c. 330	<i>Burke</i> (DDG-51) c. 300	<i>Zumwalt</i> (DDG-1000) c. 150
United States	Surface Escort (Frigate)	<i>Knox</i> (FF-1052) c. 260	<i>Perry</i> (FFG-7) c. 220	<i>Freedom</i> (LCS-1) c. 50+25 <sup>2</sup>
United Kingdom	Surface Escort (Destroyer)	Type 82 c. 400	Type 42 – B3 c. 300	Type 45 c. 190
United Kingdom	Surface Escort (Frigate)	<i>Leander</i> c. 260	Type 23 c. 180	Type 26 c. 120
France	Surface Escort (1st Rate Escort)	F-67 <i>Tourville</i> c. 300	FASM-70 <i>G Leygues</i> c. 240	<i>Aquitaine</i> (FREMM) c. 110
India	Surface Escort (Destroyer)	<i>Rajput</i> <sup>3</sup> c. 320	Project 15 <i>Delhi</i> c. 350	Project 15A <i>Kolkata</i> c. 325
India	Surface Escort (Frigate)	<i>Nilgiri/Leander</i> c. 260	Project 16 <i>Godavari</i> c. 310	Project 17 <i>Shivalik</i> c. 260

**Notes:**

1 The table is intended to give a broad indication of general trends in warship crew numbers, acknowledging the significant differences that can exist in the size, function and capability of ships within a common heading.

2 The US Navy's LCSs deploy with a core crew plus an additional, mission-specific crew.

newer, more technologically-evolved navies but has often come with a penalty in terms of fleet size. This is because an almost continual increase in costs has resulted in fewer, if larger and more capable, platforms entering service.<sup>4</sup>

Additionally, whilst modern technology incorporated within these new ships encompasses vast advances in weaponry and sensors compared to their Cold War counterparts, automation has also facilitated smaller manpower establishments onboard. The introduction of labour-saving devices has been ongoing for a long time but the pace of acceptance – and the resultant reduction in manning levels

achieved – have accelerated since the start of the century. Most notably, units such as the US Navy's littoral combat ships have a core crew sized at a third or less of those they replace. Over 300 personnel have been saved as a result of the introduction of the much-publicised automated weapons handling system in the British Royal Navy's *Queen Elizabeth* class aircraft carriers. Table 9.0.2 provides a broad indication of falling crew sizes from the 1970s to the present day in different classes of naval vessel.

The resultant reduction in overall numbers of sailors has not been a universal one, as some emergent navies – which are also undergoing large

modernisation programmes – have been expanding their manning levels at the same time as growing their physical assets. The need to allow for adequate support ashore to accommodate demands resulting from enhanced technology not encountered before has probably been as important as the requirement for personnel at sea in these fleets.<sup>5</sup> The fact that many of these fleets benefit from manpower costs that are cheaper than those faced by the more mature navies also partly explains this exception, although even some developing fleets are now suffering from wage inflation as economic growth fuels labour costs in the broader market.<sup>6</sup>



Significant reductions in overall naval manning have been achieved by the increased use of automation to reduce warship crew sizes. These images show three generations of US Navy frigate-sized vessels, the Mexican Navy's *Knox* class *Mina* – formerly *Whipple* (FF-1062) – first commissioned in 1970; the 1980's era *Perry* class frigate *Rodney M. Davis* (FFG-60) and the *LCS Fort Worth* (LCS-3), delivered in 2012. Over this period complement has shrunk from around 260 to a core of just fifty in the new LCS. (*US Navy*)

## QUANTITY V QUALITY

Conversely, a need to control manpower costs has often been a key concern amongst the established fleets. This is a particular consideration in a comparatively highly paid, all-volunteer force. Equally, there is a recognition that the more highly educated and trained crew that a volunteer force allows means that sailors can multi-task between different functions in a way that would have been inconceivable to many of their conscript forbears. In effect, the ending of conscription by a number of navies over the last two decades has substantially reduced their manning levels, but provided a consequent increase in the skill base of the remaining recruits. The benefits of this are covered in more detail later.

## FINANCIAL PRESSURES

Financial issues have also made an impact on personnel numbers. Almost all North American and European militaries considerably shrank with the ending of the Cold War and the imposition of the 'peace dividend' by government treasuries across the Atlantic Alliance. Navies were not immune to the process with both manpower and procurement being reduced. Sometimes this process was carried out far from efficiently, with simultaneous redundancy of experienced personnel and curtailment of new recruitment subsequently creating a series of manning shortfalls in specific areas, often those requiring highly technical skills.<sup>7</sup>

Heavy reductions in personnel were also seen as a necessary, if knee-jerk, reaction to a worrying trend that became apparent at the end of the Cold War of (reduced) defence budgets being swallowed up by personnel expenditures. For instance, in 1990 almost fifty per cent of the United Kingdom's defence budget went on pay and pensions compared with less than forty per cent today. For some countries, the equivalent figure was (and sometimes still is) as much as eighty or even ninety per cent of the total defence budget, naturally having a massive detrimental impact upon platforms, training, deployments and procurement. The fact that procurement costs themselves are under pressure has added to the impetus to achieve personnel savings.

## CONSEQUENCES OF LEAN-MANNING

Though manpower savings have been achieved, serious questions have been raised by a number of commentators and naval personnel about the effectiveness of ships with reduced complements, partic-



A damage-control party fighting a simulated fire on the US Navy aircraft carrier *Harry S. Truman* (CVN-75). There are concerns that the lean-manning practices increasingly adopted in modern warships will hamper effective damage control. (US Navy)

ularly in scenarios such as damage control and the conduct of humanitarian missions. The key area of damage control, whether in wartime or peacetime, requires 'spare capacity' in terms of adequately-trained personnel to deal with the emergency that may have arisen. Naturally, this is a much easier task for a ship with a complement that numbers in the hundreds rather than one of a hundred or less.<sup>8</sup>

Moreover, navies are often at the forefront of a nation's disaster response, using vessels involved in deployed missions such as anti-piracy, anti-terrorist and drug interdiction to facilitate a fast reaction to a crisis overseas. Naval assets are able to access the vast majority of the world's population centres and are sometimes the only platforms able to do so if destroyed land bases, airfields and infrastructure deny other forms of response. This was clearly demonstrated in the December 2004 and March 2011 tsunamis in the Indian Ocean and off Japan. However, this inherent flexibility could well be curtailed if the small crew complements increasingly seen meant few personnel could be spared to assist a response. One counter to this has been building ships – the US Navy's littoral combat ship and

French Aquitaine FREMM frigates are examples – that combine small crews with the surplus accommodation to surge specialised personnel should this be desirable.

## CHANGES IN NAVAL AVIATION

Naval vessels have not been the only fleet areas to experience manning adjustments, with naval aviation also seeing considerable manpower changes. Cost considerations, such as the expense involved in the training and maintenance of extra aircrew, together with technological developments, have helped to reduce the numbers of aircraft in many of the world's fleets and simultaneously lower aircrew strengths. However, once again, certain emergent naval powers, notably China and India, have been increasing the numbers and quality of their naval air assets.

Superficially, fixed-wing naval aviation has changed little since the end of the Cold War, with manned aircraft still employed as a key power-projection tool. Interest in carrier aviation has grown, with a number of new nations aspiring to join the carrier club. However, the most significant development has been alteration to aviator force structures amongst

the existing members to achieve greater efficiency. For instance, in America the US Navy and US Marine Corps are replacing the four-seat Grumman EA-6B Prowlers used in the suppression of enemy air defence role with two-seat F-18G Growlers.

However, it is, perhaps, the Joint Strike Fighter programme that has raised the most eyebrows, as there will be no twin-seat F-35s as a result of both cost and engineering considerations. Potential training issues arising from this will be resolved through increased use of training simulators and other platforms. In combat, the solitary pilot will be well supported by the new onboard systems, in theory eradicating the need for a backseat weapons operator. This is not totally ground-breaking, as the French Navy has followed a similar path with their Rafale M. Today the *Aéronavale* pilots operate alongside their *Armée de L'Air* counterparts (who maintain a considerable fleet of two-seater Rafales) and the US Navy for much of their training. Arguments about complexity and information overload have now been largely set aside due to the operational success of the Rafale's sophisticated systems, which have been proven in combat over Afghanistan, Libya, Iraq and Syria.

Crew numbers in naval helicopters have changed slightly but not fundamentally. When a Wessex crew is compared to a Sea King's, and the latter's to a Merlin or NH-90 there is little to choose. However, the numbers of machines in a service have decreased considerably since the Cold War as technology has created far greater capability from the assets remaining. For instance an entire squadron of Sea King ASW platforms would have been needed to close the English Channel whereas only one (possibly two) Merlin HM1 helicopters would be required. The modernised HM2 is even more capable and numbers are falling again. There has therefore been a diminishing number of ASW squadrons in most naval arms, though with something of a balancing increase amongst developing navies, who are acquiring this capability for the first time. Land based maritime patrol aircraft have also seen some manpower reductions. Whilst in America and much of the world the P-3C Orion operates with a crew of eleven or twelve, its replacement in the form of the P-8A Poseidon operates with just nine. The growing number of twin turboprop 'lower end' patrol aircraft have even fewer.

However, it is the growing introduction of unmanned air vehicles (UAVs) that has presented

the most questions, with many yet to be answered adequately. Do UAVs save manning and manpower costs or not? What are the challenges in terms of their running costs and growing complexity? Many believed in the 1990s that UAVs would be cheaper to procure and operate than conventionally, manned planes. Additionally, the loss of an UAV was thought to be potentially less troubling to governments due to the omission of a flight crew and a consequent lack of personnel to fall into enemy captivity or be killed. It was therefore thought that they offered both financial and political advantages.

Today, however, it seems UAVs and the more offensively-focused unmanned combat air vehicles (UCAVs) are as complex, if not more so, than their manned counterparts and are consequently as expensive. The United States' X-47 programme has achieved a number of notable firsts on board US Navy carriers but its follow-on programme is mired in uncertainty. European programmes such as the BAE Systems' Taranis technology demonstrator may show Europe's thinking on possible carrier-based UCAVs in the future but these are still in the early

stages of development. To date, it seems that manpower savings from the current generation of unmanned vehicles is minimal as aircrew are still needed, even if they now more closely resemble teenage gamers rather than the pilots of old. Also, the increasingly sophisticated machines still need maintainers to keep them flying. UAVs have already found roles in fixed-wing and maritime patrol operations, such as the broad area maritime surveillance role envisaged for the US Navy's MQ-4C Tritons. However, they are often finding themselves flying alongside manned platforms rather than entirely replacing them, potentially placing further demands on manpower. Finally, UCAV operations have not given politicians the 'easy ride' that was initially envisaged given adverse publicity over 'killer drones.'

### A NEW BREED OF SAILOR

As well as changes in technology, personnel have also greatly changed. The end of conscription for many now sees navies welcoming new recruits who possess a desire to be there rather than merely being sent. This brings dividends in terms of training and



A trend towards single seat naval fast jets is changing aviator force structures amongst members of the 'carrier club'. France's *Marine Nationale* has now moved to this operating model, with all its navalised Rafale Ms ordered in single seat configuration. Here a pilot awaits the catapult launch of his Rafale from the deck of *Charles de Gaulle* in May 2013. (*Dassault Aviation/S Fort*)

behaviour on the part of naval manpower. Their ability to assimilate information and perform in the working environment is greatly improved, with loyalty and efficiency materially enhanced. To ensure this continues navies have to remain capable of attracting the most skilled in the working population and retain them upon completion of initial training. Conditions, pay and incentives to remain have therefore improved throughout many navies. A number of services have also lengthened the term of enlistments to retain consistency and continuity. This has been particularly true for senior non-commissioned and commissioned personnel, maintaining a more experienced and professional manpower pool.

There has also been a realisation that it might be better to recruit younger sailors. This reverses the trend of the later Cold War years, when many believed that older, more experienced and better educated personnel would be advantageous. Less need for training and education, together with a worldly-wise attitude, was seen as being beneficial to navies. This view has now been challenged and – although there will be always a place for the latter type of individual – the need for younger, more malleable personnel who are able and willing to provide a long period of service is seen as an important requirement. Besides a greater return of service, together with more successful indoctrination, there is a recognition that, with the greater complexity of today's platforms and systems, a younger, more dextrous mind is needed.

Moreover, this technical dexterity needs to be complemented by a more knowledgeable recruit with an appreciation of the world they are operating in and, perhaps more importantly, why they are doing so. Consequently there has been an expansion in the education processes of many navies beyond the accepted technical realm – especially in political science, history, ethos and the culture of their service – to create a better understanding of why they do what they do. It is critically important for navies to educate their own personnel to the highest standards so they can think more laterally than their Cold War predecessors, who sometimes suffered from tunnel vision in their appreciation of naval power, and lost track of its many attributes. A thinking body of naval manpower is more likely to be successful not just in performing its many and varied duties but also in articulating the case of naval power to the political decision makers and purse-string holders. In doing



Sailors aboard the US Navy LCS *Fort Worth* (LCS-3) prepare to launch a MQ-8B Fire Scout UAV during an Asian deployment in 2015. Although seemingly offering manpower savings, UAVs still need to be flown and maintained. (US Navy)

so, they are more likely to ensure their service's future rather than reactively relying on an existence brought about by a known threat, as in the Cold War.

### AN INTERNATIONAL OUTLOOK

A final trend that warrants discussion is the significant expansion in the international experience and outlook of personnel serving in navies across the globe. For all but the largest fleets, operations and training during the Cold War were increasingly focused upon a scenario centred in the Atlantic and dominated by submarine activity, notwithstanding the publication of the US Maritime Strategy of the 1980s. Experiences since 1989 have been drastically different and vastly more numerous due to the actual deployment of navies since the end of the Cold War on a range of 'live' operations resulting from a more unstable and less predictable international environment. Since 1989 navies have found themselves serving globally in a series of wars and interventions such as the liberation of Kuwait, the Balkans struggles, East Timor, Sierra Leone, Afghanistan, Iraq, Libya, and against Islamic State.

The willingness of governments to employ naval power as a 'first responder' to situations and often as the key and sometimes sole instrument to the emergent crises has brought considerable benefits to institutional learning.

Interventions have also witnessed the rise of international coalitions and this has also brought further dividends for today's naval personnel. Working alongside other navies, and not just neighbours and alliance partners but extra-regional and global powers, has deepened the experiences of many, particularly for what are termed developing navies. Training changes have had to be made, staff work improved and the complexity of coalition warfare and deployments understood. This is not just the case for western alliance nations. The wars on terrorism and piracy in the Indian Ocean and Arabian Sea extend worldwide to encompass South East Asia, the waters off West Africa and even on the Amazon Basin. Drug interdiction in the Caribbean involves local forces, the US Coastguard and three European navies.

In simple terms this has been fed back into the

training of new and existing manpower, where the bonuses of being trained and educated by personnel who have been on active deployments bring benefits beyond the previous theoretical knowledge imparted by many in the past. In contrast with the situation prior to 1989 and a situation where few navies had experienced real life operations and actual combat scenarios, these opportunities have now become plentiful and commonplace. More importantly, international deployments are being experienced by navies beyond the traditional global 'blue-water' fleets such as the US Navy, British Royal Navy and French *Marine Nationale*. Today most European navies – and many in Asia – have deployed on counter terrorism, anti-piracy, peace enforcement, drug interdiction and even actual war alongside each other and far away from home. Others in Africa and Latin America have also experienced deployments far in excess of what they would normally have experienced in the decades after the Second World War, deepening the expertise of their naval personnel.

## CONCLUSIONS

The changes in naval manning since the end of the Cold War have been many and profound. The decreases in manpower levels partly brought about by the end of conscription but also as a result of financial pressures and the growing process of automation have resulted in a growth in professionalism and individual effectiveness. The creation of professional forces has also been broadened by the arrival of female personnel in the frontline with most western nations allowing women onboard ships from the 1990s, and subsequently into air assets and even submarines.<sup>9</sup> These trends, combined with the growing use of naval power globally, has seen a deepening in the knowledge base and expertise of the personnel which has been fed back into new recruits. The likelihood of deployments decreasing in intensity in the years ahead is minimal. As such, it seems the experience of the world navies will continue to broaden.

There have been some developments which have bucked these general trends. Numerically, many of the world's naval infantry units, normally marines, have either remained static or actually increased over years. This has resulted from the desire of many nations wishing to develop capabilities to project power from the sea in greater strength than hitherto, possibly reflecting the increased importance of the



A Royal Navy engineering electrical technician manning a console in the ship control centre of the Type 45 destroyer *Diamond*. The greater complexity of today's warships means that technical dexterity is a key requirement of today's sailors, although a broader appreciation of the world is needed as well. (Crown Copyright 2013)



A boarding party from the Royal Norwegian Navy frigate *Fridtjof Nansen* inspecting a fishing boat off the coast of Somalia in the course of anti-piracy operations in 2013. Experience of international operations is now extending beyond the traditional blue-water fleets. (Royal Norwegian Navy)

The demands on sailors and marines from major land-based commitments have resulted in many gaining new experience and skills, for example in riverine patrolling. This image shows US personnel assigned to Riverine Squadron (RIVRON) 1 undergoing pre-deployment training in 2012. (US Navy)

littoral. Moreover the demands placed upon these troops from major land-based commitments – often linked to the so-called ‘War on Terror’ – have brought new experiences and skills for many, particularly with respect to riverine patrolling and counter insurgency. Other naval services have seen broader growth, usually due to the perception of greater regional threats such as those faced by the navies of Vietnam and the Philippines. Others still have grown as a result of peculiarly internal factors such as the Bolivian Navy, expanding in 2014–15 by an extra 2,500 personnel.<sup>10</sup>

Fundamentally naval manning has dramatically changed since 1989 in terms both of numbers and skill base. This trend is likely to continue as the demands placed upon naval power and the importance attached to the seas increases in the ‘maritime century’.



## Notes

1. In fairness, this was an understandable position in that it seemed pointless in investing limited resources in building ships that could survive attacks together with crews that were trained in dealing with any contingency when the rest of the world was plummeting into a nuclear abyss.

2. The Boards, held in the summer of 1982, highlighted a number of factors, such as poor damage-control equipment and large-scale use of non-fire retardant materials in addition to deficiencies in damage-control training.

3. On 7 July 2002, the Type 42 destroyer *Nottingham* ran aground on Wolf Rock near Lord Howe Island between Australia and New Zealand. Although five compartments were flooded from a c. 50m-long breach to the hull, she was kept afloat and ultimately repaired. On 16 December 2008, the ice patrol ship *Endurance* was saved from sinking after suffering an engine-room flood whilst transiting the Straits of Magellan. Although returned to the United Kingdom, she has not been repaired.

4. For example, the Franco-Italian ‘Horizon’ and associated British Royal Navy Type 45 air-defence destroyer programmes ultimately delivered only around a half of the units initially envisaged. The US Navy’s *Zumwalt* (DDG-1000) destroyer programme saw even more radical

curtailment as a consequence of ballooning costs.

5. Interestingly a number of more-established navies have transferred some of their maintenance work that was previously carried out by service personnel to contractors, either the initial providers of the platform or third-party contractors, in an attempt to save costs and service manpower levels.

6. There have been ongoing reports in India that steadily rising personnel costs are starting to distort the overall defence budget. Amongst recent commentaries on this problem is Laxman Kumar Behera’s *ISDA Issue Brief: India’s Defence Budget 2015-16* (New Delhi: Institute for Defence Studies & Analyses, 2015).

7. For example, in May 1994, only sixty ‘Young Officers’ joined Britannia Royal Naval College as opposed to the normal 100–120. Of those sixty some twenty were from allied navies, twenty were long-time senior rates from within the service, whilst a further ten were short-term junior rates. Only ten were new recruits for the service.

8. A number of technological innovations have been devised to help alleviate this problem, such as the use of personal organisers to alert crew to potential system and damage control issues in the Dutch *Holland* class OPVs.

Nevertheless, there are a number of indications that the trend toward lean-manning may have been pushed too far. A widely-reported Government Accountability Office report on the minimally-manned US Navy LCS *Freedom*’s inaugural overseas mission suggested that the crew struggled to get adequate sleep in spite of assistance from specialised mission module personnel embarked for the deployment and from outside contractors. See *Deployment of USS Freedom Revealed Risks in Implementing Operational Concepts and Uncertain Costs GAO-14-447* published by the Government Accountability Office, Washington DC, in July 2014.

9. The Royal Navy’s first frontline female crew members deployed in the summer of 1990, with the first female submariners successfully passing their courses in 2014. The US Navy began their first female submariner training in 2015. However, Scandinavian countries have been at the forefront of women in front-line naval posts with Norway deploying its first women in submarines as far back as 1995.

10. This is not a bad increase for a land-locked nation, though the reason was purely to raise pressure on Chile to return the northern Bolivian territories lost in the War of the Pacific (1879–83) and thereby regain direct access to the world’s oceans.