



CAMMELL LAIRD



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Above: Hunter-killer submarine sailing up the Clyde estuary, by LA(Phot) Jonathan Massey, © Crown Copyright 2009.
Front cover: Hunter-killer submarine arrives at Faslane, by Andrew Linnett, © Crown Copyright 2009.
Back cover: Hunter-killer submarine during sea trials, by LA(Phot) Will Haigh, © Crown Copyright 2012.

INTRODUCTION

Linked to a proud history of shipbuilding that stretches back almost 200 years, the Cammell Laird name is among the most famous in British industry. More than 1,390 commercial and naval ships have been built at the company's yard on the banks of the River Mersey in Birkenhead, among them iconic vessels including CSS Alabama, HMS Ark Royal (1950), HMS Prince of Wales and RMS Mauretania (1938).

Cammell Laird's submarines

Between 1915 and 1992, Cammell Laird established itself as a leading centre for submarine production, with a total of 69 boats built on behalf of the Royal Navy in that time. Many played a key role in conflicts including the First World War, the Second World War and the 1980s Falklands War, as well as during countless peacetime operations.

Building for the future

Today, Cammell Laird is a diverse marine and engineering services company that specialises in shipbuilding, ship repair, military refit and ship conversion. Commercial shipbuilding returned to

Cammell Laird in 2012 with the construction of two car ferries – MV Sound of Seil and MV Sound of Soay – the first complete ships built by the company in 20 years.

Return of submarine construction

Cammell Laird's ability to deliver highly advanced engineering projects was highlighted once again following the awarding of contracts to build flight decks for the Royal Navy's new Queen Elizabeth-class aircraft carriers. Submarine production has also returned to Birkenhead, with the yard providing support to BAE Systems through the construction and delivery of modules for the latest hunter-killer and ballistic missile submarine projects. While we will never enter whole submarine production again, we're proud to deploy our construction skills on these vital national programmes.

**Proud to be
deploying our
construction skills
on vital national
programmes**



SUBMARINE

Hull No.	Launched	Name	Hull No.	Launched	Name
814	1915	HMS E41	1050	1940	HMS Thrasher
815	1916	HMS E42	1051	1941	HMS Thorn
816	1916	HMS E45	1052	1941	HMS Tempest
817	1916	HMS E46	1057	1941	HMS Safari
832	1917	HMS L7	1058	1942	HMS Sahib
833	1917	HMS L8	1059	1942	HMS Saracen
872	1918	HMS H33	1062	1942	HMS Sibyl
873	1918	HMS H34	1063	1942	HMS Seadog
876	1918	HMS R11	1083	1942	HMS Sea Nymph
877	1918	HMS R12	1084	1942	HMS Sickle
941	1929	HMS Phoenix	1085	1942	HMS Simoom
989	1934	HMS Sealion	1096	1942	HMS Stubborn
990	1934	HMS Salmon	1097	1942	HMS Surf
1011	1936	HMS Spearfish	1098	1943	HMS Syrtis
1027	1938	HMS Thetis	1107	1943	HMS Stoic
1028	1938	HMS Trident	1108	1943	HMS Stonehenge
1036	1939	HMS Taku	1109	1943	HMS Storm
1040	1940	HMS Talisman	1110	1943	HMS Stratagem

Hunter-killer submarine by WO(Phot) Ian Arthur, © Crown Copyright 2009.

BROCHURE

Hull No.	Launched	Name	Hull No.	Launched	Name
1114	1943	HMS Spirit	1144	1945	HMS Aeneas
1115	1943	HMS Statesman	1145	1946	HMS Alaric
1122	1943	HMS Sturdy	1238	1957	HMS Grampus
1123	1943	HMS Stygian	1239	1959	HMS Finwhale
1129	1944	HMS Subtle	1265	1959	HMS Sealion
1130	1944	HMS Supreme	1288	1960	HMS Odin
1131	1944	HMS Sea Scout	1297	1961	HMS Oracle
1132	1944	HMS Selene	1306	1963	HMS Opossum
1134	1944	HMS Solent	1319	1966	HMS Onyx
1135	1944	HMS Sleuth	1316	1967	HMS Renown
1136	1944	HMS Sidon	1317	1968	HMS Revenge
1137	1944	HMS Spearhead	1330	1969	HMS Conqueror
1138	1944	HMS Spur	1379	1989	HMS Unseen
1139	1944	HMS Scorcher	1380	1991	HMS Ursula
1140	1945	HMS Sanguine	1381	1992	HMS Unicorn
1141	1945	HMS Saga			
1142	1945	HMS Springer			
1143	1945	HMS Affray			

HMS E41 Launched 1915

E-class boats formed the backbone of the Royal Navy's submarine fleet during the First World War. For Cammell Laird, the completion of HMS E41 in 1915 marked the beginning of an important new chapter in the company's history – one that would see a total of 69 submarines launched from Birkenhead over the coming decades and further strengthen Cammell Laird's reputation as a world-class naval engineering company.

HMS Sealion Launched 1934

HMS Sealion was the first S-Class submarine built by Cammell Laird. Designed to offer quick diving and good manoeuvrability, the 62-strong S-class fleet remains the largest group of submarines ever built for the Royal Navy. HMS Sealion, HMS Salmon and HMS Spearfish were all launched between 1934 and 1936. Cammell Laird went on to produce a further 32 S-Class boats between 1940 and 1945.

HMS Thetis Launched 1938

On June 1, 1939, Triton-class submarine HMS Thetis sailed from Birkenhead to undertake sea trials in Liverpool Bay. Of the 103 people on board, 69 were sailors belonging to Thetis' crew, while many of the remaining men were engineers from Cammell Laird. A fault in one of the submarine's torpedo tubes caused two forward compartments to flood during a dive and the boat was unable to resurface, resulting in the loss of 99 lives. A memorial carrying the names of those who died was unveiled in Birkenhead in 2014.

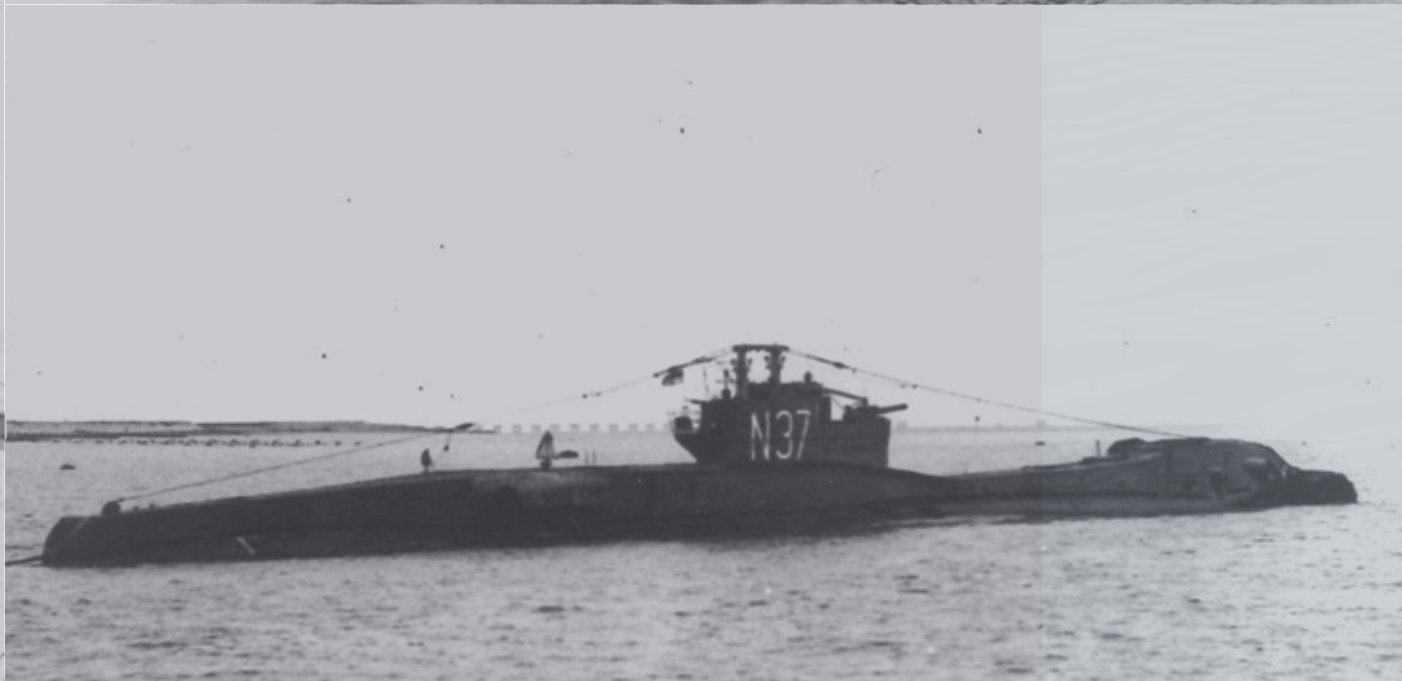
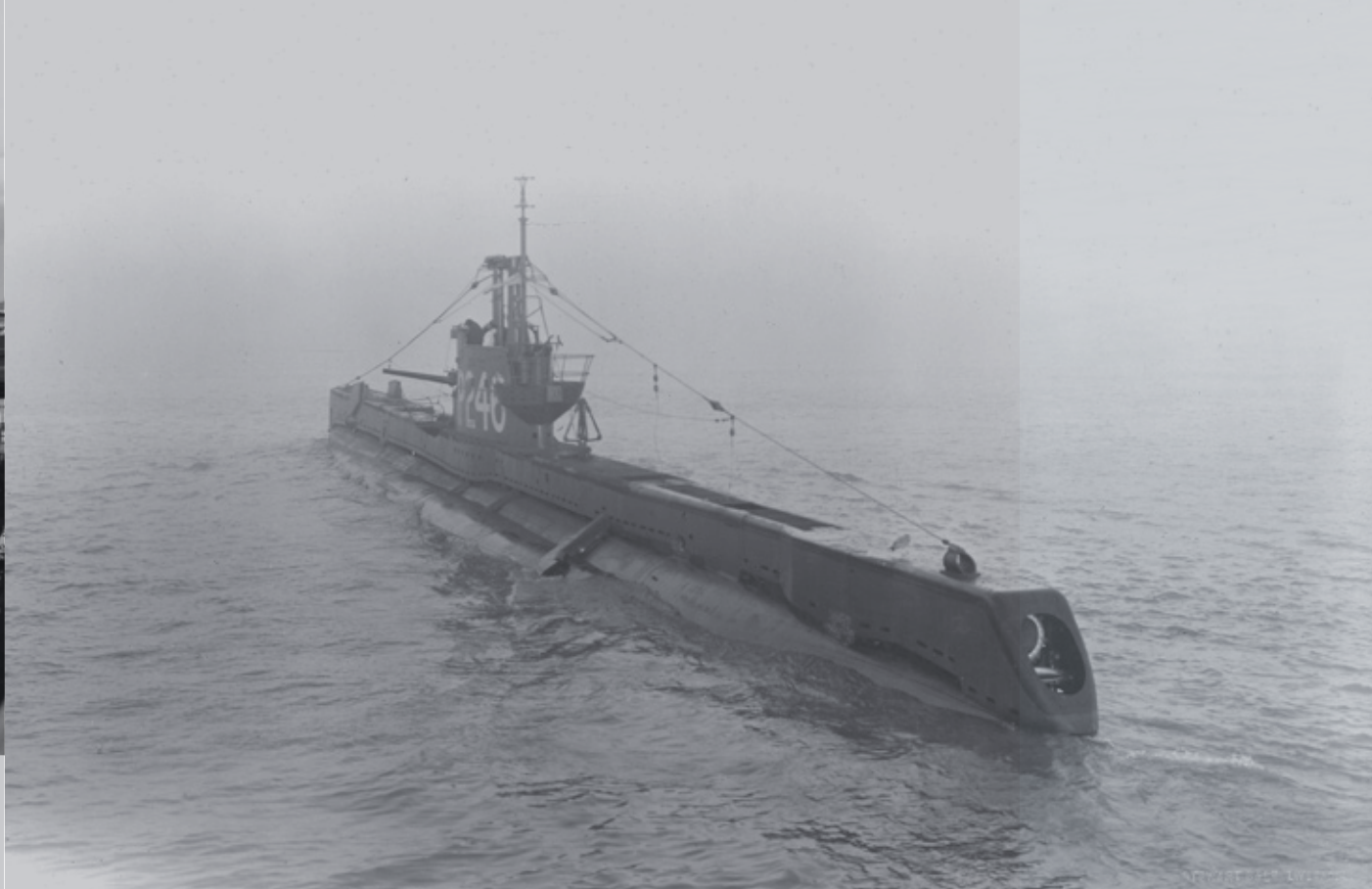
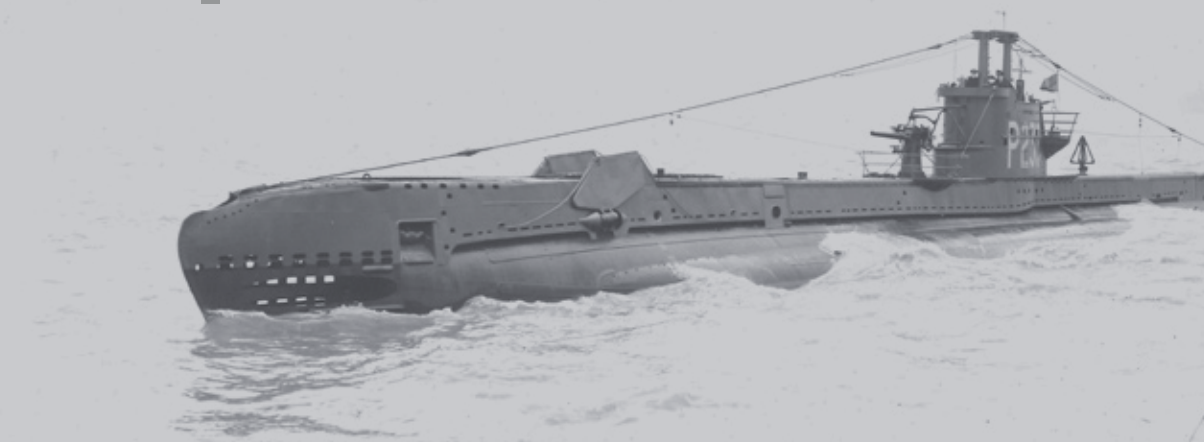


Opposite - clockwise from left: HMS Sealion; HMS Salmon; HMS E42 and HMS E41 under construction. All images courtesy of Wirral Archives Service and BAE Systems, all rights reserved.



HMS Stubborn was inspected in drydock by Lt. Cdr Alastair Mars:

“She gave the impression of a skeleton’s chest; for her ribs protruded whilst between them, her steel plates had been pressed inwards to form concave curves, this bizarre effect providing unforgettable tribute to the workmanship of the men who built her.”¹



HMS Thrasher Launched 1940

Another Triton-class submarine HMS Thrasher was laid down in November 1939 and launched just over 12 months later. The following July she surfaced off the coast of Crete and responded to a flashing SOS message coming from land. Over the next few hours the boat’s crew successfully brought on board more than 70 people, the majority of those rescued being Allied servicemen from Australia and New Zealand.

HMS Statesman Launched 1943

HMS Statesman was another of the 62 boats that formed the navy’s S-class fleet. Launched on September 14, 1943, she was armed with 13 torpedoes, one 3” gun, one 20mm cannon and three .303-calibre machine guns. As part of the Royal Navy’s Eastern Fleet, she was responsible for sinking numerous Japanese vessels, including the army cargo ship Sugi Maru No.5.

HMS Stubborn Launched 1942

In 1944, HMS Stubborn was forced to return to Devonport naval base in Plymouth after sustaining considerable damage during an engagement with a German convoy off the coast of Norway.

Resolution Class Launched 1967 & 1968

Cammell Laird built two of the Royal Navy’s four Resolution-class submarines – HMS Renown and HMS Revenge. The nuclear-powered boats carried up to 16 Polaris A3 ballistic missiles with a target range of 2,500 nautical miles, providing Britain with its first submarine-based nuclear weapons delivery system. At least one of the four boats was always on patrol to provide a continuous at-sea deterrent.

¹ - Mars, A; British Submarines At War 1939-1945; William Kimber & Co Ltd, 1971. Opposite - clockwise from top left: Resolution-class submarine under construction; HMS Statesman; HMS Thrasher; HMS Stubborn. All images courtesy of Wirral Archives Service and BAE Systems, all rights reserved.

HMS Conqueror

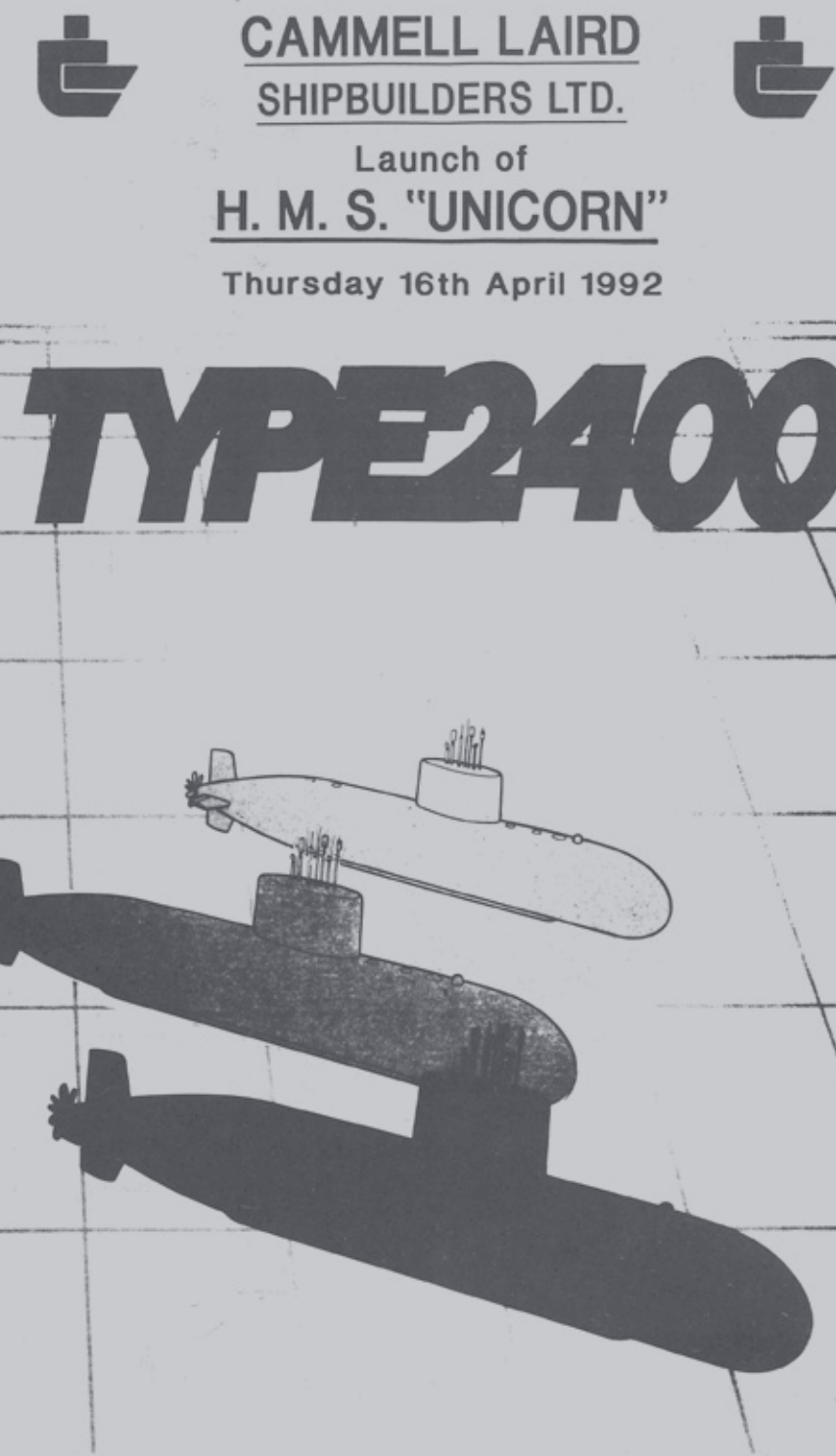
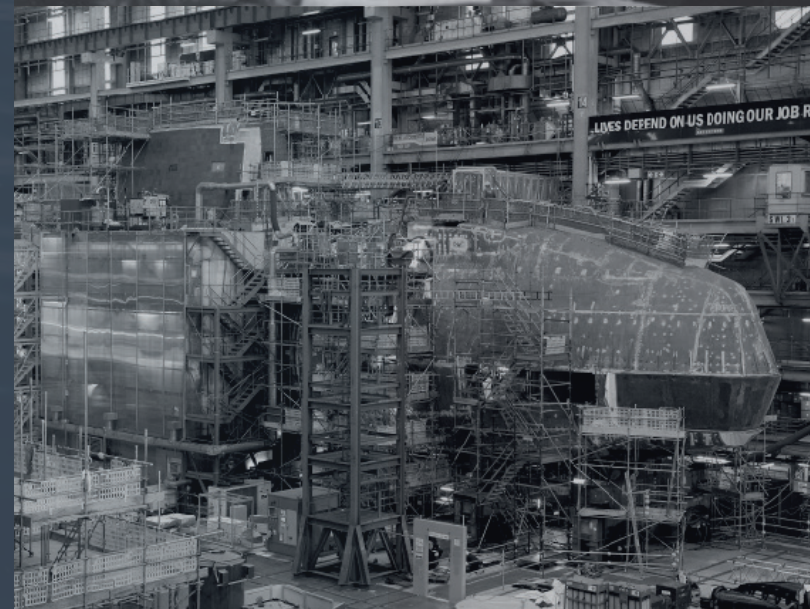
Launched 1969

Britain sent a naval taskforce to the South Atlantic Ocean in April 1982 after Argentine forces invaded the Falkland Islands. Nuclear-powered hunter killer submarine HMS Conqueror formed part of that taskforce, sinking the Argentinian cruiser General Belgrano on May 2. She remains the only nuclear-powered submarine to have engaged an enemy ship with torpedoes.

Upholder Class

Launched 1989 – 1992

Cammell Laird built three of the Royal Navy's four Upholder-class submarines – HMS Unseen, HMS Ursula and HMS Unicorn. The boats were commissioned as the Cold War was ending and as a result only spent a short time in service with the Royal Navy. All four boats remain in active service following their sale to the Royal Canadian Navy. HMS Unicorn was not only the final boat in the diesel-electric fleet, it was also the last submarine to be fully built in Birkenhead. However, specialist submarine-building skills have returned to the yard once again thanks to Cammell Laird's involvement with the Hunter-killer and ballistic missile submarine programmes.



Opposite - clockwise from top left: Launch of HMS Conqueror, 1969 (Courtesy of Wirral Archives Service); HMS Unicorn launch brochure (courtesy of Wirral Archives Service and BAE Systems, all rights reserved); Hunter-killer submarine, by LA(Phot) Stu Hill; © Crown Copyright 2012; Hunter-killer submarine, by Andrew Linnett; © Crown Copyright 2013.



**The Cammell Laird
Shipyard - an unrivalled
environment for modern
day engineering**

WORLD-CLASS FACILITIES

The Cammell Laird shipyard is spread across a 130-acre site on the banks of the River Mersey, offering a layout and facilities ideally suited to submarine construction. It's home to one of Europe's largest modular construction halls – an unrivalled undercover building environment that allows large steelwork units such as complete hulls or project-specific modules to be constructed without environmental interference.

Direct river access is available via a slipway launch, while the site's 15-acre non-tidal wet basin allows for the loading and unloading of ships over a continuous period without tidal restrictions.

The ability to offer heavy load-in and load-out services for a broad range of structures provides the option to fabricate and outfit units that are too large or heavy for road transportation.

Other key assets include dry docks, and a blast and coating facility, as well as fabrication, pipe, machine and fitting shops.

The height of the workshops and the capacity of the yard's cranes all lend themselves to handling large steel units, and coping with the demands of modern engineering.



WORLD-RENOWNED SKILLS

Cammell Laird employs in the region of 1,500 people directly and indirectly. An experienced management group, specialist technical teams and a skilled production workforce combine to ensure the highest standards are maintained throughout every project.

The company's dedication to bolstering growth and sustainability is evidenced by annual investments of more than £1.2million in staff training, ensuring workers are in possession of the very latest manufacturing skills. A specialist supply chain that currently includes more than 300 businesses also benefits from this unwavering focus on growth and skills.

Cammell Laird runs one of the biggest apprenticeship courses in the North West of England, employing between 18 and 22 individuals each year. Around £18million has been invested in the scheme over the past decade, allowing for the employment and training of 250 apprentices. Following the start of Cammell Laird's involvement in the hunter-killer and ballistic missile submarine programmes, apprentices have been provided with opportunities to engage with the projects during their training period.

The combination of world-class engineering facilities and a highly skilled workforce has enabled the company to secure recent major shipbuilding contracts for polar research vessel RRS Sir David Attenborough and the RoRo freight ferry Red Kestrel, both of which were won against tough international competition. The successful completion of a project to build flight decks for the Royal Navy's Queen Elizabeth-class aircraft carriers, as well as ongoing contracts to produce a variety of modules and components for Britain's hunter-killer and ballistic missile submarines, has once again highlighted the breadth of Cammell Laird's technical expertise. It has also further demonstrated Cammell Laird's ability to deliver high profile, hugely demanding projects worth tens of millions of pounds.



Ensuring the highest standards for high profile high value projects



**Pioneers of
excellence in training
and developing
world-class skills**



NUCLEAR ADVANCED MANUFACTURING RESEARCH CENTRE

Innovation and diversification into new sectors have always been regarded as key to the future success of Cammell Laird. The company has taken steps to demonstrate how its workforce and infrastructure can be used beyond maritime, in sectors such as civil nuclear.

In 2017, this led to the formation of a new partnership with the UK's Nuclear Advanced Manufacturing Research Centre (NAMRC), and as a result, the opening of a new nuclear sector R&D hub at the firm's Birkenhead site.

This facility pioneers excellence in training and developing world-class nuclear sector manufacturing skills. During the past two years research has focussed on areas including robotic welding, and how various advanced welding and x-raying processes can support civil nuclear projects. In addition, staff at the NAMRC have carried out research into electron beam welding in order to determine how this fast welding process can be adapted for use in a range of industries, including shipbuilding.

As a result of the stringent quality standards being adhered to at the NAMRC, and across the hunter-killer and ballistic missile submarine programmes, Cammell Laird has been able to create a new sub-category of welders. Individuals that make up this core group have the capability to work across all three projects, pushing up standards and supporting the development of a fully flexible workforce.

HUNTER-KILLER SUBMARINES

Designed to replace Britain's Trafalgar-class fleet of submarines, state-of-the-art hunter-killer boats are the largest and most advanced attack submarines to enter service in Royal Navy history.

The seven-strong fleet of nuclear-powered boats will carry a mix of Spearfish torpedoes and Tomahawk cruise missiles. Cammell Laird supported BAE Systems Maritime – Submarines during the construction of boats five, six and seven, marking the start of a new chapter in the company's long-standing relationship with Britain's submarine fleet.

The contract saw Cammell Laird produce Command Deck Modules and Manoeuvring Deck Modules to go inside the submarines' pressure hulls, along with bridge fin units and casings designed to sit on top of the hull in order to create a flat deck. Up to 60 Cammell Laird employees were involved in the project, including steel workers, welders, grinders and quality control specialists. Apprentices were also involved throughout, providing them with a unique opportunity to appreciate the quality requirements necessary for the construction of a nuclear attack submarine.

Completed components were all transported by ship from Birkenhead to BAE Systems' shipyard in Barrow-in-Furness. Cammell Laird's location on the banks of the River Mersey served to simplify the process, as did the availability of a non-tidal wet basin, allowing loading over a 24-hour period without tidal restrictions.

Opposite - clockwise from top left: Hunter-killer submarine, by LA(Phot) Will Haigh, © Crown Copyright 2012; Hunter-killer submarine, by LA(Phot) Paul Halliwell, © Crown Copyright 2012; Tomahawk cruise missile test, by POA(Phot) Paul Punter, © Crown Copyright 2011; Hunter-killer submarine, by LA(Phot) Jonathan Massey, © Crown Copyright 2009.



**The most
advanced attack
submarines
in Royal Navy
history**





Constructing the UK's strategic nuclear deterrent force

BALLISTIC MISSILE SUBMARINES

Cammell Laird's involvement in the construction of the next generation of British submarines will continue following the successful conclusion of its role in the hunter-killer submarine programme.

In October 2018, the company was awarded a further contract to support BAE Systems with the delivery of four ballistic missile boats - successors to Britain's Vanguard-class submarines that represent the UK's strategic nuclear deterrent force.

The contract will see Cammell Laird produce a total of 29 components for the four ballistic missile boats. All are either outer or inner hull items, as BAE Systems will construct the pressure hulls itself. Units include decks and bulkheads that will be fitted inside the submarine, along with keels for the pressure hull to sit on if it rests on the seabed. Additional units range from ballast tanks to a bridge fin that houses the conning tower, aials and periscope. Production is underway, with the final module due to leave Birkenhead for Barrow-in-Furness in 2030.

The project differs from the hunter-killer submarine contract in that Cammell Laird will build from raw materials rather than ready-made components. Between 140 and 160 employees are expected to work on the Dreadnought-class project, with construction of parts for each boat due to overlap.

Opposite - clockwise from left: Modules for the hunter-killer submarine programme being loaded for transport at Cammell Laird, image used courtesy of BAE Systems, all rights reserved; Hunter-killer submarine, by Andrew Linnett, © Crown Copyright 2013; Image by LA(Phot) Will Haigh, © Crown Copyright 2013; Hunter-killer submarine, © Crown Copyright 2012.

