

Ship-shape production

Shipbuilding has been modularised and productionised for the Type 45 Destroyer. Mike Nash went to see the module panel production line at VTS' new £50 million Portsmouth facility

"I love doing this job, it's just like making a big Airfix model," beams Andy Shaw about his role as strategic planning executive at Vosper Thornycroft Shipbuilding (VTS). The rather large kits in this case are major bow, mast and superstructure elements of the Type 45 Destroyer, the future backbone of the Royal Navy's operations. The decision to build part of this mighty ship at Portsmouth Naval Base (the first time ships have been built at the historic port since 1967) is a major reason for an extraordinary redevelopment by VTS of a 33-acre site.

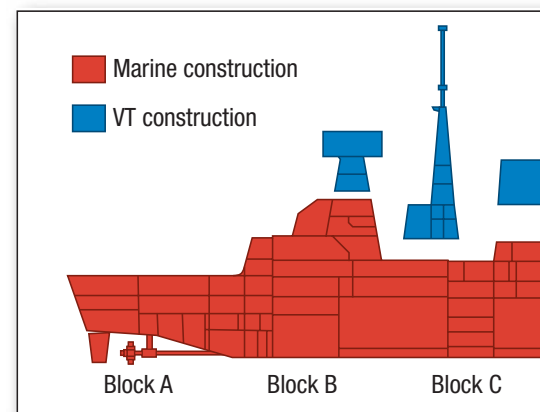
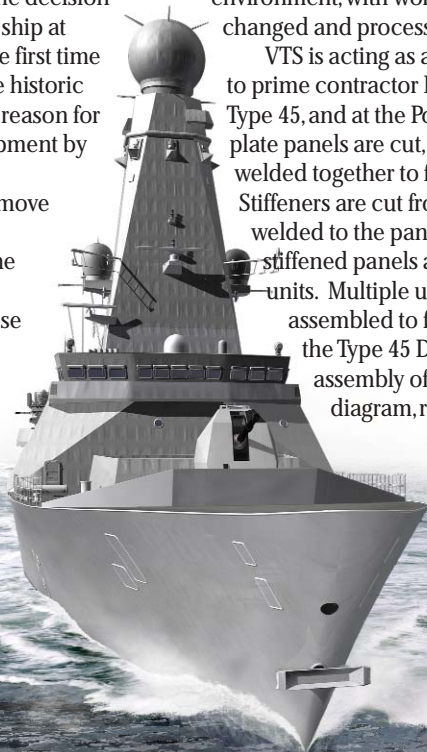
The company made a move from "ad hoc and random production processes" at the Woolston (Southampton) shipyard (scheduled to close in March 2004) to a "very structured, workstation-based system". The new

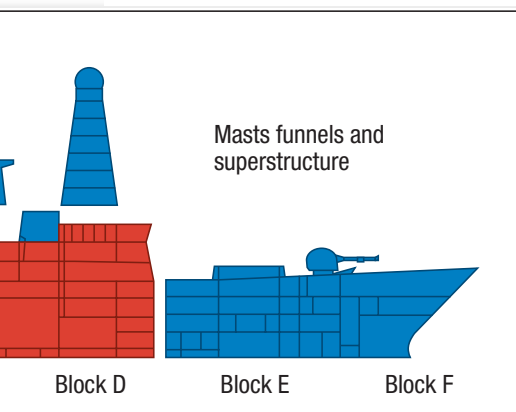
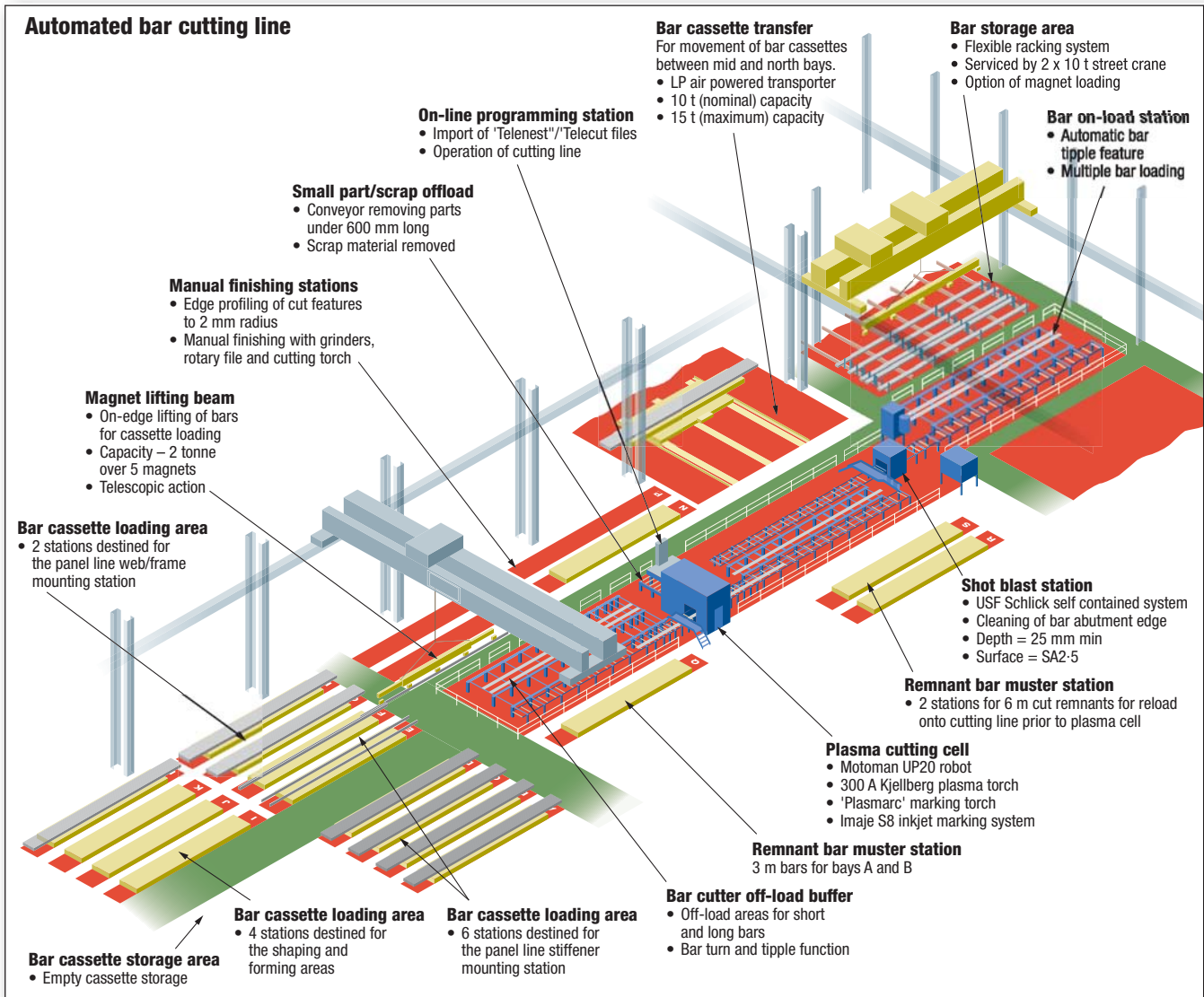
£50 million site, where development began in February 2002, is one of the most advanced naval shipbuilding yards in the world, featuring automated fabrication and construction, incorporating steel production equipment, construction and assembly halls. It will also be a far better working environment, with workstation layouts changed and processes redeveloped.

VTS is acting as a 'strategic partner' to prime contractor BAE Systems for Type 45, and at the Portsmouth site plate panels are cut, profiled then welded together to form larger panels. Stiffeners are cut from bar and welded to the panels, and the stiffened panels are assembled into units. Multiple units are then assembled to form a block. And the Type 45 Destroyer is an assembly of such blocks (see diagram, right). Completed

blocks will be assembled and launched at Scotstoun on the Clyde with remaining ships built and launched at Govan and Scotstoun.

The scale of redevelopment at Portsmouth is impressive. One dry dock has been filled to allow construction of a Ship Assembly Hall (130 m long, 52 m wide and 40 m high with a 400 tonne crane capacity) and Unit Construction Hall (130 m long by 43 m wide with cranes of 120 tonnes capacity). The Unit Construction Hall will assemble panels, bulkheads and decks into units, which will move next door to the Ship Assembly Hall where final assembly and outfit will take place (for the Type 45, this will be the forward hull block). The hall will also be able to accommodate whole ship assembly of Offshore Patrol Vessels





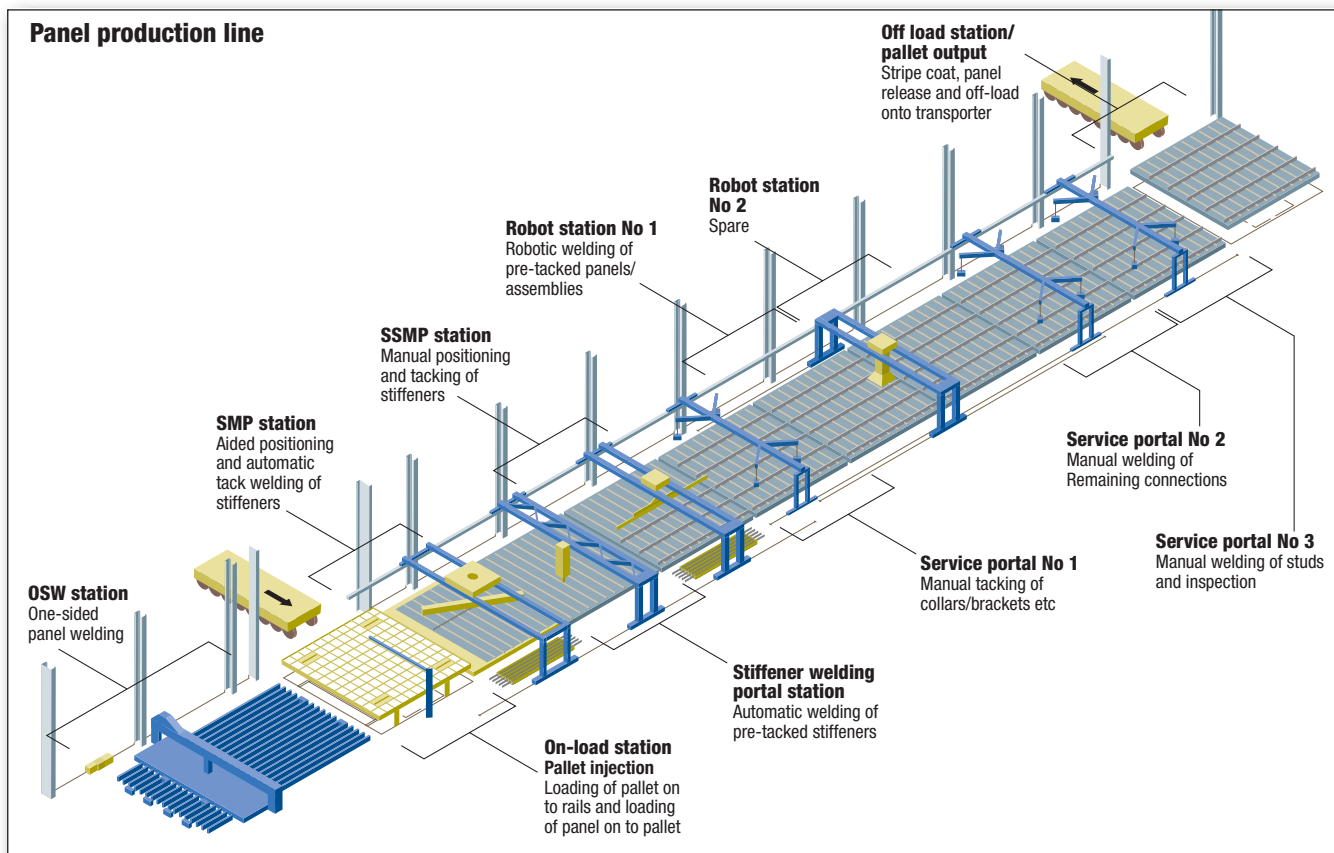
(OPVs) and corvettes. The existing quay wall was also extended by seven metres and dry dock 13 (where the Ship Assembly Hall now stands) was filled in with around 100 000 tonnes of marine dredged material pumped in by barge over three days, providing the massive structure's base.

STEEL CATHEDRAL

To feed the assembly halls with steelwork sections and panels, VT has converted and extended the former Fleet Support Ltd Combined Workshop building into a dedicated Steel Production Hall (SPH).

This cathedral-like structure – measuring 175 m by 73 m – incorporates a production line forming the hub of the manufacturing process, including steelworking production equipment, laser cutting, automated robotic bar cutting and robotic and semi-automated welding equipment. Overall, some £7-8 million has been invested in machinery here.

According to Bob Deakin, SPH production manager, the process is 'pull' not 'push', with demand for sections and panels determined by the assembly halls and "ultimately the launch date." This makes overproduction less likely and the



SPH has been designed with adequate, but not generous areas for stock holding. Operating on a just-in-time (JIT) principle, only around two weeks' worth of work is in the SPH at any one time, making around 25 tonnes of steel hull, decking and associated fittings per day for the 90 m barge that will sail the completed Type 45 bow, mast and superstructure sections up to Scotland for final assembly. The barge – which will be ready by May next year – provides a useful test for the facility with panel production 70 per cent complete. The Portsmouth production site went live for Type 45 in the last week of October 2003.

Mr Shaw differentiates between product and process, defining product down to every bar and plate. Processes are replicated using a simulation program through which the product is "squirted" to see how the manufacturing environment reacts. A key benefit is identification of bottlenecks and confirmation that the

SPH has sufficient capacity to do Type 45 and other work. It reveals if a workstation is sufficiently fast to handle product combinations required in a certain time period. This off-the-shelf, inexpensive software helped convince "BAE that we had built a facility that could actually meet their requirements in terms of throughput."

WORKSTATION PHILOSOPHY

Impressive productivity improvement targets have been set by VTS as production ramps up, and much time has been spent on the planning philosophy within the yard and obtaining performance feedback. "All good shipyards work around a common workstation philosophy", declares Mr Shaw. Workstation performance reports adorn the walls of the SPH, and from this data production strategies can be developed.

Shopfloor data collection is also

being rolled out across the yard in the next few months. Throughout the site, workshops are linked by fibre-optic cable to VTS' Computer Aided Design areas, enabling data to be sent electronically. "Essentially it is collecting cost against a workstation, all done with bar codes."

In the SPH, 13 m by 3 m steel plates are cut and 13 m long bars profiled by computer controlled cutting machines. The doctrine cited throughout is getting the right bar to the right place at the right time to meet the right piece of plate that is coming through.

Plate is cut using a Messer Griesheim 4 kW CNC laser plate cutting machine, considerably faster and more powerful than VTS' old cutter. Component shapes are nested for maximum use of the steel plate, with components ink-jet marked for identification. The planning process dictates what is cut, when and in what order.

Plate then enters a Pemamek 11-

Type 45: vital statistics

The Type 45 Destroyer's future versatility in maritime and joint operations for multi-threat environments is of huge significance to the Royal Navy. In tandem with the Future Aircraft Carrier (CVF), it represents the backbone of the navy's air defences up to 2040, primarily in anti air warfare, protecting ships, carriers and auxiliary and merchant vessels. Type 45 will be able to engage numerous targets simultaneously with a combat system to counter anti-ship missiles and aircraft, providing a multi-role, general-purpose platform capable of peace support and defence diplomacy through to high-intensity warfare.

At around 7350 tonnes and 152.4 m long, the Type 45 is considerably larger than the Type 42 it replaces. 'Room for growth' was a key operational requirement. Crew complement is 190 with space for up to 235, allowing transport of specialist teams and equipment for special missions. Designed for assignments up to 45 days long, the ship will cover 7000 nautical miles at 18 knots, reaching a maximum speed of over 27 knots. Its main armament is the Principal Anti Air Missile System (PAAMS), counteracting sea-skimming, high-diving, supersonic, stealthy or highly manoeuvrable missiles, and controlling numerous missiles in the air at once. Ship design allows accommodation of alternative weapons systems.

The first of class, HMS Daring, is scheduled for launch in 2005, entering service in 2007. The ships will be built from modules built on the Clyde and at VTS' Portsmouth facility. Completed modules will be assembled and launched at Scotstoun on the Clyde with remaining ships built and launched at Govan and Scotstoun. VTS and BAE Systems Naval Ships on the Clyde will make and outfit substantial sections of each ship.

station panel line (page 10) that carries out various steel processing operations as materials move along a 150 m long production line – the only one in the world using palletised production rather than rollers – vital to keep the comparatively thin plate flat. Correct positioning of the plate on the pallet is crucial. At the head of the line is a new semi-automatic, 13 m wide single-sided seam-welding machine which can produce panels up to 12 m long by 13 m wide. Completed panels are loaded and attached onto the train of large pallets using a vacuum lifting frame, which are then transported along the line using a chain pull mechanism.

Bar sections (used as transverse and vertical stiffeners for hull, bulkheads and decking) are cut and profiled using an ISU robotic profile cutting line (page 9). This transports profiles on rollers from the store area through an edge shot blasting booth and robotic plasma cutting booth onto out-feed rollers, from where the

sections are loaded by magnetic crane into cassettes.

The panel line is fed profile sections by cassette from the ISU robotic bar cutting line and the profiles are magnetically lifted and positioned on the plate using a specialist lifting portal. The line utilises semi-automated welding processes to attach the bar stiffeners to the plate. Panel fabrication is completed using a six-axis CNC robotic welding cell, fed by information directly from a CAD model.

All panel line equipment has been supplied and integrated by Pemamek (Finland) on a turnkey basis using various sub-contractors including Motoman for the robot, and RINAS (Denmark) for the robot welding software. ISU (Germany) was chosen for its bar profiling

system, Kone (Finland) for the lifting machinery and ESAB for all welding equipment.

At the end of the panel line, steel assemblies are transported to the shipbuilding bays using a transporter, where they are consolidated into ship blocks and pre-outfitted. Vessels will be moved from the hall, using specialist heavy lift transporters, onto a dedicated barge. Some ships will be moved to outfitting dry docks, where they will be floated off the barge.

Although much of the machinery is new, a major logistics operation was required to move equipment from Woolston, including a 100-year-old steel plate rolling machine purchased in the 1950s. "There was no need to buy a new one – it does the job", says Mr Shaw matter-of-factly. Overall, over 500 bits of kit were moved. The transition period was handled well. "We spent a lot of time working out the sequences – what machines were going to be moved and when." Equipment moved included the plasma cutting machine and laser cutter, "all big items, that could take two or three weeks to install at the other end".

The Type 45 represents 60-70 per cent of current capacity and VTS has orders for six destroyers up to 2008. But as and when production for the future aircraft carrier (CVF) comes on line "we may be tripling production out of here by 2006-7", as VTS is one of four first tier suppliers in this project. Productivity will increase dramatically. But for Mr Shaw it is vital not to run before you can walk. "We must be aiming for stable processes. This will enable us to balance the line more easily thus making the whole process more manageable."

The benefits of productionised panel and module building are already clear, but the completed 'airfix kit' is three years away. 

