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BAE SYSTEMS



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Interview-Partner
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Company profile

BAE Systems, Barrow-in-Furness is the leading UK submarine design and build company. It has also designed and built surface ships for the UK Navy. The current workload involves design and fabrication of the Astute Class submarine series.

BAE Systems employs approx 4500 employees. Welding and fabrication forms a major part of the companies structure; and at present approx 200 structural welders are engaged on the Astute class contract.

The Astute class submarines are the next-generation nuclear fleet submarines of the Royal Navy. When completed, the boats will set a new standard for the Royal Navy in terms of weapons load, improved communications facilities, stealth and comfort for the crew.

Astute-class boats are about 30 per cent larger than previous British attack submarines at a length of 323 feet (92 metres), which were powered by smaller reactors. This gives them the capability of 29 knots. It will be the first Royal Navy submarine class to have a bunk for each member of the ship's company, ending the practice of 'hot bunking', whereby two sailors on opposite watches shared the same bunk.

What is the role of welding within your projects?

« Structural welding is crucial to our company. The fabrication of submarine pressure hull structure and high category structures including bulkheads is carried out to a very high quality standard. Additionally, many quality full penetration welds involve tee frames, decks and internal components also. »





What welding procedures are applied?

« For Astute Class, we employ the submerged arc (SA) process for joining the pressure hull circumferential butts. We use a mammoth column and boom that is worked in conjunction with high-duty rotators for welding these sub-unit circumferential butts. We employ a tandem submerged arc system (AC/DC), and Oerlikon products, OE S3 Ni Mo1 & OP 121TT have been used since its inception. Twin tandem SA is also used for tee frame web-to-table butt fabrication; and single-wire SA process is used for welding the tee frames to the pressure hull.

The other main process is flux cored arc welding (FCAW) for vertical seam welds, and all-positional welding. We use Oerlikon's CITOFLUX R 550V consumables for pressure hull components, and Oerlikon consumables for welding on the Main Machinery Raft.

In particular, the introduction of CITOFLUX R 550V is a major achievement for Air Liquide Welding. BAE Systems had been looking to introduce a new FCAW consumable at the outset of the Astute contract. There was a considerable development project carried out by Air Liquide Welding to provide a FCAW consumable which would match the onerous technical requirements for Q1N weld metal; and provide excellent weldability for all-positional welding carried out on the Astute Class submarine project. »

How do you qualify your welding consumables?

« The qualification of welding consumables for UK submarine manufacture is in accordance with UK Naval Engineering Standards. This involves extremely onerous destructive testing of all pressure hull consumables – flawed bulge explosion testing (FBE), static CTOD testing, and also standard tensile and Charpy testing.

Additionally, each consumable employed on the pressure hull is required to be batch tested. For each batch test, we have to ensure each consumable batch exceeds 550 MPa yield strength, and Charpy values of 50 J minimum average at -50 °C are obtained.

This is an onerous requirement, but since batch testing was introduced several years ago, we have had no mechanical test failures with the Oerlikon submerged arc product. »





Is there a joint project with Oerlikon you would highlight in particular?

« Our company has been the premier UK design and build company of submarine manufacture since its inception. Several years ago, we became involved with designing and fabricating surface ships for the UK Navy. Since we had not been involved with surface ship work for several years, BAE had to develop and approve new submerged arc procedures on our SA seamer station. During this development process, we worked closely with Oerlikon to ensure that consistent quality welds were achievable using single-sided single-run SA welds with Oerlikon SA products.

The initial welding trials had been carried out by Oerlikon in advance; which proved invaluable regarding achieving project timescales. »

What do you see as the technical challenges in the future?

« There is a drive to examine the 690 MPa yield steels, and a current contract involves welding and fabrication of this high-yield steel. We will be involving Oerlikon and Air Liquide Welding Group in the selection of consumables covering the SA, FCAW and MIG processes for 690 MPa grade steels. »



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