



Shipbuilding CoBot Alliance



Production Processes, Planning and Facilities July 28, 2026



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ADDRESSING THE NEED



The top three shipbuilding manpower shortages are welders/metal fabricators, structural fitters/shipfitters, and painters/blasters, with welders and metal-fabrication trades alone facing an annual U.S. shortfall of about 48,000 workers and shipyards needing roughly 250,000 additional skilled trades over the next decade.

Copilot Search



BLUF



- U.S. shipbuilding faces a manpower crisis at a time when production needs to ramp up significantly.
- Bringing people into shipbuilding, especially for welding and other “dirty” jobs is a challenge for all shipbuilders and suppliers.
- Collaborative Robotics (CoBots) offer an automation solution that significantly increases the productivity and quality of workers across all skill levels.
- Implementing CoBots for U.S. Navy work is time consuming and difficult due to training and qualification requirements.
- The Shipbuilding CoBot Alliance was established to create a streamlined path to implementation.
- The Maritime Industrial Base has already funded CoBot implementation projects at a few shipyards and suppliers. The SCA’s goal is to expand the effort across the entire Maritime Industrial Base in a standardized and repeatable fashion.



<https://www.kranendonk.com/solutions/stiffener-mounting-gantry/>

- Similar to new stiffener gantry installed at beginning of CVN-80 construction
- Replaces a linear fit and weld system with a multi-directional fit and weld
- Allows for fitting beams of different geometries
- Feeds a robotic panel welding station on the line



<https://www.kranendonk.com/solutions/web-and-micro-panel-welding/>

- Similar to recently installed systems constructing CVN-80 and Constellation Class Frigates
- Replaces linear panel weld systems with 6 DOF robot welders
- Allows for nearly full robotic welding of different shapes and orientations
- Feeds a manual weld services station on the line



Portable Welding Robot

Early CoBot Concept



Background/Problem

- Hundreds of thousands of repetitive, ergonomically difficult welds
- Cycle times to complete tasks create bottlenecks and schedule delays for next task in sequence
- ~300,000 stowage rail clips welded in dock
- ~2000 deck tie downs (DTD) welded in steel fab
- ~16,000 chocks and brackets in the panel line alone



Benefits

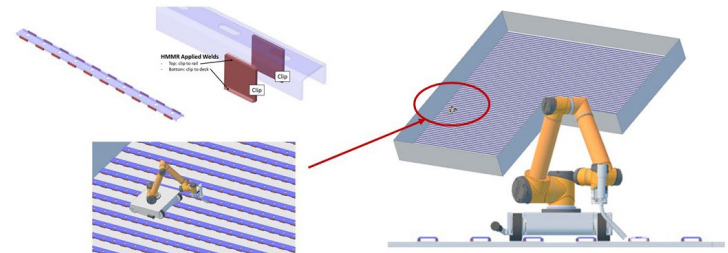
- Robot typically performs welding operations at approximately 4X the rate of human
 - Human in-the-loop with portable robotics
- 1 operator controlling 4 robots yields a 16X improvement
- 300,000 clips / 30 clips/hr = 10,000 hrs manual welding
 - $10,000/4X = 2500$ hrs robotic welding 1 robot
 - $10,000/16X = 625$ hrs robotic welding 4 robots
- 2000 DTD / .5 DTD/hr = 4000 hrs manual welding
 - $4000/4X = 1000$ hrs robotic welding 1 robot
 - $4000/16X = 250$ hrs robotic welding 4 robots
- 16,000 chocks / 2 chocks/hr = 8,000 hrs manual welding
 - $8,000/4X = 2000$ hrs robotic welding 1 robot
 - $8,000/16X = 500$ hrs robotic welding 4 robots

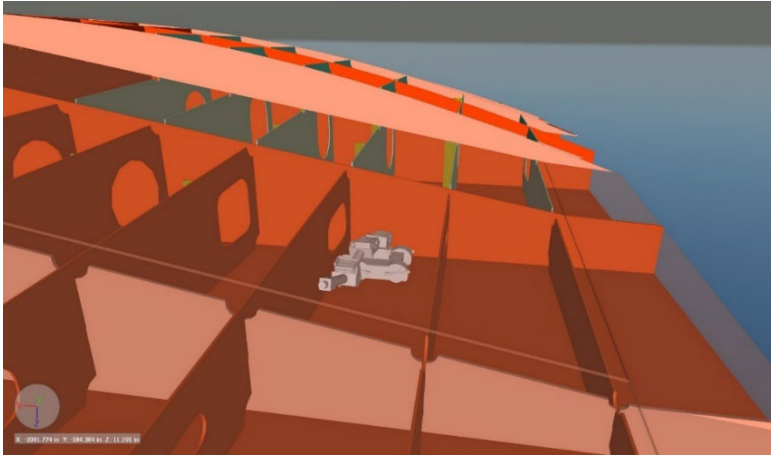
Solution

- 8 DOF Portable Arm Welding Robot

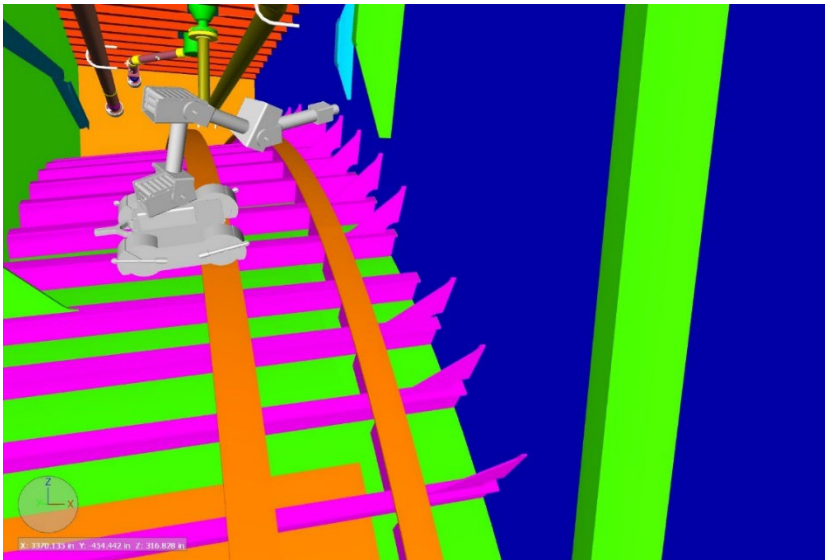


Concept > HMMR(s) Autonomously Welding Clips





- Puts robotics in ergonomically horrible spaces
- Welder can control remotely from adjacent space
- Augments rather than replaces the human – CoBoT concept





WHAT IS A COBOT?



- CoBot – Collaborative roBot
- Robot intended for direct human interaction with shared space or proximity (IFR)
- Traditional robotics – achieve safety by separating robots from human contact during operation
- CoBots – achieve safety through weight, materials, geometry, sensing, controls
- Recent development (1997 patent) stemming from GM robotics center and University research

Four Levels of Collaboration between worker and CoBot (IFR)

Coexistence	Work side by side (no protective barrier)	
Sequential Collaboration	Share the workspace	
Cooperation	Work on the same part, at the same time	
Responsive Collaboration	CoBot responds to worker	



COMPARING ROBOT SPECIFICATIONS: COLLABORATIVE VS. TRADITIONAL



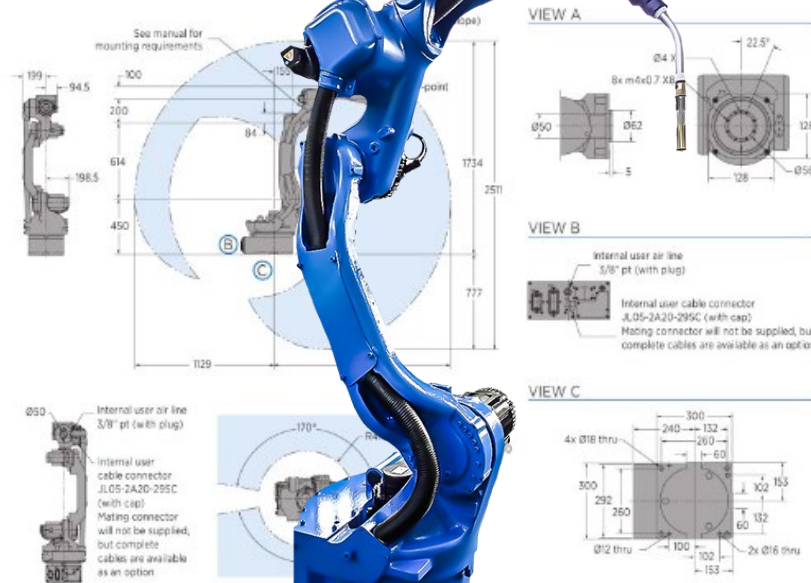
UR10 Technical specifications

Item no. 110110

6-axis robot arm with a working radius of 1300 mm / 51.2 in

Weight:	28.9 kg / 63.7 lbs
Payload:	10 kg / 22 lbs
Reach:	1300 mm / 51.2 in
Joint ranges:	+/- 360°
Speed:	Base and Shoulder: 120°/s. Elbow, Wrist 1, Wrist 2, Wrist 3: 180°/s. Tool: Typical 1 m/s. / 39.4 in/s.
Repeatability:	+/- 0.1 mm / +/- 0.0039 in (4 mils)
Footprint:	Ø190 mm / 7.5 in
Degrees of freedom:	6 rotating joints
Control box size (WxHxD):	475 mm x 423 mm x 268 mm / 18.7 x 16.7 x 10.6 in

MA1440 ROBOT



All dimensions are metric (mm) and for reference only.
Request detailed drawings for all design/engineering requirements.

SPECIFICATIONS

Axes	Maximum motion range [°]	Maximum speed [°/sec.]	Allowable moment [N·m]	Allowable moment of inertia [kg·m ²]	Controlled axis	
S	±170	230	-	-	Maximum payload [kg]	6
L	+135/-90	200	-	-	Repeatability [mm]	±0.08
U	+240/-175	230	-	-	Horizontal reach [mm]	1,440
R	±150	430	10.5	0.28	Vertical reach [mm]	2,511
B	+90/-135	430	10.5	0.28	Temperature [°C]	0 to +45
T	±210	630	3.2	0.06	Humidity [%]	20 - 80
					Weight [kg]	130
					Power rating [kVA]	1.5
					Internal I/O cable (feeder control)	18 conductors
					Internal gas line	(1) 3/8" connection

- Similar payload and reach, 29 vs. 130kg arm mass

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Hurdles to Implementation



- Tech_Pub_248_S9074-AQ-GIB-010_248_rev1_11.12.19 specifies requirements for robotic welding for U.S. Navy applications
- Rev 0 required Level 1 Qualification (including failure tests on specimens) at the serial number level plus essential elements (amps, volts, gas type, material, grade, filler etc.) for a qualified Weld Procedure Specification (WPS)
- Rev 1 requires Level 1 Qualification at the make/model level plus essential elements for a qualified Weld Procedure Specification (WPS)
 - Additional machines in the same make/model with same essential elements only require level 2 Qualification (visual inspection) to a qualified WPS
- Other applications (cutting, weld prep, coating removal, gouging) do not have to be qualified for use with a CoBot beyond finished product inspection



SHIPBUILDING COBOT ALLIANCE



- 2024 NSRP Project “Establishment and Operation of a Shipbuilding CoBot Training and Development Center” (NSRP RA No. 24-02)
- Objective – Establish a pipeline for personnel training and qualification, application development, CoBot qualification for Navy work and Research and Development to improve CoBot functionality and versatility in ship construction and repair applications.

- Method –

Establish 2 regional Centers, one at NWTC in Marinette, WI run by Northern Wisconsin Technical College and a second at Tabet Manufacturing in Norfolk, VA run by GENEDGE, the VA MEP.

Equip each center with CoBot application cells with an emphasis on welding

Other applications include cutting, grinding, paint removal, weld prep

Centers will be equipped with access to testing equipment to fully qualify to NAVSEA Tech Pub 248.1 for Level 1 Weld Qualifications





Alliance Mission



THE SHIPBUILDING CoBot ALLIANCE IS ESTABLISHED AS A LOOSELY STRUCTURED CONSORTIUM OF SHIPBUILDERS, CoBot SUPPLIERS, SHIPYARD SUPPLY CHAIN SUPPLIERS, NAVY TECHNICAL AUTHORITIES AND INDUSTRY EXPERTS. THE PURPOSE OF THE ALLIANCE IS TO ACCELERATE THE IMPLEMENTATION OF CoBOTS IN SHIPBUILDING APPLICATIONS BY PROVIDING A STREAMLINED AND EFFICIENT PATH TO QUALIFICATION OF PERSONNEL AND EQUIPMENT TO NAVY AND INDUSTRY STANDARDS. A SPECIFIC FOCUS IS THE IDENTIFICATION AND RESOLUTION OF ISSUES AND ROADBLOCKS CURRENTLY IMPEDING THE USE OF CoBOTS IN SHIPYARD WELDING APPLICATIONS. THE MISSION WILL BE ACCOMPLISHED THROUGH TRAINING AND QUALIFICATION CENTERS ESTABLISHED IN NORFOLK, VA AND MARINETTE, WI WITH POTENTIAL FOR EXPANSION AS THE NEED REQUIRES.



Business Case



- CoBot suppliers provide equipment to centers as cost share
 - Labor support is funded
- Centers provide a pathway to qualifying multiple WPS on a specific make model
 - Independent trainer provides operator training to a standardized curriculum
- Shipyards and suppliers have access to training with an end result of Welder and CoBot qualified to an approved WPS
 - Training can be on multiple systems to support investment decisions or on a specific system if one has been chosen
 - Performing entity is required to sign off on their own WPS and then submit for approval
- NAVSEA is engaged to provide guidance on the qualification process
- Suppliers can sell the qualified system off the floor



Operating Plan



- Each Facility has a qualified trainer(s)
- Each Activity (shipyard, shipyard supplier, etc.) needs to review the training curriculum and approve it for use by their personnel.
- Each Activity needs to either provide their own WPS or use an established baseline to develop a WPS as covered in the Qualification Test Plan.
 - Each activity is responsible for witnessing their employee's qualification welds – or an approved representative
- Test specimens will be created during training and sent to lab for analysis and creation of PQRs.
- Each Activity is responsible for sending qualified WPS and PQRs to their Approval Authority and/or Prime Contractor Activity



Alliance Charter Members



■ CoBot Suppliers

- ESAB
- Lincoln Electric
- Miller
- Switchweld
- THG Automation

■ Shipyards

- FMM Marinette
- Newport News Shipbuilding
- Master Boatbuilders
- Pacific Shipyards

■ Equipment Suppliers

- Atmospheric Plasma Solutions
- NC-Seamless

■ Management Team

- CahillConsulting, LLC
- Hepinstall Consulting Group, LLC

■ Center Management

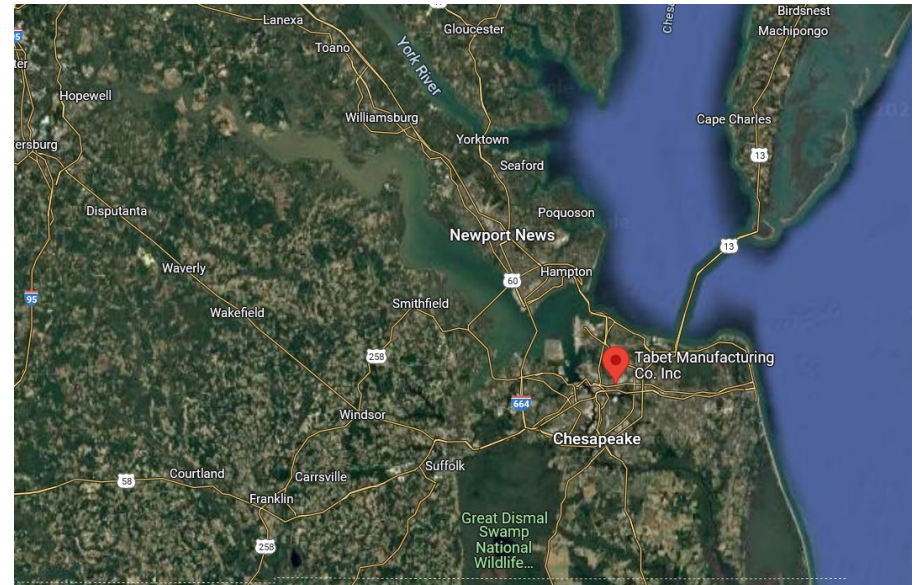
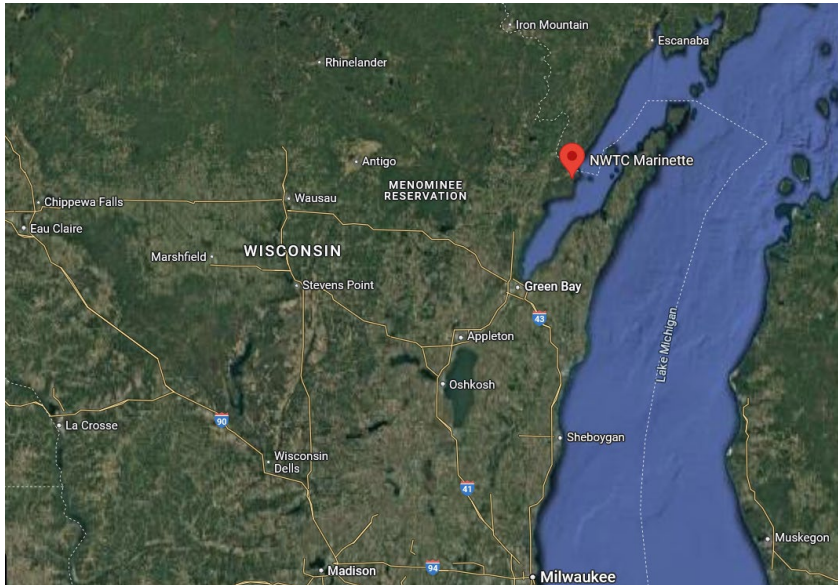
- NWTC (host and manager)
- GENEDGE (manager)
- Tabet Manufacturing (host)

■ Technology Team

- Robotic Technologies of Tennessee
- Edison Welding Institute
- VA Digital Maritime Center

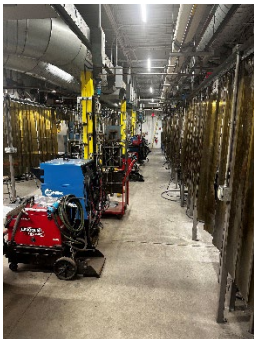
■ Technical Support

- NAVSEA



NWTC, Marinette, WI

Tabet Manufacturing, Norfolk, VA



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Lincoln Electric Company
Cooper™ GoFa-10 A/C
WB Welding CoBot
Cart (GEN II)



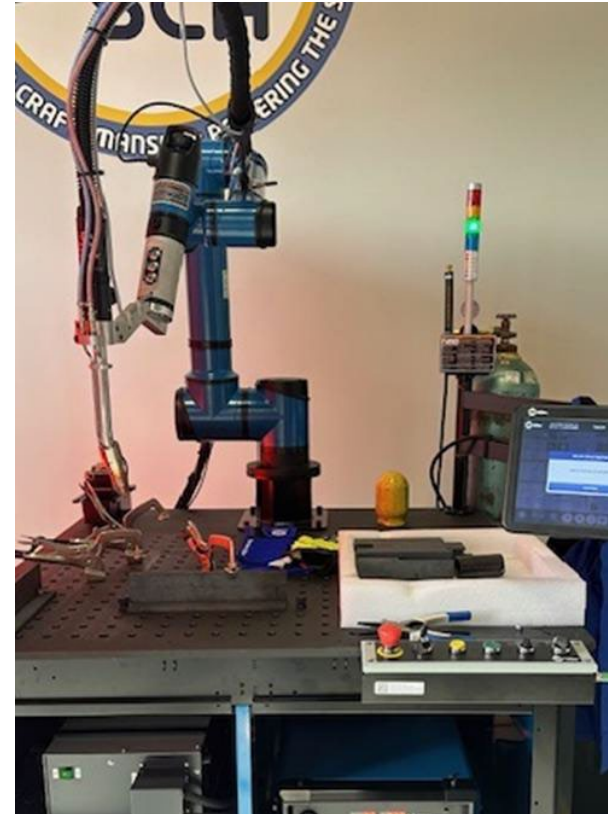
THG Automation L.L.C.,
URW-2PA System



ESAB Smoot CoBot 500I
x Power source, U8
Robust Feeder, URIO TT
Arm



Robotic Technologies of Tennessee i10 SwitchWeld system



Miller CoPilot Table System, includes Water-Cooled, Seam Tracking, Auto Deltaweld 500, and 400 VAC input



SCA ACCOMPLISHMENTS



- Navigated an extensive array of organizational and contractual hurdles
- Stood up training centers in Norfolk and Marinette
- Obtained cost shared systems from 5 vendors and installed in both locations
- Developed comprehensive 40 hour 1 week course that provides basic CoBot welding operations on 5 separate brands
- Conducted multiple training sessions with the curriculum development team and vendors to compress and refine the curriculum
- Held “guinea pig” training sessions with team members to critique and refine the curriculum
- Obtained Edison Welding Institute certification for 40 professional development hours in Cobotic welding for shipbuilding



SCA OUTREACH



- Conducted over 16 training sessions for 77 people and 27 organizations including:
 - Shipyards - NNS, FMM, PSI, Master Boats
 - Both TRFs
 - Supply base manufacturers
- Refined curriculum to provide a 2 day introductory course
- Obtained a HAMMER (Hampton Roads Advanced Manufacturing Modernization with Emerging Robotics) grant to offer training sessions at the Norfolk center
- Developed comprehensive 40 hour 1 week course that provides basic CoBot welding operations on 5 separate brands
- Held open houses at both centers that were well attended
- Coordinated with NAVSEA to move closer to a smoother path to qualification



SCA NEXT PHASE



- Shipbuilding CoBot Alliance incorporated as an Alabama 501 (3)(c) non-profit in March 2026
- Sustainment grant from the Submarine Industrial Base program office through Blue Forge Alliance in final contract phase
- Next Phase funds \$2.6M for:
 - Standing up a 3rd center in San Diego area to be operated and managed by the El Camino Community College system
 - Updating course curriculum and increasing portfolio of course offerings
 - Awarding and overseeing the implementation of 5 starter kits including CoBot, training, vendor support and implementation guidance for selected companies
 - Quarterly training (min rqmt) at all 3 facilities
 - Training grants for companies to attend training
 - Industry outreach



JOIN THE ALLIANCE



- CoBot suppliers and integrators
 - Place your machines in one or more centers and contribute to the training material
 - Be in the mix for starter kit grants
 - Use the facility outside of class time for advanced customer training
- Prime contractors, shipyards and suppliers
 - Work with SCA to approve a single industry standard for CoBot training
 - Primes provide guidelines for subcontractors to qualify CoBot use
 - Train personnel and qualify equipment for production use
 - Use SCA grants for training and compete for a starter kit
- Other equipment suppliers and workforce development organizations
 - Opportunity to introduce CoBot related equipment and processes into the training curriculum
 - Opportunity for future expansion to other welding training centers



Shipbuilding CoBot Alliance



Questions?

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