Automated Back Gouging of Thick Plate Weld Joints for DDG 1000 Construction

General Dynamics - Bath Iron Works (BIW) manually arc gouges and grinds the Peripheral Vertical Launch System (PVLS) and Anti-Propagation Wall (APW) structures on DDG 1000 to produce the desired weld joint profile and quality. This labor-intensive process is slow, and the repetitive motion causes numerous injury claims, such as carpal tunnel syndrome. This project developed an automated back gouging tool that will leverage work done in a previous Navy Metalworking Center (NMC) project that developed a track weld shaver system. The system was modified to create a proof-of-concept demonstration that was successful in back gouging thin (<1 inch) plates requiring a shallow profile depth (1/4 to 1/2 inch). In order to meet the DDG 1000 back gouging requirements for PVLS and APW, the weld shaver was modified with; 1) larger diameter slotting cutter, 2) a redesigned housing, 3) a higher torque cutter drive and 4) drive and guide wheels in order to be able to back gouge to a depth of 1-1/2 inches.

Modifying the track weld shaver for DDG 1000 back gouging has increased the production rate by at least 150% and eliminated the labor required to clean and dress by grinding a deep arc gouged joint. As a result, estimated labor savings of approximately $400K per DDG 1000 has been identified.

Bruce Horn and Timothy Friedhoff, Concurrent Technologies Corp.

A New Hybrid Laser Arc Welding Center Opens Up

Traditional welding processes have forced designers and fabricators to account for the limitations in arc welding. The hybrid laser arc welding process takes advantage of traditional gas metal arc advantages and couples that with the high energy density of laser welding. This merger of technologies gives a weld that has advantages over either process separately.

Doug Zoller, American Tank & Fabricating Co.
Hydrogen Induced Cracking in Welding High Performance Steels

Over the past decades, steelmakers made significant alloying- and processing changes to lower Heat Affected Zone (HAZ) hardenability in structural steels. Accordingly, hydrogen induced cracking was found to have ‘migrated’ from the HAZ to the Fusion Zone. Typical Tekken (Y-groove) testing for HAZ became less useful in predicting minimum preheats. Instead, Gapped Bead-On-Plate or GBOP testing proved to be a better tool for predicting hydrogen induced cracking susceptibility. The presentation discusses work performed on GBOP testing High Performance Steels for bridge fabrication having yield strength up to 100 ksi, in which most preheats were eliminated by control of diffusible hydrogen, consumable strength and heat input. These studies were funded by the American Iron and Steel Institute, Federal Highway Administration and several state Departments of Transportation.

Yoni Adonyi, LeTourneau University

Investigation of Weld Metal Cracking in a Hydrotreater Vessel

Following several inspections and just prior to the on-site erection of a heavy-wall 2½Cr-1Mo-¼V hydrotreater vessel, a continuous, through-wall transverse crack was discovered in one of its girth welds. This case study details the investigation of this costly and unusual crack to its even more unusual root cause, how it managed to evade prior detection, and the implications and code interpretations that arose from the tests that ensued.

Robert W. Warke, LeTourneau University

Preventing Cracking in Nickel-Base Alloys

There are numerous causes for weld-associated cracking in nickel alloys and they generally can be classified as happening during welding, during heat treatment, or during service exposure. This presentation will examine the various cracking mechanisms that can occur during each of these scenarios. Examples will be given and suggestions will be offered regarding how to prevent the cracking.

Donald J. Tillack, Tillack Metallurgical Consulting, Inc.

Phased Array Ultrasonics for Detecting and Sizing Cracks in Welds

Cracking in new construction welds can be a serious problem as it can lead to structural integrity issues. Detection of cracking for AWS applications is normally performed using standard AWS D1.1 procedures. These procedures involve inspecting using search units with 45°, 60° or 70° beams with conventional manual ultrasonics. Manual inspections are now being performed using a special AWS array with a special wedge that generates all three beams – in compliance with the AWS D1.1 Code. The special phased array is built to AWS specifications, i.e. 2.25 MHz and correct aperture. The crack detection scans are used with a manual instrument that permits accurate location of the defect on an appropriate weld overlay. In addition to these standard AWS D1.1 approaches, Time-Of-Flight Diffraction and back diffraction detection and sizing examples will be shown, even though these are outside the AWS D1.1 Code.

Michael Moles, Olympus NDT

Pressure Vessel Crack Prevention in Weld Repairs and Alterations

The American Society of Mechanical Engineers (ASME) Code provides design rules for fabricating pressure vessels. After the Data Report is signed and the vessel is in service, the National Board Inspection Code (NBIC) shall be followed for all repairs and alterations. NBIC Part 3, Repairs and Alterations provides requirements to help prevent weld cracking in the repair and alteration of pressure vessels.

James T. Worman, The National Board of Boiler and Pressure Vessel Inspectors

Modern Power Source Technology that Drives Process Improvement

The goal of the welding industry is no different than that of other industries – improve productivity, ensure consistent quality, and of course lower costs. It is difficult if not impossible to attain these goals without accurate real-time and historical weld process information. In the past, some companies have attempted to use “bolt on” equipment to obtain this type of information. Welding power source manufacturers have now begun to incorporate weld process and production management information into their product offering. This discussion will focus on how the information provided by this new generation of power sources can be used to increase productivity, improve quality, reduce costs, and better manage the overall welding operation. AXCess power source will be used as an example.

Todd McEllis, Miller Electric Mfg. Co.

AC Pulse GMAW for Aluminum, Mild and Stainless Steels

This presentation will explain AC Pulse Mig welding, a new GMAW transfer used for welding thin sections and gap filling of aluminum and other alloys. Introducing Electrode Negative polarity to the GMAW Pulse arc to control heat input and improve travel speed will be explained.