

Laser Pipe Welding Project

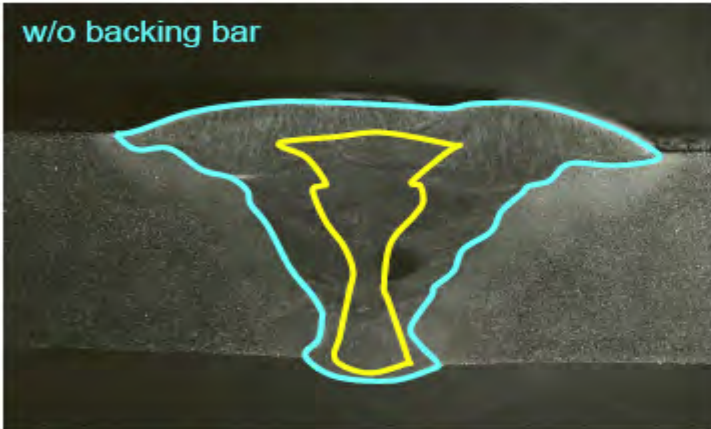
Center for National Shipbuilding Technology (CNST)
Pipe Welding Project Overview –
Updated Feb 2006

- Design a Hybrid Laser-GMA Pipe Welding System (30 Sept 2005)
 - Enlist commercial suppliers to be on team – participate in design reviews

Two companies eliminated and “Itemized Best and Final” released 26 Jan 2006, now in final discussion with the remaining two companies
- System to include:
 - Edge preparation and fixturing to guarantee suitable tolerance
 - Rotary fixture
 - Automatic seam tracking, and adjustment of weld schedule dependent on joint gap and geometry

Conventional Welds

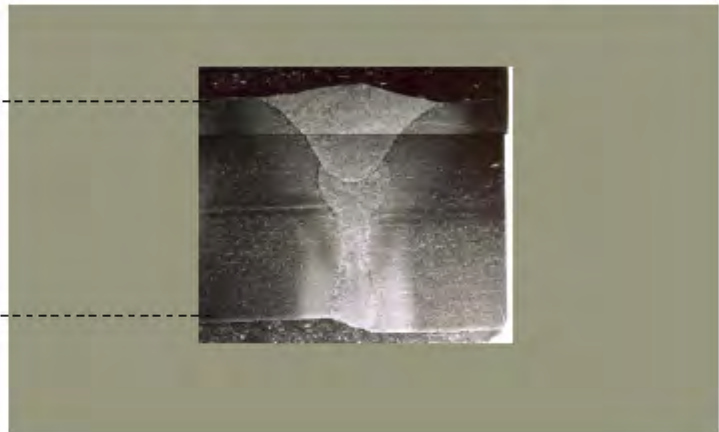
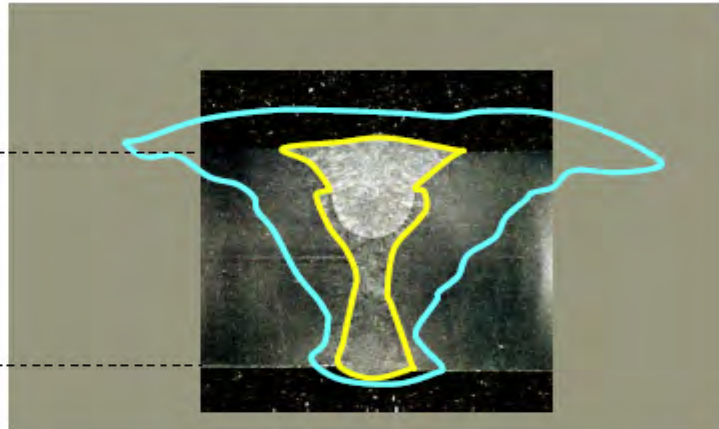
w/o backing bar



with backing bar



Hybrid Welds



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Pipe Welding Project Overview –
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- Assemble and test system, and develop process parameters at the Laser Processing Division at ARL Penn State (31 Aug 2006)

Current IPG Photonic 7.0 KW Fiber Laser Lease due to arrive at the end of April 2006

- Perform 3-month pre-production demonstration at NASSCO Shipyard (Sep-Nov 2006) –

Due to delays in Pipe Welding System procurement and IPG Fiber Laser Procurement, NASSCO pre-production demonstration likely to be delayed until Jan-Mar 2007

- Qualify Hybrid Welding of pipes to ensure rapid shipyard implementation in production –

Continued discussions with American Bureau of Shipping (ABS) and NAVSEA 05M .

This can begin in earnest once the Pipe Welding System is delivered to ARL

Project Plan -- Through May 2006

Hybrid Pipe Welding System


- Select Hybrid Pipe Welding System subcontractor
- Execute Hybrid Pipe Welding System subcontract

Fiber Laser Lease

- Complete, execute Fiber Laser Lease
- Receive, install and commission Fiber Laser at ARL Penn State

Parameter Development / Qualification

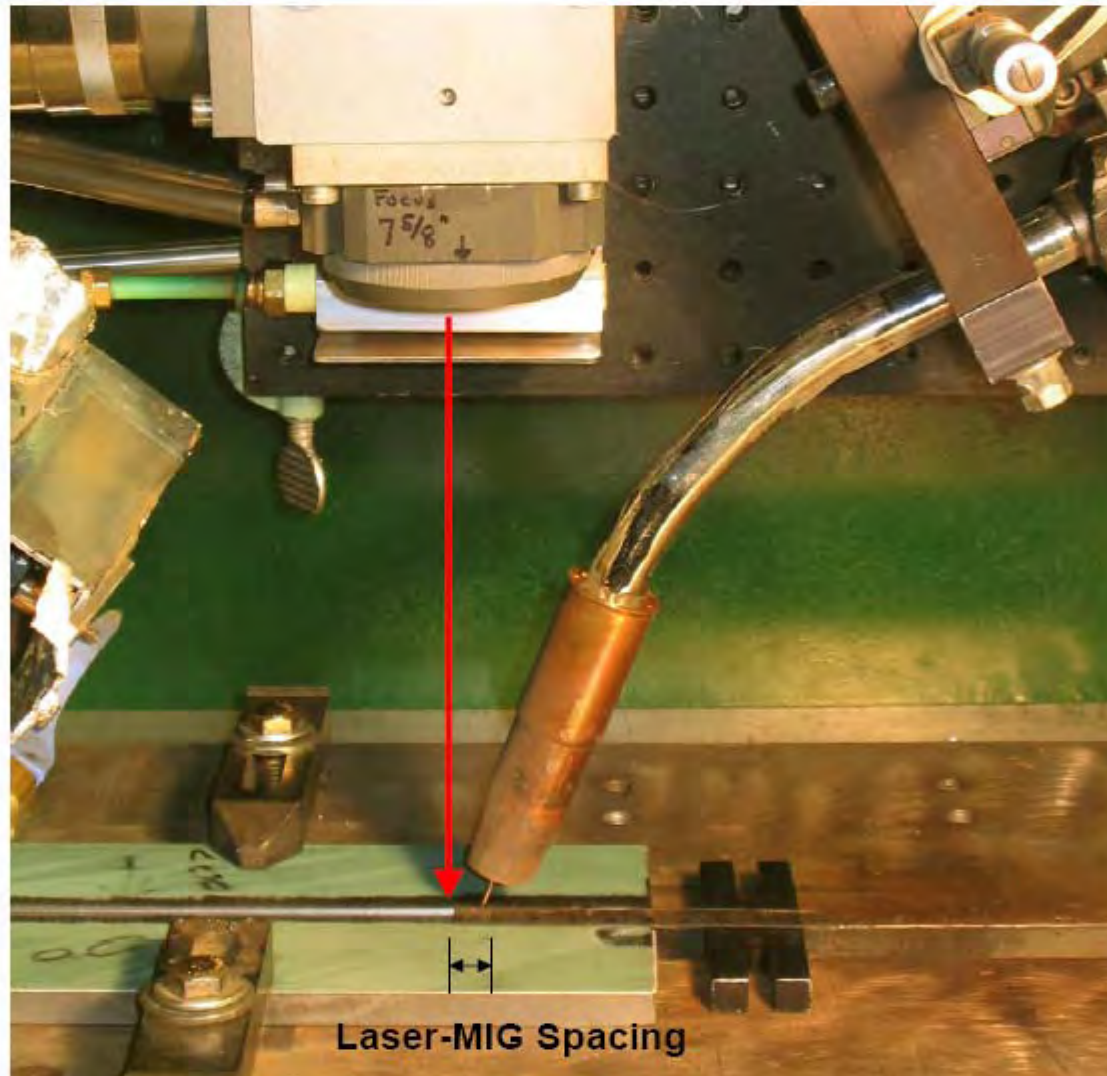
- Perform additional experiments with Fiber Laser

	<p align="center">PRODUCT SPECIFICATION LASER Model YLR-7000-B</p>	<p>Spec: Revision: Page:</p>	<p>PS-YLR-7000-B 2 4 of 12</p>
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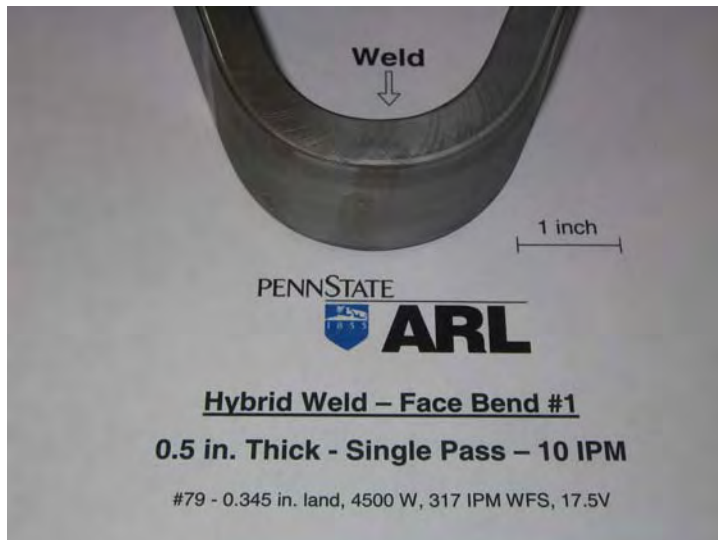
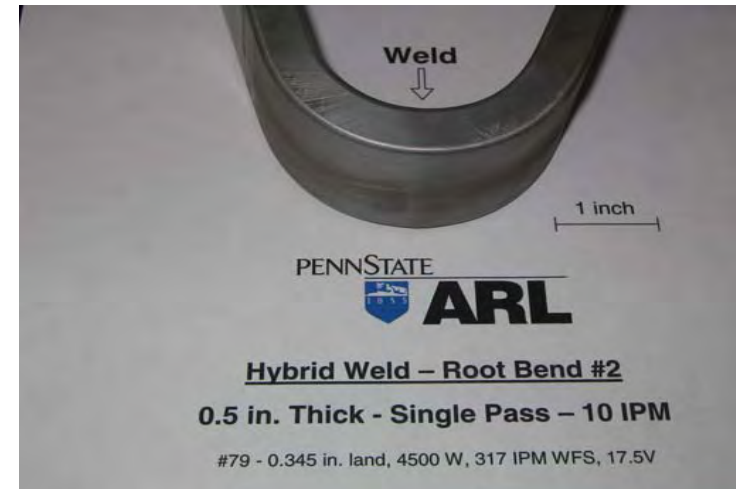
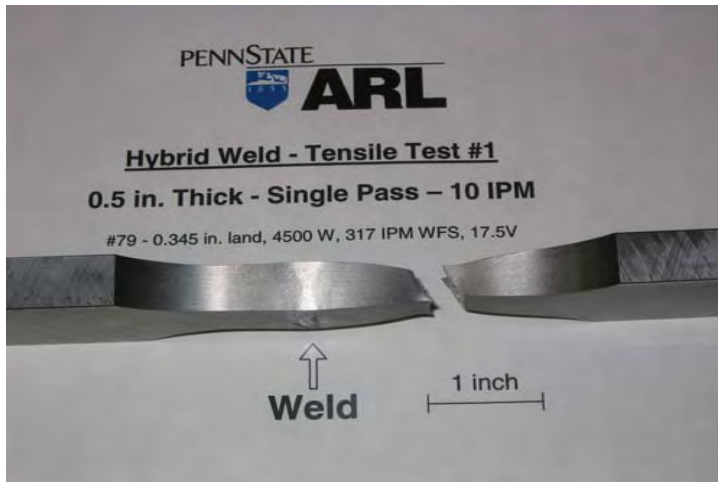
2.0 General Characteristics

Parameters	Test conditions	Min.	Typ.	Max	Unit
Operation Voltage (3 phases)		480V/3P+PE			VAC
Frequency		50/60			Hz
Power Consumption	$P_{OUT} = 7 \text{ kW}$		28	30	kW
Operating Temperature Range		+ 10		+ 50	°C
Humidity: without conditioner with built-in conditioner ¹	T < 25 °C T < 40 °C			90 95	%
Storage Temperature	Without water	- 40		+ 75	°C
Dimensions, H x W x D	NEMA-12 IP-55	1490 x 856 x 806			mm
Weight			500		kg
Plumbing		NPT Threaded Stainless Steel and/or Plastic Tubing			

¹ Option could be installed on customer request.





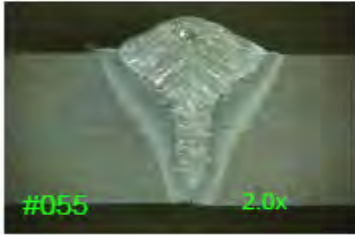

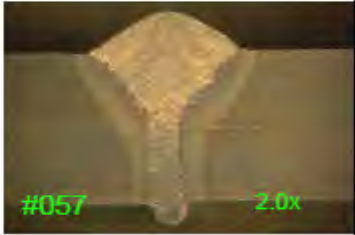
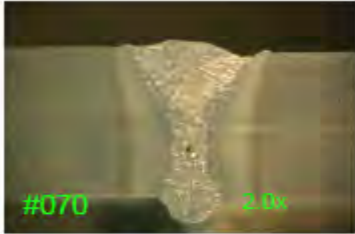


Mechanical Test Results



- All mechanical tests passed
- 0.5 in. thick 4.5 kW laser hybrid at 10 ipm travel
- 0.25 in. thick 4.5 kW laser hybrid at 65 ipm travel

Hybrid Welding

Travel
Speed
WFS
Voltage

	50 ipm 250 20.5V	60 ipm 300 23.7V	70 ipm 350 27V
			
			
			



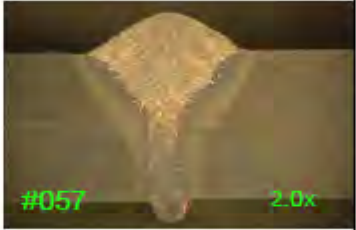





Hybrid
4500W
No Gap

4mm
Spacing
Laser
Leading

4mm
Spacing
Torch
Leading

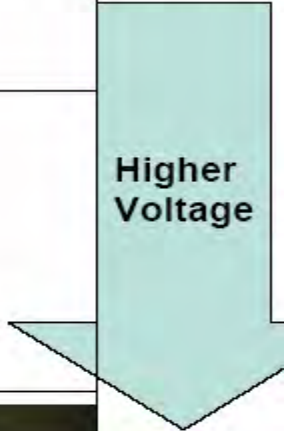
10mm
Spacing
Torch
Leading

Hybrid Welding

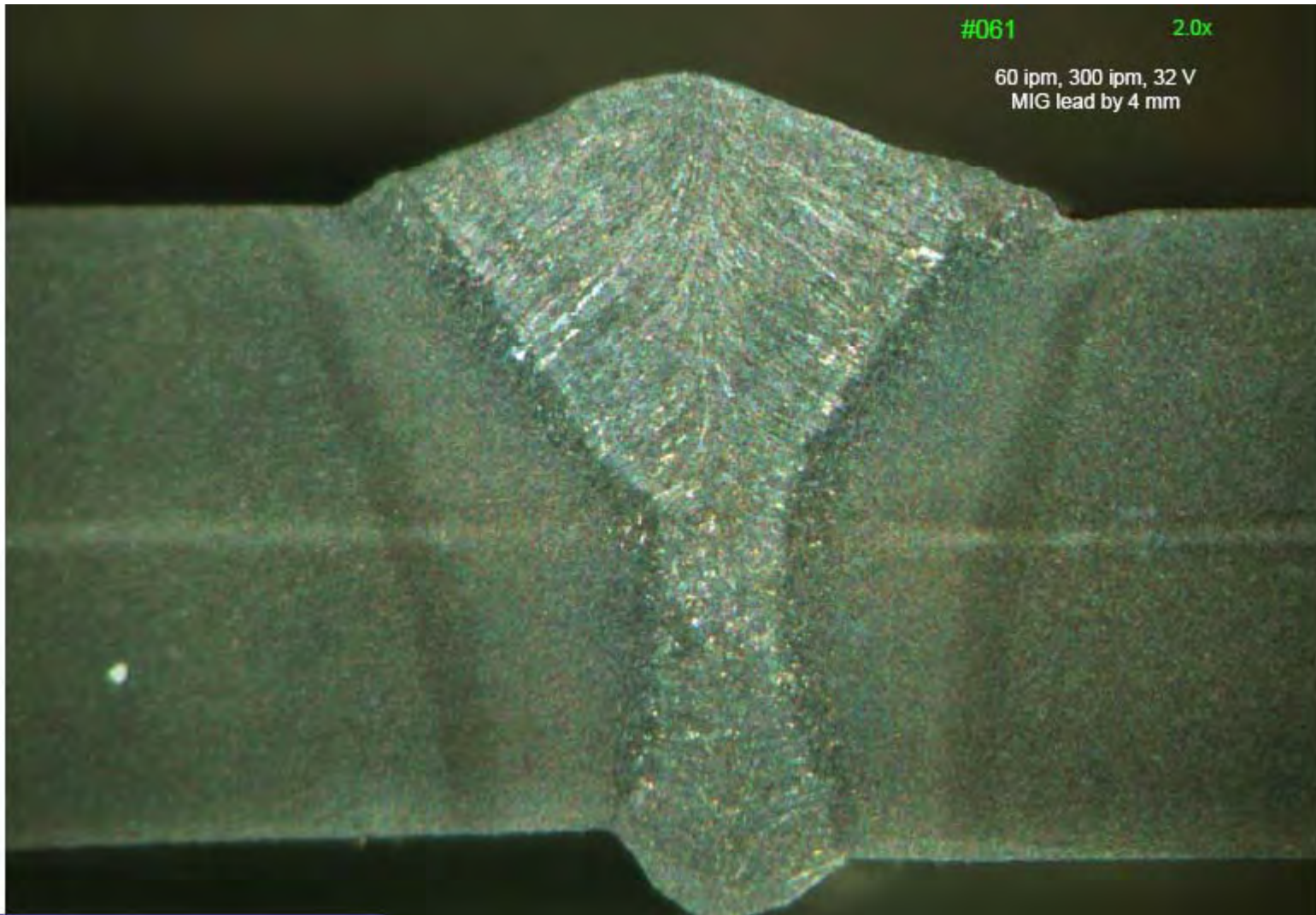
Travel Speed	50 ipm	60 ipm	70 ipm	80 ipm
WFS	250	300	350	400
				
Voltage	20.5V	23.7V	27V	
				
Voltage	29V	30V		
				
		32 V	33 V	35 V

Hybrid
 4500W
 No Gap
 4mm
 Spacing
 Torch
 Leading

Higher
 Voltage



Preliminary Data
 Please obtain permission prior to distributing further.



Laser Power 4500W

Travel Speed 60 ipm

3mm MIG-Laser Spacing

WFS 300 ipm

MIG Leading

32 Volts

No Backside Gas Shielding

