Center for Naval Metalworking
Cold Cutting Steel
Navy ManTech Project S2892

PoP: Sep 2020 – Jan 2023

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For additional information contact: https://cnm.ati.org/contact-us/

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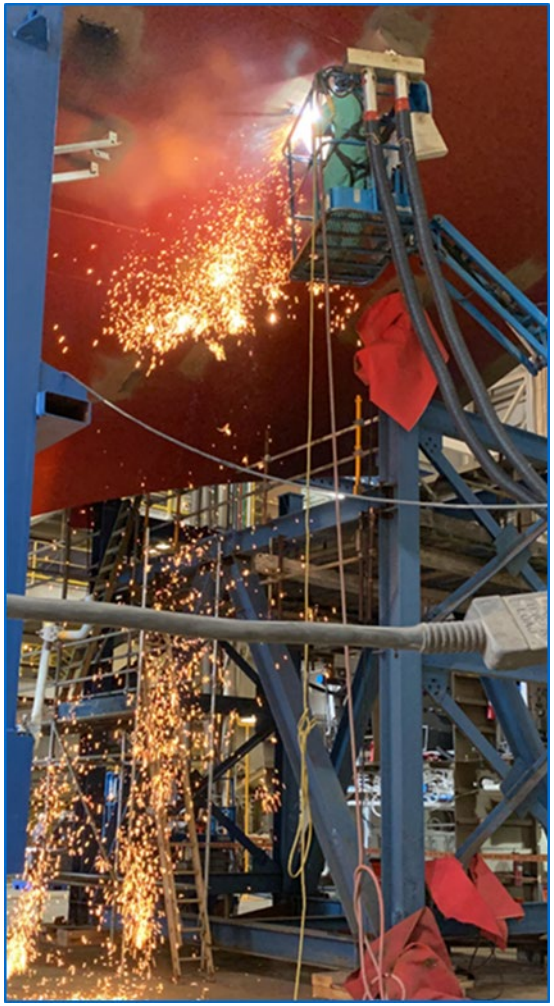
Problem Statement

- During the building of steel ships, it is common practice to employ “hot work” methods for cutting steel, not only in fabricating the ship components such as plate and shape products, but also when removing temporary attachments or other welded components that may need to be relocated later in the construction cycle.
- Current hot work methods employ the use of handheld burning torches and arc gouging equipment, which lends way to imprecise cuts.
- These cuts can result in wasting lifting pads by cutting too much material and cause rework due to damage on finished areas of the hull.



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Project Goals

- **Primary goal is to reduce hot work when removing Lifting & Handling attachments during later stages of construction**
  - Reduces impact to far-side, finished interior spaces
    - Eliminates requirement for hot work mitigation plan
      - Backside evaluation
      - Protective fire coverings
      - Fire watch
      - Paint/insulation/equipment removal
  - Reduces need for surface repair of base material (hull)
  - Reduces extent of hot work safety boundary
  - Allows operator to work outside of immediate cutting area



- **Secondary goal is to provide a clean cut to the attachment**
  - Diamond wire cutting creates a clean cut
    - Decreased labor hours for refurbishment of attachments
  - Customized pulleys will place wire rope close to the hull surface
    - Maximizes re-use of attachments
    - Reduces grinding requirements for removal of slug left behind from the attachment
  - Reduced extent of rework for paint touch ups in way of the attachments

- **Additional potential benefits:**
  - Opportunity for expanding cold cutting applications
  - Improved safety environment and reduced potential of injuries or long term ergonomic issues

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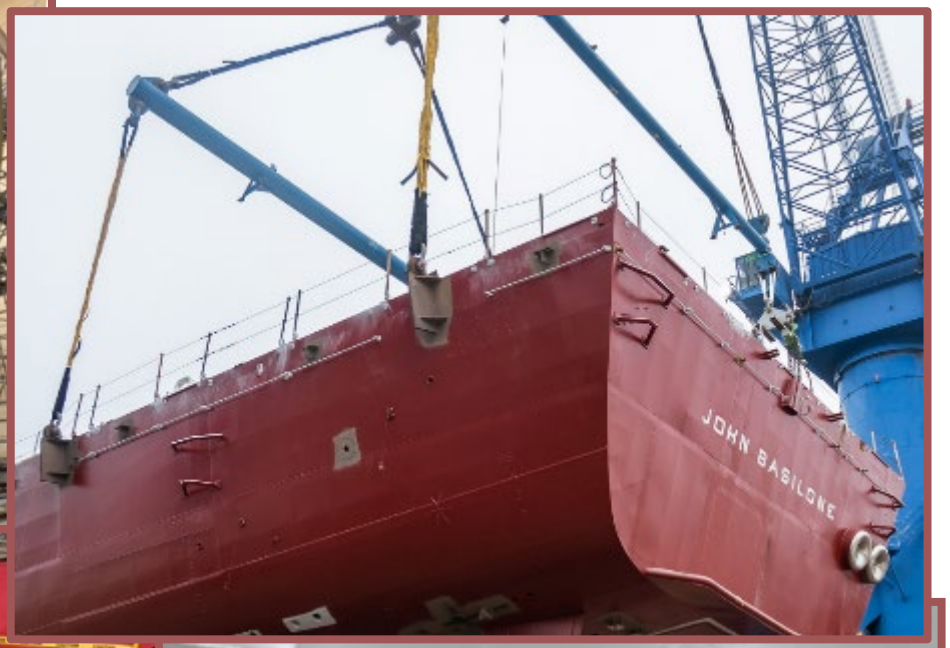
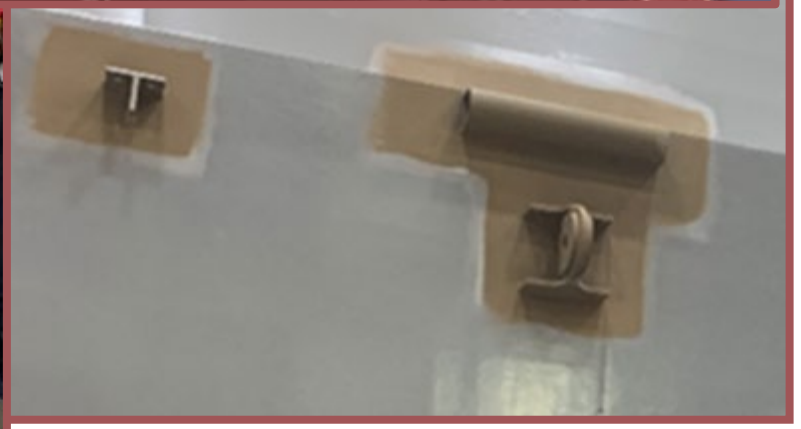
Temporary Attachments











Example of temporary attachments at BIW

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Selected Technology

WCE17 High Cycle Wire Saw



Specifications:

Wire Capacity:	56 feet
Wire Required:	Minimum 11 feet
Maximum Wire Storage:	41 feet
Weight:	190 lbs. without cover, 216 lbs. with cover
WCH17 Hydraulic Requirements:	17-21 GPM Power Pack,BS-2 Remote Control Unit
WCE17 Electric Requirements:	30 kW Power

- Modular Wire Saw for one-person operation-assembles into separate light-weight pieces
- 16kW, 22HP fully electric-no requirement for compressor air or hydraulics to actuate the take in cylinder
- Became available in November of 2021
- Includes inverter and remote control
- Stocked item

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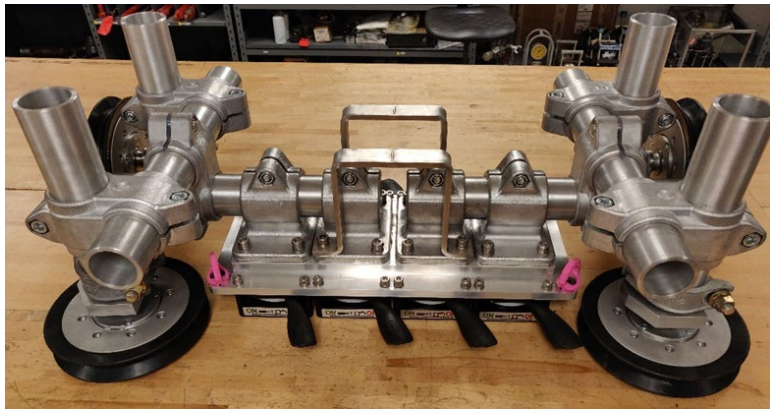
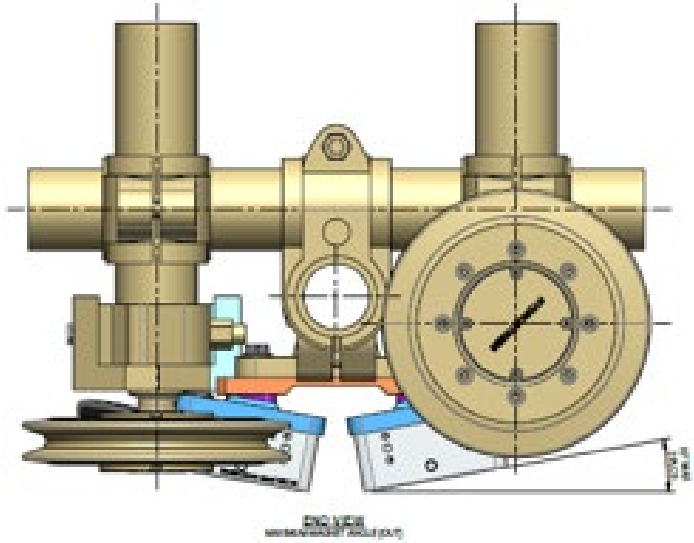
Prototype Development

- **Magnetic Wire Guide**
  - A custom wire guide developed to transition wire from the cutting unit to a plane parallel with the attachment to be cut.
  - Keeps the wire as close as possible to the surface of the base material to provide a near-flush cut, without damage to the base material
- **Design development after initial cutting**
  - Handles have been improved to move away from connections and rated to use for safety tie off
  - Replaced machined (custom) shims with angled ball connection





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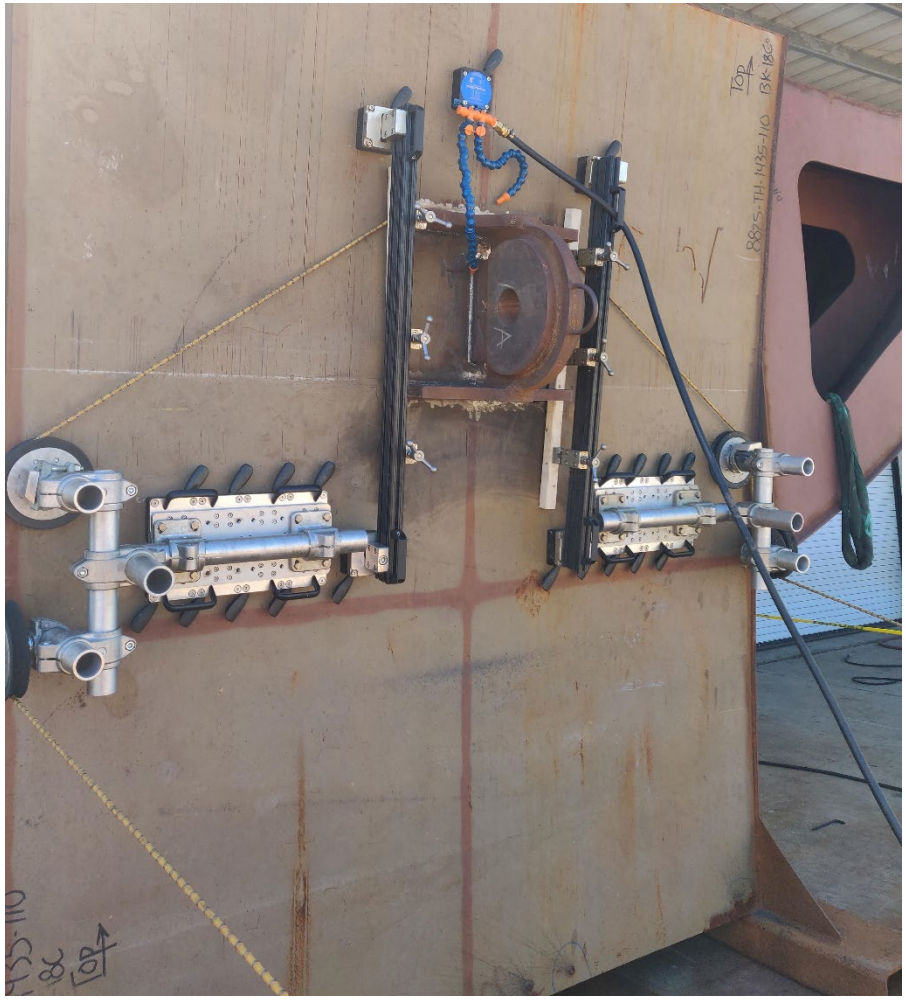
Prototype Development

- **Separated into two units for optimizing placement and easier lifting**
  - Allows magnetic pulley guide to be placed away from the attachment
  - Lessens impact of uneven surfaces caused by welding of back-side structure
  - Reduces hard angle on diamond wire
  - Moves magnetic base away from metal shavings from cutting process



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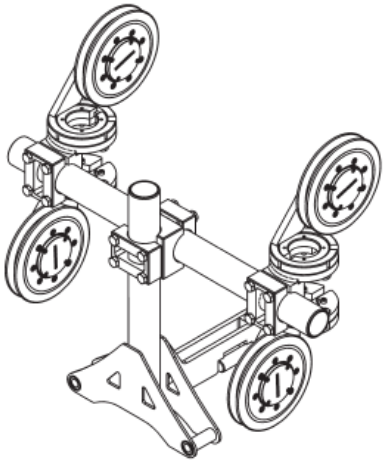
Prototype Development

- **Magnetic base option added to Universal Transition Pulley for mounting to the deck without using welded studs**







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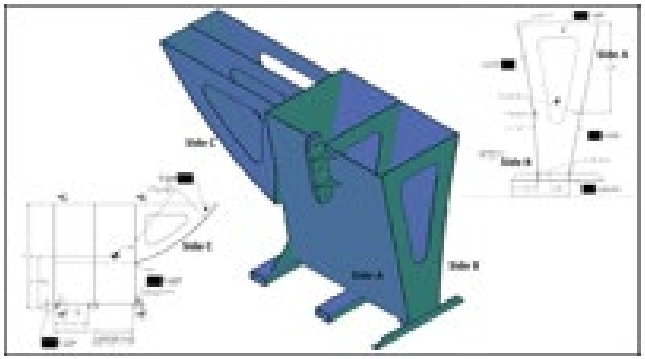
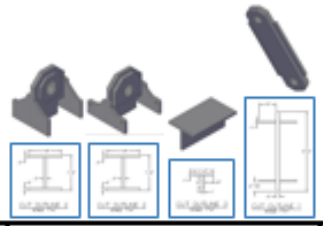
Testing

- Demonstration of Functional Requirements with various configurations and attachment sizes





Clevis		DW		Trial No.	Attachment Type				Vertical Surface			Attachment Location [on mock]	Setup Approach [DWS placement]		Services						surface		Tools Required										
Video option	mock drum	Ship drum	mock drum		Type I	Type II	Type III	Type IV	A	B	C				Crane	Crane Lift	Staging	Ship Ladders	Catch ceiling/grt	Power (elec)	Air	Water	Other (detail)	Bare steel	Painted		Initial setup time	Cut time	Cutting rate	Temperature	Performance 2	Flush cut	Surface gouge	Removal flexibility (no. mods)	Total time mods	Damage to attachment	(Dry Cut Cycle)
					35T ft	100T ft	Panel Line	300T Platen	Straight	Contour	Contour																Functional Requirement No.										
																											5	2	2	5	11	13	13	14	14	16	
	✓			1	X						X	6" from top edge	Desk		✓	✓			✓	✓		✓					X	X	X	X		X	X	X	X	X	
			✓	2	X						X	scallop of overall height		Ground	?				✓	✓		✓					X	X	X			X	X	X	X	
yes	✓		✓	3		X			X			6" from top edge	Desk		✓			✓	✓		✓					X	X	X	X		X	X	X	X	X	
	✓			4		X				X		1/3 overall height from top edge		Ground	✓				✓	✓		✓					X	X	X			X	X	X	X	
yes	✓		✓	5			X		X			6" from top edge	Desk		✓				✓	✓		✓					X	X	X			X	X	X	X	
	✓			6			X			X		scallop of overall height		Ground	✓				✓	✓		✓					X	X	X			X	X	X	X	
yes	✓		✓	7			X				X	scallop	Desk						✓	✓		✓					X	X	X			X	X	X	X	
	✓			8				X	X			upper bracket is 6" below top edge	Desk		✓				✓	✓		✓					X	X	X	X	X	X	X	X	X	X	
yes	✓		✓	9				X		X		upper bracket is 6" below top edge		Ground	✓	✓			✓	✓		✓					X	X	X	X	X	X	X	X	X	X	
		✓		10											✓				✓	✓		✓														
		✓		11															✓	✓		✓														
		✓		12															✓	✓		✓														

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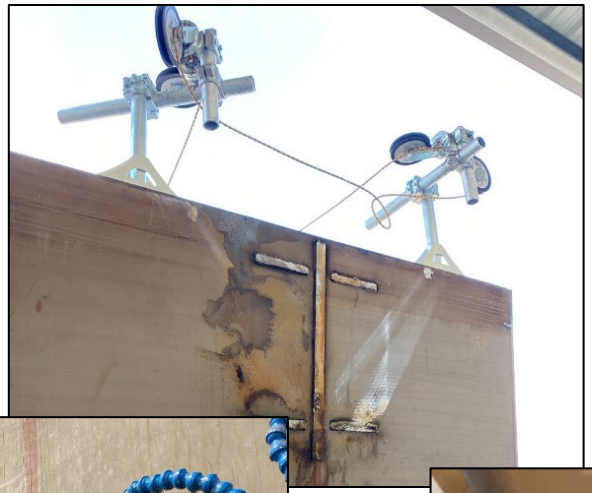





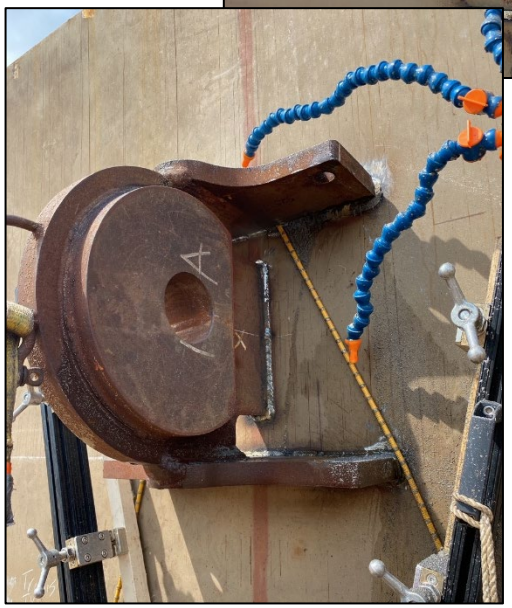



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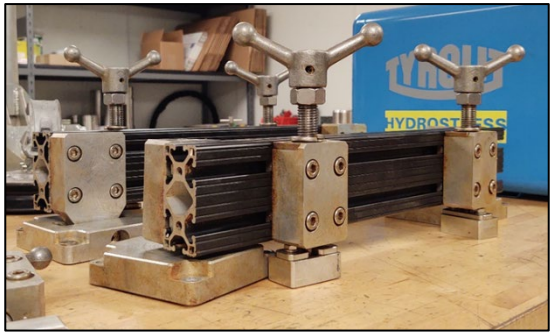
Lessons Learned

- **Wire Guide System**
- **Improved design to interchangeable magnet and angle bar configuration**







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Lessons Learned



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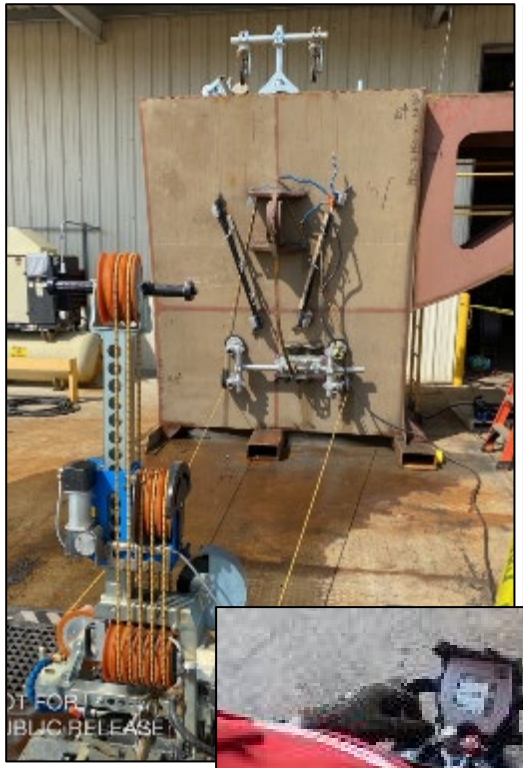
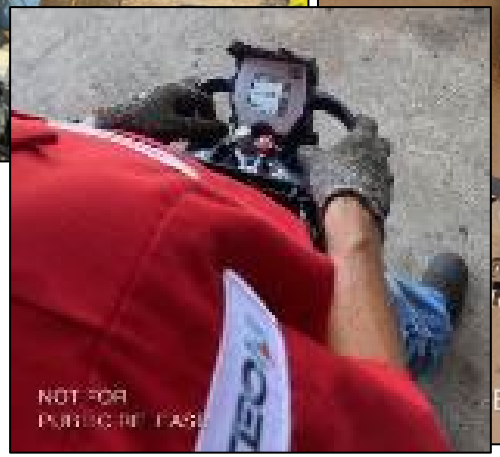
Lessons Learned









Initial testing at Claxton

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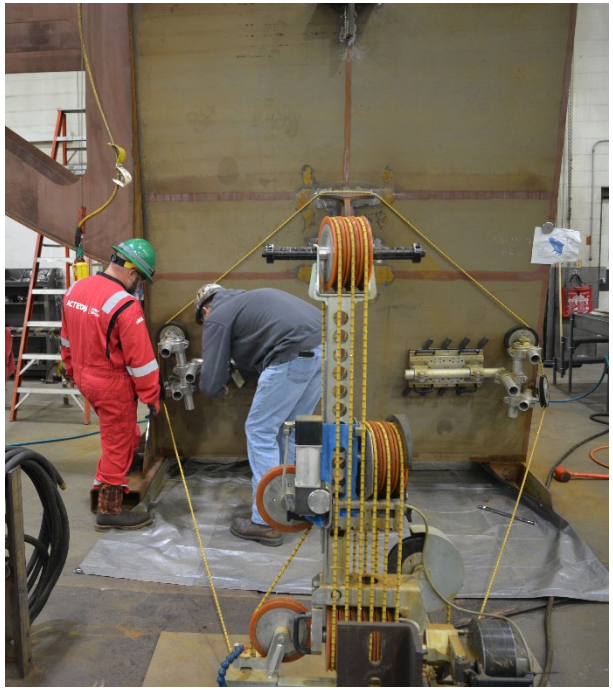
Accomplishments

- Fabrication of testing mocks with representative structure
- Development of Prototype Pulley System







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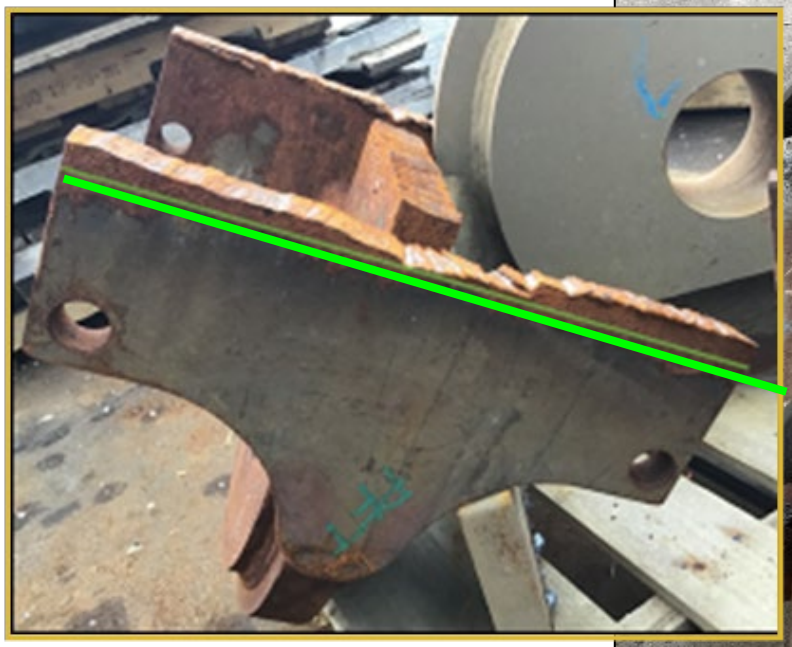
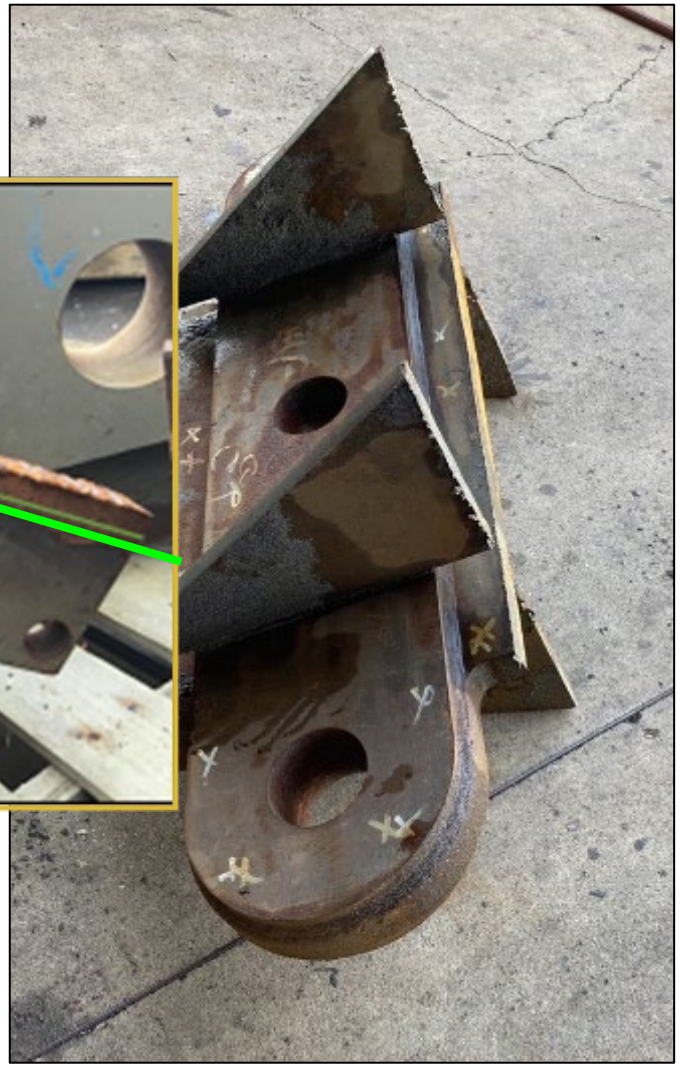
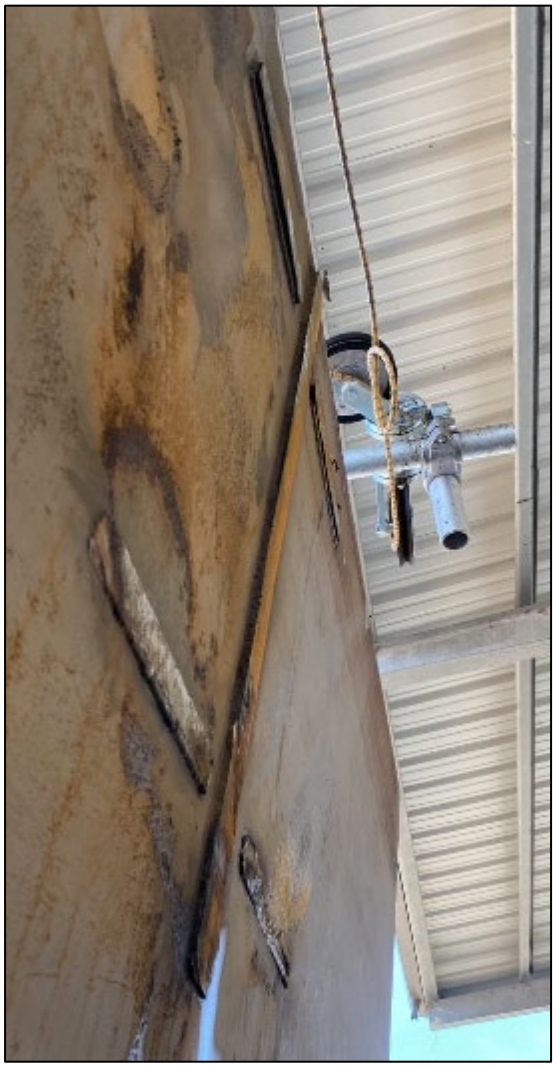
Improvements







Cut Performance

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Improvements



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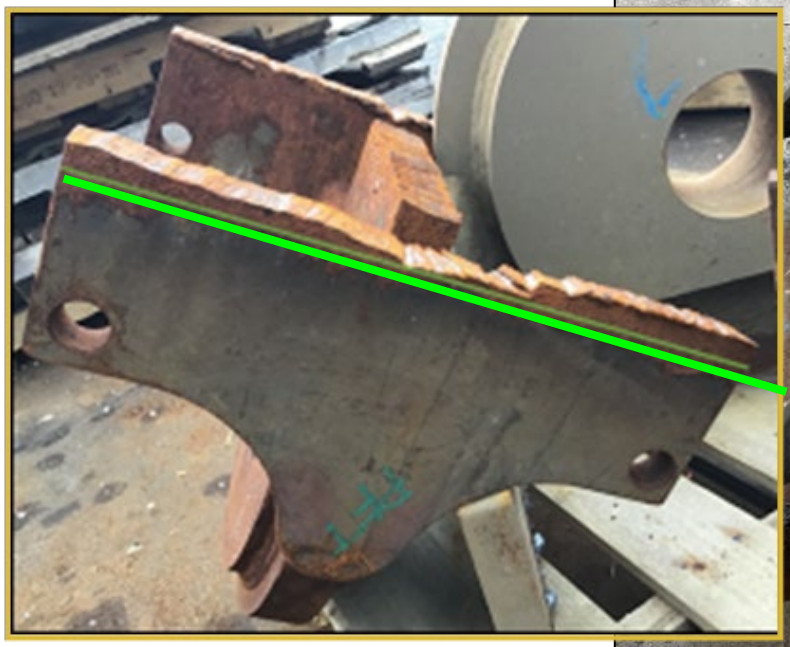

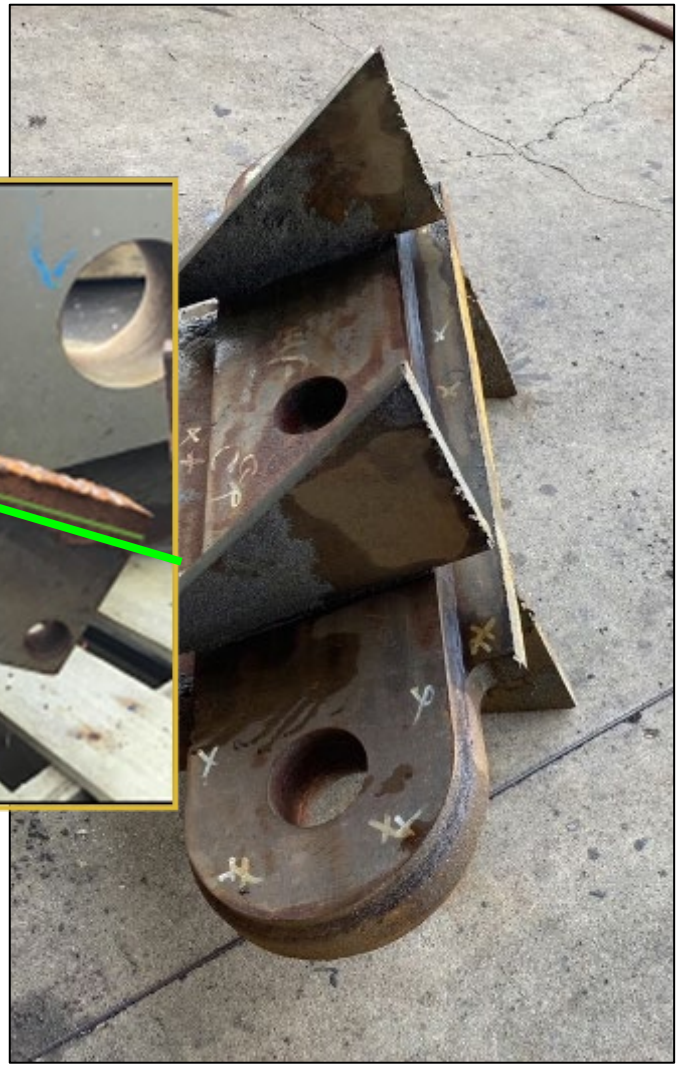

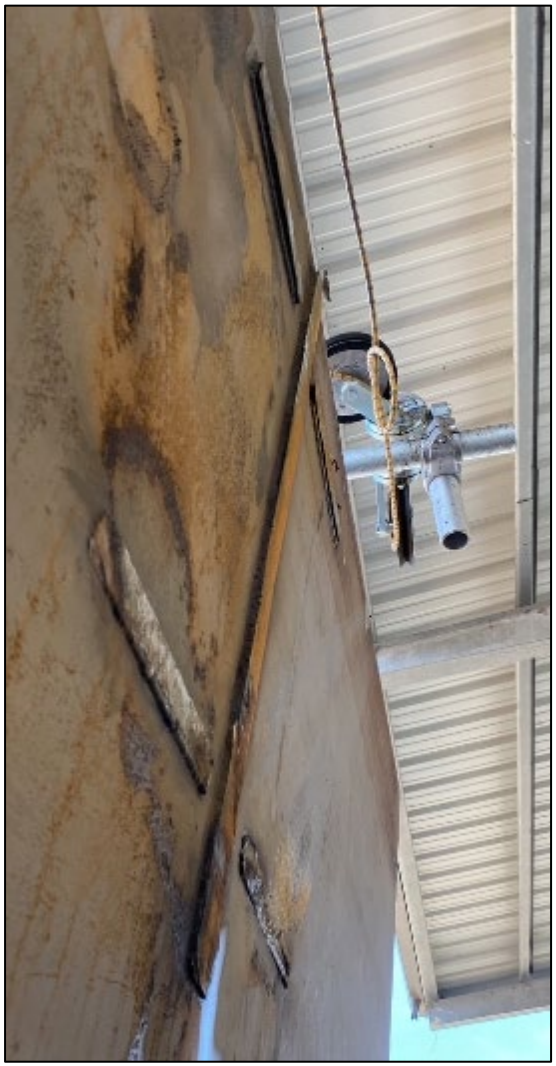

Cut Performance

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Summary & Benefits

- New cutting method
- Reduce costs for engineered lifting attachments by 66% per year
- Reduce costs of rework due to hot work damage by 75% per year
- $1.7M five year savings
- ROI = 0.91

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