

## CASE STUDY

### APPLICATION

# Multi-material Glass Bottle Molds

### EQUIPMENT

AMBIT™ FLEX LMD ON 5-AXIS CNC



**ROSS**  
INTERNATIONAL  
WHERE EXCELLENCE TAKES SHAPE



**HYBRID**  
MANUFACTURING  
TECHNOLOGIES



## Background

Few molding applications are more demanding than making glass bottles.

Molten glass is highly abrasive so glass bottle molds must be wear-resistant and rapidly remove heat from the glass.

A typical glass bottle mold can produce more than half a million bottles in its lifetime.



# Opportunity

Ross International subsidiary  
Moldes Medellin desired to  
improve:

**Molding performance** with

- Faster Heat Removal &
- Higher Wear-resistance

**Moldmaking** with

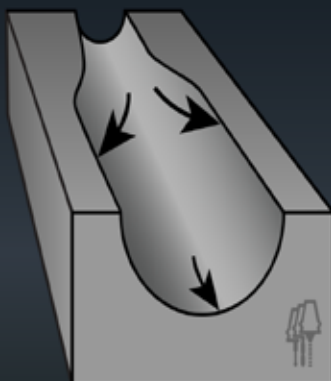
- Reduced Lead time &
- Fewer Production Steps

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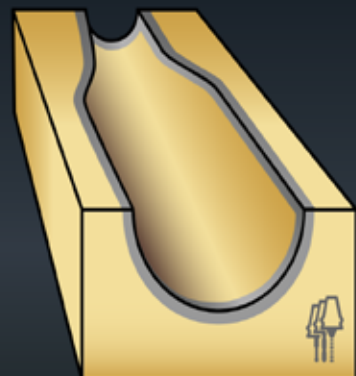
# Innovation

The insight that wear-resistance is most critical at the mold edges (see black arrows) prompted use of a thermally conductive material for the bulk of the mold with reinforcement at the edges.



**Shift From:**

Cast iron mold  
(single material mold)



**Move To:**

Bronze mold with reinforced  
edges (multi-material mold)

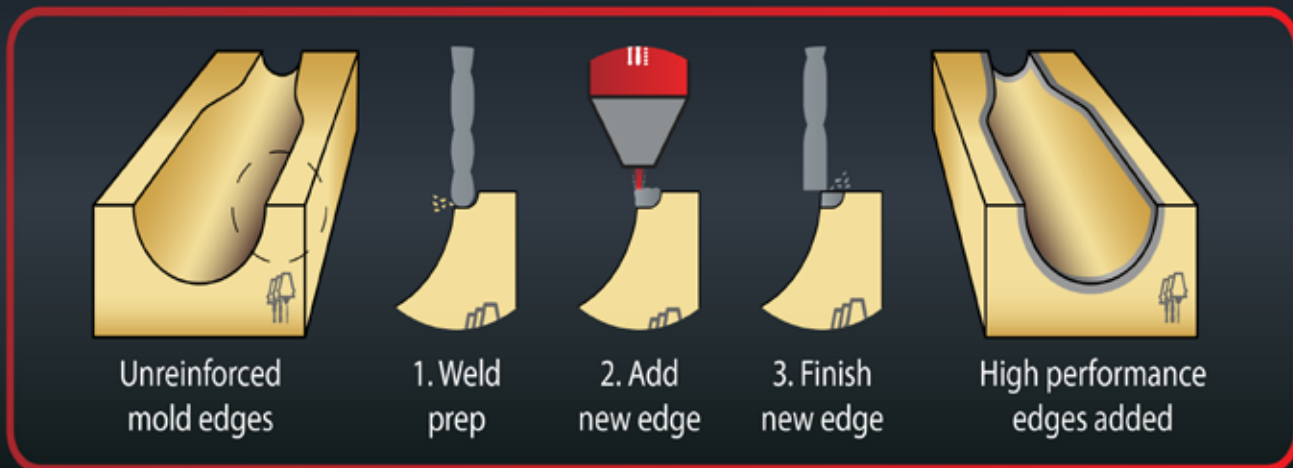
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# Multi-material Moldmaking

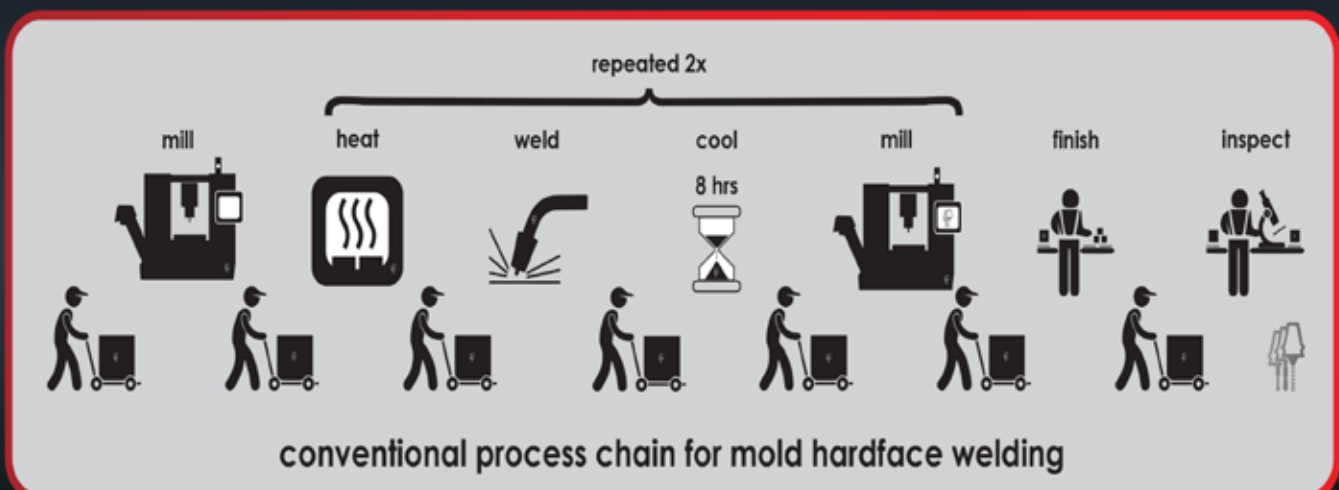
Multi-material moldmaking begins the same way as single material moldmaking: the bulk mold material is cast into a slightly oversized (near net) shape and machined to the final (net) shape. However, multi-material molds require three additional steps to “hardface weld” the edges as shown here:



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## Moldmaking Process Chain - 1st Iteration

A conventional hardface welding process chain was adopted to add high performance (and repairable) edges. To avoid cracking (due to the high heat input of welding) two sets of preheat, weld, and cool down cycles were required (many setups) as shown here:

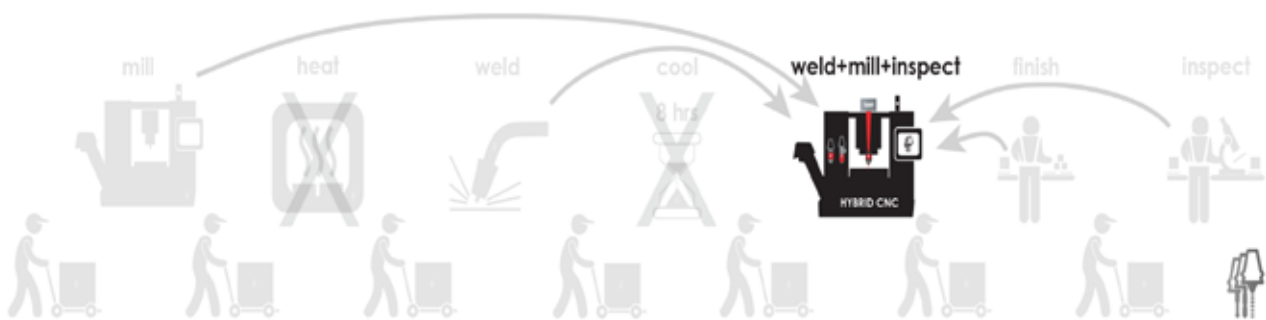


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# Moldmaking Process Chain Consolidation

Adopting AMBIT™ hybrid manufacturing machines enabled the consolidation of many manufacturing steps. Laser-based hardface welding eliminated the need for preheat and cool down. Fewer setups resulted in significant efficiency gains.

## AFTER



consolidated process chain for mold hardface welding using a hybrid CNC

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## CASE STUDY



## RESULTS

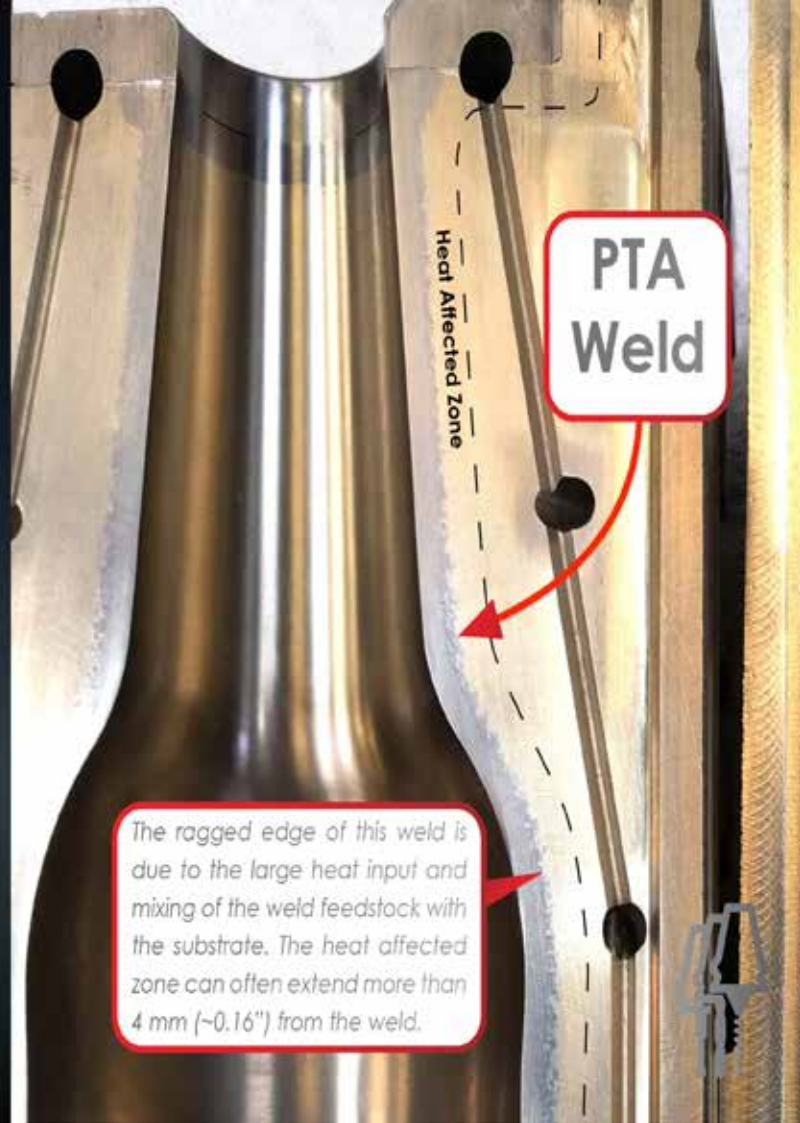




## Mold Performance - Interim Step

Traditionally, hardface welding was achieved using arc-based (plasma transferred arc, "PTA"). While this provided a long wearing edge, material in the adjacent heat affected zone "HAZ" (dashed line) became susceptible to the release agent used during molding. This led to failures where the bronze eroded out from behind the hard edges and they fell off.

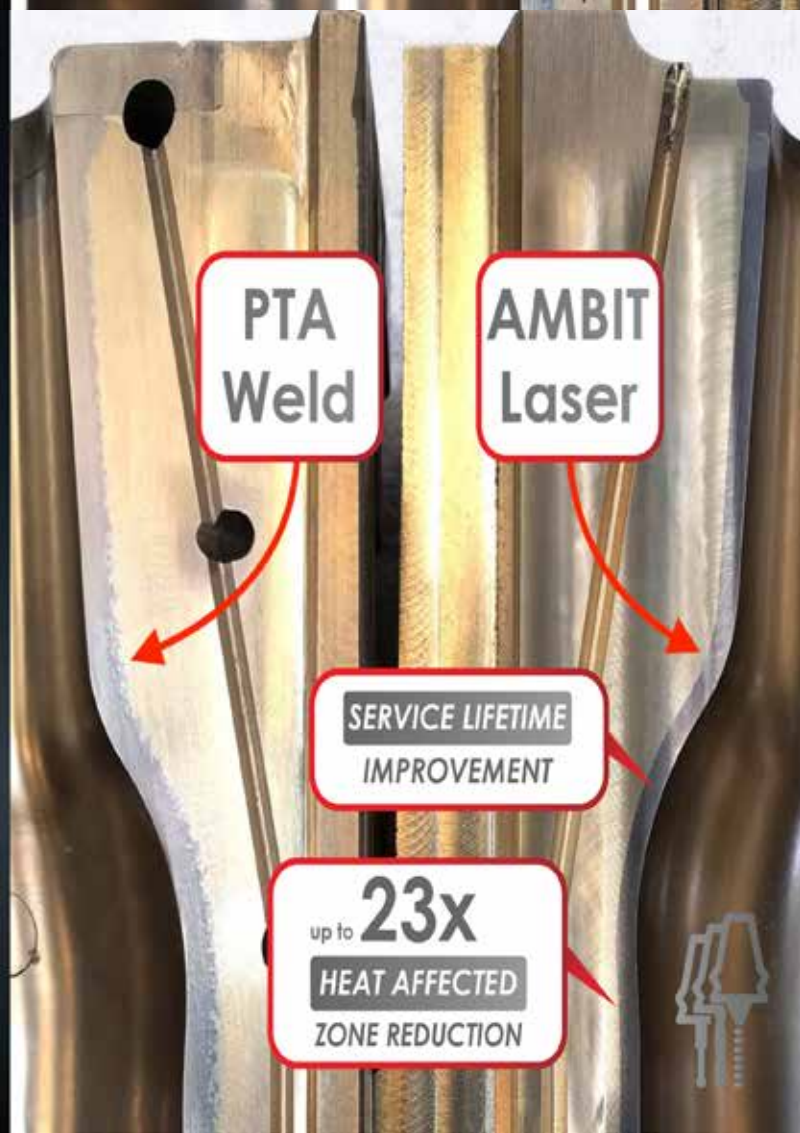
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## Mold Performance

Moving to laser-based AMBIT™ hybrid machines enabled hard-face welding without preheat and with less heat input. This significantly reduced the heat affected zone, down to ~0.2 mm (~0.008"), and thereby reduced the mold's susceptibility to failure. This achieved the desired **molding performance** with faster heat removal and longer lasting wear-resistance.

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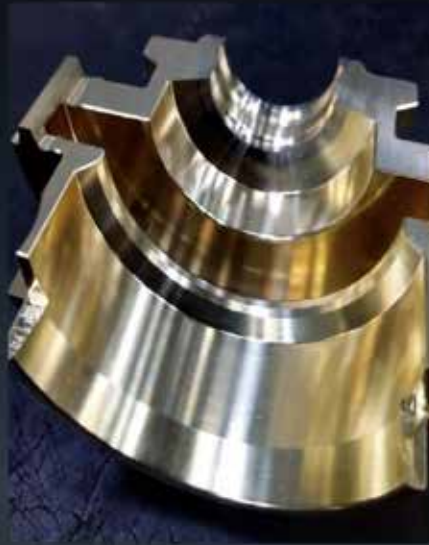




# Metrics



up to **42x**  
**LEAD TIME**  
IMPROVEMENT



up to **17x**  
**PRODUCTION**  
SPEED IMPROVEMENT



up to **41%**  
**PRODUCTION**  
COST SAVINGS



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## Moldmaking - Fewer Production Steps



Adopting AMBIT™ hybrid CNC machines enabled fewer production steps which reduced lead time, setups, and production time dramatically.

up to **93%**  
**WORK IN PROCESS**  
REDUCTION

**10 → 2**  
**SETUPS**  
REDUCTION

**9 → 2**  
**EQUIPMENT**  
REDUCTION



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# People



Improving the lives of people is the ultimate driver for the adoption of AMBIT™ technology.



**NO HOT**  
PART HANDLING  
ELIMINATED



**5 → 1**  
DATA SYSTEMS  
UNIFIED

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## Return on Investment

Adopting hybrid processing can reduce enough work in process to free up cash to cover the purchase of a hybrid CNC. Even excluding this, the payback period for an AMBIT™ system (at 85% utilization) is often less than 12 months:

**7-9** MONTHS  
PAYBACK  
PERIOD

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Multi-material  
mold produced  
with AMBIT™  
hybrid CNC



"By using HMT's AMBIT™ - subtractive & additive manufacturing on the very same CNC machines, we have reached **levels of efficiency never imagined**, nor possible before... everyone producing glass bottle molds should be adopting this approach."

Juan Cadavid  
Executive Vice President  
ROSS INTERNATIONAL LTD

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## CASE STUDY

"AMBIT™ solutions make it practical to produce multi-material products profitably"

Dr. Jason Jones  
Co-founder & CEO



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