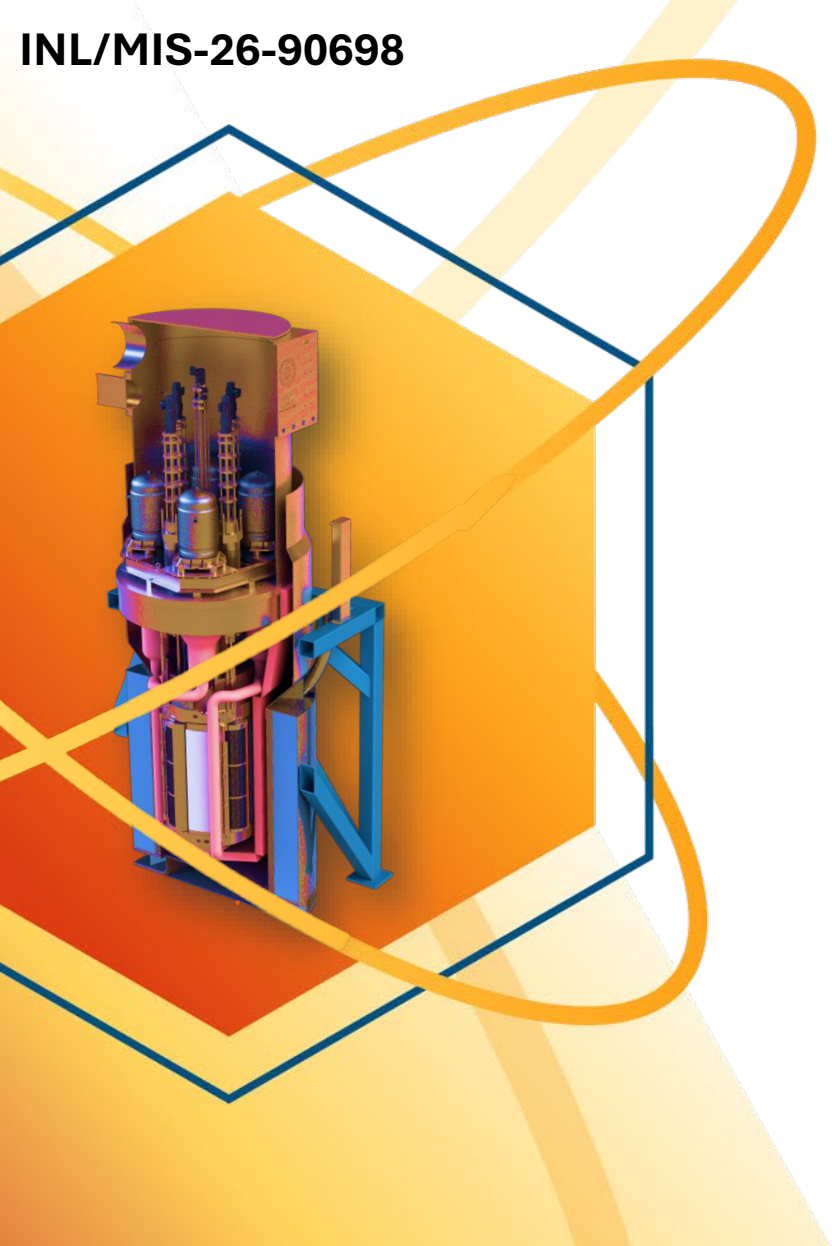


# MARVEL – Reactor Component Fabrication

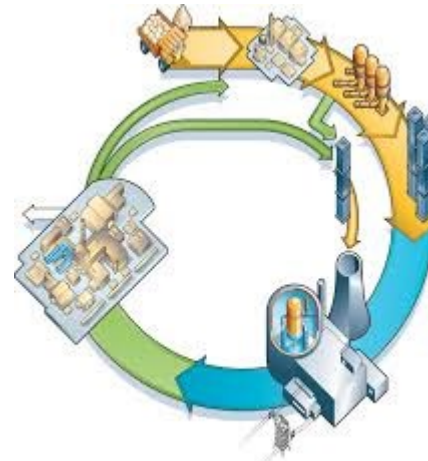
Microreactor Program Review  
March 2026

R. Gannon & R. Clark

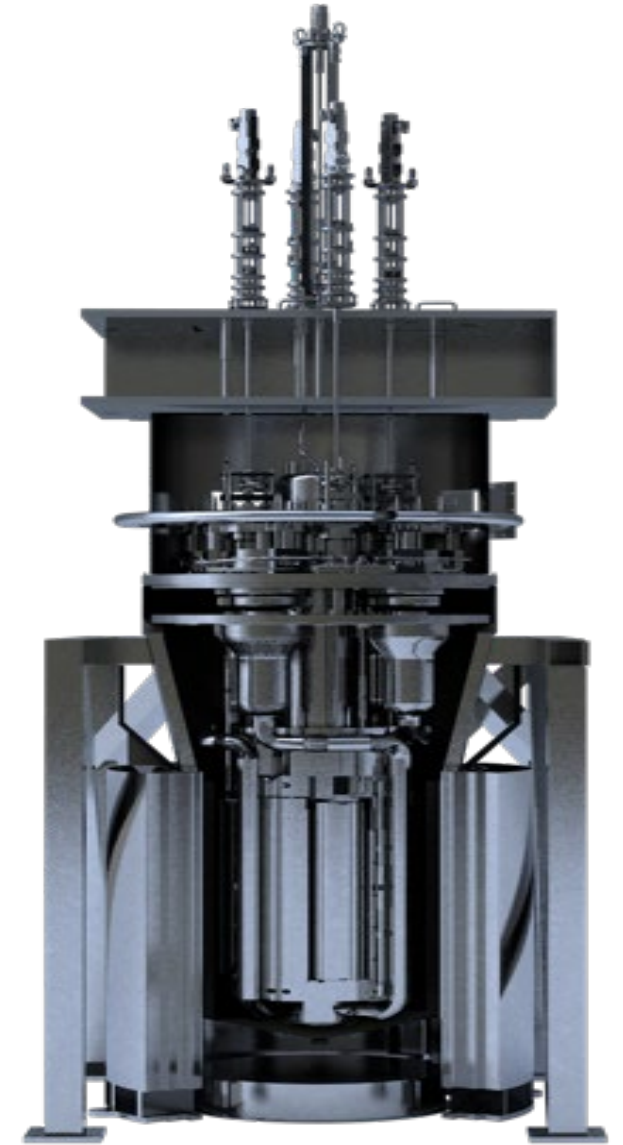


# MARVEL Reactor Fabrication

- Introductions
- Challenges & Successes
  - Reactor Design and Fabricability
  - Fabrication Challenges
  - Material Characteristics
  - Supply Chain & Market Priority
- Fabrication Status
- Keys to Project Success
  - Commercial Grade Dedication
  - On-site Fabrication QA Presence
  - Strong Project Team

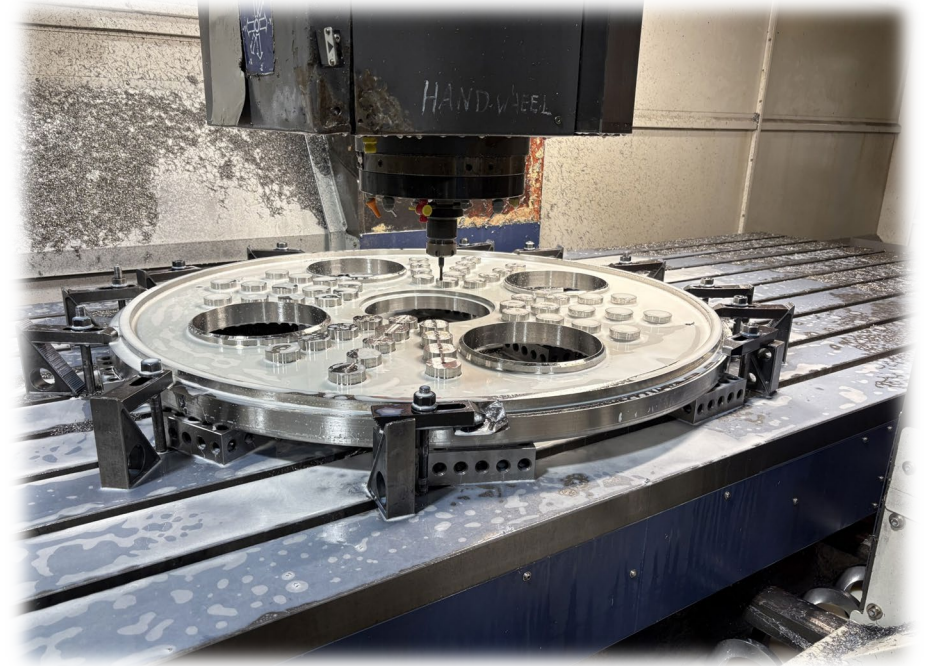


Closed Career  
Cycle



# Fabrication Challenges

- Fabrication Expertise
  - Precision machining is in extremely high demand
  - Multiple business sectors are leaning on the same proven and tried vendors
  - Backlog of work at leading vendors prevented bidding on contracts with aggressive timeframes
  - ASME Section III requires extensive QA and NDE inspections, getting these to align with fabrication activities has proven to be a challenge
  - MARVEL's fabrication subcontractor maintains an impressive network of sub tier companies
  - Early and continuous planning for scheduled fabrication activities to hold overall project schedule
- Design Challenges
  - Control Drum Drive Design
  - Shaft Splines
  - Machine – Then Design



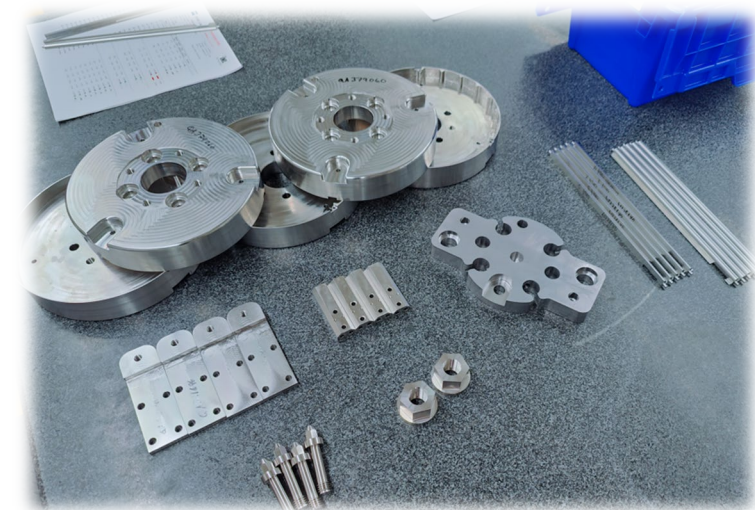
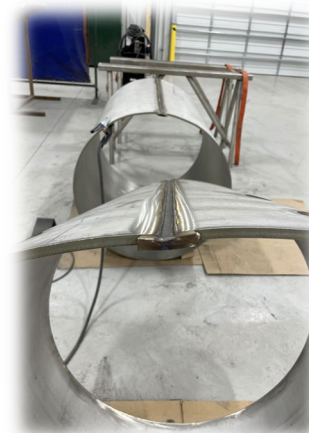
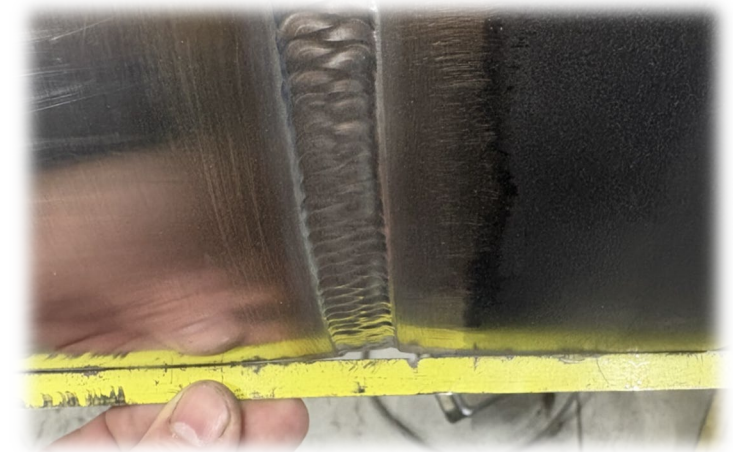
# Material Characteristic Challenges

## Design Required Material

- MARVEL system components are fabricated mostly of 316H Stainless Steel (SS)
  - 316H high-carbon austenitic stainless steel designed for elevated temperature service
  - Higher Carbon ensures enhanced tensile and creep-rupture strengths at higher temperatures

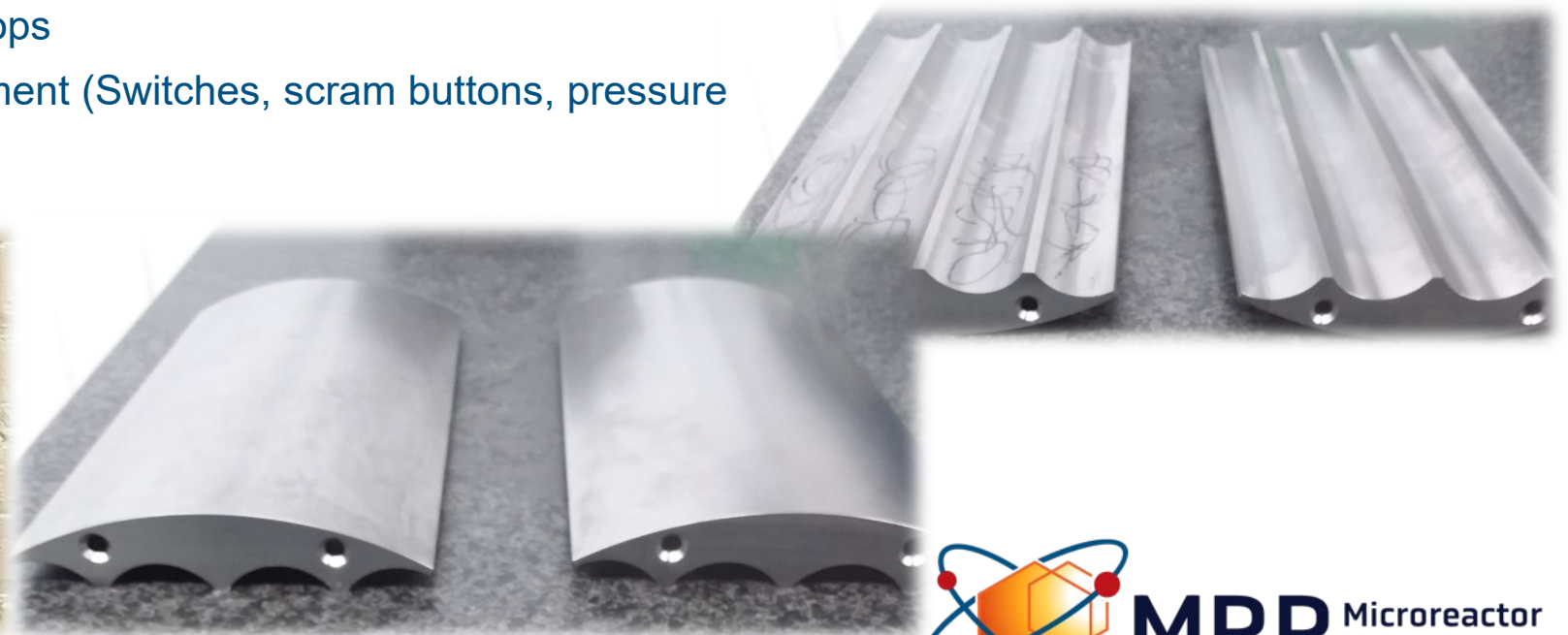
## SS 316H Difficulties

- Reactor Control System (RCS) at the MFC Fabrication Shop
  - Project experienced warpage of the material during machining
- Primary Coolant System
  - Project experienced localized weld distortion during fabrication
- Lessons Learned
  - Carbide cutting tools at high cutting speeds
  - Methodical cutting with consistent cooling
  - Procure extra material for rework
  - Use of semi-automated MIG welding procedures for minimizing material shrinkage

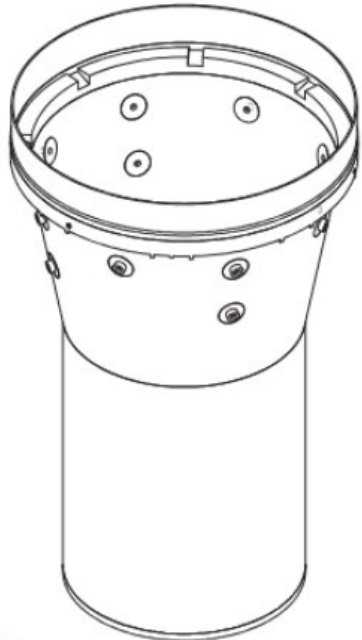


# Supply Chain and Market Priority

- Supply Chain
  - Availability of 316H SST for common shapes, sizes and configurations has proven to be limited with long lead times.
  - Fabrication planning, order additional material for re-work, practice, spares, etc.
- Defense Priorities and Allocations Systems (DPAS) Rating
  - DPAS DO Rating Applied to Key Contracts
    - Beryllium Metal Reflectors
    - Sub-tier Machine Shops
    - Safety related equipment (Switches, scram buttons, pressure gauges, etc.)

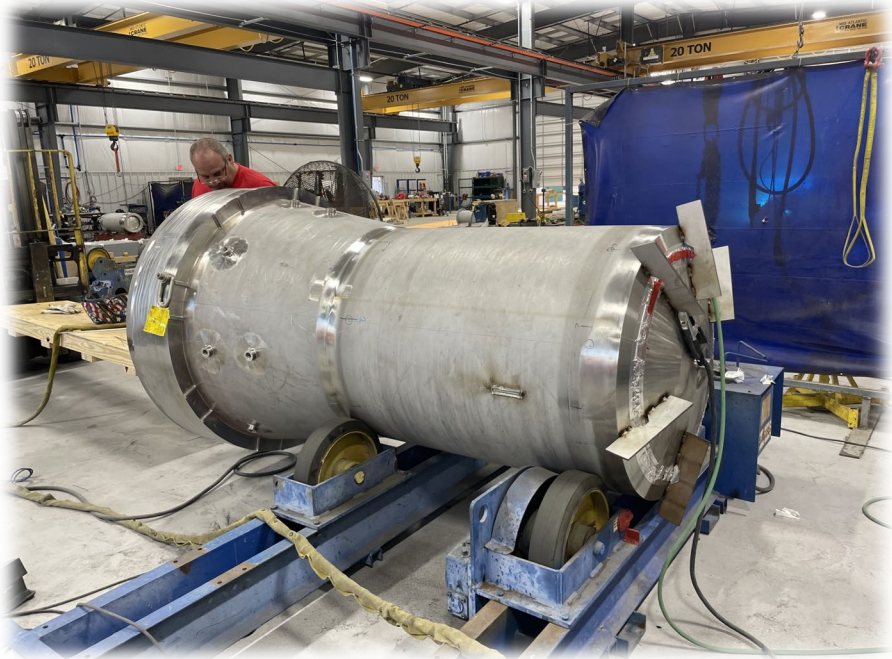
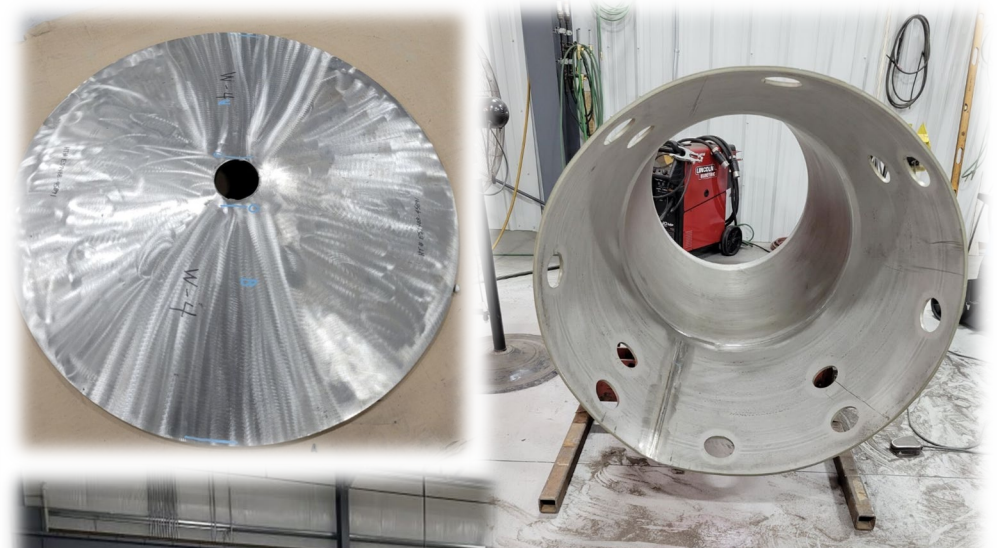


# Guard Vessel Progress

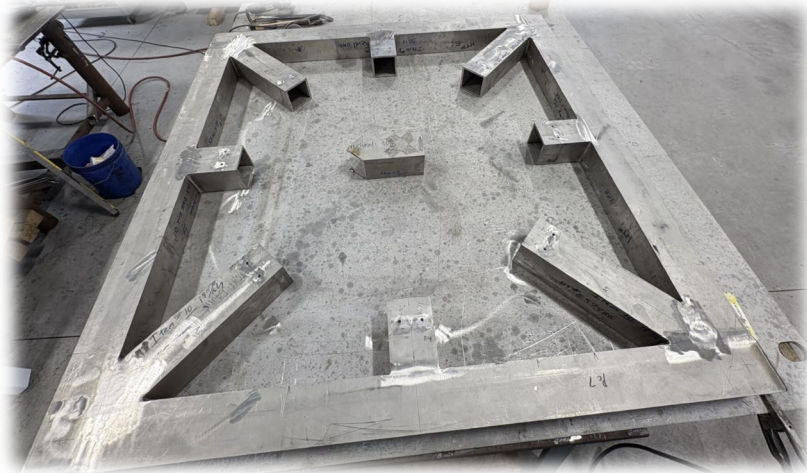
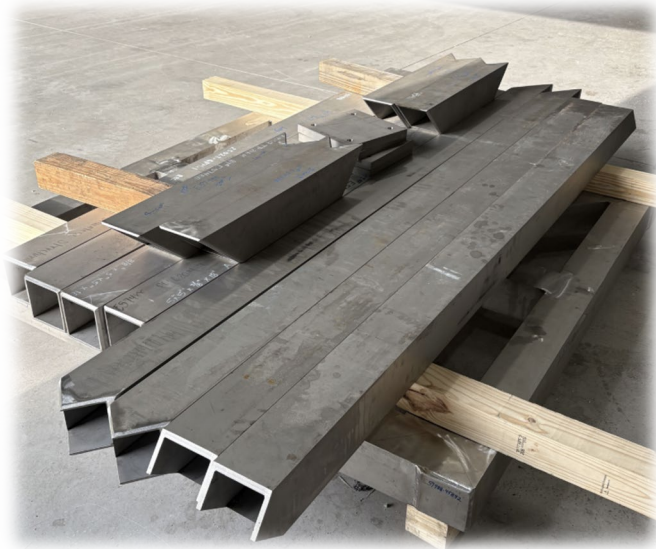
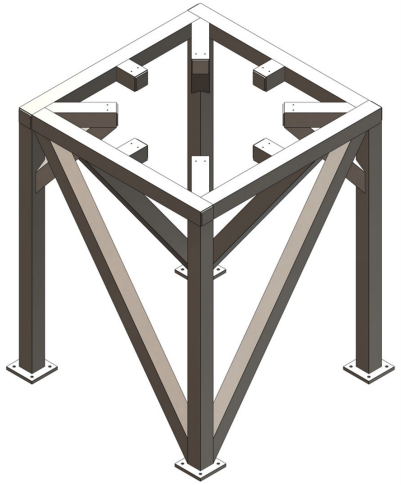


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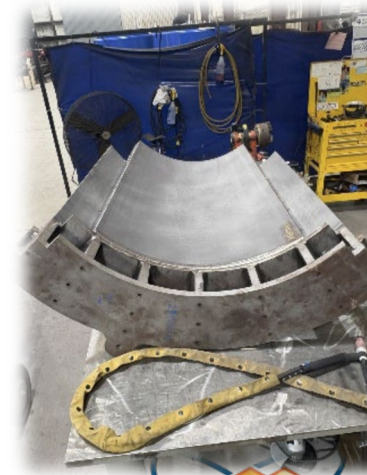
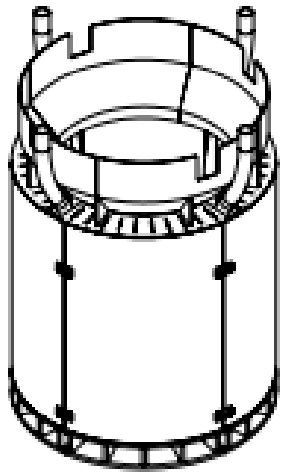
ISOMETRIC VIEW  
SHOWN FOR CLARITY  
SCALE: NONE



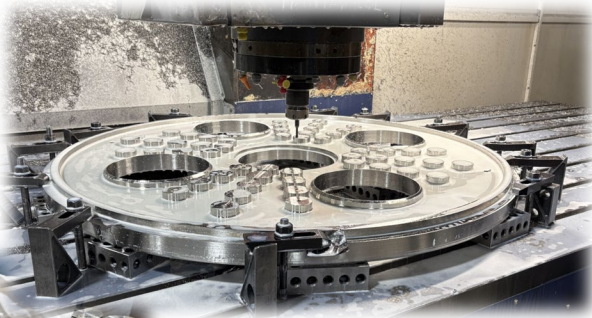
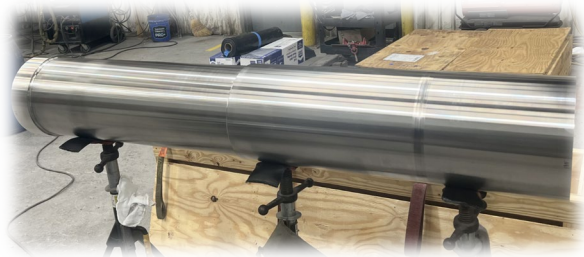
# Reactor Support Frame (RSF)



# Outer Shield System



# Primary Coolant System



# Keys to Project Success

## Commercial Grade Dedication

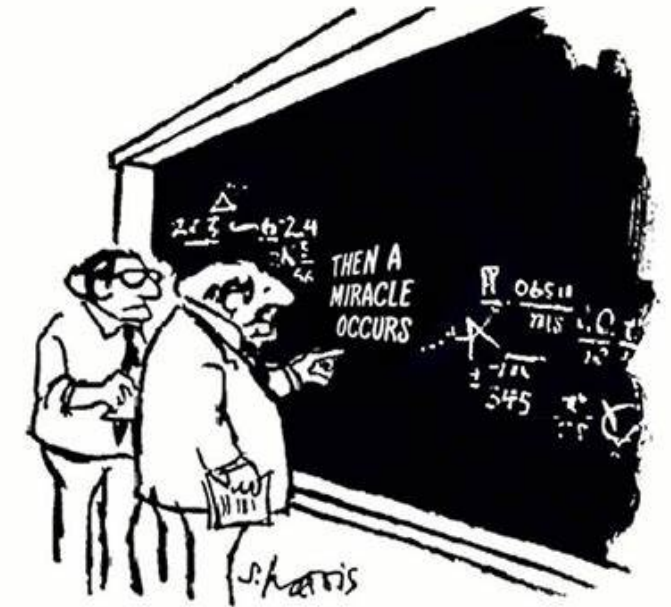
- While ASME Section III doesn't permit CGD, it has been successfully implemented on other components for the MARVEL Project
  - Secondary Shielding (WEP and Lead fill)
  - Beryllium Metal
  - Control Drum Bearings
- Use of CGD has enabled the project to expand its supply chain and streamline the procurement process

## On-Site Quality Presence

- INL presence at fabricator's facility
  - Real-time discovery, inspection, and resolution
  - Builds confidence and relationship with Subcontractor(s)

## Strong Project Team

- Expanded the Project Team and developed roles
  - Allowing for technicals to focus on their scope
  - Divide and conquer based on experience
- Develop a rhythm to address ongoing design/fabrication efforts along with incorporating the new GIO requirements with minimal impacts to the project
- Constant communications and early engagement



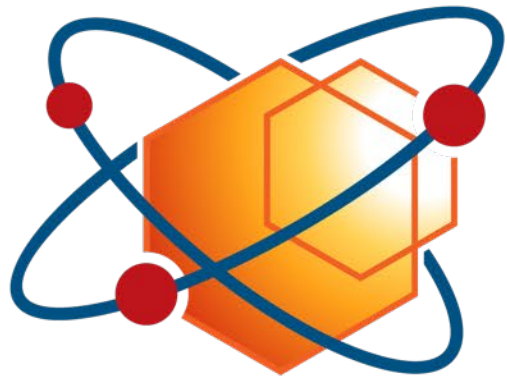
*"I think you should be more explicit here in step two"*

# Questions?

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**MRP** Microreactor  
Program