

# Mobile Arm Retrieval System (MARS)

PRESENTATION AT  
2009 DOE OFFICE OF  
WASTE PROCESSING  
TECHNICAL  
EXCHANGE...DENVER, CO

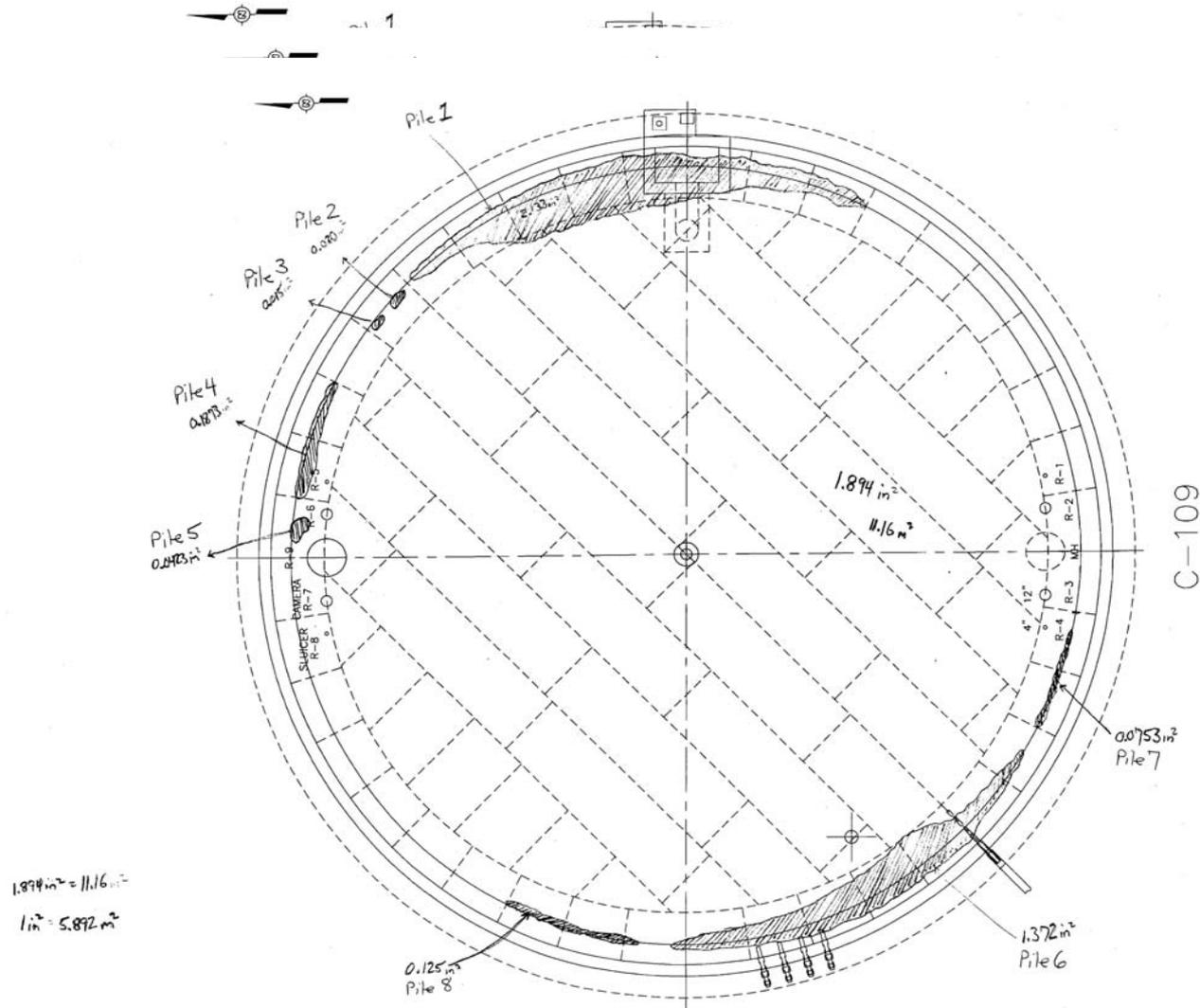
May 20, 2009



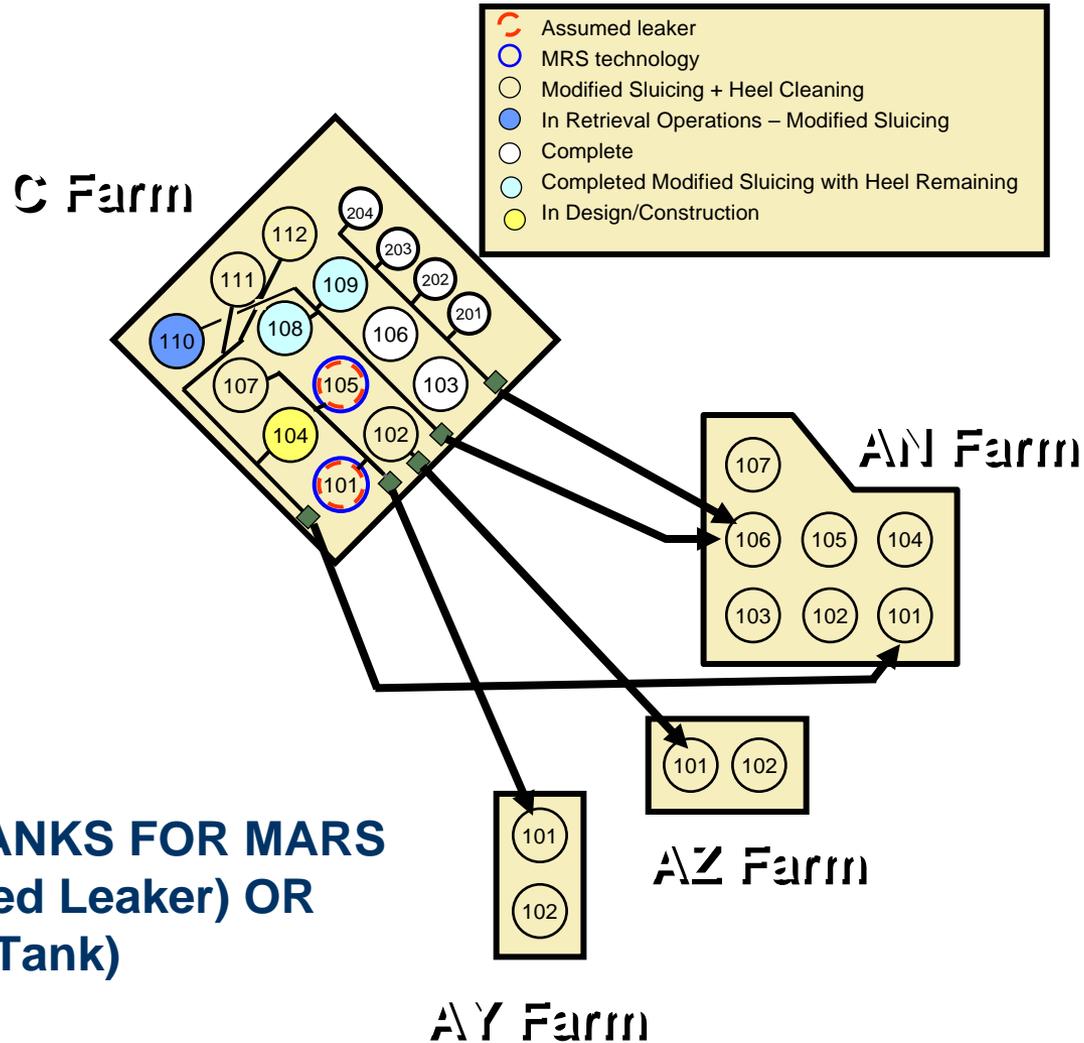
- Background
- Schedule
- Design Strategy
  - Sound Tank System
  - Assumed Leaking Tank System
- Key Technical Issues
- Design Progress
- Fabrication Progress
- Testing Progress
- Q & A

- DST Space is Limited Until WTP is On Line
  - C-Farm, A-Farm, AX-Farm
- Use of Sluicing for Bulk Retrieval has been Effective, however:
  - Hard Heel and Residuals remain (e.g., 7,000 to 8,000 gallons in C-108/C-109)
- Required to remove key radionuclides to the maximum extent technically and economically practical (DOE M 435.1-1)
- Method of Retrieving Waste from Assumed Leakers

# Background- Sludge Mounds in C-109



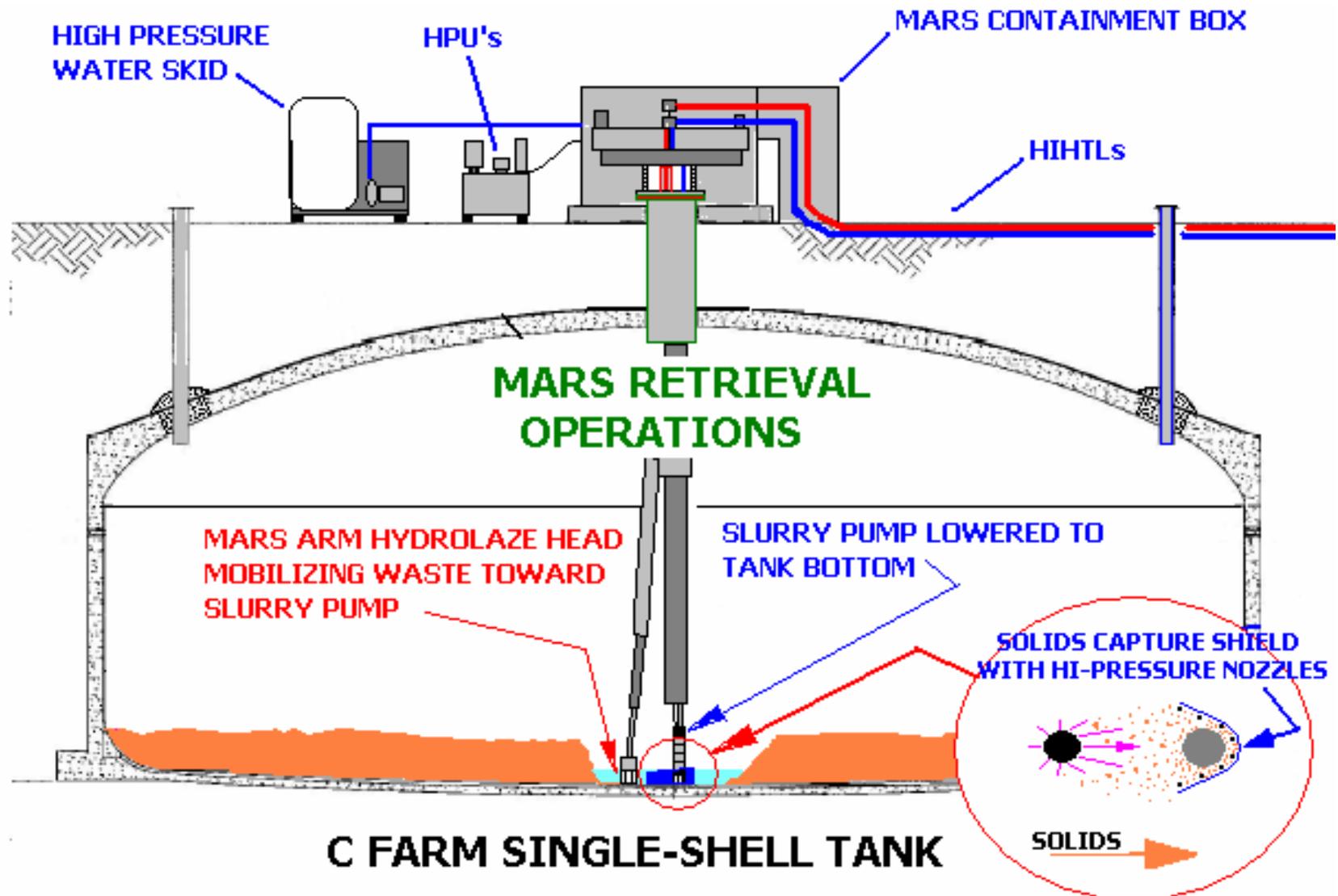
# Background



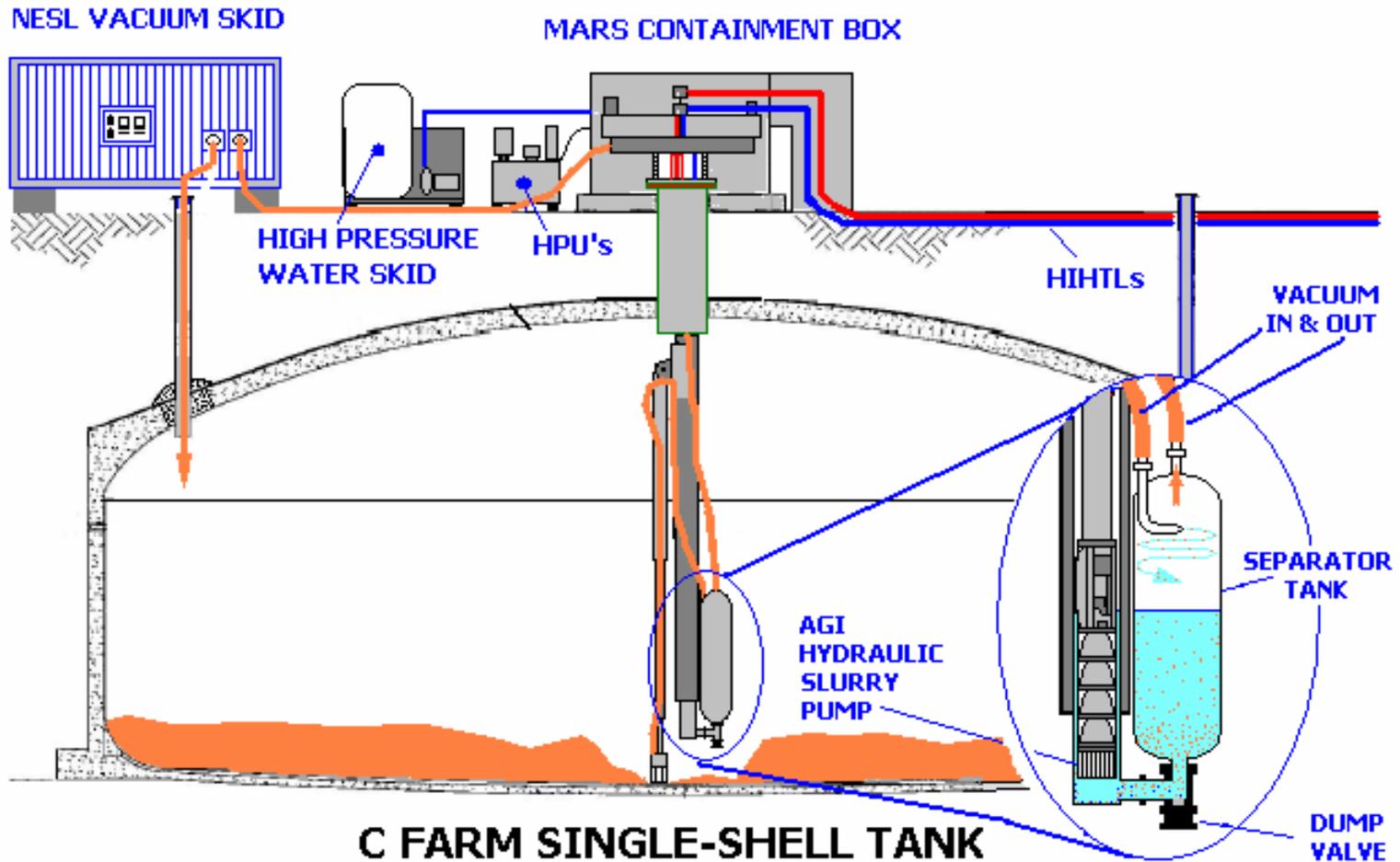
## Schedule

- Phase I Testing                      June 10, 2009
  - Proof of Principle/Component testing
- Preliminary Design                  Jun 22, 2009
- Final Design                            August 4, 2009
- Phase II Testing                        September 29, 2009
  - System Testing

# MARS Design Strategy- Sound Tank System



# MARS Design Strategy- Assumed Leaking Tank System



- Arm Robustness
- Hose Management
- Carriage Elbow Pivot Point
- Waste Mobilization Concepts
- Mobility
- Radiation Shielding / Dome Loading
- Complexity

## Design

- Same arm for retrieving either an assumed leaking tank or a sound tank
- Installation of Large, Centrally-Located Riser Required (~42-inch)
- Vacuum system (For assumed leaking tanks)
  - Use existing vacuum skid
  - Vacuum Separator Tank (VST); tank in SST
- Waste Pumping System
  - Centrifugal Pump for both:
    - Vacuum System (Assumed Leaking Tanks)
    - Sluicing System (Sound Tanks)

## Design

- Mast, Carriage, and Arm design
  - Modular approach
  - Focus on Highest Factor Of Safety possible
  - Steel construction using 5-segment arm (Adaptation of commercial technology)
  - In-tank hose management
- Turntable
- Containment Box Design
  - Focus on minimizing dome load, while providing acceptable radiation shielding (ALARA)
  - Dose limited by use of:
    - Rotary union
    - Vertical pump hose management

## Design

- Portable Instrument and Valve Box
- Control System
  - Controlled from a temporary trailer/control room
  - Human factors and lessons learned are being incorporated into the system design
  - General Service; Safety Significant interlocks are hard-wired
- Wrist and End Effectors
  - Required to be robust; many options considered
  - Current design has protective cage
  - Design allows for change-out if necessary
  - Adapting commercially available technology

## Fabrication

- Arm(s) received (Commercial Units), and are being adapted for use with MARS.
- Support Structure (12' X 12' structure) welding complete
- Support Structure top and adapter
- Turntable barrel being fabricated by support vendor
- Test tank fabricated by local vendor
- Mock up of mast and carriage planned (parts on order)
- Test end effectors fabricated

# MARS Fabrication Progress

**Commercial Arm  
Received at Fabricator**



# MARS Fabrication Progress

TEST ARM- RETRACTED



# MARS Fabrication Progress



TEST ARM- EXTENDED

# MARS Fabrication Progress



# MARS Fabrication Progress

TEST ARM- FULLY EXTENDED



# MARS Fabrication Progress



**SUPPORT PLATFORM  
(WELD INSPECTION)**

# MARS Fabrication Progress



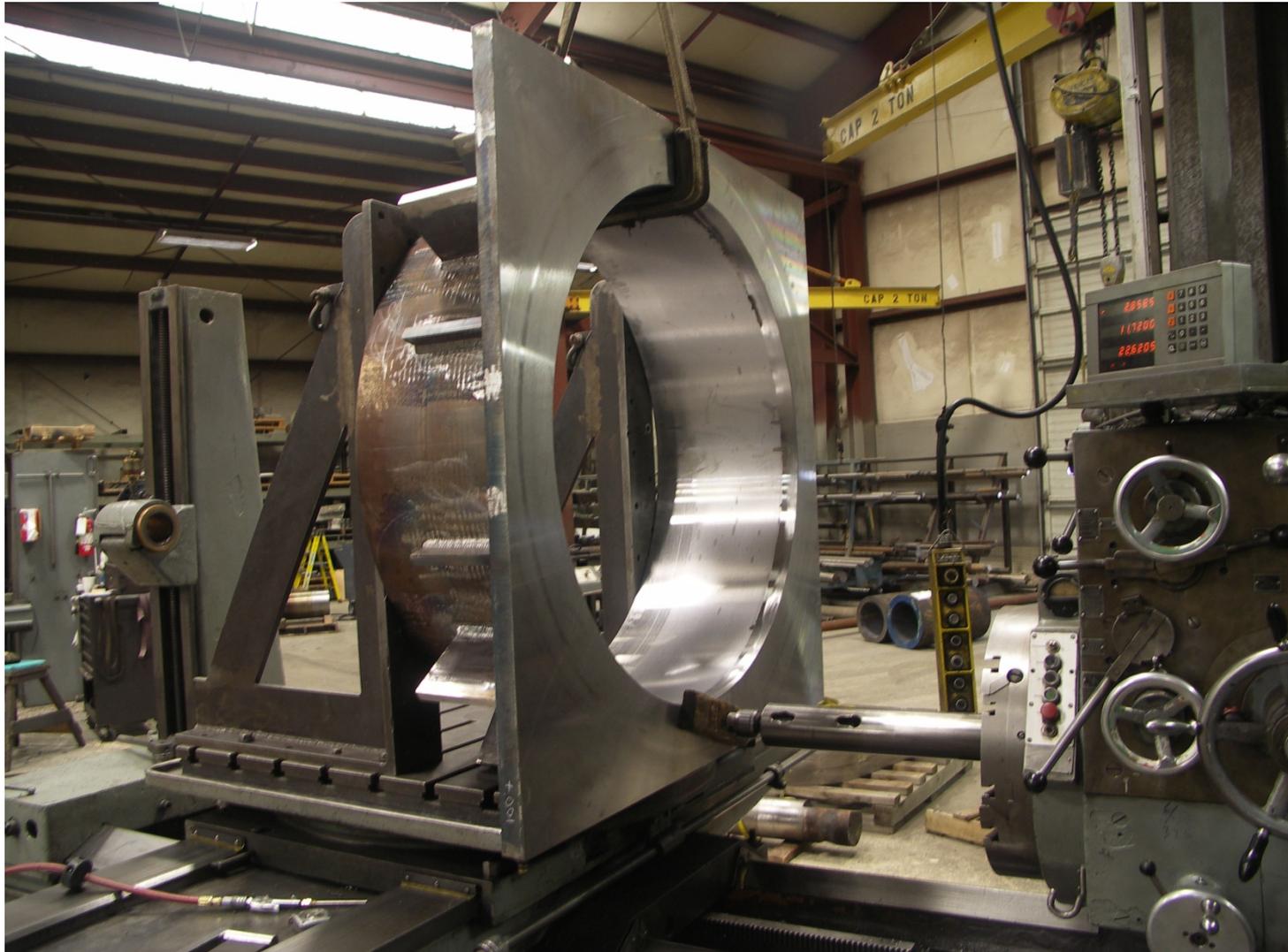
**SUPPORT PLATFORM:  
2-INCH PLATE**

# MARS Fabrication Progress

## SUPPORT PLATFORM 2-INCH ADAPTER RING



# MARS Fabrication Progress



MILLING PLATE AT LAMPSON FACILITY IN PASCO, WA

# MARS Fabrication Progress



**VACUUM SEPARATOR  
TEST TANK**

# MARS Fabrication Progress

## VACUUM SKID:

- Fully containerized
- Liquid Ring Vacuum Unit
- Remotely-Operated...controlled by a PLC



## Testing

- Consists of 3 areas: Proof of Principle, Phase I, Phase II
- Proof of Principle Status:
  - Low/High Pressure nozzle tests complete
  - Initial system feasibility test completed
  - Vacuum system performance tests (ongoing)
  - End effector configuration tests (planned)
  - Pump Backstop initial tests (planned)

# MARS Testing Progress



**TEST JIG  
(NOZZLE CONFIGURATION)**

# MARS Testing Progress



**LOW PRESSURE  
IN DEEP CUT**



# MARS Testing Progress



**RESULTS OF LOW PRESSURE CUT**

# MARS Testing Progress

**LOW PRESSURE CUT-  
SOFT SIMULANT**



# MARS Testing Progress



**RESULTS OF HIGH PRESSURE CUT**

# MARS Testing Progress



# MARS Testing Progress



## Testing

- Phase I tests:
  - Scheduled to complete 6/10/09
  - Eight discrete test areas scheduled:
    - End Effector (low and high pressure)
    - Telerobotic Arm performance
    - Mast and Carriage strength tests
    - Decontamination spray ring
    - Pump backstop
    - Above-grade hose management
    - In-tank hose management
    - Vacuum Separator Tank performance

# Summary

- Q & A