IMX-104 High Explosive (HE) Loading of 81mm & 120mm Mortars

Joint U S Army & U S Marine Corps

Department of the Army
Pilot Plant Melt Pour/ Cast Cure Loading Facility
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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

OUTLINE

- Program Objective
- Background
- Developed IM Process
- Melt Pour Process
- IM Loading Equipment
- Intelligence Control Modeling (ICM) & Equipment
- Conclusion

PROGRAM OBJECTIVE

- Support PM CAS effort to develop an IM Comp B replacement for the 81mm and 120mm mortar.
- Utilize ARDEC's melt pour pilot plant facility to rapidly develop and document loading process parameters while supplying acceptable mortars for IM testing.
- Transition developed loading process parameters to the Industrial Base.

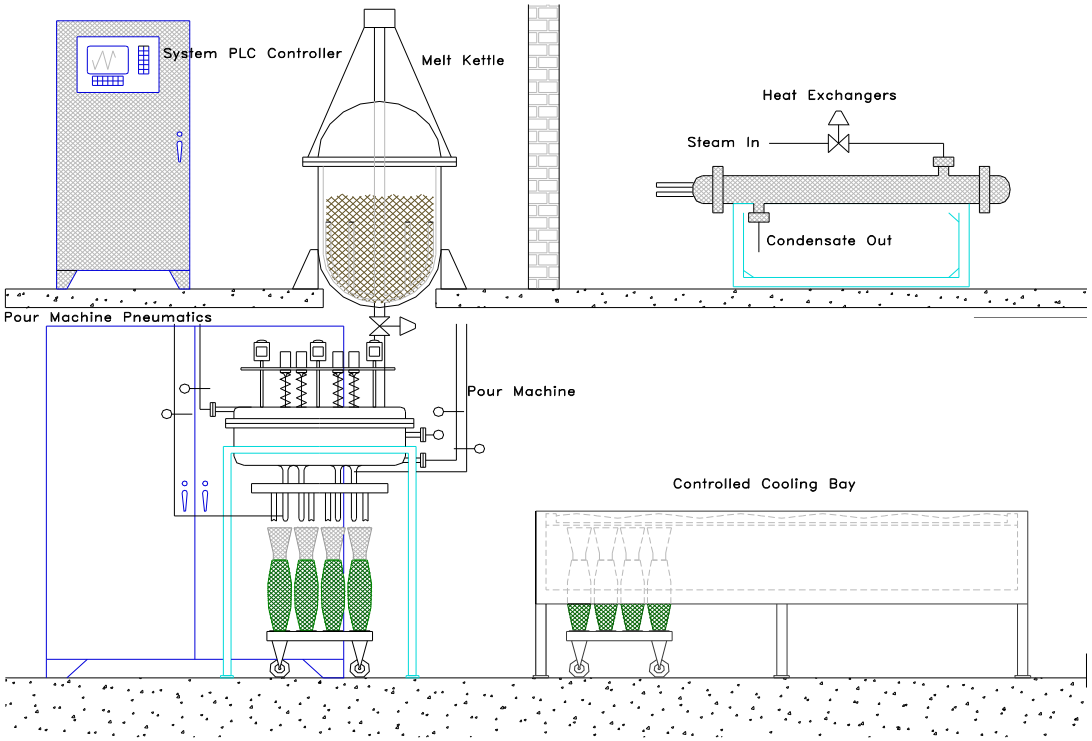
BACKGROUND

- PM CAS selected IMX-104 as an IM replacement for Comp B, and tasked the pilot facility to develop loading processes for mortars.
- In order to provide 81mm & 120mm mortars with new never before loaded HE, the ARDEC pilot plant loading facility was utilized.
- Tight controls over equipment and processes are necessary to meet cast quality specification requirements for mortar rounds
- The state-of-the-art melt pour equipment at ARDEC was well suited to execute the development of a process for this multi-component explosive.
- By Sep. 2010, the ARDEC pilot plant facility provided several 81mm & 120mm mortars for IM performance tests.

Developed IM Processes

- Processes for several IM candidates have been developed utilizing ARDEC's melt pour equipment.
  - TNT Replacement Candidates
    - IMX-101
      - Currently being transition to the NTIB
    - IMX-102
    - IMX-103
  - Comp B Replacement
    - IMX-104

Melt Pour Process Diagram

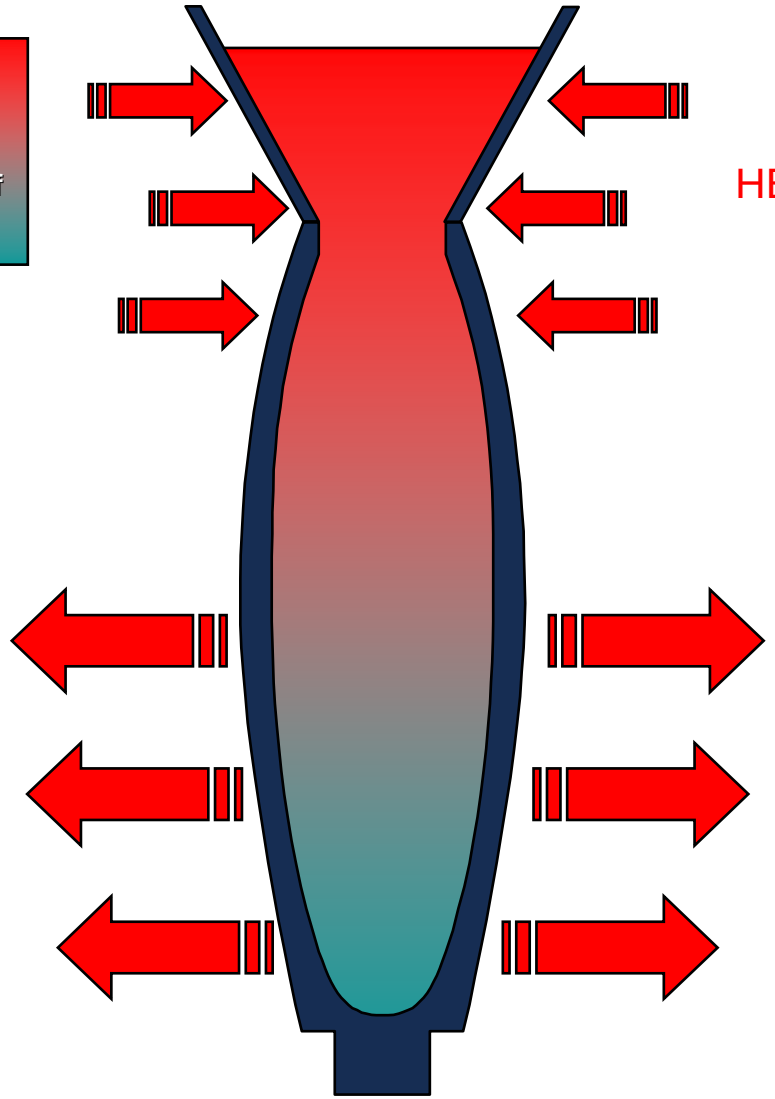


Initial Loading Equipment

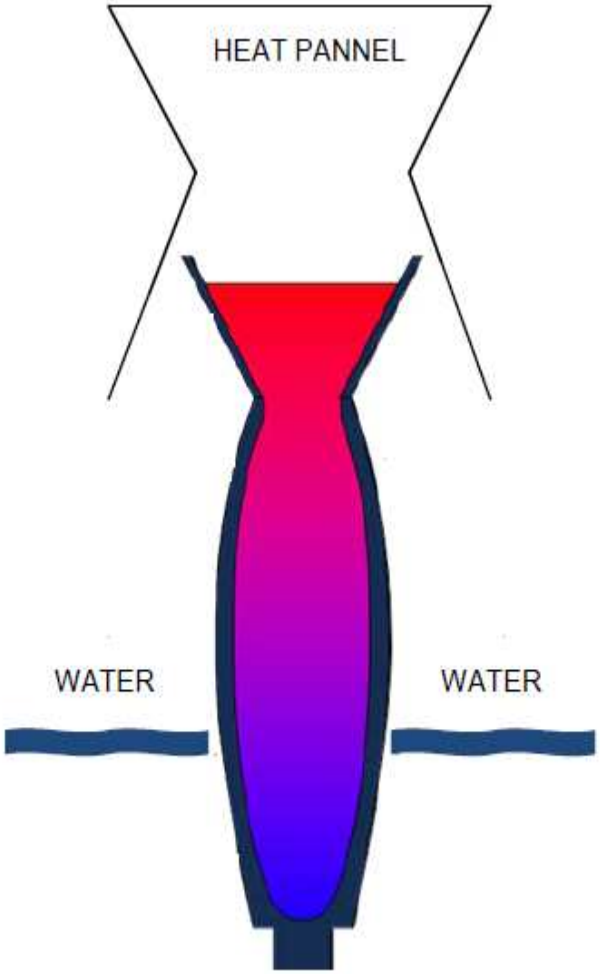
- Initial loading effort was preformed on the mortar loading system
  - 75 gallon melt kettle
  - 16 Nozzle pour machine
  - Mortar Oven (Air cooled process)
- The mortar oven did not provide an environment that would yield quality cast.
  - Insufficient heating of the funnels
  - Inadequate temperature gradient.

Bottom Up Cooling Method

Active heating of the funnel and neck is required in order to maintain molten explosive in the funnel and upper portion of the shell while heat is removed from the lower portion of the shell in a controlled manner resulting in a bottom-up solidification cast profile.



155mm Cooling Oven



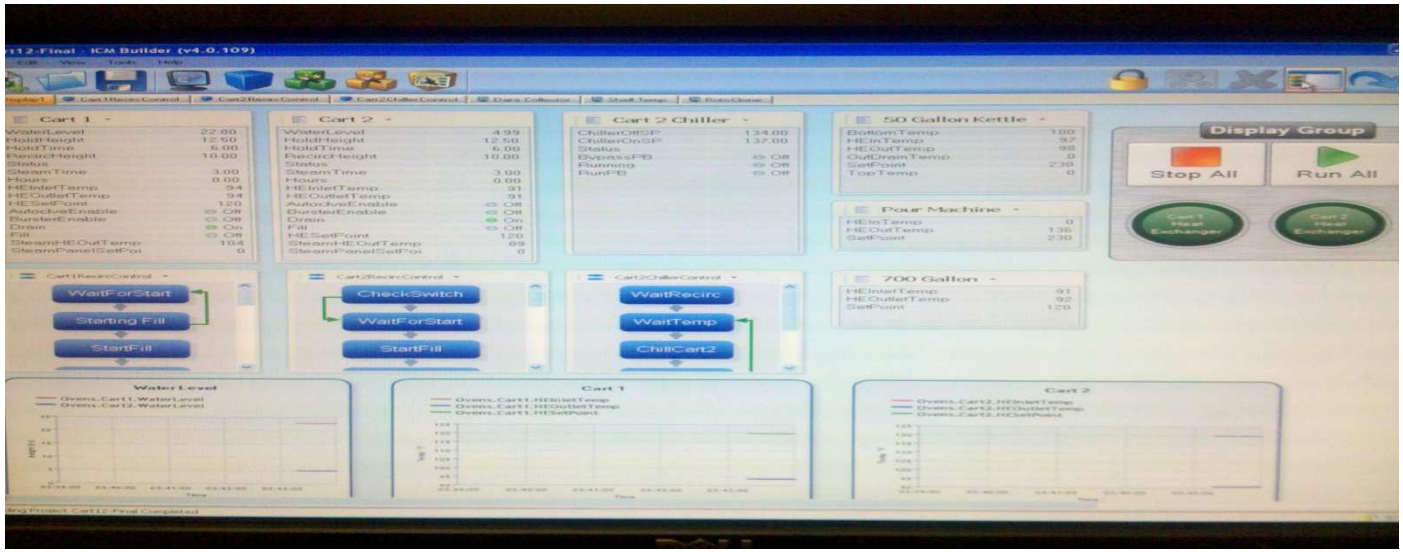
155mm Cooling Oven

Revised Loading Equipment

- The loading effort was preformed on the 155mm loading system
  - 50 gallon melt kettle
  - 4 Nozzle pour machine
  - 155mm Cooling Oven (Water cooled process)
- The 155mm cooling oven provided an environment that would yield quality cast.
  - Sufficient heating of funnels
  - Water as the cooling media establish a temperature gradient that promoted bottom up cooling.

Intelligence Control Modeling (ICM)

- The ICM System utilizes cart water level sensors, thermocouples, data collectors, and real time control screens to develop loading processes.
- The ICM system allows for changes to be made to cooling parameters in real time or by analyzing the results of previous test runs.
- The ICM uses these tools to control the Bottom Up Cooling Method



Conclusion

- The use of data acquisition and tightly monitored process controls allows for the development of loading processes that can be transition to the industrial base with minimal changes.