Muskogee
- In house pattern shop
- In house machine shop
- Heat treat
- Upgrade division (MPT, LPT, UT, RT)
- 40 lb – 4500 lb cast wt

Bixby
- Alloy division
- Flask-less molding
- 1 lb - ≈ 80 lb cast wt

Investment (lost wax)
- .1 lb ≈ 75 lbs cast wt

200 different alloys – steel, stainless steel, exotics

9 coreless induction furnaces
• 3200 B.C. copper casting produced
• 2000 B.C. Iron discovered
• 645 B.C. Sand molding discovered
• 500 A.D. Cast crucible steel produced
• 1642 First iron foundry in USA
• 1818 First cast steel produced in US by Valley Forge Foundry
• Design of finish casting
• Tooling design (draft, cored features, determine cope/drag, shrink factor, gating system)
• Pattern/Core box construction begins
• Mold, set cores. (zircon wash)
• Pour casting
• Cleaning/Heat treat
• Orientation
• Can it draw out of the sand? Draft/Core
• Proper draft allowance
• Undercuts/Loose Pieces
• How and where to apply feeding aids
• Where to gate mold cavity
• Can it be cleaned properly
Hollowing of cores

• Why?
  – Allow the core to “collapse” to eliminate the potential “tearing” that could occur in thin sections
  – Passageway for core gas to escape the mold
  – Could affect the integrity of the core when handling
  – Some may not be possible at all
• Why are they used?
  – Insulate the metal to allow this mass to be the final place to solidify
  – Improve casting yield

• Exothermic vs Insulating
  – Insulating sleeves provide a thermal insulating layer
  – Exothermic sleeves cause a chemical reaction that liberates heat
Phenolic Urethane (AFG)
- Quick cure time
- High thermal stability
- Higher bonding strength
- Easy to reclaim

- 80-100 psi tensile (0.7%)

Furan (Printed Molds)
- Longer cure time to PU
- Reduction in sulfuric emissions
- Easy shakeout
- Prone to veining

- 240 psi tensile (1.2%)
• Silica - $88/ton
• Olivine - $460/ton
• Chromite – $1,073/ton
• Zircon - $3,445/ton
• Iron oxide additive
• Zircon wash  
  – Prevents burn-on
  – Improve surface finish
Conventional Process

- Design Pattern and Core Box
- Manufacture Pattern
- Manufacture Core Box
- Produce and Assemble Cores
- Produce Cope and Drag Mold

Digital Process

- Casting Requirement
- Develop CAD Part File
- Solidification Model
- Design 3D CAD Mold Package
- Print Mold Package
- Assemble Mold Package
- Pour Castings
• Conventional parting nullified
• No restrictions on gating systems
• Expands feeding capabilities/locations
  – Optimize yield
• Core hollowing and venting incorporated into CAD file
• More accurate when changing material types (shrink factor)
- Excess sand removal
- Binder types (furan)
- Silica sand ONLY (83 GFN)
- Currently no sand additives
- Print size
- Incorporating chills
- No insulating sleeves
Traditional parting line
Mold Preparation

- Center Core
- Zircon Mold/Core Wash
- Risers Inside Core
CHILLS DOVETAILED AND BACKFILLED IN THE MOLD TO HOLD IN PLACE
Back filled mold in a flask to prevent run-out

Splash guard
Printed cores

- Case printed around the cores and sand
- Ease in shipping
- Increase shelf life because cores will not absorb moisture
Take precaution when cleaning out excess sand

Printed Cores

- Difficult to mold
- Eliminated draft
Traditional air set mold from hardwood pattern

Set printed cores
Any added information after submission of this presentation can be found in the link below

https://copy.com/QuqhsFOk79gHGNWL