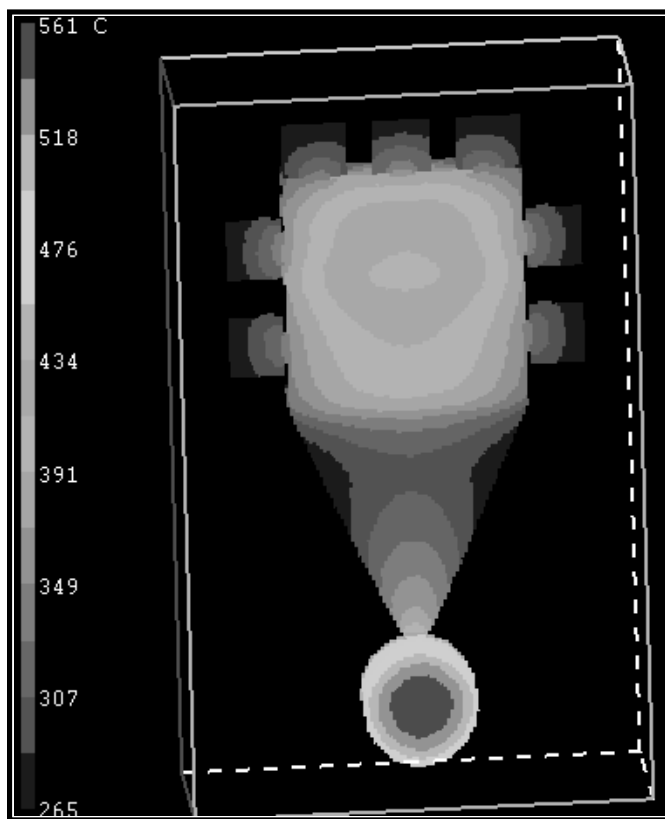


## INDUSTRIAL TECHNOLOGIES PROGRAM

### Design Support for Tooling Optimization

Over the past several years, the Center for Die Casting at Ohio State University has developed part design evaluation tools based primarily on qualitative reasoning and implemented them in a software system called CastView. From the start, the methods behind the CastView program were constructed with the explicit objective of providing a very quick, conservative screening tool that could provide up-front design information within a few minutes. The data provided are not full details, but general indicators of potential problems such as hot spots, shrinkage, difficult fill conditions, difficult vent conditions, trapped air problems that accompany venting, die steel conditions that result in high maintenance costs, and some ejectability issues.

Researchers from Ohio State University have developed techniques to compute the die equilibrium temperature (spatial distribution of the average cycle temperature once the process reaches quasi steady-state) based on a voxel model. In addition to addressing thermal management, the researchers are improving the fill pattern reasoning methods so that the techniques can be applied to other casting processes, including squeeze, semi-solid and permanent mold casting. This work is extending the utility of the CastView approach to additional important casting processes. Researchers are creating design wizards to aid in screening evaluations for castability so that the data produced can be used more effectively.



**Part Ejection Temperature Computed Using Equilibrium Temperature Methods. The ability to generate this data quickly supports optimization die cooling and the casting cycle.**



#### **Benefits for Our Industry and Our Nation**

- *Data/communication resulting in better designs and processes.*
- *Improved efficiency through better designs and processes.*
- *25 percent or more reduction of trapped gas, shrink porosity, lack of fill and similar in-process scrap.*
- *More uniform die temperature reducing soldering and increasing productivity.*

#### **Applications in Our Nation's Industry**

*These new techniques will optimize thermal and cycle management for any process that uses a permanent mold. This upgrade of the CastView software will enable die casting designers to design more accurate molds and increase first shot capabilities for die casters.*

## Project Description

The goals of this project are to extend the work on equilibrium temperature calculations, improve the Fill Pattern Visualization for High Pressure Die Casting, extend the reasoning techniques used for high-pressure casting, and extend the Castability Assessment work to include “wizards” that incorporate industry-wide North American Die Casting Association (NADCA) or company design standards.

The tasks of this project are:

- Creation of cooling system designs and thermal management that will implement test methods to optimize die casting and permanent mold cooling channel layouts.
- Extend fill pattern visualization by improving the results for high-pressure die casting and providing techniques applicable for high-integrity casting processes.
- Creation of design wizards, a structured set of steps that are built into the evaluation software that guide a user through the decision process.

## Milestones

### Results to Date

1. Preliminary testing of a software program to extend fill pattern visualization has been completed
2. A lumped parameter model was developed for impact pressure spike modeling
3. Performance metrics have been developed for thermal/cycle optimization

### Future Milestones

1. Design Wizards will be developed
2. Computational, laboratory, and field testing will be conducted
3. Release and distribution of software

## Project Partners

*Ohio State University*  
Columbus, OH

*North American Die Casting Association*, Wheeling, IL

*Cast Metals Coalition Partnership*  
Charleston, SC

*AMCAN*  
Burlington, Ontario

*Exco Engineering*  
Newmarket, Ontario

*Ried & Assoc.*  
Portage, MI

*Ryobi Die Casting, Inc.*  
Shelbyville, IN

*St. Clair Die Casting*  
St. Clair, MO

*Walkington Engineering, Inc.*  
Cottage Grove, WI

## A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy

### Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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