



Understanding the Relationship Between Filling Pattern and Part Quality in Die Casting

Center for
Die Casting

A Cast Metal Coalition Project
DOE Project Number DE-PS07-99ID13751
Metalcasting Industry of the Future

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Objective

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The fundamental objective of the proposed research is to understand the phenomena involved in the filling of the die cavity and the relationships between fill parameters and part quality.



Milestone Status Table

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ID Number	Task / Milestone Description	Planned Completion	Actual Completion	Comments
1.0	Real Time Radiography	4/30/02		New date 11/30/02
1.1	Select die geometry	10/31/00	10/31/00	
1.2	Design casting apparatus	7/31/01	7/31/01	
1.3	Establish x-ray parameters	8/31/01	9/31/00	
1.4	Conduct experiments	3/31/02		New date 11/30/02
1.5	Evaluate data	4/30/02		New date 11/30/02
2.0	Computer Simulations	12/31/01		New date 11/30/02
2.1	Create computer models	10/31/00	10/31/00	
2.2	Simulate gate conditions	4/30/01	4/30/01	
2.3	Simulate filling patterns	6/30/01	6/30/01	
2.4	Compare to x-ray results	4/30/02		New date 11/30/02
2.5	Evaluate results	4/30/02	2/28/02	Annual report of 3/02



Milestone Status Table

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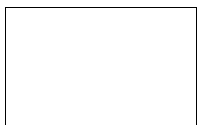
ID Number	Task / Milestone Description	Planned Completion	Actual Completion	Comments
3.0	Water Analog Studies	7/31/02	7/31/02	
3.1	Manufacture transparent die	10/31/00	10/31/00	
3.2	Conduct experiments	3/31/01	3/31/01	
3.3	Evaluate results	7/31/01	7/31/01	Annual report of 3/01
4.0	Casting Trials	4/30/02		New date 11/30/02
4.1	Manufacture castings	8/31/01	8/31/01	
4.2	Evaluate casting quality	10/31/01	10/31/01	
4.3	Compare with computer, x-ray and water analog results	2/28/02		New date 11/30/02
5.0	Project Management/Review	4/30/02		New date 1/31/03
5.1	Quarterly review meetings	4/30/02		New date 1/31/03



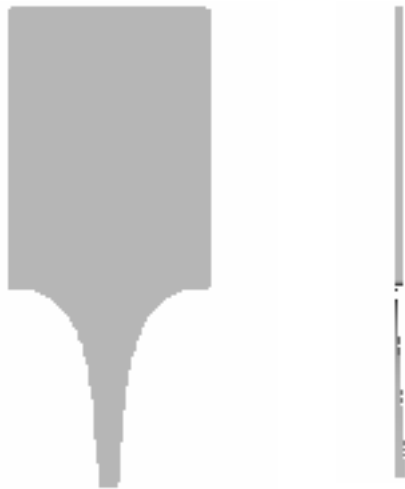
Computer Modeling

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- **CastView**
 - Qualitative Reasoning
- **MAGMASOFT**
 - Finite Difference Method
- **NovaCast**
 - Finite Difference Method
 - results provided by **Bill Walkington**
- **Flow3D**
 - Finite Difference Method
 - results provided by **Boris Lukezic**



Parametric Solid Models

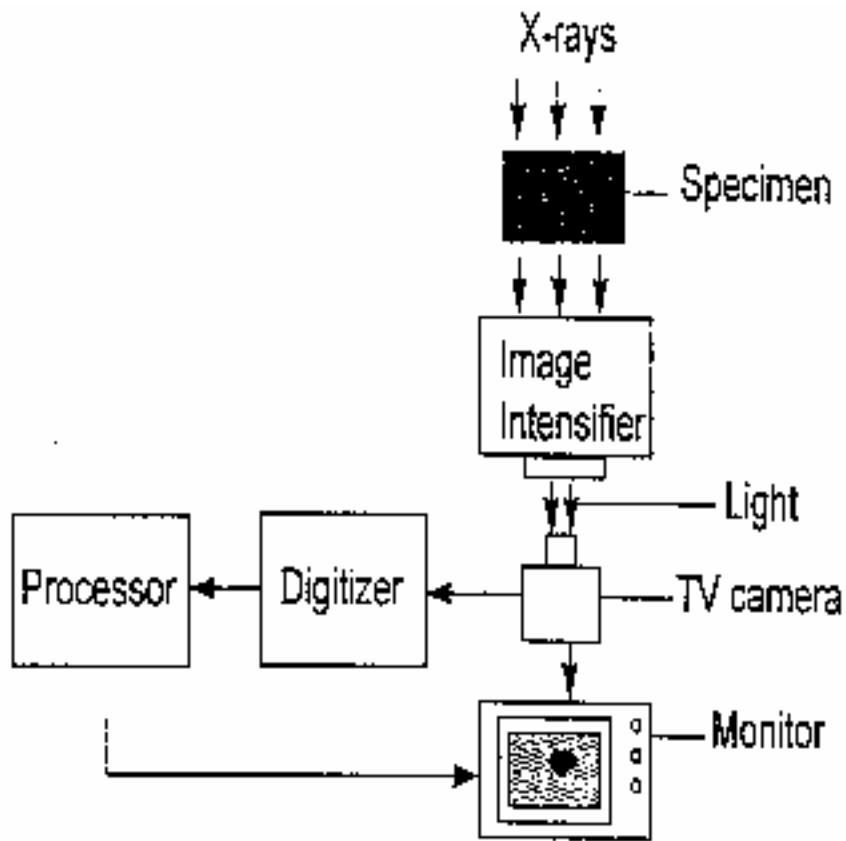


**Simple complexity part
front view and side view**

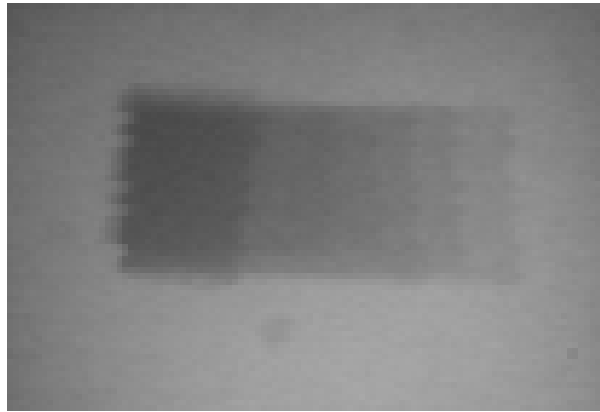


**Intermediate complexity part
front view and side view**

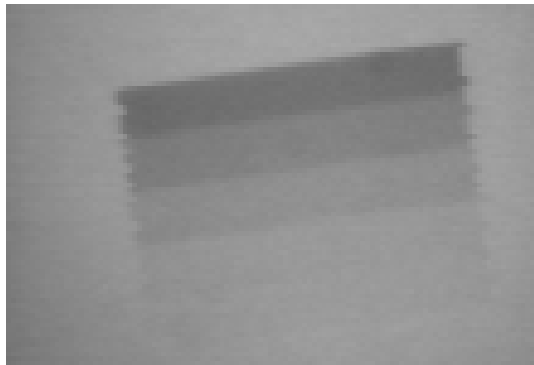
Real Time Radiography



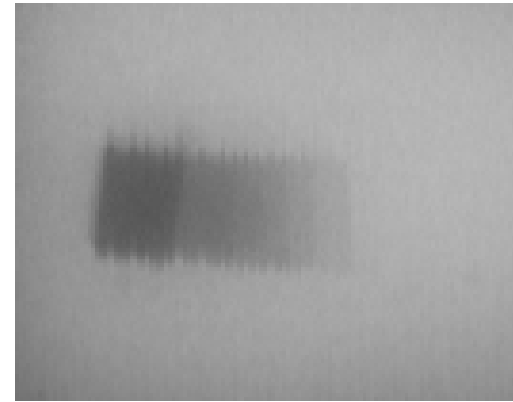
Results



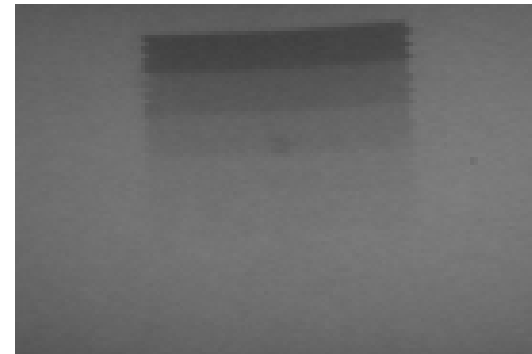
**0.002'' - 0.020'' Pb Target
Seen Through 4'' of Al**



**0.012'' - 0.202'' Zn Target
Seen Through 4'' of Al**



**0.002'' - 0.020'' Pb Target
Seen Through 1'' of Steel**



**0.012'' - 0.202'' Zn Target
Seen Through 1'' of Steel**



Activities to Complete Work

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- **Complete dynamic radiography system resolution capability testing**
- **Finish design work on and build casting apparatus for real time radiography**
- **Conduct actual real time radiography casting trials**
- **Compare real time radiography results with both water analog and computer simulation results**

