

**Project Title:  
Cast Metals Coalition Technology Transfer  
And  
Program Management  
Final Report**



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## Executive Summary

The Cast Metals Coalition (CMC) partnership program was funded to ensure that the results of the Department of Energy's (DOE) metalcasting research and development (R&D) projects are successfully deployed into industry. Specifically, the CMC program coordinated the transfer and deployment of energy saving technologies and process improvements developed under separately funded DOE programs and projects into industry. The transition of these technologies and process improvements is a critical step in the path to realizing actual energy savings.

At full deployment, DOE funded metalcasting R&D results are projected to save 55% of the energy used by the industry in 1998. This closely aligns with DOE's current goal of driving a 25% reduction in industrial energy intensity by 2017. In addition to benefiting DOE, these energy savings provide metalcasters with a significant economic advantage. Deployment of already completed R&D project results and those still underway is estimated to return over 500% of the original DOE and industry investment. Energy savings estimates through December 2008 from the Energy-Saving Melting and Revert Reduction Technology (E-SMARRT) portfolio of projects alone are  $12 \times 10^{12}$  BTUs, with a projection of over  $50 \times 10^{12}$  BTUs ten years after program completion.

These energy savings and process improvements have been made possible through the unique collaborative structure of the CMC partnership. The CMC team consists of DOE's Office of Industrial Technology, the three leading metalcasting technical societies in the U.S: the American Foundry Society; the North American Die Casting Association; and the Steel Founders' Society of America; and the Advanced Technology Institute (ATI), a recognized leader in distributed technology management. CMC provides collaborative leadership to a complex industry composed of approximately 2,100 companies, 80% of which employ less than 100 people, and only 4% of which employ more than 250 people. Without collaboration, new technologies enabling energy efficiencies and environment-friendly improvements are slow to develop, and have trouble obtaining a broad application.

The CMC team was able to effectively and efficiently transfer the results of DOE's metalcasting R&D projects to industry by utilizing and delivering the numerous communication vehicles identified in the proposal. The three metalcasting technical associations achieved significant technology transition results under this program. In addition to reaching over 23,000 people per year through *Modern Casting* and 28,000 through *Engineered Casting Solutions*, AFS had 84 national publications and reached over 1,200 people annually through Cast Metals Institute (CMI) education courses. NADCA's education department reached over 1,000 people each year through their courses, in addition to reaching over 6,000 people annually through *Die Casting Engineer*, and publishing 58 papers. The SFSA also published 99 research papers and reached over 1,000 people annually through their member newsletters. In addition to these communication vehicles, the CMC team conducted numerous technical committee meetings, project reviews, and onsite visits. All of these efforts to distribute the latest metalcasting technologies contributed to the successful deployment of DOE's R&D projects into industry.

The DOE/CMC partnership demonstrated significant success in the identification and review of relevant and easy-to-implement metalcasting energy-saving processes and technologies so that the results are quickly implemented and become general practice. The results achieved in this

program demonstrate that sustained technology transfer efforts are a critical step in the deployment of R&D projects to industry.

## CMC Partnership

**Table 1: CMC Proven Benefits**

1. **Partnership structure/methodology**
2. **Partnership Executive Board**
3. **Partnership Technical Committee**
4. **Unique Partnership National Technology Transfer process**
5. **Industry Roadmap & Vision**
6. **R&D project selection process; significant technology proposals to choose from**
7. **R&D project oversight process**
8. **Respected Printed Media distribution channels**
9. **CMC website**
10. **Established cost and accomplishment reporting system; Quarterly, Annual, and Final reports**

Table 1 summarizes the benefits delivered by CMC. A significant synergy from these delivered benefits is the breadth and depth of metalcasting industry technical, operating, and management participation that the CMC partnership achieves. From light metalcastings produced in automated processes; to wide varieties of alloys cast in a single process; to new processes that save energy and improve casting properties; to new efficiencies in older processes; to casting sizes from tiny to huge; to participation by management, shop floor, and technical metalcasting employees; the CMC partnership encompasses the entire spectrum. From this unique position, the partnership is

able to effectively apply the industry Roadmap and Vision to the selection of promising new technologies for R&D. The partnership's insight avoids "dead-end" technologies. Researchers respect the CMC research project selection and oversight process. Finally, the metalcasting industry associations participate in other DoD and DOE sponsored programs. The partnership coordinates efforts among these programs and its own, looking for synergy and avoiding duplication.

Working together since the original enabling legislation of P.L. 101-425 in 1989, the partnership exists in a jointly funded technology transfer effort to the metalcasting industry. The Cast Metal Coalition was formally established as a partnership in 1996 with appropriate filings at the Departments of Commerce and Justice. Membership in CMC is open to relevant metalcasting industry technical societies. CMC is composed of the three leading metalcasting technical societies in the U.S: the American Foundry Society (AFS, which uniquely represents all metalcasting alloy groups, process groups, and suppliers); the North American Die Casting Association (NADCA, which represents by far the largest volume of castings produced in single class of processes); and the Steel Founders' Society of America (SFSA, which represents over 66% of carbon, low alloy, and high alloy steel casting producers using sand processes and a significant percentage of those using investment and centrifugal processes). DOE selected the Advanced Technology Institute (ATI), a recognized leader in distributed technology management, to head the implementation and day-to-day operations of the Coalition.

**Table 2: Cast Metal Coalition Organizational Structure**

<p><b>Executive Board</b></p> <p>Member: Andy Behler (Industry)          Member: Jerry Call (AFS)          Member: Mike Gwyn (ATI)          Member: John Kujawa (Industry)          Member: Mark May (Industry)          Member: Raymond Monroe (SFSA)          Member: Daniel Twarog (NADCA)          Secretary: Thornton White</p>	<p><b>Technical Committee</b></p> <p>Lead: Debo Aichbhaumik (DOE)          Member: Malcolm Blair (SFSA)          Member: Tom Prucha (AFS)          Member: Steve Udvardy (NADCA)          Member: Thornton White (ATI)</p> <hr/> <p><b>Project Management</b></p> <p>Manager: Thornton White (ATI)          Administrator: Chris Bergner (ATI)</p>
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## CMC Deliverables

**Table 3: CMC Deliverables**

Item	Deliverable	Frequency	Industry Reach	CMC Accomplishments
1	<b>Technical Committee Meetings/ R&amp;D Project Reviews/ Onsite Visits with Researchers</b>	Each association has a project review, onsite visit, or conference call with the principal investigators of all projects they oversee on a monthly basis.	At the research project reviews, the association's reach out to all members advising those who would like to attend a particular project's review.  For the project reviews, potentially this is an industry reach of 50 people per association.	See Appendix A for details Over 525 Technical Committee Meetings, Conference Calls, R&D Project Reviews, and on-site visits with researchers
2	<b>Utilization of Research Results in Continuing Education</b>	2 times per year/project	NADCA's education dept. will reach over 1,000 people each year. AFS will reach over 2,500 people each year through CMI courses	See Section 2 for details NADCA's education department reached over 1,000 people each year through their courses AFS reached over 1,200 people annually through Cast Metals Institute (CMI) education courses
3	<b>National Publications CMC research publicity</b>	3 times per year/association	The associations' coverage of CMC projects will reach 68,000 people/ year	See Section 3for details Coverage of CMC research reached, on average, over 60,000 people per year AFS had 84 national publications and reached over 1,200 people annually NADCA published 58 papers SFSA published 99 research papers Research promoted annually at Metalcasting Congress / CastExpo
4	<b>Case Studies of DOE Research Projects-</b> Associations will highlight DOE research that has resulted in substantial energy savings as well as verify lessons learned	2 times per year/project/association	NADCA will reach 6,000 people per year through <i>Die Casting Engineer</i> AFS will reach over 23,000 people per year through <i>Modern Casting</i> and 28,000 through <i>Engineered Casting Solutions</i> . SFSA will reach over 1000 people/year through member newsletters	See Section 4 for details 59 Case Studies of metalcasting research project in conjunction with industry partners AFS reached over 23,000 people per year through <i>Modern Casting</i> and 28,000 through <i>Engineered Casting Solutions</i> NADCA's education department reached over 6,000 people annually through <i>Die Casting Engineer</i> SFSA reached over 1,000 people annually through their newsletters / conferences
5	<b>CMC Website</b>	Updated continuously with upcoming events and current project information	An average of 945 user sessions per month.	See Section 5 for details The CMC website averaged 1,034 page views and 821 visits per month over the ten year period of the program.

**Table 4: Technology Transfer Mechanisms**

Item	Partnership Action	Frequency of Occurrence	Purpose	Participants
1	Partnership Structure / Methodology	Continuous	Improve technology and efficiency of metalcasting energy & environmental profile	DOE/OIT, Industry Oversight Panel Industry Technical Associations: American Foundry Society, North American Die Casting Association, Steel Founders' Society, Advanced Technology Institute, University researchers, Metalcasting companies
2	Partnership Executive Board	2 times/ year	Ensure partnership objectives are being met	DOE/OIT; Metalcasters; AFS; NADCA; SFSA; ATI
3	Partnership Technical Committee	2 times/ year plus monthly conference calls	Technical oversight of R&D projects; Coordination with other DOE/OIT programs, e.g. NICE <sup>3</sup> , Best Practices, etc.	DOE/OIT; Metalcasters; AFS; NADCA; SFSA; ATI
4	Unique National/Industry Networking System	Weekly	Technology Transfer from planned, focused research to actual technical and operating employees in metalcasting companies; AFS/CMI and NADCA technical courses	Coordinated by ATI and DOE/OIT among IOP, AFS, NADCA, and University Researchers <u>to Metalcasting industry employees.</u>
5	Updated Industry Roadmap and Vision	09/02 Vision 10/01 Roadmap	Update Vision for Metalcasting industry for 2010; Clarify worthy trends; Define needed technology  Rework existing Roadmap to reach Vision	Blue Ribbon Panel from: DOE/OIT, Industry Oversight Panel Industry Technical Associations, AFS, NADCA, SFSA, ATI, University researchers, Metalcasting companies
6	R&D Selection Process	Annual: Merit Review (March); R&D Project Selection (April)	Solicitation and selection of R&D projects which match Vision and Roadmap	IOP + selected DOE/OIT, AFS, NADCA, SFSA, ATI, and Metalcasting industry technical leaders.
7	Participation in DOE /OIT R&D Project Oversight	Monthly via Technical Committee; Published schedule of dates/times via CMC website link available to participants	OIT coordinates oversight information with AFS, NADCA, SFSA, and ATI for mutual benefit	Technical Committee; DOE/OIT representatives
8	Printed Media Distribution Channels	Monthly; Quarterly; Annual	Technology Transfer: Die Casting Engineer, Modern Castings, Engineered Casting Solutions, Casteel Reporter	Industry Technical Associations: AFS, NADCA, SFSA, DOE/OIT University Principal Investigators
9	Improved CMC Website	Ongoing thru Mar 2002	Complete calendar of upcoming events; Updated summaries of all R&D projects (as given by DOE), including updates of estimated deployed energy savings. Updated milestones in R&D projects; Improved links to DOE websites; Improvements to existing AFS, NADCA, SFSA websites	ATI; DOE/OIT; Technical Assn's; Principal Investigators
10	Cost Accomplishment Reporting System	Quarterly, Annual & Final Reports	Accountability	Compiled by ATI; Input from University PI's, Technical Associations, and CMC Committees

# Accomplishments

## **1. Technical Committee Meetings/ R&D Project Reviews/ Onsite Visits with Researchers**

Appendix A contains a list of events by quarter, consisting of technical committee meetings, research reviews, meetings with principal investigators, and other events that promoted the technology transfer of metalcasting R&D into industry for improved energy savings.

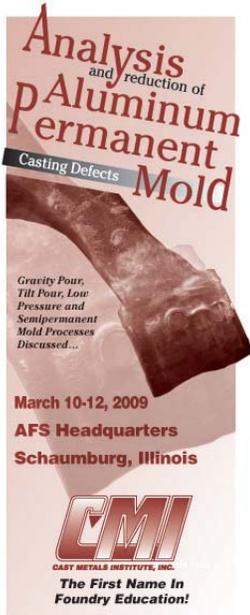
## **2. Utilization of Research Results in Continuing Education**

An important benefit of the CMC partnership was the introduction of talented young students to new and innovative metalcasting technology research that is being conducted at so many universities. The metalcasting research is addressing the growing need in training and recruiting technical professionals for the next generation of leadership for the metalcasting industry.

AFS reaches over 1,200 people each year through Cast Metals Institute (CMI) courses. In addition, AFS has implemented research findings from the Energy-Saving Melting and Revert Reduction Technology (E-SMARRT) portfolio of projects into various CMI courses to augment, improve, and update the core curriculum. The following are CMI Classes that have been updated and the E-SMARRT tasks that provided important new metalcasting energy-saving information:

- Introduction to Metal Casting: Applied information from the following E-SMARRT Tasks:
  - 3.8 - Manufacturing Advanced Engineered Components Using Lost Foam Casting Technology
  - 5.3 - Casting Porosity-free, Grain Refined Magnesium Alloys
  - 3.2 - Lost Foam Thin Wall: Feasibility of Producing Lost Foam Castings in Aluminum and Magnesium Based Alloys
  - 3.14 - Light Metals Permanent Mold Casting
  - 3.1 - Clean Steel Casting Production
  - 3.13.2 - Predicting Pattern Tooling And Casting Dimension For Investment Casting
  - 5.11 - Aging of Graphitic Cast Irons and Machinability
- Introduction to Metallurgy (Internet course): Applied information from the following E-SMARRT Tasks:
  - 5.3 - Casting Porosity-free, Grain Refined Magnesium Alloys
  - 3.14 - Light Metals Permanent Mold Casting
  - 3.1 - Clean Steel Casting Production
  - 5.11 - Aging of Graphitic Cast Irons and Machinability
- Melting & Heat Treatment Class (Internet course): Applied information from the following E-SMARRT Tasks:
  - 5.3 - Casting Porosity-free, Grain Refined Magnesium Alloys
  - 3.14 - Light Metals Permanent Mold Casting
  - 5.11 - Aging of Graphitic Cast Irons and Machinability

- 5.4 - Development of Elevated Temperature Aluminum MMC Alloy and Process Technology



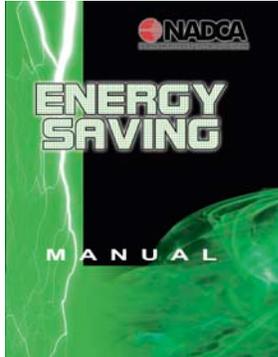
- Permanent Mold Coating Fundamentals: Applied information from the following E-SMARRT Task:
  - 3.14 - Light Metals Permanent Mold Casting
- Permanent Mold Aluminum – Tilt Pour: Applied information from the following E-SMARRT Task:
  - 3.14 - Light Metals Permanent Mold Casting
    - Analysis & Reduction of Casting Defects: Applied information from the following E-SMARRT Tasks:
      - 3.8 - Manufacturing Advanced Engineered Components Using Lost Foam Casting Technology
      - 5.3 - Casting Porosity-free, Grain Refined Magnesium Alloys
      - 3.2 - Lost Foam Thin Wall: Feasibility of Producing Lost Foam Castings in Aluminum and Magnesium Based Alloys
  - 3.14 - Light Metals Permanent Mold Casting
  - 3.1 - Clean Steel Casting Production
- Melt Control for Ni, Co and Stainless Steel: Applied information from the following E-SMARRT Task:
  - 3.1 - Clean Steel Casting Production
- Metallurgy of Gray & Ductile Iron: Applied information from the following E-SMARRT Task:
  - 5.11 - Aging of Graphitic Cast Irons and Machinability
- Magnesium workshop: Applied information from the following E-SMARRT Tasks:
  - 5.3 - Casting Porosity-free, Grain Refined Magnesium Alloys
  - 3.2 - Lost Foam Thin Wall: Feasibility of Producing Lost Foam Castings in Aluminum and Magnesium Based Alloys

NADCA also provides continuing education courses to the foundry industry, reaching over 1,000 people each year through their courses. NADCA has incorporated research findings from the E-SMARRT portfolio of projects into various these courses to improve the information disseminated. The following are NADCA courses that have been updated to provide new metalcasting energy-saving information from E-SMARRT:

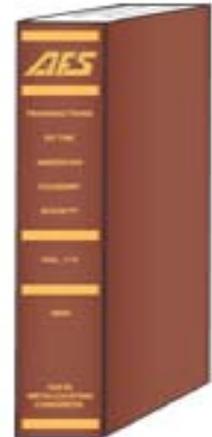
- An on-line video course entitled “Why Save Energy” was developed and added to NADCA’s list of on-line video courses. This can be accessed at: <http://www.diecasting.org/training/energy/>
- The long-standing NADCA EC-501 Die Material Metallurgy & Extending Die Life Course has been updated with information resulting from the CWRU Project on Improved Die Casting Process to Preserve the Life of the Die Casting Dies. The course is offered 1-2 times per year at NADCA and through NADCA Chapters.



- NADCA Course EC-503 Die Coatings and Surface Treatments was developed in conjunction with Dr. John Moore of the Colorado School of Mines (CSM). This course includes information on multi-layer coatings and the coating application techniques developed through the DOE funded multi-layer coatings efforts at CSM.



In addition, a metal melting workshop, based on the NADCA Energy Savings manual and the Melting Efficiency project at Case Western Reserve University (CWRU), has been developed and was offered for the first time in 2008. NADCA plans to continue to offer the workshop in various regions of the country throughout 2009 and beyond.



### 3. National Publications / CMC research publicity

- AFS Transactions
  - *Studies On Fluid Flow In Permanent Mold Casting Of Copper Alloys Using Water Modeling* (20020223) Transactions of the American Foundry Society V 109 Paper No 01-122 P 1-12, 2001
  - *Comparative Corrosion Resistance Of Selected Copper-Base Alloys Cast In Permanent And Green Sand Molds* (20020222) Transactions of the American Foundry Society V 109 Paper No 01-127 P 1-15, 2001
  - *Mechanical Properties Of Aluminum Bronze Alloy C95400* (20020214) Transactions of the American Foundry Society V 109 Paper No 01-123 P 1-14, 2001
  - *Comparison Of Image-Analysis And Pycnometry Results For The Percentage Porosity Evaluation Of Two A356 Castings* (20010562) Transactions of the American Foundry Society V 109 Paper No 01-027 P 1-12, 2001
  - *Effect Of Abrasive Inclusions On The Machinability Of Cast Steel* (20020269) Transactions of the American Foundry Society V 109 Paper No 01-112 P 1-11, 2001
  - *Age Strengthening Of Gray Cast Iron Phase Iii - Effect Of Aging Temperature* (20020177) Transactions of the American Foundry Society V 109 Paper No 01-081 P 1-9, 2001
  - *Critical Material Properties For Predicting Pattern Tooling Dimensions In Investment Casting* (20010526) Transactions of the American Foundry Society V 109 Paper No 01-017, P 1-18, 2001
  - *Cast Metal Matrix Composites: Past, Present And Future (Silver Anniversary Paper, Div. 2)* (20020253) Transactions of the American Foundry Society V 109 Paper No 01-133 P 1-25, 2001
  - *Dimensional Control Parameters In Lost Foam Casting* (20020184) Transactions of the American Foundry Society V 109 Paper No 01-106 P 1-14, 2001
  - *Experimental Simulation Of Pattern Degradation In Lost Foam* (20020185) Transactions of the American Foundry Society V 109 Paper No 01-104 P 1-32, 2001
  - *Effects Of Applied Pressure During Feeding On The Fatigue Properties Of Critical Cast Aluminum Alloy Components - An AFS / CMC Research Project Progress Report, No. 2* (20020601) Transactions of the American Foundry Society V 110 Paper No 02-075 P 339-345, 2002

- ***Observations On The Effect Of Gating Design On Metal Flow And Defect Formation In Aluminum Lost Foam Castings: Part I (20020129)*** Transactions of the American Foundry Society V 109 Paper No 01-056 P 1-15, 2001
- ***Observations On The Effect Of Gating Design On Metal Flow And Defect Formation In Aluminum Lost Foam Castings: Part Ii (20020126)*** Transactions of the American Foundry Society V 109 Paper No 01-052 P 1-16, 2001
- ***Technological Developments And Worldwide Market Growth In Lost Foam Casting Production (20020182)*** Transactions of the American Foundry Society V 109 Paper No 01-105 P 1-16, 2001
- ***Grain Refinement Of Permanent Mold Cast Copper-Base Alloys (20020731)*** Transactions of the American Foundry Society V 110 Paper No 02-108 P 505-514, 2002
- ***Age Strengthening Of Gray Cast Iron: Nitrogen Effects And Machinability (20020654)*** Transactions of the American Foundry Society V 110 Paper No 02-120 P 983-993, 2002
- ***Fuzzy Control Of A Cupola Iron Melting Furnace (20020640)*** Transactions of the American Foundry Society V 110 Paper No 02-095 P 1221-1232, 2002
- ***Thin Wall Compacted Graphite Iron Castings (20020664)*** Transactions of the American Foundry Society V 110 Paper No 02-176 P 1113-1130, 2002
- ***Microstructure Characterization Of Ductile Thin Wall Iron Castings (20020739)*** Transactions of the American Foundry Society V 110 Paper No 02-177 P 1131-1147, 2002
- ***Tensile Properties Of Thin Wall Ductile Iron (20020743)*** Transactions of the American Foundry Society V 110 Paper No 02-178 P 1149-1162, 2002
- ***Parametric Study Of The Effects Of Casting Parameters On Dimensional Variation In Thin Wall Iron Castings (20020663)*** Transactions of the American Foundry Society V 110 Paper No 02-102 P 715-731, 2002
- ***Effects Of Shot Blasting On Dimensional Variation Of Castings (20020667)*** Transactions of the American Foundry Society V 110 Paper No 02-105 P 747-757, 2002
- ***Machinability Of Gray Cast Iron (20020655)*** Transactions of the American Foundry Society V 110 Paper No 02-159 P 1067-1083, 2002 (17 p)
- ***Determination Of Solidification Characteristics Of Al-Si Alloys By Thermal Analysis (20020630)*** Transactions of the American Foundry Society V 110 Paper No 02-033 P 285-296, 2002)
- ***Performance And Control Of A Green Sand System During The Installation And Operation Of An Advanced Oxidation System (20020696)*** Transactions of the American Foundry Society V 110 Paper No 02-099 P 705-713, 2002
- ***Prediction Of Wax Pattern Dimensions In Investment Casting (20020662)*** Transactions of the American Foundry Society V 110 Paper No 02-103 P 733-746, 2002
- ***A Visualization Tool For Density Gradients In Sand Molds/Cores (20020649)*** Transactions of the American Foundry Society V 110 Paper No 02-130 P 805-814, 2002
- ***Observations On The Effect Of Alloy Composition On Metal Flow And Defect Formation In Aluminum Lost Foam Castings (20020670)*** Transactions of the American Foundry Society V 110 Paper No 02-092 P 1449-1461, 2002

- ***Degradation Of Expanded Polystyrene Patterns*** (20020675) Transactions of the American Foundry Society V 110 Paper No 02-101 P 1483-1496, 2002
- ***Real-Time X-Ray Investigations On Lost Foam Mold Filling*** (20020414) Transactions of the American Foundry Society V 110 Paper No 02-011 P 1347-1356,
- ***Effect Of Casting Size And Geometry On The Critical Gate Area In Aluminum Lost Foam Castings*** (20020672) Transactions of the American Foundry Society V 110 Paper No 02-089 P 1427-1434, 2002
- ***Evaluation Of Grain Refinement Of Lead Yellow Brass (C85800) And Envirobrass Iii (C89550) Using Thermal Analysis*** (20030201) Transactions of the American Foundry Society V 111 Paper No 03-119 P 417-434, 2003
- ***Hard Spot Formation In Grain Refined Yellow Brass And Envirobrass Iii*** (20030350) Transactions of the American Foundry Society V 111 Paper No 03-052 P 407-415, 2003
- ***Microstructure Of Thin-Wall Ductile Iron Castings*** (20030261) Transactions of the American Foundry Society V 111 Paper No 03-136 P 949-959, 2003
- ***Qualitative And Quantitative Description Of EPS Foam For Lost Foam Casting*** (20030297) Transactions of the American Foundry Society V 111 Paper No 03-113 P 1293-1302, 2003
- ***Influence Of Bead Chemistry On Metal Velocity And Defect Formation In Aluminum Lost Foam Castings*** (20030299) Transactions of the American Foundry Society V 111 Paper No 03-105 P 1279-1292, 2003
- ***Effects Of Foam Pattern Fusion On The Quality Of Lost Foam Aluminum Castings: Real Time And Digital X-Ray Observations*** (20030302) Transactions of the American Foundry Society V 111 Paper No 03-083 P 1245-1253, 2003
- ***The Effect Of Ferrous Charge Materials And Covered Melting On Metallic And Alloy Recovery In Iron Melts*** (20030295) Transactions of the American Foundry Society V 111 Paper No 03-042 P 1101-1112, 2003
- ***The Role Of Pattern Permeability In Lost Foam Casting*** (20030300) Transactions of the American Foundry Society V 111 Paper No 03-090 P 1265-1277, 2003
- ***Recent Developments In The High Strength Aluminum-Copper Casting Alloy A206*** (20030199) Transactions of the American Foundry Society V 111 Paper No 03-135 P 341-354, 2003
- ***Visualizing Defects Formation in Gray Iron Castings Using Real Time X-Rays***
- ***Static Mechanical Properties Of Ferritic And Pearlitic Lightweight Ductile Iron Castings*** (20030263) Transactions of the American Foundry Society V 111 Paper No 03-109 P 895-910, 2003
- ***Age Strengthening Of Gray Cast Iron: Kinetics, Mechanical Property Effects*** (20030285) Transactions of the American Foundry Society V 111 Paper No 03-037 P 733-741, 2003
- ***Thermal Expansion Of Investment Casting Pattern Wax*** (20030291) Transactions of the American Foundry Society V 111 Paper No 03-040 P 489-499, 2003 (11 p)
- ***A Study Of Porosity And Pore Morphology In Aluminum A356.2 Step Castings*** (20030219) Transactions of the American Foundry Society V 111 Paper No 03-045 P 147-157, 2003
- ***Fatigue Behavior Of Permanent Mold Cast A359-20% SiCP Composite*** (20030341) Transactions of the American Foundry Society V 111 Paper No 03-151 P 373-384, 2003

- ***Emissions Studies At A Test Foundry Using An Advanced Oxidation-Clear Water System (20030286)*** Transactions of the American Foundry Society V 111 Paper No 03-152 P 579-598, 2003
- ***Process Control Of Metal Penetration Defect In Lost Foam Castings (20040763)*** Transactions of the American Foundry Society V 112 Paper No 04-004 P 1087 - 1095
- ***Thermal And Morphological Characterization Of EPS Foam And Relationship With Processing Parameters (20040764)*** Transactions of the American Foundry Society V 112 Paper No 04-054 P 1097 - 1112
- ***Comparison Of Aluminum Alloys And EPS Foams For Use In The Lost Foam Casting Process (20040760)*** Transactions of the American Foundry Society V 112 Paper No 04-110 P 1161 - 1174
- ***Optimization Of Composition And Mechanical Properties Of Aluminum Bronze Alloy C95400 (20040700)*** Transactions of the American Foundry Society V 112 Paper No 04-109 P 509 - 520
- ***Fading Of Grain Refinement In Permanent Mold Cast Copper Alloys (20040702)*** Transactions of the American Foundry Society V 112 Paper No 04-112 P 521 - 526
- ***Using Helium To Increase Heat Transfer At The Metal/Mold Interface In Permanent Mold Casting (20040791)*** Transactions of the American Foundry Society V 112 Paper No 04-023 P 193-207, 2004
- ***Effects Of Pressure Applied During Feeding On Porosity Reduction With Reference To Fatigue Behavior (20040727)*** Transactions of the American Foundry Society V 112 Paper No 04-037 P 237-250, 2004
- ***Fluidized Bed Reactor Heat Treatment Of A356 Alloy: Microstructure Analysis And Mechanical Properties (20040717)*** Transactions of the American Foundry Society V 112 Paper No 04-055 P 289-304, 2004
- ***SSM Processing Of Al<sub>2</sub>O<sub>3</sub> Grain Refined Al-Si Alloys (20040788)*** Transactions of the American Foundry Society V 112 Paper No 04-053 P 273-287, 2004
- ***Continuous Rheoconversion Process For Semi-Solid Slurry Production (20040725)*** Transactions of the American Foundry Society V 112 Paper No 04-056 P 305-323, 2004
- ***Development Of A Heat Transfer Coefficient Evaluator (20040782)*** Transactions of the American Foundry Society V 112 Paper No 04-078 P 71-78, 2004
- ***Modeling Of Temperature Measurement Process With Thermocouple: A Comprehensive Parametric Study And Some Experimental Results (20040771)*** Transactions of the American Foundry Society V 112 Paper No 04-044 P 37-54, 2004
- ***Thermophysical Properties Of Zircon And Fused Silica-Based Shells For Investment Casting (20040752)*** Transactions of the American Foundry Society V 112 Paper No 04-081 P 649 - 661
- ***Effects Of Advanced Oxidation Treatment On Green Sand Properties And Emissions (20040777)*** Transactions of the American Foundry Society V 112 Paper No 04-069 P 635 - 648
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#### **4. Case Studies of DOE Research Projects**

Appendix B contains a letter from Ray Donahue, Senior Director, Advanced Materials and Foundry Technology at Mercury Marine describing the successful application of the AFS-sponsored Lost Foam technology at Mercury Marine.

Below are examples of NADCA's case studies:

##### **Example 1. Die casting die and machine modeling work at OSU**

Sometimes a problem is not always what you think it might be. This is what one die caster discovered in resolving an issue with tie bolt failures on a miniature 66 NT Techmire hot chamber zinc machine while running a seat belt inertia lock casting with Zamak #5 alloy. The castings run in a four-cavity die and had an original cycle time of 10.2 seconds. Tie bolt fatigue failures were occurring within 80-240 hours of operation.

Computer modeling was turned to in an attempt to resolve the tie bolt issue. Modeling indicated that there was an unbalanced load being applied to the tie bolts and subsequent

efforts were focused on trying to predict the parting surface shape at operating temperatures so the surface could be modified to eliminate the load imbalance. Modeling of the thermal distribution in the parts and die cavities revealed areas of unbalanced heat load and potential heat growth due to the orientation of the parts in the die and with relation to the runner system. Modeling a change in the orientation of the parts by rotating them about their axis showed that the heat distribution could be made more uniform. Further modeling and evaluation showed that the cooling line layout could be improved because the hottest areas were not being very effectively cooled.

The caster seized the opportunity revealed by the computer modeling results and modified the die accordingly – part orientation and modified cooling lines. The result was a die thermal growth differential of 0.025 mm as opposed to 0.077 mm and the elimination of tie bolt failures. Here's the bonus! Due to the more uniform distribution of heat and better cooling, not only were the tie bolt failures eliminated, but also the cycle time was reduced from 10.2 seconds to 6.3 seconds. This represents a productivity gain of 38% and an equivalent reduction in energy for holding the molten zinc casting alloy! Reduced failures, enhanced productivity, and lower energy usage were made possible by the initiative to utilize advanced modeling techniques.

#### Example 2. Die materials work at CWRU

Major strides have been made toward the extension of die life. Through research efforts in die material chemistry modification and heat treatment optimization, die life extension of up to 50% and more have been witnessed in the field for Premium Grade H13. In one case study, a 20-30% improvement in die life resulted in \$150,000 less die steel purchased and heat treated per year, a 5% scrap reduction, 1% decrease in down time for die repair, and an energy savings of  $4.6 \times 10^9$  BTU/year. In another case, a new die steel chemistry was used and die life was increased from 50,000 shots to over 200,000 shots.

Die material and heat treatment information from the research efforts has been captured in latest NADCA recommended procedures for die steel and heat treatment acceptance. Die steel chemistries other than H-13 that have proven to offer higher resistance to heat checking and gross cracking have now been encompassed in the recommended procedures.

#### Example 3. SSM work at WPI

Semi-solid metal (SSM) processing can be accomplished by two major routes – thixocasting, which utilizes specially prepared billet that is heated to the semi-solid state, and rheocasting, which utilizes molten metal that is cooled to the semi-solid state. Various versions of rheocasting have been developed, one of which is the CRP (continuous rheocasting process) developed by the Worcester Polytechnic Institute (WPI). The CRP process allows for a simple adaptation to a conventional high pressure die casting machine by placing a CRP reactor between the pour ladle and the pour hole of the shot sleeve. The benefits include: elimination of more costly specially prepared billet utilized in thixocasting; lower casting temperatures as compared to conventional die casting, therefore lower energy utilization, faster solidification times, and less thermal fatiguing of dies; and, high integrity cast products that are heat treatable.

Work on assessing the impact of various alloying elements on process friendliness for producing SSM microstructures has established specific composition ranges for standard alloys. Staying within the specific ranges provides for a reasonably wide operating window and robust process. Buhler has embraced the CRP technology and is marketing it as the LTC (low temperature casting) process, thus bringing the CRP to commercialization.

Low temperature casting increases the economic efficiency of die casting systems as the die casting process is set to a lower energy process window. Benefits in addition to lower energy utilization include:

Reduced cycle time (smaller temperature change and time to solidification) and increased die service life (due to lower thermal gradients in the die).

Below are examples of SFSA's case studies:

#### Example 4. Improved Melting Efficiency at MS&T:

The rescheduling of melting program at one member foundry (Monett Metals) has demonstrated a saving in gas consumption of 30%. Savings in electrical power remains to be determined. Electric Arc Furnace melting using a basic lining showed that when a Co-Jet unit is installed the kWh/ton was reduced by 10%. In addition the melt down time was reduced by 13%, these measurements were taken over almost 1200 heats.

#### Example 5: Instrumentation Studies at ISU:

The development of shorter cycle heat treatments has been implemented by a number of foundries, as presented in *Implementing Wireless Embedded Thermocouple Control* by Willy Oyarzabal at the 2008 SFSA T&O Conference.

#### Example 6: Corrosion Studies at Lehigh and Transformation Diagrams at ISU:

The development of an improved heat treatment procedure for 6%Mo stainless steels has showed major improvements in the corrosion resistance of the cast products. This improvement has demonstrated that cast products will have comparable corrosion resistance. Foundries are now looking to see how they can implement this finding. A secondary result of this work is the possible development of a screening test for these materials. A combination of the work of these two universities will ensure improved service life and a reduction in unscheduled shutdowns that is a source of large energy losses in start up and shut downs of chemical and petrochemical plants.

#### Example 7: Hot Tearing Research at Iowa

The simulation model developed by UI is being incorporated in commercially available software (MagmaSoft) and will be made available to all steel castings producers. MagmaSoft is one of the most commonly used pieces of solidification software by steel castings producers.

## Yield Improvement Studies at Iowa

As a result of the work on leaking valve bodies the chemical, petrochemical and engineering companies have funded additional work to further develop the use of solidification simulation as a means to approve vendors. The power of simulation has been exploited to reinforce radiographic inspection by allowing the detection of areas in castings that have a high tendency to form microshrinkage, undetectable by radiography. This technique will improve the integrity of steel castings used for pressure containing parts. There is also interest in this technique to identify areas that may subject to higher stresses in structural parts. Companies and organizations involved in this work include Materials Technology Institute, and its' members which include Exxon, Shell, Dow, and Dupont.

The following companies have been involved in the testing and application of metalcasting research:

### **Cast Material Applications:**

- Brillcast – Grand Rapids, MI
- Metaldyne - Twinsburg, OH
- Contech - Portage, MI
- GM Powertrain – Bedford, IN
- RCM Industries – Franklin Park, IL
- Briggs & Stratton - Wauwatosa, WI

### **Computer Modeling Applications:**

- SKS - Alameda, CA
- Port City Group - Muskegon, MI
- GM Powertrain - Bedford, IN
- Premier Tool & Die Casting - Berrien Springs, MI
- RCM Industries - Franklin Park, IL

### **Die Materials and Coatings Applications:**

- Premier Tool & Die Casting - Berrien Springs, MI
- St. Clair Die Casting - St. Clair, Missouri
- Twin City Die Castings Co. - Minneapolis, MN
- GM Powertrain - Bedford, IN
- Chicago White Metal - Bensenville, IL
- Empire Die Casting - Macedonia, OH
- St. Clair Die Casting - St. Clair, Missouri
- RCM Industries - Franklin Park, IL
- Pace Industries - Fayetteville, Arkansas
- Briggs & Stratton - Wauwatosa, WI
- Diversified Machine Bristol - Bristol, IN

### **Process Technology and SSM Applications:**

- Mercury Marine - Fond du Lac, WI
- BuhlerPrince - Holland, MI and Buhler – Uzwil, Switzerland
- Spartan Light Metal Products – St. Louis, Missouri

- Empire Die Casting - Macedonia, OH
- RCM Industries - Franklin Park, IL
- NEMAK – Sylacauga, AL
- GM Powertrain - Bedford, IN
- Briggs & Stratton - Wauwatosa, WI

### **Yield Improvements**

- Wollaston - Braintree, MA
- Bradken Atlas – Tacoma, WA
- Matrix Metals – Keokuk, IA
- Bradken (formerly A.G. Anderson) - London, Ontario (Canada)
- Stainless Foundry & Engineering - Milwaukee, Wisconsin
- Sivyer Steel - Bettendorf, Iowa
- Exxon/Shell/BP Amoco/Stauffer/Akzo Nobel/Dow/Dupont – various locations

### **Improved Steel Melting Efficiency**

- Monett Metals – Monett, MO
- Harrison Steel – Attica, IN
- Pacific Steel, Berkeley, CA

### **Hot Tearing**

- Bradken (formerly A.G. Anderson) - London, Ontario (Canada)
- Caterpillar, Champaign, IL

### **Shrouding**

- Rexnord FALK – Milwaukee, WI
- Harrison Steel – Attica, IN

### **Short Cycle Heat Treatment**

- Rexnord FALK - Milwaukee, WI
- Spokane Steel – Spokane, WA

### **Clean Steel: Melting Practices**

- Sivyer Steel - Bettendorf, Iowa
- Bradken Atchison - Atchison, KS
- Harrison Steel – Attica, IN

### **Corrosion/Phase Transformation**

- Stainless Foundry & Engineering - Milwaukee, Wisconsin
- Wollaston - Braintree, MA

## **5. CMC Website**

The CMC website successfully promoted the DOE metalcasting research and development into industry. Over the ten year period of the program, the website averaged 1,034 page views and 821 visits per month. It was updated regularly with events and project information of interest to the metalcasting supply chain. The CMC website was compiled by ATI with input from CMC's partners, including university researchers, metalcasting industry associations, government

partners, and CMC committee members. It includes a complete calendar of upcoming events and links to updated summaries of all metalcasting R&D projects in the Energy-Savings Melting and Revert Reduction Technology (E-SMARRT) program. Included in the CMC website are links to the DOE website and the metalcasting industry associations' websites (AFS, NADCA, and SFSA).

## **Conclusions and Recommendations**

Although the CMC contract was not fully funded by DOE, the CMC Partnership has demonstrated effectiveness in deploying metalcasting R&D into industry. The primary conduit of this technology transfer was comprised of the three metalcasting associations, AFS, NADCA, and SFSA. The three metalcasting industry associations utilized a process which maintains information dissemination and keeps technology transfer efforts focused on the industry. These efforts have reached the level of individual metalcasting technical and operating employees responsible for company functions where DOE/OIT R&D applies. In a highly diverse and fragmented industry, the focused technology transfer efforts over time allowed for the successful R&D transfer into actual process changes.

Process energy savings and emission reductions from DOE/OIT R&D are already underway and are being continued under the DOE-sponsored Energy-Savings Melting and Revert Reduction Technology (E-SMARRT) program, proving the effectiveness of the CMC Partnership. Light metalcasting process savings have already been demonstrated in the automotive, truck, and recreational marine market segments.

Further deployment of R&D completed and underway is estimated to return over five times the DOE/OIT and industry dollar investment. In terms of BTU's, full deployment will save about 55% of the industry's 1998 energy usage.

Significant new metalcasting R&D projects have been developed that will save additional energy and reduce emissions. Industry, represented in this partnership, urges the Department of Energy to continue this important work to assure full deployment of benefits for the Metalcasting Industry of the Future.

## Appendix A: CMC Consolidated Quarterly Reports

### Q42008

**Status:** The following occurred during the fourth calendar quarter of 2008:

- SFSA attended the Heavy Section Product Group and National Management meeting in Milwaukee on October 9-10.
- SFSA attended the High Alloy Product Group meeting at Fisher Controls in Marshalltown, IA on October 28-29.
- The SFSA Specifications Committee met in St. Louis, MO on November 18.
- SFSA attended the 62<sup>nd</sup> national Technical & Operating conference on December 11-13 in Chicago, IL.
- NADCA attended the Plant Management Conference in Greenville, SC on October 22-24.
- NADCA attended the Product Standards Committee meeting at NADCA Headquarters in Wheeling, IL on November 5.
- AFS International Lost Foam Conference Oct. 21-23, in Asheville, NC
  - AFS Division 11 meeting
  - Lost Foam Consortium meeting
  - Conference & Exhibition attended by 70 people, including US, Canada, Mexico, Germany, China and India
  - Plant tour of BRP
- AFS attended the Division 11 & LFC meeting in Birmingham, AL, prior to AFS Southeast Regional Conference
- AFS held a meeting at MS&T to review past project activity on Aging Iron and the AFS funded bridge project.

### Q32008

**Status:** The following occurred during the third calendar quarter of 2008:

- A CMC / E-SMARRT Industry Review Board Conference Call was held on July 29, 2008.
- The E-SMARRT Technical Advisory Committee met on September 4, 2008, in Chicago, IL.
- NADCA held the WPI International Summer School on High Integrity Casting on July 28-August 1 at WPI. NADCA was a co-sponsor.
- NADCA held a Product Standards Revision Task Force meeting at NADCA, Wheeling, IL, on August 20.
- NADCA made a presentation encompassing die life at the NADCA Chapter 7 meeting on September 24 in Newark, NJ.
- AFS published an article on Aging Iron in August Modern Casting – Iron, Better With Age.
- A Technical Paper for the special International Journal of MetalCasting (IJMC) Fall 2008 research Issue on Aging Iron was updated by AFS.
- A Gray Cast Iron Research 5H Committee meeting was held at AFS on September 9.
- A Ductile Iron 5I Research Committee meeting was held at MS&T on September 18.
- AFS held an Aluminum Division 2 meeting at AFS on September 23-24.
- AFS held a Steel Division meeting at AFS on September 11.

- SFSA conducted the Carbon and Low Alloy Research Review in Rosemont, IL on July 16-17.
- SFSA attended the Western Division Technical & Operating meeting on August 14-15 in Portland, OR.
- SFSA attended the Safety & HR Meeting on August 20-21 in Pewaukee, WI.
- SFSA attended the Eastern Division Technical & Operating meeting on August 26-27 in London, Ontario, Canada at AmeriCast London, Casting Division.
- SFSA attended the annual meeting in Charleston, SC on September 6-9.

## Q22008

**Status:** The following occurred during the second calendar quarter of 2008:

- A one-day Die Coatings event entitled “Surface Engineering for High Performance Die Casting Tooling” was held at the Hilton Garden Inn O’Hare in Chicago on April 23. This was jointly sponsored by ASM and NADCA.
- NADCA held a Die Materials Task Force meeting at CSM in Golden, CO on June 10.
- NADCA held a Die Materials Committee meeting at CSM in Golden, CO on June 11.
- NADCA held an R&D Committee meeting at CSM in Golden, CO on June 12.
- NADCA held a Product Standards Revision Task Force meeting at NADCA HQ on June 18.
- NADCA held a Computer Modeling Task Force meeting at OSU in Columbus, OH on June 18.
- AFS and NADCA-sponsored E-SMARRT projects made several presentations at CastExpo 2008 in Atlanta, GA, May 17-20.
- The LFC (Lost Foam Consortium) and AFS Division 11 (Lost Foam) held a meeting at AFS June 25 - 26 (Papers 08-198, 08-090, 08-091,08-150).
- Part 1 – Analysis of “Mold Filling in Lost Foam Casting of Aluminum: Method” was published in the AFS International Journal of MetalCasting (IJMC) Summer 2008 Volume 2 Issue 3. Part 2 will be published in Winter 2009, Volume 3 Issue 1.
- ESI is finalizing E-SMARRT Task 3.13.2 for commercializing the wax shrinkage prediction model. Data from ORNL has been supplied to ESI and they are working to create a commercial code. AFS is adding funding with AFS research funds for code verification and demonstration of the project at University of Alabama and some of the industrial partners. EMTEC is assisting with the technology transfer. A meeting was held during CastExpo 2008 in Atlanta with AFS 4L Committee. Some of the issues UAB encountered accounting for wax injection pressure were discussed. The model is being modified to accommodate injection pressures.
- A paper on the Aging of Graphitic Cast Irons and Machinability work was published in AFS International Journal of MetalCasting (IJMC) Winter 2008 Volume 2 Issue 1. Also, several presentations on the latest results, kinetics and verification model for aging casting iron were presented at CastExpo 2008 in Atlanta. This gray cast iron phase project is in its final completion phase. Since funding has stopped, the next phase to investigate ductile iron is on hold. A paper will also appear in the August issue of Modern Casting on the latest results and summarizing what was presented at Atlanta.
- In the Development of Elevated Temperature Aluminum MMC Alloy and Process Technology project, a new batch of MMC material, anticipated using the results of the previous work, is on hold until additional funding can be secured. This will be used to

cast test specimens for developing room temperature mechanical properties as well as some example test castings.

- Conducted a joint CMC / ESMARRT Technical Advisory Committee (TAC) meeting, at NADCA in Wheeling, IL on May 29.

## Q12008

**Status:** The following occurred during the first quarter of 2008:

- AFS Division 5H Gray Iron Research & 5I Ductile Iron Research Committees will meet on January 8-9 at AFS, Schaumburg, IL.
- AFS Division 2F Aluminum Metal Matrix Composites & 2E Permanent Mold Committees will meet on January 15-16 at AFS, Schaumburg, IL.
- Publication of 2<sup>nd</sup> issue of AFS International Journal of MetalCasting (IJMC) Winter 2008, which includes Aging of Gray Iron article by Von Richards.
- 58<sup>th</sup> World Foundry Congress and Energy technical Forum in Chennai, India February 7-10, including presentation by T. Prucha on DOE sponsored work “Implementation of Metal Casting Best Practices”.
- AFS International Permanent Mold Conference will be held on February 10-12 in Dallas, TX, which will include presentations by Canmet on Hot Tear PM project and HIMAC projects.
- AFS Research Board meets February 19 at AFS, Schaumburg, IL.
- AFS Division 6 Magnesium will meet on February 20th at AFS, Schaumburg, IL.
- The 11th Lost Foam Consortium meeting is planned for Vulcan engineering in Birmingham, AL on February 20 with the AFS Division 11 Lost Foam meeting on February 21.
- AFS Wisconsin Chapter meeting in West Allis, WI on March 17. Tom Prucha will be reviewing AFS-sponsored and monitored research projects including AFS DOE projects.
- NADCA will hold Die Materials Task Force meetings at NADCA Headquarters in Wheeling, IL on February 12.
- NADCA will hold a Die Materials Committee meeting at NADCA Headquarters in Wheeling, IL on February 13.
- NADCA will hold an R&D Committee meeting at NADCA Headquarters in Wheeling, IL on February 14.
- Papers for the NADCA congress sessions to be held at the CastExpo'08 in Atlanta this May are in the review process.
- SFSA High Alloy Research Committee will have a joint meeting with MTI in Tampa, FL on February 13.
- SFSA Safety Committee & Human Resources Committee meeting will meet at Berkeley, CA on March 6-7.

## Q42007

**Status:** The following occurred during the fourth quarter of 2007:

- AFS Division 6 Magnesium met October 2 at AFS, Schaumburg, IL.
- AFS Division 2C Aluminum Research & 2E Permanent Mold Committees met on October 9 at AFS, Schaumburg, IL
- AFS Technology Development Council Meeting met on October 10 to discuss and review progress and milestones of AFS-sponsored R&D projects.

- AFS NE Ohio Chapter met in Cleveland, OH on October 11 to review AFS-sponsored and research projects.
- AFS Mo-Kan (Missouri-Kansas) Chapter met in Kansas City, MO. on October 18.
- AFS Saginaw Valley State University Student Chapter met on November 1.
- The Foundry Education Foundation (FEF) annual CIC meeting was held at the Drake Hotel, Chicago, IL on November 9.
- The 10th Lost Foam Consortium met at UAB, Birmingham, AL on November 27, with the AFS Division 11 Lost Foam meeting held on November 28.
- The AFS Research Board met on November 27 at AFS, Schaumburg, IL.
- NADCA held a Die Materials Task Force meeting at NADCA Headquarters in Wheeling, IL on October 16.
- NADCA held a Die Materials Committee meeting at NADCA Headquarters in Wheeling, IL on October 17.
- NADCA conducted an R&D Committee meeting at NADCA Headquarters in Wheeling, IL on October 18.
- The 2007 NADCA Marketing Conference met on October 23 - 24 in Indianapolis, IN at the Radisson North.
- SFSA High Alloy Research Review Meeting was conducted at Shell Research, Houston, TX, October 3-4.
- SFSA T&O was successfully conducted in Chicago, IL, December 12-15.

### Q32007

**Status:** The following occurred during the third quarter of 2007:

- The 9<sup>th</sup> Lost Foam Consortium meeting was held at AFS, Schaumburg, IL., July 18. The AFS Division 11 Lost Foam Committee meeting was held the following day, July 19.
- The AFS Research Board Meeting was held at AFS, Schaumburg, IL on August 28.
- AFS Division 5H Gray Iron Research Committee met on September 11 at AFS, Schaumburg, IL.
- AFS 5I Ductile Iron Research Committee and tour of University of Missouri – Rolla was conducted on September 26-27.
- The SFSA Western Division Technical & Operating Meeting was held in Berkeley, CA on July 12-13.
- The SFSA Carbon & Low Alloy Research Review (highlighting SFSA’s Energy-SMARRT research projects) was held in Rosemont, IL on July 18-19.
- SFSA’s Eastern Division Technical & Operating Meeting was held in Cincinnati, OH on August 8-9.
- SFSA’s Annual Meeting was held at the Alyeska Resort in Alaska on August 18-22.
- The SFSA Safety Committee & Human Resources Committee meeting was conducted at Atchison Steel (Kansas) on September 18-19.
- NADCA’s Plant Management Conference was held at the Hilton Milwaukee City Center, Milwaukee, WI on September 19-21.

### Q22007

**Status:** The following occurred during second quarter, 2007:

- A review of ORNL’s “Prediction of Wax Pattern Tooling and Final Investment Casting Dimensions” project was held on April 10 at ORNL, Knoxville, TN. After the meeting

the decision was made to focus activities to commercialize the code for wax pattern injection dimension prediction. A meeting to finalize approach was conducted at 111<sup>th</sup> Metalcasting Congress, Houston TX. An ORNL presentation was made by the steering committee, a planning meeting held, and a revised proposal prepared and submitted to ATI and DOE to contract the code development work to ESI.

- An SFSA Spring Management Meeting was held on April 13 at the Spring Hill Suites O'Hare, in Chicago, IL.
- On April 5, there was an SFSA review of UI projects at the Naval Surface Warfare Center, Carderock Division.
- A NADCA Government Affairs Conference was held at the Hotel George in Washington, D.C. on April 24-25.
- UMR's Aging Cast Iron project review was held May 1-3 during AFS 5H (Gray Iron Research) and 5I (Ductile Iron Research) Committee meetings at AFS Headquarters in Schaumburg, IL.
- CMC TAC meetings were held at NADCA in Wheeling, IL on May 8 and June 25.
- The 111th Metalcasting Congress (co-sponsored by AFS & NADCA) was held at the Hilton Americas in Houston, TX, on May 15-18.
- NADCA Committee meetings were held on May 17 at the Hilton Americas in Houston, TX.
- A NADCA Board of Governors meeting was held on May 18 at the Hilton Americas in Houston, TX.
- The CMC Executive Board met at NADCA in Wheeling, IL on June 25.
- CANMET's "Feasibility of Producing Lost Foam Castings in Aluminum and Magnesium Based Alloys" project review was held June 27 during AFS 2C (Aluminum Research) and 2E (Permanent Mold) Committee meetings at AFS Headquarters in Schaumburg, IL.
- Eck's "Development of Elevated Temperature Aluminum MMC Alloy and Process Technology" project review was held June 27 during AFS 2F Committee meeting at AFS Headquarters in Schaumburg, IL.

## Q12007

**Status:** The following occurred during first quarter, 2007:

- A UMR Aging Cast Iron project review was held January 10-11 during AFS 5H (Gray Iron Research) and 5I (Ductile Iron Research) Committee meetings at AFS Headquarters in Schaumburg, IL.
- A Canmet Clean Steel project review was held January 10 during AFS 9A (Steel Executive) meetings via a Webex conference call.
- An SFSA Technical Steering Committee meeting and review of all research projects took place on January 11.
- An SFSA board meeting was held on January 13-14.
- A review of UI projects took place at UI on January 16.
- A project review meeting with the University of Iowa was held January 16-18.
- A project of review of Canmet's "Feasibility of Producing Lost Foam Castings in Aluminum and Magnesium Based Alloys" project was held January 23 during AFS 2C (Aluminum Research) and 2E (Permanent Mold) Committee meetings at AFS Headquarters in Schaumburg, IL.

- A review of Eck's "Development of Elevated Temperature Aluminum MMC Alloy and Process Technology" project was held on January 23 during a AFS 2F Committee meeting at AFS Headquarters in Schaumburg, IL.
- A CMC Technical Advisory Committee (TAC) Meeting was held on January 25 in Chicago, IL.
- NADCA Committee Meetings were held on January 25 at NADCA Headquarters in Wheeling, IL.
- The NADCA Board of Governors meeting was held on January 26 at NADCA Headquarters in Wheeling, IL.
- A CMC Technical Committee Conference Call took place on February 2. Conference call minutes were distributed to the Technical Committee and are on file at ATI.
- An AFS Wisconsin Regional meeting was held at the Pfister Hotel in Milwaukee, WI, on February 8-9.
- An AFS/CMI Board of Directors Meeting was held at the Renaissance Resort at World Golf Village, St. Augustine, FL, on February 11-12.
- NADCA held a Die Materials Task Force meeting at NADCA Headquarters in Wheeling, IL on February 20.
- NADCA held a Die Materials Committee meeting at NADCA Headquarters in Wheeling, IL on February 21.
- NADCA held an R&D Committee meeting at NADCA Headquarters in Wheeling, IL on February 22.
- A NADCA CEO Conference was held at Mauna Lani Bay Hotel & Bungalows on the Kohala Coast of the Island of Hawaii on February 18-22.
- An AFS Southeast Regional Conference was held at the Crown Reef Resort in Myrtle Beach, SC, February 28-March 2.
- An AFS Northwest Regional Conference was held at the Coast Plaza Hotel & Suites in Vancouver, BC, Canada on March 1-3.
- A CMC TAC Conference Call was held on March 9.
- On March 13, an SFSA High Alloy Research Committee meeting took place to discuss the Lehigh (5.7) and Iowa State (5.6) projects.
- A UAB Lost Foam Workshop was held March 13-15 in Birmingham, AL. There were tours on the 15th of both a lost foam aluminum and a lost foam iron foundry.
- There was an AFS Government Affairs Conference in Washington, DC on March 28-30.

## Q42006

**Status:** The following occurred during fourth quarter, 2006:

- CMC Technical Committee Conference Calls took place on November 3 and December 8. Conference call minutes were distributed to the Technical Committee and are on file at ATI.
- The NADCA Board of Governors meeting was held on October 6 at NADCA Headquarters in Wheeling, IL.
- The AFS Technology Development Council met on October 11 to discuss new project funding requirements, intellectual property policy, and metrics to track project outcomes.
- Presented overview of CMC / E-SMARRT programs to South Carolina Energy Symposium in Columbia, SC on October 16.

- NADCA Die Materials Committee meeting was held at NADCA Headquarters in Wheeling, IL on October 18.
- NADCA Cast Materials Task Force meeting was held at NADCA Headquarters in Wheeling, IL on October 18.
- NADCA R&D Committee meeting was held at NADCA Headquarters in Wheeling, IL on October 19.
- An AFS Workshop on Energy Saving in the Foundry was held at AFS Headquarters in Schaumburg, IL on October 25-26. DOE Best Practices were presented by Dick Bennett. Other topics included melting, metal holding and transfer, industrial assessment centers, space/process heating & lighting.
- AFS and CANMET presented “Technology for Magnesium Castings: Design, Use and Applications” at CANMET’s facility in Ottawa, ON, on October 31-November 1.
- The Manufacturing Advanced Engineered Components Using Lost Foam Casting, WBS 3.8, program review was held at UAB on November 1.
- The Manufacturing Advanced Engineered Components Using Lost Foam Casting, WBS 3.8, Ad Hoc Committee prepared a draft ASTM lost foam standard to review at the November 2 AFS Lost Foam Casting Division Meeting at Teksid, Sylacauga AL.
- An AFS Division Council meeting was held at AFS Headquarters in Schaumburg, IL, on November 8.
- John Moore provided a die surface engineered coatings presentation for NADCA Chapter 39 in Southwestern Michigan on November 9.
- An AFS Advanced Foundry Environmental Seminar was held at The Crown Plaza Atlanta Airport Hotel in Atlanta, GA, on November 13-14.
- The annual Foundry Education Foundation (FEF) College Industry Conference was held at the Drake Hotel in Chicago IL on Nov. 16-18. All key metalcasting professors and their students gather annually to learn new developments and become better acquainted with the industry.
- The CMC Technical Advisory Committee conducted a conference call on November 21.
- AFS Research Board Meeting was held at AFS Headquarters in Schaumburg, IL, on November 28.
- The SFSA held its 60th Technical & Operating Conference at The Drake Hotel in Chicago, IL, on December 13-16. The meeting attendance was 207, and 50% of the 39 papers presented came from operating steel foundries. Researchers presented information on all of the Energy SMARRT tasks. The winner of the best first time speaker award reported on the implementation of the Iowa State University work at FALK Corporation.

### **Q32006**

**Status:** The following occurred during third quarter, 2006:

- CMC Technical Committee Conference Calls took place on August 4 and September 29. Conference call minutes were distributed to the Technical Committee and are on file at ATI.
- The SFSA held a Western Division T&O meeting in Tacoma, WA on July 13-14.
- The Light Metals Permanent Mold Casting, WBS 3.14, Steering Committee held a conference calls on July 13 and 26. Plans for the 2007 Metalcasting Congress paper were reviewed along with the completed plant trials analysis.
- A CMC Technical Advisory Committee conference call took place on July 25. A CMC Meeting took place in Chicago on September 27.

- *Light Metals Permanent Mold Casting*, WBS 3.14, review and planning conference call took place on July 26.
- A NADCA Technology Administration Group meeting was held in August.
- A NADCA Computer Modeling Task Force meeting was held in August.
- An SFSA High Alloy Product Group meeting was held August 2-3 in Baytown, TX.
- An AFS Research Board meeting on sustained R&D funding was held at AFS headquarters in Schaumburg, IL on August 1.
- A SFSA Carbon and Low Alloy Research Review was held on August 9 - 10 in Chicago.
- An AFS Chapter Officers Conference was held at Sheraton Suites, Elk Grove Village, IL, on August 10-11. Completed R&D posters were available for local chapter meetings.
- There was an SFSA Marketing Committee meeting in London, Ontario on August 22-23 to discuss market applications.
- A quarterly AFS Research Board meeting took place at AFS headquarters in Schaumburg, IL on August 29.
- Plans for updating the Hot Tear Control Handbook were discussed with the Light Metals Permanent Mold Casting, WBS 3.14, Steering Committee, and its request for support from the Aluminum Division in September during its meeting.
- The CMC Executive Board met in Chicago on September 5.
- The 2006 Industrial Technologies Program Corporate Peer Review took place at the Sheraton National Hotel in Arlington, Virginia on September 6-7.
- The SFSA Annual meeting was held on September 11-12.
- An AFS Foundry Executive Management Conference was held at the Silverado Resort in Napa Valley, CA on September 10-12.
- The AFS 18th Environmental Health & Safety Conference was held at Sheraton Music City Hotel in Nashville, TN on September 17-20.
- A call for papers for the 111<sup>th</sup> Metalcasting Congress was issued and other related planning will continue.
- The 2006 NADCA Plant Management Conference was held on September 20-22 in Minneapolis, Minnesota at the Marriott City Center.

## Q22006

**Status:** The following occurred during second quarter, 2006:

- CMC Technical Committee Conference Calls took place on Apr. 28, May 26, and June 27. Conference call minutes were distributed to the Technical Committee and are on file at ATI.
- The AFS/NADCA 110<sup>th</sup> Metalcasting Congress was held April 18-21 in Columbus, OH. ATI hosted a booth promoting CMC and Energy SMARRT projects and information.
- A NADCA Board meeting was held in April.
- NADCA held a Die Specification and Heat Treat Task Force meeting in April.
- The AFS 4-L committee met on April 20 in Columbus OH, and recommended a paper for the Fall 2007 ICI Conference to provide awareness of the plans and accomplishments on Prediction of Wax Pattern Tooling and Final Investment Casting Dimensions (ORNL-EMTEC), WBS 3.13 to seek broader adoption and project participation.
- SFSA attended an ISO Technical Committee 17SC11 on April 25 - 26.
- The AFS Research Board approved funding in May for a 4L Committee proposal with the University of Alabama on industry guidelines for investment casting modeling. This

works support s the wax trials planned for Prediction of Wax Pattern Tooling and Final Investment Casting Dimensions (ORNL-EMTEC), WBS 3.13.

- A CMC Technical Advisory Committee meeting was held on May 2 in Chicago, IL.
- An AFS Technology Development Council meeting was held at AFS Headquarters in Schaumburg, IL, on May 3.
- SFSA Board of Directors, Technology Steering, and Marketing Committee meetings were held on May 9 - 11. Plant tours of Michigan Steel and Eagle Alloy in Muskegon, MI were also provided during this time.
- The AFS Cast Iron Research Committees met on May 9 (Gray Iron) and May 11 (Ductile Iron) to review the Aging of Graphitic Cast Irons and Machinability (UMR), WBS 5.11.
- An AFS Division 9 meeting was held on May 16.
- An AFS Research Board Meeting will take place at AFS Headquarters in Schaumburg, IL on May 23.
- The AFS Technology Development Council met on May 24.
- The WPI ACRC Review was held on May 24 - 25 at WPI. NADCA attended.
- AFS Research Board met on May 31.
- SFSA visited Harrison-Deox on June 8 regarding the Energy SMARRT Clean Steel project.
- An AFS Permanent Mold Practices Committee 2-E, took place on June 13.
- The AFS Aluminum Division 2 met with CANMET to review the progress of the WBS 3.14, Light Metals Permanent Mold Casting at Muskegon MI on June 13.
- An AFS Magnesium Division 6 meeting took place on June 15.
- A CMC Executive Board meeting was held on June 20 in Chicago. Minutes were distributed and are on file at ATI.
- SFSA attended Heavy Section and Eastern Division meetings and participated in a plant tour in Carlisle, PA on June 21 with about 20 SFSA members.
- The AFS Division Council met at AFS in Schaumburg IL on June 21.
- CMC Technical Advisory Committee conference call was held on June 23.
- Program sponsors reviewed the UAB Manufacturing Advanced Engineered Components Using Lost Foam Casting, WBS 3.8, at AFS, Schaumburg IL on June 28.
- NADCA held Die Materials and R&D Committee meetings and Task Force meetings in June at Case Western Reserve University.

## Q12006

**Status:** The following occurred during first quarter, 2006:

- CMC Technical Committee Conference Calls took place on January 20, February 24, and March 24. Conference call minutes were distributed to the Technical Committee and are on file at ATI.
- A CMC Technical Advisory Committee (TAC) meeting took place on January 4 in Schaumburg, IL.
- A review of UMR project 5.11, "Aging and Machinability of Cast Iron" was reviewed on January 11 at AFS offices in Schaumburg, IL.
- A CMC / ESMARRT program status and plans and SFSA Board Meeting occurred on January 14-15 in Wailea, Hawaii.
- A NADCA Board meeting was held on January 20 at NADCA HQ in Wheeling, IL.
- ATI visited Colorado School of Mines on January 26 for a project review.

- Thornton White of ATI and Debo Aichbhaumik of DOE Go met in Golden, CO on January 27 to discuss the CMC and Energy SMARRT programs.
- An AFS/CMI Board of Directors Meeting took place at Mansion on Forsyth Park, in Savannah, GA, on January 29-31.
- An AFS Foundry Environmental 101 Seminar was held at the Crown Plaza Airport Hotel in Atlanta, GA, on February 6-7.
- An SFSA Carbon and High Alloy Meeting was held at Lehigh University in Bethlehem PA on February 7.
- An AFS Wisconsin Regional meeting was held at the Pfister Hotel in Milwaukee, WI, on February 9-10.
- An AFS Southeastern Regional Conference was held at the Hilton Downtown in Nashville, TN, on February 15-17.
- NADCA held a Die Specification and Heat Treat Task Force meeting and a Die Materials Development Task Force meeting on February 21 at NADCA HQ in Wheeling, IL.
- NADCA held a Die Materials Committee meeting and a Thin Wall Zinc Project Review meeting on February 22 at NADCA HQ in Wheeling, IL.
- A sponsor review for UAB's project 3.8, "Manufacturing Advanced Engineered Components Using Lost Foam Casting Technology" was held on February 22 in Birmingham, AL.
- The NADCA CEO conference was held February 19-23 at the Fairmont Turnberry Isle Resort in Aventura, FL.
- An SFSA Carbon & Low Alloy Research Committee Meeting took place at the University of Iowa, Iowa City, IA on February 23.
- NADCA held a R&D Committee meeting and a Process Technology Task Force meeting on February 23 at NADCA HQ in Wheeling, IL.
- A sponsor review conference call took place on Feb. 27 with regard to CANMET's project 3.1, "Clean Steel Casting Production".
- An AFS Northwest Regional Conference occurred at the Red Lion Hotel in Seattle, WA, from March 2-4.
- A CMC / ESMARRT TAC Conference Call was held on March 3.
- An AFS Conference on Advancements in Low Emissions Castings Technology (Co-sponsored by CERP) took place at the Hilton Cincinnati Netherland Plaza in Cincinnati, OH, on March 14-15.
- An AFS Texas Regional Conference was held at the Doral-Tesoro Resort in Dallas/Ft. Worth, TX, on March 23-25.
- The NADCA Product Standards Task Force completed its effort on the 2006 revision of the Product Specification Standards for Die Casting which is now in print.

## **Q42005**

**Status:** The following occurred during fourth quarter, 2005:

- Monthly CMC Technical Committee conference calls were held on November 18 and December 16.
- An AFS International Conference on High Integrity Light Metal Castings was held at the Holiday Inn Airport in Indianapolis, IN from October 31-November 1.
- An SFSA Technical and Operating Conference and Workshop, was held November 2-5 in Chicago, IL.

- SFSA proposed additions to ASTM standard based on University of Tennessee work, November 9, Dallas, TX.
- Lost Foam Casting of Powertrain Parts took place November 15-16 at Mercury Marine, Fond Du Lac, WI.
- NADCA held R&D and Die Materials committee meetings.
- CMC Technical Advisory Committee (TAC) meeting was conducted on November 16 at AFS, Schaumburg, IL.
- NADCA held a Product Standards Task Force meeting.
- Joint CMC Board / ESMARRT IRB Meeting was conducted on December 13 at NADCA, Wheeling, IL.

### Q32005

**Status:** The following occurred during third quarter, 2005:

- Monthly CMC Technical Committee conference calls were held on July 15, August 19, and September 30.
- SFSA held a Carbon and Low Alloy Research Review on July 13 - 14.
- NADCA attended a Thin Wall Zinc project kick-off meeting at Teckcominco in Toronto on July 14.
- An Energy SMARRT Industry Review Board meeting was held on August 2 at NADCA in Wheeling, IL.
- The AFS Gray Iron Research Committee (5- H) met at ORNL, Oak Ridge TN.
- Eck Industries in Manitowoc, WI visited AFS for an informal program review on August 3.
- On August 3, Steve Udvardy of NADCA accompanied Rob Naranjo and Bob Eppich on evaluation and implementation of DOE research assessment visit to a Metaldyne facility in Niles, IL.
- An SFSA Eastern/Southern Division meeting was held in Cleveland, OH on August 16.
- SFSA held a Marketing Committee meeting on August 16 - 17 in Milwaukee, WI.
- An SFSA Western Division meeting was held in Spokane, WA on August 18 -19.
- An AFS EH&S Conference was held at the Dearborn Inn, Dearborn, MI, on August 21-24.
- An SFSA High Alloy Product Group meeting was held in Rosemont, IL on August 25.
- An AFS Research Board meeting was held on Tuesday, August 30.
- NADCA participated in a Product Standards Committee conference call on August 31.
- NADCA participated in Process Technologies Task Force Net meetings on September 1 and 14.
- SFSA held an annual meeting from September 10 – 14.
- NADCA held a plant management conference from September 21-23.
- ATI hosted a CMC booth at the Ohio Technology Showcase on September 27-29, in Cleveland.
- An AFS Conference on Cast Iron Inoculation was held at the Hyatt Hotel in Schaumburg, IL from September 29-30.
- NADCA will hold a Congress Plant Management Conference and a Product Standards Task Force Meeting.

### Q22005

**Status:** The following occurred during second quarter, 2005:

- The CMC Technical Committee held conference calls on May 20 and June 17. Meeting minutes are on file at ATI.
- A report was prepared by NADCA for an energy and technology assessment audit of GM PowerTrain.
- SFSA attended the NASCC meeting in Montreal from April 6-8.
- All CMC members attended CastExpo in St. Louis, MO from April 16-19. Certain Energy SMARRT projects were reviewed during the Congress Sessions. Those not reviewed during the Congress were reviewed during a one-day DOE Metalcasting Portfolio review on April 20 in St. Louis. All presentations are listed below under the “presentations/publications” section.
- The World Foundrymen Organization held a Technical Forum on April 19 in St. Louis, MO to discuss the future direction of Metalcasting research.
- The Technical Steering Committee met April 28 to discuss the DOE Best Practices Implementation Special Study with Eppich Technologies and BCS in Chicago, IL.
- SFSA’s Marketing Committee meeting and Heavy Section Product Group meeting was held at Harrison Steel in Attica, IN on May 3-4.
- AFS held a Magnesium Division Technology Roadmap Workshop, ANL, on May 10-11. Topical discussion of the energy saving within and beyond the foundry in non-automotive applications of magnesium were discussed.
- NADCA held a board meeting on May 13.
- SFSA held a Specifications Committee meeting on May 17 in Reno, NV.
- The AFS Northwest Regional Conference was held at The Monarch Hotel and Conference Center in Clackamas, OR on May 19-21.
- The CMC - Lost Foam Consortium met at Fond du Lac, WI for both a tour of Mercury Marine’s Lost Foam Casting with pressure line, and a program review on May 21.
- An AFS Research Board meeting was held at AFS Headquarters in Schaumburg, IL on May 24.
- NADCA attended a May 24 - 25 semi-annual review of SSM projects at WPI in Worcester, MA.
- AFS held a conference call with Eppich Technologies and BCS on May 26 to identify Lost Foam Casting foundries for study.
- The Materials Peer Review was held June 1 – 3 in Chicago, IL.
- The Sensors Peer Review was held in conjunction with the Sensors Expo and Conference on June 6 in Chicago, IL.
- An SFSA Technical Steering Committee meeting was held on June 7 in Chicago, IL.
- NADCA attended a Computer Modeling Task Force meeting at Ohio State on June 9.
- SFSA attended ASTM meeting E07 on June 13.
- A NADCA R&D meeting and related project reviews was held on June 15.
- An AFS Division Council meeting was held at AFS Headquarters in Schaumburg, IL on Jun 15.
- On June 21-22, NADCA attended a Die Materials Committee and a Task Force meeting at Ohio State for project reviews and NADCA spec preparation.
- NADCA Die Materials Committee meetings and related project reviews were held on June 28 - 29.
- A NADCA Product Standards Task Force meeting to continue the document revision process was held on May 12 and June 23.

- SFSA provided an updated discussion document for heat treatment procedure qualification work being used for development of ISO specification at ISO TC17/SC11 meeting held on June 27 - 28.
- AFS assisted DOE GO to obtain a draft final report for “Improvements in Sand Mold/Core Technology: Effects on Casting Finish” by John Lanutti at OSU.

## Q12005

**Status:** The following occurred during first quarter, 2005:

- Held CMC Technical Committee Conference calls on January 21 and March 23.
- An AFS Steel Cast Committee Project Review was held on January 5.
- A Computer Modeling Task Force meeting was held at OSU on January 14, with AFS in attendance.
- An SFSA National Technical & Operating (T&O) Conference Committee meeting was held on January 14.
- An SFSA Technical Steering Committee meeting was held on January 15.
- An SFSA Industry Board of Directors meeting was held on January 16.
- A NADCA Board meeting was held on January 28 at NADCA Headquarters. A brief R&D update was provided.
- SFSA High Alloy and Carbon and Low Alloy Research Committee meetings were held February 2-3.
- An AFS Wisconsin Regional meeting was held on February 10.
- A NADCA R&D Committee meeting and related project reviews were held on February 16 at NADCA Headquarters.
- On Feb 16, SFSA met at Cal Poly, Pomona to discuss tech transfer of Transformation Diagram data and experimental techniques.
- Held NADCA Die Materials Committee meetings and related project reviews were held on February 22 - 23 at NADCA Headquarters.
- A NADCA Product Standards Task Force meeting was held on February 24 at NADCA Headquarters.
- AFS Technical Committee meetings were held January 21.
- The AFS Aluminum Division Committee met January 25 and reviewed project status for “Development of Elevated Temperature Aluminum MMC Alloy and Process Technology” (Energy SMARRT project 5.4 by Eck Industries).
- High Alloy and Low Alloy Research Committee meetings were held on February 2-3.
- An AFS Wisconsin Regional meeting was held on February 10.
- ATI taught a Casting Design class for the American Foundry Society’s Engineered Castings Solutions magazine on March 1 in Detroit, MI. There were over 40 attendees, many from automotive companies and tier one supply base.
- The “Heat Transfer Coefficient – Phase II” Steering Committee met by conference call on March 31 to review status and upcoming Congress presentations.
- AFS and NADCA reviewed CastExpo papers and made logistical preparations for the event.
- NADCA prepared a report for an energy and technology assessment audit of Littler Die Casting.
- AFS reviewed a draft final report on Lost Foam Casting – Phase V by UAB.
- AFS identified and archived periodical literature and ITP final reports for web retrieval.

## Q42004

**Status:** The following occurred during fourth quarter, 2004:

- Held CMC Technical Committee Conference calls on November 12 and December 20, 2004.
- The CMC edited Energy SMARRT fact sheets.
- In October, SFSA met with industry suppliers.
- In October, SFSA reviewed Iowa State University projects at the University.
- The Thin Wall Iron Group held a program review on October 5.
- The AFS Technology Development Council met on October 6. They are responsible for the planning and execution of technology development required for global competitiveness.
- A NADCA R&D Committee meeting was held on October 14 at WPI.
- AFS's Lost Foam Casting Conference was held in Toledo OH, October 19-21.
- The Heat Transfer Coefficient in Permanent Mold Light Metals project held a review on October 26.
- AFS Division 11 participated in the review of the EPS Pattern inspection program by IAC on October 21.
- NADCA Die Materials Committee meetings were held on October 26 - 27 at CWRU for project reviews and technical transfer discussion.
- NADCA Committee Meetings and Board of Governors meetings were held October 28 - 29 at NADCA Headquarters in Wheeling, IL.
- NADCA Produced storyboards for a DOE Process Heating Event held in IL on November 1.
- On November 3, NADCA held a Technology Administration Group meeting via teleconference for project reviews and updates.
- SFSA's National T&O Conference was held from November 3-6 in Chicago, IL. An update on research status was provided.
- The AFS Division Council met on November 10, 2004. They are administrative and coordinating group for all technical and management activities of the Society.
- AFS's Labor Relations & Human Resource Conference was held at the Drake Hotel, Chicago, IL, November 10-11.
- On November 18, the NADCA Product Standards Task Force meeting was held at NADCA Headquarters to discuss which recent project results can be incorporated into the next revision of the NADCA Standards.
- An AFS Research Board Meeting was held by Conference Call on November 30. Potential new energy-saving programs from committees are identified.
- On December 1-2, NADCA attended project reviews at WPI in Worcester, MA.
- Heat Transfer Coefficient in Permanent Mold Light Metals held a review on December 7.
- A meeting to review the Precision Castings project (Energy SMARRT subtask 3.11 by UMR) was held December 9 - 10 at Mercury Marine in Fon Du Lac, WI.
- A meeting to review the Surface Indications project (Energy SMARRT subtask 5.10 by UAB) was held at the University of Alabama at Birmingham on December 13 - 14.
- SFSA visited Monett Foundry to discuss research projects and trouble-shoot on December 15 - 16.
- SFSA visited St. Louis Precision Castings to discuss research projects on December 17.

### Q32004

**Status:** The following occurred during third quarter, 2004:

- Held CMC Technical Committee Conference calls on July 16, August 13 and September 24.
- An AFS/CMI Board of Directors Meeting was held at the Heidel House in Green Lake, WI on July 25-27
- The AFS 2004 Marketing & Selling of Castings Conference was held at the Sofitel Chicago OHare, in Rosemont, Illinois on August 2-3.
- The AFS Cost-Effective Casting Design Seminar was held at the Sofitel Chicago O'Hare in Rosemont, IL on August 4.
- An SFSA Western Division Meeting was held in Portland, OR on August 19-20.
- An AFS Research Board meeting was held at AFS Headquarters in Des Plaines, IL on August 30.
- A Sponsor review conference call for the Light Metals Permanent Mold project (Energy SMARRT subtask 3.14, CANMET) was held on September 2.
- The NADCA Product Standards Revision meeting was held on September 9 at NADCA Headquarters.
- Steel Founders Society of America (SFSA), Annual Meeting was held at The Ritz Carlton, Amelia Island, FL, September 11-15.
- The AFS East Coast Regional Conference was held at the Inner Harbor Marriott Courtyard in Baltimore, MD, September 23-25.
- The AFS Foundry Executive Conference was held at the Hyatt Hill Country in San Antonio, TX, September 26-28.
- A NADCA Marketing Conference and Plant Management Conference was held at the Indianapolis Marriott Downtown in Indianapolis, IN from September 29 – October 1.
- An SFSA Southern Division Meeting was held in Houston, TX from September 30 – October 1.
- Papers were solicited for the 2005 AFS/NADCA Expo.
- The NADCA Energy Manual has been revised is scheduled for release in October.

### Q22004

**Status:** The following occurred during second quarter, 2004:

- SFSA reviewed the Heat Treatment Procedure Qualifications project with Bob Voight on June 5.
- SFSA attended an April 12 - 13 kick-off meeting for Shell Cracking, Lost Foam and Melting Efficiency projects at University of Missouri, Rolla.
- The SFSA Carbon and Low Alloy Research Committee meeting, was held in Rosemont, IL on April 13.
- Held CMC Technical Committee meetings (by conference call) on April 14, May 14, and June 18.
- Held a Sponsor Review conference call on June 7 for “Heat Transfer Coefficient in Permanent Mold Light Metals” project.
- Held a kick-off meeting for “Energy SMARRT” research projects on April 28 in Chicago, IL.

- The AFS Southeastern Regional Conference was held at the Chattanooga Marriott in Chattanooga, TN on Mar 31-Apr 2.
- The AFS LFC Div 11 Conference committee met April 19 and May 3 to organize the AFS 2004 International Lost Foam Casting Conference and Tabletop Exhibit on October 19-21, Toledo OH.
- NADCA Computer Modeling Task Force met at The Ohio State University in Columbus, OH on April 21.
- The SFSA North Central Technical & Operating Meeting was held in Milwaukee, WI on April 23.
- The AFS Technology development Council met on May 5 at AFS.
- The SFSA Heavy Section Product Group Meeting and Plant Tour was held in Bay City, MI on May 11 - 12.
- NADCA's 2004 Washington Briefing at the National Association of Manufacturers Headquarters in Washington, DC was held on May 12-13.
- The SFSA Specifications Committee meeting was held in Salt Lake City, UT on May 18.
- AFS, SFSA and ATI attend the Metalcasting Technology Forum, Rock Island, May 18 - 19.
- NADCA attended a WPI project review May 24 - 25 in Worcester, MA.
- SFSA attended the High Alloy Product Group meeting at Lehigh University in Lehigh, PA on May 26-27.
- The AFS Research Board met on June 1.
- The AFS Environmental 101 Seminar was held at the Hilton Northbrook in Northbrook, IL on June 3-4.
- NADCA presented Inland Die Casting in Wheeling, IL with research results on June 4.
- AFS hosted Sponsor review conference calls for the UM heat transfer project on June 7.
- The SFSA Carbon and Low Alloy Research Review was held in Rosemont, IL on June 14-15.
- A NADCA R&D Committee meeting was held June 13 -14.
- The 108th Metalcasting Congress (Sponsored by AFS and NADCA) was held at the Hyatt Regency O'Hare in Rosemont, IL, on June 12-15. Attendance was over 1,400 people.
- The AFS Chapter Officers Conference was held at the Hyatt Regency O'Hare in Rosemont, IL on Jun 15-16.
- A NADCA Die Materials Committee meeting was held on June 15.
- A NADCA Board of Governors Meeting was held in Rosemont, IL on June 15.
- SFSA attended an ISO TC17/SC11 meeting in Prague, Czech Republic on June 21-22.
- AFS Div 11 met in conjunction with the review meetings for the IAC Pattern Inspection and the UAB Advanced LFC technology consortium review meetings on June 29-30.

## **Q12004**

**Status:** The following occurred during first quarter, 2004:

- Held CMC Technical Committee meetings (by conference call) on January 23, February 12 and March 10.
- Completed the Energy Footprint Study Report.
- Completed the Minimum Energy Study Report.
- Proposed an "Energy Profile Extension" Special Study.

- Planned a kick-off meeting for “Energy SMARRT” research projects.
- AFS hosted Machinable Iron sponsor review meeting January 28.
- NADCA Committee Meetings, January 29.
- NADCA Board of Governors Meeting, January 30.
- SFSA Technical Steering Committee Meeting, Rosemont, IL, February 5.
- AFS hosted Sponsor review conference calls for the UM heat transfer project on January 7 and February 19.
- SFSA Review of Iowa State University project, Frank Peters, Ames, IA, February 23.
- SFSA Review of University of Iowa Project, Christoph Beckermann, Iowa City, IA, February 24.
- AFS Wisconsin Regional Meeting, Pfister Hotel, Milwaukee, WI, February 12-13.
- NADCA CEO Conference, Four Seasons Resort, Maui at Wailea, HI on February 15-19.
- AFS Div 11 met in conjunction with the review meetings for the IAC Pattern Inspection and the UAB Advanced LFC technology consortium review meetings on February 17-18.
- AFS Research Board Meeting, AFS Headquarters, Des Plaines, IL, February 24.
- NADCA Die Materials Committee meeting, February 25.
- NADCA Technology Administration Group meeting, February 25.
- NADCA R&D Committee meeting, February 26.
- SFSA North Central Technical & Operating Meeting, Milwaukee, WI, February 27.
- ATI, AFS, NADCA and SFSA representatives attended the DOE Peer Review, March 9 - 10 in Washington, DC and participated in speaker panels.
- AFS Northwest Regional Conference, Hotel Vancouver, Vancouver, BC, March 11-13.
- AFS Metalcasting Industry Government Affairs Conference, J.W. Marriott Hotel, Washington, D.C., March 21-23.
- AFS LFC Div 11 Conference committee met on March 24 to organize the AFS 2004 International Lost Foam Casting Conference and Tabletop Exhibit on October 19-21, Toledo OH.

## Q42003

**Status:** The following occurred during fourth quarter, 2003:

- Distributed the final Technology Roadmap.
- Edited the Energy Footprint Study Report.
- Edited the Minimum Energy Study Report.
- Held a CMC Portfolio Review in Rosemont, IL on October 14 - 15.
- AFS Foundry Executive Management Conference was held at Hilton Sandestin Beach & Golf Resort, Destin, FL on October 12-14.
- NADCA Technology Administration Group Meeting was held at NADCA Headquarters in Rosemont, IL on October 15.
- NADCA R&D Committee Meeting was held at NADCA Headquarters in Rosemont, IL on October 16.
- SFSA North Central Technical & Operating Meeting was held in Milwaukee, WI on October 24.
- NADCA Die Materials Specification and Heat Treat Task Force Meeting at held at NADCA Headquarters in Rosemont, IL on October 28.
- NADCA Die Materials Committee Meeting was held at NADCA Headquarters in Rosemont, IL on October 29.

- Attended the WV IOF meeting with a CMC display on October 29-31 at the Stonewall Jackson Resort in Roanoke, WV.
- AFS 2003 Midwest Regional Conference was held at the Cleary International Centre in Windsor, ON, Canada on October 26-28.
- AFS International Conference on Structural Aluminum Castings was held at Sheraton World in Orlando, FL, on November 2-4.
- AFS International Conference on Iron Melting was held at Sheraton World in Orlando, FL, on November 3-4.
- SFSA Board of Directors Meeting was held at the Hotel Inter-Continental in Chicago, IL on November 5.
- SFSA Marketing Committee Meeting was held at the Hotel Inter-Continental in Chicago, IL on November 5.
- AFS Technology Development Council meeting was held in Des Plaines IL on November 5.
- SFSA Annual Meeting was held at the Hotel Inter-Continental in Chicago, IL on November 5-6.
- SFSA National T & O Conference was held at the Hotel Inter-Continental in Chicago, IL on November 5-8.
- NADCA Computer Modeling Task Force Meeting was held at The Ohio State University in Columbus, OH on November 12.
- AFS OSHA Compliance Seminar was held at the Hilton Northbrook in Northbrook, IL, on November 11-14.
- SFSA Specifications Committee was held in Tampa, FL on November 18.
- A CMC Technical Committee conference call was held on November 20, 2003.

### Q32003

**Status:** The following occurred during third quarter, 2003:

- The CMC Technical Committee met by conference call on July 9, August 6, and September 12.
- The Metal Casting Technology Roadmap was finalized.
- A final report for the Energy Footprint Study was received.
- SFSA Carbon & Low Alloy Research Review was held in Rosemont, IL on July 29-30.
- AFS 15th EHS Conference was held in Indianapolis, IN, August 17-20.
- SFSA Western Division T & O was held in Berkeley, CA, on August 21-22.
- SFSA High Alloy Product Group was held in Chicago, IL, on August 27-28.
- SFSA Centrifugal Product Group Meeting and plant tour was held in Watertown, WI, on September 2-3.
- SFSA Southern Division T & O, Longview, TX, September 9-10.
- NADCA International Die Casting Congress & Exposition was held in Indianapolis, IN on September 15-18. Total attendance was 3,869.

### Q22003

**Status:** The following occurred during second quarter, 2003:

- In May, DOE administration of the CMC contract was transferred from Idaho Falls, Idaho to Golden, Colorado.

- The Theoretical Minimum Energy Study was begun by Keramida Environmental, Incorporated.
- The AFS Texas Regional Conference was held in San Antonio, TX from April 9 – 12.
- The NADCA Plant Management Conference was held in Nashville, TN on April 10-11.
- The NADCA Computer Modeling Task Force met on April 23 at OSU in Columbus, OH for a project review meeting.
- SFSA's North Central T&O was held in Milwaukee, WI on April 25.
- Attended and displayed CMC booth at the AFS Exposition in Milwaukee, WI from April 26 - 29.
- The SFSA Specifications Committee met in Milwaukee, WI on May 6.
- SFSA Marketing Committee met in Birmingham, AL on May 6-7.
- NADCA staff member assisted with the audit at Spartan Light Metal in Mexico, MO on May 12-13 for the energy footprint study.
- Attended and displayed CMC booth at the Wisconsin IOF Symposium in Milwaukee, WI on May 13.
- The SFSA Heavy Section/Operations Meeting was held in Milwaukee, WI on May 21.
- The SFSA Board of Directors and Technical Steering Committee met in Rosemont, IL on June 10-11.
- The CMC Technical Committee met by conference call on April 15, May 8, and June 12.
- Began planning the CMC Portfolio Review, to be held October 14 - 15 in Chicago, IL.
- The NADCA Die Materials Committee and R&D Committee met at CSM in Golden, CO for project oversight reviews on June 24-26.

## Q12003

**Status:** The following occurred during first quarter, 2003:

- On January 23, 2003, a sponsors meeting on the UAB Clean Machinable Iron Project was held for AFS to critically review progress and future plans.
- Technology Roadmap Workshop in Rosemont, IL, January 27-28, 2003. Approximately 50 attendees from industry, DOE, National labs and Universities were present.
- A sponsors meeting on the UA Tin Wall Iron Project was held January 31, 2003 at AFS to critically review progress and future plans.
- Shell cracking project meeting, February 4- 5, 2003
- CMC Technical Committee Meeting, February 6, 2003
- The NE Ohio Chapter meeting in Cleveland Ohio on February 13, 2003 had a presentation by CWRU on their past work on the Gating of Permanent Molds. Poster boards of this work highlighted the social hour and resulted in extended discussions with the presenter and attendees at the conclusion of the meeting.
- A sponsors meeting on the IAC NDE of Foam Patterns Project was held February 18, 2003 at UAB to critically review progress and future plans.
- A sponsors meeting on the UAB Lost foam casting Project was held February 19-20, 2003 at UAB to critically review progress and future plans.
- CMC Technical Committee Meeting, March 3, 2003.
- The OIT IOF metalcasting research on casting design properties, virtual manufacturing, and developing new capability was highlighted in an SAE paper during the SAE World Congress, March 3-6.

- Attended sessions and displayed CMC booth at Pennsylvania IOF Symposium, March 24-25.
- Conference calls on the UM and MSSU project on the heat transfer of light metals in permanent molds was held on January 29, February 13, and March 13 to critically review progress and future plans.

## Q42002

**Status:** The following occurred during fourth quarter, 2002:

- CMC Technical Committee Meeting, Tuesday, October 9.
- CMC Roadmap Workshop Steering Committee Meeting, Tuesday, October 15.
- CMC Technical Committee Meeting, Wednesday, December 4.
- CMC Roadmap Workshop Steering Committee Meeting, Wednesday, December 4.
- Attended and displayed CMC booth at West Virginia IOF Symposium December 10-12 in Charleston, WV.
- Submitted a CMC Strategic Management Plan in response to DOE's stated shift in solicitation process.
- Detailed planning took place in preparation for the upcoming January Roadmap Workshop.
- The Energy Footprint Study continued with the profiling of Citation in Berlin, WI; Farrar Corporation in Norwich, Kansas; and Intermet – Archer Creek in Lynchburg, VA. Eppich Technologies is conducting the Energy Footprint Study with the help of IACs.

## Q32002

**Status:** The following occurred during third quarter, 2002:

- CMC Technical Committee Meeting, August 13.
- CMC Technical Committee Meeting, September 9.
- Roadmap Steering Committee Meeting, September 26.
- Attended and displayed booth at NADCA Congress, September 30 – October 2, Chicago.
- DOE's reorganization of OIT continued to evolve during the quarter. It became clear that the R&D solicitation process will change. The CMC Executive Board began to plan how to address DOE's new solicitation priorities.
- The Roadmap Workshop was rescheduled and detailed planning began to take place. The Workshop will be held on January 27-28 in Chicago.
- The CMC Technical Committee shared new research project findings.
- The Energy Footprint Study continued with the profiling of Stroh Die Casting, Dalton Foundries and Quad City Die Casting. Eppich Technologies is conducting this study with the assistance of IACs.

## Q22002

**Status:** The following occurred during second quarter, 2002:

- The Metal Casting Vision was finalized.
- CMC participated in the AFS Cast Exposition, May 4-7 in Kansas City, MO.
- Participants in the Energy Footprint Study are being identified and scheduled. Industrial Assessment Centers will participate in data collection.
- CMC displayed a booth at a Best Practices Conference on June 5 in Cleveland, OH. The event was presented by the Cleveland Engineering Society and the Ohio IOF.

- Dep. Asst. Sec. for EERE, Buddy Garland, toured three metal casting facilities on June 7.
- A Metal Casting Roadmap Workshop was cancelled due to low industry registration. In lieu of a Roadmap document from a Workshop, a draft document is being created using industry feedback from surveys.
- The CMC Technical Committee met via conference call in April, May, and June.

### Q12002

**Status:** The following occurred during first quarter, 2002:

- A CMC extension was awarded, beginning January.
- A draft of the Metal Casting Vision was made available for Industry review. After incorporation of Industry feedback, the Vision will be finalized.
- The CMC Technical Committee met via conference call in January, February, and March.
- The Executive Board met via conference call in January and February.

### Q42001

**Status:** The following occurred during fourth quarter, 2001:

- A draft of the Metal Casting Vision was reviewed by the Planning Team and IOP. The Vision has further reviews to go through before it is completed in March.
- The CMC website was updated.
- CMC members and Asst. Sec. of DOE David Garman attended NADCA Congress & Exposition October 29. Secretary Garman's IOF field visit also included Metal Casting industry members in the Cincinnati, OH area.
- The Executive Board conducted a conference call on November 29.

### Q32001

**Status:** The following occurred during third quarter, 2001:

- An Interim Funding Request was Submitted in early July, and approved. ATI received the extended funding by the end of July.
- Participated in the Metalcasting Vision Workshop at Ohio State University October 3-4.
- Technical Committee conference call - Friday August 17.
- Technical Committee conference call - Friday September 14.
- Technical Committee conference call - Friday October 19.

### Q22001

**Status:** The following occurred during second quarter, 2001:

- R&D Proposal Recommendations have been submitted to the Deputy Assistant Secretary.
- An Interim Funding Request was Submitted in early July, and approved. ATI expects to have the extended funding in hand by the end of July.
- Merit Review, Tuesday April 17, Chicago.
- Industrial Oversight Panel (IOP), Tuesday May 8, Chicago.
- Technical Committee conference call, Friday May 18.
- Technical Committee conference call, Friday June 15.
- Technical Committee conference call, Friday July 20.

### Q12001

**Status:** The following occurred during first quarter, 2001:

- The FY 2002 Merit Review is scheduled to occur on April 17. At that time, the 18 R&D proposals that were submitted will be reviewed and rated by the Merit Review Committee.
- Technology Transfer funding will pose as a problem over the next four months. With 25% of the funding year left in the existing contract the technical societies have spent at 95% of the budget supporting R&D activity.

### Q42000

**Status:** The following occurred during fourth quarter, 2000:

- CMC Technical Committee Conference Call, November 9.
- Whitepaper Review via Conference Call, December 15.

### Q32000

**Status:** The following occurred during third quarter, 2000:

- AFS asked DOE – HQ for an additional \$5K of funding for the Cupola project. Should resolve funding to go direct from DOE or through ATI. The Technical Committee also agreed that UMR (Steel Foundry Refractory) will receive an additional \$62K in funding dependent upon End-of-Year Funds.
- Technical Committee Conference Call, August 25.
- Technical Committee Meeting in Charleston, October 5.
- Technical Committee Conference Call, November 9.

### Q22000

**Status:** The following occurred during second quarter, 2000:

- Denise Swink at DOE HQ approved all FY 2001 Merit Review recommendations. FY 2002 solicitation will call for a new proposal format.
- Technical Committee Conference Call, May 2.
- IOP Meeting, May 19.
- Executive Board Meeting, May 23.
- Technical Committee Conference Call, June 23.

### Q12000

**Status:** The following occurred during first quarter, 2000:

- Technical Committee Conference Call, January 7.
- Full Proposals Due and Technical Committee Conference Call, February 25.
- Merit Review Committee Meeting, March 28-29.

### Q41999

**Status:** The following occurred during fourth quarter, 1999:

- FY 2001 project proposals in process. Time compression for the overall selection process continues favorably, with key industry R&D reviewers accelerating whitepaper and proposal evaluation timelines. Net time savings versus 2000 cycle is expected to be 30 days.

- Confirmed new industry members for the Merit Review Committee.
- Implementing “significant events” reporting from industry to OIT.
- EB/IOP Meeting with Denise Swink in Washington DC, October 5.
- Technical Committee Conference Call, October 15.
- 2-Step Solicitation released, October 30.
- Technical Committee Conference Call, November 8.
- FY 2001 Whitepapers Due, November 19.
- Merit Review Call, December 14.

### Q31999

**Status:** The following occurred during third quarter, 1999:

- FY 2000 proposal process completed and awards taking place at DOE-Idaho. Three projects of the 20 recommended by the Merit Review were declined by the S.S.O.
- FY2001 solicitation process began in October.
- Preparations for the DOE/CMC Booth at the NADCA Expo in Cleveland performed and the show will take place November 1-4.
- The FY 2001 2-step solicitation will be released in late October by DOE-Idaho. The Merit Review Committee will make recommendations on the white papers in December 99. Energy Assessments for the 2001 projects will be due at proposal submission.
- Technical Committee Conference Call, August 17.
- Technical Committee Conference Call, September 17.
- Technical Committee Conference Call, October 15.
- IOP/Executive Board/Technical Committee Meeting, November 9-10.
- Technical Committee Conference Call, December 17.

### Q21999

**Status:** The following occurred during second quarter, 1999:

- A CMC/IOP meeting was held at AFS June 2 to discuss the FY2000 proposals
- An Executive Board meeting followed the CMC/IOP briefing for project approval.
- Technical Committee conference call, April 14.
- Technical Committee meeting, May 26 to score all the proposals. FY 2000 proposals selected at the Merit Review and sent to DOE HQ for final approval.
- The following projects have completely closed out their contracts with ATI: (UNI) Wear Analysis and (WPI) Semi-Solid Metals Processing. No cost extensions were given to (MPC) Develop Database Design Rules, (NUPRO) Plasma Refining and all three of the CANMET projects. ATI is waiting for the final reports from MPC and NUPRO. All other open contracts are on schedule and within Budget.

### Q11999

**Status:** The following occurred during first quarter, 1999:

- Technical Committee Conference Call, January 19.
- Deadline for metalcasting Whitepapers, February 4.
- CMC meeting with the Industrial Oversight Panel (IOP), February 8.
- Technical Committee Meeting in Washington DC, February 9.
- DOE Request for Proposal (RFP) issued for metalcasting research projects, February.

- Deadline for metalcasting R&D proposals, March 24.

### **Q41998**

**Status:** The following occurred during fourth quarter, 1998:

- Cast Metals Coalition (CMC) Transfer and Program Management contract awarded.