Versatility and innovation marked the 2006 International Die Casting Competition sponsored by the North American Die Casting Association (NADCA). From using new alloys in automotive components to producing miniature designs, this year’s award winners provided outstanding examples of the versatility, quality, innovation and cost savings that can be achieved with aluminum, zinc and magnesium die cast components.

“The entrants in this year’s competition showcased numerous applications for die casting in today’s global marketplace,” said NADCA President Daniel L. Twarog. “Several winners used new processes or alloys to create parts that previously were not suitable for die casting. These initiatives will continue to expand the market for the die casting process.”

Among the first-time uses for die cast products were a cast aluminum automotive sub-frame, a magnesium engine cradle and a die cast aluminum steering knuckle.

A TRULY INTERNATIONAL COMPETITION

The winners were chosen from nearly 40 entries. Submissions ranged from the U.S. and Canada, to Japan to Wales, proving that advances in die casting know no boundaries.

The winning casting entries were recognized at the 110th Casting Congress, April 17-21, 2006 in Columbus, Ohio.

NADCA wants to thank all the die casters for their submissions to this year’s competition and congratulate the winners. Descriptions of this year’s winners are featured in the following pages.
WHAT: Front Steering Knuckles for Jaguar Vehicles

PROBLEM: Steering knuckles are integral to the steering and braking mechanisms for cars. They traditionally are made by forging, or as iron or steel components. Automaker Jaguar wanted to switch to aluminum components because of their weight savings. The initial process they pursued failed, and with production in jeopardy, they turned to Contech, which had experience making aluminum knuckles, although not as large or complex as Jaguar’s component.

SOLUTION: Contech statistically proved static mechanical properties, confirmed chemical analysis and produced test data to prove their process and material. Both Contech and Jaguar rigorously tested the new parts in the lab and in the cars with punishing driving tests. The castings survived each time. Contech installed the necessary equipment to make the first aluminum squeeze cast knuckles. This included a DCM, built for their P2000 process, a melting furnace, robotics, and an X-ray facility to enforce acceptance standards.

PROJECT LEADER: Keith Brown

ALLOY: Aluminum A.356.2 (T6)

WEIGHT: 9.7 lb.

CASTER’S COMMENTS: “This was a project that necessitated a ‘right first time’ result. Failure would have damaged Contech’s reputation and would have stopped the manufacture of two car lines at Jaguar. The customers, both at the machinist and the vehicle manufacturer, are delighted not only with the performance of the casting, but also with its physical appearance. The success immediately led to a second order. We are looking to apply the same technology to other new customers throughout Europe.”

ABOUT THE CASTER: Contech Metal Forge, located in Portage, Michigan, is a division of SPX Corporation, a multinational company. Its facilities are located throughout the American Midwest and Wales, UK. Established in 1852, the company developed cold steel forging and, in the 1950s, aluminum die casting. Known by several different names during its long history, Contech Metal Forge prides itself on its high-quality engineered metal-formed products.
Aluminum Under 1 Pound
PHB DIE CAST, INC.

WHAT: Right Hand and Left Hand Reflector for Minivan

PROBLEM: An automotive reflector is used in a fog light assembly. In the past, the lights were a combination or a plastic housing assembled with an aluminum casting. Both parts had to be metalized by depositing aluminum on the reflective surfaces. The die cast part was the reflector and was also used to support and adjust the light on the minivan. The customer wanted to make an aluminum reflector as a stand-alone assembly to reduce the piece cost and the assembly costs.

SOLUTION: The new light is a die casting with the reflective optics, the pivot bosses, and height adjustment built into the casting. There are two single cavity dies, one for the right hand and one for the left hand. Each die has four slides that cast the external detail used in assembling and supporting the fog light. The part is leak-proof, has thin walls to reduce weight, has strong pivot bosses, and meets critical tolerances to seal the bulb and direct the light's beam.

PROJECT LEADER: Rick Zukowski, PHB; John Koehler, North American Lighting Inc.

ALLOY: Aluminum 383

WEIGHT: 0.66 lb.

CASTER’S COMMENTS: “We have been successful in meeting the part specifications with a cost savings of 14.5 percent per assembled unit.”

ABOUT THE CASTER: PHB Die Cast, Inc., located in Fairview, Pennsylvania, is a supplier of parts and assemblies with multiple manufacturing capabilities. They provide products and service to the automotive, appliance, telecommunications, electronics, transportation, medical, aerospace and defense and other industries and are highly regarded for their engineering and product development.
**Aluminum 1 to 10 Pounds**

**TORAL CAST LIGHT METAL TECHNOLOGIES**

**WHAT:** L4 Cam Cover for Engine

**PROBLEM:** GM Powertrain wanted to replace the existing plastic cam cover used on their in-line 4 engines. The camshaft cover provides a seal with the cylinder head to prevent oil leakage. Its additional functions include noise suppression, oil fill port, ventilation, and spark plug access. The goal was to further improve structural integrity at elevated temperatures, sealing to prevent oil leakage, NVH performance and the removal of condensed water on the top surface.

**SOLUTION:** Toral Cast developed an innovative die design and die casting process using a three plate die with a central gating system (instead of side-gating) at the central coil mount bores. This new design allowed better flow and solidification, which reduced poor fill, porosity, distortion and internal stress. Die cast aluminum A380 allows thinner wall sections and shorter coil mount bores as well. Aluminum avoids the part distortion and degradation that plastic suffers at high temperatures. The new design provides better sealing and noise suppression.

**PROJECT LEADER:** L4 Cam Cover Launch Team
Timothy Jackson, Design Release Engineer, GM Powertrain

**ALLOY:** Aluminum 380

**WEIGHT:** 9.72 lb.

**CASTER’S COMMENTS:** “The newly designed aluminum cam cover to replace plastics provides both challenges and opportunities to the die casting industry. The greater strength of aluminum allows applying additional load on the cover. In this case, stake pins are cast for riveting baffle plates. Together with fewer fasteners and aluminum’s recycle ability, total manufacturing cost is reduced.”

**ABOUT THE CASTER:** Toral Cast Light Metal Technologies is located in Concord, Ontario, Canada. It is part of the Magna Powertrain Group, a global supplier for the automotive industry, in the fields of drivetrain, engine and chassis, including design, developing, testing and manufacturing.
Aluminum 10 Pounds and Up

AHRESTY CORPORATION

WHAT: Rear Sub-Frame for Auto Body

PROBLEM: The rear sub-frame serves as part of the skeleton of the automobile. This part demands high strength, including in-sections joined by welding. Conventional die casting methods did not provide the strength and reliability of demanding conditions and also limited weight reduction of the part.

SOLUTION: The Ahresty team developed a new high vacuum die casting technology to produce a stronger yet lighter-weight sub-frame. The technique allows the die to be filled under a very high vacuum condition to produce castings with very little gas inclusion. They use a specially designed holding furnace, which decreases debris and gases that cause weakening in a casting. Their use of special aluminum alloys also enhanced the strength and toughness of the castings.

PROJECT LEADER: Arata Takashi, President
Kazutoshi Kondo, Engineering Manager, (both with Ahresty)

ALLOY: Aluminum Silafont 36

WEIGHT: 20 lb.

CASTER’S COMMENTS: “The new high vacuum die casting technology reduced the weight of the sub-frame by 38 percent compared to steel stamping, but provided the strength to absorb impact. The parts produced by this new technology are connected to another aluminum part by MIG welding.”

ABOUT THE CASTER: Ahresty Corporation’s motto is Research, Service and Technology. Ahresty offers an advanced Research and Development center for its customers around the world. Its pore-free and gas-free die casting capabilities provide a wide range of shapes, sizes and applications to both automotive and non-automotive manufacturers. Ahresty Corporation is headquartered in Tokyo, Japan.
Magnesium Under .5 Pounds

PRODUCT TECHNOLOGIES

WHAT: Backbone (Left and Right) for Dewalt 18 Volt Cordless Nail Gun

PROBLEM: Black & Decker and Product Technologies worked on creating lightweight left and right backbone parts to serve as the skeleton of a new product development, the Dewalt 18 Volt Cordless Nail Gun. The backbone had to support all of the Nail Gun’s internal and external components.

SOLUTION: It was important that the parts be lightweight but have superior casting integrity, along with the high elongation provided with AM60. The parts were competitively produced using chamber technology and minimal machining on dedicated machine tooling.

PROJECT LEADER: Product Technologies Engineering Team
Craig Schell and the Black & Deck Engineering Team

ALLOY: AM60

WEIGHT: Left: 0.214 lb. Right: 0.284 lb.

ABOUT THE CASTER: Product Technologies, located in Maple Lake, Minnesota, specializes in magnesium die casting. Their team assists customers from project concept through prototype to the supplying of finished volume production parts. They supply finishes and coatings, fasteners, form-in-place gaskets and more for their technology partners.
Magnesium Over .5 Pounds
MERIDIAN TECHNOLOGIES

WHAT: Z06 Corvette Engine Cradle

PROBLEM: Until now, either steel or aluminum has been used in the engine cradle. To reduce weight in GM's Z-6 Corvette engine cradle, the decision was made to develop magnesium chassis components. The automaker's goal was to reduce their car's weight, improve fuel economy, provide better weight balance and improve steering.

SOLUTION: Meridian Technologies used a new high-temperature AE44 magnesium alloy and high pressure die cast process to create a 24-pound engine cradle with a weight savings of approximately 33 percent. The single-piece magnesium design also improves assembly and provides structural integrity. By allowing integration of the steering gear attachments into the cradle, the design also improved vehicle responsiveness.

PROJECT LEADER: David R. Greer, Jr., Business Development Manager, Meridian Technologies
Richard J. Osborne, Donald E. Penrod, (both with General Motors Corporation)

ALLOY: AE44 from Norsk Hydro Magnesium

WEIGHT: 24 lb.

CASTER'S COMMENTS: “This is the auto industry’s first magnesium high pressure die cast chassis component. The addition of magnesium as a viable option opens the door for additional weight savings opportunities in vehicle parts that were previously not possible, including chassis and power train.”

ABOUT THE CASTER: Meridian Technologies, Inc. is a multi-national corporation that provides design solutions, engineering and manufacturing of high quality magnesium die cast components for automotive clients around the world. Meridian Technologies is based in Strathroy, Ontario, Canada.
Zinc Under 6 Ounces/Non-Electroplated

WHAT: Low Voltage Waterproof Wire Connector

PROBLEM: Low voltage wire connectors have always needed at least a wire stripper and possibly pliers to squeeze the connector together. Connectors also need true long-term waterproofing. For this new design, the goal was to eliminate the tools required to make a connection, to make it easy to use, foolproof, cost efficient and waterproof.

SOLUTION: The design used a non-conductive plastic housing to rotate the conductive zinc shaft, which strips the wire insulation, contacts the conductors and moves the non-hardening silicone grease with a built-in sweep feature. The advantages of the new design are fewer parts; lower tooling, assembly and part costs; improved quality and usability; and a product that is waterproof, and not merely water resistant.

PROJECT LEADER: Al Loeffelman, Jeff Loeffelman, and Mark Preuss, Production Castings, Inc.
Tom King, Duane Smith, and Doug Kirk, Blazing Products, Inc.

ALLOY: Zamak 7

WEIGHT: .096 ounces

CASTER’S COMMENTS: “We believe this to be a new use for a zinc die casting. Such a miniature casting can be difficult to fill because of its extremely thin walls and unique shape. This 4-cavity mold runs in a miniature high speed 2” x 2” inch machine. NADCA’s PQ2 and Castview software was helpful in the design of the gates and runners.”

ABOUT THE CASTER: Production Castings, Inc., located in Fenton, Missouri, focuses on miniature, small and medium-sized zinc and aluminum die castings. Established in 1976, the company provides die design, tooling, machining, assembly and painting, plating and powder coating services.
Zinc Over
6 Ounces/Non-Electroplated

**ZF LEMFORDER CORP.**

**WHAT:** IMA Stabilizer Link for OEM Automotive Suspension

**PROBLEM:** ZF Lemforder Corp. was welding precision stamped rings onto the end of stabilizer link rods. Many things made the process costly. The ring needed an expensive secondary sizing operation and the rod was costly because of the close tolerances required to meet the correct capability for length after resistance welding. Another cost included shipping for plating the parts after welding. FisherTech helped convert their stabilizer link to a die casting.

**SOLUTION:** In the new die cast process, pre-plated and knurled rods with die cast rings on the ends are placed directly into the die and the zinc is cast directly onto the knurls. After casting, the part is directly transferred to final assembly equipment and completed.

**PROJECT LEADER:** John Belding, Brian Perkins, Mark Kittridge, and Dan Dearing, ZF Lemforder Corp.

Meinard Machler, Les Agnew, and Karel Vycpalek, all with Fisher Cast Global

**ALLOY:** Zamak 5

**WEIGHT:** 7.8 ounces

**CASTER’S COMMENTS:** “Zinc is much less expensive than the stamped ring. We saved over 20 percent in our material cost. By using pre-plated rods, we reduced inventory and shipping costs. The automated IMA die casting process is also highly versatile compared to the welding process. By changing the rod and housing orientation, we are able to make a different part for another application.”

**ABOUT THE CASTER:** ZF Lemforder was established in Brewer, Maine in 1980. It supplies automobile components such as low friction ball and socket type suspension components, plastic and steel stabilizers, toe links, ball joints and cross axis joints throughout the world. Its customers include DaimlerChrysler, Ford, GM, Tower, Dana, Arvin Meritor, Metal Forge, New Mather, and others.
Zinc Any Size with Decorative Finish

DERO ENTERPRISES, INC.

WHAT: Cover for the Base of a Funeral Casket Handle

PROBLEM: The previous handle cover was a utilitarian-looking steel stamping without the aesthetics many customers would prefer. Used temporarily during funeral services and re-used in most cases, the part also needed to be durable for extended use.

SOLUTION: Dero developed this cover to make it look more ornamental after it is attached to the casket. They patterned their zinc die casting after DaVinci's Last Supper and created the model on computer by inputting a scanned 2D image and using a new advanced software to give it 3D depth. This allowed the use of a uniform wall, reduced weight and avoided heat sinks, which helped maintain the integrity of the artwork's faces. It also allowed Dero to have a faster lead time and be competitive with world suppliers. The part was manufactured in-house using Cad/Cam and CNC machining and has an electro-plated finish. In addition, the die cast part is extremely rugged, looks new for a long time and can be recycled.

PROJECT LEADER: Dan De Liello, President
Monty Rutherford, Engineering Manager

ALLOY: Zamak 3

WEIGHT: 1.41 lb. (wt. of part)

CASTER’S COMMENTS: “The product is our own and we chose it as a superior replacement to the steel stamping. Although the cost is greater, there is no comparison between the two parts when one considers aesthetics. The extra cost is often secondary to our customers in consideration of what it is used for. We feel that our die cast part shows our customers that for many cosmetic applications, die casting is beyond comparison with other manufacturing methods.”

ABOUT THE CASTER: “Founded in 1964, Dero Enterprises, Inc. specializes in zinc die casting and plastic injection molding for small- and medium-size runs. It manufactures zinc and plastic parts and products for the automotive, electronic, electric lighting, household wares and sport industries and others. Dero is located in Montreal, Quebec, Canada.”

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WHAT: Bezels for controllers and network hardware

F5 Networks, Inc., Liberty Lake, WA, created bezels and faceplates for controllers and other network hardware with core inserts to allow for different connector arrangements and product variations, including doors for power supply access. Designed in two sizes for equipment going in standard computer racks, the die cast parts replaced previously used plastic pieces. The aluminum and zinc die cast parts provided greater structural rigidity, the ability to mold all the features needed in a single piece and they eliminated the need to coat parts to provide EMI shielding.

2007 ENTRY INFORMATION

If you have a casting that meets the criteria, why not consider entering the 2007 International Die Casting Competition? Award-winning castings will be displayed during the 111st Casting Congress, May 15-18, 2007 at the Hilton Americas in Houston, Texas.

The competition is open to three alloys: aluminum, magnesium and zinc. Within those alloys, there are more specific levels: aluminum under 1 pound; aluminum 1-to-10 lb.; aluminum over 10 lb.; aluminum squeeze/semi-solid; zinc under 6 ounces/non-electroplated; zinc over 6 ounces/non-electroplated; zinc any size with decorative finish; magnesium under 1 lb.; and, magnesium over 1 lb.

Any number of castings may be entered. Send a separate entry form for each casting or assembly of castings. As-cast entries are required. The metal surface cannot be improved or concealed by tumbling, shot blasting, coating or other surface treatments. NADCA encourages sending secondary processed samples, but they must be in addition to the as-cast parts.

All castings submitted for the competition MUST have approval in writing from the customer indicating that the customer consents to allowing NADCA to display the casting(s) in exhibitions, magazine articles and other publications. When possible, information and photographs describing the design process will be printed in Die Casting Engineer. However, entrants may request that certain information not be shared because of proprietary reasons. Such exceptions should be noted in the entry.

Judging is conducted by an independent panel of die casting experts, with no ties to eligible casters.

You can download the 2007 entry form at www.diecasting.org/castings/competition

Send it, along with a sample casting and description to:
NADCA
241 Holbrook Drive
Wheeling, IL 60090

All entries must be postmarked by Friday, February 23, 2007.

For more information, please contact Director of Membership & Marketing, Leo Baran at 847.808.3153 or baran@diecasting.org.