Automotive components led the way this year in the 2007 International Die Casting Competition of the North American Die Casting Association (NADCA). All but one of the winning castings were designed for automobiles, light trucks or SUVs. Such an outcome should not be surprising in a year when automakers faced major challenges and fuel prices climbed to new heights. It demonstrates just how significant die casting design is for everyone’s bottom line.

The International Die Casting Competition is dedicated to demonstrating the versatility, quality, innovation and cost savings that can be achieved with aluminum, zinc and magnesium die cast components. In particular, this year’s innovative die cast automotive parts provide economical solutions for manufacturers and help to enhance performance and fuel economy. Several winning components can be considered breakthroughs in casting for the auto manufacturing sector because of their reduced weight, a significant factor in automobile engineering.

“Our judges faced a difficult task in choosing among the entries in several of the categories, and they determined that each of these castings had certain characteristics that should be acknowledged,” said NADCA President Daniel L. Twarog.

Entries were judged on the combination of quality, ingenuity, design excellence and value in the finished part, along with their contribution to expanding the market for castings.

Sources of Success

The winners profiled in the following pages succeeded because of their innovative designs, manufacturing precision, extraordinary quality and overall cost effectiveness. It also should be noted that a number of competitors stressed the importance teamwork played within and between companies.

NADCA wants to thank all the die casters for their submissions to this year’s competition and congratulate the winners. The winning die castings were recognized during the recent 111th Metalcasting Congress in Houston, TX.
WHAT:  
Rack & Pinion Steering Gear Housing

PROBLEM:  
Rack and pinion steering gears have increased in size just as light trucks and sport utility vehicles have.  
With these steering systems operating at pressures up to 4,500 psi, the steering gear housing’s integrity is critical.  
Sometimes, steering systems also are required to share the load.  
For its large-scale Tundra and Sequoia models, Toyota needed higher mechanical properties and burst requirements than the standard casting process permits, as well as a challenging porosity specification.  
In addition, Toyota expected a high volume of these housings to be produced.

SOLUTION:  
Contech used casting modeling software to predict the flow and solidification of the ADC-12 alloy in order to identify optimum gate geometry and location and performed simulations to correct any casting defects related to cooling, metal flow and shrink porosity.  
The team developed an innovative tooling design capable of producing the large, complex housing in a two-cavity die and met the customer’s burst test requirement and end-cost target.  
The housing is cast using the CONTECH P2000 HVSC process with a 2000-ton Prince DCM, incorporating a vertical shot into a die split vertically, with horizontally moving die blocks.  
The castings surpassed Toyota’s burst test requirement, averaging 7,644 psi.  
Although neither CONTECH nor Toyota had ever worked on a rack and pinion gear housing this large, the launch of what they referred to as “The Bazooka” was a success.

PROJECT LEADERS:  
Tim Harmeyer, Tom Flees, Chuck Barnes, Randy Malterer, Forrester Asher

ALLOY:  
Aluminum Alloy ADC-12 (T6)

WEIGHT:  
9.2 lb.

CASTER’S COMMENTS:  
“This was a project that required a substantial amount of innovative thinking.  
The successful launch of this program can be directly attributed to the level of communication and cooperation that existed between the two parties.  
In the end, the desired results were achieved, while at the same time, new levels of confidence were instilled within and between our organizations.”

ABOUT THE DIE CASTER:  
CONTECH U.S., LLC is a market leader in providing highly engineered, complex, light-weight cast components for the automotive industry.  
It offers a variety of die cast process technologies and produces a full range of thick-wall and thin-wall components for cars and trucks.  
Established in 1952 and known by several different names during its history, CONTECH specializes in aluminum/magnesium die casting innovation and prides itself on high-quality engineered products.  
The company is based in Portage, MI, with other facilities in the United States and Wales.
WHAT:
Exhaust Gas Recirculating (EGR) Housing for Car & Truck Diesel Engines

PROBLEM:
An EGR housing is designed to reduce vehicle emissions. Originally, the customer’s housing was a two-part assembly using two aluminum die castings with a steel bracket and a stainless steel insert. The manufacturer sought weight reduction and a more practical, economical manufacturing process.

SOLUTION:
Twin City Die Castings produced a one-piece casting with two stainless steel inserts. The piece positions and houses the valve actuator, maintains alignment of the valve guide, fixes the valve seats and provides a sealing surface for the valve disks. It is cast in a two-cavity die with two stainless steel inserts per cavity and six core pulls, with two pulls sequenced to pass through each other. The automated process includes robot casting, loading of the inserts and unloading, as well as quenching, trimming, conveyance of scrap away and of parts to the operator. The stainless steel insert molding weighs less than a stainless steel cast housing, without sacrificing performance or durability.

PROJECT LEADERS:
Tom Heider – Vice President of Engineering, TCDC
Michael Irrer – Project Engineer, Pierburg Inc.

ALLOY:
380 Aluminum

WEIGHT:
0.87 lb.

CASTER’S COMMENTS:
“This housing incorporates many design critical features that are typically done with multiple die and sand cast components. It allows the engine designer to use a dual poppet valve rather than two slightly smaller valves. The stainless steel insert molding allows considerable weight reduction with minimal reduction in valve performance or long-term durability.”

ABOUT THE DIE CASTER:
Twin City Die Castings Co. (TCDC) manufactures aluminum, magnesium and zinc die cast components. The TCDC team recommends modifications that reduce tooling and metal costs, using designs, simulation software and prototypes to assist customers. A full-service operation, TCDC also offers in-house machining capabilities and tight-tolerance work and finishing, sub-assembly, milling, tapping, drilling, painting, anodizing and assembly. The company has three locations: Minneapolis, MN; Watertown, SD and Monticello, MN.

www.diecasting.org/dce
WHAT:
Shock Tower for BMW E70 X5

PROBLEM:
Shock towers are used in a vehicle’s suspension system for mounting and alignment and thus aid in handling and steering. Their castings must resist an axial load in positive and negative directions. Therefore, eliminating porosity is essential. In addition, handling and steering can be compromised if the shock towers are not machined with precision. The customer wanted a lower-weight casting to improve handling by reducing mass higher in the system, thereby lowering the vehicle’s center of gravity.

SOLUTION:
Shock towers traditionally are made from a series of steel stampings that are welded together during the first stages of manufacturing a vehicle’s body. By using a lighter weight aluminum casting, CONTECH provided a weight saving of approximately 40% and reduced the number of components to assemble onto the vehicle. Produced by a new casting technology called High-Q-Cast™, these heat-treated aluminum shock towers have very thin walls, yet give manufacturers the ability to weld and rivet the castings to other components.

PROJECT LEADERS:
Ernie Mohley, Sean Seaver, Gerald Craycraft, Phil Burton, Mike Burgess – CONTECH U.S., LLC
Peter Gaehrken, Sloan Rogers, Sabine Roehrl – BMW

ALLOY:
Aluminum Alloy Aural 2™

WEIGHT:
7.18 lb.

CASTER’S COMMENTS:
“This shock tower is the first high-volume application of thin-wall heat-treated aluminum castings in North America. It is the product of a new casting technology called High-Q-Cast™ that provides lightweight solutions for customers. The mechanical properties of the shock tower and the ability to weld and rivet these castings to other components make these products truly unique and a breakthrough in die casting application in the automotive sector.”

ABOUT THE DIECASTER: CONTECH U.S., LLC is a market leader in providing highly engineered, complex, light-weight cast components for the automotive industry. It offers a variety of die cast process technologies and produces a full range of thick-wall and thin-wall components for cars and trucks. Established in 1952 and known by several different names during its history, CONTECH specializes in aluminum/magnesium die casting innovation and prides itself on high-quality engineered products. The company is based in Portage, MI, with other facilities in the United States and Wales.
WHAT:
Front Engine Module Assembly (FEMA) for V6/V8 Engine

PROBLEM:
Typically, a front engine module assembly incorporates the water pump, oil pump, coolant temperature sensors, front engine and timing chain cover, and belt tensioner and idler pulleys. It requires complex passages that route fluid from the oil and water pump to the engine. The typical sand or semi-permanent mold casting reduces fluid flow efficiency, and its porosity can allow leaks. Overall, such casting tends to have undesirable weight, is costly and requires complicated tooling and machining.

SOLUTION:
Metaldyne used their patented insert molded tube technology in the FEMA die casting to allow for fluid passages inside the housing. Mandrel bent 304 stainless steel, which is used for its strength and corrosion resistance, is welded together to make the tube assembly. Each casting is produced from 380 aluminum with a minimum wall thickness of 3.0mm. Special tooling or equipment is not required for the process. Compared to sand or semi-permanent mold casting, insert molded tubes improve fluid flow efficiency, eliminate leaks and reduce weight and cost.

PROJECT LEADERS:
Tom Ketelhut, James Joyce, Matt Kissel, Krishna Pai, Amol Inamdar

ALLOY:
380 Aluminum

WEIGHT:
15 lb.

CASTER’S COMMENTS:
“Insert molded tubes have many advantages, including improved fluid flow efficiency, reduced weight, reduced cost, simplified and lower cost die cast tooling, reduced machining and the elimination of plugs necessary for machining intersecting cored passages.”

ABOUT THE DIE CASTER:
Metaldyne is a leading supplier of engine, driveline and chassis products used in vehicles. Some of their customers include DaimlerChrysler, Ford, General Motors, Honda, Hyundai and Toyota. With 38 facilities in 14 countries, Metaldyne is a world leader in supplying wheel-end and mini-corner modules, with major programs in North America, Europe and Asia. It is the world’s largest supplier of aluminum valve bodies, offering a unique segmented die technology and NVH technology. Metaldyne’s corporate offices are in Plymouth, MI.
WHAT:
CRU Frame for Electronic Storage Device

PROBLEM:
The CRU frame’s overall assembly injects and ejects 3.5-inch hard drives from a server, squelches and dampens vibrations from the disk drives and offers EMI protection. The cast part is the assembly’s backbone, holding fiber channels, clips, an EMI shield, hard drive, a locking mechanism and a pin connector. Zinc was previously used in the assembly. The customer sought further improvement for the component.

SOLUTION:
Phillips Plastics used a magnesium molding to make the assembly instead of zinc. Magnesium dampens vibration well and brings inherent EMI protection. It also allows for several zero draft features to be cast into the part. In addition, Phillips made improvements to the tooling, drawing from their experience with lifter geometry. In addition, the advanced trim tooling leaves minimal secondary operations after trimming.

PROJECT LEADERS:
Dave Coon, Phillips Plastics
Dave Howard, Richard Ceraldi, Greg Titus – LSI Logic Corp.

ALLOY:
Magnesium A291D

WEIGHT:
50 g

CASTER’S COMMENTS:
“A key aspect of the success of the product was teamwork. Everyone involved — from product design, to tooling, to manufacturing — worked together continually improving all aspects of the process. Volume of this product exceeds 120,000 units per month during peak demand.”

ABOUT THE DIE CASTER:
For more than 40 years, Phillips Plastics has designed and developed products for original equipment manufacturers in virtually every market. It is one of the major sources for custom plastic and metal injection molded components for the automotive, consumer, defense and medical sectors. The corporation provides one-stop service, with development from the drawing board to the packaged product. They are known for keeping pace with trends and innovations, as well as the latest technology, and have a history of guaranteeing confidentiality to those who use their services.
MAGNESIUM OVER 0.5 POUNDS
Lunt Manufacturing Co.

WHAT:
E-70 Cross Car Beam for BMW X5

PROBLEM:
The cross car beam provides support for the instrument panel of the vehicle. Traditionally, steel has been used for this component, but the customer was looking for a weight savings and a cost savings over steel. A new design required crash energy absorption and stiffness for the cross car beam and steering column and had to allow attachment points to various areas in the instrument panel.

SOLUTION:
By using magnesium instead of steel for a die cast cross car beam for BMW, Lunt Manufacturing provided a 50% weight savings. The part provides improved stiffness for the beam and steering column as well as crash energy absorption, and the design allows attachment points to numerous instrument panel areas, such as the heads-up display, on-board diagnostics connection, knee bolsters, floor panel, wiring harness, glove box, instrument panel, steering column, fuse box, center console, entertainment and information center, speakers and more.

PROJECT LEADERS:
E70 Engineering Team – Lunt
Dr. Oliver Jarosch – BMW AG

ALLOY:
AM60B Magnesium

WEIGHT:
12.51 lb.

CASTER’S COMMENTS:
“By using magnesium, we provided a 50% weight savings over steel and a significant cost reduction for the customer.”

ABOUT THE DIE CASTER:
Since 1973, Lunt Manufacturing Co. has worked exclusively with magnesium die casting. A full-service operation, Lunt offers services that include product design and engineering, prototyping, die construction, machining, painting, assembly and packaging of finished castings. Products as diverse as automobiles, power tools, computers and bicycles have employed Lunt castings. Headquartered in Schaumburg, IL, the company also has facilities in Hampshire, IL, and Detroit, MI.
WHAT:
Rearview Mirror Mount for Volvo Autos & SUVs

PROBLEM:
Gentex Corporation is the world’s leading manufacturer of electrochromic, automatic-dimming rearview mirrors for the auto industry. A widely used safety feature, the auto-dimming mirror eliminates rearview glare and blindspots. Currently, Gentex is working on making their rearview mirror smarter, with the goal of displaying the compass heading and outside temperatures and of turning on headlights and unlocking doors. The mirror mount needed an improved housing for the placement of a humidity sensor and the internal wiring for the added electronic features.

SOLUTION:
Cast Products, Inc. created a new design for Gentex’s rearview mirror mount. They used zinc for its wear resistance, tensile strength and ability to mold thin-wall sections. The casting was designed around the mirror mount’s humidity sensor to make the smallest possible footprint. Requirements included flash-free castings with solid structural integrity, the ability to in-die degate and part/runner separation at the machine. To meet pricing, casting had to be dropped from the die casting machine ready to ship to the customer. This windshield-to-mirror head transition housing allows the mounting of the sensor and related wiring and harnesses.

PROJECT LEADERS:
Dave Haener – Cast Products
Josh Owen – Gentex

ALLOY:
Zamak #5

WEIGHT:
4.1 oz.

CASTER’S COMMENTS:
“The mold was designed and built in 6.5 weeks, 1.5 weeks early, and tooling was completed 11% under the quoted price. The castings were 100% dimensionally correct with the first sample. Zamak #5 meets or exceeds the customer’s material requirement, and the customer price-point was met.”

ABOUT THE DIE CASTER:
Cast Products, Inc., often referred to as CPI, manufactures custom zinc die castings for various industries. The company was founded in 1966 on the premise that customers would be best served by a single supplier who could handle all aspects of a project from design to delivery. Today’s second-generation owners continue to focus on improvement and added value for their customers, bolstered by new technologies and an exceptional work force. CPI, which is based in Norridge, IL, produced 80 million zinc die castings in 2006 with 112 employees and an on-time delivery rating of 96%.
Do you have an innovative die casting design? If so, you should consider entering the 2008 International Die Casting Competition. Winners will be on display during CastExpo, May 17-20, 2008, at the Georgia World Congress Center in Atlanta.

TO COMPETE:
The competition is open to three alloys: aluminum, magnesium and zinc die castings. Within those alloys, there are more specific levels: aluminum under 1 lb.; 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 components.

All castings submitted for the Competition MUST have approval in writing from the customer indicating that the customer consents to allowing NADCA to utilize 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, but because of proprietary reasons, not all information can be shared. Such exceptions should be noted in the entry.

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

You can download the entry form at www.diecasting.org/castings/competition. Send it, along with a sample casting and description, to:

North American Die Casting Association
241 Holbrook Drive
Wheeling, Illinois 60090
USA

All entries must be postmarked by: Friday, Feb. 22, 2008.

For more information, contact NADCA’s Leo Baran, director of membership services & marketing, at (847) 808-3153 or baran@diecasting.org.