Variety was the prevailing theme of the 2008 International Die Casting Competition sponsored by NADCA. Whether designing and manufacturing a complex component for the automotive industry or creating an intriguing marketing item for a recognized manufacturer, this year’s design teams exhibited both creativity and engineering excellence.

Each year, the International Die Casting Design Competition showcases the versatility, quality, innovation and cost savings of aluminum, zinc and magnesium die cast components. This year’s winners are no exception. These die casters have helped customers bolster their product, performance and cost savings. In the automotive sector, in particular, a number of the companies provided economical solutions for OEMs as they helped to enhance performance and fuel economy. Of significance in 2008 was the increased use of die castings in suspension components and engine mounts. For a large engine base bracket, the winner used a totally new casting design and process, thereby opening new possibilities for the die casting process. At the same time, in another market segment, the winning team created and manufactured for the first time a design for a decorative knot and expanded future prospects for die casting.

NADCA wishes to thank all the die casters who submitted their entries in the 2008 competition, while congratulating the winners. The selected die casting entries were displayed recently at CastExpo’08, in Atlanta, GA.
WHAT: Rear Axel Thrust Rods for BMW E70/E71 Vehicles

PROBLEM: In general, thrust rods in suspension systems have been manufactured from steel stampings, extrusions and steel rods. The customer sought to reduce the weight of the thrust rod while maintaining the stiffness properties at a lower cost.

SOLUTION: To meet the stiffness requirements, the team designed specially shaped ribs that were strategically placed on the thrust rod. The casting reduced the original three-piece design down to a single part and reduced mass by about 50%. A high pressure process produced this outstanding example of a thin-walled casting.

PROJECT LEADER: Randy Ryder, Chuck Barnes, Price Sandhu, Sean Seaver, Phil Burton

ALLOY: Aluminum 380 Alloy

WEIGHT: 0.79 lb.

CASTER’S COMMENTS: “While the thrust rod appears to be a relatively simple component, it proved to be a design challenge. The rib design allowed the casting to meet the stiffness requirement while maintaining the integrity of the packaging space currently in the vehicle.”

ABOUT THE DIE CASTER: CONTECH U.S. LLC is a market leader in providing highly engineered, complex, lightweight 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, CONTECH specializes in aluminum/magnesium die casting innovations. Known by several different names during its history, CONTECH prides itself on its high quality engineered products. The company is based in Portage, MI, with facilities in the U.S. and in Wales.
**WHAT:** Engine Base Bracket for Honda Accord

**PROBLEM:** The engine base bracket is an adaptor between transmission, engine and cradle and is mounted on top of the vehicle’s sub-frame, under the engine. Previously, the base bracket was made of stamped steel with welded nuts and punched holes, weighed 11 pounds and consisted of 16 parts. The customer wanted to reduce the component’s weight and part count and had a goal for major mass reduction.

**SOLUTION:** Together with its customer Honda, Ryobi Limited invented the HV²™ (High Vacuum and High Velocity) die casting process to create this new design. The new one-piece casting weighs 6.2 pounds, with a weight savings of 43.6%.

**PROJECT LEADERS:** Yeou-Li Chu, Ricky Takayama, Takashi Yokoyama, Tom Johnson and Launch Team – Ryobi
Shigemi Waku, Tetsuya Miyahara – Honda R&D Co. Ltd.

**ALLOY:** ADC3SF jointly developed with Honda, compatible with SF36, Aural 2

**WEIGHT:** 6.2 lb.

**CASTER’S COMMENTS:** “This is a brand new design casting. Replacing a previously stamped part, the new part is 27 in. long, thin-walled, with screw bosses, totally eliminating the welding operation.”

**ABOUT THE DIE CASTER:** Ryobi Die Casting (USA) Inc. is a subsidiary of the Ryobi Group’s die casting business in North America. A leader in high-pressure aluminum die castings, the company supplies aluminum die castings primarily to the U.S. automobile industry. Among its products are transmission cases, housings, engine parts and structural parts. Ryobi Die Casting is located near Indianapolis, in Shelbyville, IN.
**WHAT:** Composite Engine Sub-Frame for Acura RL

**PROBLEM:** The engine sub-frame is part of the vehicle’s structure that holds the engine. A sub-frame is bulky and heavy and usually is made of stamped steel with welded nuts and punched holes. It has a big impact on a vehicle’s dynamics. With demands growing for environmental protection, fuel efficiency and better turning response and drivability, the customer was looking for lighter component weight.

**SOLUTION:** Ryobi and Honda attempted to create a single piece HV²™ cast of the sub-frame. After studying the problem, they discovered it was impossible to fit all the shape and functional requirements of the sub-frame into a single-shot casting. Instead, they divided the sub-frame into three sections. The front section is formed using aluminum bulging tube, the middle is hydro-formed and the rear is die cast in HV²™. The weight savings is 35-40%. In addition, the components were reduced by 66%, from 48 to 16 pieces, and weld length decreased by 46%. Although welding is still required, blistering has been eliminated with high vacuum casting.

**PROJECT LEADERS:** Takashi Yokoyama and Launch Team – Ryobi
Fumiaki Fukuchi, Tsutomu Ogawa – Honda R&D Co. Ltd.

**ALLOY:** ADC3SF jointly developed with Honda, compatible with SF36, Aural 2

**WEIGHT:** 13.5 lb.

**CASTER’S COMMENTS:** “If a high-toughness suspension component such as a sub-frame can be die cast, other suspension components should be prime candidates for die casting as well.”

**ABOUT THE DIECASTER:** The Ryobi Group is a worldwide manufacturer of die castings, printing equipment, power tools and hardware, with group companies in Japan as well as the U.S., Europe and China. The Ryobi Ltd. Hiroshima Plant strives to produce lighter weight, cost-saving aluminum castings for vehicles. To meet a wide range of customer demands, the company offers die design, casting, machining, painting and assembly. The Hiroshima Plant is Ryobi’s mainstay plant for die design and fabrication and handles the manufacturing of large dies.
ALUMINUM SQUEEZE/SEMI-SOLID
CONTECH Operating UK Ltd.

WHAT: Rear Steering Knuckle for Jaguar XK8 Sports Car

PROBLEM: The function of automobile steering knuckles is to link moving parts and withstand strain. They connect the tie-rod to the hub and give support to the wheel bearing. Traditionally, steering knuckle castings were cast in iron to withstand the intense stress. However, there has been a growing demand for the use of aluminum in order to improve performance and fuel economy. CONTECH has worked with Jaguar before on the redesign of front steering knuckles, but, in this case, the revised durability standard was tougher. The challenge was to maintain mechanical properties while removing as much mass as possible from previous designs, all while meeting a higher level of durability.

SOLUTION: The team used mold fill and solidification modeling during the design stage. CONTECH and Jaguar both conducted testing on the component. Fatigue test simulations included a hub fatigue rig test with a cornering load of 1.4g, greater than the previous expectation. The knuckles are cast as a pair (one LH and one RH casting) from a single die, using the CONTECH P-2000™ HVSC process. Each individual part undergoes an auto defect recognition system and is numbered for 100% traceability.

PROJECT LEADERS: Richard Blythe, Keith Brown, Zach Brown, Paul Dodd, Mark Simpson – CONTECH
Mark Annis, Gary Barr, Peter Blackmore, David Jameson, Steve Morris – Jaguar Cars Ltd.

ALLOY: Aluminum Alloy A356.2 (T6)

WEIGHT: 4.6 lb.

CASTER’S COMMENTS: “The end result was a fitting reward for all of the up-front planning. The component out-performed all previous aluminum steering knuckles that Jaguar had tested, and this was to a fiercer testing regime than ever before.”

ABOUT THE DIE CASTER: CONTECH’s U.K. plant is based in Wales and focuses on axle, engine, steering and suspension components. The Welshpool plant is one of Europe’s leading producers of aluminum one-piece power rack and pinion housings and ships more than 8.5 million pounds of aluminum annually. With their Process 2000 technology, they can offer close dimensional tolerances, complex tooling, minimal porosity and structural integrity.
WHAT: Lift Handle Base for Sunchaser RV Patio Awning

PROBLEM: The lift handle base assembly allows for the adjustment of the awning arm height when the life handle is pulled up. Previously, the materials Zamak #3 and Zamak #5 were used to make the product. Because of potential wind and water loads on an open awning, the integrity and quality of this casting is critical.

SOLUTION: This die casting created cost savings for a high volume part yet at the same time delivered a higher performance part. Selection of a special high strength zinc alloy AcuZinc 5 solved problems of field failures. A switch to auto de-gating miniature tooling and a high performance die casting process allowed the die caster to stay competitive.

PROJECT LEADERS: Dave Haener, Manager, Engineering Group – Cast Products
Mike Hicks, Engineering Group Leader – Dometic Corp.

ALLOY: ACuZinc 5

WEIGHT: 4.65 oz.

CASTER’S COMMENTS: “This casting is the perfect example of the evolution of a product, a process and a relationship. For the last 12 years, our engineering group has worked diligently with Dometic’s team to redesign various components. This program has translated into the success and growth of two companies.”

ABOUT THE DIE CASTER: Cast Products Inc. (CPI), located in Norridge, IL, manufactures custom zinc die castings for various industries. Its services include product design assistance, mold design, tool construction and maintenance, secondary machining, finishing and light assembly. CPI was founded in 1966 to serve customers in all aspects of product projects from design to shipping. The company produced more than 80 million zinc die castings in 2007 with an on-time delivery rating of 98%.
WHAT: Type PR Plus Air Suspension Height Control Valve for Truck and Trailer

PROBLEM: Suspension height control valves help to maintain a truck’s load stability over the road and facilitate loading dock activity. Previously, sand casting and zinc casting were used. The project included many “must haves,” including strength, good flow, tight tolerances throughout, stability, good surface finish, small footprint, the elimination of trimming and reaming, and a single mold to meet high production demands.

SOLUTION: The goal was for a unit with a high-flow design for rapid dump and fill response to save the drivers time and effort in loading and unloading. Aluminum and polymer were tested, but the robustness and moldability of zinc alloy Zamak #3 made it the choice for the valve body. The pressure tight die cast valve body incorporates an innovative die and process design for a high volume truck industry part.

PROJECT LEADERS: Dave Haener, Manager, Engineering Group – Cast Products Victor Plath, Senior Engineer – Haldex Brake Products Corp.

ALLOY: Zamak #3

WEIGHT: 8.65 oz.

CASTER’S COMMENTS: “In severe duty testing, the life expectancy of the Haldex Type PR Plus valve surpasses 100 million cycles — the industry’s longest product life expectancy.”

ABOUT THE DIECASTER: Cast Products Inc. (CPI), located in Norridge, IL, manufactures custom zinc die castings for various industries. Its services include product design assistance, mold design, tool construction and maintenance, secondary machining, finishing and light assembly. CPI was founded in 1966 to serve customers in all aspects of product projects from design to shipping. The company produced more than 80 million zinc die castings in 2007 with an on-time delivery rating of 98%.
WHAT: Knot

PROBLEM: This knot was conceptualized as a distinctive marketing item for a major zinc metal producer. It required an unusual casting design.

SOLUTION: The die cast part used a zinc alloy to form its unusual shape. It displays ingenious part and tooling design for a novel marketing item.

PROJECT LEADERS: Giacomo Zammattio, General Manager – EDT Diecasting Technology
Didier Rollez, Market Development Zinc & R&D – Nyrstar

ALLOY: ZP5

WEIGHT: 5.5 grams

CASTER’S COMMENTS: “The item’s design has the kind of shape that has never been industrially manufactured.”

ABOUT THE DIE CASTER: European Diecasting Technology (EDT) is a supplier of die casting components made with zinc alloys (Zamak) and aluminum alloys. The company is an OEM supplier of assembled devices for the automotive, computer, electronics and hardware industry. Located in Suzhou, in China’s Jiangsu Province, EDT is owned by three Italian companies.
WHAT: Shield Main Ti10 & Shield Internal Standoff for Fluke Thermal Imager

PROBLEM: The thermal imager contains a radiometric infrared camera used for troubleshooting electrical installations and equipment. Its IR Fusion technology captures a digital photo. Formerly, the component was molded plastic with metalized coating. The customer needed a new, lighter weight casting to house and better protect the imager’s electronics. One of the most important requirements was sturdiness.

SOLUTION: The design team produced a thin-wall, lightweight magnesium casting for the thermal imager’s shield. The magnesium shield holds an IR sensor, protects the electronics and provides the proper location to mating components. It accurately positions electrical features for grounding.

PROJECT LEADERS: Bob Krismer, Todd Olson, Nathan Wagner, Ed George Jr., Larry Tupper, Michael Paul – Twin City
Justin Sheard – Fluke Corp.

ALLOY: AZ91D

WEIGHT: 0.14 lb. and 0.04 lb.

CASTER’S COMMENTS: “Using magnesium provides improved rigidity and ruggedness for shielding. The design allows threads and other features to be grounded to electrically.”

ABOUT THE DIE CASTER: Twin City Die Castings Co. (TCDC) manufactures aluminum, magnesium and zinc die cast components. A full-service operation, they recommend modifications that reduce tooling and metal costs, using their designs, simulation software and prototypes to assist customers. 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 and Monticello, MN; Watertown, SD.
WHAT: L0940 Fairing Support Bracket for Buell 1125R Superbike

PROBLEM: The support bracket provides support for the motorcycle’s instrument cluster, windshield/cowling, direction signals and rearview mirror. Formerly, Thixo-mold magnesium was the material used for the bracket.

SOLUTION: The new design provides improved de-gating, was less labor intensive and increased capacity compared to the previous process. The bracket now has cleaner parting lines and better surface quality. It incorporates a high number of mounting points in a stylish, lightweight design.

PROJECT LEADERS: Bob Krismer, Todd Olson, Nathan Wagner, Ed George Jr., Larry Tupper, Michael Paul – Twin City
Scot Ferguson (Lead Purchasing Engineer), Dave Schofield (Designer) – Buell Motorcycle Co.

ALLOY: AZ91D

WEIGHT: 2.71 lb.

CASTER’S COMMENTS: “This design provided the customer with a cost savings of approximately 26%.”

ABOUT THE DIE CASTER: Twin City Die Castings Co. (TCDC) manufactures aluminum, magnesium and zinc die cast components. A full-service operation, they recommend modifications that reduce tooling and metal costs, using their designs, simulation software and prototypes to assist customers. TCDC also offer 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 and Monticello, MN; Watertown, SD.
If you have an innovative die casting design, you should consider entering the 2009 International Die Casting Design Competition. Selected castings will be displayed next year at the 113th Metalcasting Congress, April 7-10, 2009, in Las Vegas, NV.

TO COMPETE:
The annual industry competition is open to those companies producing aluminum, magnesium and zinc die castings. Within each alloy group, there are more specific levels: aluminum under 1 pound; aluminum 1-to-10 pounds; aluminum over 10 pounds; aluminum squeeze/semi-solid; zinc under 6 ounces/non-electroplated; zinc over 6 ounces/non-elecetroplated; zinc any size with decorative finish; magnesium under 1 pound; and, magnesium over 1 pound.

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 these 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 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 magazine, but because of proprietary reasons, not all information can be shared. Such exceptions should be noted in the entry.

The competition’s judging is conducted by an independent panel of die casting experts, with no ties to eligible companies.

You may download the entry form at [www.diecasting.org/castings/competition](http://www.diecasting.org/castings/competition). Send your entry, along with a sample casting and detailed description, to:

NADCA
241 Holbrook Drive
Wheeling, IL 60090

All entries must be postmarked by Friday, Feb. 20, 2009. For more information, call Dan Meyer, NADCA’s design engineer, at (847) 808-3158 or e-mail him at meyer@diecasting.org.