



Using plastic to consolidate parts in door modules can reduce weight and maintain or improve side impact safety

plastics & autos

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- “Global accident statistics show that side impacts account for approximately 30% of all impacts and 35% of the total fatalities.”—German In Depth Accident Study – GIDAS, National Automotive Sampling System – NASS & BMW accident databases¹
- Automakers can use injection-molded plastic parts in door interiors to reduce weight in vehicles while meeting side impact protection standards. The 2005 Mustang and 2006 PT Cruiser are two examples.^{2,3,4,5,6}
- The 2005 Mustang has a plastic door trim with an integrated acoustic chamber and subwoofer that saves more than 18 lbs. per vehicle. “This is the first door ever produced with an eight-inch subwoofer enclosed within a hermetically sealed acoustic chamber.”⁴
- The 2005 Mustang door has two fewer subwoofers⁷ but an increase in sound quality.²
- The integration of parts decreased the need for a separate pelvic cushioning component in the door. Instead, the door’s acoustic chamber is designed with a collapsible wall in the side impact zone that allows the vehicle to meet side impact standards without the use of a standard hip bolster.²
- The 2006 PT Cruiser also utilizes plastic for parts consolidation. Its “RackLift™” window regulator system is made of injection molded plastic nylon components that reduce the typical 21 parts of a traditional steel window lift system to just 13 parts—a 33% parts reduction.⁸
- “Compared to conventional steel [window lift] designs, the RackLift™ system achieves a 25% mass reduction—saving 6 to 14 lb (2.7 to 6.4 kg) per four-door vehicle—and an approximate 15% reduction in cost largely through consolidation and elimination of parts (eight fewer parts and three fewer attachment points than the previous system).”⁹
- The 2005 PT Cruiser without the plastic window lift system and the 2006 PT Cruiser with the plastic window lift system were both NHTSA-rated with a 4-star front side-impact crash rating and a 5-star rear side-impact crash rating; safety was not compromised.⁵
- According to the Society of Plastics Engineers, the 2006 PT Cruiser all-plastic window lift system “improved crash performance and durability.”³

The integrated acoustic chamber and subwoofer in the 2005 Ford Mustang saves more than 18 lbs. and enhances safety by using a collapsible plastic hip cushioning component.*



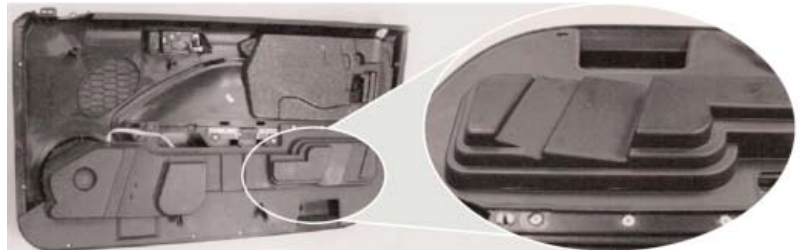
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Additional Information

- According to Deborah F. Mielewski, a plastics research technical leader at Ford, a single injection-molded plastic part can do the job of many metal pieces welded together.¹⁰
- The Society of Plastics Engineers (SPE) awarded the all-plastic 2006 PT Cruiser window lift system with a 2005 Innovation Award, and the 2005 Mustang's plastic door trim with integrated acoustic chamber and subwoofer with a Body Interior Category Award and the 2004 SPE Automotive Division Grand Award for "The Most Innovative Use of Plastics."^{3,4}



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By converting from steel to plastic, the 2006 PT Cruiser's all-plastic window lift system achieved 25% lower mass and maintained a 5-star rear side-impact crash rating.*

*Information drawn from bullets.

"A specialized blend of polypropylene was developed for this subwoofer application. Glass fiber provides the stiffness required for the subwoofer and is impact-modified to perform as an integrated pelvic impact bolster."² The design of the subwoofer chamber integrated the characteristics of a pelvic impact bolster. This allowed for the elimination of a separate bolster as well as increasing the volume of the chamber for the subwoofer.²

Works Cited

- 1 McNeill, A., et al. "Current Worldwide Side Impact Activities – Divergence Versus Harmonisation and the Possible Effect on Future Car Design." 19th International Technical Conference on the Enhanced Safety of Vehicles (ESV) Conference, June 2005. Paper Number 05-0077. <http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/esv/esv19/05-0077-O.pdf> (accessed March 15, 2007).
- 2 Visteon. Door Trim with Integrated Subwoofer. Van Buren Township, MI: Visteon, 2005. http://www.visteon.com/products/automotive/media/trimdoor__integratedsubwoofer.pdf (accessed March 9, 2007).
- 3 Cole, Suzanne. "SPE Automotive Division Announces 11 Winners of 35th Anniversary Innovation Awards Gala." Press Release, November 30, 2005. <http://www.speautomotive.com/pdfs/05winners.pdf> (accessed March 9, 2007).
- 4 Society of Plastic Engineers Automotive Division. "2004 Innovation Awards Program." Automotive Plastics News 34, no. 2, January 2005: 10. http://www.speautomotive.com/pdfs/jan05__newsletter.pdf (accessed March 9, 2007).
- 5 MSN Autos. "2006 Chrysler PT Cruiser Safety & Crash Test Ratings." Crash test data provided by the Insurance Institute for Highway Safety (IIHS) and the National Highway Traffic Safety Administration (NHTSA). <http://autos.msn.com/research/vip/safety.aspx?year=2006&make=Chrysler&model=PT%20Cruiser> (accessed March 9, 2007).
- 6 MSN Autos. "2005 Chrysler PT Cruiser Safety & Crash Test Ratings." Crash test data provided by the Insurance Institute for Highway Safety (IIHS) and the National Highway Traffic Safety Administration (NHTSA). <http://autos.msn.com/research/vip/safety.aspx?year=2005&make=Chrysler&model=PT%20Cruiser> (accessed March 9, 2007).
- 7 Ogando, Joseph. "This Door Strikes the Right Note." Design News for Mechanical and Design Engineers, November 18, 2004. <http://www.designnews.com/article/CA481091.html?ref=nbra> (accessed March 9, 2007).
- 8 Vasilash, Gary S. "Creating Clever Things With Plastics." Automotive Design and Production. December 2005. <http://www.autofieldguide.com/articles/120501.html> (accessed March 9, 2007).
- 9 Gehm, Ryan. "SPE recognizes innovative plastics use." Automotive Engineering International: Material Innovations, December 2005: 41. <https://shop.sae.org/automag/material/12-2005/1-113-12-38.pdf> (accessed March 13, 2007).
- 10 Tullo, Alexander H. "Driving Efficiency." Chemical & Engineering News 84, no. 24, June 12, 2006: 12-18. <http://pubs.acs.org/cen/coverstory/84/8424plastics.html> (accessed March 15, 2007).

Bibliography

- Cole, Suzanne. "SPE Automotive Division Announces 11 Winners of 35th Anniversary Innovation Awards Gala." Press Release, November 30, 2005. <http://www.speautomotive.com/pdfs/05winners.pdf> (accessed March 9, 2007).
- Gehm, Ryan. "SPE recognizes innovative plastics use." Automotive Engineering International: Material Innovations, December 2005: 41. <https://shop.sae.org/automag/material/12-2005/1-113-12-38.pdf> (accessed March 13, 2007).
- McNeill, A., et al. "Current Worldwide Side Impact Activities – Divergence Versus Harmonisation and the Possible Effect on Future Car Design." 19th International Technical Conference on the Enhanced Safety of Vehicles (ESV) Conference, June 2005. Paper Number 05-0077. <http://www-nrd.nhtsa.dot.gov/pdf/nrd-01/esv/esv19/05-0077-O.pdf> (accessed March 15, 2007).
- MSN Autos. "2006 Chrysler PT Cruiser Safety & Crash Test Ratings." Crash test data provided by the Insurance Institute for Highway Safety (IIHS) and the National Highway Traffic Safety Administration (NHTSA). <http://autos.msn.com/research/vip/safety.aspx?year=2006&make=Chrysler&model=PT%20Cruiser> (accessed March 9, 2007).
- MSN Autos. "2005 Chrysler PT Cruiser Safety & Crash Test Ratings." Crash test data provided by the Insurance Institute for Highway Safety (IIHS) and the National Highway Traffic Safety Administration (NHTSA). <http://autos.msn.com/research/vip/safety.aspx?year=2005&make=Chrysler&model=PT%20Cruiser> (accessed March 9, 2007).
- Ogando, Joseph. "This Door Strikes the Right Note." Design News for Mechanical and Design Engineers, November 18, 2004. <http://www.designnews.com/article/CA481091.html?ref=nbra> (accessed March 9, 2007).
- Society of Plastic Engineers Automotive Division. "2004 Innovation Awards Program." Automotive Plastics News 34, no. 2, January 2005: 10. http://www.speautomotive.com/pdfs/jan05__newsletter.pdf (accessed March 9, 2007).
- Tullo, Alexander H. "Driving Efficiency." Chemical & Engineering News 84, no. 24, June 12, 2006: 12-18. <http://pubs.acs.org/cen/coverstory/84/8424plastics.html> (accessed March 15, 2007).
- Vasilash, Gary S. "Creating Clever Things With Plastics." Automotive Design and Production. December 2005. <http://www.autofieldguide.com/articles/120501.html> (accessed March 9, 2007).
- Visteon. Door Trim with Integrated Subwoofer. Van Buren Township, MI: Visteon, 2005. http://www.visteon.com/products/automotive/media/trimdoor__integratedsubwoofer.pdf (accessed March 9, 2007).

Pictures

- Mustang door interior: http://www.visteon.com/products/automotive/trimdoor__integratedsubwoofer.shtml
- Mustang door module: http://www.visteon.com/products/automotive/media/trimdoor__integratedsubwoofer.pdf
- Mustang subwoofer chamber: http://www.visteon.com/products/automotive/media/trimdoor__integratedsubwoofer.pdf
- PT Cruiser window lift system: <http://www.speautomotive.com/pdfs/05winners.pdf>

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