Vehicle Safety and Driver Assist Technologies

At Ford, we aim to Go Further. That's our brand promise, and it's a promise that focuses us on creating great products, a strong business and a better world. Part of that brand promise involves giving customers peace of mind and making the world safer by developing an array of advanced safety technologies and making them available across a wide range of vehicles.

These technologies include everything from high-strength steels and world-first rear-seat inflatable seat belts to radar-based driver assist technologies and technologies that encourage safer driving, such as the Ford MyKey® system. Going Further also means working with partners to create a future in which connected vehicles talk to each other, and to the roadway, in order to potentially avoid accidents and traffic jams.

In short, vehicle safety is a critical part of our aim to Go Further, and we work to build in safety from the very beginning of each product development process. Indeed, safety is one of four global brand pillars that guide our every design and engineering effort.[1]

Ford remains among the global leaders in vehicle safety. To date, for example, Ford Motor Company has earned more "Top Safety Picks" from the Insurance Institute for Highway Safety (IIHS) – a total of 78 – than any other manufacturer in the seven-year history of that crash testing program.[2] To earn a Top Safety Pick, a vehicle must receive a rating of "good" in offset frontal impact, side impact, rear impact and roof strength evaluations, and offer electronic stability control.

Our recent safety highlights include the following:

- Twelve Ford Motor Company vehicles earned Top Safety Picks from the IIHS in 2012: The Ford Fiesta (sedan and hatchback), Focus, Fusion, Taurus, Edge, Explorer, Flex and F-150 (crew cab) and the Lincoln MKZ, MKS, MKT and MKX.
- The Ford Fusion has been an IIHS Top Safety Pick for four years in a row (2009–2012).
- The Ford Ranger and the Ford Focus both earned five-star safety ratings in the revised and more stringent 2012 European New Car Assessment Program (EuroNCAP) assessments.

75 percent

of Ford Motor Company vehicles earned IIHS Top Safety Picks in 2012

78

Top Safety Picks earned by Ford Motor Company to date, more than any other manufacturer in the seven-year history of that crash testing program[3]

Ford Ranger

The European Ford Ranger earned a five-star EuroNCAP rating; it's the first and only pickup to achieve this honor.

Innovative Safety Technology

We brought to market the world's first automotive inflatable safety belts – a brand-new technology that has won several prestigious awards.

Driver Education

In 2011, we reached 35,000 teen drivers on the Ford Driving Skills for Life high school tour.

- The new European Ford Ranger, designed by engineers in Ford of Australia, is the first and only pick-up to achieve a five-star rating in the EuroNCAP assessment. It scored 89 percent for overall safety – the best score ever earned by a pick-up and one of the highest scores recorded by EuroNCAP for any type of vehicle. Moreover, the new Ranger achieved the highest rating (81 percent) of any vehicle ever tested by EuroNCAP for pedestrian protection.
- The Ford Focus now has an industry-leading total of four EuroNCAP "Advanced Awards" for offering Lane Keeping Aid, Active City Stop, Forward Alert and Driver Alert technologies.
- The Ford Fiesta was awarded a five-star rating in the Chinese NCAP during 2011.
- The 2011 Ford Territory, Falcon, Kuga, Ranger and Focus were all awarded five-star ratings in the Australasian NCAP.
- In the newly founded Latin NCAP, the Ford Focus achieved a best-in-class four-star rating for adult protection and three stars for child protection.
- The 2013 Ford Taurus Police Interceptor will be the only police pursuit sedan on the market tested in 75-mph rear-end crash tests.
- The 2012 Ford Fiesta is the first vehicle in its class to offer a driver's knee airbag.
- Our available rear-seat inflatable safety belts, launched on the 2011 Ford Explorer, are an automotive industry exclusive and have won numerous awards. In the 2012 model year, we expanded the availability of these safety belts in North America to the Ford Flex and the Lincoln MKT.
- In South America, the 2012 Ford Edge was first-in-segment to offer Blind Spot Information System (BLIS). The 2013 Ford Fusion will also be first-in-segment to offer BLIS. BLIS uses radar sensors to help inform the driver when a vehicle is detected in the blind spot zone.
- In 2011 we introduced Lane Keeping System, a driver assist feature, in Europe on the new Ford Focus. Its availability will be expanded to North America on the 2013 Lincoln MKS, MKT, MKZ and Ford Explorer and Fusion.
- We launched Curve Control on the 2011 Ford Explorer. This driver assist technology helps slow the vehicle when it senses the driver is taking a curve too quickly. We are expanding the availability of Curve Control to the 2013 Ford Taurus and Flex and the 2013 Lincoln MKS and MKT. A majority of Ford's products will be equipped with Curve Control by 2015.

The 2012 Ford Fusion

1. The other brand pillars are quality, fuel efficiency and smart technologies.
2. Historic totals include all brands and entities owned and controlled by the manufacturer during the 2006–2012 calendar years. For Ford Motor Company, this includes Ford, Lincoln, Mercury and – through 2010 model year – Volvo. Totals do not include Mazda.
3. Historic totals include all brands and entities owned and controlled by the manufacturer during the 2006–2012 calendar years. For Ford Motor Company, this includes Ford, Lincoln, Mercury and – through 2010 model year – Volvo. Totals do not include Mazda.

How We Manage Vehicle Safety

At Ford, our objective is to design and manufacture vehicles that achieve high levels of vehicle safety for a wide range of people over a broad spectrum of real-world conditions. Real-world safety data, driver behavior, research, regulatory requirements and voluntary agreements provide much of the input into our safety processes, including our Safety Design Guidelines (SDGs) and Public Domain Guidelines (PDGs). (See graphic below.) The SDGs are Ford's stringent internal engineering design targets that exceed regulatory requirements and define additional requirements that are not regulated. The PDGs are Ford guidelines that focus specifically on helping to ensure that our vehicles earn top marks in relevant public domain assessments.

Our PDGs are continually reviewed for possible revisions to address ongoing changes in major public domain vehicle testing programs around the world. Please see the case study for information on the most recent changes.

Internally, Ford utilizes engineering analyses, extensive computer modeling and crash and sled testing to evaluate the performance of vehicles and individual components. These rigorous evaluations help to confirm that our vehicles meet or exceed regulatory requirements and our even more stringent internal guidelines. Our state-of-the-art crash-test facilities include the Safety Innovation Laboratory in Dearborn, Michigan, and the extensive crash-test facilities in Merkenich, Germany, and Dunton, England. We also operate a high-tech, full-motion driving simulator in Dearborn called VIRTTEX, for VIRtual Test Track Experiment.

Haddon Safety Matrix

We use the Haddon Safety Matrix to take a holistic view of the factors that may affect vehicle safety. (The matrix was developed by William Haddon, a former administrator of the U.S. National Highway Traffic Safety Administration and also former president of the Insurance Institute for Highway Safety.) The Haddon Matrix illustrates how traffic safety can be the product of complex interactions among the driver, the vehicle and the driving environment.

The Haddon Matrix is used to look at crashes in terms of causal and contributing factors, including human behavior, vehicle safety and the driving environment. Each factor is then considered in the pre-crash, crash and post-crash phases. In the pre-crash phase, the focus is to help avoid the crash. In the crash and post-crash phases, the primary objective is to help reduce the risk of injury to occupants during and after a collision. Another goal is to minimize the amount of time that elapses between the crash and when help arrives.

Related Links

This Report

- Case Study: Public Domain Ratings

	Human Behavior	Vehicle Safety	Environment
			
Pre-Crash Accident avoidance	• Research • Education • Advocacy	• Crash avoidance technologies • Security	• Road design for accident avoidance • Traffic control
Crash Occupant protection	• Technology and proper use	• Restraints • Structures that absorb and reduce crash energy and intrusion	• Road design for injury mitigation • Research
Post-Crash Injury mitigation	• Telematics	• Post-crash notification	• Emergency medical services
Examples of Ford Actions	• SYNC® technology • MyFord Touch® driver connect technology • MyKey® • Ford Driving Skills for Life	• Accident avoidance features • Inflatable safety belts • Roll Stability Control®	• Accident research • Development of “vehicle-to-infrastructure” communication systems

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Encouraging Safer Driving

The U.S. Department of Transportation conducted a national survey from 2005 through 2007 that sought to identify environmental, vehicle and driver factors in crashes involving light passenger vehicles. They found that in 95 percent of the crashes studied, a driver-related factor was the "critical reason for the critical pre-crash event."

According to studies by the Insurance Institute for Highway Safety, the crash rate for 16–19-year-old drivers is four times higher than the crash rate for older drivers. The difference is attributed to both the immaturity of teen drivers (e.g., higher rates of risky driving such as speeding) and lack of experience (e.g., less capability in unfamiliar situations).

We at Ford have developed an array of programs and technologies that help to encourage safer behavior on the roadways for both experienced and novice drivers.

For example, Ford Driving Skills for Life (FDSFL), Ford's driver education program, demonstrates our commitment to help new drivers to improve their motoring skills. In the U.S., FDSFL focuses on teen drivers; in our Asia Pacific and Africa markets, the program is aimed at first-time drivers of all ages.

Summer Schaive and Allison Brockel from Riverton High School show off their "Teens Against Distracted Driving" shirts at a Ford Driving Skills for Life event that was part of Operation Teen Safe Driving

In 2012 in the U.S., FDSFL plans to visit 30 high schools in five states with a transporter featuring specially equipped vehicles and professional instructors. The program delivers a full day of multifaceted activities that build young drivers' skills in four key areas: driver distraction, speed/space management, vehicle handling and hazard recognition. FDSFL reached 35,000 teen drivers on the high school tour in 2011, and the same number is expected to participate this year. In addition, FDSFL continues to provide interactive web-based training called "The Academy" on www.drivingskillsforlife.com, and free materials upon request for students, educators, parents and community organizations.

In Ford's global markets, FDSFL is in its fifth year training newly licensed drivers in Asia and Africa, with programs in China, India, Taiwan, South Africa, Thailand, Vietnam, the Philippines, Indonesia and Malaysia. FDSFL programs are tailored in each of these markets to reflect the local driving environment and road conditions. So far, 50,000 people have participated in the program across Asia and Africa, with another 12,000 expected in 2012.

Every year, Ford partners with the Illinois Department of Transportation, secretary of state and

Related Links

Ford Websites

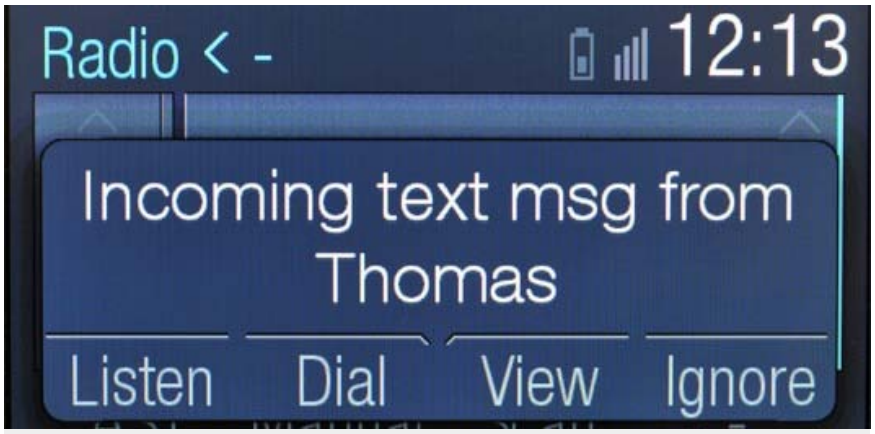
- Ford Driving Skills for Life
- Ford SYNC®

External Websites

- Operation Teen Safe Driving

state police to run a seven-month statewide program – modeled on Ford Driving Skills for Life – designed to reduce teen crashes and fatalities. Called Operation Teen Safe Driving, this campaign gets high school students directly involved by challenging them to develop and implement a teen safe driving community awareness campaign using FDSFL resources. The program involves 883 schools in 102 Illinois counties, and has the support of the governor, the secretary of state and the Chicago Board of Education. During the 2010–2011 program year, the program reached 3.2 million Illinois residents. The results have been remarkable: Illinois has seen a 45 percent reduction in teen fatalities since the program was launched in 2007.

Another way Ford has been working to encourage safer driving is to focus on the issue of driver distraction. For example, Ford SYNC® – while primarily a convenience feature – provides a way for drivers to use cell phones and MP3 players through voice commands alone, while keeping their eyes on the road and their hands on the wheel. Ford's SYNC system even addresses concerns regarding text messaging: When a text message arrives, SYNC does not display that message but instead gives the driver the option of ignoring it or reading it aloud through text-to-speech technology. It then provides a list of canned replies for the driver to select rather than key-in or compose manually. SYNC also locks out certain features (such as adding or editing a phone book contact) while driving.



The SYNC in-car connectivity system, which can read aloud incoming messages through a text-to-speech feature

In addition, the MyFord Touch® driver connect technology – launched in 2010 – replaces many of a vehicle's traditional buttons, knobs and gauges, and is designed to increase focus on driving while providing access to information, entertainment and connectivity features. The system includes a state-of-the-art voice recognition system with more than 10,000 available commands and color LCD displays, along with two five-way controllers on the steering wheel. While MyFord Touch has been continuously improved with each successive vehicle introduction since 2010, Ford launched the first major software upgrade of the system with the 2013 Ford Taurus and Flex. The upgrade includes better voice recognition and enhancements to the touch screen interface, with faster response time, simpler graphics and bolder text that is easier to use. These features encourage drivers to maximize the time their eyes are on the road and their hands are on the steering wheel. The upgraded system will roll out to all new 2013 models that offer MyFord Touch, and the improved software will be offered to more than 300,000 current owners.

The 2013 F-Series Super Duty with MyFord Touch

Finally, the Ford MyKey® system is an innovative technology designed to help parents encourage their teenagers to drive more safely. MyKey allows owners to program a key that can

limit the vehicle's top speed and the audio volume. MyKey encourages safety-belt usage by enabling Ford's Belt-Minder® to chime every minute indefinitely until both of the front passengers are buckled in, rather than ceasing after five minutes, and also through a "no belt/no tunes" feature that mutes the audio system until the belt is buckled. In addition, MyKey provides an earlier low-fuel warning (at 75 miles to empty rather than 50); sounds speed-alert chimes at 45, 55 or 65 mph; and will not allow manual override of other safety systems.

The Ford MyKey

Early in 2012 on the Ford Taurus and Explorer, Ford upgraded MyKey with a world-first technology that allows parents to limit a vehicle's top speed at any of four different settings: 65, 70, 75 or 80 mph. The upgrade, which will quickly be offered across a variety of Ford and Lincoln models, also invokes SYNC's Do Not Disturb feature, which sends incoming phone calls and text messages to the synced phone's mailbox, and it allows parents to block explicit radio programming while their teens are driving. For the 2012 model year, MyKey is available on nearly all Ford Motor Company retail vehicles in North America, and its availability is expanding to other regions.

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Safety and Driver Assist Technologies

Ford Motor Company continues to invest in new technologies to address real-world needs and customer wants. Our advanced research strives to understand the many variables that can influence a safety need and develop solutions that advance our commitment to provide safe and efficient transportation. (See more in the NCAP case study.)

In this section we discuss three categories of technologies and provide a few examples of Ford's offerings in each. The categories include:

- Accident Avoidance and Driver Assist Technologies
- Occupant Protection Technologies
- Post-Crash/Injury Mitigation Technologies

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- Case Study: Public Domain Ratings

Accident Avoidance and Driver Assist Technologies

A variety of Ford technologies, in addition to each vehicle's handling and braking capabilities, can assist drivers by helping the driver control the vehicle or alerting the driver to potential risks. Also, these technologies can support everyday driving tasks by improving comfort and reducing demands on the driver.

Curve Control, for example, which launched on the 2011 Ford Explorer, is designed to sense when a driver is taking a curve too quickly. In those situations, it rapidly reduces engine torque and can apply four-wheel braking, slowing the vehicle by up to 10 mph in about a second. The technology is designed to be effective on wet or dry pavement, and is expected to be helpful when drivers are entering or exiting freeway ramps with too much speed. Curve Control will roll out in the majority of Ford products by 2015.

Ford's Lane Keeping System consists of three elements to help a driver maintain proper lane position: Driver Alert, Lane Keeping Alert and Lane Keeping Aid. Using a small, forward-facing camera behind the inside rearview mirror, the system "looks" down the road, monitoring lane lines to determine that the vehicle is on course. Driver Alert computes a vigilance level for the driver and displays it in the instrument cluster upon request. The vigilance judgment is based on statistical analysis of lane information collected by the forward-looking camera and the vehicle's yaw behavior. If the driver vigilance level falls below a certain level (i.e., if the driver gets tired), visual and audible warnings are given. Lane Keeping Alert is designed to warn the driver, via a vibration in the steering wheel and a warning chime, when the front-view camera detects that an unintentional lane departure is happening. Lane Keeping Aid goes a step further. It applies a steering torque in the direction the driver needs to steer to keep the vehicle in the current lane. If the front-view camera detects that a lane departure is still likely to occur, the system vibrates the steering wheel to help the driver recognize that additional action is needed.

Ford's innovative Lane Keeping System

Lane Keeping System can be activated and deactivated manually via a switch on the turn indicator stalk or tuned to allow the driver to retain full steering control of the vehicle. The system is automatically deactivated at speeds below 38 mph, so as not to interfere in urban conditions when intentional lane crossing is relatively frequent. Lane Keeping Alert and Driver Alert were first available in Europe on the Ford Mondeo, S-MAX and Galaxy. The updated Lane Keeping System was introduced in Europe on the new Focus; it will be offered in North America on the 2013 Lincoln MKS, MKT and MKZ and the 2013 Ford Explorer and Fusion.

Ford's Collision Warning with Brake Support technology activates a visual and audible warning when the system detects a high risk of collision with the vehicle in front. In addition, the

Related Links

Vehicle Websites

- Ford Edge
- Ford Escape
- Ford Expedition
- Ford Explorer
- Ford E-Series
- Ford Flex
- Ford Fusion
- Ford Super Duty®
- Ford Taurus
- Ford F-150
- Lincoln MKS
- Lincoln MKT
- Lincoln MKX
- Lincoln MKZ
- Lincoln Navigator

Ford.co.uk

- Ford Focus
- Ford Galaxy
- Ford Mondeo
- Ford S-MAX

brake system is pre-tensioned and the “servo boost” assistance system is modulated to provide faster brake performance (e.g., as soon as the driver lifts the gas pedal), if required by the driver. Range and speed information are sensed with long-range radar mounted on the front of the vehicle. Collision Warning with Brake Support can be activated or deactivated as the driver wishes. If the sensor becomes blocked by snow, ice or mud, the driver will receive a notice of reduced or suspended functionality. This technology is available in North America on the Ford Taurus, Edge and Explorer and the Lincoln MKS, MKX and MKT, and in Europe on the Ford Mondeo, S-MAX, Galaxy and Focus. The technology will also be available on the new 2013 Ford Fusion in North America.

Visual warnings from Ford’s Collision Warning with Brake Support technology

Finally, Ford’s industry-leading innovation known as AdvanceTrac® with Roll Stability Control® (RSC) continues to give drivers more driving confidence. RSC actively measures and helps control both yaw and roll movements. It uses two gyroscopic sensors to detect when a driver corners too fast or swerves sharply to avoid an obstacle. It then applies pressure to select brake(s) to help the driver maintain control, thus potentially reducing the risk of a rollover event.

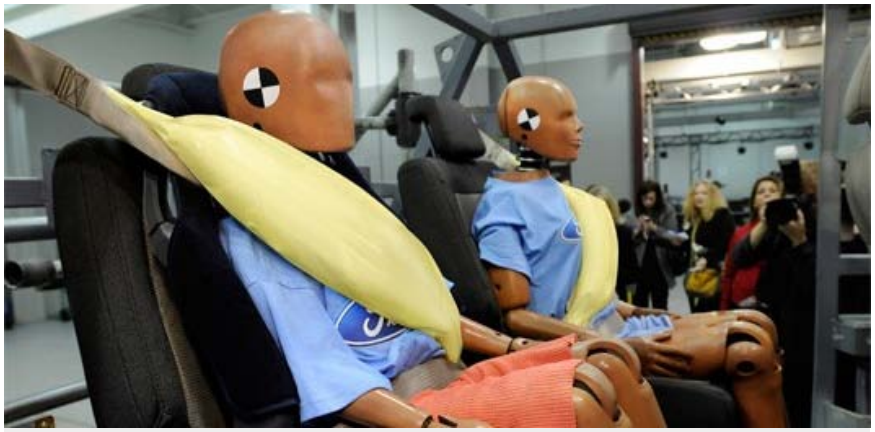
Roll Stability Control is standard equipment on the Ford Flex, Explorer, Expedition, Edge, Escape and F-150, as well as E-Series wagons and vans and the 2011 SuperDuty with single rear-wheel configurations. It is also standard equipment on the Lincoln Navigator, MKX and MKT.

As of the 2012 calendar year, 100 percent of Ford vehicles (under 10,000 lbs. gross vehicle weight) in North America come standard with either RSC or our standard electronic stability control system.

Occupant Protection Technologies

Many factors influence a vehicle's crash performance, including the design of the vehicle's structure (i.e., its ability to absorb impact energy) and the use of passive safety equipment such as air bags to supplement safety belts. Ford's commitment to advancing the state-of-the-art in vehicle safety includes research on and development of technologies that further enhance occupant protection in a wide variety of crash circumstances.

Safety belts remain the most important vehicle safety technology available. For the 2011 model year, Ford brought to market the world's first automotive inflatable safety belts – a brand-new technology that has won several prestigious awards. Specifically, it won Gold in the 2011 Edison Award's Applied Technology category, *Popular Mechanics'* "Breakthrough Award," *Popular Science's* "Best of What's New" award and the Automobile Journalists Association of Canada's "Best New Technology" award. The inflatable safety belts combine the attributes of traditional safety belt and air bag technologies to help reduce the risk of head, neck and chest injuries for rear-seat passengers.



Inflatable safety belt technology

Inflatable belts are designed to deploy over a vehicle occupant's torso and shoulder in less than 40 milliseconds in the event of a crash. Each belt's tubular air bag inflates with cold compressed gas. The inflatable belt distributes crash force energy across the occupant's torso, helping to further reduce the risk of injury. In everyday use, the inflatable belts operate like conventional safety belts and are safe and compatible with infant and child safety car and booster seats. In Ford's research, more than 90 percent of those who tested the inflatable safety belts found them to be similar to, or more comfortable than, a conventional belt.

Ford introduced rear-seat inflatable safety belts on the 2011 Ford Explorer in North America; their availability was expanded to the Ford Flex and Lincoln MKT in early 2012, and will be expanded to the Lincoln MKZ in mid 2012. Plans are also in place to implement rear-seat inflatable belts in other markets.

As part of our continuing effort to enhance the safety and fuel efficiency of our vehicles, Ford is using more ultra-high-strength steels than ever, as well as researching other advanced materials. Increased use of these materials helps us design vehicle structures with enhanced crash energy management, while balancing overall vehicle weight – even as we add more features, equipment and safety devices. As an example, the body structure of the new 2012 Ford Focus is constructed of 55 percent high-strength materials.

Related Links

Vehicle Websites

- Ford Explorer
- Ford Flex
- Ford Focus
- Lincoln MKS
- Lincoln MKT
- Lincoln MKZ

Ford Websites

- Inflatable Safety Belts

Post-Crash/Injury Mitigation Technologies

One method of assisting emergency responders to reach the scene of a vehicle crash quickly is through in-vehicle emergency call systems, also called post-crash notification. These systems can help occupants to summon assistance in an urgent situation.

In the U.S., Ford SYNC® is an award-winning, in-car connectivity system introduced on certain 2007 model year vehicles. Beginning with the 2009 model year, SYNC-equipped vehicles come with an occupant communications capability called SYNC 911 Assist, Ford's in-car, non-subscription call-for-help system. In the event of a severe crash, the ability to directly contact the local 911 emergency operator could be critical, for both the vehicle occupants and first responders. While any cell phone alone could be used in an emergency situation, SYNC can assist in placing a call to a local 911 emergency operator – when a phone is properly paired, turned on and connected to SYNC and where the system and cell phone remain powered and undamaged – should a crash with an air bag deployment or fuel shutoff switch activation occur. The key advantage of SYNC 911 Assist is speed, as calls are placed directly to local 911 operators and do not have to be routed through a call center (as in competitors' versions), which can delay the time it takes to get help on the way. SYNC 911 Assist gives the occupants a choice as to whether or not to make the emergency call, and places the call if the occupant does not respond after a short time.

In November 2011, Ford participated in discussions with the U.S. National Highway Traffic Safety Administration, the Centers for Disease Control, other automobile manufacturers and government agencies on future directions for advanced automatic crash notification systems. Ford presented information about the next generation of SYNC 911 Assist, which will include the ability to communicate additional information to 911 operators such as the impact velocity of the vehicle, which is highly correlated to the probability of serious injury.

In Europe, beginning in 2012 with the new B-MAX, Ford will offer SYNC with Emergency Assistance, a system similar to SYNC 911 Assist. Ford worked with the European Emergency Number Association (EENA) to develop Emergency Assistance and gained valuable input into the system's design. The EENA aims to ensure a consistently high level of response to 112 emergency calls across Europe. Emergency Assistance alerts local emergency services operators after an accident, in the correct language for the region. It will be available in more than 30 countries across Europe and beyond.

The SOS-Post Crash Alert System, which is standard equipment on most Ford and Lincoln vehicles, is another advance in post-crash safety technology. The SOS-Post Crash Alert System automatically activates the horn and emergency flashers in the event of an air bag deployment or safety belt pre-tensioner activation. The second-generation system – introduced in the 2011 model year – also is designed to automatically unlock vehicle doors subsequent to an air bag deployment or safety belt pre-tensioner activation, to aid in rescue. The system is designed to alert passersby and emergency services to the vehicle's location.

Related Links

Ford Websites

- SYNC® 911 Assist

Ford.co.uk

- Ford B-MAX

External Websites

- European Emergency Number Association
- National Highway Traffic Safety Administration

VEHICLE SAFETY AND DRIVER ASSIST TECHNOLOGIES

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Collaborative Efforts

Ford Motor Company continues to collaborate with other automotive companies on precompetitive safety projects to enhance the safety of the driving experience and develop future technologies. The connected vehicles case study describes several of these collaborations, including the Crash Avoidance Metrics Partnership and Vehicle Infrastructure Integration Consortium, among others. This section includes two other major examples: The U.S. Council for Automotive Research and our university partnerships.

U.S. Council for Automotive Research (USCAR)

Ford collaborates with General Motors and Chrysler through USCAR's various safety-related working groups, committees and councils. These include the Safety Technical Leadership Council (Safety TLC), the Occupant Safety Research Partnership (OSRP) and the Crash Safety Working Group (CSWG).

A number of years ago, the OSRP initiated the development of WorldSID, a male side-impact dummy that is recognized as the most advanced crash-test dummy ever created. The U.S. National Highway Traffic Safety Administration concluded that the biofidelity of WorldSID is better than that of the dummy in the current side-impact regulation. And, WorldSID is the first side-impact dummy with the potential to be commonly used in side-impact regulations around the world.

In 2010, the OSRP designed tools and procedures for evaluating testing devices to measure pedestrian lower-leg impact; these devices could become the standard in future vehicle-to-pedestrian impact testing. In 2011, the OSRP released information aimed at helping researchers and suppliers verify and validate "out-of-position" occupant-protection results in crash simulations.

The CSWG conducts and directs precompetitive research on crash-related safety issues, with a current focus on issues associated with aspects of advanced, alternate-fueled, energy-efficient vehicles. Recently, this working group completed a study relating to the testing of advanced batteries used for applications in electric passenger vehicles. The study included examining vehicle crash data for frontal, frontal offset, side and rear impacts. The CSWG documented the findings in a Society of Automotive Engineers (SAE) technical paper that will be presented at the 2012 SAE World Congress.

University Partnerships

Ford increasingly collaborates with university partners on a wide range of research projects, including research into advanced safety technologies. In recent years, we have fine-tuned the objectives of our grant-providing University Research Program (URP), moving away from exploratory, long-term research and toward highly collaborative projects focused on innovations with more near- and mid-term implementation potential.

In 2010, Ford awarded 13 new URP grants to 12 universities around the globe. Recipient schools included, for example, Wayne State University in Detroit, Michigan; Stanford University in Palo Alto, California; RWTH Aachen University in Aachen, Germany; and Tsinghua University in Beijing, China. These Ford URP projects add to an active research portfolio that now comprises 30 studies in partnership with 26 universities globally. More URP proposals from various universities globally and covering a wide spectrum of engineering disciplines are to be awarded in 2012.

In addition to the URP projects, Ford has major research alliances with the Massachusetts Institute of Technology (MIT), the University of Michigan and Northwestern University.

Safety is a central thrust in many of these collaborative university programs. The following are some examples of current projects:

- Projects within the Ford–MIT alliance are yielding progress in areas of vehicle autonomy and

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- Case Study: Connected Vehicles

External Websites

- U.S. Council for Automotive Research

active safety, including computer vision, lane keeping, vehicle controls, obstacle detection and avoidance, and accurately assessing the driver's interaction with the vehicle. One project aims to assess the role of accident avoidance technologies, features and functions in reducing driving-related stresses and enhancing driver wellness.

- At Auburn University, Ford has an ongoing project to conduct "sensor fusion" – that is, to coordinate between Global Positioning System sensors and the motion sensors in a vehicle's stability control systems, to predict when a driver is about to lose control. The ultimate goal is to use satellites to feed data to a vehicle's electronic stability control system, allowing it to adjust and potentially prevent a loss-of-control accident.
- At the University of Michigan, safety work includes a portfolio of projects on 360° sensing and developing more robust and capable active vehicle control and enhanced collision avoidance systems, utilizing both onboard sensors and offboard information sources.
- A project at the State University of New York's Downstate Medical Center should yield an improved understanding of human tolerance to pelvis injury.
- Collaborative work is ongoing with Purdue University investigating enhanced vehicle dynamics and stability control.
- As part of its accident research projects in Germany, the U.K. and Australia, Ford works closely with internationally acknowledged safety experts from the Universities of Hannover, Loughborough, Dresden, Birmingham and Monash.

Collaborative university work catalyzes innovation at Ford by providing access to leading researchers at the cutting edge of vehicle dynamics and stability control, accident avoidance and driver assist safety technology, to name just a few. Ford will continue to integrate these collaborative innovations, driving continuous improvement in real-world safety and sustainability for all Ford Motor Company products.

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VEHICLE SAFETY AND DRIVER ASSIST TECHNOLOGIES

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Data

DATA ON THIS PAGE

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A. Percent of Nameplates Achieving 3-star or Better in Rollover NCAP

Data are for the model year noted.

	2011	2012
Ford	98	95
Toyota	100	100
GM	100	100

Third party rated (NHTSA)

Notes to Data

The National Highway Traffic Safety Administration (NHTSA) has significantly changed its New Car Assessment Program (NCAP), such that the results for 2011 and 2012 model year vehicles cannot be accurately compared to previous model years. For example, NHTSA has added a “rigid pole impact test” to assess side-impact safety (in addition to an existing side-impact test); implemented the use of a smaller dummy in the passenger seat in frontal and side impact tests; and made significant changes to the injury criteria. For detailed information on the new NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

Related Links

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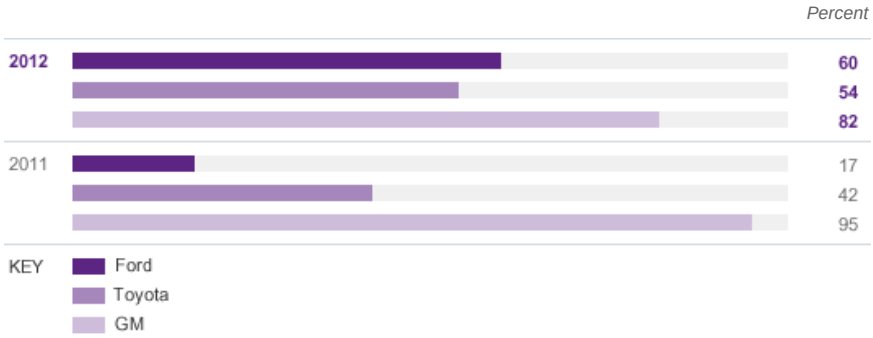
B. Percent of Nameplates Achieving 4-star/4-star Frontal NCAP or Better

Data are for the model year noted.



	2011	2012
Ford	17	60
Toyota	42	54
GM	95	82

Third party rated (NHTSA)

Notes to Data

The National Highway Traffic Safety Administration (NHTSA) has significantly changed its New Car Assessment Program (NCAP), such that the results for 2011 and 2012 model year vehicles cannot be accurately compared to previous model years. For example, NHTSA has added a “rigid pole impact test” to assess side-impact safety (in addition to an existing side-impact test); implemented the use of a smaller dummy in the passenger seat in frontal and side impact tests; and made significant changes to the injury criteria. For detailed information on the new NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

The data for the 2011MY NHTSA NCAP percentages were misstated in our last report. The corrected data are included in this graph.

Related Links

In This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

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C. Percent of Nameplates Achieving 5-star/5-star Frontal NCAP

Data are for the model year noted.

	2011	2012
Ford	0	0
Toyota	0	0
GM	11	25

Third party rated (NHTSA)

Notes to Data

The National Highway Traffic Safety Administration (NHTSA) has significantly changed its New Car Assessment Program (NCAP), such that the results for 2011 and 2012 model year vehicles cannot be accurately compared to previous model years. For example, NHTSA has added a “rigid pole impact test” to assess side-impact safety (in addition to an existing side-impact test); implemented the use of a smaller dummy in the passenger seat in frontal and side impact tests; and made significant changes to the injury criteria. For detailed information on the new NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

The data for the 2011MY NHTSA NCAP percentages were misstated in our last report. The corrected data are included in this graph.

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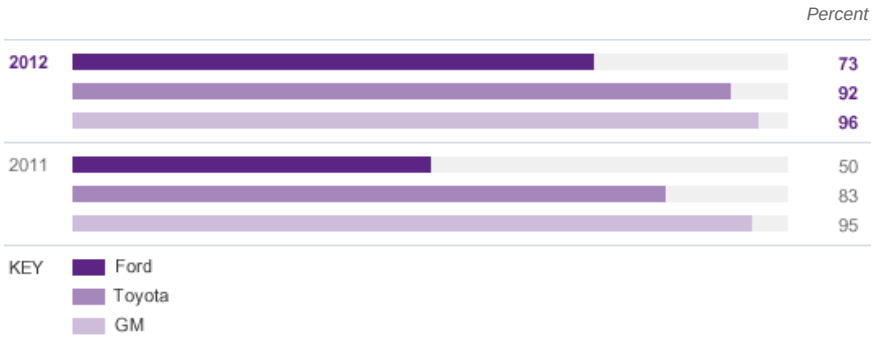
D. Percent of Nameplates Achieving 4-star/4-star or Better in LINCAP

Data are for the model year noted.



	2011	2012
Ford	50	73
Toyota	83	92
GM	95	96

Third party rated (NHTSA)

Notes to Data

The National Highway Traffic Safety Administration (NHTSA) has significantly changed its New Car Assessment Program (NCAP), such that the results for 2011 and 2012 model year vehicles cannot be accurately compared to previous model years. For example, NHTSA has added a “rigid pole impact test” to assess side-impact safety (in addition to an existing side-impact test); implemented the use of a smaller dummy in the passenger seat in frontal and side impact tests; and made significant changes to the injury criteria. For detailed information on the new NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

The data for the 2011MY NHTSA LINCAP percentages were misstated in our last report. The corrected data are included in this graph.

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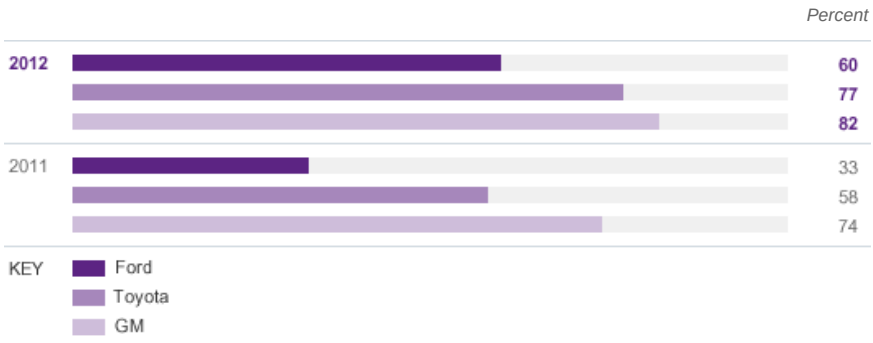
E. Percent of Nameplates Achieving 5-star/5-star or Better LINCAP

Data are for the model year noted.



	2011	2012
Ford	33	60
Toyota	58	77
GM	74	82

Third party rated (NHTSA)

Notes to Data

The National Highway Traffic Safety Administration (NHTSA) has significantly changed its New Car Assessment Program (NCAP), such that the results for 2011 and 2012 model year vehicles cannot be accurately compared to previous model years. For example, NHTSA has added a “rigid pole impact test” to assess side-impact safety (in addition to an existing side-impact test); implemented the use of a smaller dummy in the passenger seat in frontal and side impact tests; and made significant changes to the injury criteria. For detailed information on the new NCAP system, see www.safercar.gov, and in particular http://www.safercar.gov/staticfiles/toolkit/pdfs/faq.pdf (pdf, 213kb).

The data for the 2011MY NHTSA LINCAP percentages were misstated in our last report. The corrected data are included in this graph.

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- Vehicle Safety and Driver Assist Technologies
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F. IIHS Frontal Offset – Percent of Nameplates Achieving "Good" Rating

Data are for the model year noted.

	2011	2012
Ford	90	90
Toyota	95	100
GM	89	100

Third party rated (IIHS)

Related Links

In This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

External Websites:

- IIHS

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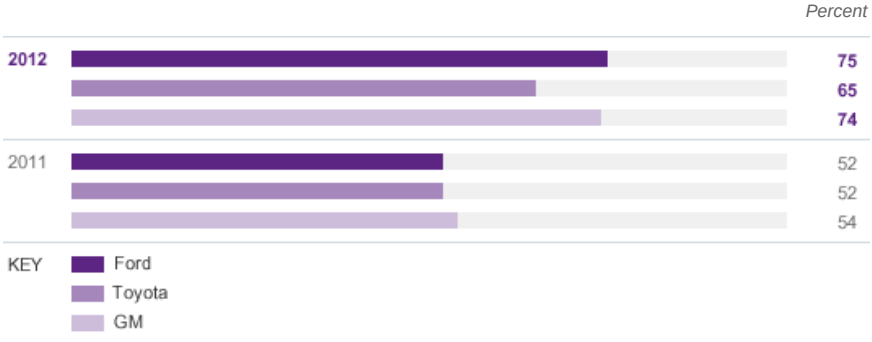
G. Percent of Nameplates Achieving IIHS Top Safety Pick by Manufacturer

Data are for the model year noted.



	2011	2012
Ford	52	75
Toyota	52	65
GM	54	74

Third party rated (IIHS)

Related Links

In This Report:

- Vehicle Safety and Driver Assist Technologies
- How We Manage Vehicle Safety

External Websites:

- IIHS

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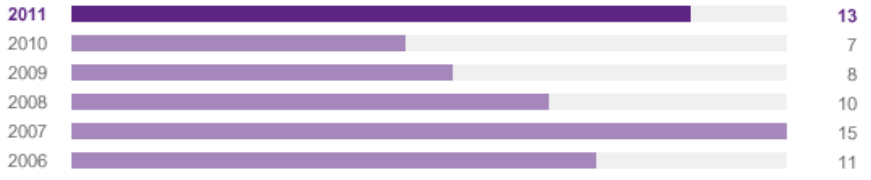
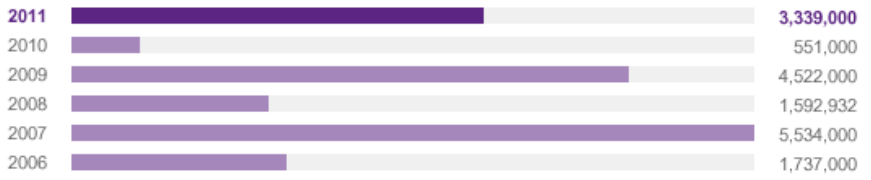
H. U.S. Safety Recalls

Number of safety recalls



Number of units



	2006	2007	2008	2009	2010	2011
Number of safety recalls	11	15	10	8	7	13
Number of units	1,737,000	5,534,000	1,592,932	4,522,000	551,000	3,339,000

Reported to regulatory authorities (NHTSA)

Notes to Data

In 2011, three recalls involved the high volume F-Series vehicle line, accounting for 2.706 million of the total vehicles affected. One other recall, involving older Windstar minivans, accounted for 425,000 of the total vehicles recalled in 2011. Note also, last year we reported that Ford issued 7 U.S. safety recalls in 2011. That was incorrect and the actual number of U.S. safety recalls in 2011 was 9. The number of units recalled was correctly reported.

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- Vehicle Safety and Driver Assist Technologies

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Case Studies

IN THIS SECTION

Case Study: Connected Vehicles

In the future, vehicle technologies will allow cars to communicate wirelessly with one another and with roadway infrastructure using advanced Wi-Fi signals or dedicated short-range communications. Learn about Ford technologies that are already showing what is possible in the realm of connected vehicles, as well as collaborative research we are undertaking with others to help the vision become reality.

Case Study: Public Domain Ratings

Public domain rating programs that perform vehicle crash testing and other assessments, which differ around the world, have regularly updated their testing protocols and evaluation criteria. Read about the changes that several of these programs have made over the past two years – changes that are making it increasingly difficult to achieve the highest ratings, even though vehicles are safer than ever.

Case Study: Connected Vehicles

Imagine a future in which vehicles "talk" to each other – and to stoplights, other transportation infrastructure and even pedestrians and bicycles – in a way that might have seemed like science-fiction fantasy just a few decades ago. In this future, vehicle technologies will allow cars to communicate wirelessly with one another using advanced Wi-Fi signals or dedicated short-range communications on secured channels. The Wi-Fi-based radio system will allow 360 degrees of detection, so it can "look" around corners for potentially dangerous situations, such as when a driver's vision is obstructed.

Such connected vehicles could warn drivers if there is a risk of collision when changing lanes or approaching a stationary or parked vehicle, or if another driver loses control. Drivers also could be alerted if their vehicle is on a path to collide with another vehicle at an intersection, when a vehicle ahead stops or slows suddenly, or when a traffic pattern changes on a busy highway. If vehicles approaching from opposite directions were communicating with each other, they could warn the drivers of each other, potentially avoiding head-on collisions.

By potentially reducing collisions, connected vehicles could also ease traffic delays, which could save drivers both time and fuel, thereby reducing their environmental impacts. Traffic congestion also could be avoided through a network of connected vehicles and infrastructure that processes traffic and road information. A traffic management center would send this information to connected vehicles, which could then suggest less-congested routes to drivers and other connected travelers.

These types of systems could have real safety benefits, potentially helping in a significant fraction of police-reported vehicle-to-vehicle crashes involving unimpaired drivers, according to a U.S. National Highway Traffic Safety Administration (NHTSA) report.

Already, Ford has unveiled an array of accident avoidance and driver assist technologies that use radars and cameras to warn the driver of a potentially dangerous situation, and in some cases provide assistance to the driver. And we are taking part in numerous research projects – on our own and in cooperation with other companies and government bodies – to develop and prove out other technologies.

Ford Technologies

Driver assist technologies introduced by Ford in recent years are beginning to show what is possible in the realm of connected vehicles. Among the first of these technologies was Adaptive Cruise Control (ACC), which helps drivers maintain a pre-set distance from the vehicle in front of them. With ACC, a radar module is mounted at the front of the vehicle and used to measure the gap and closing speed to the vehicle ahead. The system automatically adjusts the speed of the car to help maintain a pre-set distance from the vehicle in front. Radar-based ACC is available on a wide range of Ford and Lincoln models.

Other key technologies that build on the functionality of forward-looking radar and cameras include Lane Keeping System and Collision Warning with Brake Support, which are discussed on the Accident Avoidance and Driver Assist Technologies page.

Related Links

This Report

- Accident Avoidance and Driver Assist Technologies

External Websites

- DRIVE C2X
- EuroFOT
- interactIVe
- National Highway Traffic Safety Administration

Ford's Lane Keeping System

We are now rapidly expanding our commitment to connected vehicles that can wirelessly talk to each other. In 2011, in fact, we doubled our investment in connected vehicles, forming a new 20-member task force of scientists and engineers to explore the technology's broader possibilities and become the first automaker to build prototype vehicles for demonstrations across the U.S. We have also initiated a series of research and advanced projects to begin the rollout of connected vehicle technologies into our product lineup.

In the U.S., NHTSA is expected to decide in 2013 whether to initiate a rulemaking process for vehicle-to-vehicle technologies that could require these systems in new vehicles starting in some future model year. Ford's goal is not to just wait for governmental action in this area, but to accelerate the vehicle connectivity landscape to be a leader in smart, safe and eco-friendly customer solutions.

Collaborative Research

To help achieve this, we take part in collaborative active-safety research with other automotive companies. In Europe, for example, the "Safe Intelligent Mobility – Test Field Germany" (known as "sim^{TD}" for short) is investigating vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications under everyday conditions in a large-scale field operational test. In sim^{TD}, 120 vehicles are outfitted with V2V and V2I communications systems, and roadside units are set up in select locations around the test area. Both are also linked up to traffic control centers. During the test, participating drivers may, for example, receive information about a traffic jam or road accident, so they can choose an alternate route. More than 100 drivers are actively participating and collecting data by completing specific driving tasks. Ford is providing test vehicles for the project, as well as leading the development of the Electronic Emergency Brake Light system, which warns the driver of a heavily braking vehicle ahead. The sim^{TD} project is taking place near Frankfurt, Germany, and will run through 2013. It is a joint effort with other vehicle manufacturers, suppliers, telecommunication providers and research institutes, as well as public authorities. It receives partial funding from the German government.

Ford is also contributing to the European harmonization and standardization of wireless communication systems and applications within the framework of the DRIVE C2X project, which is co-funded by the European Commission. DRIVE C2X is the acronym for "DRIVing implementation and Evaluation of C2X communication technology in Europe" (C2X refers to "car-to-car and car-to-infrastructure" communication, and means the same as V2V and V2I). This project kicked off in January 2011 and brings together more than 40 stakeholders, such as vehicle manufacturers, suppliers, universities and public authorities from all over Europe. Within the framework of DRIVE C2X, field operational tests in a real-world environment will be conducted in seven test sites across Europe.

Both sim^{TD} and DRIVE C2X are working to pave the way for the full deployment of V2V and V2I systems in Europe, and will provide Ford with some of the data needed to develop next-generation safety and mobility features.

In January 2010, a consortium of 29 partners – led by the Ford European Research Center in Aachen, Germany – joined forces in the Accident Avoidance by Active Intervention of Intelligent Vehicles (interactIVe) European research project. This consortium seeks to support the development and implementation of accident avoidance systems, and consists of seven automotive manufacturers, six suppliers, 14 research institutes and three other stakeholders. The European Commission is covering more than half of the €30 million budget.

During the planned 42-month duration of interactIVe, the partners are testing the performance of implemented safety systems through active intervention, including autonomous braking and steering in critical situations, with the aim of avoiding collisions or at least mitigating impact severity in accidents.

In 2011 we completed another major European research project (called EuroFOT) that served as a large-scale field operational test of the real-world impact of accident avoidance systems. Under the EU's Seventh Framework Program (FP7) for research and technological development, this project joined together 28 partners – including vehicle manufacturers, suppliers, universities and research centers. More than 1,500 cars and trucks were equipped with eight technologies, along with advanced data-collection capabilities. This allowed a thorough evaluation of the new technologies for safety, efficiency and driver comfort, in real-world scenarios and with ordinary drivers. The project had a total budget of €22 million and was led by the Ford research center in Aachen, Germany. It included 100 Ford vehicles.

Finally, it's important to note that much of our work in the area of accident avoidance and connected vehicles builds on research conducted by the Crash Avoidance Metrics Partnership (CAMP), which was launched in 1995 by Ford, General Motors and the Vehicle Infrastructure Integration Consortium (VIIC). The purpose of CAMP and VIIC has been to conduct precompetitive accident avoidance research with other vehicle manufacturers, suppliers and the U.S. government.

VIIC, a consortium of nine vehicle manufacturers (including Ford, BMW, Chrysler, GM, Honda, Daimler, Nissan, Toyota and VW-Audi), worked with the U.S. Department of Transportation (DOT) to address the key policy issue for V2X technology for both safety and mobility applications. And within CAMP, the Vehicle Safety Communications Two (VSC-2) Consortium, which included Ford, GM, Toyota, Daimler and Honda, worked with the DOT on projects to develop safety applications that utilize vehicle communications. CAMP VSC-2 successfully completed projects that demonstrated the basic feasibility of wireless vehicle-to-vehicle technology and evaluated several applications.

CAMP has now formed a VSC-3 Consortium with Ford, GM, Honda, Hyundai-Kia, Mercedes, Nissan, Toyota and VW-Audi to continue work on V2V communications for safety applications. This consortium is being funded by the DOT to complete all of the precompetitive work necessary for a deployment decision on vehicle safety communications in 2013. The consortium conducted driver clinics of V2V safety systems around the U.S. in 2011. In 2012, Ford will participate in a model deployment of V2V systems in Ann Arbor, Michigan, and will supply eight fully integrated vehicles for a year-long test. The model deployment will be the world's largest test ever of connected vehicles and will include passenger vehicles, commercial vehicles, transit vehicles and aftermarket connected-vehicle devices, along with equipped infrastructure.

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Case Study: Public Domain Ratings

Safety regulations and public domain rating programs differ around the world, and they are constantly evolving in response to various regional factors. The public domain rating programs that perform vehicle crash testing and other assessments have regularly updated their testing protocols and evaluation criteria to reflect the needs of the region. In the past two years, several of these programs have markedly revised their vehicle rating systems, making it increasingly difficult to achieve the highest ratings. Some of the changes include the addition of new assessment items (such as different-size dummies in different seating positions), more-stringent crash evaluation criteria and greater emphasis on accident avoidance and driver assist features. A major challenge for a global automotive company like Ford is that the complexities of these evolving programs may initiate a demand for different vehicle technology offerings in different markets.

In the 2010 calendar year (2011 model year), three major public domain ratings systems were significantly revised: the New Car Assessment Program (NCAP) implemented by the U.S. National Highway Traffic Safety Administration (NHTSA); the Top Safety Pick program run by the Insurance Institute for Highway Safety (IIHS) in the U.S.; and the EuroNCAP system sponsored by seven European governments as well as motoring and consumer organizations. In addition, new NCAP-type systems are currently being launched in regions where they have not existed in the past. This is partly due to the influence of a new nonprofit organization based in London called Global NCAP that is promoting the establishment of NCAPs around the world. They have already helped to develop a Latin NCAP system, which is now rating vehicles in South and Central America. In 2012, they are planning to launch a new ASEAN NCAP in Malaysia.

NHTSA's NCAP program includes a 35 mph (56 km/h) full frontal impact, a side barrier impact and a static stability rating. In the 2011 model year program, NHTSA updated its program by adding a rigid pole impact test to its side-impact evaluation; implementing the use of a smaller dummy in the passenger seat in frontal impact tests; and significantly changing its injury criteria. In addition, NHTSA now provides an overall vehicle score (a "star" rating, from one to five stars) representing a combination of the vehicle's front, side and rollover ratings.

The IIHS evaluations include a 40 mph (64 km/h) deformable barrier frontal offset (40 percent overlap) crash, a side crash test with a higher barrier simulating an SUV, a rollover test, plus evaluations of head restraints in a rear-impact simulation performed on a sled fixture. In 2011 a new roof strength test was added. To earn a Top Safety Pick from the IIHS, a vehicle must receive a "good" rating for the new roof strength test, in addition to "good" ratings in the front, side and head restraint assessments. Beginning in the 2013 program, the IIHS will add a small (25 percent) overlap frontal test, simulating minimum engagement or an impact with a narrow object, to their Top Safety Pick rating system. Vehicles that perform at a "good" level in this new small offset test will earn an IIHS Top Safety Pick–Plus award. This designation will allow vehicles that are currently Top Safety Picks to keep that award for a time while IIHS phases in the new test mode. The phase-in is expected to last several years.

Euro NCAP conducts a 64 km/h (40 mph) frontal offset (40 percent overlap) crash, a side crash and a side pole impact, as well as pedestrian protection and child safety evaluations. Recent changes to the EuroNCAP include the addition of a test for whiplash neck injury protection in rear impact, and rewards for speed limiters and the inclusion of electronic stability control technologies as standard features. Like NHTSA, EuroNCAP also gives each vehicle an overall star rating representing a combination of individual assessments. In addition to publishing the main vehicle ratings, EuroNCAP has added an Advanced Rewards program to recognize certain driver assistance and accident avoidance technologies that are not currently rated under their protocols. EuroNCAP has also announced significant changes to its rating system between 2013 and 2015. These changes are far-reaching and include a stronger focus on accident avoidance and driver

Related Links

External Websites

- Australasian New Car Assessment Program
- China New Car Assessment Program
- European New Car Assessment Programme
- Global New Car Assessment Programme
- Insurance Institute for Highway Safety
- Latin New Car Assessment Program
- U.S. National Highway Traffic Safety Administration

assist features, new and revised crash tests and dummies, and changes to the assessments for pedestrian and child safety.

The emerging programs being developed by Global NCAP are basing their testing and assessment methods on existing protocols – typically those from EuroNCAP.

In addition, revisions to the China and Australasia NCAP programs are planned in stages and began taking effect in 2011. In 2012, changes to China NCAP include increasing the offset frontal impact test speed from 56 km/h to 64 km/h, the introduction of whiplash assessments and the inclusion of rear dummy assessments in the ratings. Australasia NCAP has published a rolling "road map" detailing changes they plan to introduce by 2016. These include whiplash and roof-strength assessments and increased requirements for accident avoidance and driver assist technologies.

As a result of the numerous and significant changes to the major public domain evaluation programs, it has become more difficult to compare vehicle rating results to previous model years. For example, many vehicles that achieved the highest rating of 5-star/5-star under the former NHTSA NCAP frontal crash evaluation now have lower ratings under the evaluation criteria implemented with the 2011 model year. Thus, even though Ford vehicles are safer than ever, our vehicle ratings in this evaluation are not comparable to previous years. (See the Data page.)

In addition, while some of the basic test methods are similar in the global evaluation programs, each program varies in the ways in which vehicle ratings are determined. This means that for an identical car, achieving the highest rating in one region or evaluation program does not guarantee the same result in another region or program.

Just as rating programs vary by region, so do regulations, road infrastructure, the competitive landscape and other factors that can influence real-world safety. We work to understand all of these variables and to deploy and offer safety features that meet the needs of the region. And we continue to invest in new technologies to prepare for future societal needs. At Ford, we strive to make technology available on a wide range of our products, even as we remain competitive in the markets in which Ford vehicles are sold. This approach promotes greater societal benefits through broad market acceptance of new technologies, which ultimately improves real-world safety.

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VEHICLE SAFETY AND DRIVER ASSIST TECHNOLOGIES

- How We Manage Vehicle Safety
- Encouraging Safer Driving
- Safety and Driver Assist Technologies
- Collaborative Efforts
- Data
- Case Studies
- Voice: Dr. Saeed Barbat

Dr. Saeed Barbat

Executive Technical Leader for Safety
Ford Research and Advanced Engineering

I have been at Ford for 20 years, and over that time I've been involved in developing a host of technologies, tools and safety test methods that have made significant contributions to automotive safety. I concentrate on enhancing "passive-safety" technologies – such as vehicle safety structures, vehicle interiors and trim, airbags and safety belts – which are aimed at helping to protect occupants in the event of a crash. ("Active-safety" technologies, by contrast, are those that seek to prevent crashes.)

A decade or so ago, for example, we began to think more about how to mitigate the problems that occur when light-duty trucks and SUVs collide with small passenger cars. As one response, we developed the BlockerBeam™ in 1999, an industry-first technology for SUVs and light trucks that helps absorb crash energy in collisions and reduce or inhibit potential "over-ride" by lowering the point of impact, thereby providing better compatibility with smaller vehicles. We've also focused on the safety of our own small vehicles. The newly redesigned Ford Fiesta, for example, is made with high-strength steels and includes advanced airbag technologies. It has performed exceptionally well in third-party crash tests. We continue to focus on the safety of smaller cars as we respond to increasing consumer demand for lighter, more fuel-efficient vehicles.

One of our more recent passive-safety advancements was the world's first rear-seat inflatable safety belt, which debuted on the 2011 Ford Explorer and has won numerous awards.

We have a comprehensive, science-based system at Ford for developing and executing new safety-related technologies. This system takes into account real-world accident data and societal trends, so we can focus on the kinds of enhancements that will make a difference in real-world safety.

And, real-world safety needs and safety regulations differ by global region. As a global company, we have to take these differences into account and respond to them appropriately. In India and China, for example, many vehicle-related fatalities involve pedestrians and cyclists. So regulations and countermeasures in those regions take into account those modes of transport. In China, we offer the Ford Mondeo and Edge equipped with safety technologies to help achieve the five-star requirements of the China New Car Assessment Program. Also, the Ford Fiesta earns top crash-test ratings in multiple global regions, including China, Europe and the U.S.

We're using industry-leading tools to help develop our safety features. For example, we employ an adult digital human body model (developed by Ford) as a research tool to help us better understand the extent of tissue injuries that can occur during a crash. (By contrast, crash-test dummies measure the force of impact, but not potential injuries to internal organs.) We are also developing a child-size human body model to better understand the impacts of crashes on young passengers. These tools will also help in the development of more human-like crash dummies, with more sophisticated instrumentation.

Looking ahead, we'll continue research on rear-seat restraint systems for children and adults. Forthcoming research will also look at elderly protection, driver wellness, lithium-ion batteries, and even better lightweight technologies, such as parts made from carbon fiber.

Related Links

This Report

- Case Study: Connected Vehicles
- Occupant Protection Technologies

When I think about the roadways of the future, I imagine a world of autonomous vehicles in which some accidents can be avoided altogether. Already, we're seeing the regular introduction of new accident avoidance and driver assist technologies – such as Ford's own Lane Departure Warning, Blind Spot Information System and Active Park Assist – which are moving us in that direction. These types of technologies will only increase in the years to come, and then autonomous driving may become reality.

Our vision is continuous safety improvement in our products worldwide. To further enhance real-world safety and to reduce fatalities, we also focus on integrated safety – in other words, find more ways to integrate passive and active safety technologies to allow greater flexibility in occupant crash protection under a variety of crash conditions, through restraint and structure "adaptivity." We're already doing this in some cases; for example, Ford's Collision Warning with Brake Support technology uses sensors to determine if a crash is imminent, and then "pretensions" the brakes so they can be deployed more quickly. So, an area for future work is to determine how we can increasingly put active sensors to work in combination with passive-safety systems.