2005 Cadillac STS SAE 100

Not just any Cadillac STS, but the Cadillac STS SAE 100, a technology integration vehicle that General Motors engineered with the help of an array of suppliers in order to mark the 100th anniversary of SAE, the Society of Automotive Engineers.

As 2005 was the centennial year for SAE, the people at General Motors decided that they wanted to do something a bit out of the ordinary to help celebrate that event. So, beyond throwing in support of various influential sorts to the SAE Congress, the Powers That Are at the automaker brought together some of its top engineers under Al Oppenheiser, director of Concept Vehicles (part of the Performance Div. headed up by Mark Reuss), gave them an '05 STS, and charged them with creating what's called a "technology integration vehicle" with the Cadillac as its platform. Although this is a car created to be blazingly quick—there is an LS2 engine under the 8-kg carbon fiber hood (sourced from Prefix (www.prefix.com), which also provided the carbon fiber low-mass wheelhouses, which are 50% lighter than their metal variants), a 505-hp engine with an Eaton M122 intercooled supercharger (www.eaton.com)—that's not the point of the exercise. (There will be an STS-V for '06 with a supercharged Northstar under the hood—albeit one that produces 440 hp.) Rather, the point was, Oppenheiser explained, to deploy a range of technologies to show the sorts of things that can be used in advanced vehicles.

General Motors revealed the most technologically integrated vehicle ever at the opening of the 2005 SAE World Congress. The Cadillac STS SAE 100, which pays homage to SAE's 100th anniversary, will serve as a working laboratory that will aid engineers in developing future production vehicles.

"We have challenged our engineers to take the best of today's vehicle technologies and integrate them with promising future technologies to demonstrate how they will function together in a real-world driving environment," said Jim Queen, GM vice president, Global Engineering and general chairperson of the 2005 SAE World Congress. GM is the host company for this year's World Congress.

GM worked with 38 suppliers to integrate 50 different technologies into the STS SAE 100, ranging across safety, chassis, powertrain, electrical and comfort and convenience categories. Nineteen have never been in production, 22 are in production somewhere other than the 2005 STS and nine are currently on the production 2005 STS.

The vehicle, commissioned by Queen and executed by the GM Performance Division Vehicle Development Center, is much more than a "dream team" of technologies: Engineers will use it to document how the various technologies interface with each other and how they can be applied to future production vehicles.

"Vehicle integration is behind game-changing safety features like electronic stability control, which we are rolling out across our entire fleet," said Queen.

"Our goal with this vehicle was not simply to see how many different technologies can be incorporated into one vehicle. We want to learn how a variety of relevant current and future technologies can be made to function harmoniously while enhancing the total driving experience."

STS SAE 100 technologies include (for the full list of technologies and their suppliers see below):

- 3-D navigation system: This prototype system uses actual pictures taken by satellites to provide the driver with a "bird's-eye-view" of the vehicle's surroundings. The images are so detailed that even trees and lampposts are visible. This detail helps the driver to relate the images on the navigation screen to his surroundings.
- Oil condition sensor: An industry first in new vehicle features, this oil probe can determine and detect the actual level and remaining engine oil life. It can reduce the need for costly engine repairs due to poor oil maintenance as well as prevent unnecessary oil changes.
- Inside rear-view mirror with embedded organic LED screen: This new device offers clear images from the rear seat (via a rear seat camera) or back-up camera, depending on what gear the vehicle is in. In addition to improving visibility behind the vehicle, it can reduce the distraction associated with tending to rear seat passengers.
- Electronic limited slip differential: Unlike passive LSD, this technology enhances vehicle traction without brake/engine intervention, as well as provides additional vehicle stability from the differential yaw dampening effect. It also is easier to integrate with electronic stability control systems.
- Two-piece carbon fiber wheel with magnesium spokes: This two-piece wheel is designed to be the lightest yet strongest wheel in production, which reduces unsprung weight. Reducing unsprung weight improves acceleration, braking efficiency, handling and fuel consumption.
- Lane departure warning: Using a real-time vision system, it detects road markings and notifies the driver with a visual signal and a vibration (haptic alert) in the seat when a vehicle traveling at more

than 35 mph crosses over the markings unintentionally. This technology could be especially promising in curbing drowsy-driving crashes.

- Side blind zone alert: Radar sensors warn a driver about to change lanes if another vehicle is in the driver's blind spot. According to the National Highway Traffic Safety Administration, these crashes damage 830,000 vehicles annually.
- Capless fuel system: Removing a gas cap can be difficult for arthritic, disabled or elderly people. With this system, the user simply pushes an interior button and an electronically activated ball spins open to allow access to the fuel pipe, and closes when the nozzle is removed. In addition, a capless system means there's no cap to lose and no risk of a loose cap triggering a dashboard warning light.
- Adaptive cruise control: Rear impacts account for nearly 29 percent of police-reported crashes, and most are due to driver inattention. Adaptive cruise control, already available on some Cadillacs, uses sensors to detect objects in the vehicle's path and slow it accordingly.
- Reconfigurable color head-up display: This HUD projects digital readouts of key data (speedometer, navigation system turn prompts, tapshift, audio settings and adaptive cruise control status and alerts) onto the windshield in an easy-to-read and intuitive way.
- Rear seat entertainment system: Who says only the people in the front seat can have fun? This entertainment system consists of two, 6.5-inch headrest-mounted LCD screens, wireless infrared headphones and two Microsoft Xboxes with DVD packages. Players can even "feel" the action with a haptic controller.
- Rear vision camera: This system provides a wide angle view of the area behind the vehicle for detecting obstacles while backing up. The field of view is projected onto the navigation screen in the instrument panel.
- The STS SAE 100 is powered by a supercharged LS2 engine yielding 505 horsepower at 5600 rpm and 520 lb.-ft. of torque at 3600 rpm. It is mated to GM HydraMatic's newly developed, longitudinal 6L90E six-speed transmission, capable of supporting more powerful engines like the supercharged LS2. The transmission features Driver Shift Control, which gives the driver the ability to shift gears sequentially with a tap up/ tap down mechanism.

The STS SAE 100 was tested at GM's proving grounds in Milford, Mich. and Mesa, Ariz.

Safety is Standard

Crash-avoidance technologies represent the next wave in curbing deaths, injuries

Vehicles that sense impending crashes, intervene in time to avoid many of them and also provide advanced occupant protection in a crash can reduce traffic-related deaths and injuries.

The Cadillac STS SAE 100, introduced today at the SAE World Congress, integrates several current and future crash-avoidance and crashworthiness technologies that illustrate GM's comprehensive approach to vehicle safety. The most technologically integrated vehicle ever, the STS SAE 100 demonstrates 50 technologies from 38 different suppliers, 10 of which focus on safety.

"This industry has done an excellent job of using technology to help protect people during a crash," said Jim Queen, GM vice president, Global Engineering and general chairperson of this year's SAE World Congress. "Effective crash prevention has always been a challenge because most crashes involve some driver error.

"Customers are now realizing the safety benefits of integrating chassis technologies like antilock brakes, traction control and adaptive cruise control," said Queen. "The benefits we have seen led GM to make StabiliTrak electronic stability control standard across our lineup in the U.S. and Canada by the end of the decade."

Developing technologies to prevent crashes requires an understanding of what causes them. For the STS SAE 100, GM and supplier safety engineers used an important 1997 study by GM and the University of Michigan Transportation Research Institute (UMTRI).

Called "44 Crashes," the study benchmarked a very large sample of crashes, categorized them into distinct crash scenarios, as well as how frequently they occurred, the rate of injuries and the functional, or income-earning, years of life lost associated with each. It also reaffirmed previous studies that show driver inattention or error causes the majority of motor vehicle crashes.

For example, crashes that result in vehicles leaving the road account for 42 percent of functional years lost, the very crashes that electronic stability control is designed to help prevent. Vehicles running into other vehicles accounted for another 48 percent of functional years lost.

The National Highway Traffic Safety Administration is currently developing an updated version of the study,

which should provide researchers with even deeper insight into what causes crashes.

In addition to the important life-saving features already on the STS, such as safety crush zones, advanced front and side air bags, and advanced safety belt systems, the STS SAE 100 includes multiple collision-avoidance technologies:

Lane departure warning: At speeds above 35 mph, using a real-time vision system, it detects road markings and notifies the driver with a visual signal and a vibration (haptic alert) in the seat when the vehicle crosses over the markings unintentionally. This technology could be especially promising in curbing drowsy-driving crashes.

Side blind zone alert: Radar sensors warn a driver about to change lanes if another vehicle is in the driver's blind spot. According to NHTSA, these crashes damage 830,000 vehicles annually.

Adaptive cruise control: Rear impacts account for nearly 29 percent of police-reported crashes, and most are due to driver inattention. Adaptive cruise control, already available on some Cadillac models, uses sensors to detect objects in the vehicle's path, warn the driver, and automatically slow the vehicle as well.

In addition to collision avoidance and occupant protection technologies, the Cadillac STS SAE 100 is also equipped with OnStar to ensure urgent notification and deployment of emergency response teams should they be required. Together, the crash avoidance, crashworthiness and post-collision technologies are representative of comprehensive safety in GM cars and trucks.

STS Technology Integration Vehicle Subsystem Vehicle Content

Technology - Supplier Partner / Source

** Already available on 2005 STS*

^ "In production or aftermarket, but not a feature on 2005 STS"

~ Not available on current production vehicles

Powertrain

~ 505 horsepower / 520 ft.-lb. torque supercharged LS2 - GM Powertrain with Eaton

~ Next-generation electronic throttle control - GM Powertrain

^ Hi-output generator - Denso

~ 6-speed 6L90E automatic transmission - GM Hydra-Matic

~ Oil condition sensor - GM

* Driver shift control - GM

Chassis

^ Electronic limited slip differential - GKN

^ Multi-link front suspension - McLaren

^ Variable gear ratio steering - Toyoda

^ Ceramic brake rotors - calipers: 6-piston front / 4-piston rear - Brembo

^ Adjustable pedals - GM Internal

* MR damping - Delphi

* Remote start and keyless entry - Siemens

* Adaptive cruise control - Continental Temic

^ Active exhaust valve system - GM Internal, C6 Z06

^ Two piece carbon fiber (rim) and magnesium (spoke) wheels - wheels: Dymag

Tires: Pirelli

Electrical

* Reconfigurable color HUD - Intier

* Sound system. 5.1 DVD surround audio - Bose

~ Next-generation OnStar 6.1 - OnStar

~ LCD instrument cluster - Promate

~ Three dimensional navigation - Bosch

~ Rear-seat DVD (X Box) - Microsoft

~ Performance tracking - GM Internal

~ High output EL extruded wire - Robert Miller Electronics

Exterior

^ Heated washer fluid - Microheat

^ Infinite check link - Stabilus

* Rain sense wipers - TRW

^ Power decklid - Hoerbiger

^ Obstacle detection sensing - Metzeler

^ Capless refueling - ITW

^ Ultrasonic front / rear park assist - Bosch

^ Carbon fiber low mass hood - Prefix

Interior

^ Variable Temp (Heat and Cool) Front Seat - Amerigon

* Heated Steering Wheel - Delphi

^ Beverage Heating and Cooling - Tellurex

~ Second Row Supplemental Storage - Stewart Reed Design

^ Platinum Interior - Drexelmaier

Structure / Glass / Lighting

~ Advanced LED headlight / fog light optics - Visteon

* Theft deterrent side glass - Saint Gobain Sekurit-USA

~ Carbon fiber low mass wheelhouse - Prefix

HVAC Systems

~ Supplemental rapid passenger compartment heating - Ventech

Crashworthiness / Safety

^ Side blind zone alert - Valeo

^ Lane departure warning system - Mobileye

^ Rear vision - Panasonic

^ Roll over roof rail air bags - GM

~ Seat mounted thorax / pelvis air bags, front/rear - GM

~ Dual depth front passenger air bag - GM

~ Crash alert seat (driver) massage seat (passenger) - InSeat

~ Rear seatbelt engagement warning for driver - Takata

~ Second row cameras with OLED screen - Daewoo

Source: General Motors Corporation