GM Press Release: November 6, 1997: Corvette Active Handling System Debuts

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Corvette Active Handling System Debuts

LAS VEGAS — The Chevrolet Corvette has a well-deserved reputation for cutting-edge technology and high performance -- all delivered at a very competitive price. That reputation will soon be enhanced when an optional Active Handling chassis control system (JL4) becomes available on all Corvette models early in 1998, and standard on convertibles with the Indy 500 Pace Car package.

Corvette's Active Handling system features a unique blend of sensors that are capable of reading steering inputs, vehicle yaw rate and lateral g force, then activating the vehicle's brakes on a selective basis to help stabilize the car in emergency maneuvers. When added to Corvette's well-developed ABS braking and traction control systems, Active Handling greatly enhances the accident avoidance capabilities of the already nimble Corvette. No other sports car has a system like this, and similar but less-sophisticated systems are currently offered on only a handful of high-end luxury cars.

Active Handling works to reduce excessive understeer or oversteer. Understeer is the tendency for a vehicle to "push" or run wide in a corner, and oversteer is the tendency for the back end of the car to swing out in a corner.

As mentioned earlier, the Corvette Active Handling system senses these usually negative conditions and helps the driver overcome them by selectively applying individual wheel braking to pull the car back into line during an emergency maneuver.

The concept is similar to steering a canoe. If the front of a canoe starts turning to the right, it can be brought back on course by dipping a paddle into the water on the left to act as a rudder and brake. Of course, the Corvette Active Handling system is much more sophisticated, so the individual wheel braking happens in less time than it takes for the blink of an eye. Like ABS brakes or traction control systems, Active Handling goes into action only when the car's limits have been exceeded in some way so it will be relatively transparent to the driver, even in emergency conditions.

The Corvette Active Handling system goes a step further than other similar systems by giving the driver more latitude before engaging, thereby retaining the more aggressive feel of a true sports car. For the racetrack, there's even a competition mode which deactivates the traction control part of the system to allow for wheel-spin and acceleration -- conditions that highly-skilled drivers sometimes find useful on the racetrack. This is a feature not offered on any similar chassis control systems.

As good as it is, Active Handling has its upper limits. At some point the laws of physics will take over, and at that point not even the most sophisticated system or driver can prevent a loss of control.

Note to Editors: What follows is a more in-depth explanation of the Corvette's new Active Handling system should you care to utilize it. As always, if you have any questions please feel free to contact us.

Corvette Active Handling: In Depth

The Corvette Active Handling system is a logical next step in the evolution of enhanced chassis control systems like ABS brakes and traction control.

Working in close concert with those other two systems, Active Handling enhances the accident avoidance capabilities of the already nimble Corvette. It will be offered as an option (JL4) on all 1998-1/2 Corvette models. Additionally, it will be a required option on replicas of the ’98 Corvette convertible Indy 500 Pace Car.

What Active Handling Does

The Active Handling system activates when there is a significant difference between how the driver intends for the car to corner and how the car is actually cornering. Working together with the ABS and traction control systems as needed, it automatically applies any of the four brakes to help correct the situation .

A real-world example of this might be a sudden lane change on a wet road surface to avoid a unexpected hazard -- like a huge pothole (see attached illustration).

Faced with that scenario, many drivers may turn the wheel abruptly to the left to avoid the pothole. That input, combined with the reduced traction available, could exceed the limits of traction available to the front tires, and a condition called "understeer" could make itself apparent. In an understeer situation the car tends to plow straight ahead -- not at all what the driver may want it to do.

In this scenario, Active Handling will work to help correct the car’s understeering behavior by automatically applying the left side rear brake, helping to "pull" the car into the left turn.

Once the car is in the left lane, the driver tries to straighten it out, but the car’s yaw inertia could cause it to turn even more than the driver wants it to, and a condition called "oversteer" could come into play. That’s when the car’s rear wheels lose traction and the back of the car starts to swing around.

Active Handling should once again sense that the car is doing something that

the driver doesn't intend, and it will work to help correct it by, in this case, applying the left side front brake. The resulting torque tends to straighten the car.

Depending on vehicle speed, and the traction available, the car could continue to be influenced by the "whipping" motions that the first two steering inputs created, so a few more steering wheel movements may be required to settle it down -- and Active Handling will continue to apply individual brakes as necessary to assist the driver in maintaining control.

In another scenario a driver could find that he's entered a turn too aggressively, thereby setting up similar understeer and oversteer conditions. Once again, Active Handling would react to the conditions and work to help bring the vehicle back into control by selectively (and automatically) applying the car's brakes as needed. How Does It Do That?

Active Handling uses a simple yet sophisticated system of sensors to detect unwanted vehicle manuevers. These sensors include a steering angle sensor, yaw-rate sensor, lateral accelerometer and sensors in the vehicle's ABS brake and traction control systems. All of the data that these sensors provide is fed into the Corvette's onboard computer where specially-developed software "reads" all of the inputs and automatically activates the car's brakes selectively to help the driver bring the vehicle back under control.

Steering Angle Sensor: This digital sensor monitors the driver's steering inputs immediately and communicates the steering angle that the driver has selected back to the system. It is accurate to within one degree of steering angle change and is located in the car's steering column.

Yaw-Rate Sensor: This solid-state device utilizes a tiny pair of ceramic tuning forks to measure the actual rate that the car is turning or yawing from the centerline. This data is continuously fed into the Corvette's computer where the yaw rate is compared to the steering angle. Any variation beyond a pre-programmed set of values will result in activation of the Active Handling

system’s assist features. The yaw-rate sensor on the Corvette is located inside the center console.

Lateral Accelerometer: The lateral acceleration sensor measures the centrifugal force created in a turn. The data it provides is weighed against all of the other inputs and is used to calculate whether or not the car’s limits are being exceeded for the speed and traction conditions that exist. This sensor is located beneath the passenger seat.

Unique Controller & Software : All of the information being provided by the sensors mentioned above is processed by the Corvette Active Handling system’s computer through a very sophisticated and specialized software package. This computer is actively linked to the ABS brake system and the traction control system -- all these systems share information continuously. This multiple linkage is vital because the combined inputs from each system make the fully-integrated system better able to respond to a wider variety of inputs from the driver.

During the 1998 model year, just prior to production of cars with the Active Handling option, the Corvette’s ABS brake hydraulic control unit will be relocated to the front of the engine compartment to facilitate quicker Active Handling system "warm-up" and shorten front brake response time when the brake fluid is cold. In temperatures below 14oF the Corvette’s Driver Information Center (DIC) will display an "Active Handling Warming Up" message as soon as the vehicle reaches 6-mph. That’s a caution to the driver that Active Handling is not fully-functional yet. As soon as the system warms up, another message "Active Handling Warmed Up" will be sent to the driver via the DIC.

Competitive Driving Mode

The Corvette Active Handling system will be the first of its type to offer dual mode operation. In addition to an "OFF" mode, in which Active Handling is disabled, the system also allows the driver to select a "COMPETITIVE

DRIVING" mode for autocross or gymkhana competitions. In this mode, the Active Handling system remains fully-functional -- measuring steering, yaw rate and lateral acceleration inputs as well as applying individual wheel brakes as required -- but the traction control system is disabled, allowing for some wheelspin and oversteer that skilled drivers often find beneficial in competitive driving.

Summary of Active Handling System Modes

ON - Active Handling is automatically enabled when the car is started. This is also true of the ABS brake and traction control systems **OFF** - Like traction control, the Active Handling system may be manually turned off if the driver so desires. This is not true of the ABS brake system which is always enabled. **COMPETITIVE DRIVING** - In this mode, Active Handling and ABS are both enabled, but traction control is shut off.

The OFF and COMPETITIVE DRIVING modes are important features on a high-performance sports car like the Corvette. As mentioned earlier, skilled drivers may find that some wheelspin and oversteer can be beneficial to their lap times in competitive events, and the Corvette system allows them to operate the car in this fashion when appropriate. Chevrolet recommends against selecting these modes for street use. Limitations

The overall effectiveness of the Corvette Active Handling system, or any similar system, is directly related to available tire traction and the aggressiveness of a given maneuver. Active Handling is designed to work to use existing traction to assist the driver -- but it cannot overcome the laws of physics. The Active Handling system reacts only in extreme situations, and special care should be taken when the system does activate because it’s a clear signal that vehicle or tire limits are being exceeded.