Stick Shifts:
To Be or Not to Be?

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The theme of this month's issue is manual transmissions and clutches. You will read good technical articles on the subject, and you will see a dazzling array of companies that can supply you with the products you need to repair and service gearboxes and clutches.

In the United States, automatic transmissions make up about 80% of the marketplace. We are always hearing dire predictions from assorted analysts and experts who pontificate ad nauseam about the imminent demise of the standard transmission. From this writer you will hear an opposite view that says manual gearboxes are alive and well and actually will increase in market share within the next decade. This may sound like big talk, but by the end of this article I am sure you will agree that I have made my case.

For openers, it is important to realize we all have some form of tunnel vision, in that we tend naturally to look only at the U.S. market, for this is where we make our living. It is very important to realize that there is a huge world market for automobiles, and although American consumers buy a great number of cars, we do not dominate the total market for cars and trucks. Our market is dominated by automatic transmissions, but in the world market they are only a fraction of sales.

In Europe, for instance, the numbers of automatics are very small. Europeans want the control and fuel economy available with a manual gearbox. The advent of widespread models in the U.S. equipped with automatics correlates directly to the decline of American driving skill. Automatic-equipped vehicles meant that anyone could make a car "go." You read news articles every few months about some nine-year-old who took mom's car for a joy ride.

When I learned to drive, there were very few vehicles with automatic transmissions, and the skill of shifting – paying the attention needed to match the engine revs to the gearbox shift points, and learning to double-clutch at speed to catch first gear, which wasn't synchronized – meant you had to devote all your attention to the job at hand.

In our country today very few drivers actually drive. They make the car go while doing a variety of things that detract from everyone's safety. Talking on the cell phone, putting on makeup, shaving, reading books and even getting dressed are all considered normal activities while driving today, and the body shops are full to capacity. Only about 15% of American drivers could pass a German or Italian driving-license exam the first time.

In Germany, getting a driver's license costs about $2,500 worth of schooling and requires an extensive written test, and the road test usually takes 1½-2 hours. The left lane of the Autobahn is unlimited for speed. If your car is capable of 160 mph, feel free; on the other hand, Germany is not about to let anyone use its roads who is not in the government's eyes capable of being in traffic that goes from 60 mph in the right lane to unlimited speed in the left. You also should be aware that driving slowly in the left lane is a very serious infraction, with megabuck fines and loss of license a real possibility.

Now that we have established that automatics are mainly concentrated in the United States, we can move on to transfer cases. With the huge increase in SUV sales worldwide, the number of transfer cases in production has gone off the scale. In the '60s and '70s, six models of transfer cases made up almost the entire light-duty market. Today there are at least 45 domestic models and an equal number of imports, with new designs appearing daily. If you count a transfer case as a manually controlled gearbox, my prediction is already a sure thing. Some of you may now be crying foul, but stay tuned and I will make my case.

In order to see the future of any product, you have to go to the cutting edge of development, where new ideas find a budget and become reality. In the automotive world, racing is the cutting edge, and if you look at the technology being developed in racing, you will see how it will work its way into passenger vehicles.

Some of you probably are unaware that part of the way I pay my bills is driving a race car professionally. Because of my lifelong involvement with racing, I have come to use technology on the track that makes it to the highway years later. Radial tires, disc brakes, independent suspension, electronic ignitions and fuel injection are all racing developments that now appear as standard equipment on street vehicles. You can see that every manufacturer has at least one model that represents its performance commitment, because racing and performance sell cars. Even though these performance models usually don't sell in large volume, they give the factory a chance to show it is on the cutting edge.

Let us take a look at what is on the horizon. The next big change we will see in the showroom is the sequential gearbox, which now is used in many forms of racing. The sequential gearbox is far from a new design, having been used in motorcycles for decades. The shifts are in sequence in a straight line without the typical H pattern. The design advantages are a more-compact unit and a simpler shift mechanism.

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Coupled with this will be an automatically shifted sequential gearbox. In order to understand how this unit functions and how it was developed, we must take a slight detour into recent history.

The absolute zenith of racing technology is found in Formula One racing. In the early '90s, Formula One cars were developed with "active suspension." Using state-of-the-art computer control that could measure instantly all the G forces, corner loads, and pitch, roll and yaw that the vehicle could undergo at speed, the computer then would operate a complex set of hydraulics that would counteract the spring compression at the corners of the car by stiffening the suspension where needed. This made it possible to eliminate the roll, squat and dive that occur under braking, acceleration and cornering and keep the tire footprint squarely on the road surface.

The most amazing thing about these systems was how fast they had to work. From input to the computer to the application of proper suspension adjustments took 30 milliseconds, or 0.0030 second. The final icing on the cake was to program a track map into the computer that was triggered by an electronic signal in the team's pit so that the computer could measure the car's progress around the racetrack in real time and anticipate the distances and time to the next corner and make the necessary adjustments based on all the parameters it was receiving.

About now you may be thinking, "This is really cool stuff, but what in the world does it have to do with my business?" Be patient, ye of little faith, and all will be made clear soon.

Later in the '90s the Formula One sanctioning body banned active suspensions, believing rightfully that it eliminated the skill levels necessary to be a truly world-class driver. The Formula One teams had upward of $100 million invested in a technology that they had perfected and now were forbidden to use. Necessity being the mother of invention, they converted this technology into shifting the transmission. The teams reasoned that if the driver did not have to take his hands off the wheel to shift and they could regulate the clutch and shifts through computer control, they could protect very expensive engines from failure due to over-revving and give the driver more control of the cornering process.

The transmissions are six-speed sequentially shifted transaxles that are mounted behind an engine in the rear of the car. Shifts are accomplished through two paddle-shaped switches that are mounted on the underside of the steering wheel near the driver's fingers. One paddle shifts up and the other down, with a series of LEDs on the front of the wheel to tell the driver which gear he is currently in. The clutch also is computer controlled to provide disengagement and prevent the engine from running away during the gear change.

Although the systems vary, most commonly the driver uses the clutch to take off in 1st gear, and then all upshifts and downshifts occur without use of the clutch pedal at speed. Computer controls apply and disengage the clutch and match shifts to engine rpm to prevent over-revs and will refuse to make shifts to an incorrect gear for the conditions in the vehicle it is monitoring. Take into account that these cars are capable of pulling 4 G's under braking and can achieve speeds of more than 200 mph with engine speed at 14,000 rpm.

It is amazing to think of carrying 190 mph into a slow corner where exit speed may be 60 mph, shifting at full throttle from 6th to 2nd with a few taps of an electronic switch without using a clutch, taking your hands off the wheel or blowing up a mega-dollar motor.

The doubtful among you will say that this is space-age tech that we never will see in our shops. Surprise! It already is here. Admittedly, it is found presently in high-line vehicles. Ferrari has it, and Porsche is using a variation in its "Tiptronic" transmissions. On the other side of the spectrum, these types of units already are on the highways in trucks. Eaton Corp., the manufacturer of Fuller Road Ranger transmissions, has computer-controlled, electronically shifted manual gearboxes that provide clutchless shifting in various new trucks.

Not to be left behind, Spicer Corp., now part of Transmission Technology Corp., has introduced 7-speed and 10-speed models that also are computer shifted and clutchless. Driving these units is an amazing experience. The shifts are effortless and smooth with the computer matching engine speed and torque load to the transmission gears better than any driver is capable of. These systems will protect the engine from over-rev damage, prolong clutch and transmission life, make up for poor or unskilled driving habits, and at the same time increase fuel economy and control emissions. This is a win-win deal for everyone.

Cleaning up emissions on vehicles that use automatic transmissions has been relatively easy, because automatics shift at open throttle. Sticks shift with the throttle closed, giving the driver ultimate control over emissions and generally being unpopular with our friends at the EPA. Some attempts have been made in the past to tie the gearbox to emissions with "skip-shift" technology found in T-56 and ZF S-640 transmissions, but these were the crude beginnings of more-complex and efficient systems. The technology is now on the road to bring manually shifted units out from under the driver's control and into compliance with the ever-stricter clean-air codes.

The news of the imminent death of the manual gearbox is premature. The integration of the computer in motor-vehicle management systems is still evolving, and we have seen only the tip of the iceberg. Few of us realized how computers would influence our society until the invention of the Internet (by Al Gore, ha ha; I still can't say it with a straight face) and the creation of the World Wide Web. Only the surface has been scratched where vehicle design and engineering are concerned. New computer electronic controls will resurrect older technology that will be integrated into the wave of the future. TD

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87 Useful information.
88 Not useful information.
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