

# AUTOMATED MANUAL TRANSMISSION FOR A HYBRID VEHICLE

## *Project Brief*

This project was performed for a foreign client. A manual transaxle was converted to an Automated Manual Transaxle (AMT) so that the client could integrate it into a hybrid passenger car. Southwest Research Institute (SwRI) designed and fabricated clutch and shift actuators and integrated them into a transaxle. The AMT system included a Rapid Prototype Electronic Control System (RPECS) that was configured to control the actuation of the clutch and the shift actuator based upon a desired gear command from the client's hybrid vehicle controller.

The actuator system consisted of a clutch actuator and a shift actuator. Both actuators used DC electric motors. The clutch actuator attached to the conventional clutch shaft and incorporated an assist spring to minimize actuation power. The shift actuator replaced the conventional manual shift rod with a direct actuation system. This system utilized individual DC electric motors to control the position of each individual shift fork. Shift time was minimized by eliminating the "H gate" so that shifts that require actuation of two different shift forks can be completed much quicker.

The manual transaxle was modified to incorporate the AMT actuators and it was integrated with the RPECS controller, which used SwRI's Autosifter™ AMT control algorithm. The AMT system was tested in a laboratory dynamometer test stand. The test stand incorporated the engine and AMT driving through two gearboxes to a load dynamometer and a flywheel to simulate road loads and vehicle inertia. The AMT system was calibrated and fine tuned to a multitude of test conditions.



*AMT Dynamometer Testing*