

## **Executive Summary of Crash Test Report 1970 Ford F-100 Pickup Truck & 1999 Ford Crown Victoria Police Interceptor**

Ford Crown Victoria Police Interceptors (FCVPI) have been involved in numerous rear end crashes where the structural integrity of the gas tank was compromised, creating fuel-fed fires. This test program evaluates two safety enhancements that can prevent the types of fires that are occurring in these crashes. The test was conducted by Goodrich Aerospace at its Hurricane Mesa Test Track (HMTT), a military testing facility in Hurricane Utah.

### **Summary of Test Protocol**

To maximize the crash and energy forces to the FCVPI, it was decided to crash a 1970 Ford F-100 pickup truck (see Figure 1), of greater than 4,000 pounds curb weight, into a 1999 Ford Crown Victoria Police Interceptor (see Figure 2) and do so at a speed of at least 80 mph. The FCVPI had its fuel tank filled with approximately 14 gallons of regular unleaded gasoline to simulate a real world crash condition. The FCVPI was stationary, in “Park”, with its flashers on (possible electrical ignition source for a fire). Weights (200 pounds) were placed in the driver’s seat to simulate the weight of an officer. The impact of the front of the pickup truck with the rear of the FCVPI was a centerline impact, bumper to bumper. The entire crash sequence was filmed by a series of cameras to create a record of the event. Still photos were taken of the vehicles both before and after the crash. The post crash analysis evaluated the extent of the damage to each vehicle, measured the movement of the FCVPI after its impact, examined the fuel tank and observed for any fuel spillage.



**Figure 1** Truck with rocket sled (pre-test)



**Figure 2** 1999 Ford Crown Victoria Police Interceptor (FCVPI)

To prevent or limit fire risk in these crashes, the FCVPI was equipped with two modern safety appliances. The FIRE Panel creates a powder plume around the rupturing tank to “inert” the environment and prevent ignition of the leaking fuel. The Fuel Safe prototype bladder provides additional structural integrity to the fuel tank while limiting the possibility of fuel spraying from the damaged fuel tank. If fuel leakage from the damaged fuel tank is eliminated or minimized by the bladder, and if at the same time we inert the proximity of the fuel tank with fire retarding powder, the fire hazard will be limited, if not eliminated.

### **Test Day:**

The FCVPI was driven to the test area and parked so that the centerline of the rear bumper would align with the centerline of the bumper of the pickup truck at impact. The flashers on the FCVPI were turned on to serve as a potential ignition source. Just prior to the test, weather conditions were noted. Visibility was excellent. Temperature was 81.5°F. Skies were sunny and clear. Wind was only 4 knots from the SSE. Per facility safety procedures, all test observers had to remain a minimum distance of 300 feet from the impact site during the test.

The pusher/rocket sled was located at Test Station (TS) 2815. All engines on the rocket sled ignited as planned. The rocket sled accelerated to approximately 100 mph – peak speed. At TS 2263, the water brake caused separation of the rocket/pusher sled, allowing the sled with the F-100 pickup truck to coast into the targeted FCVPI. Between TS 2000 and TS 1950 was the “speed trap” to measure the speed of the pickup truck just 16 feet before impact with the FCVPI. The sled hit the FCVPI at 81.9 mph. The force of the

impact moved the FCVPI 79.4 feet down the track, with the FCVPI coming to rest at TS 1855.4 (see Figure 3). The sled with the pickup truck came to rest at TS 1911. The HMTT Safety Officer declared the site safe to inspect in a matter of minutes.



**Figure 3** Ford Crown Victoria Police Interceptor post-crash

#### **Post Crash Assessment:**

The impact of the pickup truck into the FCVPI caused substantial damage to the FCVPI. However, there was no fire. Fuel leakage was minimal and only at the point of rest and had stopped within minutes of the impact.

In observing the high-speed video footage of the test, one can see a cloud of powder emanating from the rear portion of the FCVPI. This is the powder being released from the FIRE Panels as they are shattered by the crushing of the FCVPI (see Figure 4). The amount of powder in the proximity of the fuel tank and potential ignition sources explains why any potential leaking fuel would not catch fire. The powder lingers in the proximity of the FCVPI for a reasonable period of time after the FCVPI stops moving from impact. Inspection at the site of the FIRE Panels shows that they fractured as expected and released the majority of their contents. Had the vehicle traveled even farther after impact, additional powder was present to add to the “cloud”.



**Figure 4** FIRE Panel post-crash

The initial on site inspection could not locate any rupture of the fuel tank. However, the compression of the rear of the FCVPI was so severe that making out the details of the fuel tank was impossible. However, it was possible to note that there was minimal leakage at the site. The leakage that could be seen appeared to be coming from the area where the filler neck entered the fuel tank and below a collector unit mounted aft of the tank. The amount of fuel that leaked appeared to be only a few ounces.

The vehicle was collected and transported to Phoenix where it was examined by P.E.B. Consulting. Analysis showed that there were three perforations at various points on the tank body but there were no tears in the bladder at those points. No leakage was observed from any of the perforations in the tank due to the presence of the bladder.

The following text was taken from the report prepared by Mr. Dick Higgins, Manager and Crash Test Engineer of the Goodrich Aerospace, Hurricane Mesa Test Track. “...I offer the following observations: The FCVPC with the emergency flashers operating was impacted at 81.9 MPH completely crushing the trunk and causing extensive damage to the rear seat area up to the aft end of the front doors. There was minimal leakage from the fuel tank estimated at no more than one (1) or two (2) ounces as noted by the very small stains caused by gasoline on the sand and gravel road base and a negligible fuel odor in the immediate area around the rear portion of the target vehicle. There was significant evidence of the F.I.R.E. powder in and around the impact area. There was no fire during or following the collision.”