

Executive Summary

Ferox International in conjunction with County Sheriff's Office (DCSO) conducted a fuel efficiency test to evaluate whether Ferox Fuel Tablets would improve patrol fleet fuel efficiency. Ferox International supervised the test to ensure that test procedures were consistently applied and results auditable.

Currently, fuel prices continue to escalate, increasing the tax payer financial burden to provide adequate security and support. The escalating cost of fuel continues to impact fundability of all DCSO programs and training.

One complete Patrol Shift with eight vehicles was committed to test Ferox Fuel Tablets. The test was executed from November 7th through December 5th, 2007.

17,894 total miles were driven in the conduct of the test. 4,561 miles were used to verify the vehicles fuel economy before Ferox Fuel Tablets were inserted into any vehicle. Four vehicles were selected, representing the oldest and newest vehicles in the test group. These vehicles were tested for 9,029 miles with Ferox Fuel Tablets. An additional 4,304 miles were driven to provide comparison, or control data for the vehicles testing Ferox Fuel Tablets. One vehicle, VIN 05-09, was the Shift backup vehicle and logged so few miles that its performance was excluded from the study.

All vehicles were monitored for their fuel efficiency and evaluated according to the onboard computer miles per gallon (MPG) readings, the miles driven divided by the gallons used, and the registered gallons per hour (GPH) by the vehicle computers as per Scan Gauge II readings.

Careful testing procedures ensured that the engines of each vehicle were evaluated at the same temperature, RPM, etc., at the time of each computer testing.

While Ferox International supervised the test, the County Sheriff department provided the actual pump data and odometer readings from which the evaluation is documented.

Ferox Fuel Tablets prove to be effective in improving fuel economy. The four test vehicles registered an average of 1.42 better mpg. This is a 11.9 % improvement in fuel efficiency. The Ferox Fuel Tablet vehicles outperformed the Control Group by 11.7 %.

For the three weeks of the test, Ferox Fuel Tablets saved \$176.97 in gas. The long term implications for fleet savings are significant.

DCSO has budgeted \$243,000 for fuel for 90,000 gallons of fuel for Fiscal Year 2008. Use of Ferox Fuel Tablets in bulk fuel at \$200.00 per 5,000 will save DCSO, after subtracting the cost of Ferox, an estimated \$25,110 for the Fiscal Year.

INDEX

	County Sheriff's Office Ferox Fuel Test	1 - 6
	Annex	
A	Recorded Test Data	A-1 – A-11
B	Vehicle 05-10 Data	B-1
C	Davis County Pump Fuel Records	
	VINs: 05-09, 05-10, 05-11, 05-12	1 – 5
	VINs: 06-01, 06-02, 06-03, 06-04	1 – 8
	VIN: 06-21	1 – 2

1. Purpose

Ferox International and DCSO conducted a fuel test from November 7th, through December 5th, 2007, to evaluate whether Ferox Fuel Tablets would increase the fuel efficiency of DCSO patrol vehicles and save the County money.

Fuel prices have increased significantly over the past year and are negatively impacting the DCSO financial structure. Money needed for training and equipment has been diverted to fund fuel requirements. Ferox Fuel Tablets were evaluated to see what effect it would have on reducing the impact of increasing fuel costs.

2. Methodology

The DCSO Patrol Division selected one complete Patrol Shift to conduct the test. This allowed total control of the personnel and vehicles for the test.

DCSO patrol vehicles have a unique requirement. They provide 12 hour per day security support for the County. While there are times when they log significant miles - which improve mile efficiency - they also have significant idle time. The result is a low mile per gallon average. Gallons per hour may be the best overall measurement for this type of service. However, it is reasonable to assume that over time, miles per gallon will average out as a constant.

The patrol shift has a total of eight (8) vehicles that were isolated for the test. The following vehicles (by vehicle number) were used for the test:

VIN
05-09
05-11
05-12
06-01
06-02
06-03
06-04
06-21

Seven vehicles of the Patrol Shift were used to validate the test results. One vehicle, 05-09, is a reserve vehicle and was used infrequently to provide adequate data for fair evaluation. Four vehicles were selected to test Ferox Fuel Tablets and three vehicles were used to monitor fuel efficiency throughout the test for comparative or control analysis. Only models from

2005 and 2006 were selected in order to use the onboard computers to track vehicle engine performance data.

Vehicles 05-11, 06-01, 06-02, and 06-21 were all selected for Ferox Fuel Tablets testing because they were used daily, and would provide consistent test data. Vehicle 05-11 was selected for Ferox testing because it was the oldest and highest mileage, regularly used test vehicle and would demonstrate the effect of Ferox Fuel Tablets as vehicles increase in age and use. Vehicle 06-21 was selected because it was the newest and lowest mileage, regularly used test vehicle, and would demonstrate the effect of Ferox Fuel Tablets on newer, lower mileage vehicles.

Vehicles 05-12, 06-03, and 06-04 were tested as control vehicles. All vehicles were evaluated throughout the test and provide sufficient data to validate the Ferox Test results.

The County bulk fuel was used for the test to ensure consistent fuel quality. Additionally, all fuel drawn from the Counties' pumps is recorded by gallons fueled and vehicle odometer reading at the time of fuelling.

A daily fuel and mileage log was maintained by all test vehicle operators.

During the reconciliation of the County Pump Data with the daily logs, it was noted that the complete fuel data for vehicle 05-10, a non-test vehicle was included. This information is attached in Annex B. While not part of the test package it serves as a totally independent tool that adds additional validation to the test results.

Two methods of evaluation were used to record test results: 1) vehicle computer data recorded from the engine computer, and 2) recorded odometer and gallons used during the test.

The increasing development of automobile computers to control all engine operations improves vehicle performance while recording significant vehicle functional data.

Model 2005 and 2006 vehicles were used to take advantage of the onboard computers. The odometer reading, trip data and miles per gallon reading were recorded every time test data was recorded.

A Scan Gauge II, manufactured by Liner Logic in Mesa Arizona, evaluated engine performance every time a vehicle was tested or checked. Controlled testing procedures ensured that the engines were operating at the same performance level when each reading was recording. Scan Gauge II provided the following additional data:

Gallons per hour
RPM
Throttle Position Setting
Engine water temperature
Volts produced by alternator
Intake air temperature
Timing advance setting
Engine load (percent of available power)
Manifold Absolute Pressure

Every engine computer was checked at the beginning of each recording to ensure that there were no engine malfunctions during the test.

Again, testing procedures ensured that engines were recorded at a standard level. Miles per gallon and gallons per hour data provide significant measures of vehicle fuel efficiency. Ferox International checked each vehicle and recorded the results to ensure consistent procedures.

The test began on November 7th, 2007, by recording every vehicle computer's data and odometer reading. Each vehicle was issued a daily log to record odometer reading (miles driven), and gallons of fuel added. *Additional data was taken from the County Pump Site records to ensure a solid baseline figure.*

On November 14th, 2007, the vehicles were checked, recording every vehicle engine setting and odometer and gallons used reading. This reading was used to set the fuel efficiency baseline for the four Ferox Fuel Tablet test vehicles. It also provides a base line for comparison for the three control vehicles. Two Ferox Fuel Tablets were added to every vehicle to begin the Ferox Fuel Tablet test. A ten pack Ferox Fuel Tablet pack was issued to each Ferox Fuel Tablet test vehicle. One Ferox Fuel Tablet was added for each 10 to 15 gallons each time the vehicle was fueled. (Please note that a Ferox Fuel Tablet was added to the gas tank each time fuel was added. While this may have been more Ferox than needed, it ensured that the fuel was maintained at the maximum Ferox efficiency level. Additional Ferox will not harm the vehicle in any way. This ensured maximum efficiency for the test.)

On November 14th, 2007, the four Ferox Fuel Tablet Test Vehicles' computers were reset by disconnecting the battery polls. Vehicle computers set fuel mixture settings and record mile per gallon computations by averaging fuel utilization over time. Once Ferox is circulated through the vehicle, resetting the computer will reset the fuel mixture to the default setting until the fuel is burned, and give current Ferox mile per gallon readings. This is important for the gallons per hour and miles per gallon computer readings for the test.

Vehicles were then tested on November 21st, November 30th and December 5th. The test plan scheduled a test period for November 28th, but operations necessitated a reschedule to November 30th.

The final reading or measurement was conducted on December 5th, 2007.

3. Results

The four Ferox Fuel Tablet test vehicles recorded the following fuel efficiency improvement when measuring miles per gallon (actual):

Vehicle	Baseline MPG	Test Average MPG	MPG Change	Percent MPG Increase
05-11	10.9	12.9	2.0	18.7 %
06-01	12.6	14.3	1.6	13.0 %
06-02	11.5	13.1	1.6	13.5 %
06-21	11.9	13.8	1.8	15.4 %
Total	11.9	13.3	1.4	11.7 %

Although the four Ferox Fuel Tablet vehicles' computers were reset on November 14th, it appears that two vehicles – 05-11 and 06-21 - did not reset. The four Ferox Fuel Tablet test vehicles recorded the following fuel efficiency improvement when measuring miles per gallon (from vehicle computer):

Vehicle	Baseline MPG	Test Average MPG	MPG Change	Percent MPG Increase
05-11	12.0	12.0	0	0 %
06-01	12.8	15.1	2.3	18.0 %
06-02	11.8	13.2	1.4	12.1 %
06-21	11.9	12.7	.8	7.2 %
Total	12.1	13.2	1.1	9.2 %

The Ferox Fuel Tablet test vehicles recorded the following fuel efficiency improvement for gallons per hour (GPH):

Vehicle	Baseline Gallons per Hr	Test Average Gallons per Hr	Gallons per Hr Change	Percent GPH Decrease
05-11	0.44	0.36	-0.08	-17.2 %
06-01	0.45	0.41	-0.04	-7.9 %
06-02	.0.41	0.36	-0.05	-11.1 %
06-21	0.49	0.44	-0.05	-10.0 %
Total	0.45	0.39	-0.05	-11.5 %

* Ferox Fuel Tablets test vehicles lowered (improved) the gallons per hour at idle.

Ferox Fuel Tablet test vehicles demonstrated a significant fuel improvement. Both the miles per gallon per actual odometer reading divided by gallons consumed or gallons per hour recorded similar savings. While the computer calculated gallons per hour shows a strong improvement, it appears that two of the computers failed to reset, therefore understating the results.

The control vehicles recorded the following fuel efficiency when measuring miles per gallon (actual) by miles and gallons:

Vehicle	Baseline MPG	Test Average MPG	MPG Change	Percent MPG Increase
05-09	0	0	0	0 %
05-12	0	10.7	0	0 %
06-03	14.9	12.7	-2.2	-15.0 %
06-04	0	12.5	0	0 %
Total	12.1	13.2	1.1	9.2 %

The control vehicles recorded the following fuel efficiency when measuring miles per gallon (computer):

Vehicle	Baseline MPG	Test Average MPG	MPG Change	Percent MPG Increase
05-12	10.8	11.0	0.2	2.0 %
06-03	13.8	12.1	-1.7	-12.1 %
06-04	10.8	12.9	2.0	18.7 %
Total	12.2	12.2	-0.03	0.28 %

Please note that vehicle 06-04 had an exceptional improvement. This appears to be caused by faulty data, missing fuel that was probably procured at a service station (This is an occasional practice but was excluded for the test in an effort to standardize fuel). In an effort to use only test data the figures have not been rationalized.

The control vehicles recorded the following fuel efficiency when measuring gallons per hour:

Vehicle	Baseline Gallons per Hr	Test Average Gallons per Hr	Gallons per Hr Change	Percent GPH Decrease
05-12	0.40	0.40	-0.00	-0.0 %
06-03	0.40	0.44	0.04	10.8 %
06-04	0.45	0.46	0.01	3.0 %
Total	0.42	0.39	0.03	7.1 %

During the conduct of the test, the average temperature dropped over 12 degrees Fahrenheit. Average temperature for the test period was:

1 – 7 Nov	8 – 14 Nov	15 – 21 Nov	22 – 30 Nov	31 Nov – 5 Dec
46	47	40	28	31
44	48	45	32	28
43	57	54	33	38
46	49	55	35	34
46	41	61	34	34
45	51	40	39	
	37	32	30	
			36	
			35	
45.1 Av	47.1 Av	46.7 Av	33.6 Av	33.0 Av

All vehicles recorded a drop off of fuel economy as the temperatures dropped.

While the Ferox Fuel Tablet treated vehicles improved fuel efficiency in miles per gallon by 11.9 % and gallons per hour by 11.5 %, the Control vehicles fuel efficiency remained basically the same. The end result is that Ferox fuel Tablet treated vehicles performed 11.7 % better than the control vehicles.

The total test covered 17,894 miles. Of these miles, 9,029 were treated with Ferox Fuel Tablets. 4,561 miles were used to establish a baseline to evaluate the impact of Ferox Fuel Tablets. 4,304 miles were driven to provide a control group to compare the Ferox Fuel Tablet treated fuel. 9,029 miles is sufficient to capture a statistically reliable sample.

4. Conclusions

Ferox Fuel Tablets resulted in a 11.7 % fuel savings for DCSO, as noted previously. The financial implications of the test are as follows:

Ferox Fuel Tables savings for the test:

Total Ferox Miles	9,029
Total gallons used with Ferox	678.8
Ferox miles per gallon improvement	1.42
Gallons required with out Ferox	759.8
Test gallons saved by Ferox	81
Dollars save during test @ \$2.52/Gal	\$182.94
Cost of Ferox for the test *	\$27.15
Ferox savings for test	\$176.97

* This was a price for the test at \$156.00 per 5,000 gallons of fuel treated.

County Sheriff's Office Ferox Fuel Tablet Test

The implications of this test when applied over FY 2008 will be:

County Sheriffs Department Fuel Budget	\$243,000
Total estimated gallons needed without Ferox	90,000
Total estimated gallons needed with Ferox	79,515
Total gallons saved at 11.7 %	10,485
Projected Cost of Fuel with Ferox	\$214,690
Total dollars saved at 11.7 % @ \$2.70/Gal	\$28,310
Total cost of Ferox	\$3,200
Total estimated dollars saved	\$25,110