



# National Law Enforcement and Corrections Technology Center

# BULLETIN

A Program of the National Institute of Justice

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## Michigan State Police Tests 2003 Patrol Vehicles

**P**atrol vehicles are among the most critical purchases that a law enforcement agency makes. For both large and small agencies, patrol vehicle purchases frequently represent the second largest expenditure, after personnel, in their annual operating budgets. Selecting a vehicle that balances both budgetary and performance requirements has become an increasingly challenging task for police fleet administrators. Many agencies are painfully aware of the consequences that result from being “penny wise and pound foolish,” where vehicles with inadequate performance, such as regular production passenger vehicles not specifically designed for police service, are selected because they cost less than police-package vehicles. Although some agencies have had limited success with nontraditional police vehicles, most agencies find that the increased maintenance costs resulting from such vehicles breaking down under the stress of police service quickly offset any initial savings.

For more than 25 years, the Michigan State Police (MSP) has conducted extensive evaluations of the performance capabilities of each new model year’s police vehicles as part of its annual vehicle procurement process. Since 1981, the National Institute of Justice (NIJ), through its National Law Enforcement and Corrections Technology Center (NLECTC) system, has sponsored these tests through a partnership with MSP. By disseminating these

results to State and local law enforcement agencies, NIJ helps these agencies select vehicles that maximize their budgets and ensures that evaluated vehicles provide reliable and safe performance under the increased demands of police service.

The 2003 model year patrol vehicles were evaluated from September 21 through 23, 2002. For the purposes of the MSP evaluation, police-package vehicles are those that are designed and manufactured for use in the full spectrum of law enforcement patrol service, including pursuits. A special-service vehicle is a vehicle that may be used by law enforcement agencies for specialized use (e.g., off-road, inclement weather, K-9, or commercial vehicle enforcement), but is not designed or manufactured to be used in high speed or pursuit situations. By creating this distinction, it is hoped that it will be easier for agencies to realistically assess the capabilities of each vehicle.

Each vehicle is subjected to six major tests and evaluations. The results are weighted to reflect the relative importance of each attribute as related to MSP operational requirements. Exhibit 1 lists the tests and point scores. MSP scores each vehicle’s overall performance, reviews the manufacturer’s bid price, and calculates a final score for each vehicle using a sophisticated formula that combines both factors.

## Exhibit 1 Tests and scoring

Test	Points
Vehicle dynamics	30
Acceleration	20
Top speed	15
Braking	20
Ergonomics and communications	10
Fuel economy	5
<b>Total</b>	<b>100</b>

Four police-package vehicles and five special-service vehicles were submitted for evaluation. Exhibit 2 provides a list and description of each vehicle. This NLECTC bulletin contains a synopsis of the test results; a detailed report also is available. Page 8 of this bulletin contains information on how to obtain the report.

The MSP vehicle specifications, test categories, and scoring reflect MSP needs. If your department employs this or a similar method, consider your own needs carefully and alter the weighting factors accordingly.

## What's New for 2003

**AM General:** The AM General Hummer was once again submitted for testing as a police-package vehicle. There are no significant changes from the 2002 model.

**Chevrolet:** For the 2003 model year, the Impala is once again available in both the 9C1 police package and the 9C3 unmarked police package. One enhancement for the 2003 model year is that the fuel cut-off has been

increased to 129 miles per hour (mph). Also, the following items that were optional in previous years are now standard:

- Engine oil cooler.
- External transmission oil cooler.
- Low frequency radio interference suppression.
- UT7 ground stud for the electrical system.

The Tahoe is again available in either a 2-wheel-drive (2WD) or 4-wheel-drive (4WD) special-service package. In addition to the standard 4.8L (292 cid) engine, the 5.3L (327 cid) engine, rated at 285 horsepower, is an available option on both models. Also, several upgraded interior amenities that had previously been optional are standard in 2003, such as power windows and rear air conditioning.

**DaimlerChrysler:** DaimlerChrysler's entry in the 2003 model year tests is the Dodge Intrepid sedan, which was introduced in 2002 as the first police-package sedan entered by DaimlerChrysler in the MSP tests since the Dodge Diplomat in 1989. The 2003 Intrepid remains basically unchanged from 2002. Representatives of DaimlerChrysler's police vehicle engineering team state that the power steering and antilock brake system (ABS) have been enhanced from the 2002 model, and side air bags and remote keyless entry are now available as optional equipment.

**Ford:** The 2003 Police Interceptor was introduced as a midyear replacement in March 2002, and a preproduction version was evaluated in 2002's tests. The 2003 models feature a new, hydroformed steel frame, which Ford engineers state will improve the strength of the

## Exhibit 2 Vehicles tested

Category	Vehicle	Engine
Police	AM General Hummer HMCS	6.5L (396 cid) Turbo-Diesel
Police	Chevrolet Impala	3.8L (231 cid) SPFI
Special Service	Chevrolet Tahoe (2-wheel drive)	5.3L (327 cid) SPFI
Special Service	Chevrolet Tahoe (4-wheel drive)	5.3L (327 cid) SPFI
Police	DaimlerChrysler Dodge Intrepid	3.5L (214 cid) SPFI
Police	Ford Police Interceptor	4.6L (281 cid) SPFI
Special Service	Ford Expedition (2-wheel drive)	5.4L (329 cid) SMPI
Special Service	Ford Expedition (4-wheel drive)	5.4L (329 cid) SMPI
Special Service	Ford Explorer (2-wheel drive)	4.6L (281 cid) SPFI

cid = cubic inch displacement

L = liter

MPFI = multiport fuel injection

SPFI = sequential port fuel injection

Turbo = turbocharged

SMPI = sequential multiport fuel injection

frame and improve front-end crash performance. Also new are the shocks, springs, suspension, and rack-and-pinion steering. The brake system is all new, and ABS is now standard. A new tire, the Goodyear Eagle RS-A Plus, is featured, which Ford engineers say will improve steering feel and wet and snow traction, and has longer tread life. Powertrain improvements include a new variable speed electric fan for engine cooling, and a knock sensor prevents detonation from low-octane fuels.

New interior safety features for 2003 include a higher head rest, which provides greater support behind the head in a crash to prevent whiplash. For units produced after July 2003, side air bags will be standard on vehicles equipped with power seats and optional for vehicles equipped with manual seats. Ergonomic interior improvements include adjustable cup holders to accommodate a wide variety of cup sizes, and a new power point below the cup holders provides a location to plug in additional equipment. To assist in installing aftermarket equipment such as emergency lighting systems, radios, and computers, a new power distribution box is standard in the passenger compartment and optional in the trunk. It provides 10 fuse locations to provide power to aftermarket equipment and signal connections for 6 key functions.

A compressed natural gas (CNG) version of the Police Interceptor will be available in January 2003. However, Ford elected not to submit a CNG version for testing for this model year. The 2003 CNG model will feature the same 4.6L engine as the gasoline-fueled Police Interceptor and will meet ultra-low emission vehicle (LEVII) emission standards for Green States and Tier 2, Bin 3 emission standards for Federal applications.

No information was available from Ford at press time regarding the Explorer and Expedition special-service vehicles.

## Vehicle Dynamics Testing

**Objective:** To determine high-speed pursuit handling characteristics. The 2-mile road racing course contains hills, curves, and corners; except for the absence of traffic, it simulates actual pursuit conditions. The evaluation measures each vehicle's blending of suspension components, acceleration capabilities, and braking characteristics.

**Methodology:** All vehicles are driven over the course a total of 32 timed laps by four separate drivers, each one driving an 8-lap series. The final score for the vehicle is the combined average of the 5 fastest laps of each of the four drivers.

Exhibit 3 shows the average results of the vehicle dynamics test.

## Acceleration and Top-Speed Testing

### Acceleration

**Objective:** To determine the time required for each test vehicle to accelerate from a standing start to 60 mph, 80 mph, and 100 mph.

**Methodology:** Using a Datron Non-Contact Optical Sensor in conjunction with a personal computer, each vehicle is driven through four acceleration sequences—two northbound and two southbound—to allow for wind direction. The average of the four is the score on the competitive test.

Exhibit 3 Results of vehicle dynamics testing

Make/Model	Average*
AM General Hummer HMCS 6.5L Turbo Diesel	02:00.87
Chevrolet Impala 3.8L SPFI	01:44.25
Chevrolet Tahoe (2-wheel drive) 5.3L SPFI	**
Chevrolet Tahoe (4-wheel drive) 5.3L SPFI	**
DaimlerChrysler Dodge Intrepid 3.5L SPFI	01:42.07
Ford Police Interceptor 4.6L SPFI	01:41.65
Ford Expedition (2-wheel drive) 5.4L SMPI	**
Ford Expedition (4-wheel drive) 5.4L SMPI	**
Ford Explorer (2-wheel drive) 4.6L SPFI	**

Note: Times are in minutes, seconds, and hundredths of a second; e.g., 1:29.74 = 1 minute, 29 seconds, and 74/100 of a second.

\* Average of the 20 fastest laps out of 32 total laps (the overall average of the 5 fastest laps for each of the four test drivers).

\*\* The vehicle manufacturer has indicated that these vehicles are neither designed for nor intended to be used as pursuit vehicles. Therefore, these vehicles were not subjected to vehicle dynamics testing.

## Exhibit 4 Results of acceleration and top-speed testing

Speed (mph)	AM General Hummer HMCS	Chevrolet Impala	Chevrolet Tahoe (2WD)	Chevrolet Tahoe (4WD)	Daimler Chrysler Dodge Intrepid	Ford Police Interceptor	Ford Expedition (2WD)	Ford Expedition (4WD)	Ford Explorer (2WD)
0-20	2.90	1.96	2.12	2.17	2.14	2.01	2.81	2.24	2.33
0-30	5.46	3.22	3.52	3.50	3.42	3.40	4.53	3.81	3.84
0-40	9.05	4.66	4.92	4.90	4.87	4.86	6.33	5.59	5.79
0-50	14.24	6.70	6.72	6.90	6.81	6.72	9.15	8.28	8.37
0-60	20.65	9.25	9.34	9.31	9.14	9.14	12.30	11.27	11.75
0-70	31.54	12.09	12.04	11.97	11.82	11.80	15.88	14.72	15.54
0-80	54.77	15.63	15.17	16.14	14.93	15.35	21.82	19.75	20.57
0-90	0.00	20.69	21.15	21.81	19.41	19.91	29.56	26.85	28.39
0-100	0.00	26.73	0.00	0.00	24.80	25.58	40.91	35.83	37.87
<b>Top speed</b>	<b>85</b>	<b>126</b>	<b>98</b>	<b>98</b>	<b>136</b>	<b>128</b>	<b>100</b>	<b>100</b>	<b>101</b>

Note: Figures represent the average of four runs. All vehicles are equipped with electronic speed limiters.

### Top Speed

**Objective:** To determine each vehicle's speed at a distance of 1 mile and 2 miles and the actual top speed attainable within a distance of 14 miles from a standing start.

**Methodology:** Following the fourth acceleration run, the vehicle continues to accelerate to the top speed attainable within 14 miles from the start of the run. The highest speed attained within the 14 miles is the vehicle's score on the competitive test.

Exhibit 4 summarizes the acceleration and top-speed test results.

### Braking Testing

**Objective:** To determine the deceleration rate attained by each test vehicle on 12, 60-to-0 mph impending skid (threshold) stops, with ABS in operation if the vehicle is so equipped. Each vehicle will be scored on the average deceleration rate it attains.

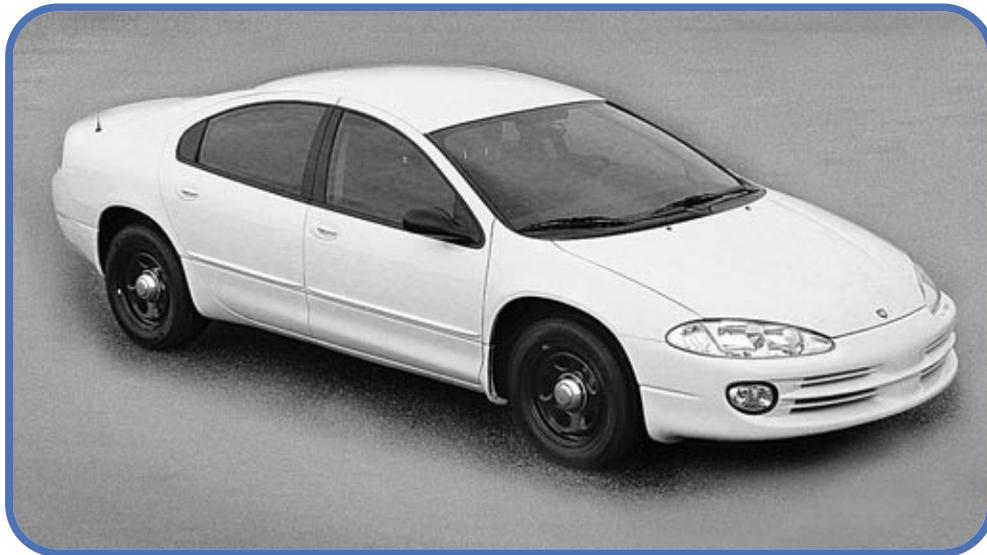


Photo courtesy of Michigan State Police.

DaimlerChrysler submitted the Dodge Intrepid sedan for testing. The power steering and antilock brake system have been enhanced.

**Methodology:** Each vehicle will make two decelerations at specific, predetermined points on the test road from 90 to 0 mph at 22 ft/sec<sup>2</sup>, with the driver using a decelerometer to maintain the deceleration rate. Immediately after these heat-up stops are completed, the vehicle will be turned around and will make six measured 60-to-0 mph impending skid (threshold) stops with ABS in operation, if the vehicle is so equipped, at specific, predetermined points. Following a 4-minute heat soak, the entire sequence will be repeated. The exact initial velocity at the beginning of each of the 60-to-0 mph decelerations and the exact distance required to make each stop will be recorded by means of a Datron Non-Contact Optical Sensor in conjunction with a personal computer. The data resulting from the 12 stops will be used to calculate the average deceleration rate, which is the vehicle's score for this test. Exhibit 5 shows the results of the braking test.

## Ergonomics and Communications

**Objectives:** To rate the vehicle's ability to provide a suitable environment for patrol officers to perform their job, to accommodate the required communications and emergency warning equipment, and to assess the relative difficulty of installing the equipment.

**Methodology:** A minimum of four officers independently and individually score each vehicle on comfort and instrumentation. Personnel from MSP's Communications Division who are responsible for new car preparation conduct the communications portion of the evaluation, based on the relative difficulty of the necessary installations. Each factor is graded on a 1-to-10 scale, with 1 representing totally unacceptable and 10 representing superior. The scores are averaged to minimize personal prejudice. Exhibit 6 shows a comparison of the exterior and interior

Exhibit 5 Results of braking test

Phase I	AM General Hummer HMCS	Chevrolet Impala	Chevrolet Tahoe (2WD)	Chevrolet Tahoe (4WD)	Daimler Chrysler Dodge Intrepid	Ford Police Interceptor	Ford Expedition (2WD)	Ford Expedition (4WD)	Ford Explorer (2WD)
Avg. initial speed (mph)*	59.6	59.8	60.0	59.6	59.9	59.8	59.8	60.0	59.8
Avg. stopping dist. (ft)*	168.63	132.33	149.65	149.18	145.03	147.45	145.97	155.68	144.28
Avg. deceleration rate (ft/sec <sup>2</sup> )*	22.71	29.04	25.83	25.67	26.57	26.07	26.38	24.95	26.64
<b>Phase II</b>									
Avg. initial speed (mph)*	59.5	59.7	60.1	59.9	59.9	60.1	59.8	60.2	59.8
Avg. stopping dist. (ft)*	167.14	131.23	151.92	155.12	144.18	149.20	158.45	158.67	143.73
Avg. deceleration rate (ft/sec <sup>2</sup> )*	22.81	29.21	25.55	24.95	26.81	26.03	24.34	24.56	26.77
<b>Avg. Deceleration Rate (ft/sec<sup>2</sup>)**</b>	<b>22.76</b>	<b>29.12</b>	<b>25.69</b>	<b>25.31</b>	<b>26.69</b>	<b>26.05</b>	<b>25.36</b>	<b>24.76</b>	<b>26.70</b>
Projected stopping distance from 60 mph based on average deceleration rate (ft)	<b>170.1</b>	<b>133.0</b>	<b>150.7</b>	<b>153.0</b>	<b>145.1</b>	<b>148.6</b>	<b>152.7</b>	<b>156.4</b>	<b>145.0</b>

Note: All vehicles have antilocking braking systems.

\* Figures represent the average of six measured stops.

\*\* Calculated from the average deceleration rate (ft/sec<sup>2</sup>) of 12 measured stops.

## Exhibit 6 Summary of exterior and interior dimensions

Manufacturer/Model	Length (inches)	Height (inches)	Wheelbase (inches)	Weight (lbs)	Head Room (front)	Head Room (rear)	Leg Room (front)	Leg Room (rear)
AM General Hummer	184.5 (a)	75.0	130.0	7,660	37.5	36.7	36.0	36.0
Chevrolet Impala	200.1	57.3	110.5	3,583	39.2	36.8	42.2	38.4
Chevrolet Tahoe	198.9	76.3	116.0	5,142/5,290 (b)	40.7	39.4	41.3	38.6
DaimlerChrysler								
Dodge Intrepid	203.7	55.9	113.0	3,567	38.3	37.5	42.2	39.1
Ford Police Interceptor	212.0	58.5	114.7	4,155	39.4	38.0	42.5	39.6
Ford Expedition	204.6	74.3	119.1	5,359/5,846 (b)	39.7	39.8	41.2	38.6
Ford Explorer (2WD)	189.5	69.2	114.0	4,602	39.9	38.9	42.4	37.2

Manufacturer/Model	Shoulder Room (front)	Shoulder Room (rear)	Hip Room (front)	Hip Room (rear)	Interior, Front (cubic feet)	Interior, Rear (cubic feet)	Interior, Combined (cubic feet)	Trunk Capacity/Max. Cargo* (cubic feet)	Fuel Capacity (gallons)
AM General Hummer	78.8	78.8	50.6	50.6	61.6	61.6	123.2	57.85	42.0
Chevrolet Impala	59.0	58.9	56.5	55.7	56.5	48.2	104.7	17.6 (c)	17.0
Chevrolet Tahoe	65.2	65.1	61.4	61.3	94.3	57.3	151.6	57.3	26.0
DaimlerChrysler									
Dodge Intrepid	59.0	58.1	56.3	56.6	55.0	49.5	104.5	18.4	17.0
Ford Police Interceptor	60.8	60.3	57.1	59.0	58.2	51.1	109.3	20.6	19.0
Ford Expedition	63.9	64.4	63.0	62.4	93.2	55.8	149.0	106.1	26.0
Ford Explorer (2WD)	59.1	58.9	55.0	54.2	81.8	44.5	126.3	88.0	22.5

\* Sedans are measured for trunk capacity; SUVs and special-service vehicles are measured for maximum cargo (rear seats folded down).

(a) With winch.

(b) 2-wheel drive/4-wheel drive.

(c) With compact spare tire.



Photo courtesy of Michigan State Police.

Ford Motor Company submitted the Explorer (left front), the Expedition (4WD and 2WD, rear) and the Police Interceptor (right front) for testing.

dimensions of the vehicles evaluated. Exhibit 7 shows the results of the ergonomics and communications test.

## Fuel Economy

**Objective:** To determine fuel economy potential. The scoring data are valid and reliable for comparison, but may not necessarily be an accurate prediction of the car's actual fuel economy.

**Methodology:** The vehicles' scores are based on estimates of city fuel economy to the nearest  $\frac{1}{10}$  of a mile per gallon from data supplied by the vehicle manufacturers. Exhibit 8 shows the estimated Environmental Protection Agency (EPA) fuel economy ratings, rounded to the nearest whole number, for city, highway, and combined driving conditions.

### Exhibit 7 Results of ergonomics and communications test

Manufacturer/Model	Score
AM General Hummer	154.40
Chevrolet Impala	196.32
Chevrolet Tahoe (2WD)	215.59
Chevrolet Tahoe (4WD)	219.69
DaimlerChrysler Dodge Intrepid	199.14
Ford Police Interceptor	196.90
Ford Expedition (2WD and 4WD)	202.73
Ford Explorer (2WD)	179.44

Note: Scores are the total points the automobile received for each of the 29 attributes the MSP considers important in determining the acceptability of the vehicle as a patrol car—for example, front seat adjustability, clarity of instrumentation, and front and back visibility. The higher the number, the better the vehicle scored.



Photo courtesy of Michigan State Police.

Chevrolet Motor Division of General Motors Corporation submitted the Impala (left front) and the Tahoe (2WD and 4WD, right front and rear) for testing. Shown at the left rear is the AM General Hummer.

**Exhibit 8 Fuel economy**

Manufacturer/Model	EPA Miles Per Gallon		
	City	Highway	Combined
AM General Hummer HMCS 6.5L (396 cid) Turbo Diesel	9	10	9*
Chevrolet Impala 3.8L (231 cid) SPFI	20	29	23
Chevrolet Tahoe (2-wheel drive) 5.3L (327 cid) SPFI	15	20	16.5
Chevrolet Tahoe (4-wheel drive) 5.3L (327 cid) SPFI	14	18	15
DaimlerChrysler Dodge Intrepid 3.5L (235 cid) SPFI	19.8	27	22
Ford Police Interceptor 4.6L (281 cid) SPFI	15	22	18
Ford Expedition (2-wheel drive) 5.4L (329 cid) SMPI	14	19	16
Ford Expedition (4-wheel drive) 5.4L (329 cid) SMPI	N/A	N/A	N/A
Ford Explorer (2-wheel drive) 4.6L (281 cid) SPFI	16	21	18

\* Estimated; Class III vehicle, not tested to EPA national fuel economy standards.  
 N/A = Information not available at press time.

If you would like a copy of the full report, write or call the National Law Enforcement and Corrections Technology Center, 2277 Research Boulevard, Mail Stop 8J, Rockville, MD 20850, 800-248-2742, or 301-519-5060; or download it from JUSTNET, [www.justnet.org](http://www.justnet.org).

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