
# Police Car System Improvements

presented to
The Department of Justice

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presented by
THE AEROSPACE CORPORATION


Polic Patrol Car
Systems Improve
And
Planning
NEW ORLEANS POLICE
Prog

# PRODUCTIVITY

The police patrol car has become one of the major tools relied upon by the police to enhance their productivity. In addition to its use as basic transportation, it is used as a mobile platform for patrol and surveillance and as a means for pursuit and apprehension. The police patrol car has become a communications terminal which puts a wide range of information at the fingertips of the patrol officer. The police patrol car is where most police officers spend the majority of their duty time. It is the patrolman's office. It must protect the officer from the environment and from the offender. It is where the officer writes most of his reports and where he conducts most of his interviews. In addition to its use as an office, it also is a jail where prisoners are detained. And finally, the police car is what many citizens think of when they think of the police.

# Productivity

## THE POLICE PATROL CAR IS A MAJOR TOOL WHICH IMPROVES POLICE PRODUCTIVITY

- TRANSPORTATION
- PATROL/SURVEILLANCE
- PURSUIT/APPREHENSION
- COMMUNICATIONS TERMINAL
- ALL-WEATHER OFFICE
    - WRITING REPORTS
    - INTERVIEWING WITNESSES, VICTIMS AND SUSPECTS
- FOCUS OF CITIZEN ATTENTION
- TEMPORARY DETENTION FACILITY

# COST

Surveys of the various law enforcement agencies indicate that there are at least 160,000 police patrol cars in this country. Since it costs over $6,000 to acquire a fully-equipped police patrol car, a one billion dollar national inventory of police cars appears reasonable. Considering an average life of three years and a resale value of one thousand dollars per car, one can calculate that the police community spends about one-quarter billion dollars per year to acquire police cars. The annual fuel cost for operating police patrol cars approaches one-half billion dollars. The cost of maintenance is also a considerable investment -- $100 million annually, as is the cost of accidents involving the police patrol car. And finally, a most important cost associated with the police patrol car is the cost of the patrolman who uses it. To man one car with a two-man patrol for twenty-four hours a day costs over $200,000 annually.

# Cost

| | |
|---|---|
| ACQUISITION | $ 1 BILLION |
| REPLACEMENT | $ 250 MILLION |
| FUEL | $ 500 MILLION |
| MAINTENANCE | $ 100 MILLION |
| ACCIDENTS - PHYSICAL DAMAGE | $ 100 MILLION |
| ACCIDENTS - INJURY | $ 40 MILLION |

**THE COST OF ONE MOTORIZED PATROL BEAT IS $200,000 ANNUALLY**

# GOALS/IMPACT

Early in this program we assessed what improvements could reasonably be made in the police patrol car by applying new and innovative technology. Based on this assessment, specific goals were established in the areas of economy, safety and productivity. The principal economy goal was to increase the miles obtained per gallon of gasoline by 7.5. The national impact of achieving this goal would be an annual savings of one-quarter billion dollars. Other economy goals included reducing vehicle replacement cost and reducing maintenance cost. The principal safety goal was to reduce the accident rates for police patrol cars from 30 per million miles to 27 per million miles, while also reducing the rate of injury per accident from three per ten accidents to two per ten accidents. Several goals have been set in the area of productivity. Several important productivity goals relate simply to meeting our economy goals without decreasing today's productivity. For example, by going to a low weight vehicle we can save fuel, but we may decrease the functional space available. Therefore, a specific productivity goal is to maintain today's standard car functional space in a low weight vehicle. Several productivity goals deal with improving the ability of the patrolman to access and handle data. A productivity goal which also is related to safety is to eliminate the carbon monoxide problem so that patrolmen will be better able to perform their jobs. While we do not feel that we can set meaningful numbers for all of these goals we do believe that very significant improvements can be made. For example, we believe that if we can improve the effectiveness of the patrolman by ten percent by improving the police patrol car, we can have an effective improvement in police services which would otherwise cost some 400 million dollars.

# Goals/Impact

## ECONOMY/SAFETY GOALS

- TO INCREASE MILES PER GALLON BY 7.5 MPG - $250 MILLION ANNUAL NATIONAL SAVINGS
- TO REDUCE VEHICLE REPLACEMENT COST BY $1550/CAR - $82 MILLION ANNUAL NATIONAL SAVINGS
- TO REDUCE ANNUAL MAINTENANCE COST BY $260/CAR $42 MILLION ANNUAL NATIONAL SAVINGS
- TO REDUCE ACCIDENT RATES FROM 30 PER MILLION MILES TO 27 PER MILLION MILES, AND REDUCE INJURIES PER 10 ACCIDENTS FROM 3 TO 2 $20 MILLION ANNUAL NATIONAL SAVINGS

## PRODUCTIVITY GOALS

- TO MAINTAIN STANDARD CAR FUNCTIONAL SPACE IN A LOW WEIGHT VEHICLE
- TO INCREASE INFORMATION AVAILABILITY TO THE PATROL FUNCTION WHILE MAINTAINING APPROPRIATE DATA SECURITY
- TO DECREASE REPORT PREPARATION/FILING TIME BY 35%
- TO ELIMINATE MISSED MESSAGES
- TO EXPAND IN-CAR INFORMATION AVAILABILITY TO OUT-OF-CAR ACTIVITY
- TO ELIMINATE THE CARBON MONOXIDE PROBLEM
- A 10% INCREASE IN PRODUCTIVITY EQUALS $400 MILLION

## APPROACH

There are many concepts which appear hopeful in achieving our specific goals in the areas of economy, safety and productivity.

With respect to improving the economy of police patrol operations, the most important concept is encouraging the use of a lightweight vehicle. Economies can be expected in terms of better fuel economy, lower maintenance cost, and lower acquisition and replacement cost. Another concept that shows promise is the use of vehicle diagnostics to improve maintenance. For example, through the use of such devices, a middle road could be achieved between the high-cost concept of regularly scheduled preventive maintenance and the lower cost, but sometimes disastrous concept of driving the vehicle until it breaks down. The use of driver-aid devices to condition the driver to economical driving habits is a concept which also shows promise in helping to achieve our economy goals. The police patrol car is generally operated in two extreme modes -- very low power cruise and idle, and very high power emergency response. It appears feasible to build a drive train system which could provide the best of two worlds, i.e., ensure economy for lower power operation and to provide high performance when necessary.

With respect to improving the safety of the police patrol car, several concepts appear hopeful. Among them are included anti-lock brakes, carbon monoxide sensors, hands-free communications and improved seats and restraint systems.

To improve the patrolman's productivity through improving the police patrol car, many concepts will be explored. Computer controlled communication and data transfer is very hopeful. Computer-aided report writing should free the patrolman of clerical tasks. Hand-held remote communications terminals should extend the effective range of the patrolman's activity. Automatic vehicle location systems should enable more effective patrol and response patterns and also provide increased officer safety. Rapid data retrieval will allow increased flexibility in checking for stolen automobiles and other property as well as provide a means for identifying wanted persons.

# Approach

## TO IMPROVE THE ECONOMY

- ENCOURAGING THE USE OF LOW WEIGHT VEHICLES
  - BETTER FUEL ECONOMY
  - LOWER MAINTENANCE COST
  - LOWER ACQUISITION/REPLACEMENT COST
- IMPROVED MAINTENANCE THROUGH VEHICLE DIAGNOSTICS
- FUEL ECONOMY DRIVER AID DEVICES
- DEVELOP DUAL-MODE DRIVETRAIN SYSTEM

## TO IMPROVE THE SAFETY

- ANTI-LOCK BRAKES
- CARBON MONOXIDE SENSORS
- HANDS-FREE COMMUNICATIONS
- IMPROVED SEATS AND RESTRAINT SYSTEM

## TO IMPROVE THE PRODUCTIVITY

- COMPUTER-CONTROLLED COMMUNICATIONS AND DATA TRANSFER
- COMPUTER-AIDED REPORT WRITING
- HAND-HELD REMOTE COMMUNICATIONS TERMINAL
- AUTOMATIC VEHICLE LOCATION
- RAPID DATA RETRIEVAL

# FUEL COST VS WEIGHT

Significant savings in fuel cost can be achieved by going to a lower weight vehicle. Studies have shown that by going from a standard weight vehicle to a compact weight vehicle and keeping all other factors equal, e.g., ratio of engine size to weight, economics on the order of several miles per gallon can be achieved. The extent of the savings will vary according to the type of driving cycle utilized. Using the standard EPA urban driving cycle, we find economics of three miles per gallon. Since there is no standard police driving cycle, one was simulated for test purposes. Using this simulated police driving cycle, economics in the order of 2 miles per gallon were achieved. Translated into national cost, we are talking in the range of 125 million dollars per year savings.

There are two primary alternatives in going to a lightweight car. First, we might use today's compact car and, second, we might design a new lightweight car specifically for police use. The advantages and disadvantages of each of these alternatives will be discussed herein.

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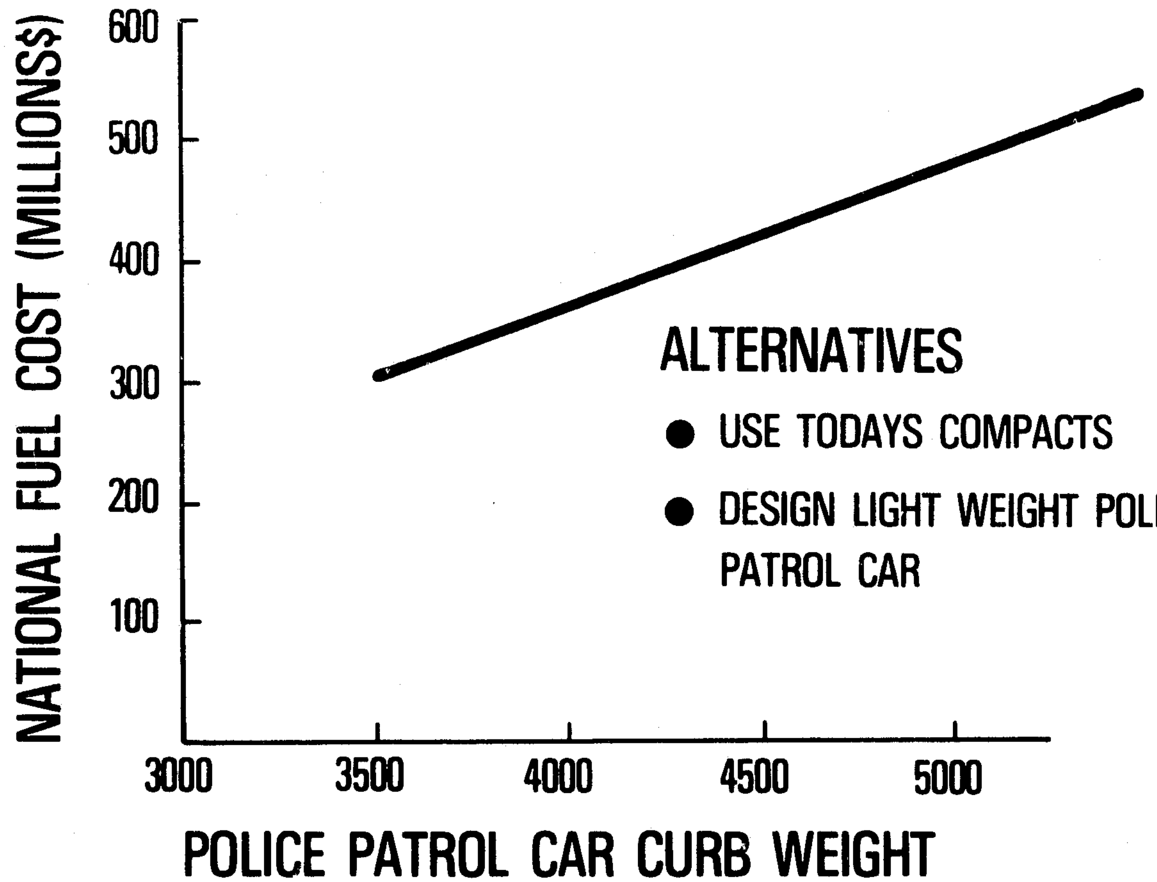
# Fuel Cost Vs. Weight

## (based on estimated police driving cycle)




ALTERNATIVES

- USE TODAYS COMPACTS
- DESIGN LIGHT WEIGHT POLICE PATROL CAR

# THE COMPACT CAR

The use of today's available compact car results in many of the advantages of a low weight vehicle. There is greater fuel economy and lower acquisition, replacement and maintenance cost than for the standard car. The vehicle is also more maneuverable in crowded urban areas. And a primary advantage is that it is available today.

However, there are several significant disadvantages. The major disadvantage is that the interior space is too small. Many police officers are just too big to get in and out of these compact cars. This is especially true under emergency conditions. And once an officer is in the car, he just does not have the room that he had in the standard-sized vehicle. This may result in decreased comfort and productivity. Also, it is very difficult to place a prisoner with his hands handcuffed behind him into a compact car. Another disadvantage is that the compact car does not provide enough room for all of the electronic and other equipment that a patrolman needs to have available. While some studies indicate that smaller cars have a somewhat lower accident rate, most studies indicate that in an accident, especially with a larger car, the compact car occupant stands a higher chance of being injured. Finally, most compact cars available today do not have the high performance characteristics found in larger vehicles.

# The Compact Car

## ADVANTAGES

- FUEL ECONOMY
- ACQUISITION AND REPLACEMENT COST
- MAINTENANCE COST
- BETTER MANEUVERABILITY
- AVAILABLE TODAY

## DISADVANTAGES

- LIMITED INTERIOR SPACE
  - INGRESS/EGRESS
  - COMFORT/PRODUCTIVITY
  - PRISONER SPACE
- LIMITED EQUIPMENT SPACE
- HIGHER PROBABILITY OF INJURY IN ACCIDENT INVOLVING LARGER CAR
- LOWER ACCELERATION/SPEEDS

## THE LONG-TERM SOLUTION

While today's compact car can serve as a short-term solution, its inherent disadvantages make a better long-term solution desirable. Two approaches that appear to offer long-term solutions will be discussed. The first approach is to build a police patrol car with its body specifically configured to meet the unique needs of the police while maintaining the same weight as a compact car. The second approach is to build a drive train for a police car that has dual modes of operation - an economy mode which would be utilized for most police activity, such as patrol, and a high performance mode which would be available when required for the infrequent needs of emergency response. Each of these approaches can be used independently of each other. The use together, however, is complimentary and offers the optimum long-term solution.

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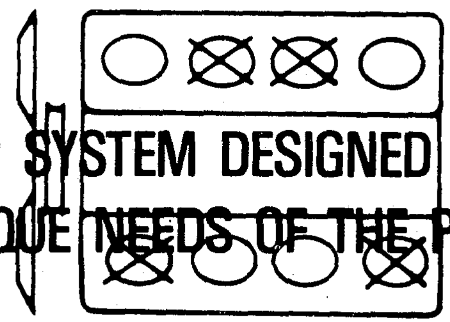
# The Long-Term Solution

- BODY CONFIGURATION DESIGNED TO MEET THE UNIQUE NEEDS OF THE POLICE



- DRIVE TRAIN SYSTEM DESIGNED TO MEET THE UNIQUE NEEDS OF THE POLICE

# ALTERNATE BODY CONFIGURATION STUDY

To determine the practicality of building a lightweight vehicle designed specifically for police use, a study on "Alternate Body Configuration" was undertaken. The objective of the study was to develop and assess body design concepts for significant weight reduction potential and improved human and equipment interfaces. Three subcontracts were awarded to provide unique and independent conceptual designs. The subcontractors were: Autodynamics Corporation of America, Pioneer Engineering and Manufacturing Company, and AMF Incorporated Advanced Systems Laboratory. Next, comments were obtained from the police community and from automobile manufacturers on the resultant design concepts. And finally, we have recommended a prototype which we believe to be the most practical. We have tentatively determined the cost of producing such a vehicle and have recommended a time-table for its construction.

# Alternate Body Configuration Study

- OBJECTIVE
  - DEVELOP AND ASSESS BODY DESIGN CONCEPTS FOR SIGNIFICANT WEIGHT REDUCTION POTENTIAL AND IMPROVED HUMAN AND EQUIPMENT INTERFACES
- APPROACH
  - THREE SUBCONTRACTS AWARDED TO PROVIDE UNIQUE CONCEPTUAL DESIGNS
    - AUTODYNAMICS CORPORATION OF AMERICA
    - PIONEER ENGINEERING AND MANUFACTURING COMPANY
    - AMF INCORPORATED, ADVANCED SYSTEMS LABORATORY
  - OBTAIN COMMENTS FROM POLICE COMMUNITY AND AUTOMOBILE MANUFACTURERS ON RESULTANT DESIGN CONCEPTS
  - RECOMMEND PROTOTYPE PRICING AND CONSTRUCTION

# ALTERNATE BODY CONFIGURATION EVALUATION

The findings of the "alternate body configuration" study are summarized on the facing page. The principal result is that interior space in excess of that available with today's full sized sedans can be obtained at weights comparable to compact sedans and at costs approximately 20% higher than compact sedans. Three of the concepts merit construction of prototypes: the AMF new concept, the Autodynamics concept and the AMF minor modification of a Dodge Aspen two-door. The prototypes should be presented to the police community for evaluation prior to operational test of a small fleet of twenty.

# Alternate Body Configuration Evaluation

W-00353

| | AUTO DYNAMICS | AMF | | | PIONEER | NOVA | PLYMOUTH GRAN FURY |
|---|---|---|---|---|---|---|---|
| | | NEW | MOD ASPEN | MINOR MOD | | | |
| HEAD ROOM FT/RE | 41.0/36.5 | 43.1/ | 38.5/ | 37.5/ | 40.0/59.0 | 39.5/36.5 | 38.9/38.0 |
| LEG ROOM FT/RE | 42.5/39.0 | 42.2/ | 42.2/ | 42.2 | 43.0/39.0 | 41.7/36.3 | 42.5/58.8 |
| SHOULDER ROOM | 60.0/60.0 | 57.0 | 55.8/ | 55.8/ | 56.0/56.0 | 56.6/56.7 | 64.0/63.8 |
| HIP ROOM | 60.0/60.0 | 57.4/ | 57.4/ | 57.4/ | 56.0/52.0 | 55.9/46.4 | 59.3/59.7 |
| OVERALL LENGTH | 171.0 | 194.5 | 194.5 | 197.5 | 196.0 | 196.7 | 22.2 |
| HEIGHT | 63.0 | 59.0 | 58.8 | 58.8 | 57.0 | 54.3 | 54.3 |
| WEIGHT | 3204 | 3908 | 3978 | 3998 | 3325 | 3720 | 4700 |
| COSTS | | | | | | | |
| ONE PROTOTYPE | 400,000 | 455,000 | 188,000 | 102,000 | 295,000 | — — | — — |
| TWENTY PROTOTYPES | 30,000 | 72,000 | 29,400 | 18,000 | 20,000 | — — | — — |
| PRODUCTION TOOLING | | 70,000,000 | 21,000,000 | 7,200,010 | 2,500,000 | — — | — — |
| PRODUCTION UNIT COST | 4,700 | 4,150 | 3,900 | 3,700 | 4,800 | 3,900 | 5,300 |
| FEATURES | INTERIOR SPACE REPAIRABILITY 4-DOOR | INTERIOR SPACE 3-DOOR | MODERATE CHANGE 3-DOOR | MINOR CHANGE 3-DOOR LOW COST | MINOR CHANGE 4-DOOR LOW COST | AVAILABLE | AVAILABLE |

# DUAL-MODE DRIVETRAIN DEVICES FOR POLICE PATROL VEHICLES

The routine police patrol consists largely of cruise, light acceleration, idle and other low-power modes of engine operation. However, because of the occasional need for high power in emergency situations, the police usually procure a high-performance engine. This conventional engine design compromises low-power fuel economy for high maximum power output capability. There are several concepts which offer the best of both worlds -- fuel conservation in a low-power mode and high-power output in a high-power mode. The following concepts were investigated: supercharging*, two-stage carburetion, two-stage fuel injection, water injection, bi-level drive ratio*, variable-cylinder engine*, module engine* (Wallis Concept), variable camshaft timing and dual fuel system. These concepts were reduced to four (those with asterisks) for detailed evaluation.

# Dual-Mode Drivetrain Devices for Police Patrol Vehicles

- ROUTINE PATROL DUTY CYCLE CONSISTS LARGELY OF CRUISE, LIGHT ACCELERATION, IDLE, AND OTHER LOW POWER MODES OF ENGINE OPERATION
- CONVENTIONAL ENGINE DESIGN COMPROMISE LOW POWER FUEL ECONOMY FOR HIGH MAXIMUM POWER OUTPUT CAPABILITY
- DRIVETRAIN MODIFICATIONS TO CONSERVE FUEL IN LOW POWER DEMAND MODE WITH OPTION FOR HIGH POWER OUTPUT APPEAR POSSIBLE

## CONCEPTS INVESTIGATED

- SUPERCHARGING
- TWO-STAGE CARBURETION
- TWO-STAGE FUEL INJECTION
- WATER INJECTION
- BI-LEVEL DRIVE RATIO
- VARIABLE-CYLINDER ENGINE
- MODULE ENGINE (Wallis Concept)
- VARIABLE CAMSHAFT TIMING
- DUAL FUEL SYSTEM

# DUAL MODE

The results of the dual mode studies are summarized on the facing page. The principal finding is that such developments are feasible and would be cost effective for police use. Two urban use concepts with maximum three year payoff are 1) the high compression supercharger with water injection and 2) the valve controlled variable cylinder (8 or 4 cylinders operating) engine. Prototypes of these two concepts should be constructed and field tested. The bi-level drive ratio is helpful only in highway patrol applications. Savings of 152 million dollars can be realized if implemented on all police patrol vehicles.

# Dual Mode

| DUAL MODE CONCEPT | PERFORMANCE | | ECONOMICS OF IMPLEMENTATION | | |
|---|---|---|---|---|---|
| | MODE OF MAXIMUM BENEFIT | PERCENT FUEL ECONOMY IMPROVEMENT | COST FOR DEVELOPMENT OF EXPERIMENTAL PROTOTYPE | UNIT COST IN PRODUCTION (a) | YEARLY SAVINGS IN COST OF FUEL (b) |
| SUPERCHARGING | | | | | |
| ● REDUCED COMPRESSION ENGINE | URBAN | 13 | 100,000 | 400 | 290 |
| ● WITH WATER INJECTION | URBAN | 25 | 130,000 | 550 | 500 |
| BI-LEVEL DRIVE RATIO | HIGHWAY | 12 | 20,000 | 300 | 270 |
| VARIABLE-CYLINDER ENGINE | | | | | |
| ● VALVE-CONTROLLED | URBAN | 18 | 50,000 | 150 | 380 |
| ● CARBURETOR-CONTROLLED | URBAN | 13 | 40,000 | 80 | 290 |
| MODULE ENGINE | URBAN | 34 | 200,000 | 1,000 | 590 |

(a) 50,000 UNITS/YEAR

(b) REFERENCED TO CURRENT CONSUMPTION (5,000 GAL./YR./CAR ASSUMED)

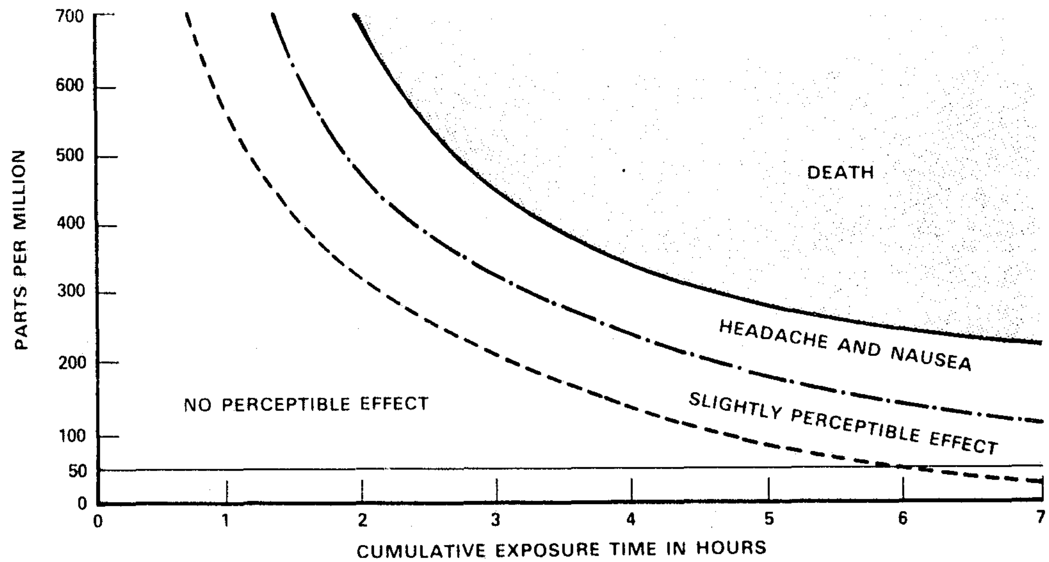
## THE CARBON MONOXIDE PROBLEM

In addition to achieving advantages in weight and in drivetrain systems, there are several independent and specific concepts that will be utilized in the police patrol car improvement program. One such concept is carbon monoxide sensing. The extent of the carbon monoxide hazard to patrolmen is not clearly defined. We are aware of the serious cases where officers were killed or seriously incapacitated, but we do not know the effect of exposure in lesser concentrations. To determine this exposure level as well as to warn the patrolman of dangerously high concentrations, carbon monoxide sensors are being evaluated. The most convincing theory for police car susceptivity to this problem is that their exhaust systems are often damaged when the police car jumps a curb or otherwise "bottoms out". It is possible to design the exhaust system to prevent such damage, but in the short term it is difficult to convince major automobile manufacturers to make such a major design change.

W-00494

# The Carbon Monoxide Problem

- APPROXIMATELY 6 SERIOUS CASES REPORTED IN 1975
  - BALTIMORE
  - COLORADO
  - NEBRASKA
- UNKNOWN IMPACT ON DAY-TO-DAY PRODUCTIVITY
- DAMAGED EXHAUST SYSTEM




## POTENTIAL SOLUTIONS

- EXHAUST SYSTEM DESIGNED TO PREVENT UNDERCARRIAGE DAMAGE
- MORE FREQUENT INSPECTIONS
- CARBON MONOXIDE MONITORING DEVICES

## COMMENTS

- MAJOR DESIGN CHANGE
- IMPOSSIBLE TO ANTICIPATE ALL FAILURE MODES
- A NECESSARY ELEMENT IN ALL SOLUTIONS
- EXPENSIVE
- MASS PRODUCTION AND NEW TECHNOLOGY MAY BRING COST DOWN
- WILL PROVIDE BETTER PROBLEM DEFINITION DATA

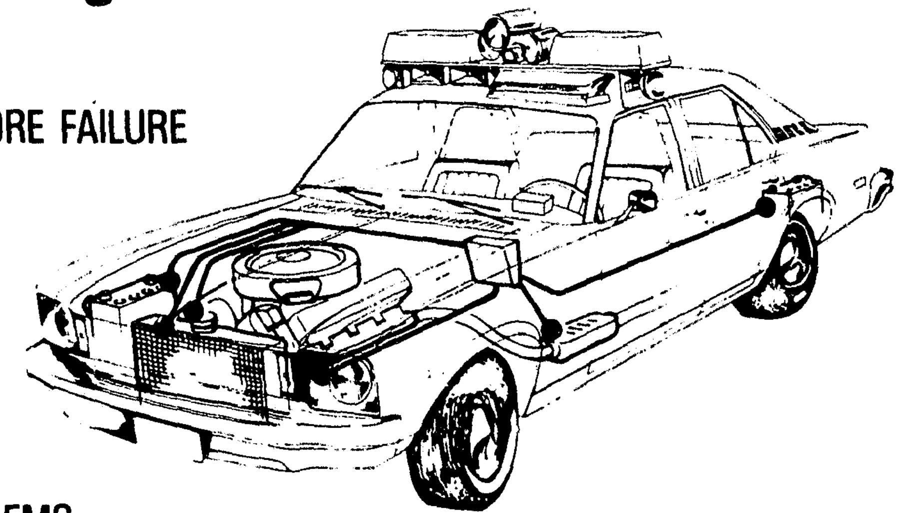
FEDERAL OCCUPATIONAL HEALTH AND ENVIRONMENTAL STANDARD 50 PARTS PER MILLION - AVERAGE OVER 8 HOUR SHIFT

## VEHICLE DIAGNOSTICS

The use of vehicle diagnostics can offer significant advantages in economy, safety, and productivity. From the standpoint of economy, one can develop a maintenance policy which is less expensive than a total preventive maintenance program while avoiding the hazards of a drive-until-break program. From the standpoint of safety, the patrolman will always know the status of his vehicle. He will be able to anticipate many dangerous conditions and take corrective action. From the standpoint of productivity, there are two important advantages. First, maintenance can be scheduled so that a patrolman will have minimum downtime. Second, because the diagnostics will also provide data on the vehicle activities, research can be conducted into how to improve patrol productivity. The functions monitored can be "yes or no" discrete signals or quantitative measurements. Functions which are quantitative measurements can include coolant temperature, engine oil pressure, engine oil temperature, transmission oil temperature, fuel flow, catalytic converter output temperatures, etc. Discrete signals that can be monitored include car door open or closed, siren on/off, tire pressure low, officers restraint system buckled up, etc. Both the quantitative measurements and the discrete signal status can be monitored from the police car or from the base station at police headquarters.

# Vehicle Diagnostics

W-00492



- ANTICIPATES MAINTENANCE PROBLEMS BEFORE FAILURE
- PROVIDES MAINTENANCE DEPARTMENT WITH DAILY PRINTOUT OF VEHICLE STATUS
- ALERTS DRIVER AND/OR DISPATCHER OF ABNORMAL VALUES
- IDENTIFIES INHERENT VEHICLE DESIGN PROBLEMS

### DIRECT MEASUREMENT FUNCTIONS

ITEM

COOLANT TEMPERATURE
ENGINE OIL PRESSURE
ENGINE OIL TEMPERATURE
TRANSMISSION OIL TEMPERATURE
SPEEDOMETER
ODOMETER
TACHOMETER
BATTERY VOLTAGE
FUEL FLOW
FUEL LEVEL
FUEL TOTALIZER
EXHAUST TEMPERATURES
  CATALYTIC CONVERTOR INPUT
  CATALYTIC CONVERTOR OUTPUT
CARBON MONOXIDE CONCENTRATION

### YES/NO OR ON/OFF DISCRETE SIGNALS

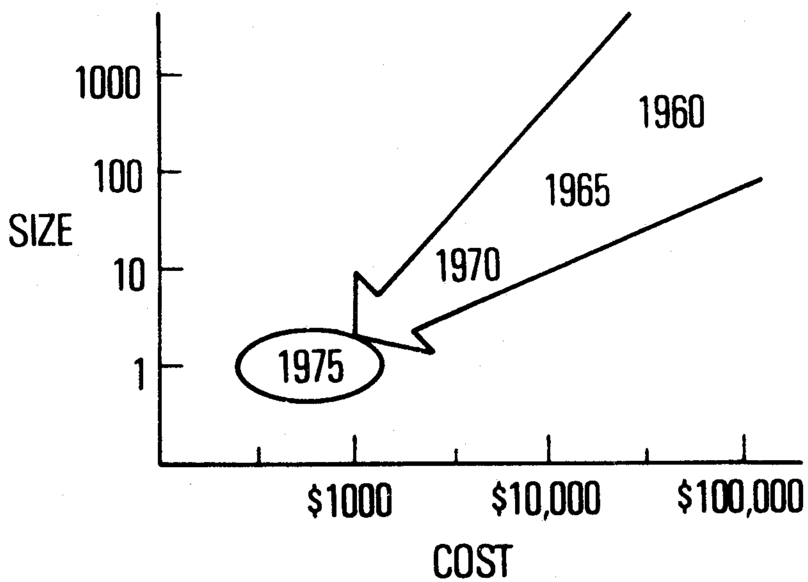
- OFFICER(s) SITTING IN CAR
- CAR DOOR OPEN OR CLOSED
- OFFICER(s) RESTRAINT SYSTEM BUCKLED UP
- TIRE PRESSURE LOW
- ENGINE RUNNING
- BRAKE SYSTEM
  - BRAKE PEDAL DEPRESSED
  - ANTI-LOCK BRAKE SYSTEM ENABLED
  - ANTI-LOCK BRAKE SYSTEM FUNCTIONALLY READY
  - ANTI-LOCK BRAKE SYSTEM MODULATING BRAKES
- HEADLIGHTS ON/OFF
- SIREN ON/OFF
- WARNING LIGHTS ON/OFF
- COOLANT LEVEL OK/LOW
- BRAKE PADS OK/WORN THIN
- HANDS FREE COMMUNICATION SYSTEM IN USE

## MICROPROCESSOR TECHNOLOGY

The rapid advance in computer technology in the last few years, and especially the reduction in cost and size of the equipment, has provided many possibilities for enhancing the patrol function. The development of the microprocessor has made it possible to put a traditional computer in a patrol car. Such a capability will enable the automatic monitoring of many vehicle functions. It will enable the reduction of menial tasks, allowing the patrolman to perform his intended job. And it will allow flexibility in adapting to new developments in procedure and technology.

# Microprocessor Technology

## HISTORICAL TRENDS




## IMPACT FOR THE PATROL FUNCTION

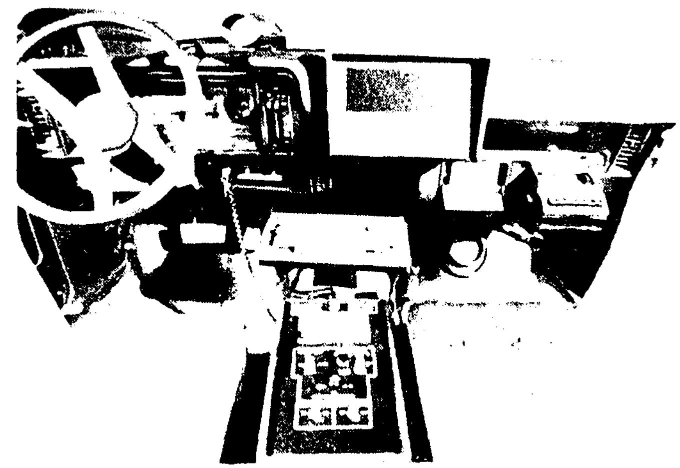
- AUTOMATIC MONITORING OF MANY FUNCTIONS
- ACCESS TO LARGE VOLUME OF STORED DATA
- REDUCTION OF MENIAL TASKS
- FLEXIBILITY IN ADAPTING TO CHANGES IN OPERATIONS AND EQUIPMENT TECHNOLOGY

IMPROVING PATROL PRODUCTIVITY

More specifically, the use of the microprocessor will allow the officer to use his time more effectively by providing him with information when he needs it and by performing for him certain routine functions. For instance, he will be able to access a data base of stolen vehicle license numbers without dispatcher assistance. This reduces the amount of communications congestion, provides data more rapidly, frees the dispatcher for other functions, and encourages the patrolman to run more license checks. Another example is the use of automatic reference of roll call data. In many police forces, the officers attend roll call before going on duty. Using the microprocessor and data transfer capabilities, the roll call can be conducted while the officer is in the patrol car and beginning his patrol function. Just by eliminating the roll call function, we can achieve an eight percent improvement in an officer's productivity.

W-00489

# Improving Patrol Productivity



- DIRECT DATA BASE INQUIRY, WITHOUT DISPATCHER ASSISTANCE
- HARD AND/OR SOFT COPY OF DISPATCH MESSAGES
- AUTOMATIC REFERENCE OF ROLL CALL DATA
- COMPLETE REPORT PREPARATION FOR LATER AUTOMATIC LOGGING/PRINTING
- STORAGE OF MESSAGES WHEN OFFICER NOT IN CAR
- ACCESS TO COMMUNICATIONS AND DATA WHEN OFFICER OUT OF CAR
- RECORDED CONVERSATIONS VICTIM/SUSPECT WITNESSES
- VEHICLE MALFUNCTION AND MAINTENANCE REQUIRED ADVISORIES
- GENERATION OF DATA BASE FOR OPERATIONS ANALYSIS
- IMPROVED EMERGENCY STATUS REPORTING
- CONTINUOUS BASE STATION MONITORING/CONTACT
- MONITORING OF VEHICLE SENSORS

# HAND-HELD TERMINALS

The use of a hand-held terminal which the patrolman can carry when he leaves his patrol car will enable him to maintain full voice and digital communications with another officer in the car or with the dispatcher at headquarters. The hand-held terminal will greatly expand the range of activity that the patrolman could engage in when remote from the patrol vehicle. For instance, using the digital communications features of the hand-held terminal, he could conduct a search for stolen property by remotely accessing an in-car data file of serial numbers of stolen items or could use the in-car data system to relay his request for information to a headquarters computer. Similarly, he could request information from a wanted person or stolen motor vehicle file. The patrolman can also use the voice communications capability of the hand-held terminal during interviews with witnesses or questioning of suspects. This information can be relayed directly to headquarters or a permanent record made by use of a voice recorder located in the patrol car. The hand-held terminal offers a quick and effective means for requesting assistance in an emergency situation. By depressing a single button on the terminal, the officer is identified and the fact that he needs immediate help is automatically brought to the attention of the dispatcher at headquarters.

W-00488

# Hand-Held Terminal

## APPLICATION

- OUT-OF-CAR COMMUNICATIONS CAPABILITY
- DIRECT (one button) EMERGENCY ASSISTANCE REQUEST
- REMOTE DATA BASE ACCESS
- REMOTE INTERVIEW

# AUTOMATIC VEHICLE LOCATION SYSTEM

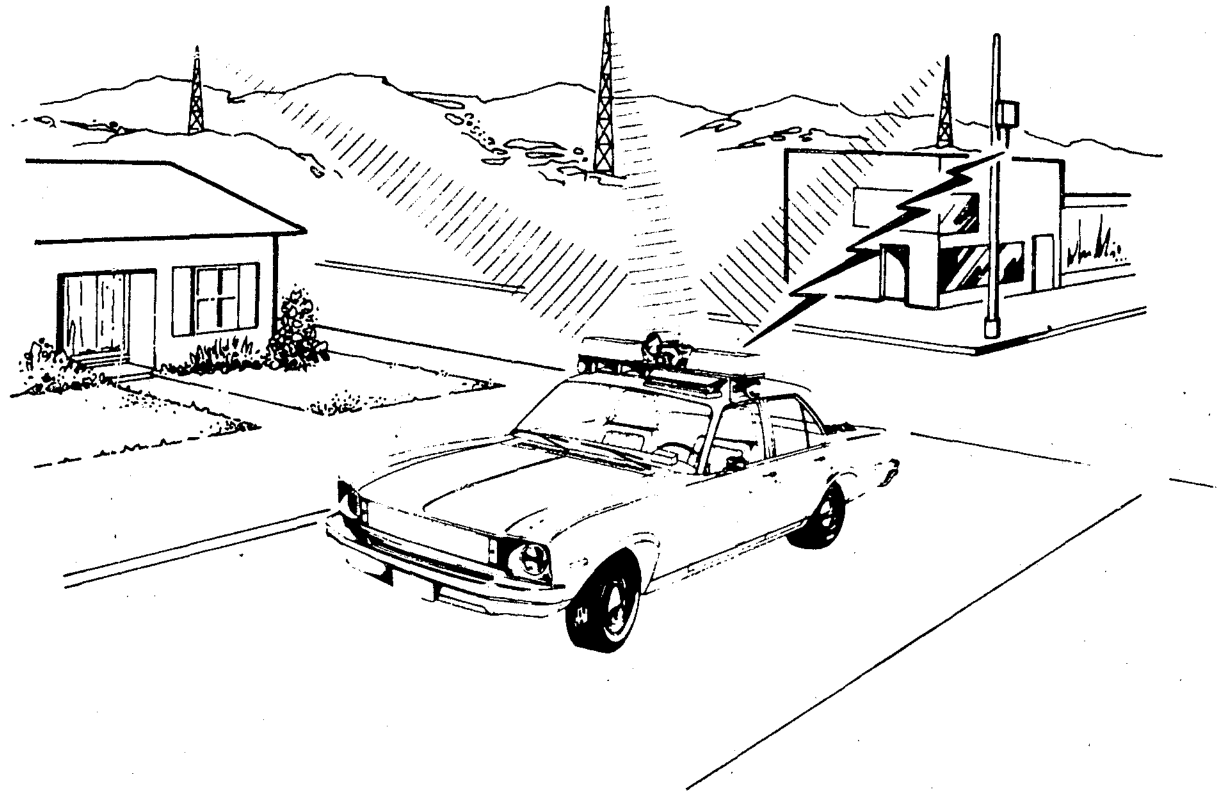
The use of an automatic vehicle location system will provide significant productivity benefits. LEAA research has resulted in the availability of a low-cost vehicle location system which relies upon the signals from existing AM commercial radio stations to determine the vehicle location. By being able to constantly know the location of a patrol vehicle, one will be able to reduce the complaint response time because the patrol car nearest the scene can be assigned. The assignment function could be performed by a computer as well as by a dispatcher. Also, because the location of all patrol vehicles will be constantly known, search and patrol patterns can be better conducted and verified. The patrolman in trouble need not manually report his location; he would merely push an emergency "officer needs help" button and his precise location is immediately available to his backup units. And finally, this data can be made available to the research community for research into how to make patrol more effective.

W-00490

# Automatic Vehicle Location System

## CONTINUOUS REAL TIME VEHICLE POSITION DATA

- DECREASED COMPLAINT RESPONSE TIME
- BETTER COORDINATION OF SUSPECT SEARCH PATTERNS
- FASTER BACK-UP RESPONSE
- VERIFICATION OF PATROL PATTERNS
- BETTER RECORDS TO ASSESS VALUE OF PATROL PATTERNS



**ACCURACY WITHIN 50 FEET**

# COST BENEFITS COMPARISON

The facing page illustrates the cost comparison between today's standard police patrol car and a proposed lower-weight police patrol car. The proposed vehicle is an alternative which utilizes a body designed specifically for patrol operations, but which does not utilize a dual mode drive system. Acquisition costs are amortized over the useful life of the item acquired to provide the per-year increase in cost or the per-year savings. The acquisition cost of a compact is some $1500 less than a standard size car. Assuming three-year life, the use of compacts result in a savings of $500 per year. The per-unit acquisition cost of the new body design is some $2100. Spreading this over three years results in an increased cost of $700 per year. Thus a compact sized car with a special body design results in a net increased cost of $700 less $500, or $200, per car per year over the standard police patrol car. The proposed electronic equipment will cost an additional $5000. This equipment is expected to have a ten-year life; resulting in a cost increase of $500 per year. Significant annual savings should be achieved in fuel cost - $1650 per car; in car maintenance - $260 per car; and in the reduction of accidents and injuries - $100 per car. However, we anticipate an increased cost in the annual maintenance of the electronic equipment in the order of $300 per car. The improvements to the police patrol car are expected to produce an estimated 10% increase in officer productivity, which represents a savings of $2500 per year. The net savings for the low-weight police patrol car is thus estimated to be $3500 per car per year. The net potential savings, on a national basis, is about one-half billion dollars per year.

# Cost Benefits Comparison

| | AVERAGE YEARLY | |
|---|---|---|
| | INCR. COST | SAVING |
| ACQUISITION – COMPACTS | | $ 500 |
| ACQUISITION – EQUIPMENT | $ 500 | |
| FUEL | | $ 1650 |
| MAINTENANCE – CAR | | $ 260 |
| MAINTENANCE – EQUIPMENT | $ 300 | |
| PHY. DAMAGE/INJURY | | $ 100 |
| PRODUCTIVITY | | $ 2500 |
| NEW BODY | $ 700 | |
| | NET SAVINGS | $ 3500 |

THE ANNUAL SAVINGS POTENTIAL FOR 160,000 PATROL CARS IS $500 MILLION

## THE FIELD TEST PROGRAM

An important aspect of this program is to see how well these new concepts work in the real world. Can they stand up to the police environment? Will patrolmen use them? In order to determine this, a standard police package compact car was selected to field test these concepts. One such car has been so equipped and it is available today for demonstration. Because of time and budget constraints, the alternate body concepts and dual mode drive systems are not yet utilized. Twenty vehicles similar to the one available today will be built in the latter part of this year. Ten of these vehicles will be field tested by the New Orleans Police Department and ten will be field tested by the Dallas Police Department. The field test will be of six-month duration. The test will be conducted and evaluated by professionals that have no vested interest in the hardware being evaluated. The test will also provide valuable statistics on patrol car performance, use, and operations. Such statistics are virtually nonexistent today. Further valuable data on the extent of training and maintenance problems will also be obtained.

W-00279b

# The Field Test Program

IDENTIFY
SPECIFIC
PROBLEM AREAS

1975

IDENTIFY
AVAILABLE SOLUTIONS
(off the shelf technology)

1976

**FIELD TEST SOLUTIONS**
OPERATIONAL ENVIRONMENT

1977

DISSEMINATE RESULTS

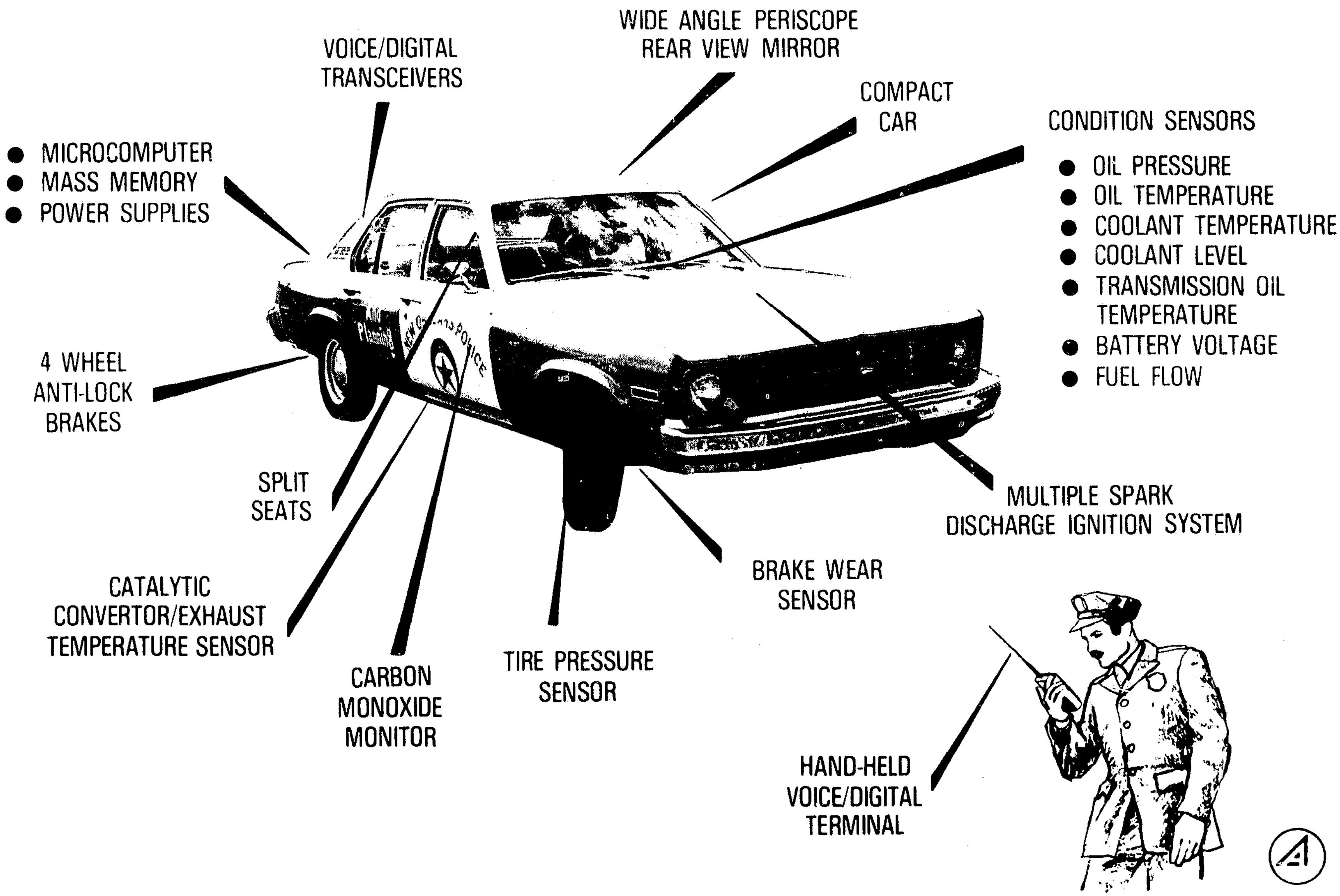
- POLICE COMMUNITY
  - PROCUREMENT RATIONALE
- INDUSTRY
  - NEW IMPROVED PRODUCT LINES

## PROGRAM IMPLEMENTATION

The car shown is the Chevrolet Nova in the standard police configuration. It has been equipped with the capabilities discussed earlier as illustrated on the facing page, and is the prototype for twenty vehicles that will be field-tested next year in New Orleans and Dallas. An important point to be made is that we are not advocating this car as a perfect police car. What we are trying to do is to evaluate the effectiveness of each of the concepts discussed. What we really have developed is a mobile test bed which can be used to evaluate many separate and independent concepts and devices.

W 00390

# Program Implementation



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