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For Immediate Release

THE GMH RESEARCH VEHICLE

THE HOLDEN HURRICANE, CODE NAMED RD 001

An experimental aerodynamic wedge shaped mid-engined car less than 40" high with a unique power elevating cockpit canopy mechanism has been designed and built by GMH.

Brilliant metallic orange in colour and code named RD 001, the two passenger research vehicle incorporates many advanced ideas in car design including oil cooled disc brakes, a Pathfinder highway route system and a closed circuit television rear vision screen.

It is powered by an experimental V8 engine developed by GMH, which is positioned forward of the rear axle.

The Research and Development section of the Engineering Department at the GMH Technical Centre, Fishermen's Bend, designed this research vehicle to study design trends, propulsion systems and other long range developments.

The vehicle has no doors. Instead an electric swing forward canopy combines with power elevator seats, to allow passengers to step nearly upright into the car at armchair height. At a touch of a switch, occupants are lowered 10" to a semi-reclining position beneath a roof that closes down above them.

Latest wind tunnel experience in automotive aerodynamics is incorporated into the wide stance chassis and low swept body of RD 001.

The low profile fibreglass body is finished in an experimental aluminium flake based metallic orange. The passenger compartment which includes twin astronaut-type contour seats is trimmed in black vinyl.

The RD 001 is a joint effort of styling and engineering to peer into the future and see what the vehicle of tomorrow might be like.

EXTERIOR

The exterior lines of the RD 001 are functional and simple. The sleek aerodynamic profile is a direct result of wind tunnel tests, giving efficient airflow and stability.

All the openings and access panels have a definite purpose for engine cooling and passenger air conditioning.

The fixed position headlamps are concealed to preserve a smooth, uninterrupted front end appearance. Panels on the rounded fender contours automatically depress to bring them into view when the headlamps are switched on.

CONSTRUCTION

The fibreglass body which is mounted on a steel box section perimeter frame is in three sections:

1. A canopy which tilts up and forward over the front wheels to allow passenger access.
2. An engine hood which pivots up and back over the rear wheels, and which can be completely removed for major service.

3. A body shell which is mounted to the perimeter frame with rubber insulated mountings. The body shell is recessed into the chassis frame, thus lowering the body and gaining the added side protection from the frame.

INTERIOR

The passenger compartment is designed along the lines of a cockpit and the interior is padded for safety and comfort.

To enter the passenger compartment the canopy pivots up and forward over the front part of the body to provide adequate entrance room. This movement is effected by hydraulic rams connected to a pivoting linkage. The steering column also pivots upwards and forwards and both seats raise 10" making it easier to get in and out. All these systems are electro-mechanically powered and sequentially timed so that the canopy opens and steering column rises before the seats elevate.

As a safety feature the car cannot be started until the canopy is locked down, seats fully lowered and driver's seat belt secured. The seat belts are a fully retractable reel type which automatically lock in any position, ensuring the correct tension.

The two "astronaut" type form fitting seats are built as one unit and the back rests are extended up to the canopy providing a full head restraint. The foot pedals and tilt-telescopic steering are fully adjustable, giving the driver complete choice over his control position. These features make it possible to have a fixed seating arrangement.

The seats are separated by a console which houses the main instruments. The controls are designed to allow the driver to concentrate maximum attention on the road. Major instruments such as the speedometer and tachometer are of "Electronic Digital Readout" type for instantaneous

comprehension. Warning lights immediately tell the driver of major malfunctions and keep him informed of the vehicle's condition.

Control buttons for head and parking lights, interior lights and instrument panel dimmer switch are located in the roof panel which also contains a loop antenna for the station-seeking radio.

Rear vision is provided by closed circuit television. To obtain a wide unobstructed rear view, a small television camera with a wide angle lens is installed at the rear of the car and the picture is transmitted to a screen in the console. A photocell automatically adjusts the camera to ensure a clear picture under all conditions during day or night. The television has no separate switch as it is turned on with the ignition.

The Comfortron air conditioner used in the RD 001 incorporates an automatic temperature control, allowing the driver to pre-set any desired temperature between 65 and 85 degrees. This temperature is then automatically maintained regardless of outside temperatures. The Comfortron is a fully integrated system designed as part of the car.

A major innovation is the Pathfinder, an automatic route indicator system. Magnetic signals picked up from road senders are compared with a coded tape containing instructions for the shortest highway route to any desired destination on a freeway network.

The driver receives advance notice of forthcoming turns from a panel mounted in the centre of the dash. For straight ahead driving a central green arrow is illuminated. Should a right or left turn be needed, a warning buzz will alert the driver and an amber arrow will be illuminated one road before the turn is required, a red arrow to show that the turn is required on the next road available.

POWER TRAIN

The RD 001 is a mid-engined rear wheel drive vehicle. The location of each major mechanical component has been carefully selected to obtain the best weight distribution and vehicle control balance. The engine is set forward of the rear axle, driving through a clutch to the transmission at the rear, and in turn the transmission is connected to the rear axle positioned between clutch and transmission. The power is provided by an experimental GMH designed V8 engine which features a 4 barrel carburettor. All four forward gears have synchromesh and are operated by a console mounted lever.

Operating on an entirely new principle, the oil cooled front disc brakes are completely free from fade and require no pad changes. The kinetic energy of the vehicle is directly converted to heat in the oil, which is then dissipated through separate individual cooling systems for each front brake. Rear brakes are conventional 11.75" diameter single piston discs. A common brake pedal operates the independent circuits.

The rear brake lights, sequentially operated traffic indicators and back-up lights are all of dual intensity, bright in daylight with reduced output at night, thereby eliminating excessive glare.



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HOLDEN HURRICANE
TECHNICAL INFORMATION

STYLING

The styling of the Hurricane is functional and simple. The sleek aerodynamic profile is a direct result of wind tunnel testing to achieve efficient airflow and stability. The vehicle has a very low drag coefficient, thus minimizing air resistance as well as maintaining a good uniform downward pressure force on the vehicle.

The Hurricane features a low graceful wedge-shaped profile, with smooth contours and sleek lines uninterrupted by unnecessary protrusions. All body openings have a definite purpose and provide for good engine cooling and passenger air conditioning requirements.

The experimental orange exterior paint finish of an anodized aluminium flake base was used to obtain the brilliance and light characteristics desired.

BODY

Dimensions

Length	161.8 ins.
Width	71.0 "
Height	39.2 "
Dry Weight	2250 lbs.
Wheelbase	96.0 ins.
Front Track	55.0 "
Rear Track	55.9 "

Construction

The body is constructed of fibreglass to give greater versatility to the design

and to allow revisions to accommodate future experimental work. It is envisaged that the car will be continually revised to evaluate new ideas and methods.

The fibreglass body consists of three main units:

1. The body shell is a one piece self supporting integral unit, incorporating the normally separate items - such as underbody, body side sills, front and rear bulkheads, front wheelhouses, and the whole nose section of the body. This unit is attached to the frame by seven rubber insulation mounts, and two cantilever mounts to the front bumper.

The underbody has a centre tunnel to accommodate gear shift mechanism, fuel lines and electrical wiring. This tunnel also provides additional strength. To further stiffen the structure, the underbody and rear bulkhead are contoured around the seats. The body shell is recessed into the chassis frame, thus lowering the body and gaining the added side protection from the frame.

2. The canopy comprises of the whole upper portion of the body, back to the rear bulkhead. The windshield is perspex, however, a new safety glass screen using polycarbonate material is under development and will replace the present screen when fully developed.
3. The engine hood is a one piece fibreglass cover, enclosing motor, transmission, drive shafts and wheels. For minor service the hood may be pivoted rearward, held by an inbuilt stay. For major service, the whole hood may be lifted off by removing two bolts.

Entry

Ease of entry is achieved by raising the canopy and pivoting it forward over the front part of the body to provide adequate entrance room. At the same time the steering column also pivots upwards and forwards and the seats are raised 10", thus making it easier to get in and out.

Canopy and steering column are electro-hydraulically actuated and seat operations are electrically powered. In case of failure of any of the circuits a manual canopy release is provided. The circuits are sequentially timed, i. e. canopy and steering column move out of the way prior to seats lifting. The car cannot be started unless seats are in fully lowered position, canopy is closed and driver's seat belt is fastened.

Interior

Cockpit Seating

The passenger compartment is of the "cockpit" type, fully padded and fitted with two seats integrated into a common fibreglass shell, separated by a console which houses the main instruments. The back-rests are extended up to the canopy to provide adequate head restraint. The seats are pivoted at the front and rise 10" on an electric ball-bearing screw to provide easier entrance and exit. The handbrake is positioned in the centre of the seats and rises with them.

The foot pedals are fully adjustable fore and aft over six inches. This movement is effected by an electrically driven ball-bearing screw - controlled from a button on the centre console.

The energy absorbing steering column has a tilt/telescopic action: this, together with the adjustable pedals, gives the driver complete choice of his control position. With these features it is possible to have a fixed seating arrangement, thus ensuring safe and secure seat and seat belt attachments.

Self-Adjusting Seat Belts

The self-adjusting seat belts are a fully retractable reel type, bolted securely to the chassis frame. These belts lock automatically to provide a comfortable and safe fit of the correct tension to persons of various sizes. The lap and sash belts are latched independently giving the user a choice of either lap or lap/sash combination.

The driver's lap belt is linked electrically to the ignition ensuring the car cannot be started until the belt is secure. All belts are linked to the seat and canopy motions ensuring that these cannot be operated while the belts are attached. This protects the driver from injury when the seats rise with the seat belts still attached.

Instrumentation

The vehicle is designed to allow the driver to concentrate maximum attention on the road. For this reason, major instruments are digital readout for instantaneous comprehension, and warning lights are provided to draw attention to major malfunctions.

In the centre of the cockpit is a console which contains a closed circuit television rear view screen and gauges to cover various functions. Air conditioning controls, gearshift lever and control switches are also in this area.

The speedometer and tachometer are of "Electronic Digital Readout Type" and located in the area immediately in front of the driver. Four warning lamps to advise of failure of the headlamps, tail and parking lamps, stop lamps and turn lamps are also contained in this area together with warning lights for other major controls.

In the roof panel are control buttons for head and parking lights, interior lights and instrument panel dimmer switch, also a loop antenna for the radio.

The automatic station-seeking radio and air conditioning outlet are alongside the driver with a similar outlet beside the passenger.

Closed Circuit Television Rear View

Rear vision is provided by closed circuit television. A small television camera with an extra wide angle lens is installed in the rear of the vehicle to provide a wide unobstructed rear view. The picture is transmitted to a screen mounted on top of the central console of the driver's compartment. A photocell automatically adjusts the camera to maintain a clear picture under all lighting conditions.

The use of closed circuit television has resulted in a much wider angle of rear vision than is usually possible in conventional cars.

Automatic Temperature Controlled Air Conditioning System

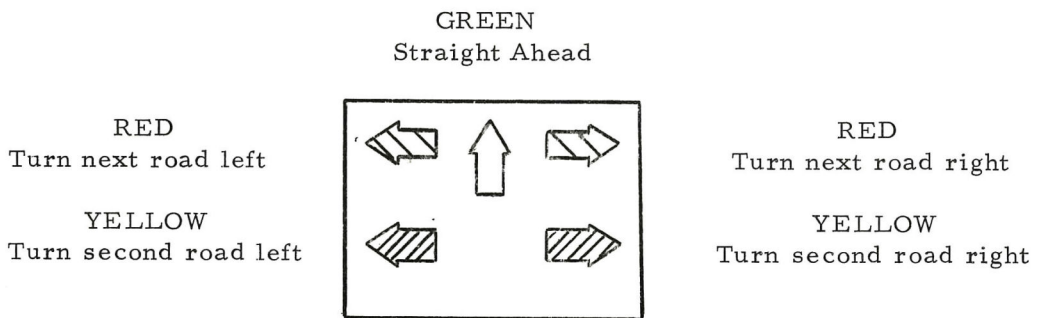
The Comfortron air conditioning system was designed as an integral part of the Hurricane.

The system eliminates interior windshield misting thus providing maximum visibility. Controls mounted on the console are comprised of temperature selection, demist air and an additional fan output for increased air flow if desired. A temperature sensor in the driving compartment automatically controls the cooling and heating systems to maintain the temperature at any setting between 65 and 85 degrees. This unit reduces driver fatigue by maintaining a comfortable cabin temperature under all weather conditions.

Pathfinder Automatic Route Finder

The Pathfinder is an experimental system for directing the driver to his desired destination by the shortest possible route on a freeway network.

The Pathfinder magnetically codes signals picked up from magnetic sending units in the road lanes and compares them against instructions electronically stored on punched tape containing directions for the shortest route to a desired destination.



The driver receives advance notice of forthcoming turns and other normal manoeuvres from a panel mounted in the centre of the dash panel. For normal straight ahead driving, the green indicator in the centre is illuminated. Should a right or left turn be required, a warning buzz will alert the driver and the appropriate instruction will appear on the indicator panel.

Sequential Turn Indicators

The four outermost lamps on each side of the rear of the car are arranged to flash in sequence from the innermost lamps outwards. The outermost amber lamp is lighted for a period approximately twice that of the innermost lamp. The system is controlled by a small solid state control unit.

InstrumentsOn Dash Panel:

Speedometer)
) Electronic Digital Readout
 Tachometer)

Pathfinder Control Panel

Warning Lights -

Ignition
 Main Beam
 Seat Belt
 Canopy Lock
 Handbrake
 Low Fuel

Failure Lights - (Indicating failure of following circuits)

Headlights
 Tail Lights
 Brake Lights
 Direction Signal Lights
 Loss of Brake Fluid
 Fire Danger - Engine Comp.

On Console:

Closed Circuit TV Rear Vision Screen
 Engine - Oil Temperature
 Engine - Oil Level
 Engine - Oil Pressure
 Fuel - Pressure
 Fuel - Level
 Water - Temperature
 Volts
 Amps

On Console cont'd.

Engine Vacuum
Inside Temperature
Outside Temperature
Brake Fluid Reservoir Level
Radiator Water Level
Electronic Clock

Air Conditioning:

With automatic temperature control

Radio:

Automatic station-seeking, located on the
driver's right. The loop antenna is
integrated into the canopy.

Comfort Items:

Ash receiver/cigar lighter
Interior lighting - canopy operated

MECHANICAL DESIGN

In the mechanical design of the Holden Hurricane, extensive use of computers was made to analyse the front and rear suspensions geometries, steering linkage mechanisms and for the stresses in all major mechanical components.

CHASSIS

The mechanical layout comprises a mid-engine and rear wheel drive installation with the location of each major mechanical component carefully selected to obtain the best weight distribution and vehicle control balance.

Wide front and rear wheel tracks and a low centre of gravity provide characteristics required to ensure good handling.

The forward of front wheels location of steering linkage provides a precise, accurate and light steering system.

FRAME

The car features a main frame of welded high tensile steel box section perimeter type construction. A tubular steel auxiliary space frame with an anti-roll bar is incorporated, which also carries a steel fireproof bulkhead.

The main side rail sections are connected with crossmembers, and mounting brackets are provided for installation of front and rear suspensions, steering mechanism, power plant and body assembly units. The front end is designed to provide maximum protection for the passenger compartment.

The complete frame design was made versatile to provide for future investigations in chassis suspension design.

FRONT SUSPENSION

Independent coil spring ball jointed suspension, drag strut, S. L. A. (Short and Long Arm) type with the coil springs mounted on lower control arms. The direct double acting shock absorbers are mounted in the front crossmember. To conserve space the front crossmember is utilized to provide a fluid reservoir for the front brakes.

The drag struts connect each lower control arm to the frame mounted pivot brackets to positively control the front wheels. Rubber bushes at the frame mountings permit a controlled degree of flexibility to absorb road forces applied at the wheels. The lower arm pivots are adjustable to enable studies to be made on the effects of variations in wheel alignment.

Good camber characteristics can be obtained by maintaining a constant wheel to road angle and minimum track change. Improved cornering and handling are thus obtained from the maximum tyre to ground contact area. The anti-dive control is obtained by inclining the inner, lower and upper control arm pivots to reduce nose dive under braking.

REAR AXLE, REAR SUSPENSION AND DRIVE LINE

Fully independent coil spring swing axle rear suspension, with trans-axle differential assembly and 4-speed transmission mounted to engine assembly. The locus of each wheel is established by three links; double universally jointed axle drive shaft and lateral strut, with trailing control arm pivoted at frame side rail.

The car is supported at the rear on coil springs mounted to each lower control arm and damped by double acting telescopic shock absorbers located rear of the rear wheels.

The pivot axes are inclined to eliminate acceleration squat, lift and tramp, and the trailing arms are proportioned against wheel hop during braking. As in the front suspension, the lower link pivots are adjustable to enable studies to be made on variations to suspension geometry.

The rear axle is of semi-floating type with straddle mounted hypoid gear. The differential carrier contains hypoid gear with overhung pinion gear, supported by two taper roller bearings. Hypoid gear ratio 3.27:1.

STEERING

Manual steering, recirculating ball nut type, 24:1 ratio. The three link, parallelogram type steering linkage is mounted forward of centreline of front wheels to provide deflection understeer characteristics for improved handling and safety. The linkage geometry is designed to reduce wheel fight and shake and to provide light, precise and responsive control.

The energy absorbing column with tilt and telescopic head provides 3" of longitudinal and 25 degrees of angular adjustment. The steering wheel and column are attached to the dash section of the canopy with plastic energy absorbing, break away ferrules, and swivels with the canopy to improve ease of entry. The column also incorporates a theft proof steering and ignition lock.

The 13" diameter safety padded steering wheel requires a maximum of 3 turns from lock to lock. The horn actuating mechanism is built into the inside of the steering wheel rim and operates by squeezing the hand.

WHEELS AND TYRES

Wheels: 15" diameter, 6" wide front, 8" wide rear, safety wheel rims

Tyres: Front - Dunlop R7 500 N15 tyres, width 8.9 in.

Rear - Dunlop R7 600 N15 tyres, width 10.8 in.

Five studs and nuts are provided for attachment to front and rear axles.

BRAKES

The braking system is a dual circuit, front oil cooled multi-disc brake and rear ventilated double faced disc brake system. The mechanically actuated parking brakes are integrally cast with each rear brake.

Front Brakes:

The front brakes are oil cooled multi-disc brakes compatible with high performance work and which also eliminate pad changes and fade. The multi-disc design is extremely compact and much lighter than a drum brake of similar capacity.

The brake operates on the principle of four fixed plates to which is bonded a brake facing surface and three rotating plates sliding on a splined surface on the wheel hubs. The whole unit is encased in an aluminium alloy housing attached to the steering knuckle. The clutch plates are actuated by means of a large diameter piston applied by hydraulic pressure through a master cylinder using hydraulic oil. The kinetic energy of the vehicle is directly converted to heat in the oil, which is then dissipated through the individual brake cooling radiators.

The cooling system is based on a wheel driven pump element in the brakes which circulates oil through two separate oil cooler radiators for each front brake. A common oil reservoir used as a heat sink is located in the front cross member.

Rear Brakes:

Double faced cast iron ventilated disc brakes spaced by integrally cast cooling passages (11.75 in. in diameter). Swept area is 230 sq. in. The calipers are single floating piston with a piston diameter of 2.938 in.

Braking Ratios:

Pedal	4.5
Hydraulic - Front	8.5
Rear	5.8

Braking Ratios cont'd.

Overall - Front	38
Rear	26

Distribution of Braking Ratio:

Front	50%
Rear	50%

Master Cylinder:

Twin bores, 1" diameter both for front and rear brake systems.

Foot Pedal Travel:

3½", pedal position adjustable - 6" travel.

Parking Brakes:

Type - Drum, cast integral with each rear cast iron vented disc, internal expanding shoe, mechanically actuated.

Control - Lever, mounted in centre console with flexible cable and conduit connections to each rear wheel.

Drum Diameter - 6.5"

Brake Lining: 2 shoes per each rear wheel, total lining area 34 sq. in.

ENGINE

The engine is an experimental Holden designed V8 of 253 cu. ins. (4.146 litres) mounted forward of rear wheels in order to obtain balanced weight distribution. Gross Brake Horsepower is 260 b. h. p. developed at 6,000 r. p. m., and gross torque is ~~155~~ ²⁶⁰ lbs. ft. developed at 3,800 r. p. m.

The engine is an overhead valve, crossflow head of over-square design of 3.625 in. bore, 3.062 in. stroke and compression ratio of 10.0:1. A special high lift camshaft in conjunction with solid cam followers is fitted to increase torque output for higher performance. The camshaft and ancillary units are driven by a neoprene rubber, fibreglass reinforced toothed belt.

The engine incorporates closed positive crankcase ventilation incorporating a pressure control valve and provides for air conditioning compressor installation. The engine features an external oil pump and filter installation.

Fuel is supplied from a submerged electric pump in a poly-foam lined fuel tank to a 4 barrel automatic choke carburettor. The accelerator control is by hydraulic servo system connected to the pedal.

Estimated performance figures are:

0 - 30 m. p. h.	2.0 sec.
0 - 45 "	3.5 "
0 - 60 "	5.3 "
0 - 75 "	7.5 "
Standing quarter mile	13.0 "

Engine Cooling

The engine cooling system consists of a radiator mounted on the left side of the engine and a belt driven fan incorporating a thermostatically controlled fan clutch.

The water pump, located on the right side of the engine, is driven by the camshaft toothed belt and supplies water to the cylinder block through the inlet manifold to the radiator.

An auxiliary circuit connected to the pump inlet, provides a heat source for the air conditioning system.

Location of the ancillary services, such as radiators, fan alternator and water pump to the side of the engine, enabled a reduction of power plant length to 24.2 in. and enabled a short wheel base to be obtained.

TRANSMISSION

Manual 4 speed transmission located at the rear of the differential carrier, synchromesh on all forward gears, close coupled gear box.

Ratios:

First	3.11
2nd	2.20
3rd	1.47
4th	1.00
Reverse	3.11

Transmission controls are of tubular rod and universal joint construction, located in the central duct and operated by a console mounted gearshift lever which contains electrical position indicators.

CLUTCH

Conventional Belleville spring type, with 10" diameter driven disc. Cast aluminium clutch housing with integral hydraulic cylinder for clutch fork operation. Clutch controls are hydraulic with vacuum assist.

FUEL TANK

Located in the nose of the car, urethane foam lined $9\frac{1}{2}$ gallons capacity, incorporating a submerged electric fuel pump and electric "fluid head" type contents transmitter.

EXHAUST SYSTEM

Cast iron exhaust manifold connected to twin resonators. Extension type tail pipes are mounted within rear grille.

ELECTRICAL AND ACCESSORIES

Battery

60 amp. hour heavy duty, lead acid in polypropylene case.

Front Lamps

4 headlamp system, 2 double filament and 2 single filament Halogen quartz iodine bulbs. (4 on for full beam, 2 outer lights for dipped beam.)

Headlamps are concealed and protected by an electrically operated cover when not in use, which automatically open and close as the headlamps are operated.

White turn signal and parking lamps located under bumper. White side marker lamps.

Rear Lamps

8 brake and stop lights located in top of engine hood, arranged in two banks of 4, separated by a reflector.

Direction signal flashers and parking lights on each side of vehicle - sequential flashing operation.

Red side marker lights.

Two back up lamps are mounted symmetrically behind rear engine hood grille.

Note: All brake, park and turn signal lamps are of dual intensity - bright in daylight and reduced output at night to reduce glare.

Horns

Dual tone mounted - behind headlights - operation by squeezing horn contact strip built into inside of steering wheel rim.

MAJOR SAFETY FEATURES

The safety features are individually detailed below, but a highlight of the vehicle's design is the recognition that the primary safety features of road holding, handling and braking are a vital part of overall safety and for this reason the vehicle has been designed to investigate the best possible road holding and handling characteristics.

Cockpit Safety Features

1. Energy absorbing steering column.
2. Tilt and telescopic steering column to suit the physical and comfort requirements of the driver.
3. Steering wheel incorporates safety padding and squeeze rim horn actuation.
4. Fixed seats - automatic adjustable movable pedals with 6 in. travel to suit physique of driver, allows best seat belt design.
5. Full height seats incorporate head restraint.
6. Self-adjusting seat belts interlocked to ignition, car cannot be started when seat belts are not fastened.
7. Canopy and engine hood interlock with ignition, car cannot be started if not fully closed.
8. Closed circuit TV rear view screen supplies wide angle rear vision.
9. Electronic - quick read - digital speedometer and tachometer.
10. Shielded anti-glare instruments.
11. Failure warning lights for all main lighting and signal systems.
12. Engine compartment fire danger warning.
13. Automatic air conditioning reduces driver fatigue, eliminates interior windshield misting thus promoting maximum visibility and maintains uniform cabin temperature through thermostatic control.
14. Theft proof steering and ignition lock.

Mechanical and Body Safety Features

1. Two complete separate disc brake systems - operated from common brake pedal.
2. Integral roll bar for passenger compartment.
3. Integral Hypalon microcellular urethane energy absorbing front bumper.
4. Steel, fireproof, bulk head and fibreglass insulation isolates passenger compartment from engine bay.
5. Surge proof urethane foam lined fuel tank.
6. Dual intensity brake and turn signal lights for bright day operation and non-dazzle night operation.
7. Directional indicators have sequential operation and are mounted for maximum visibility and safety.
8. Recessed wheel hubs and caps.