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1994 DESIGN & ENGINEERING AWARDS

Best Products, Designs And Ideas Of The Year

Popular Mechanics

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And that gives you far better accuracy, increased projectile velocity and added strength. It is all but impossible to blow that barrel up.

You'll find hammer-forged rifling in the barrel. You get better accuracy, higher velocity and added strength.



special significance. And the reasons for that dura-

bility take on a special

importance in deciding whether

Glock is the pistol to buy.

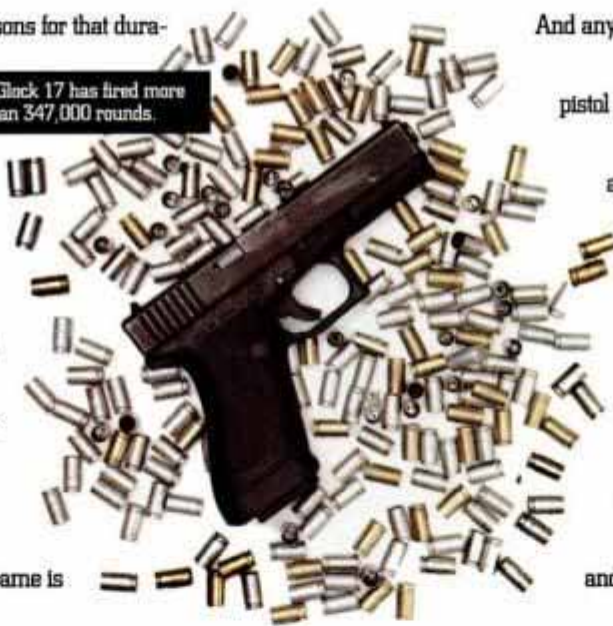
There are very few parts in a Glock. So it follows, fewer parts wear out or break. About those

parts that do exist: the polymer frame is

durable, lightweight and helps reduce recoil. It can't corrode.

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cisely the moment they need

them. Even if it's the kind of mo-

ment that seems to last forever.



The steel slide on a Glock is

Tennifer treated. It can't rust.

The barrel features hammer-



The Tenifer treatment on the steel slide is virtually as hard and strong as a diamond.

Popular Mechanics®

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NO. 1



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EDITOR'S NOTES

• You've heard President Clinton mention it. You've read about it in news magazines. They talk about it all the time on the TV news shows. Now understand it by reading our cover story on the information superhighway. Five hundred TV channels? Interactive TV? A combination TV-telephone? Yes, all that and more as our lives are changed by the great telecommunications revolution that will sweep the world in the next 10 years. Since it was founded in 1902, POPULAR MECHANICS has chronicled—and explained—the great technological changes that have taken place through the ages. So you would expect PM to take the lead in explaining this newest sector of a changing world to our readers. And that's exactly what we're doing. We've committed new resources and personnel to covering—and explaining—the telecommunications revolution to our readers as it occurs. Our pledge to you is to ensure that you continue to be the best informed reader in the world. . . . Our annual **Design & Engineering Awards** always cause a stir and we don't think this year will be an exception. Usually, you agree with most of our selections of the best new products, designs and innovations, but you always have some ideas of your own regarding some of our choices. Check out this year's winners, then let me know what you think of our picks. . . . **Detroit Editor Jim Dunne** is generally



World's greatest spy photog.



Even the Behring building is art.

regarded as the world's greatest auto spy photographer. Car manufacturers have actually put up fences, planted trees and bushes and erected walls to keep Dunne's long lens from capturing advance shots of future products. But those measly obstacles are no match for our intrepid reporter, as you'll read in Dunne's account of some of his greatest adventures in the pursuit of a scoop. "I Spy" begins on page 52. . . . I recently had the opportunity to finally visit the beautiful Behring Auto Museum (3700 Blackhawk Plaza Circle, Danville, CA; (510) 736-2277), and I must say the wait was worth it. The Behring facility treats the cars within its walls as works of art, pieces of rolling sculpture. Even the building itself is a beautiful work of art. If you love classic cars, I highly recommend a visit. . . . I was sorry to note the recent passing of Gen. James H. Doolittle. We recounted the well-known World War II heroics of Jimmy Doolittle in "Thirty Seconds Over Tokyo" in our November 1992 issue. What is lesser known, however, is the fact that Gen. Doolittle was a lifelong friend—and reader—of POPULAR MECHANICS. In his autobiography, "I Could Never Be So Lucky Again," he credits articles he read as a boy in 1909 issues of POPULAR MECHANICS as inspiring him to pursue a career in aviation. Rest in peace, Gen. Doolittle. Till next time.


Joe Oldham

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PM HOTLINES

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DRIVE A BETTER CAR

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LETTERS

Last Chance To See 'Possible Dreams'



Recently I was in Dearborn, Michigan, to see the "Possible Dreams" exhibit at the Henry Ford Museum. This exhibit is creative, colorful and stimulating to eye and ear. Also stimulated were the many visitors, myself included, who were, I believe, surprised to see and understand the history of creative innovation in our country and the world. I'm biased, of course, as my sister, Mary Seelhorst, was one of the creative forces involved. Congratulations to your publication on such an investment in education.

DONNA LUNDEEN
PITTSBURGH, PA

Wow, I can't believe all of the things that I saw in your exhibit! I never knew that shoes like the Reebok pump sneakers were actually around in the 1920s. Yikes, I thought that the '90s were really advanced. Thanks for showing me differently—I learned more today than in a history class.

NICOLE M. RASHID
GROSS POINTE, MI

I particularly liked the quotes from people of

many years ago—some of the predictions have come true, while others were off the mark. I chuckled at the quote about how auto racing would cease because it was too dangerous!

JUDI SMOLINSKI
NASHUA, NH

Boy, was I impressed. The exhibit brought back a lifetime of memories. It represents something very important in America: the ability to dream, create, make and build to completion and success. Your action is especially meaningful at a time when so many sound values seem to be disappearing in America. I salute you in your excellent exhibit. You have helped make the Henry Ford Museum a *living* museum—showing how technology can personally enrich our lives.

ROBERT M. KELLEY
KETTERING, OH

I left the museum exhibit with a stronger appreciation for POPULAR MECHANICS magazine and the drama of human imagination and inventiveness.

STEVE BONI
ALLEN PARK, MI

The exhibit "Possible Dreams: POPULAR MECHANICS And America's Enthusiasm For Technology" will run through Jan. 9, 1994, at Henry Ford Museum in Dearborn, Michigan. For complete information about museum hours, admission fees, nearby accommodations and attractions, call (800) 343-1929.

People Kill

I just read Rick Johnson's objections to handgun ads in the December Letters column. He considers guns to be tools used to kill and, thus, terminated his subscription. I'm so sorry that he will be missing your marvelous articles about airplanes, tanks, submarines and cannons, as well. Meanwhile, I congratulate you and will or-

der a subscription to your magazine for my married daughter. She's on her way to compete in the Olympics—shooting for the United States, not killing anything.

A. POZZUOLI
CLIFTON, NJ

New Car Club

I would like to introduce you to the National Beretta & Z24 Owners Association. We are a new car club and would appreciate any help you could give us in getting our organization off the ground.

LARRY ASHCRAFT
MANAGEMENT DIRECTOR
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Letters are subject to editing for length, style and format.

Reader Project Of The Month



From l. to r.: Lori Dynes, Nicole Meyer and Stacey Crawford.

I thought you would appreciate an interesting application by three of my students using, as their basis, the canoe project that you ran in your May 1990 issue. I built the canoe myself, following your directions and adding a few modifications. When not in use, I have it hanging in the back of my classroom. This provides tangible incentive for students to realize that they can do anything they put their minds to. With a little advice and minimal assistance from me, they made a cellute—a cross between a cello and a lute.

RICHARD B. FARR
LAMAR JUNIOR HIGH SCHOOL
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TIME MACHINE

90 YEARS AGO: JANUARY 1904

Popular Mechanics

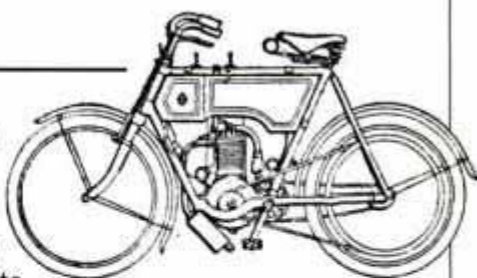


Nuke Roots

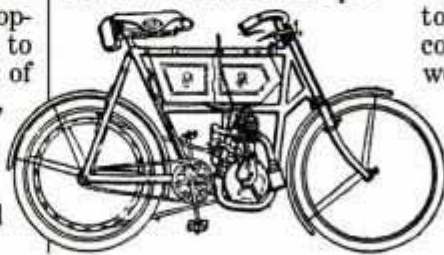
Radioactivity, for which the Curies shared the 1903 Nobel Prize, held the turn-of-the-century world in its glow. Radium, in particular, mesmerized chemists and charlatans alike. With its perpetual luminescence and curative yet lethal properties, radium seemed to harbor the very secrets of life and death. Jewelry, heating and lighting were proposed uses for the substance, of which only 3 pounds existed outside the Curies' labs.

Hog Heaven

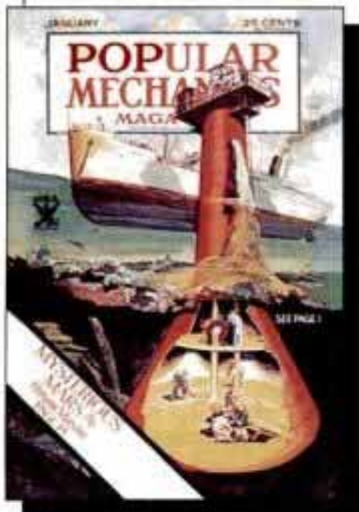
Motorcycles were becoming "as thick as horseflies" in Britain, where 120 manufacturers had recently swamped auto shows in London. Suspensions and brakes were pro-



gressing rapidly, as English manufacturers worked toward the durable but conservative designs that would dominate the industry after World War I. But the high seats and light frames showed that motorcycles had yet to roar away from their bicycle origins.

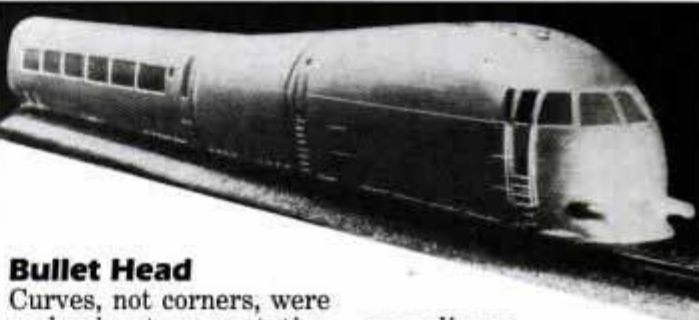


60 YEARS AGO: JANUARY 1934



Buried Treasure

Once again, salvagers were trying to extract \$12 million in gold and silver from *La Lutine*, an English warship that had sunk off the Dutch coast in 1799. Stormy waters had beaten back salvage crews before, as had the 40 ft. of sand beneath which the shipwreck lay. But this time a huge metal cone, like a wineglass inverted and forced into the water, would shelter workers. Inside, pumps would spit out sand as the cone ground its way down.

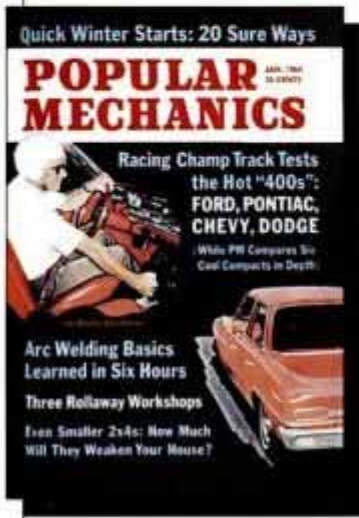


Bullet Head

Curves, not corners, were reshaping transportation as designers strove to shave away air resistance. Architect Norman Bel Geddes took the reins of the streamlining bandwagon. His blueprints for steam locomotives, cars and

oceanliners featured smooth arcs of sheetmetal. Meanwhile, the alloys that helped forge a vigorous aircraft industry were viewed as the tickets to lighter, faster ground transport.

30 YEARS AGO: JANUARY 1964



Wild Horses

The hills were alive with the sound of muscle cars as we brought four hot engines to Willow Springs Raceway in California. The cars: Plymouth Sport Fury, Pontiac Grand Prix, Chevrolet Impala Sport Coupe and Dodge Polara—each fresh off the production lines with more than 400 cu. in. beneath the hood and 1957 Indy champ Sam Hanks behind the wheel.

The Big Picture



As the New York World's Fair approached, exhibitors pushed cinematic technology to new extremes. The Port of New York-New Jersey, for example, surrounded an audience with a circular 13½-ft.-high screen. To film the 15-minute clip, a brace of 10 16mm cameras were operated through a 360° periscope. **PM**

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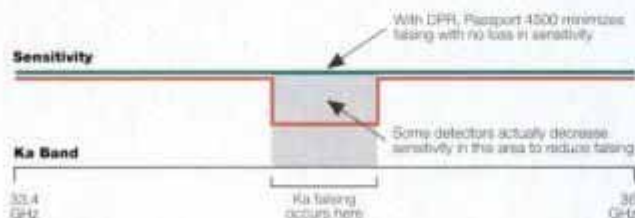


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Pedal-Powered Slot Cars For Future Commuters

WINNIPEG, CANADA—Do you cycle, drive or take mass transit to work? You could do all three at once on a human-powered transportation system called Skyway.

Proposed by KOR Product Design Inc., the system would comprise a network of lightweight tubes, made of aluminum and plexiglass, that snake their way between suburban depots and downtown-office parking complexes. Through these 2-way conduits would run fleets of bullet-shaped 80-pound pedal cars, shelled versions of today's recumbent bicycles.

In-tube fans would provide 10-mph tailwinds to cut down air resistance, while solid-rubber tires would race through metal slots. With these aids, commuters could reach cruising speeds between 35 and 40 mph. The tubes themselves would arc gently through elevations and turnouts to avoid taxing out-of-shape cyclists. Be-

neath the vehicle's front fairing, an air scoop would usher in a cooling breeze.

And for those accustomed to limousine travel, rickshaw-like driver vehicles could taxi one or two passengers to their destinations.

As in the personal rapid-transit systems now under development (see [Tech Update](#), page 17, Dec. '93), centralized traffic-management computers would detour vehicles through the network to avoid backups behind slow pedalers. The cars could also hook up in bumper-to-bumper car-

Skyway's human-powered vehicles would course through conduits at 35 mph. The pedal cars would weigh only 80 pounds.

vans to form efficient trains.

A 5-speed automatic derailleur, potentially under the control of the traffic-management computer, would keep pedaling rhythms even.

KOR reasons that a Skyway network, costing \$200 million for 100 miles of track, would pay for itself with a mileage-based user fee. The designers plan to complete the prototype vehicle early this year.

Highlights This Month

- **Watts And Water**—Homebuilt electric sternwheeler
- **Forward Progress**—China's fast-moving space effort
- **Hop, Skip And Jump**—Debut of the DC-X rocket
- **High Wings**—New stratospheric drones
- **Tomorrow's Benz**—Mercedes of the future
- **Retro Rocket**—New design featuring '60s tech
- **Blowing Again**—Rebirth of NASA's top wind tunnel

Editor/Writer: Gregory T. Pope
Reporters: Mike Fillon, Philip Chien, Scott Gourley,
Barry Rosenberg

Electric Wheeler

INDIO, CA—The Mississippi River has carried some idiosyncratic watercraft over the years, but none as freewheeling as the *Wandering Star*. Brainchild of Southern California inventor Jerry LaBine, the 45-ft. aluminum vessel will showcase homebuilt alternative technologies.

For one thing, *Star* will run on batteries. Its power sources: a photovoltaic array on its roof, a steam turbine driven by a solar concentrator and two submerged water turbines that turn with the river's flow.

A small paddlewheel will propel the boat, while four rudders will provide agility. Two of *Star's* pontoons will serve as heat exchangers to air-condition the cabin.

Star is slated for launch this spring on an expedition from the Gulf of Mexico to Grand Rapids, Minnesota.



Homebuilt riverboat combines all-electric drive with high-flotation pontoons.

FM ILLUSTRATION BY JEFF MANGIANT

AMRAAM Is SAM

CANOGA PARK, CA—Now a combat veteran, the Advanced Medium-Range Air-To-Air Missile (AMRAAM) is spawning a litter of surface-to-air offshoots.

This summer, the Norwegian army will begin fielding an air-defense system called NASAMS, which features AMRAAMs fired from standard F-16 rails inside launch boxes. Advantages include the ability to place the fire-and-forget missiles away from radar sites.

Meanwhile, Hughes Missile Systems is testing jumbo AMRAAMs. With rocket motors up to 10 in. wide, these ride as much as a 50% greater boost off the launch rail.

Giant AMRAAM (left) could make a mean SAM, while Norway already uses variant (right).



HUGHES PHOTOS



Robotic Wrecking Crew

PITTSBURGH, PA—It takes a unique mix of brawn and brain to clean up a nuclear facility. To that end, a robot named Workhorse—built but never used to clean up Three Mile Island—is serving as a testbed for a coming generation of intelligent decommissioning machines.

The 7-ft.-long robot swings a telescoping manipulator arm with a 25-ft. reach. Workhorse can demolish cinderblock walls, dismantle equipment, cut through steel pipes and pack nuclear waste into drums.

Carnegie Mellon University engineers, under DOE sponsorship, are developing supervisory-control protocols to enhance its remote operation. RedZone Robotics is collaborating.

Robotic Workhorse goes through its paces in nuclear-plant mockup.



CARNEGIE MELLON PHOTO

Synthetic Skin

CANTON, MA—Doctors report encouraging results from recent clinical trials of a new human skin replacement. Not only does the material take without triggering rejection, it replaces both the outer epidermal and inner dermal skin layers.

Known as Graftskin, the artificial tissue is a product of the biotechnology firm Organogenesis. It blends human dermal and epi-



Skin replacement combines human cells with cow-derived collagen.



ORGANOGENESIS PHOTOS

dermal cells with collagen—the protein that forms a fibrous framework for skin cells—from cows.

In clinical tests, Graftskin is treating chronic skin diseases, burns and deep wounds. Results show quick wound closure, accelerated healing, decreased infection and reduced scarring.

Great Leap Upward

XICHANG, CHINA—The Chinese space program is rapidly taking on sophistication and a broad range of capabilities. New variants of the Long March 3 will soon loft heavy communications and possibly reconnaissance satellites to geosynchronous transfer orbit (GTO), matching the lifting power of Western launch vehicles.

Right now, the Long March 3 can put 3300 pounds in GTO. The vehicle burns hydrazine and nitrogen tetroxide—the tried-and-true combo found in both Titan missiles and the Shuttle's maneuvering engines—to propel its two lower stages. Its upper stage runs on liquid hydrogen and liquid oxygen.

This year the Long March 3A will make its maiden flight, carrying a Chinese communications satellite. A beefed-up wide-body LM-3, the rocket will lift 5000 pounds to GTO. The even bigger 3B, with four strap-on boosters to boot, will be able to lob more than 10,000 pounds up to GTO, putting the vehicle in the same class as our Titan IV and Europe's Ariane 4.

Long March 3A will be China's Atlas equivalent, and a Titan counterpart is on the way.



Mars Needs Wheels

PASADENA, CA—The first vehicle to explore the Red Planet will be the 20-pound MFEX (Microrover Flight Experiment). **Rocker-bogie suspension will enable MFEX to surmount obstacles.**

Based on a Jet Propulsion Laboratory design called Rocky 4, the raccoon-size rover will off-road full-time on an articulating 6-wheel chassis.

MFEX is scheduled for a 1996 launch, bundled with the first Mars Environmental Survey lander.

Aeroflot America



MOSCOW, RUSSIA—Not only was Aeroflot's service indifferent, but the Russian airline used to fly on noisy, dirty engines and clunky avionics. But times have changed and so have the planes.

The long-range Ilyushin Il-96M is undergoing a major refurbishment. Pratt & Whitney is supplying PW2337 powerplants—flown on the Boeing 757—for the 4-engine transport.

Meanwhile, the Tupolev Tu-204 narrow-body is getting Rolls-Royce RB211-535E4 engines, also used for the 757.

New Western engines will reinvigorate Il-96M (top) and Tu-204.

Flying Cars From Flatbush

BROOKLYN, NY—The latest contender in the drive to fly an automobile is the Rapid One AMV, now developing under the wing of Rapid Research & Development.

The vehicle will run on a 240-horsepower Porsche engine with two transmissions. One will turn two rear wheels for road driving. The other will drive the compressors on twin ducted fan-jets for flying.



Folding-wing Rapid One AMV has proven concept in 1/3-scale model.



Il-96M is also getting a Rockwell-Collins electronic cockpit with six screens and three flight-control computers.

Nuclear Burper



RICHLAND, WA—A million gallons of radioactive waste fester in an underground tank. As the chemicals react, hydrogen builds up—along with heat. Every three months, the gas is vented in a potentially explosive burp.

It's a recipe for disaster at the problem-plagued Hanford Nuclear Reservation, the old weapons complex. But engineers have enlisted a 7-story pump to stir the tank's contents and let the hydrogen seep out gradually.

The device draws in liquid waste at the top of the tank and disperses it through the sludge at the bottom.

Enormous pump stirs radioactive slurry in waste tank to prevent explosive gas buildup.

Touring The Atom

MANCHESTER, ENGLAND—Nuclear physicists, who need some of the world's costliest gear, have learned to share their toys. Case in point: the globe-trotting gamma-ray detector known as TESSA, currently on a world tour of physics labs.

TESSA's spherical array of sensors upgrades older apparatus, in which single sensors sit right up next to the target.

Following a sojourn at Brookhaven National Labs, TESSA is currently touring Europe. A super-TESSA now under construction will feature 162 detectors.



Panoramic array of detectors allows physicists to track gamma rays with unprecedented precision.

Ups And Downs Of The DC-X



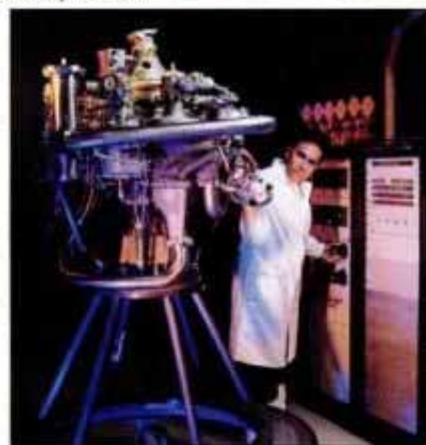
DC-X flew three times at White Sands Missile Range, launched and landed with RL-10A5 rocket engines.

WHITE SANDS, NM—Like a flying white carrot, the DC-X (see [Tech Update, page 15](#), Mar. '93) hopped, hovered, sidled through the air and landed last fall in three tests.

But, the 40-ft.-tall reusable rocket, developed by McDonnell Douglas for the Ballistic Missile Defense Organization, had only reached 1200 ft. when funding ran dry.

Experimenters had higher goals in mind, such as 30,000-ft. altitudes, somersaults and a 3-day turnaround time between flights. So far, the effort had demonstrated remote-piloting software, a small ground crew and Pratt & Whitney's throttleable RL-10A5 engines.

DC-X program managers want to proceed with a follow-on suborbital vehicle.

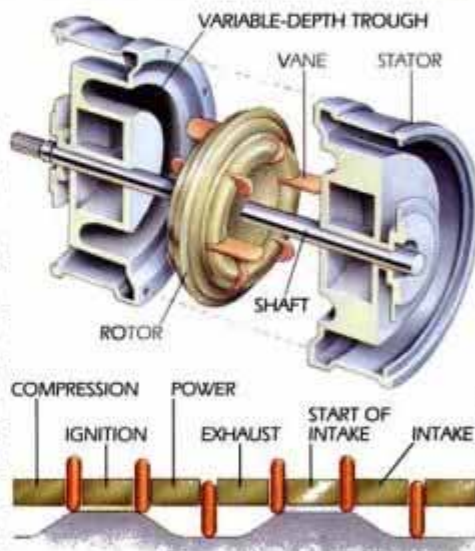


New Rotary In The Club

MORGANTOWN, WV—A new breed of rotary engine promises a high power-to-weight ratio with only seven moving parts.

Called the Rand-Cam/Direct Charge, the engine is now under development at West Virginia University. At its heart lies a rotor slotted with six movable vanes. As the rotor turns, the vanes slide up the hills and down the valleys of two flanking troughs. In doing so, they can escort volumes of gas that expand and compress in the internal-combustion cycle. The troughs house sparkplugs, fuel injectors and intake and exhaust ports.

So far the engine has worked in firings of several minutes.



Rand-Cam engine (top) features trough that, if laid out flat (bottom), would guide sliding vanes through combustion cycle.



Pathfinder (left) and Raptor/Talon (above) head for stratosphere.

types built under the Ballistic Missile Defense Organization's Raptor program (see Tech Update, page 21, Dec. '92).

balled machine, named Pathfinder, with solar panels. Its aim: to fly for weeks, spying on hostile tactical missiles.

The other, Raptor/Talon, flies on a 2-stage turbocharged Rotax engine. During low-altitude tests, a pilot straddled its nose. Scaled Composites built the craft. Its progeny are to carry Scud-busting missiles.

Soaring Scud-Hunters

EDWARDS AFB, CA—Two great mechanical condors cruised over the desert last fall. They're both proto-

One updates a battery-powered 100-ft. flying wing lofted in secret in 1983. AeroVironment Inc. refitted its moth-

America's Legal Spy Plane

OFFUTT AFB, NE—Under the Open Skies Treaty, signed in 1992, we can fly cameras over any part of any former Warsaw Pact nation (and they can do the same to us). The plane that carries the photo gear is the OC-135B, now operational.

Wright-Patterson AFB has fitted the veteran weather-recon bird with one panoramic camera and three framing cameras for low-altitude shots. Far from state-of-the-art spy sensors, they're commercially obtainable cameras available to anyone who signed the treaty. A GPS-based navigation system keeps the plane on stringently negotiated flight paths.



OC-135B can snap photos of military activity over any Open Skies Treaty signatory.



SWATH Ship For Scuba



Nekton allows divers to take the plunge from hydraulically lowered stern platform.

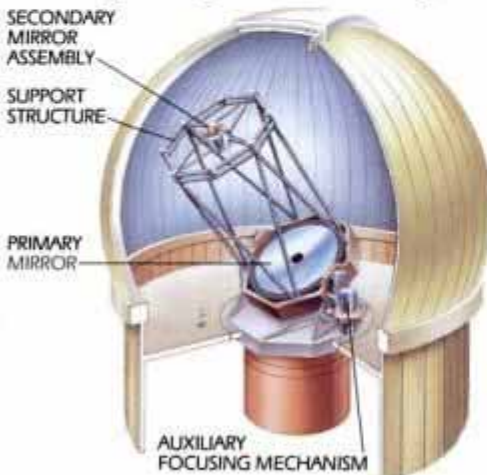
FORT LAUDERDALE, FL—As any landlubbing scuba buff will tell you, seasickness and diving don't mix. But a newly built live-aboard dive ship tames the waves with a twin-pontoon SWATH design.

Unlike the *Radisson Diamond* (see Tech Update, page 22, Sept. '93), the *Nekton Pilot* divides its two support struts into four, to trim the water-plane area. A light aluminum hull permits this minimal substructure.

Instead of dropping anchor on sensitive reefs, the *Nekton* will use bow thrusters to hold station dynamically during dives. Cruises begin this year.



Keeping Both Eyes On The Skies



Telescopes will feature thermally neutral structure to minimize turbulence.

TUCSON, AZ—As long as you're springing for one huge observatory, why not build two? That's the argument behind the Gemini project, which will train carbon-copy telescopes from Chile and Hawaii to cover the entire celestial sphere.

With a primary mirror 25 ft. across, each Gemini telescope will be smaller than the Keck Observatories. But designers are aiming for sharper pictures. One key technology: a composite support structure. The heavy steel normally used often radiates heat into the lightpath, muddying images.

The twin 'scopes, internationally funded, should open in 1998 and 2000, respectively.

Mercedes Of The Future

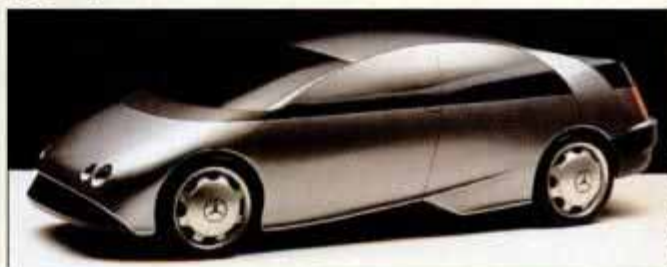
PASADENA, CA—Status symbols aren't what they used to be. Just ask the sedan-wearers executives at Mercedes-Benz, who recently sponsored a forward-looking project at the Art Center College of Design.

Students blue-printed more than a dozen designs. Not only do the vehicles share highly sculpted profiles, they incorporate features expected to appeal to luxury buyers of the future. Shown here are five shapes of Benz to come.

Jimmy Chow's sports car was envisioned as an affordable alternative to Mercedes' costly coupes, while Phil Tanioka styled a radical speedster with no front-end overhang and concealed wheels. The 2½-door utility, designed by Alec Tam, sports a combination ski rack/rollbar. David Shumate's 5-passenger minivan would burn compressed natural gas and target business leasers. And the sport sedan to its right, by John Schrenk, has doors dropping down to the rocker panel for easy access.



Top to bottom: Chow's sport coupe, Tanioka's radical roadster, Tam's miniature sport/utility, Shumate's CNG-fueled commuter van (left) and Schrenk's sedan (right).



Intelligence On Wheels

HANSCOM AFB, MA—One lesson of Desert Storm: Incompatible communications standards hindered the flow of combat intelligence among the different military services.

The Air Force is attempting to change that with its two new



Mobile Operational-Intelligence Open Systems Environment (MOOSE) vans. The 2½-ton vehicles are packed with electronic systems that can integrate intelligence data from various satellite and radio formats.

The MOOSE testbeds could also deploy as tactical operations centers in a crisis.

MOOSE's antlers are antennas to downlink intelligence data.

Superloader For New Airlifters

ROBINS AFB, GA—Getting materiel aboard cargo transports takes a small army of ground equipment. To speed future airlifts, the Air Force wants a

new loader capable of rolling 30 tons at a time into a waiting aircraft.

Called the 60K Loader, the vehicle will replace three existing machines. The huge diesel-powered transporter will outlift previous loaders by 10 tons and roll right into the cargo hold itself.

Teledyne Brown Engineering and Southwest Mobile Systems are building prototypes, one of which will be chosen this year.



New loader raises conveyor bed on hydraulic jacks and is air-transportable itself.



Rocket Glider From The '60s



Aeroballistic rocket combines plug-nozzle engines with lifting-body silhouette.

PALMDALE, CA—Looking like the lifting-body X-planes of the 1960s, an unmanned single-stage rocket could climb into orbit vertically, then land horizontally on wheels like the Shuttle. Lockheed's Skunk Works has designed such a reusable vehicle, sized to lift the load of a Titan IV.

The so-called aeroballistic rocket would ride on seven modular plug-nozzle engines arranged in a line. These engines also underwent extensive research and testing in the mid-1960s. In a plug-nozzle, expanding exhaust gases press inward against a tapered conical plug, rather than outward against a flared bell surface.

On descent, the vehicle would come in through the atmosphere like a duck to a pond, its nose up at a 45° angle, then flatten out to touch down on a runway. The unusual flight profile, combined with an underbelly contoured to shake off heat, would minimize the need for expensive heat-resistant materials.

Lockheed claims such a vehicle could drop launch costs below \$500 per pound.

Ol' Muddy's Big Tow

MOSS POINT, MI—The Army Corps of Engineers has a new flagship, the *Mississippi*. Built by Halter Marine, it's the biggest diesel towboat ever constructed in the U.S.

The 241-ft. vessel will range along the flood-shattered river, hauling barges filled with concrete mats to shore up riverbanks. Powered by three Caterpillar diesels, the *Mississippi* can tow or push up to 16 200-ft. barges.



Mississippi is Army Corps of Engineers' Mississippi queen.

Primo Pump For Shuttle

WEST PALM BEACH, FL—What if mechanics had to pull out your car's fuel pump every week for inspection? The Shuttle's fuel and oxygen pumps undergo virtually nonstop maintenance.

To minimize these interruptions, Pratt & Whitney has designed a low-maintenance oxygen pump with fewer welds and built-in portholes for fiberoptic inspection. First flight with the new pump is scheduled for 1995.



Improved high-pressure oxygen turbopump will reduce Shuttle engine maintenance.

NASA's Tunnel Of Love

MOFFETT FIELD, CA—It wasn't the biggest. It wasn't the fastest. But two generations of aerodynamicists considered it the best for sheer precision of airflow. Now the 12-Foot Wind Tunnel at NASA's Ames Research Center is undergoing a rebirth of sorts, as a new test shell rises from the foundations of the old.

Built in 1946, the previous tunnel tested the takeoff and landing characteristics of every commercial airliner in the sky. Unique among wind tunnels were its racetrack turns, which allowed air to flow into the

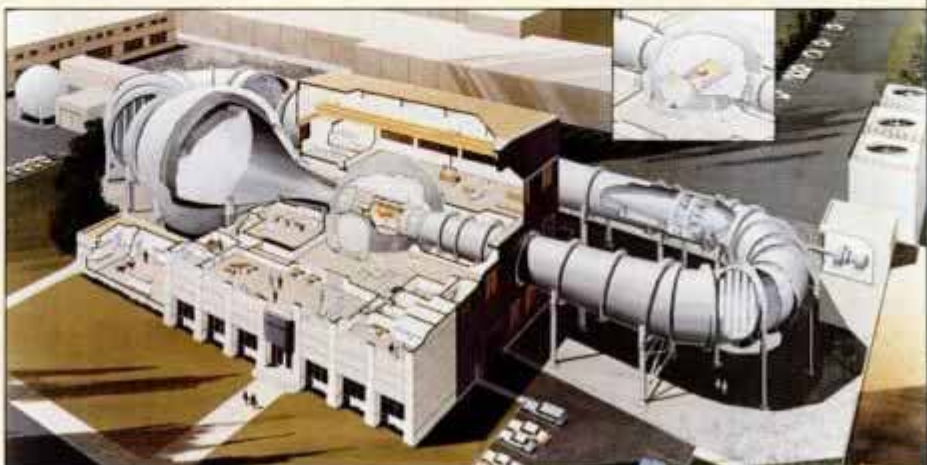
New tunnel will keep smooth racetrack turns that distinguished its predecessor.

test chamber along unruffled parallel lines. The new tunnel will have the same geometry, but several improvements inside.

For one thing, the tunnel will have an air-isolation system to avoid the

hours wasted discharging and re-pumping it between tests. A single-stage drive-fan compressor will also boost efficiency.

The big breeze will blow again in 1995.



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*Some features shown are optional. **3 years/36,000 miles. See dealer for details.

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1994 DESIGN & ENGINEERING AWARDS

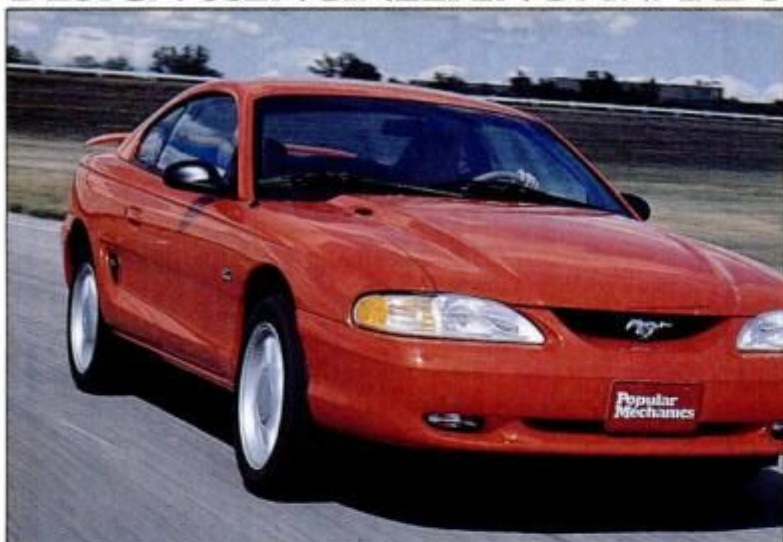
• The better mousetrap principle. It still holds true today. From giant corporations to the home workshop hobbyist, people are working to improve existing products and develop totally new ones.

Each year, our editors review thousands of new ideas, designs, innovations and developments for a POPULAR MECHANICS Design & Engineering Award. Nominations for awards are open to all. Anyone can submit any new product or innovation. The editors then evaluate the nominations based on their own expertise in their respective fields: automotive, science and technology, home improvement, boating, outdoors, electronics, telecommunications and photography.

The best of the best—be it an outstanding achievement or just ticklishly clever—are honored.

Join us in congratulating this year's winners and appreciating the significance of their achievements—each one a better mousetrap in its own way.

DESIGN & ENGINEERING AWARDS



FORD MUSTANG

Ford Division
Ford Motor Co.

No car has been as romanticized as the Mustang. When it first appeared in showrooms back in 1964, some dealers had to call police to hold back the crowds, and they were swamped with some 22,000 orders on the car's first day. The Mustang is that kind of car, consistently setting styling trends and performance standards for sporty cars for 30 years. The redesigned 1994 Mustang—with its stiffer chassis, optional 17-in. wheels and dual airbags—continues its tradition as a leader in its field.



AUTOMATIC VAN DOOR

Inland Fisher Guide
Division
General Motors Corp.

Borrowing some automatic garage door technology, GM's plastic-bodied minivans—Chevrolet Lumina, Pontiac Trans Sport and Oldsmobile Silhouette—this year get a convenient automatic sliding door option. Push a button on the overhead console, or on the remote-control key-chain fob, and the door slides open. Push again, and it slides closed. If the door meets an obstruction when closing, it reverses and opens to full-wide position. It's the latest innovation in minivan convenience.



DODGE RAM PICKUP

Dodge Division
Chrysler Corp.

Dodge's first total redesign of its line of full-size Ram pickups in over a decade sets new standards across the board for pickups in its class. From the largest, roomiest standard cab to the most powerful engine—a 300-hp V10—to the widest stance of any full-size pickup, to the first model-wide-available driver's-side airbag as standard equipment, to optional 4-wheel ABS, the Ram series breaks new ground. Couple the technology to a bold new big-truck front end, and the Ram sits apart from the rest of the pickup crowd.



GMC SONOMA/CHEVROLET S10

Chevrolet Motor Division/GMC Truck Division, General Motors Corp.

Compact pickups are exploding in popularity. And no wonder. These trucks see the most dual-purpose use of any vehicle sold in America. They're as often called upon for personal transportation as for hauling. Before the new S10 and Sonoma, most manufacturers essentially started with a truck, then modified it to make it more carlike. GM's new pickups were engineered from the ground up for the optimum balance to enhance their dual-use nature.

They're as much cars as they are trucks. They achieve new levels in passenger comfort while giving away nothing in payload capacity.



TOYOTA SUPRA

Toyota Motor Sales USA

Sports cars are expected to be the cutting edge when it comes to performance and handling. And any new version has to be that much better than its predecessors to warrant attention. The new Toyota Supra is just that. This 2+2 rocket squeezes 320 horsepower from a twin-sequential turbo inline Six and advances the envelope for minimizing aero drag. With electronic traction control, 6-speed manual or 4-speed automatic with manual-shift mode and lateral G-sensing ABS, this is one car that's curvaceous as well as bodacious.



DODGE/PLYMOUTH NEON Chrysler Corp.

Here's proof that an American car company can produce—on its own—a small car that can be world-class. Neon's size, styling, weight and powertrain will stand up to any world competitor in its class. Neon also is recognized for its efficiency in design and development, costing millions less than its domestic competition. It's a classic example of American ingenuity meeting—and beating—overseas competition.



SUPER V MOUNTAIN BIKE Cannondale Corp.

Mountain bike suspension systems are progressing by leaps and bounds, and Cannondale, with its radical Super V, is out in front of the pack. Super V discards conventional bike frame design and structure, and uses a cantilevered swing arm suspended by an oil-damped shock as the only connection between the rear wheel and frame. Up front, is the industry's first single telescoping shock above the crown as opposed to twin telescoping forks. Mountain biking will never be the same.



YAMAHA FUEL-MANAGEMENT SYSTEM Marine Group, Yamaha Motor Corp.

Boaters can now precisely control and maximize their fuel burn with Yamaha's built-in fuel-management system. The LCD fuel-management gauge reads out real-time fuel consumption as miles per gallon, gallons per hour and total fuel burned. Information can be provided for individual engines in a twin-engine installation or as a synchronized reading of both engines at the same time. The system's margin of error is less than 1/8-gallon per hour. And it goes a long way to keep you from running short on fuel.

MERCUISER BLACKHAWK Mercury Marine Corp.



The biggest, most cost-effective performance boost in the history of marine propulsion systems. That's the Blackhawk twin counterrotating prop and surface-piercing drive system. The design

alters the thrust line upward so that the prop hub is parallel with the surface of the water. Only the bottom half of the prop is in the water. The top half pierces the surface and bites only air, reducing drag in the lower unit by 90%. For boaters, it's like getting free horsepower and better fuel efficiency.



SSC RADISSON DIAMOND Diamond Cruise Inc.

The cruise ship of the future is realized with SSC (Semi-Submersible Craft) *Radisson Diamond*—the first of the new-design SWATH (small-waterplane-area twin-hull) luxury cruise ships. Riding high on twin torpedo-like submerged hulls, which contain the engines, the *Diamond* keeps passenger compartments out of choppy waves. The ship abounds in technical sophistication, which includes security measures that sniff out eavesdropping devices and extensive satellite communications services. It's the new way to ride high on the high seas.



AUTONOMOUS BENTHIC EXPLORER Woods Hole Oceanographic Institute

Able to prow the ocean floor unsupervised for up to a year at a time at depths to 18,000 ft., the Autonomous Benthic Explorer (ABE) is the first intelligent undersea machine ever turned loose for an extended tour of duty. The deep ports of call scheduled include probing the bizarre seascape around midocean hydrothermal vents, detecting seismic events and investigating ocean dump sites. ABE is expected to shed new light on the dark mysteries of the deep.

DESIGN & ENGINEERING AWARDS



THE ALAMODOME W.E. Simpson Co.

It may be old hat when building bridges, but it was an innovative idea when constructing the roof of the new Alamodome sports stadium in San Antonio, Texas. Four 314-ft. towers support the roof's 3000-ton weight through sets of steel cables. Additional sets of tie-back cables buttress the towers and transfer the load into the ground. Relieved of the roof load, the sides of the building support only the stadium seats. This makes it harder for fans to raise the roof when the Spurs win.



SEA SHADOW Lockheed Corp.

America's "invisible" warship is the result of 10 years of work perfecting sea-going stealth technology. Sharing a similar angular shape with the F-117A Stealth fighter, the *Sea Shadow* minimizes radar, sonar and infrared detection by masking its exhaust and using slanted struts to link its main hull to a pair of submerged pontoons. While the *Sea Shadow* itself has strategic importance, it also contributes as a research tool to make more conventional warships less visible to radar. The new technology will help keep an enemy guessing and give us a vital edge in naval operations.



X2000

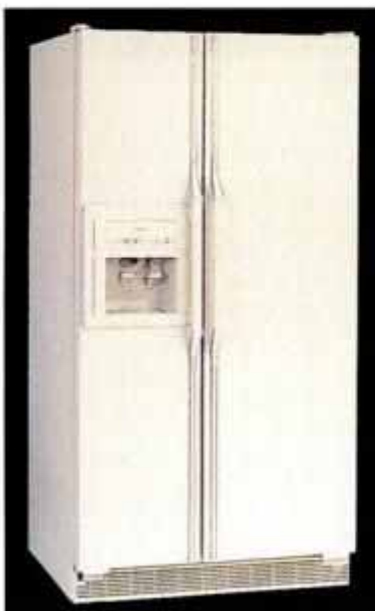
ABB Traction Inc.

Bullet-train speeds on existing tracks. That's the promise of this \$13-million Swedish-built train. Able to blast down straightaways at 155 mph, the X2000 really makes time going around corners. An innovative suspension system and body-tilting mechanism enables the train to take the curves 40% faster than conventional equipment—and on existing tracks. The X2000 may be just the ticket to ease the pressure from crowded traffic corridors in our major metropolises.



POWERSHOT STAPLE GUN Black & Decker Corp.

Form follows function in this totally new approach to the common staple gun. The PowerShot directs the force applied when squeezing the lever directly over the staple-driving end of the tool. This backward configuration eliminates kickback. The unique ergonomic design, featuring a rubber-sheathed lever, eases one-hand operation and helps drive staples completely and consistently. All this, plus features such as a staple supply window, will make this staple gun a favorite for homeowner and pro alike.



SUPER-EFFICIENT REFRIGERATOR Whirlpool Corp.

Winner in the \$30-million Super-Efficient Refrigerator Program (SERP), Whirlpool's design looks like a conventional 22-cu.-ft. side-by-side refrigerator/freezer. Under the skin, however, is better insulation, a high-efficiency compressor and an improved condenser fan motor, as well as a microchip-regulated adaptive defrost control. The SERP uses environmentally friendly CFC-free refrigerant and keeps food cold while saving cool cash on your electric bill. It's the way all refrigerators will be built in years to come.



CORDLESS DECK/DRYWALL SCREWDRIVER Ryobi America Corp.

Cordless screwdriving takes a new twist with the TDS400K Cordless Deck/Drywall Screwdriver. A microswitch turns on the tool's motor as soon as pressure is applied to the screw tip. So the time and effort needed to continuously operate a trigger is eliminated and battery power isn't wasted through continuous operation. You'll never have to lock-on a conventional trigger again. The 12-volt battery pack stores 40% more power than standard batteries, to drive 650 drywall screws on a single charge. You get the convenience of a corded tool, without the inconvenience of a cord.



INCANDESCENT LIGHT CONTROL MODULE
Beacon Light Products Inc.

Computerized lighting is the first major change in incandescent light bulbs since Thomas Edison invented them more than 100 years ago. A microprocessor computer chip fits under the base of an ordinary light bulb, or is incorporated within the bulb base itself, converting it into a 4-way bulb, a dimming nightlight or signal flasher. All control functions are activated from either a wall switch or the light fixture with no rewiring or special tools needed. Consider it a brighter idea.

VIEWCAM CAMCORDER

Sharp Electronics Corp.

A new look in camcorders is the Viewcam, which uses a 4-in. color LCD screen in place of the usual peephole viewfinder. The monitor screen rotates 180° so you can shoot while holding the camcorder over your head. Flip the screen to the same side of the lens and get into the action while monitoring the recording and running the Viewcam by infrared remote control. And the glare-resistant screen offers easy viewing of movies when you're not making them. Viewcam gives you the big picture to improve your moviemaking and viewing enjoyment.



FLAT VISION TELEVISION

Matsushita Electric Corp. of America

Carve another victory in TV's Battle of the Bulge, as this 13-in. (diagonal) screen set is perfectly flat and only 3.9 in. thick. The secret is doing away with the conventional single large cathode-ray picture tube (CRT) and using some 10,000 miniature CRTs arranged in a quilt-like pattern to present the picture. Flat Vision brings us one step closer to the TV you'll someday just hang on the wall.



NOTEJET 486 LAPTOP COMPUTER/PRINTER
Canon USA Inc.

It may look like a standard laptop, but the NoteJet is more like a portable office. With its built-in printer, the NoteJet spits out hard copy on demand, and the unit also functions as a copier. With capabilities to handle PCMCIA cards, the NoteJet can be used for special applications such as fax and modem communications. The NoteJet leads the trend to packing more and more communications and information power into a single, smaller piece of hardware.



LOW-VISION ENHANCEMENT GOGGLES

Johns Hopkins University Hospital

When conventional eyeglasses aren't sufficient to improve the sight of persons suffering from low visual acuity, the medical profession can now turn to a brand-new development—low-vision enhancement goggles. The product of spinoff technology from our space program, the goggles consist of a headset that houses two miniature video screens and three tiny video cameras. The system provides variable focus and magnification capability, and offers the hope of a brighter future for those with a dim view of the world.

PM



NEWTON MESSAGEPAD

Apple Computer Inc.

Personal computing takes another step smaller with Apple's Newton—the first in a new product category called Personal Digital Assistants (PDA). Dispensing entirely with the traditional keyboard, Newton takes input by simply writing on the screen. Newton can recognize your handwriting, interface with a variety of software, has fax, modem and information interchange capability and more. Sized to fit in your pocket, Newton is the newest—and smartest—way to keep in touch.



MAIN MENU

SALOON

Jurassic Park
Unforgotten
Batman Returns
Ethan

MAIN MENU

STI

MAIN MENU

- 1. Football
- 2. Baseball
- 3. Basketball
- 4. Hockey
- 5. Tennis



BUILDING THE INFORMATION SUPERHIGHWAY

Construction begins on an interstate data highway that promises to revolutionize communications—and the way we all live.

BY FRANK VIZARD, Electronics Editor

● The next time you think about traveling down the highway looking for adventure you may just get all you can handle without leaving home.

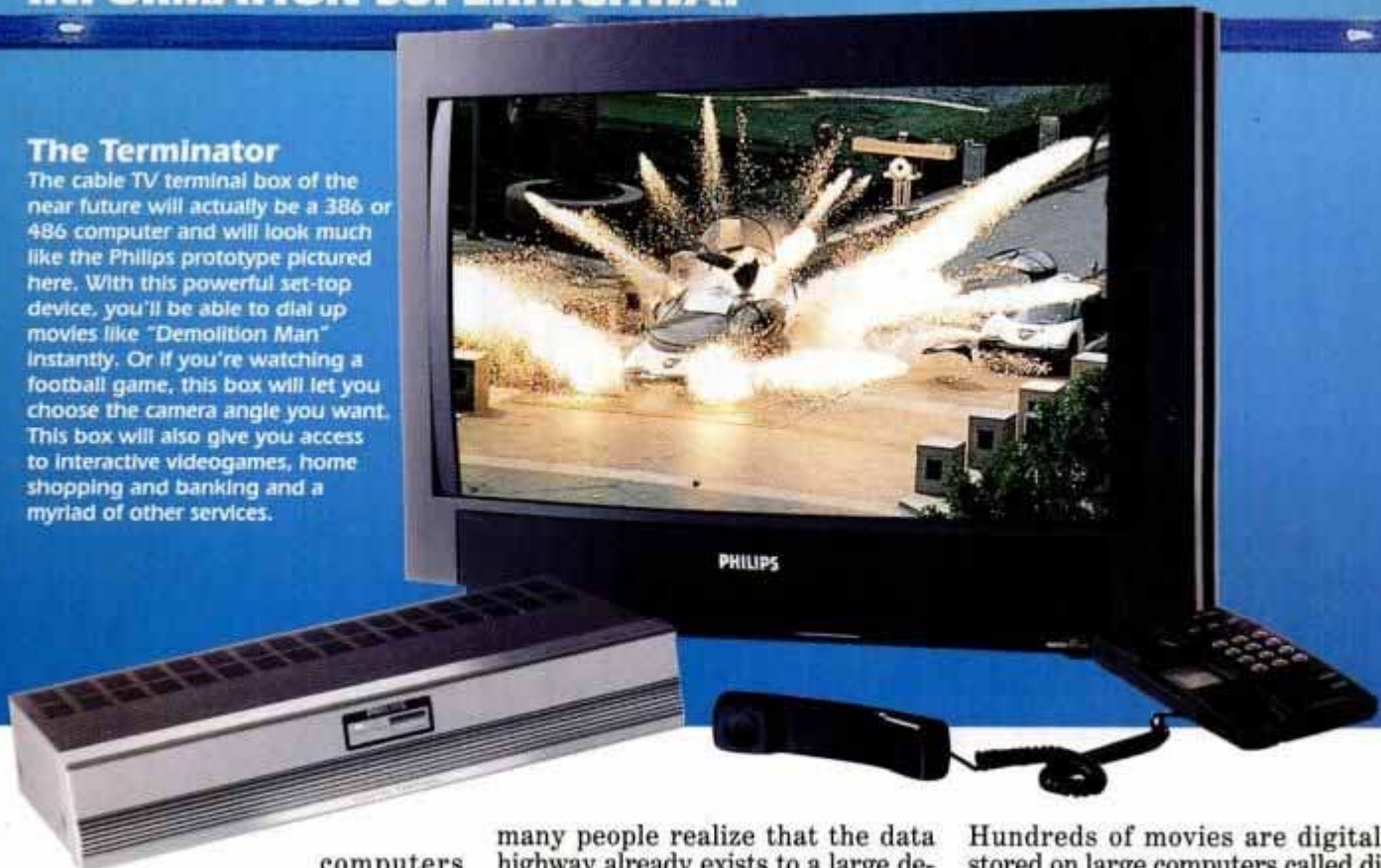
The highway destined to see more traffic than any road ever built for cars is dedicated to transporting information. Like the interstate highway system that made vehicular traffic from coast to coast simple, the data highway—more formally called the National Information Infrastructure (NII)—will link homes, offices, factories, libraries, entertainment sources, universities and just about anyone else into one big network.

This is more than just cable TV on steroids. Think of it as a level of interactivity not seen since the invention of the telephone. Multimedia communication—image, sound and text combined—can happen in the blink of an eye.

A national data highway is a dream propagated by government and industry—not to mention science-fiction writers like William Gibson—for years. As envisioned, the NII would give you access to a world of information through a variety of devices—typically through personal communicators of the Apple Newton variety, personal

The Terminator

The cable TV terminal box of the near future will actually be a 386 or 486 computer and will look much like the Philips prototype pictured here. With this powerful set-top device, you'll be able to dial up movies like "Demolition Man" instantly. Or if you're watching a football game, this box will let you choose the camera angle you want. This box will also give you access to interactive videogames, home shopping and banking and a myriad of other services.



computers and televisions. Some of these devices may be combined in the future—think of a hybrid tele-computer, for example.

What type of information can you get? You can dial up movies on demand, play videogames with people across the nation, shop, take care of banking, make travel arrangements, tour the vaults of a museum, tap into any library or just chat.

The NII promises more than just a host of consumer conveniences. Since the data highway can handle voice, video and text simultaneously and with equal aplomb, the impact on business and health services alone stands to be substantial. Manufacturing specifications can be quickly transmitted in detail. Medical disorders can be diagnosed by specialists far away from the patient. And on the education front, students can receive lessons from the best teachers without regard to geography.

The dream is suddenly becoming a reality. The proposed merger between Bell Atlantic, one of the Baby Bell phone companies, and Tele-Communications Inc. (TCI), the nation's largest cable TV operator, woke up the world to the fact that the data highway could exist in concrete terms. The merged companies have access to 22 million customers in 59 of the top-100 markets. The Bell Atlantic/TCI merger creates a pretty big highway just by itself.

The \$33 billion Bell Atlantic/TCI merger agreement suddenly made

many people realize that the data highway already exists to a large degree. Much of the technology needed to make it operable was in hand, or nearly so. The road would be fiberoptic cable, hair-like glass strands that carry data as light pulses and which have a much greater capacity than copper or coaxial wire. Today, fiberoptic cable is only being used to

The Bell Atlantic/TCI merger agreement made people realize that the data highway already exists to a large degree.

one-tenth of 1% of its capacity (a typical 32-strand fiberoptic bundle can handle up to 5000 video channels). Basically, all that is needed is a way to connect a lot of little networks to each other to form a larger network.

500 channels

For many, the entrance ramp onto the data highway probably will look much like the new Time Warner network set to debut next April in Orlando, Florida. Accessed via a set-top box, Time Warner's Full Service Network appears, at first glance, to be a pumped-up cable TV service. Indeed, you get 500 channels, but there is more to it than just that.

A big draw is video on demand.

Hundreds of movies are digitally stored on large computers called digital servers. Your movie selection travels via a variety of digital switches to what amounts to a 386 or 486 computer masquerading as a cable box sitting on top of your TV. These set-top devices will be made by various suppliers. For example, Silicon Graphics is making set-top devices for the Time Warner system, while 3DO is doing the same for a proposed US West interactive-TV trial in Omaha, Nebraska. Other potential suppliers include Philips and GTE, a company that is also engaged in a trial interactive-TV system in Cerritos, California.

The signal, being received via fiberoptic and coaxial cable, is digitally compressed so it occupies only a small fraction of the bandwidth available. With digital compression, eight to 10 video channels can be carried in the bandwidth normally required for one channel.

Of course, you can do more than just watch movies. Just imagine watching a sporting event, for example. Since the TV is now interactive, you'll be able to choose from which camera angle you want to watch the action.

You'll also be able to play videogames or engage in hobbies like rotisserie baseball with other people on the network. And since the network is 2-way, you can expect all kinds of control accessories to be available. This would include head-mounted displays (HMDs) or helmets for virtual-reality scenarios. Set-top boxes will likely come

Bundles Of Glass

A typical fiberoptic bundle might contain 32 hair-like glass strands. Data is carried as light pulses, which can travel for miles without amplification. Current capacity for a 32-strand bundle would be about 5000 video channels or 500,000 voice communications—all through a bundle measuring just 0.5 in. in diameter. Future advances in electronics will likely boost capacity to 1 million conversations per strand. Finding your way around, however, may be the biggest problem for travelers on the data highway. One proposal calls for software worms called Knowbots to act as information-retrieval agents. You wouldn't have to know where the data is—a Knowbot would just travel the data highway until it found the answer.

equipped with credit-card-size slots for PCMCIA flash memory cards so game scores can be saved. PCMCIA cards might also be used to access special channels or leagues.

PCMCIA cards could also be used as credit cards for home shopping. And in all likelihood, a small video camera atop the TV will turn your television into a picture phone for video conferencing.

Another likely byproduct of the development of the data highway is an inexpensive wireless phone service. As envisioned by the Federal Communications Commission, the Personal Communications Service (PCS) would allow pocket-size phones to be radio-linked to a series of receivers wired directly into a local cable TV system. The telephone call would travel back along coaxial wires to the cable TV system's main office where it would cross over to normal telephone lines. In theory, though, if the call recipient is part of the cable TV system, then the call would not necessarily be routed through the phone lines, appearing instead on a dedicated audio channel provided by the cable TV service.

Of course, PCS would give you access to the data highway. This fact alone is likely to spur the development of many types of wireless devices that will be able to transmit everything from faxes to video. It is expected that PCS will be relatively inexpensive—certainly cheaper than cellular phone service—because the FCC is allocating a large amount of radio spectrum for the service and is allowing as many as seven competing service providers to exist per market.



Compressing data

Digital compression of data means information can be squeezed down from the fiberoptic cable through the "last mile" of existing coaxial cable to the home. The feed points to the home and the TV terminal box will also use a new asynchronous transfer mode (ATM) switching technology that receives and reconstructs the high-speed digital packets of information sent to it. ATM essentially puts the brakes on fast-moving data so that it can easily move down the local coaxial streets.

While a fiberoptic connection to every home would be ideal, the complete rewiring of homes for fiber-optics will take many years. The last

mile of coaxial cable represents 80% of a cable TV company's infrastructure. The amount of mileage here is incredible when you consider that 95% of the 94.2 million TV homes are wired for cable, even if only about 62% actually subscribe.

The phone companies, meanwhile, are likely to be delivering video images via telephone lines in competition with cable TV companies. Until every home is wired with fiberoptic cable, the telephone companies are likely to use a new technology called an asymmetric digital subscriber line (ADSL) in the interim. ADSL allows the phone companies to send compressed video images over ordinary copper wires and still have room for



Digitizing Video

At MIT, researchers created a single image of musician Yo-Yo Ma (top segment, above) from other shots of different focal lengths using digital video technology. When digitized, video flows like a stream (right) that can be easily manipulated.



voice conversations. Fiberoptic cable would bring the signal to the last mile, after which ADSL technology, which tends to degrade over distance, would bring the signal home.

The fiberoptic cable, though, is essential for 2-way communication. With coaxial cable, the signal must be amplified every 2000 ft. In a 2-way coaxial connection the amount of electronic noise added by the amplifiers makes the signal unintelligible. With fiberoptic cable, the signal can travel for miles before needing a boost, a characteristic that keeps the signal quality very clean.

The phone companies are also looking at another technology that allows digital data to be sent over existing copper wires. Called the Integrated Services Digital Network (ISDN), this technology seems most suitable for voice and text applications. If upgraded, ISDN could prove to be a shortcut to the information highway.

On the net

All of these options are fine on the local level but how do you make the connection to larger networks that allow you to telecommute to the office or tap into Washington, D.C.'s Smithsonian Museum when you're in Des Moines?

The data highway model everyone is looking at is a confederation of computer networks called the Internet. Currently, the Internet is comprised of more than 10,000 networks—from universities, libraries, science foundations, government and businesses—that are all linked together.

Estimates as to the number of people using the Internet range to as high as 30 million. This number will

only get higher as this year Continental Cablevision Inc. provides special hookups that allow PCs to jack into the Internet via cable lines. This link allows users to download data at much faster rates since coaxial and fiberoptic lines are being used.

Internet users send electronic mail, chat with other Internet users on bulletin boards, play games or access about 2 million files on a variety of topics. In effect, the Internet is its own electronic community. More im-

The data highway model everyone is looking at is a confederation of computer networks called the Internet.

portantly—and this is an approach the federal government wants to take on the data highway—the Internet has an open architecture, meaning that it is available to all.

The Internet, however, illustrates one of the practical problems facing the data highway. The Internet is a notoriously difficult piece of cyberspace to navigate, and it is often very hard to find the information you're seeking. Software developers hope to make the information-retrieval process easier in the future. One concept involves software worms called Knowbots that crawl from source to source looking for the answers to questions. You wouldn't have to know where the information is—the worm

would just keep looking until it found the desired data. Traffic congestion, though, might turn out to be a major problem if too many worms are looking for information in the same place—another issue to be resolved.

The Internet model, however, may not be the only one pursued, particularly in a short-term future devoid of standardized protocols. AT&T, for example, is investing heavily in the ImagiNation Network, formerly Sierra On-Line, in hopes of creating a nationwide network for videogame play. The network will allow players to compete against each other using Sega Genesis gear, an AT&T peripheral device called The Edge 16 and 3DO's interactive multiplayer. Once standardized protocols are developed, the ImagiNation Network would be just another lane on the information highway.

Besides information retrieval, there are other hurdles to jump as well. One is to agree to a protocol standard that allows different networks to communicate easily with one another. And while numerous companies, ranging from General Magic to IBM, are vying to develop one, the Bell Atlantic/TCI merger may just create a de facto standard.

Smart TV

Perhaps the biggest leap forward will come when video can be transmitted digitally. Translated into zeros and ones like audio on a compact disc, video becomes easily manipulated and a whole range of options begins to appear. For instance, images of the same subject but shot at different focal lengths can be combined to produce a single image. Small details can be enlarged at will. This technology



Personal Papers

In the near future, news from a variety of sources can be customized according to your personal interests. Multimedia presentations of information will be common as demonstrated by this *News In Motion* on-line electronic newspaper.

is just around the corner.

For example, digital video will be the cornerstone of a direct broadcast satellite (DBS) service being launched by Thomson Consumer Electronics (RCA's parent company) and Hughes Communications. Scheduled to debut this April, this DBS service will use digital video and compression technologies to offer 150 channels received in the home by an 18-in. dish for about \$700.

As envisioned by researchers at MIT's Media Lab and elsewhere, digital video will have many ramifications. But perhaps most importantly, it gives your television a chance to become intelligent.

In the near future, television will have the sort of learning capabilities exhibited now by products like Apple's Newton personal communicator. As you use the television, the TV's intelligence system will note the type of programming you enjoy. So instead of channel grazing through an impossible number of channels, the TV will present you with a list of programming choices based on your viewing history. The TV may also digitally store a program it thinks you might like even when you're not at home.

Viewers will also be able to customize their viewing—of news, for example. Since the news arrives in digital form, it is relatively easy for the TV to sort through the incoming digital video stream of channels and pull out items of specific interest to you.

Or conversely, if you're interested in news footage of civil unrest in China, for example, the TV will cruise through all the news channels, pulling out any snippets relating to China. These snippets would then be

assembled automatically so what you would see is one long piece of video footage on China. You no longer have to jump from news channel to news channel looking for that extra footage or different camera angle that is often critical to an understanding of events.

Customization could even extend to other types of news sources. For instance, you might subscribe to a variety of newspapers and magazines. Your television or your computer

The arrival of digital video technology gives your television a chance to become intelligent.

would know the type of information you are generally interested in. Articles from different sources would be blended together to create your personal newspaper that would be displayed on screen. You'd also be able to quickly print a hard copy of your newspaper—in color, of course, thanks to coming improvements in printer technology—or access your personal newspaper via a wireless computer or Newton-type personal communicator.

Such capabilities already exist, although the technology is still too expensive for mass use. Nevertheless, the Sandpoint Corp. of Cambridge, Massachusetts, has a software program called Hoover that sucks items

of specific interest to its subscribers out of 5200 publications. The system, which now costs about \$28,000, prepares reports that are continuously updated.

Electronic newspapers are also likely to use multimedia in their presentations of news. A hint of things to come is the *News In Motion* on-line newspaper available on a weekly basis from Walk Soft Corp. in Rochester, New York. *News In Motion* combines audio, still pictures, animation and text to present an array of news, opinion, entertainment and sports information. With the addition of digital video, live footage could easily be integrated into the mix. You would also be able to access your personal newspaper via a wireless computer or Newton-type personal communicator.

Watching all this is the federal government, mostly with a friendly eye since Vice President Al Gore is a long-time proponent of the data highway. Indeed, someone will have to act as a data-wise state trooper to make sure commercial interests don't outweigh societal needs.

Corporate users, for instance, may be asked to pay a premium on video conferencing—money that would be allocated to install data highway terminals in the public libraries and schools of the inner city. The hope is that the federal government will take a leadership role in the creation of a common carrier channel easily accessed by all.

That role may be all the more important if, as Thomas Jefferson said, information is the currency of democracy. Thanks to the information highway, that currency is likely to get into more hands than ever. **PM**



NISSAN ALTIMA

Bargain-basement prices, penthouse chic.

BY MICHAEL LAMM, Contributing Editor; PM Photos by George Olson

● In 1993, Nissan replaced its ho-hum Stanza with the stylish Altima and introduced its capabilities in a clever way. Rather than playing the Altima against direct competitors like the Toyota Camry, Ford Taurus, Honda Accord and Mazda 626, Nissan TV commercials, implied that here was a handsome, beautifully made car that would out-slalom the BMW 325, outrake a Lexus ES 300 and out-accelerate the Mercedes-Benz 190E 2.3. In the same breath, Nissan stressed the Altima's \$12,999 base price.

Results were immediate and dramatic, well beyond the fondest expectations of Nissan marketers. Buyers flocked to Nissan showrooms and Altima sales took off.

But TV commercials can only whet

the viewer's appetite. Question is, does the Altima live up to its advertised image? And what prompted so many American buyers to spend money on the Altima, a relative unknown, rather than one of its solidly established rivals?

To answer the second question first: Styling played an important role in helping to sell the Altima, but so did price. The words sporty, sleek, elegant, luxurious and value cropped up any number of times on our questionnaires. Not too surprisingly, several owners made a styling comparison with the Infiniti J30. "My Altima *looks* expensive," said an Illinois attorney.

But it's not. At the end of the '93 model year, the basic Altima XE sedan cost \$901 less than the least-

expensive Honda Accord, \$1256 less than the Mazda 626, \$2309 less than the Toyota Camry, and it beat the Ford Taurus by \$2601. As many of our owners observed, it's "a lot of car for the money."

The basic appeal here seems to be one of the oldest—and most productive—on record. A good-looking car with lots of features for a reasonable price. And it's likely to be the major marketing theme for the rest of the decade.

Offered only as a 4-door sedan, the Altima comes in four trim levels: XE, GXE, SE and GLE. The three upper levels are essentially option packages. But even the base XE, which only 6.8% of our respondents ordered, includes a long list of standard goodies: a driver's airbag plus motor-



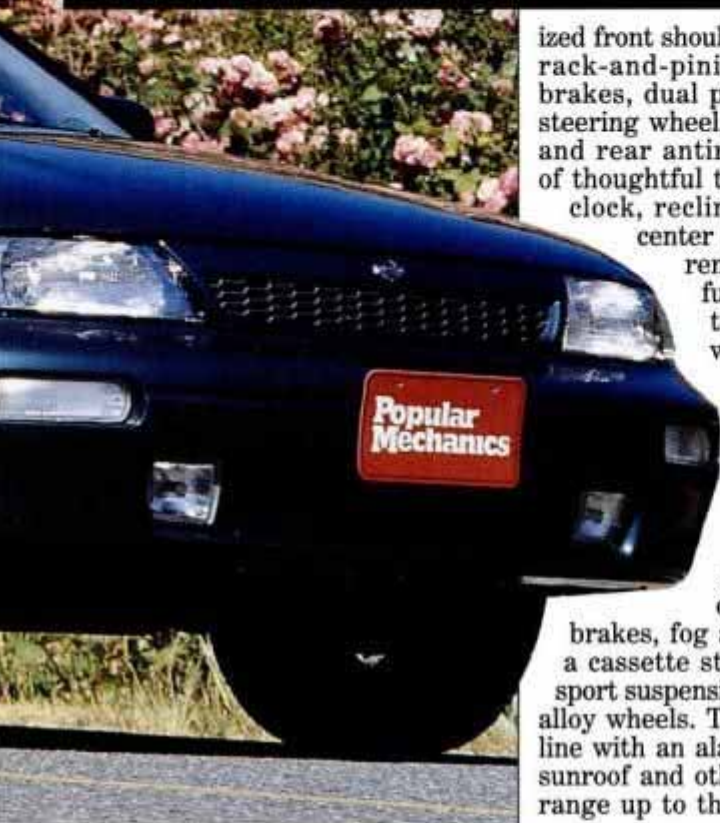
Elegant dash enhances quality look.



Seat comfort drew some criticism.



150-hp Four pleased most owners.



ized front shoulder harnesses, power rack-and-pinion steering, power brakes, dual power mirrors, a tilt steering wheel, a tachometer, front and rear antiroll bars and plenty of thoughtful touches like a digital clock, reclining bucket seats, a center console, cup holders, remote releases for the fuel-filler door and the trunklid, intermittent wipers and a rear-window defroster.

The GXE adds power windows, and door locks and a viscous limited-slip differential. In the sporty SE, you get standard air conditioning, rear disc brakes, fog and cornering lights, a cassette stereo, cruise control, sport suspension, a rear spoiler and alloy wheels. The GLE tops off the line with an alarm system, a power sunroof and other amenities. Prices range up to the mid-\$18,000 range

for the GLE, which is roughly \$3000 less than similarly equipped competing models from other Japanese manufacturers.

The Altima offers relatively few free-standing options. You can order a 4-speed automatic transmission and antilock brakes for all models, leather upholstery in the GXE only, a power sunroof and a CD player for the SE and cruise control in the XE.

There's just one source of power for the Altima family—a 150-hp 2.4-liter dohc 16-valve 4-cylinder. It's the same engine that powers the 240 SX coupe, and it gives the Altima enough go-power to keep up with the best in its class. The Altima also offers commendable braking performance, according to our owners. And the fuel economy reported by our respondents was even better than the EPA estimates: 22/29 city/highway versus the EPA's 21/29 forecast.

As for the Altima's all-around performance, a Texas homemaker delivered the majority opinion when she said, "The Altima handles so well

SUMMARY OF NISSAN ALTIMA OWNERS REPORTS*

| | | | | | | | |
|----------------------------------------------|-------------------|-----------------------------------------|-------|--------------------------------------|-------|-------------------------------------------------------------------------------------------------|-------|
| Total miles driven | 1,556,342 | Glovebox too small | 13.9% | Poor | 0.9 | Air conditioner | 6.0 |
| Average miles driven | 6225 | Motorized shoulder harness | 13.9 | Instrumentation: | | Electrical | 6.0 |
| Purchase price: | | No complaints | 9.9 | Excellent | 68.0% | Exhaust system | 6.0 |
| Average | \$16,692 | Seating comfort | 8.4 | Good | 28.3 | Fuel-injection system | 6.0 |
| Range | \$13,100-\$21,000 | Noises and rattles | 7.9 | Average | 3.7 | Repair it yourself? | |
| Why did you choose the Nissan Altima? | | Fuel economy | 6.9 | Poor | 0.0 | No | 94.0% |
| Styling | 58.4% | Suggested changes: | | Driver sightlines: | | Yes | 6.0 |
| Price/value | 42.4 | Larger glovebox | 20.0% | Excellent | 70.4% | Dealer repairs satisfactory? | |
| Handling | 21.0 | Add courtesy lights | 13.0 | Good | 25.1 | Yes | 60.0% |
| Previous Nissan ownership | 13.3 | Nonmotorized shoulder harness | 11.4 | Average | 3.7 | No | 40.0 |
| Standard equipment and features | 10.5 | Improve seating comfort | 8.1 | Poor | 0.8 | Dealer service opinion: | |
| Performance | 10.1 | Make V6 engine available | 7.0 | Overall convenience: | | Excellent | 55.0% |
| Engine power | 10.1 | Power seats neat up/down feature | 6.5 | Excellent | 66.2% | Good | 31.6 |
| Model choices: | | Engine power: | | Good | 31.2 | Average | 10.5 |
| Altima GXE | 64.1% | Excellent | 66.8% | Average | 2.1 | Poor | 2.9 |
| Altima GLE | 18.7 | Good | 29.1 | Poor | 0.4 | Dealer sales policy: | |
| Altima SE | 10.4 | Average | 4.1 | Workmanship opinion: | | Excellent | 50.0% |
| Altima XE | 6.8 | Poor | 0.0 | Excellent | 76.3% | Good | 33.2 |
| Options/Accessories: | | Handling: | | Good | 22.1 | Average | 12.9 |
| Air conditioning | 98.9% | Excellent | 85.6% | Average | 1.2 | Poor | 3.9 |
| Cruise control | 96.9 | Good | 12.3 | Poor | 0.4 | Number of vehicles owned: | |
| Antilock brakes | 39.9 | Average | 2.1 | Comfort opinion, front seats: | | This vehicle only | 30.2% |
| Sunroof | 31.1 | Poor | 0.0 | Excellent | 66.0% | Two vehicles | 40.0 |
| Avg. mpg, city/hwy: | | Braking: | | Good | 28.1 | Three vehicles | 22.7 |
| 5-speed manual | 25.3/30.6 | Excellent | 71.2% | Average | 4.7 | Four or more | 7.1 |
| 4-speed automatic | 22.0/27.9 | Good | 26.7 | Poor | 1.2 | Principal driver: | |
| Transmission choices: | | Average | 2.1 | Comfort opinion, rear seats: | | Female | 61.5% |
| 4-speed automatic | 79.8% | Poor | 0.0 | Excellent | 52.5% | Male | 37.3 |
| 5-speed manual | 20.2 | Overall performance: | | Good | 42.4 | Equal | 1.2 |
| Specific likes: | | Excellent | 79.7% | Average | 4.5 | Age distribution of owners: | |
| Styling | 59.4% | Good | 18.7 | Poor | 0.8 | Under 29 | 16.4% |
| Handling | 43.2 | Average | 1.7 | Any mechanical trouble? | | 30-49 | 58.0 |
| Ride quality | 33.3 | Poor | 0.0 | No | 80.5% | 50-plus | 25.6 |
| Engine power | 31.2 | Control layout: | | Yes | 19.5 | Based on your experiences, would you buy a Nissan Altima if you had it to do over again? | |
| Comfort | 29.5 | Excellent | 61.9% | Engine stalls | 16.0% | Yes | 65.1% |
| Performance | 17.9 | Good | 34.4 | Transmission | 14.0 | Maybe | 30.2 |
| Specific dislikes: | | Average | 2.9 | Shoulder-harness release | 10.0 | No | 4.7 |

* Percentages might not equal 100% due to rounding up or insufficient data.

NISSAN ALTIMA



Altima's Infiniti-inspired styling and high quality helped pack prospective buyers into Nissan showrooms, and aggressive pricing helped convert them into owners.

EDITORS REPORT

The Fun-To-Drive Factor

● The very first thing we did when we saw the results of this owners survey was rush to the nearest Altima test car and pop open the glovebox. And sure enough, it was a little on the small side, just as 13.9% of the owners told us under the Specific Dislikes heading of their questionnaires.

Our reaction: If that's the worst thing someone can say about a car, the manufacturers have done a very good job indeed.

Beyond the glovebox issue, our overall reaction to the Altima continues to be enthusiastic. Most of the owners in our survey were seduced by the Altima's styling and converted by its pricing. While we too like the Altima's Infiniti-inspired good looks, we think the quality that sets the Altima apart from many of its competitors is its fun-to-drive index.

Nissan's passenger-car chassis program has been among the best for a number of years now, and the Altima is yet another proof. Thanks to its stiff chassis, the Altima provides exceptionally precise and responsive handling. Nissan used to market its premium Maxima sedan as the "4-door sports car." The Altima, in our opinion, comes even closer to this standard.

It also measures up well against a number of other contemporary mid-size automotive standards. Fit-and-finish quality compares with the best, inside and out. It's impressively quiet, thanks in part to its wind-cheating ovoid shape and also to very good

isolation from road noise. Very little of what's going on under the car transmits itself into the passenger compartment.

The Altima's 4-cylinder engine also gives a good account of itself. It's reasonably potent, reasonably quiet and reasonably smooth—for a Four. However, 4-cylinder engines are no longer the last word in the midsize class. We agree with those owners who wished a V6 engine was among the Altima's options. So far, this restriction hasn't hurt sales. But with excellent V6 engines available for the Toyota Camry and Mazda 626—plus another due sometime in 1994 for the new Honda Accord—the Altima's appeal could slip just a bit.

One area where the Altima does not measure up is inside, specifically in the rear seats. The car's compact dimensions make it pretty crowded back there for adults, although it's certainly roomy enough for families with young kids.

Two welcome changes for 1994 are the addition of a front-passenger's airbag and the substitution of active front seatbelts—with adjustable shoulder anchors—for the previous motorized passive front belts.

Beyond that, though, there doesn't really seem to be much that needs changing. If Nissan can maintain the Altima's high quality and aggressive pricing, it should continue to help repair the company's U.S. fortunes—and to make owners happy—for some time to come. —Tony Swan

that I always feel in complete control. Ride is unbelievable for a small car, with no engine vibration and very little wind noise. Power feels stronger than the Camrys and Accords I test drove."

As she points out, the Altima is one of the smaller cars in the midsize class, both outside and in. It's 7.3 in. shorter than the Camry, although both cars ride a 103.1-in. wheelbase. Shoulder and hip space is tighter in the Altima. Trunk volume—at 16 cu. ft.—is 6 cu. ft. less than Camry's, although it's slightly larger than the '93 Accord.

Just over 80% of the Altimas in our survey gave their owners no trouble at all—a percentage that's identical to our most recent Toyota Camry survey. Of the 19.5% who did report problems, the most common was engine stalling. This, we're told by Nissan, was caused by a faulty computer ground, which has since been fixed.

And while most owners praised the automatic transmission's smooth shifts, some complained that part-throttle downshifts felt sluggish—not positive enough. The solution, according to Nissan, is for the driver to be more decisive with the throttle. The Altima shares this electronically controlled 4-speed automatic with the upscale Maxima SE and the Quest minivan, and it's set up for soft shifts.

A few owners also complained that their motorized shoulder harnesses weren't always releasing properly. One woman, in fact, said she'd been trapped in her car by a belt that gripped her like a python. Fortunately, that was as far as the python parallel went.

Among smaller annoyances, the Altima's glovebox took most of the hits. Too small, said 13.9%, and opening the bottom-hinged door allows contents to escape. Another peeve involved the cup holder. Owners complained that it interfered with the ashtray and some of the radio controls.

Unlike their predecessors, the Japanese-made Stanzas, Altimas are built in Smyrna, Tennessee, in the same huge complex that assembles Nissan pickups. The Tennesseans are apparently doing a good job, because Altima workmanship was rated excellent by 76.3% of our owners and good by another 22.1%. These ratings are virtually identical to the owner responses we recorded for the Camry.

It seems fair to say, then, that the Altima has lived up to its early promise. A Michigan legal secretary provided the ultimate endorsement: "When driving this car, I feel it's just built around me." **FM**

BATTERIES REBORN

Two new rechargers claim to bring dead batteries back to life. Here's our hands-on test.

BY STEPHEN A. BOOTH
Contributing Editor
PM Illustration by
Peter Van Ryzin

● Of the 3 billion alkaline batteries used in the United States each year, it's a good bet that most wind up in landfills. How many are buried alive is anyone's guess.

Most people chuck a D or C at the flashlight's last gleaming or dump those AAs when the Walkman begins to squawk. It's likely, though, that there's still some kick in a so-called single-use battery even after it appears to have gasped its last.

Two recent innovations exploit this afterlife of a cell. One aims to extend the longevity of single-use alkalines otherwise given up for



dead—especially by the companies that manufacture them. It's the Buddy L Super Charger from SLM Corp., a company best known for its kids' toys and athletic gear. The other product is an alkaline battery that is designed to be reused at least 25 times or as many as 100, depending on its karma. It's the Renewal system from Rayovac, which has been making canned juice since 1906.

Each product lived up to its claims in POPULAR MECHANICS' hands-on evaluations. After that, the differences begin, starting with a difference of opinions.

The manufacturers of conventional alkalines don't take much stock in Buddy L—and if you owned battery stocks the day Buddy L debuted, you wouldn't either. Most makers, including Rayovac, contend that batteries not designed for recharging should not be recharged. The implication is that single-use alkalines can't be recharged satisfactorily, or safely.

On the safety issue, SLM has vol-

The Buddy L recharger restores the charge to depleted alkaline batteries but not to batteries that are totally drained.

umes of independent data to confirm that its product handles alkaline (and rechargeable nickel-cadmium) cells without hazard. The owner's manual explicitly states what can be charged—and what shouldn't be (lithium batteries, for instance).

Regarding effectiveness, SLM claims only to extend the usefulness of throwaway alkalines. The charger won't restore a battery to full power repeatedly (1.5 volts)—each use and reuse is subject to diminishing returns. Nor will it recharge a battery indefinitely: Cells that have dipped below a certain point (0.9 volts) don't have a prayer. Sometime next year, SLM plans to introduce another system, called Regenatron, which the company claims will restore single-use alkalines to full power.

That's what Rayovac's Renewal Power Station does today, except that the company contends its Re-

newal batteries are specifically engineered for recharging. Put a conventional alkaline or rechargeable NiCd in the Power Station and nothing happens.

It's designed that way, because Rayovac insists single-use cells shouldn't be recharged at all, and the Power Station isn't meant for NiCd rechargeables. The company is equally insistent that Renewal batteries shouldn't be recharged in any other system, including SLM's.

According to Rayovac, its Renewal cells differ from conventional alkalines in chemistry and construction. A spokesperson explains that the chemicals in single-use alkalines are mixed in certain proportions to wring every drop of juice from the cell. These proportions are altered in Renewals, so enough substance remains in the cell to restore energy when the charging current reverses the chemical process.

Additionally, Rayovac tells PM that changes in internal construction enable the Renewal to maintain its physical integrity through multiple reuses. This construction inhibits swelling of the cathode during discharge and contraction during recharge.

Rayovac states that Renewal batteries can turn back the chemical clock 25 times to full 1.5-volt power. That's 25 cycles under real-life conditions. Theoretically, they're capable of 100 reincarnations, if the user religiously recharges them after, say, 2 hours daily in the Walkman.

For PM's hands-on evaluation, we used Renewals in a portable CD player, a color LCD television and a halogen flashlight—all high-drain devices that can really run up a battery bill and lend a lot of credence to the rechargeable concept. Each ran as long as its manufacturer said it would on AA alkalines before hitting its

Life Cycles

● Although a battery might appear dead when the device it's powering stops working, frequently it's the device that has quit and not the battery. Every battery-powered product has a voltage cutoff point, meaning the minimum amount of power it requires to operate. Often a product will reach its cutoff point before the battery has completely run out of juice.

Such a battery might have a useful second career in a product with a lower cutoff point. For example, a battery that no longer runs a camera at 1.3 volts might operate a bathroom transistor radio with a 0.8-volt cutoff for another 30 hours.

What follows is a list of typical products and their approximate cutoff points in volts. The value given is for a single AA-size alkaline cell, which has a full power rating of 1.5 volts. Most products use two or more cells. —S.A.B.

| PRODUCT | CUTOFF POINT (VOLTS) |
|-----------------------------|----------------------|
| Autofocus 35mm Flash-Camera | 1.3 |
| Halogen Flashlight | 1.3 |
| Regular Flashlight | 1.2 |
| Headphone/CD Player | 1.2 |
| Portable LCD Color TV | 1.2 |
| Pencil Sharpener | 1.2 |
| Headphone/Cassette Player | 1.0 |
| AM/FM Digitally Tuned Radio | 1.0 |
| Portable Shaver | 1.0 |
| Quartz Analog Clock | 1.0 |
| AM/FM Transistor Radio | 0.8 |
| Infrared Remote Control | 0.8* |

*Was still operating at 0.75 volt.

voltage cutoff point. This is the point below which the device won't operate even though the cells might have plenty of juice left to run devices with lower cutoff points.

For the record, Rayovac says its Renewals should run almost as long as conventional alkalines right out of the package, despite the different chemical balance. We found this claim to be true, based on actual use and measurement with a digital voltmeter. We also found that Renewal batteries ramped right back up to full power, repeatedly, after a fill-up in the Power Station.

Rayovac says Renewals really thrive on high-drain, high-cutoff devices such as these, because the bat-



Rayovac offers two versions of its Renewal recharger, one for AA and AAA batteries (above) and another for all sizes (left).



tery gets to take a refreshing nap more frequently—and therefore has a better chance of making that 100th recharge. Still, we found the Renewals bounced back for the late rounds even when depleted in low-drain, low-cutoff items such as a transistor radio or electric shaver.

Recharging takes 3 to 5 hours for the AA and AAA cells, overnight for C and D cylinders. PM evaluated the AAs, as these account for half the alkaline market.

Renewal batteries cost about \$5 per AA and AAA 4-pack or C and D 2-pack. Rayovac offers a Renewal Power Station that handles four AA or AAA cells (\$15) and another that recharges any combination of eight cells (\$30).

At typical discount-store prices, an 8-pack of AA alkalines goes for \$5. So if you spend \$20 for the smaller Renewal station and four AAs, you'd recoup your investment after eight reuses. Assuming you get the 25 reuses stated by Rayovac, the next 17 charges would save you more than \$10 on the cost of throwaways. Your calculator will tell you that subsequent Renewal 4-packs pay back on the first charge and save nearly \$58 over the next 23 cycles.

If you've got a lot of low-drain bat-

tery-powered devices, the Buddy L Super Charger is a worthwhile investment. There's a small travel-model for four AAs or AAAs (\$30) and a tabletop version (\$50) for four cells of any size.

We found experimenting with the Buddy L to be an education in battery behavior and power management. As previously stated, SLM doesn't claim to bring a battery back from the dead to full 1.5-volt vigor. What it does is pump up the remaining power, and this means a battery that will no longer operate one kind of device can have a useful, and possibly long, second career in another.

After bringing single-use alkalines down to various states of discharge in a dozen different devices, we found that, on average, the SLM recharger would increase the residual charge by 10% to 15%. This means a battery recharged at 1.2 volts might be restored to 1.32 or 1.38 volts. This might sound like small change but it'll sound pretty good in some devices.

For example, the high-drain, high-cutoff CD player and TV would give up the ghost after about 3 hours, when the batteries dipped to 1.25 volts. Recharging in the Buddy L to 1.38 volts did not run these devices for a significant amount of time, and

hardly raised a glimmer in a flashlight or camera's photoflash. But it did give the batteries new legs in a cassette player with a 1.0-volt cutoff. We got 10 strong plays from a 90-minute tape (15 hours) before recharging the batteries at about 1.2 volts.

The subsequent recharge, to about 1.3 volts, seemed to last an eternity in a \$15 AM/FM "shower" radio with a 0.8-volt threshold—about 30 hours. The Buddy L wouldn't recharge the cells at this point, as it considers an alkaline dead at 0.9 volt. Don't tell that to the infrared remote-control for our VCR. It was still beaming commands at 0.75 volt the last time we checked, and check we did, for leakage. We retired these cells, lest they suffer the indignity of old age.

Both SLM and Rayovac say it's important to develop disciplined charging habits in order to get the most use from a battery. In both cases, the more juice in the cell during recharging, the more charges you're likely to get.

Let's say you use a Walkman while commuting for an hour each way. SLM advises to recharge the batteries each night when you get home, whether they seem to need it or not. If you develop a regimen with frequently used devices—Walkmans and kids' toys come to mind—those batteries can someday become hand-me-downs for radios, quartz clocks, pencil sharpeners and things that tend to be out of sight and out of mind.


You'll contribute less to the landfills, too. Alkalines haven't been legislated a hazardous waste—most now have virtually no mercury content. But getting extra lives from your batteries is one form of recycling where you're doing well by doing good. **PM**



Call 1-800-950-2438 for a brochure. *\$19,995 price of Caprice Classic LS as shown, MSRP including dealer prep and destination charge less \$800 cash back. Tax, license, and other fees may vary in California. †Always wear safety belts, even with air bags.

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 **Caprice Classic**

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HUBBLE RESCUE

NASA's daring, high-stakes repair mission to the hobbled space telescope may also revive the beleaguered space agency.

BY PHILIP CHIEN; PM Illustration by Mark McCandlish

● It's NASA's most prestigious scientific satellite. It's also NASA's biggest embarrassment. Jay Leno has skewered the Hubble Space Telescope's flawed vision since its launch three years ago. Meanwhile, Shuttle delays, satellite failures and the endless goal-line stand defending the space station have all taken their toll on the space agency.

Now, NASA hopes, all that's about to change. On-the-spot maintenance is what Hubble was designed for. Fixing satellites in orbit is what the Shuttle was designed for. And a dramatic manned space operation is NASA's call to glory. No surprise that mission director Randy Brinkley is calling the Hubble repair flight "the Super Bowl for us."

Hubble's troubles fall into three categories. First of all, too many of its backup systems, particularly gyros, have conked out. What's more, Hubble's solar arrays quiver and jiggle the orbiting telescope as it plunges from sun-drenched day into the cold night of space. And finally, of course, there is the infamous spherical aberration, the mis-ground primary mirror that blurs Hubble's focus. Fixing all these problems adds up to an intricate mission.

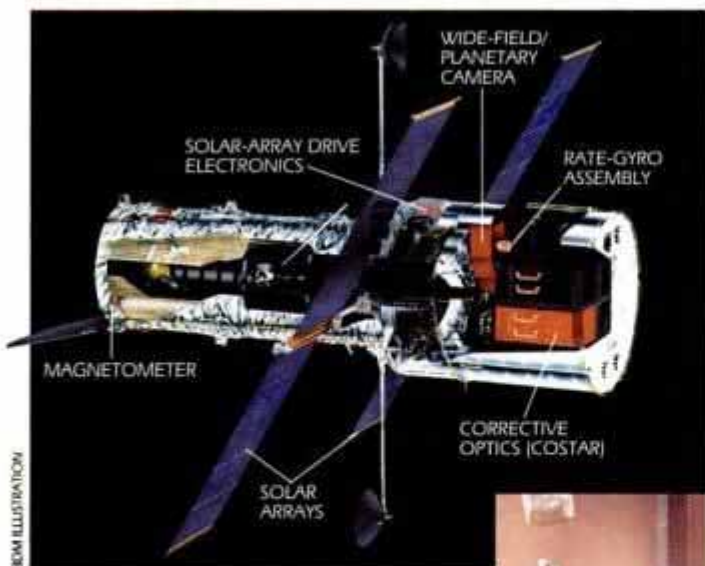
Even as you read this, Space Shuttle *Endeavour* may be already wheeling over the planet, astronauts scrambling across the telescope, tools in hand. NASA has drafted a dream team for this make-or-break mission. All are space veterans, and the repair crew—Story Musgrave, Jeff Hoffman, Tom Akers and Kathy Thornton—has racked up a total of 31 hours of extravehicular activity (EVA). They'll double that total on this mission alone.

Even with all their experience, however, the four spacewalkers still rehearsed underwater with mockup components for 350 hours. "This is the most complex EVA mission that Shuttle crews have ever attempted," says project scientist Ed Weiler.

A record five spacewalks, each running 6 to 8 hours, are in the playbook, and two more may be necessary. Astronauts liken back-to-back EVAs to soccer games—something you could do two days in a row if necessary, but not something you'd plan on. Fortunately, the repair crew can tag-team the work, with two astronauts resting every other day.

Five-day work week

The game plan calls for the action to commence on the third day of the flight. Cmdr. Dick Covey and pilot Ken Bowersox will inch *Endeavour* to about 35 ft. from Hubble, orbiting 370 miles above Earth. Under the guidance of mission specialist Claude Nicollier, the 50-ft. robot arm will snare Hubble and set it upright on the Flight Support Structure. This lazy-Susan platform in the payload bay also shunts Shuttle power into the telescope to recharge its batteries.



Cutaway (above) shows major components scheduled for transplants. COSTAR (right) will place dime-size corrective mirrors in lightpath, while Wide-Field/Planetary Camera will have built-in correction.



During the first spacewalk, Musgrave and Hoffman will replace two sets of gyros and a magnetometer. These are critical tasks to ensure that Hubble will still be able to point itself correctly even if the Shuttle mission is cut short.

The next day will see the retraction and replacement of Hubble's wobbly solar arrays. Mission planners believe that this is the task most likely to go awry. Theoretically, the arrays should roll up automatically like window blinds, but few engineers really expect that to happen after 2½ years of thermal vibration. If worst comes to worst, astronauts will simply yank off the old arrays and hurl them overboard.

Not until the third and fourth spacewalks will the astronauts tackle the spherical aberration. Ball Aerospace built the hardware fix—the Corrective Optics Space Telescope Axial Replacement, COSTAR for short. COSTAR will supplant Hubble's High-Speed Photometer, the least-used of the five scientific instruments, sacrificed for the sake of clear vision.

Once inside, COSTAR will deploy a set of corrective mirrors ground

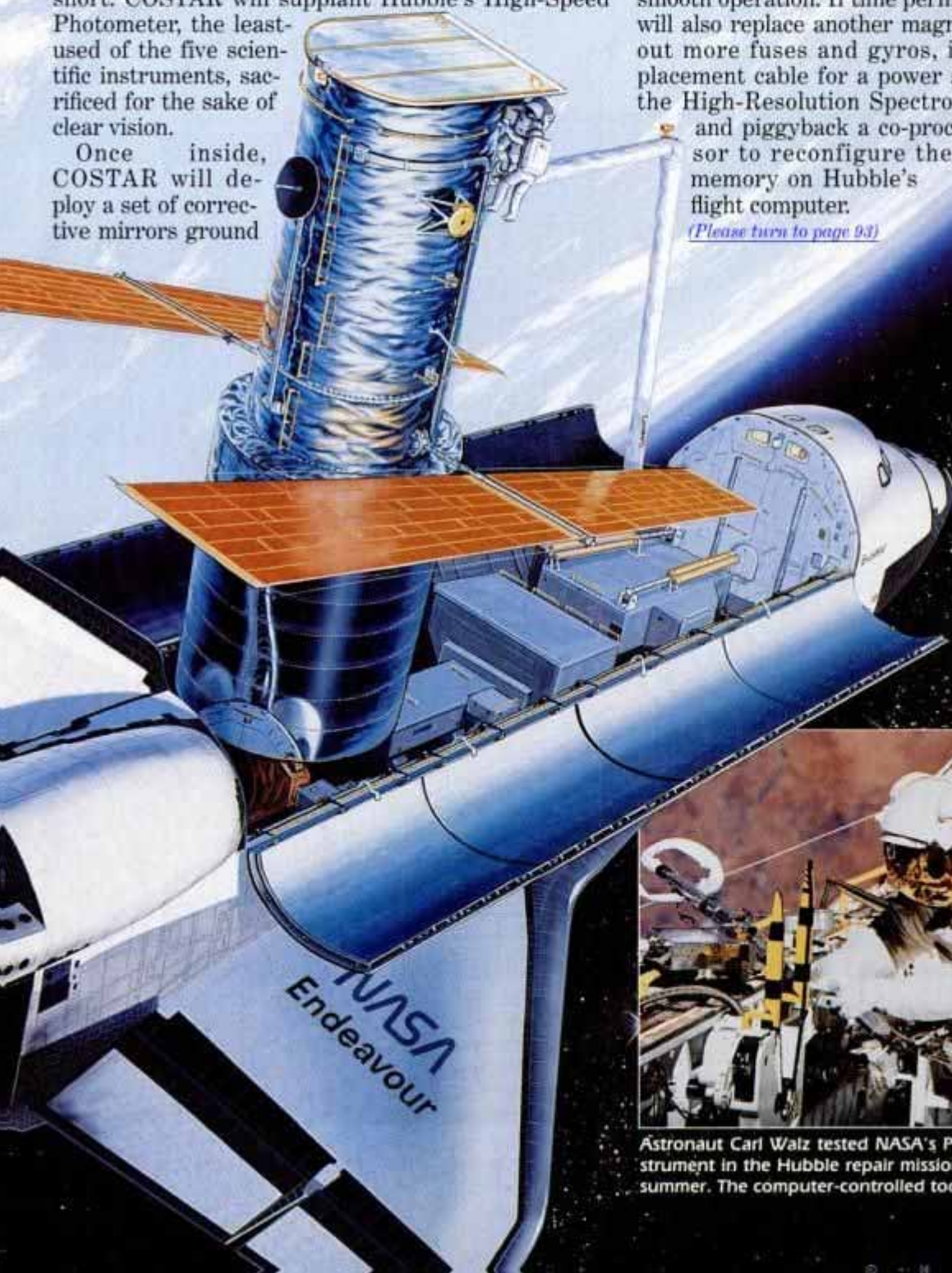
to Hubble's prescription. The mirrors will refocus light entering COSTAR, eliminating the spherical aberration. Optical paths will then relay the light down to the telescope's Faint-Object Camera, Faint-Object Spectrograph and High-Resolution Spectrograph.

Meanwhile, astronauts will insert a second-generation Wide-Field/Planetary Camera (WF/PC, pronounced "whiff-pick") with its own corrective optics. The 600-pound wedge-shaped instrument also carries an improved detector array—the camera's electronic "film"—that simply wasn't available when Hubble was first built.

The fifth spacewalk stands to be the most troublesome. Astronauts plan on replacing the Solar Array Drive Electronics (SADE), a box that wasn't designed for in-space servicing. Unbolting SADE, with its nonstandard connectors, isn't expected to be a smooth operation. If time permits, crew members will also replace another magnetometer, swap out more fuses and gyros, install a replacement cable for a power supply in the High-Resolution Spectrograph

and piggyback a co-processor to reconfigure the memory on Hubble's flight computer.

(Please turn to page 93)



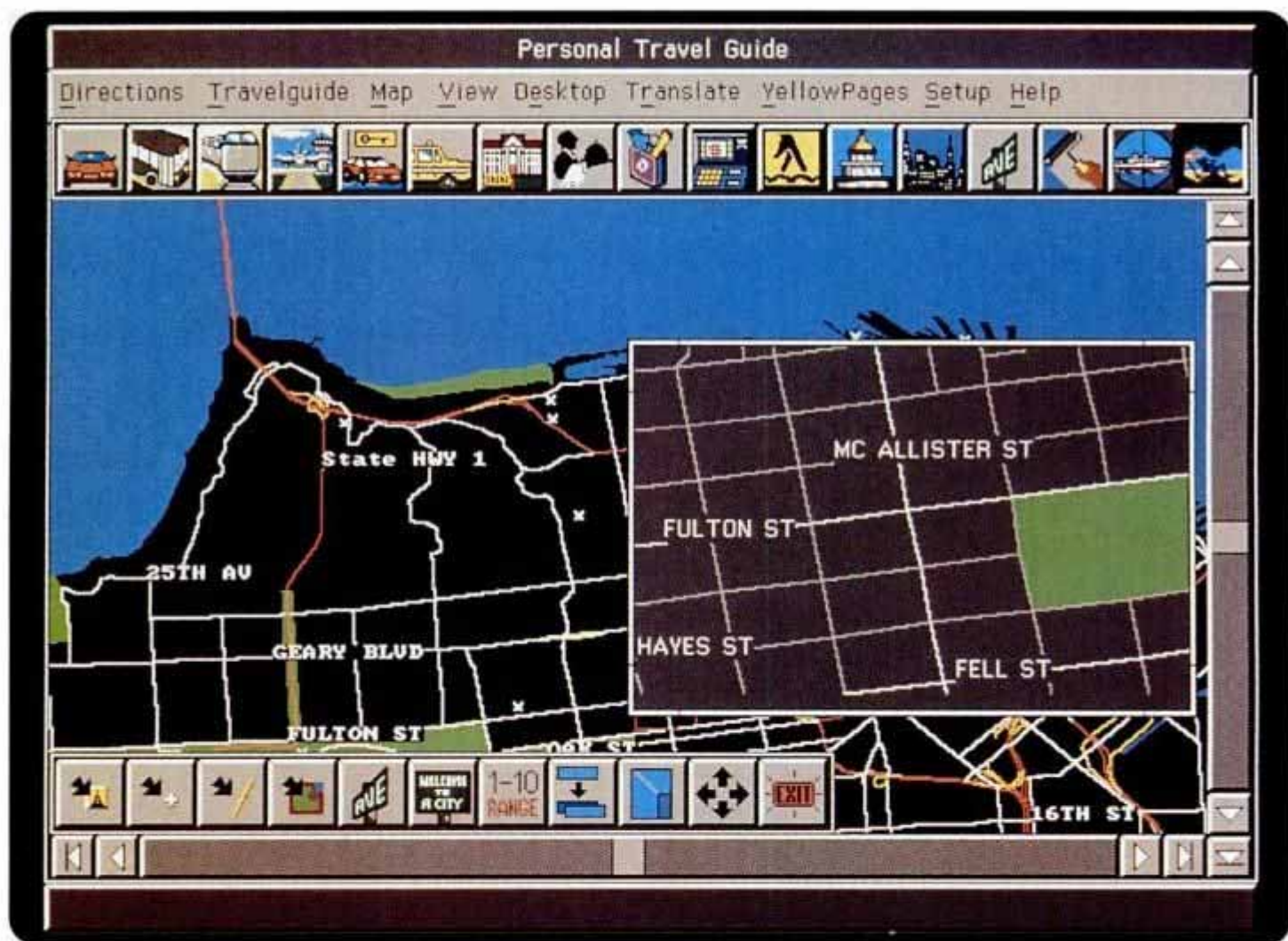
Astronaut Carl Walz tested NASA's Power Ratchet Tool, a key instrument in the Hubble repair mission, during a Shuttle flight last summer. The computer-controlled tool will be a Jack of all trades.

NASA PHOTO

PC MARKS THE SPOT

Computer software shows you the way to go, even if it's only to the best restaurant in town.

BY RON GOLDBERG



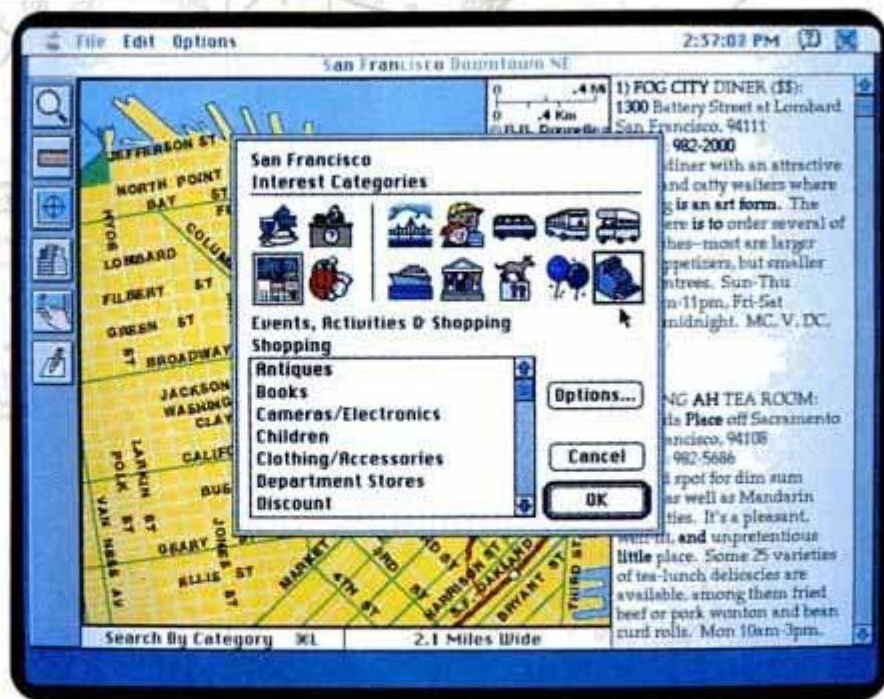
• There are a lot of sophisticated ways to get information, particularly if you use a computer. But sometimes the information you need is timelessly simple—like, “How do you get there from here?” With so many business people hopping from airport to airport and families vacationing domestically, good directions are be-

coming a necessity. Sure, you can get by with paper maps and a sense of direction, but savvy travelers are learning to do it with software.

There are plenty of advantages to using your PC as a travel guide. As good as a paper road map can be, it can't tell you exactly how many miles you've got to go or give you a specific

list of directions to your intended destination. Nor can it tell you how much your trip will cost in gas money or how long it will take. Not to mention which is the scenic route, where there's a nice restaurant in town or what time the local buses stop running. For atlas software, these jobs are a cinch. In the end, you can save

Some PC software programs are virtual survival guides for vacationers or business travelers. *Local Expert* (below) gives restaurant locations and reviews. Other information is easily accessed through a Windows-type operating system (right). And you can add personal notes to the database. *Personal Travel Guide* (opposite page) is so detailed it tells you the dress code for local nightspots. Both programs require supplemental location-specific software.



time, money and the frustration of getting lost.

If all you want is a better way of navigating the highways and main roads by car, a good place to start is *Automap Road Atlas* (\$99). With this Windows-based program, you can plan a travel route to and from any of more than 120,000 U.S. locales. Simply enter your starting and ending locations and the program will draw up a list of directions to your specifications. You can choose the quickest route, the most direct route or the one with the best views. Like any good travel map, it also lists points of interest.

One of the program's most interesting features is its cost/time calculation. Punch in the price of a gallon of gas and you get an estimated total fuel bill in advance of your trip. Because it knows what the state and local speed limits are, the software can also figure out approximately how long your trip will take. While it doesn't offer enough detail for the kind of traveler who lives on the road (no gas station or restaurant information), *Automap Road Atlas* is simple and effective.

If you need a bit more detail, you might find it in a CD-ROM called *Street Atlas USA* by DeLorme (\$169, PC or Mac). Only a CD-ROM could hold so much information because the program lets you view its maps at 16 levels of magnification. You start off with an overview map of North America, and by clicking on a zoom icon, you can get down to street level.

Navigation (the on-screen kind) is especially simple in *Street Atlas USA*. You can find a general location by phone number, zip code or city/state name. Clicking on a compass

icon moves the map in whichever direction you want, and as you get into the deeper levels of magnification, you can use another icon to find out local boundaries, rivers, railroads and the like. If you happen to be looking at a major metropolitan area, the mapping is detailed enough to tell you which side of the street a particular address is on. While *Street Atlas USA* doesn't offer the navigational niceties of *Automap Road Atlas*, it does give you a fairly comprehensive map of just about every location in the United States at your fingertips.

For business travelers, an atlas program has to give more than directions, it has to be a survival guide for whatever city in which they find themselves. That means access to food, hotels, local shopping and entertainment. *Local Expert* by Strategic Mapping tries to live up to its name by becoming a digital travel guide. Rather than offer directions on how to get to a city, *Local Expert* assumes you've already figured that out. Instead, the program concentrates on getting the user around town in style.

The software itself is \$99, but to take advantage of *Local Expert*, you need to order individual City Map-Sets (\$18-\$25) of the places you'll be traveling to. Because each city is its own separate database, *Local Expert* is extremely memory efficient, which is good news for laptop users. Call up a MapSet and you not only get a city map, but a detailed and updated list of business and recreational facilities. Need to find good sushi in Memphis or a copy shop in Kansas City? Click on a few icons and *Local Expert* will make recommendations. A notebook feature lets you add your

own notes, which the program will remember for the next time you visit that city.

For serious business travel, it's not enough to know where to find hotels and banks. You need to know which hotels have suites with an in-room modem hookup or the location of an automatic teller machine that's on the way to your morning appointment. When information this detailed and accurate is crucial, the most comprehensive of these navigation programs is *Personal Travel Guide* by Personal Travel Technologies (\$349). Available for DOS-based PCs, this program offers an incredible level of information, accessible through a simple point-and-click interface that eliminates the need for Windows and its memory-gobbling tendencies.

Suffice it to say that *Personal Travel Guide* contains just about all the useful information a business traveler might need in any given city. As much a digital Yellow Pages as an atlas, the program can tell you where to rent a car, what the dress code is at a local nightspot and where there's a Seven-Eleven so you can grab a cup of coffee. By the end of 1994, the company figures to have most major U.S. cities covered as separate Destination Databases (\$125 each), as well as key international cities.

Pretty soon, navigation programs like these will be showing up in both automobile dashboards and as plug-in cards for the handheld personal digital assistants that have just come out on the market. When that happens, you may never get lost again—as long as your batteries hold out. Of course, a good sense of direction is still a handy thing. But with these programs, you might not need it. **PM**

COMPARISON TEST

FINDING YOURSELF

Where am I? Pocket-size GPS units tell you with space-age accuracy. We test six for features and value.

BY GEORGE MANNES; PM Photos by David Dewhurst and Brian Kosoff

● The electronic device in your hand is about the size of a TV remote control. Turn it on. It displays your exact 3D location, accurate to about 100 yards. Travel to another spot and the unit tracks your progress. It marks a route, notes course deviation, updates location, monitors speed, measures distance made good and estimates time of arrival. Is this a Star Trek tricorder? No, it's the latest application of Global Positioning System (GPS) technology.

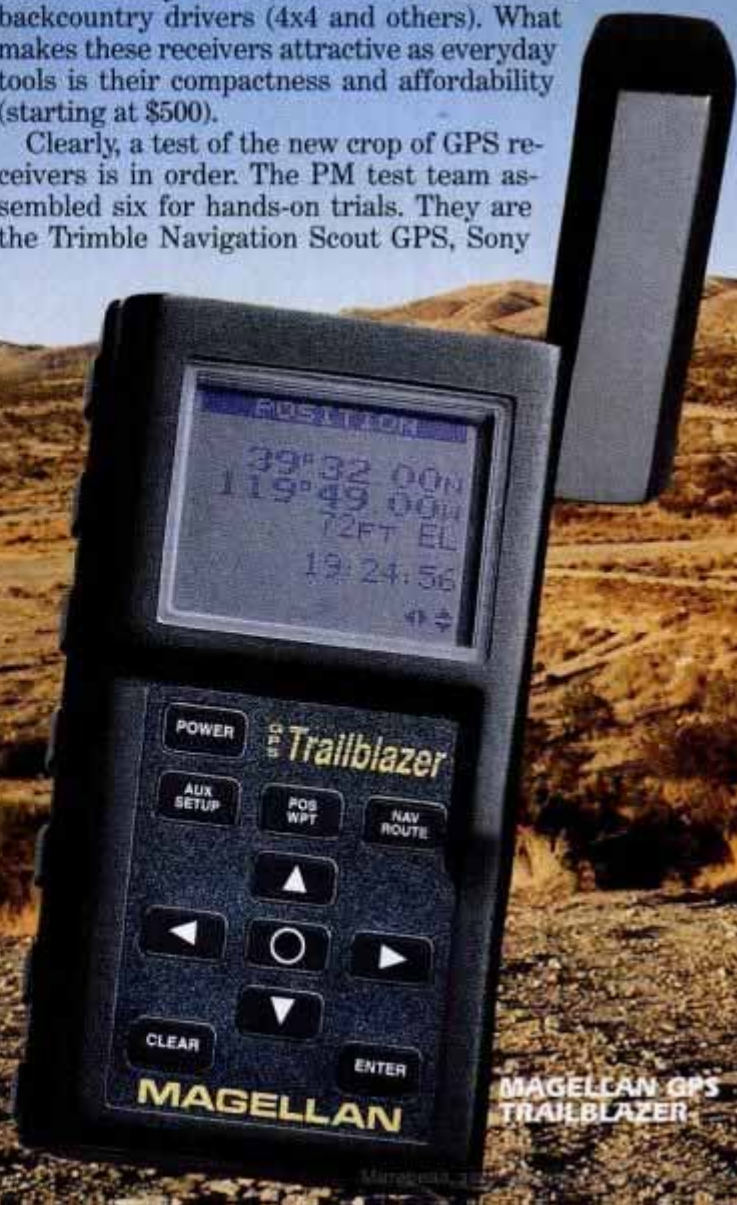
Although GPS was originally developed by the Department of Defense for military purposes, it's beginning to enjoy

widespread civilian use. (See "You Are Here" in the November 1993 issue for an overview of GPS technology.) In its current phase of development, pocket-size units are being built for hikers, mountain bikers, cross-country skiers, boaters, aviators and backcountry drivers (4x4 and others). What makes these receivers attractive as everyday tools is their compactness and affordability (starting at \$500).

Clearly, a test of the new crop of GPS receivers is in order. The PM test team assembled six for hands-on trials. They are the Trimble Navigation Scout GPS, Sony



SONY
PYXIS
IPS-760



MAGELLAN GPS
TRAILBLAZER

Pyxis IPS-760, Garmin GPS 75, Magellan GPS Trailblazer, Micrologic SuperSport and Panasonic KX-G5500. (Note: We also tested the Icom America GP-22 receiver, which is manufactured by Panasonic and is virtually identical to the KX-G5500. Therefore, all specifications and test data listed for the Panasonic model also apply to the Icom unit.)

We took several days to get familiar with the units and then put them through a variety of tests, including a 10-mile multipoint navigation route through Bucks County, Pennsylvania. Here's what we found.

Assuming there's an unobstructed view of the sky and the unit knows where it is (in other words, it's been used recently within a reasonable distance of the present location), all the receivers were able to fix a location or waypoint within a minute of being turned on. (A waypoint is a location that's generally expressed in degrees of latitude and longitude plus altitude.) When the sky's obstructed or the unit doesn't know where it is, each of the receivers can take up to 15 minutes to fix a location.

At any given moment, all units are able to save the current position in memory and plug in coordinates for other locations. All units enable you to assemble a list of waypoints into a route (a trip broken into a series of legs) and to display helpful navigational data, such as: the distance to the next waypoint, intended direction, actual heading, speed over ground and estimated time of arrival.

On some units, other displays might include cross-track error (distance deviated from the straight line between the starting

point and the destination) and velocity made good (speed toward the destination).

The sharper image

One of the biggest differences among the test units is in graphic display. At one end of the scale is the Panasonic KX-G5500, which has no graphics to speak of. Moving up in complexity are the Micrologic SuperSport and the Magellan Trailblazer, which share a rudimentary readout indicating cross-track error. A similar-looking graphic on the Trimble Scout's navigation screen shows the distance from a destination.

The Magellan unit adds a unique graphic element that displays a semicircle on the outer edge of a compass: It displays N or S (for north or south), a chosen destination and the direction you're traveling.

The Garmin GPS 75 has more elaborate screens. To help you visualize the course, it displays a highway that disappears into a horizon point. It also has a moving-map display, which features a bird's-eye view of your location relative to nearby waypoints.

In a class by itself is the Sony Pyxis IPS-760, which displays geographic images that mark your current position and selected waypoints. The Sony's large screen and fine resolution make its overhead maps much more readable than the Garmin's, which is less than half the Sony's



FINDING YOURSELF

size. However, despite the incredible detail of the Sony's map graphics, the unit is somewhat difficult to read in changing conditions. This is due in great part to its thin-line display type. To avoid eyestrain, we had to constantly adjust the screen's contrast and turn on the LCD night light, draining the unit's batteries more quickly than we would have liked.

Meanwhile, the Panasonic unit, which was the only test model with no graphic elements or contrast controls for its LCD screen, was never a problem to read.

Up and running

Ease of use in a GPS receiver depends on a variety of factors, such as quality of the operator's manuals, organization of software, layout of controls and feedback provided during operation.

How a unit lets you determine waypoints is one clue to its operational ease. At the low-tech end of the scale is the Panasonic, which identifies the waypoints by simply using a number—from one through 99. The Icom version comes with a reference card for writing down IDs for 30 waypoints to help you remember what the numbers stand for.

Fortunately, the other units let you write IDs right into the waypoint designations. Of these, the Micrologic is the only one that lacks the ability to search for waypoints alphabetically. Instead, you have to scroll through up to 199 waypoints in numerical order, reading each name as it appears.

In a class by itself, again, is the Sony, which lets the user assign each waypoint not only a name but also a

symbol, which is used in the unit's map displays. Sony's icon library includes everything from an airplane to a house to a martini glass—apparently to mark your favorite bar. Sony's large database also lets you write a memo associated with each waypoint.

One reason the Magellan is easy to

use is its no-frills software. For example, it's easy to pick out a route from its memory because it can hold only one route at a time. Its control layout is also simple. It's dominated by four directional arrow keys and a main-menu key in the center, as is the Trimble. At all times, both units use on-screen icons to tell you what function each of the buttons can execute.

The extensive keypads on the Micrologic, Sony and Garmin units did not make them easier to use. What was more helpful was the Garmin's menu at the base of the screen, which indicates current options. In this respect, the Garmin's operation is similar to the Sony's, which has four buttons at the base of the screen to help negotiate through its menu-driven display.

Bells and whistles

All the units, except for the Trimble and Magellan, have audible alarms, which are set off when you reach waypoints. In order to help you retrace your steps, the Sony, Magellan, Garmin and Micrologic units automatically record the path you've just taken.

GPS receivers need only four satellites for 3-dimensional location fixing, but all the models tracked more. The number of satellites the test units can receive simultaneously ranges from five for the Panasonic and Micrologic to 12 for the Magellan. Based on testing, our impression is that the 5-track receivers have a somewhat harder time tracking through narrow valleys and heavy tree cover, but the disadvantage isn't immense.

Some of the units have unique features that make them stand out. The

(Please turn to page 102)



**PANASONIC
KX-G5500**

**TRIMBLE
SCOUT GPS**

**MICROLOGIC
SUPERSPORT**

**GARMIN
GPS 75**

TEST DATA

| Make/Model | Size/Weight | Screen Size/Satellite Tracking | Battery Power/Battery Life | Memory Capacity | Special Features | Ease Of Use | Suggested Price |
|----------------------------------------------------------------------------------|------------------------------------------|----------------------------------|--------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------|-----------------|
| Garmin GPS 75 9875 Widmer Rd., Lenexa, KS 66215 | 1 1/2" x 4 1/2" x 6 3/4" 1 lb. 3oz. | 1 1/2" x 2 1/2" 8 satellites | 4 AAs, DC cable included/ 5-7 hours | 250 waypoints, 10 routes, 20 waypoints per route | Illuminated buttons, DGPS compatible, bird's-eye graphics | Good menu driven program, fair documentation | \$991 |
| Magellan Trailblazer 960 Overland Court, San Dimas, CA 91773 | 1 1/2" x 4 1/2" x 6 3/4" 15 oz. | 1 1/2" x 2 1/2" 12 satellites | 3 AAs, DC cable optional/ 6-7 hours | 115 waypoints ¹ , 1 route, 16 waypoints per route | Optional antenna extension, basically no frills | Very intuitive, good graphics, highly readable | \$500 |
| Micrologic SuperSport 9610 DeSoto Ave., Chatsworth, CA 91311 | 2 5/8" x 3 1/2" x 7 1/2" 2 lb. 2 oz. | 1 1/2" x 2 1/4" 5 satellites | 6 AAs, DC cable optional/ 6-8 hours | 250 waypoints ² , 9 routes, 20 waypoints per route | Man overboard button, anchor watch alarm, DGPS compatible | Fair intuitiveness, good readability, minimal graphics | \$1195 |
| Panasonic KX-G5500³ 1 Panasonic Way, Secaucus, NJ 07094 | 2 1/4" x 2 5/8" x 5 1/4" 15 oz. | 5/8" x 1 3/4" 5 satellites | 5 AAs, DC cable optional/ 5 hours | 99 waypoints, 9 routes, 10 waypoints per route | Rechargeable battery included, few frills | Good manual, no graphics, very readable screen | \$1195 |
| Sony Pyxis IPS-760 1 Sony Dr., Park Ridge, NJ 07656 | 1 3/8" x 4 1/2" x 9 1/4" 1 lb. 14 oz. | 3 3/8" x 2 3/4" 8 satellites | 6 AAs, DC cable optional/ 4 hours | 400 waypoints, 50 routes, 5 tracks (trip records) | 10' antenna cable, DGPS compatible, slots for memory cards | Great graphics, fair readability, good manual, very intuitive | \$1699 |
| Trimble Scout GPS 9020-II Capitol of Texas Hwy. N. Austin, TX 78759 | 1 1/4" x 3 1/8" x 6 1/2" 14 oz. | 3/4" x 2 1/4" 8 satellites | 4 AAs, DC cable optional/ 6-10 hours | 250 waypoints, 10 routes, 10 waypoints per route | Trimble Atlas included, Thomas Map detail, Sun/Moon locator | Intuitive, superb manual, minimal but readable graphics | \$795 |

1. 15 are temporary. 2. 51 are temporary. 3. Data applies to the Icom America GP-22, 2380 116th Ave. NE, Bellevue, WA 98004, priced at \$995. 4. With rechargeable battery the unit is slightly smaller and lighter.



CHEVY C/K PICKUP

The bottom line: They love their Chevy pickups.

BY MICHAEL LAMM, Contributing Editor; PM Photos by Scott Dahlquist

● As you're probably aware, America's best-selling cars aren't cars at all. They're pickups: Ford and Chevrolet half-ton full-size pickups.

The question is, what's so great about pickups? What makes them so popular? What gives them such wide—and steadily growing—appeal?

According to the 1993 Chevrolet C/K 1500 owners we surveyed, utility doesn't seem to have much to do with it. We noticed the same phenomenon among the Ford F-150 owners we surveyed in April 1991.

It's a matter of style. Full-size pickups, like Corvettes and Harley-Davidson motorcycles, say something about their owners. There's a certain panache. That's what the owners keep telling us.

With most C/K 1500 buyers, styling clinched the deal.

The majority of our respondents also chose the upmarket Silverado over the standard Cheyenne. This reinforces the notion that looks and luxury had a lot to do with the purchase decision.

The second most common reason that people bought C/K 1500s: They owned one or more Chevy pickups before. Repeat buyers made up 32.3% of our survey. Why did they repeat? For one thing, Chevy dealers seem to be treating their customers very well these days, especially in terms of service. No fewer than 95.8% of our respondents said their mechanical problems—minor to begin with—were repaired quickly and properly on the first visit. That's one of the highest first-fix percentages we've ever recorded. By way of contrast, owners of F-150 Fords reported that only 60.6% of



CHEVY C/K PICKUP



Owners criticized the climate controls.

Front-seat comfort drew lukewarm review.

Most owners praised Chevy powertrains.

their trucks' mechanical problems—similarly minor—were put right on the first try.

The majority of C/K 1500 owners also felt they'd been treated fairly on

price. Price ranked third as a reason for deciding on a new Chevy pickup, and 12.3% cited price/value specifically. Conversely, 10.1% called Chevy pickups too expensive.

One of the first things a pickup customer notices when he sits down with a Chevy—or GMC Truck—salesman is the tremendous number and variety of choices this line offers.

SUMMARY OF CHEVY C/K 1500 PICKUP OWNERS REPORTS*

| | | | | | | |
|-----------------------------------------|-------------------|--------------------------------------|-----------|-----------------------------|-------|-------|
| Total miles driven | 1,608,859 | 4-speed automatic | 14.9/18.3 | Driver sightlines: | No | 73.5% |
| Average miles driven | 7380 | Engine choices: | | Excellent | Yes | 26.5 |
| Purchase price: | | 5.7-liter V8 | 61.1% | Good | | |
| Average | \$18,314 | 4.3-liter V6 | 29.7 | Average | 62.3% | |
| Range | \$11,000-\$24,900 | 5.0-liter V8 | 7.3 | Poor | 34.6 | |
| Why did you choose the C/K 1500? | | 6.2-liter diesel V8 | 0.9 | Specific likes: | | |
| Styling | 46.2% | 7.4-liter V8 | 0.5 | Styling | 50.8% | |
| Previous ownership | 32.3 | Transmission choices: | | Ride quality | 45.4 | |
| Price/value | 12.3 | 4-speed automatic | 87.2% | Handling | 28.4 | |
| Performance | 7.7 | 5-speed manual | 9.6 | Comfort | 25.7 | |
| Comfort | 6.7 | 5-speed manual, extra-low First gear | 3.2 | Performance | 19.7 | |
| Power | 6.7 | Engine power: | | Power | 18.0 | |
| Model choices: | | Excellent | 56.8% | Specific dislikes: | | |
| C 1500 2wd | 53.9% | Good | 36.5 | No complaints | 15.7% | |
| K 1500 4wd | 46.1 | Average | 5.7 | Mpg lower than expected | 15.1 | |
| Trim level choices: | | Poor | 1.0 | High price | 10.1 | |
| Silverado | 79.2% | Handling: | | Handling | 7.5 | |
| Cheyenne | 20.4 | Excellent | 63.2% | Needs more power | 6.3 | |
| 454 SS | 0.5 | Good | 32.1 | Noises and rattles | 4.4 | |
| Options/Accessories: | | Average | 4.7 | Suggested changes: | | |
| Air conditioning | 95.0% | Poor | 0.0 | More interior space | 14.4% | |
| Tilt steering wheel | 81.9 | Braking: | | No changes | 9.8 | |
| Fleetside bed | 81.1 | Excellent | 60.6% | Improve seating comfort | 6.1 | |
| Premium sound system | 76.8 | Good | 37.8 | Night-visible controls | 6.1 | |
| Short bed | 64.1 | Average | 1.6 | More power | 6.1 | |
| Heavy-duty cooling | 54.0 | Poor | 0.0 | Reduce noises and rattles | 5.3 | |
| Tow hooks | 51.7 | Overall performance: | | Workmanship opinion: | | |
| Regular cab | 50.5 | Excellent | 60.4% | Excellent | 58.9% | |
| Extended cab | 50.0 | Good | 36.5 | Good | 35.5 | |
| Sliding rear window | 38.2 | Average | 3.1 | Average | 4.2 | |
| Flexible Duragrille | 37.8 | Poor | 0.0 | Poor | 1.4 | |
| Trailer package | 36.4 | Control layout: | | Front seat comfort: | | |
| Long bed | 35.2 | Excellent | 50.5% | Excellent | 55.2% | |
| W/T-1500 work equipment | 30.3 | Good | 38.9 | Good | 38.7 | |
| Cold-climate package | 29.6 | Average | 5.8 | Average | 4.7 | |
| Off-road package | 25.0 | Poor | 4.7 | Poor | 1.4 | |
| Sport performance suspension | 21.2 | Instrumentation: | | Rear seat comfort: | | |
| Avg. mpg, city/hwy: | | Excellent | 61.8% | Excellent | 28.2% | |
| 4.3-liter V6 | 17.1/20.6 | Good | 30.9 | Good | 37.7 | |
| 5.0-liter V8 | 15.5/19.2 | Average | 6.3 | Average | 31.6 | |
| 5.7-liter V8 | 14.1/17.4 | Poor | 1.0 | Poor | 2.6 | |
| 5-speed manual | 16.2/19.2 | Any mechanical trouble? | | Yes | 82.2% | |
| | | | | Maybe | 15.0 | |
| | | | | No | 2.8 | |

* Percentages might not equal 100% due to rounding up or insufficient data.

First, the salesman explains that C means 2-wheel drive and K identifies the 4x4 version. After this decision, buyers have to choose between two cabs (regular and extended), four seating configurations, two bed lengths, Fleetside and Sportside boxes, four wheelbases, five engines, three transmissions, a variety of load and towing capacities, plus a staggering array of options, extras and special packages. The option lists for pickups far exceed any for passenger cars. Therefore, the C/K 1500 buyer has to be especially patient, careful and knowledgeable.

In our survey, a mere 0.5% opted for the \$18,585 high-performance 454 SS package (which has since been discontinued). Chevy's intermediate 305 V8 turned out to be another wallflower, the choice of only 7.3% of our respondents. And a mere 0.9% of our owners chose the 6.2-liter diesel V8.

More than 15% of our respondents expected better fuel economy. V6 owners did most of this expecting. Some V6 drivers were also disappointed with their engine's 165 hp.

Actually, the V6 delivered quite respectable gas mileage, averaging 3 mpg more than the 350 V8. A few respondents voiced power/mpg complaints about the V8, but then much of this response has to do with rear-axle ratio and load.

On the topic of comfort, a Texas driver called his C 1500 a "Cadillac with a bed." Ride quality was judged excellent by 54.7%, and front seating got a similar endorsement. The rear seats of extended cab C/K 1500s, however, came in for a few frowns, 31.6% rating rear-seat comfort only fair.

Another, more general complaint had to do with the relatively large turning circle of K 1500 4wd pickups, especially those on longer wheelbases. A number of owners further suggested replacing the rear-only standard antilock brakes with 4-wheel ABS, especially since the present system works in 2wd only.

A handful of drivers grumbled about the heater and air-conditioner controls being too small, overly complicated and hard to balance for temperature. Another handful mentioned that the door-lock and power-window switches ought to be reversed. Yet fewer than a handful noted the absence of airbags.

Basically, despite these niggling nits and equally minor mechanical problems (covered by Chevrolet's 36-month/36,000-mile bumper-to-bumper warranty), 82.2% of our C/K 1500 owners said they'd still buy a Chevy pickup if they had it to do over again. All in all, it sounds like a good testament to Chevrolet loyalty. **PM**



Chevy C/K 1500 styling and past Chevy truck experience led the list of purchase motivations. Over 82% of surveyed owners said they'd be happy to repeat their choice.

EDITORS REPORT

Changing Pickup Priorities

● Generally speaking, we refrain from styling critiques in our new-vehicle evaluations. While there may be some pertinent remarks to make on this topic from time to time, our feeling is that most people can—and will—make up their own minds on this issue.

So it is with the Chevy C/K pickups, along with their GMC Truck clones. Our only observation here is that, at a glance, it might seem amazing that styling plays such an important role in pickup purchase decisions. However, the truth is that with such a myriad of product options for each of the Big Three half-tonners, functional distinctions get pretty blurry.

Perhaps that's why utility doesn't show up as a buyer priority. Thanks to their option lists, each of the Big Three full-size pickups can be equipped for hard work, and their general capabilities are quite similar. So along with brand loyalty, something that's still a part of truck-buying, styling is one of the few real distinctions to be made. It is interesting to note, though, that in our most recent Ford F-150 report our owners cited previous experience as their top purchase motivation. Styling ranked third.

Our own experiences with Chevy and GMC Truck pickups over the years have been generally positive, and our list of possible improvements is short. We agree with owners who criticize the climate controls, which are difficult to adjust for blend. And we certainly agree with owners who

think 4-wheel ABS should be standard.

Then there's the issue of roominess. Standard cab pickups have been short on legroom since time out of mind, and the current Chevy and GMC trucks are nothing if not traditional on this score. Ditto the Ford.

However, one of the few truly competitive points of the Toyota T100 is its roomy standard cab. And the new full-size Dodge Ram trucks seem likely to rewrite the standard cab rulebook for roominess. We're going to be seeing changes on this score.

Extended cab versions of the Chevy and GMC pickups cure the cramped-cab syndrome, of course. But if you're looking for roomy rear seats in any pickup, you're likely to be frustrated.

This brings us to another cautionary note: If you're thinking of buying a truck as a personal image-enhancer, you're setting yourself up for disappointment. While today's pickups are more civilized than at any time in the past, they're still designed as cargo-haulers. And rear springs designed to accommodate a half-ton of cargo don't provide the best ride quality when the cargo bed is empty.

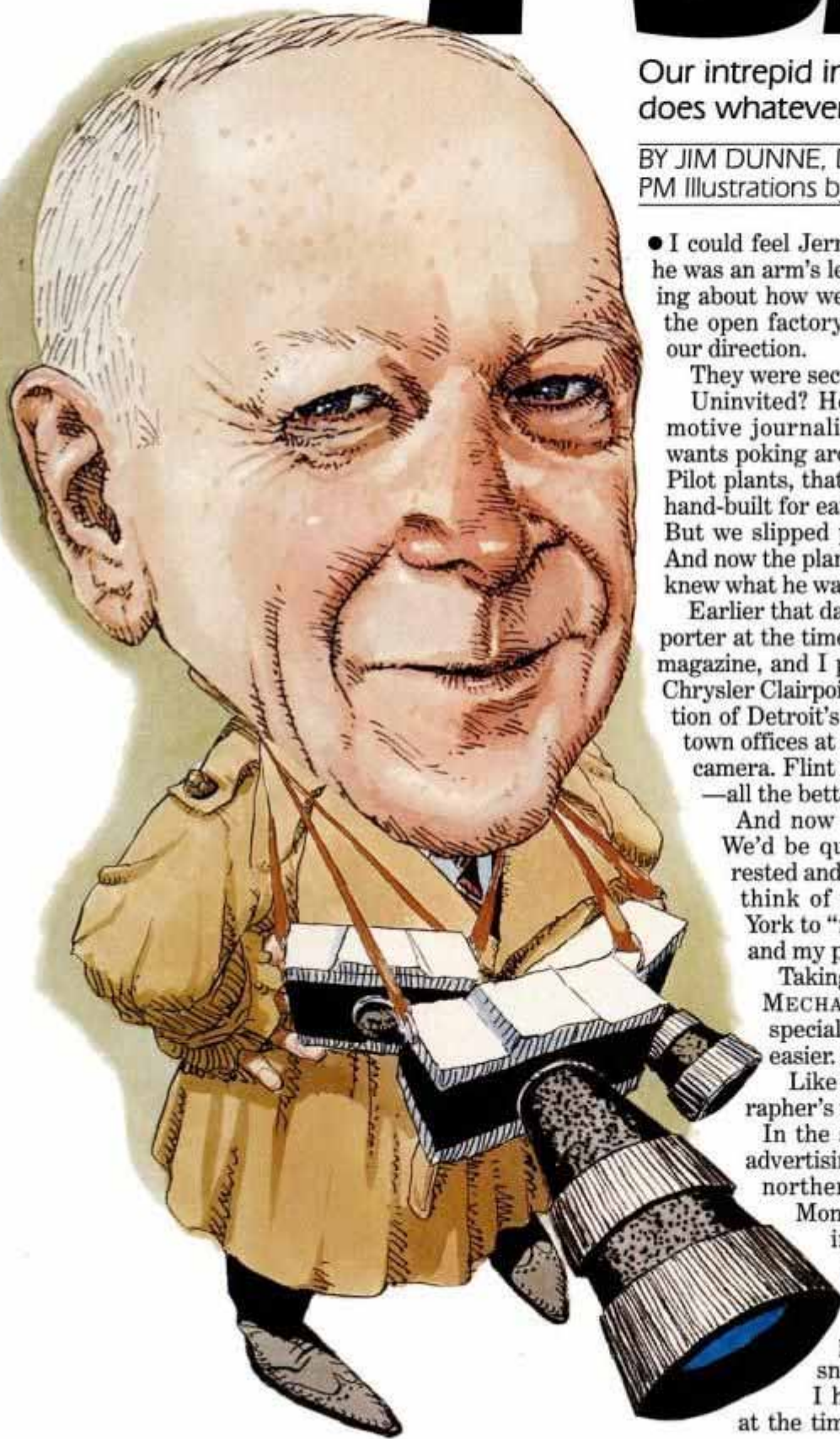
That said, we think the Chevy and GMC Truck C/K 1500 pickups should be on your full-size shopping list. The small-block V8 has more development behind it than any engine in the world, the dealers are working hard to please and the full-size universe is small. You can check 'em all in a day.

—Tony Swan

I SPY

Our intrepid in-house spy photographer does whatever it takes to get the shot.

BY JIM DUNNE, Detroit Editor
 PM Illustrations by Dick Anderson



● I could feel Jerry Flint's body stiffen even though he was an arm's length away and didn't stop chattering about how we were going to get caught. Across the open factory bay, three white shirts strode in our direction.

They were security. We were the uninvited.

Uninvited? Hell, we were the forbidden—automotive journalists are the last people Chrysler wants poking around in its super-secret pilot plant. Pilot plants, that's where the cars of the future are hand-built for early testing. Security is the tightest. But we slipped past a double line of checkpoints. And now the plant super was walking toward us. We knew what he wanted. It was put up or shut up time.

Earlier that day, Flint, a New York newspaper reporter at the time and now a senior editor at *Forbes* magazine, and I planned another penetration of the Chrysler Clairpointe pilot plant, located in an old section of Detroit's lower east side. We left our downtown offices at noon, equipped with a single 35mm camera. Flint carried the lens, I packed the body—all the better to hide in our business suits.

And now the plan was about to fall apart. We'd be questioned, searched, probably arrested and definitely embarrassed. All I could think of were my instructions from New York to "never tell a lie." I remembered that and my prepared cover story.

Taking photos of future cars for *POPULAR MECHANICS* and other publications is a specialty of mine. I work alone now. It's easier. I can move quicker.

Like the time I encountered the photographer's model with the wraparound skirt.

In the summer of 1966, Chevy set up an advertising photo session in a small town in northern Michigan for the all-new 1977

Monte Carlo. Chevy was intent on giving its best-selling car a booming sendoff. As part of the buildup, the ad agency took over Main Street, rolled out the new cars, positioned female models and snapped off some glamour shots.

I happened to be driving in the area at the time (on vacation—honest) and came

upon the scene. I hopped out of my pickup and started shooting my own photos. Almost immediately, two executive types ran toward me, waving their arms and yelling, "Stop. You can't take those pictures."

I simply stepped up on the side of my truck and shot over their heads. At this time, a quick-thinking female model took in the whole scene, whipped off her wraparound skirt and held it up in front of the Monte Carlos. I can still picture the scene in my mind—her looking back over her shoulder at me, holding that skirt up and hiding my photo opportunity. Still, what photos I did shoot covered my vacation and my expenses.

Although I work full-time for *POPULAR MECHANICS*, I sometimes sell spy photos to other publications after sending them to our New York office. What do I charge other publications for a spy photo? Anywhere from \$150 to \$3000. A modest facelift on a Crown Victoria will bring a lower price, while an exclusive cover shot of an all-new Corvette or Mustang will get top dollar. Customers come from all over the world, but the buff books and auto-industry publications in the United States are my prime outlets.

One of my best photos came from an order by *Car And Driver* magazine. Don Sherman, the editor at that time, wanted a photo of the newly designed 1984 Corvette. He wanted it bad. "Jim, we'd kill for one," he said.

I went out to Death Valley where a prototype was undergoing its standard hot weather tests. My problem was catching the car. Each time I'd spot it, it would pull away at speeds of more than 100 mph.

My solution was a helicopter. Imagine the surprise when the testers pulled over to see a helicopter landing in the desert at the side of the road. When the dust settled, I hopped out and got a shot of the test engineers scampering back into their soon-to-be-a-magazine-cover Corvette.

But that case is an extreme. My usual m.o. is to check out the proving grounds where prototypes are first tested. The grounds are off-limits to photographers. And they're protected by 8-ft. chain-link fences on the border and security patrols that roam the nearby highways.

Shooting photos over the fence from the roadway is the time-honored and surest technique. This captures new cars while they're undergoing development tests. As a counter measure, the auto companies make certain proving-ground roads off-limits to prototypes. Signs that say "Warning. Camera Area," are intended to keep new cars out of the sight of



long-range lenses.

In recent years though, the auto companies have turned to a new security practice—camouflage. Cars are clad with plastic panels that hide their true shapes. And paint patterns cover windows or create fake air scoops. For me, the camouflage is a bonus. I take photos of the disguised cars and get them published. Later, just before the cars are introduced to the public, the auto companies remove camouflage, and I get a clear photo of the vehicle. These get sold too, and that doubles my trade.

My most infamous bustout came when I did GM's Dallas clinic in the mid-1980s.

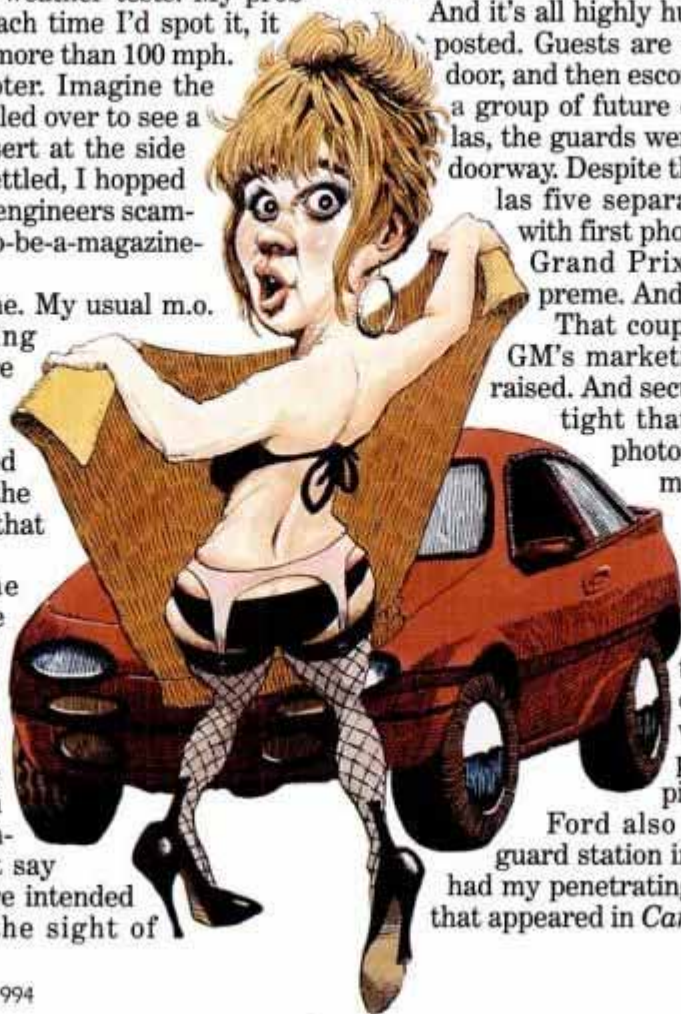
Auto companies sometimes truck their future models out of town to private shows. There, specially invited guests are given a chance to view the future designs and give their opinions. It's all part of a marketing exercise to get a good handle on the cars' acceptance well before they go into production.

And it's all highly hush-hush. Police guards are posted. Guests are carefully checked in at the door, and then escorted through the hall where a group of future cars are displayed. At Dallas, the guards were posted within 5 ft. of the doorway. Despite that setup, I penetrated Dallas five separate times, and came away with first photos of the Caprice, Lumina, Grand Prix, Regal and Cutlass Supreme. And, I never told a lie.

That coup reverberated throughout GM's marketing bureaucracy. Hell was raised. And security tightened up. It got so tight that clinic organizers posted photos of me with the guards to make certain I didn't get in.

(It was at this time that GM blamed me for Ford's decision to produce the '91 Crown Victoria. Officials at GM felt that my photo of the '90 Caprice prototype convinced Ford to go ahead with the Crown Victoria program, instead of dropping the car altogether.)

Ford also posted my photos. Each guard station in Ford's Dearborn complex had my penetrating stare (lifted from a photo that appeared in *Car And Driver*) tacked to the



I SPY

wall. I got some hint of how effective that was when I answered an invitation to the 1990 new-car preview at Ford's proving grounds in Dearborn.

"I'm here for the preview." That's all I said at the guard stop. Ford's guard didn't miss a beat, "Sure. Right over the bridge to the infield, Mr. Dunne."

Mr. Dunne? The photo in the guard shack was doing its job. Needless to say, I never try to enter the proving grounds without an invitation.

Which brings up the question of how I got into this spy-photo scheme in the first place. If you're not in the news business, the answer is probably a letdown. Working for a long-lead magazine puts you far behind the daily papers and television in the race for news. They publish within hours of a breaking story. I have to wait months.

Then I found that I could leapfrog the competition by printing news before it happens—photos of future cars. Now, when I attend an official new-car unveiling, chances are I've already published photos and details that other writers are just getting for the first time.

Nowadays there are many wannabes in the spy photography trade. You can be one too. If you see any strange cars while you're on vacation, snap off a shot. It could be valuable. Once in awhile I get a shot from an amateur that I can publish, so be sure to check with me.

My own camera equipment is simple. I use a 35mm Nikon 8008 with a 35-105 zoom lens. For more reach, I add a 500mm mirror lens and a 2X doubler. With that setup, I can shoot anything from an engine compartment closeup to a micro-mini at 700 yards. Photo quality is not a limitation. For the most part, photos can be a little fuzzy and still be acceptable.

Some are taken through the openings in a chain-link fence, a necessity that works well in the final printing—adding a spy flavor to the product. I've even been accused of using a chain-link filter on my camera to enhance the flavor of otherwise ordinary photos.

Now to get back to the Clairpointe caper. The chief white shirt was polite, but to the point. "Can I help you? What are you doing here?" he asked.

Without missing a beat, I shot back, "We're from publications. Downtown." Then I added, "We took off for lunch to get a look at the new models."

That eased the situation. White shirt—obviously thinking Chrysler publications—explained that some magazines published photos from inside the plant the year before (No kidding.). And now all visitors had to sign in. Would we care to step over to the office and get our passes?

Jerry and I said no thanks, got to get back to work.

We turned and marched out. Never to return. Never.

Sometimes, the photos come too easily. And that can cause trouble. There's a wooded hill near the General Motors proving grounds in Milford. From there you get a wide view of the test roadways inside. It's one of my favorite spots for shooting future cars.

For a couple of months during the summer of 1990, that hill became one of America's busiest photo locations. Beginner spies made it a required stop when they came to the Detroit area. It got so crowded that I had to bypass the hill three times in a row because some other photographer was already up there.

My solution? I would drive directly to the GM guard station to report this transgression. "There's someone on that hill with a great big camera around his neck," I'd tell the guard on duty. "I don't know if you're interested. But I think he's taking pictures of your cars."

That would set GM's fast-reaction security into motion. Within 5 minutes, a GM Suburban with warning lights blazing would leave the proving grounds, and flush the photographer from his hiding place on my hill.

Meanwhile, I'd be watching from down the road. After the photographer and security guards would drive away, I'd walk in for a few hours of undisturbed shooting.

My record is not all successes. Three years ago, in Rosemont, Illinois, I was stopped by a guard at an exhibition hall. GM was holding a clinic, and I was casing the joint. The guard came out of

nowhere. "Can I help you?" he asked.

"No thanks, I'm just looking around."

That didn't cut it at all. The guard asked for my ID, and directed me to the office. My pleas were that: one, I was on public property, two, I had entered through public doors, and three, I didn't do anything illegal.

"We've been waiting for you all week," the officer said as he directed me to his post. "All the guards have your picture. It's posted in the office, too."

No kidding. I was soon staring at an old photo of myself on the station bulletin board.

"Look," I protested. "I didn't do anything wrong."

That approach fell flat, too. In the best tradition of law enforcers, the guard issued an order, "Stay where you are. You've made my day."

A great finale for any story. But that wasn't the end.

After a series of calls to GM headquarters in Detroit, and after checking with the police chief, I was released. But with a warning from the police chief: "You're not staying in Rosemont tonight. I'd advise you to get a hotel room in some other town."

Sure sheriff. I'll be gone before sundown.



PM



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| | | | |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <p>BEFORE</p>  | <p>Don W., Age 27</p> | | <p>AFTER</p>  |
| | <p>Before</p> <p>Body weight: 194 lbs.</p> <p>% Body fat: 11.5%</p> <p>Waist: 33 inches</p> <p>Arms: 12.5 inches</p> <p>Chest: 40.5 inches</p> | <p>After*</p> <p>Body weight: 175 lbs.</p> <p>% Body fat: 6%</p> <p>Waist: 31 inches</p> <p>Arms: 15.5 inches</p> <p>Chest: 44.5 inches</p> | |

| | | | |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <p>BEFORE</p>  | <p>Jody Z., Age 28</p> | | <p>AFTER</p>  |
| | <p>Before</p> <p>Body weight: 119 lbs.</p> <p>% Body fat: 17.5%</p> <p>Waist: 27 inches</p> <p>Hips: 37 inches</p> <p>Thighs: 20.5 inches</p> | <p>After*</p> <p>Body weight: 111 lbs.</p> <p>% Body fat: 11.5%</p> <p>Waist: 24.5 inches</p> <p>Hips: 35 inches</p> <p>Thighs: 19.5 inches</p> | |



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HOME&SHOP JOURNAL



HOME IMPROVEMENT

CLASSY CONCRETE

Concrete that looks like brick, stone or slate.

BY ROY BERENDSOHN, Assistant Home Improvement Editor

● Most people see concrete without noticing it. To them it's ubiquitous and, worse yet, boring. They couldn't care less about its looks because it's not supposed to look good. Architects, engineers and homeowners choose it for its strength and durability. It's the material of choice for highways, dams, sidewalks and sky scrapers. It's a municipal and handy material, but many people who are not familiar with its possibilities cer-

tainly think: Mass it has, but grace and presence, no.

At first, it's hard to believe, that concrete *can* be elegant. That's a lot to ask—that something works just as well in the Hoover Dam as it does underfoot at an outdoor cocktail party. Where building materials are concerned, however, it's true—concrete has grace under pressure.

Worked by skilled hands, it can be finished in a variety of patterns, col-

ors and textures, even to the point of looking like something else, including flagstone, brick and slate. This versatility expands anyone's design options for that pool deck, patio or walkway.

Why not use brick, stone or slate? Each of these is a fine material, but natural materials (and to a lesser extent, brick) dictate the color and shape you must work with, and not all options are available in all areas.

Also, concrete is generally less expensive than quarried materials, which often must be shipped over long distances. Decorative concrete is more expensive than regular concrete, of course, and its cost varies greatly by location and even among contractors in the area. Remember, get several bids and avoid those that seem drastically low. For instance, regular con-



crete may cost \$2.50 per sq. ft. in the northeastern states, with decorative concrete costing from \$4.50 to \$8 per sq. ft.

Concrete basics

To understand what makes concrete beautiful, you have to understand what it's made of and how it works.

Concrete consists of portland cement mixed with sand and gravel or crushed stone. Portland cement, as its name implies, cements the sand and gravel or crushed stone together. The cement is made of calcium (usually finely ground limestone) silica (sand), aluminum, iron ore and small amounts of other materials (sometimes fly ash, for instance). These materials are quarried, crushed, ground and blended. Then



Concrete can look like stone, slate or brick. At this house, it was finished to look like stone on the drive and brick on the walkway. Even the "wood beam" risers are really concrete.

they are fired in a kiln with an average temperature of about 2700° F—hot enough to melt steel. The material emerges from the kiln as marble-size pellets known as clinkers. These are ground into a fine powder, and this is bagged or delivered in bulk as portland cement.

The beauty of portland cement is that, to form a rock-like mass, all you do is mix it with sand, gravel or

crushed stone and then add some water. The chemical properties of portland cement are such that it reacts with water in a process known as hydration.

Here's how hydration works: Water and cement particles form a solution. To the naked eye, this solution appears as a paste that coats each grain of

sand and each piece of gravel or stone.

If you could see the paste at a molecular level, you would notice that water molecules arrange themselves around each particle of cement (each particle is about $\frac{1}{1000}$ th of a millimeter in diameter).

In the process, heat is generated as the molecules rub against each other and arrange themselves. Excess water molecules make their way

to the slab surface and evaporate off into the atmosphere. Other water molecules are locked out of the hydration process by the bonds formed by the hydrating cement particles. It takes decades for this water to escape, and this is why concrete gets harder as it gets older.

The water that was involved in the hydration process remains behind indefinitely as a crystal known as water of hydration. Under ideal circumstances, concrete takes its own sweet time arranging these cement/water-of-hydration particles. By the time the hydration process is essentially complete (it takes several weeks), you have a well-organized mass of sand and stone bonded in a matrix of cement/water-of-hydration particles. Because this bonding takes place at a molecular level, it's extremely thorough—well knit you might say—and very strong.

Thus, the unique characteristics of concrete make it a formable and formidable pavement that you can color and shape to look like brick, stone or slate. As an added bonus, the pavement grows stronger with age.

Faux slate, stone and brick

Finishing concrete to make it look like brick, slate or stone is not a typical do-it-yourself project. You would have to invest in the tools and finish quite a bit of experimental concrete before you pour the main pavement. It takes experience and the right tools to make concrete look like something it's not, so it makes more sense to hire a masonry contractor for the job.

The basic process, however, is not complicated.

Masons pour and place the concrete like they would for regular con-



This walk is textured and colored to look like dry-laid red flagstone. The pattern choice in this paving system is unlimited. The stones can be all the same size, interlocked shapes, laid in rows or completely random in shape and pattern.

crete, using a 3000-pound to 4000-pound psi mix, the typical concrete for outdoor pavements.

At this point, there are several methods that cement masons use to shape the concrete to look like brick, stone or slate.

In one method, they press strips of building paper or a paper stencil into the wet concrete using a float (Fig. 1). For faux stone, the masons cut out strips of building paper. And for a brick pattern, they buy a ready-made paper stencil.

Next, the masons spread colored granules over the concrete to give it the desired shade of brick or stone (Fig. 2). They work the granules, known as dry-shake compound, into



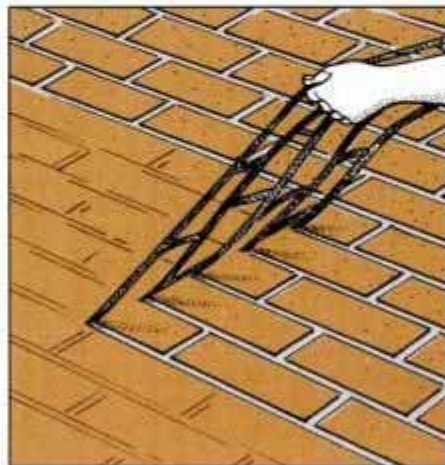
These faux granite cobblestones are finished with a sealer to give them a soft sheen and better resistance to stains.



1 A stencil is laid on the wet concrete and then pressed into the surface with a magnesium hand float.



2 Colored granules, known as dry-shake compound, are spread over the stencil. The compound is worked in with a float.



3 The stencil is peeled off, and the concrete is left to cure. The area beneath the stencil appears as mortar joints.



Faux-finished concrete is a good choice for a pool deck, since it wraps neatly around any shape. The pavement, including the faux mortar joints, can be colored to match or offset the pool itself and its surroundings.

the concrete, again using floats. Incidentally, dry-shake compound also increases the surface hardness of the concrete.

In the case of paper strips, the granules are carefully scraped off before the strips are lifted from the concrete. With paper lattice, the surface area is too large to do this, so the lattice is carefully peeled from the concrete after the dry-shake compound has been floated in (Fig. 3).

The area underneath the paper appears as mortar joints, while the area between the strips is colored to look like slate, stone or brick.

To achieve the faux finish of dry-laid stone (without contrasting-color mortar joints), the masons use stamps,

rollers and mats to press a shape into the concrete. In this case, a sheet of 2-mil polyethylene plastic is spread over the concrete. This prevents the concrete from sticking to the stamp or roller. It also gives nicely rounded edges to each stamped shape.

To achieve faux mortar joints with this method, the masons spread mortar over the slab and scrape off the excess, so it fills in the joints between the stamped patterns. Afterward, they use a rotary floor polisher to remove mortar residue from the slab's face.

Finishing up

The rest of the job is straightforward, and homeowners may elect to



Concrete patterns and colors can be intermingled. Faux tile is surrounded by concrete finished with a porous texture.

do some of it themselves. Soil is raked up to and nearly leveled with the concrete—remember, in most cases the concrete's color and shape are limited to its surface. (Concrete can be ordered in some colors, not just the typical light gray. Ask your masonry contractor for details.)

If the homeowner wants it, the masons can return and apply a sealer to the concrete to give it a slightly glossy appearance. This sealer helps protect the concrete against weathering and from stains such as those caused by the tannic acid that leaches from leaves. It also helps bring out the slab's color.

Now that that the concrete has been given a little personality, it's not surprising that people will comment on how nice all that brick, stone or slate looks. Whether you set them straight or not is up to you.

Contact the following companies for more information or the name of a contractor in your area using their process:

- Bomanite Corp., P.O. Box 599, Madera, CA 93639-0599.
- Increte Systems, 8509 Sunstate St., Tampa, FL 33634.
- Patterned Concrete Industries Inc., P.O. Box 691015, Tulsa, OK 74169.
- Goldblatt Tools, Stanley Tools, 600 Myrtle St., New Britain, CT 06050. (This company manufactures concrete finishing tools, pattern stamping mats, forms and rollers.) **FM**



Faux-finished concrete runs the gamut in terms of its level of finish. This rustic walkway looks like smooth-surface river rock with wide dark mortar joints. The rock can be a single color, or two colors can be mingled.

NEW TOOLS

NEW SEARS TOOLS

BY THOMAS KLENCK, Associate Home Improvement Editor

• With at least a half-dozen major tool manufacturers and at least that many private-label brands from the major chains, it's not difficult to appreciate that there's some healthy competition going on. And the way most companies stay alive, is to continually improve the features and variety of their product lines.

Sears, the company behind Craftsman tools, is no exception. This year Sears has put together a package of innovation and refinement that's

sure to interest home woodworkers and professionals alike.

The new products run the full range—from stationary and portable power tools to hand tools, bits, blades and accessories. While we don't have the space to show every new Sears offering, here are a few of the ones we think are especially interesting. By the way, although the big Sears catalog is no longer with us, its tool catalog is still alive and well. To get one for yourself, call (800) 377-7414.



Redesigned Plunge Routers

There are two new Sears plunge routers, both based on the same ergonomic housing design. The top-of-the-line model is a 15-amp 3½-hp router (about \$250) that comes with a soft-start feature and electronic variable speed, ranging from 10,000 to 25,000 rpm. A 12-amp 2-hp model (about \$190) runs at 25,000 rpm. Both routers feature a shaft lock and a unique plunge lock design that's operated by squeezing a trigger on the handle. For fine adjustments, each router has a micro-adjustable depth stop.



Sabre Saw Table

Now you can turn your sabre saw into a stationary jig or a scroll saw. This new bench-mounted accessory holds a late-model Sears sabre saw in an inverted position underneath the table. A rigid arm extending over the tabletop has a guide that holds the blade to reduce whip and ensure square cuts. Throat depth is 12 in. and maximum workpiece thickness is ¾ in. The No. 25439 sabre saw table costs about \$40.

Accessible Plate Joiner

If the high price of plate joinery is keeping your workshop in the dark ages, Sears has a solution. The new No. 17501 plate joiner sells for about \$100 and has a 6-amp motor turning an 8-tooth carbide blade at 10,000 rpm. The fence tilts from 0° to 90° for a full range of bevel joinery, and it's adjustable to a 2-in. height. The new Sears joiner has a 3-position depth stop to handle the most common plate sizes.



Accessory Baskets

You can keep your miter gauge, fence, push stick and other accessories hanging on the wall, or you can keep them at your fingertips with these Sears saw baskets. Designed to mount on the stand of a Sears table saw, the baskets can also be fitted on other makes and types of machinery. A set of two (No. 32040, about \$20) contains open-end and closed-end versions. Both baskets are 8¾ in. wide × 26 in. long.



Benchtop Band Saw

The new No. 22244 band saw (about \$200) boasts several improvements. It features a 1/3-hp motor that drives three 6 1/2-in.-dia. blade wheels for smooth operation. And its new blade-tension scale allows for more accurate blade tensioning. This variable-speed saw (500 to 5000 rpm) also replaces the old ribbed tabletop with a smooth top for improved handling of small work. Throat depth is 10 in. and the saw handles 3-in.-thick stock with 1/8-in. or 1/4-in. blades.



New Forstner Bits

Forstner bits are the choice for quality work, and the new Sears bits will last longer, too. Made of high-speed steel, these bits withstand higher temperatures to stay sharper longer than carbon-steel models. The 3 1/2-in.-shank 2-flute bits are available individually from 5/8 in. to 2 in. in diameter. You can also get them in a set of four (No. 25380, about \$45) or a set of seven (No. 25389, about \$80). Both sets range from 5/8 to 1 in.

Parallel-Jaw Pliers

This exclusive, patented parallel-jaw pliers design has a unique edge over traditional tongue-and-groove or slip-joint pliers. It features a spring-loaded mechanism that automatically adjusts the jaws parallel to each other to match the size of the object being gripped. The pliers come in two models: a 9-in. size to handle up to 1 1/2-in. objects and a 7-in. size that opens to 3/4 in. Dubbed RoboGrip pliers, the smaller version (No. 45028) costs about \$18, and the larger model (No. 45029) costs about \$20. **FM**



Vertical Panel Molding Kit

Traditional raised-panel cutters are unwieldy—even with heavy-duty routers. Vertical-profile bits solve the problem by allowing the router axis to be aligned vertically. This reduces the bit diameter, and the router base is parallel to the edge of the board instead of the face.

Sears has paired its carbide-tipped vertical-profile bits with a new vertical routing support. Designed to work in conjunction with Sears router tables, the support acts as an additional fence so the stock is held on both faces when routing raised panels. The vertical routing support (No. 25499) costs about \$13. The 3/4-in.-shank vertical-profile bits are available separately.



Sliding Table Saw Extension

Now you can update your Sears 10-in. table saw with the No. 32066 sliding miter table extension (about \$150). (A sliding table improves accuracy when crosscutting.) The accessory replaces the left wing on most Sears table saws and features a swiveling miter bar with a scale that's accurate to 0.5°. Table travel is nearly 2 ft. The sliding table rides on 42-in. rails and can be locked for normal use.



Thickness Planer/Molder

If you're in the market for a thickness planer, here's a chance to get molding capabilities, as well. This 12 1/2-in. planer takes stock up to 5 in. thick. It's powered by a 2 1/2-hp motor and a 3-blade cutterhead runs at 4500 rpm. A 2-speed gearbox switches feed rate from 26 to 13 fpm (feet per minute). Molding cutters are available to produce a range of profiles. The planer/molder (No. 23383) costs about \$700.



TOOL TEST

SKIL DRILL PRESS

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO,
 Contributing Editor

● If you're making a list of stationary tools for your workshop, here's one to take into serious consideration. Not only is a good drill press an important component in your arsenal of joint-making tools, but the ease in which it handles a wide range of materials, from wood to plastic and steel, also makes it a versatile addition to any workshop.

This new offering from Skil is a benchtop model—designed for situations where space is a premium and utility a priority. We tested the Model 3380 8-in. Skil drill press and found it to be a compact unit capable of meeting most of the needs of hobbyists and serious home woodworkers.

The new drill press features a powerful 1/4-hp induction motor that drives a 1/2-in.-capacity chuck. Power is transferred through one of five spindle speeds, ranging from 620 to 3100 rpm—a wide enough range to handle a variety of materials and operations from drilling steel to drum sanding a woodworking project. The maximum spindle stroke length is 2 in., and the maximum distance from the chuck to the table is 7 in. However, like most drill presses, you can swing the table out of the way and mount your work directly on the base, or swing the head to the side for even greater flexibility.

Like large heavy-duty models, both the rugged cast-iron base and the worktable are slotted for clamp access so you can hold your work securely. And, the 6 1/2-in.-square table adjusts left or right for angle drilling. To facilitate boring holes at a preset depth, this Skil drill press features an adjustable depth stop and scale.

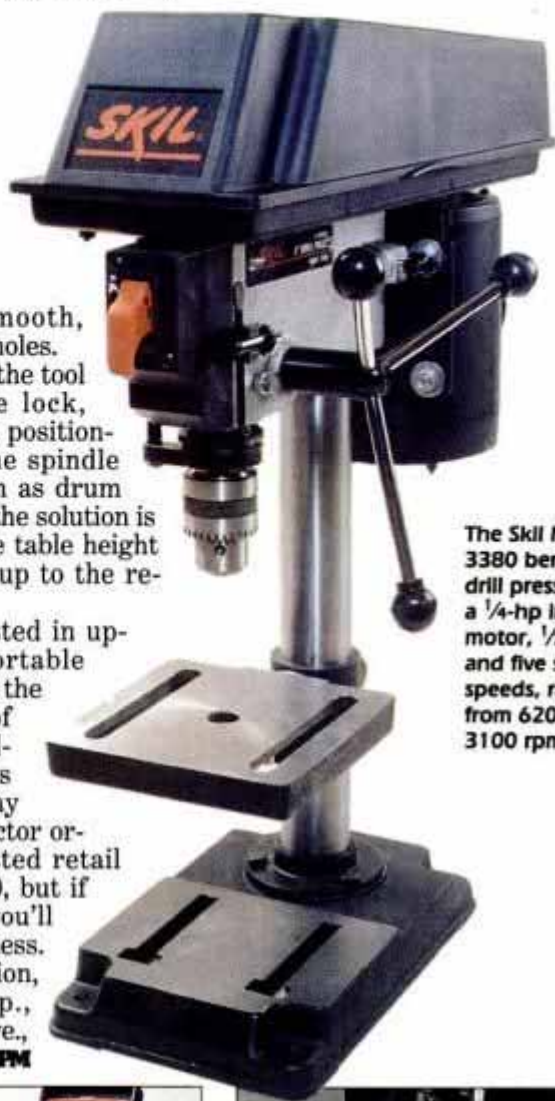
Additional features include a safety power switch that helps to prevent accidental starting and a convenient built-in storage compartment in the machine's head to store a wide selection of drill bits.

We tested the machine by performing a variety of drilling operations in both wood and metal and found that the tool performed satisfactorily. The drill press weighs just under 50 pounds and runs quietly with little vibration. This, plus a spindle that's free of play and runs true,

contributes to smooth, clean and accurate holes.

One feature that the tool lacks is a spindle lock, which would aid in positioning and holding the spindle for operations such as drum sanding. However, the solution is simply to adjust the table height to bring the work up to the required position.

If you're interested in upgrading from a portable drill while avoiding the expense and size of a typical floor model drill press, this benchtop model may be just what the doctor ordered. The suggested retail price is about \$200, but if you shop around, you'll probably find it for less. For more information, write to Skil Corp., 4300 W. Peterson Ave., Chicago, IL 60646. **PM**



The Skil Model 3380 benchtop drill press features a 1/4-hp induction motor, 1/2-in. chuck and five spindle speeds, ranging from 620 to 3100 rpm.



To keep your twist drills in order, a drill bit storage compartment is located at the top of the drill press drive housing.



The table tilts to the right or left for angle drilling. The table and the base feature clamp access slots for securing your work.



To increase capacity, the head can be rotated. Here, the tool is clamped to a workbench while the work is held in the vise.



For drum sanding, clamp board with a hole to the table. Then raise the table until the work meets the drum.

TOOL REVIEW

**WOOD-MIZER
 SAWMILL**

TEXT AND PHOTOS BY
 ROY BERENDSOHN, Assistant
 Home Improvement Editor

● Portable sawmills are not typical homeowner products. But there are rural homeowners who can put these machines to good use, especially those who are interested in starting a small custom sawing business.

Wood-Mizer sawmills are band-saw lumber mills which can be made portable if you add the company's optional trailer towing package. It's not just portability that makes these saws impressive, though, it's their engineering and effectiveness.

To see a Wood-Mizer in action, we visited Michael and Louise Peters, of Shady Lane Tree Farm in Emmaus, Pennsylvania. This husband-and-wife team of sawyers uses a top-of-the-line Model LT40HD, a 24-hp sawmill with hydraulic log-positioning controls. The machine is capable of sawing logs up to 3 ft. in diameter and up to 21 ft. long.

We watched them convert two oak logs into large piles of neatly sawn, defect-free oak boards in less than 1 hour. Except for the fact that the lumber needed to dry, the cuts were so smooth that the stock was nearly ready to use.

The Peters told us that the secrets

The Wood-Mizer is a band-saw lumber mill which can be made portable by adding a trailer towing option. The model shown here has hydraulic log-positioning controls.

to high-quality sawing with these mills are having a sharp blade and finding the right feed rate. Both are easy to do. Blade sharpening is done with an optional Wood-Mizer sharpener, and the feed rate is quickly adjustable to suit the log's density.

We were impressed by how productive a sawyer can be with a machine like this. The cant (a sawn log) is raised, lowered and clamped with the throw of a few levers. Furthermore, the saw's accuracy is guaranteed by its design. The saw carriage feeds on one rail, and the log is positioned independently on another rail so a sawyer produces boards of consistent thickness, regardless of log shape. Also the thin-kerf blade

wastes much less stock than typical circular-blade mills. These savings can really add up when sawing big cants.

Wood-Mizers come in several different models and with various options. As you go up in price, you get more power and more log handling capability. Equipped with the optional trailer, for instance, the Wood-Mizers range in price from \$7900 to \$18,300. The company also sells extension rails to saw long logs and accessories to saw shingles, lap siding and resaw dried stock.

If you're interested in these machines, write: Wood-Mizer Products Inc., 8180 W. 10th St., Indianapolis, IN 46214-2400; or call (800) 553-0182. For a catalog, call (800) 553-0219. **FM**



Once a log has four sawn surfaces, it is called a cant. At this point, the cant can be easily sawn into smooth, straight boards.



The saw has been trailered to a pile of logs outside, and away from the saw shed. One face of the log has been sawn.

**HOME
 IMPROVEMENT**

**INSTALLING
 A WATER
 FILTER**

BY MERLE HENKENIUS
 PM Illustrations by
 George Retseck

• Water quality is a hot issue these days, and one with an ironic twist. While federal and state agencies are doing more now to improve water quality than at any time in history, many of us suspect that our drinking water has never been more contaminated. The truth is, most water supplies are not as toxic as we might imagine. Still, there are exceptions.

Seventy-five percent of us get our drinking water from municipal water systems, which are subject to stringent ongoing testing and treatment. While this ensures reasonable purity at the source, contaminants, such as lead, can be picked up in the distribution piping or even from the piping in our own homes.

Moreover, a full 25% of us get our water from private or extremely limited public wells. These wells are tested for nitrates and coliform bacteria at their startup, but are seldom tested regularly thereafter.

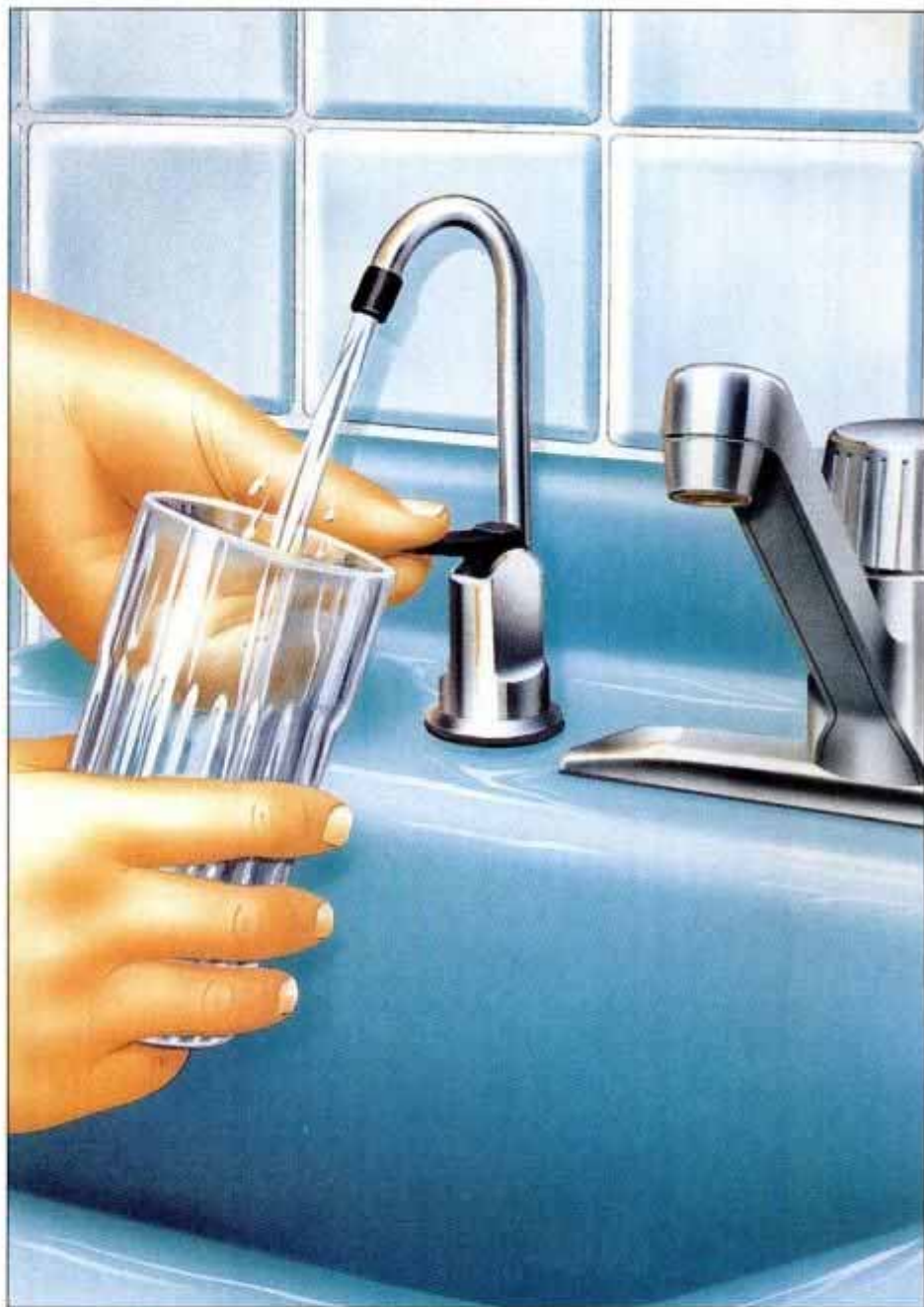
And finally, some water, while not health threatening, simply tastes or smells bad, usually owing to a high sulfur content. In other cases, sand or mineral sediment leaves water cloudy and gritty.

Defining need

No water treatment device should be installed where it's not needed. If you suspect a water problem in your home, check with your local health department about having the drinking water in your home tested. Most can arrange tests that are quite affordable, costing from \$15 to \$60. If you've recently purchased a home with a private water well, the mortgage company is likely to have required a well inspection and water test. In any case, your health department can suggest the best treatment equipment for your situation.

The filtration option

There is a wide variety of water purification devices on the market today, ranging from the familiar water



softener, to the less familiar reverse-osmosis system. But if your water is marginally high in lead, mercury, trace elements, sediment or chemical compounds (from agriculture and industry), simple filtration can be a reasonable and inexpensive solution.

While point-of-entry systems are available (which treat all water entering a home), a point-of-use system is often an acceptable alternative. The water entering your toilet or the water irrigating your lawn, for example, probably doesn't need to be treated. And because filters reach saturation limits in direct relation to the volume of water that flows through them, filtering only your drinking and cooking water makes sense.

This point is especially important

when you consider that saturated filter media actually increase your exposure to contaminants. When a filter medium such as activated charcoal fills up, it can release its contents—in high concentrations—directly into your drinking glass.

Considering features

We chose an Ametek (CMR-302) 3-filter point-of-use kit (approximately \$270), which mounts under a kitchen sink and includes its own sink faucet. We installed the faucet in the fourth deck hole of the sink (the hole often reserved for a spray attachment). Installation is surprisingly simple as the connection to the household water supply is made with a self-piercing

(Please turn to page 66)

John's losing his hair. His mission: get it back.

ASAP!
But how?
Weaving? No.
Transplant?
Not for him.
A hairpiece?
Never, never.
What John really
wants is his
own hair back.
And now he's learned,
for male pattern
baldness, only
Rogaine® has been
proven to regrow hair.

Rogaine Topical Solution (minoxidil 2%) works in part by prolonging the growth of hair, which grows in cycles. With more hairs growing longer and thicker at the same time, you may see improved scalp coverage.

After one year, over three fourths of men reported some hair regrowth.

Dermatologists conducted 12-month clinical tests. After 4 months, 26% of patients using *Rogaine* reported moderate to dense hair regrowth, compared with 11% of those using a placebo (a similar solution without minoxidil — the active ingredient in *Rogaine*). After 1 year, 48% of the men who continued using *Rogaine* in the study rated their regrowth as moderate to dense. Thirty-six percent reported minimal regrowth. The rest (16%) had no regrowth.

Side effects were minimal: 7% of those who used *Rogaine* had itching of the scalp.

Rogaine should only be applied to a normal, healthy scalp (not sunburned or irritated).

Make it part of your normal routine.

Studies indicate that *at least 4 months of twice-daily treatment with Rogaine* are usually necessary before there is evidence of regrowth. So why not make it part of your normal routine when you wake up and go to bed, like brushing your teeth.

As you'd expect, if you are older, have been balding for a longer period, or have a larger area of baldness, you may do less well.

Rogaine is a treatment, not a cure. So further progress is only possible by using it continuously. Some anecdotal reports indicate that if you stop using it, you will probably shed the newly regrown hair within a few months.

Get your free Information Kit, plus a \$10 incentive to see a doctor.

Why wait? Find out whether *Rogaine* is for you. Call 1-800-229-9331 today for a free Information Kit about the product and how to use it. **And because *Rogaine* requires a prescription**, we'll include a list of nearby *dermatologists or other doctors experienced in treating hair loss*, and a \$10 incentive to visit a doctor soon.

Call

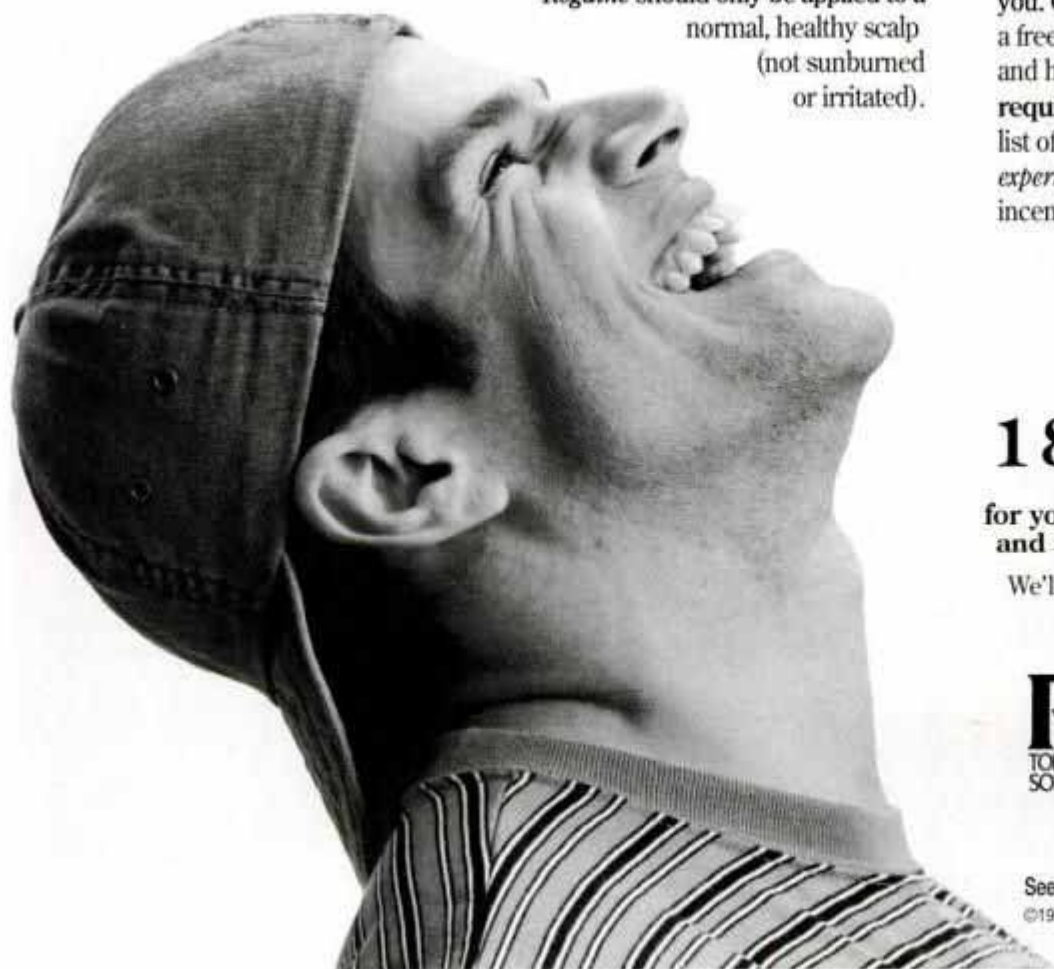
1 800 229-9331

for your free *Rogaine* Information Kit and a \$10 incentive to see a doctor.

We'll also send you a list of nearby doctors experienced in treating hair loss.

Rogaine®
TOPICAL SOLUTION minoxidil 2%

See next page for important additional information.
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Rogaine[®]
TONICAL SOLUTION minoxidil 2%

The only product ever proven to regrow hair.

What is ROGAINE?

ROGAINE Topical Solution is a prescription medicine for use on the scalp that is used to treat a type of hair loss in men and women known as androgenetic alopecia: hair loss of the scalp vertex (top or crown of the head) in men and diffuse hair loss or thinning of the front and top of the scalp in women. ROGAINE is a topical form of minoxidil, for use on the scalp.

How effective is ROGAINE?

In men: Clinical studies with ROGAINE of over 2,300 men with male pattern baldness involving the top (vertex) of the head were conducted by physicians in 27 US medical centers. Based on patient evaluations of regrowth at the end of 4 months, 26% of the patients using ROGAINE had moderate to dense hair regrowth compared with 11% who used a placebo treatment (no active ingredient). No regrowth was reported by 41% of those using ROGAINE and 58% of those using a placebo. By the end of 1 year, 48% of those who continued to use ROGAINE rated their hair growth as moderate or better.

In women: Clinical studies with ROGAINE were conducted by physicians in 11 US and 10 European medical centers involving over 600 women with hair loss. Based on patient evaluations of regrowth after 32 weeks (8 months), 23% of the women using ROGAINE had at least moderate regrowth compared with 9% of those using a placebo. No regrowth was reported by 43% of the group using ROGAINE and 60% of the group using placebo.

How soon can I expect results from using ROGAINE?

Studies show that the response time to ROGAINE may differ greatly from one person to another. Some people using ROGAINE may see results faster than others; others may respond with a slower rate of hair regrowth. You should not expect visible regrowth in less than 4 months.

How long do I need to use ROGAINE?

ROGAINE is a hair-loss treatment, not a cure. If you have new hair growth, you will need to continue using ROGAINE to keep or increase hair regrowth. If you do not begin to show new hair growth with ROGAINE after a reasonable period of time (at least 4 months), your doctor may advise you to discontinue using ROGAINE.

What happens if I stop using ROGAINE? Will I keep the new hair?

Probably not. People have reported that new hair growth was shed after they stopped using ROGAINE.

How much ROGAINE should I use?

You should apply a 1-mL dose of ROGAINE twice a day to your clean dry scalp, once in the morning and once at night before bedtime. Wash your hands after use if your fingers are used to apply ROGAINE. ROGAINE must remain on the scalp for at least 4 hours to ensure penetration into the scalp. Do not wash your hair for at least 4 hours after applying it. If you wash your hair before applying ROGAINE, be sure your scalp and hair are dry when you apply it. Please refer to the instructions for Use in the package.

What if I miss a dose or forget to use ROGAINE?

Do not try to make up for missed applications of ROGAINE. You should restart your twice-daily doses and return to your usual schedule.

What are the most common side effects reported in clinical studies with ROGAINE?

Itching and other skin irritations of the treated scalp area were the most common side effects directly linked to ROGAINE in clinical studies. About 7 of every 100 people who used ROGAINE (7%) had these complaints.

Other side effects, including light-headedness, dizziness, and headaches, were reported both by people using ROGAINE and by those using the placebo solution with no minoxidil. You should ask your doctor to discuss side effects of ROGAINE with you.

People who are extra sensitive or allergic to minoxidil, propylene glycol, or ethanol should not use ROGAINE.

ROGAINE Topical Solution contains alcohol, which could cause burning or irritation of the eyes or sensitive skin areas. If ROGAINE accidentally gets into these areas, rinse the area with large amounts of cool tap water. Contact your doctor if the irritation does not go away.

What are some of the side effects people have reported?

ROGAINE was used by 3,857 patients (347 females) in placebo-controlled clinical trials. Except for dermatologic events (involving the skin), no individual reaction or reactions grouped by body systems appeared to be more common in the minoxidil-treated patients than in placebo-treated patients.

Dermatologic: irritant or allergic contact dermatitis—7.36%, **Respiratory:** bronchitis, upper respiratory infection, sinusitis—7.16%, **Gastrointestinal:** diarrhea, nausea, vomiting—4.33%, **Neurologic:** headache, dizziness, faintness, light-headedness—3.42%, **Musculoskeletal:** fractures, back pain, tendonitis, aches and pains—2.59%, **Cardiovascular:** edema, chest pain, blood pressure increases/decreases, palpitations, pulse rate increases/decreases—1.53%, **Allergic:** nonspecific allergic reactions, hives, allergic rhinitis, facial swelling, and sensitivity—1.27%, **Metabolic-Nutritional:** edema, weight gain—1.24%, **Special Senses:** conjunctivitis, ear infections, vertigo—1.17%, **Genital Tract:** prostaticitis, epididymitis, vaginitis, vulvitis, vaginal discharge/itching—0.91%, **Urinary Tract:** urinary tract infections, renal calculi, urethritis—0.93%, **Endocrine:** menstrual changes, breast symptoms—0.47%, **Psychiatric:** anxiety, depression, fatigue—0.36%, **Hematologic:** lymphadenopathy, thrombocytopenia, anemia—0.31%.

ROGAINE use has been monitored for up to 5 years, and there has been no change in incidence or severity of reported adverse reactions. Additional adverse events have been reported since marketing ROGAINE and include eczema, hypertrichosis (excessive hair growth), local erythema (redness), pruritus (itching), dry skin/scalp flaking, sexual dysfunction, visual disturbances, including decreased visual acuity (clarity), increase in hair loss, and alopecia (hair loss).

What are the possible side effects that could affect the heart and circulation when using ROGAINE?

Serious side effects have not been linked to ROGAINE in clinical studies. However, it is possible that they could occur if more than the recommended dose of ROGAINE were applied, because the active ingredient in ROGAINE is the same as that in minoxidil tablets. These effects appear to be dose related; that is, more effects are seen with higher doses.

Because very small amounts of minoxidil reach the blood when the recommended dose of ROGAINE is applied to the scalp, you should know about certain effects that may occur when the tablet form of minoxidil is used to treat high blood pressure. Minoxidil tablets lower blood pressure by relaxing the arteries, an effect called vasodilation. Vasodilation leads to fluid retention and faster heart rate. The following effects have occurred in some patients taking minoxidil tablets for high blood pressure:

Increased heart rate: some patients have reported that their resting heart rate increased by more than 20 beats per minute.
Salt and water retention: weight gain of more than 5 pounds in a short period of time or swelling of the face, hands, ankles, or stomach area.
Problems breathing: especially when lying down, a result of a buildup of body fluids or fluid around the heart.

Worsening or new attack of angina pectoris: brief, sudden chest pain.

When you apply ROGAINE to normal skin, very little minoxidil is absorbed. You probably will not have the possible effects caused by minoxidil tablets when you use ROGAINE. If, however, you experience any of the possible side effects listed above, stop using ROGAINE and consult your doctor. Any such effects would be most likely if ROGAINE was used on damaged or inflamed skin or in greater than recommended amounts.

In animal studies, minoxidil, in much larger amounts than would be absorbed from topical use (on skin) in people, has caused important heart-structure damage. This kind of damage has not been seen in humans given minoxidil tablets for high blood pressure at effective doses.

What factors may increase the risk of serious side effects with ROGAINE?

People with a known or suspected heart condition or a tendency for heart failure would be at particular risk if increased heart rate or fluid retention were to occur. People with these kinds of heart problems should discuss the possible risks of treatment with their doctor if they choose to use ROGAINE.

ROGAINE should be used only on the balding scalp. Using ROGAINE on other parts of the body may increase minoxidil absorption, which may increase the chances of having side effects. You should not use ROGAINE if your scalp is irritated or sunburned, and you should not use it if you are using other skin treatments on your scalp.

Can people with high blood pressure use ROGAINE?

Most people with high blood pressure, including those taking high blood pressure medicine, can use ROGAINE but should be monitored closely by their doctor. Patients taking a blood pressure medicine called guanethidine should not use ROGAINE.

Should any precautions be followed?

People who use ROGAINE should see their doctor 1 month after starting ROGAINE and at least every 6 months thereafter. Stop using ROGAINE if any of the following occur: salt and water retention, problems breathing, faster heart rate, or chest pains.

Do not use ROGAINE if you are using other drugs applied to the scalp such as corticosteroids, retinoids, petrolatum, or agents that might increase absorption through the skin. ROGAINE is for use on the scalp only. Each 1 mL of solution contains 20 mg minoxidil, and accidental ingestion could cause unwanted effects.

Are there special precautions for women?

Pregnant women and nursing mothers should not use ROGAINE. Also, its effects on women during labor and delivery are not known. Efficacy in postmenopausal women has not been studied. Studies show the use of ROGAINE will not affect menstrual cycle length, amount of flow, or duration of the menstrual period. Discontinue using ROGAINE and consult your doctor as soon as possible if your menstrual period does not occur at the expected time.

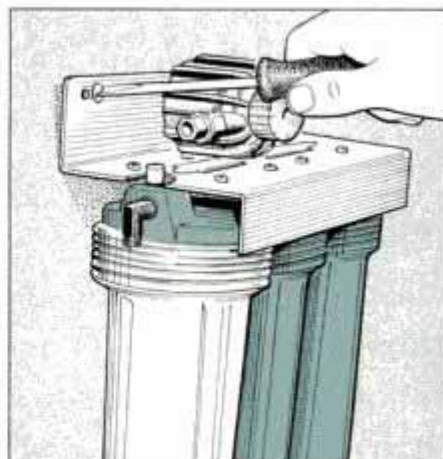
Can ROGAINE be used by children?

No, the safety and effectiveness of ROGAINE has not been tested in people under age 18.

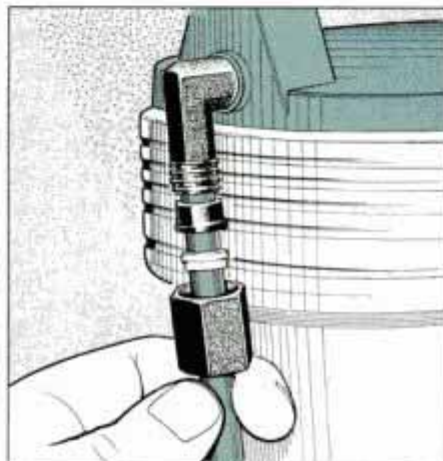
Caution: Federal law prohibits dispensing without a prescription. You must see a doctor to receive a prescription.

Upjohn | DERMATOLOGY
DIVISION

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USJ 9948.00 December 1993 CB-4-S



1 Screw filter carriage to cabinet wall using pan head screws. Keep filter housings at least 2 in. from the cabinet floor.



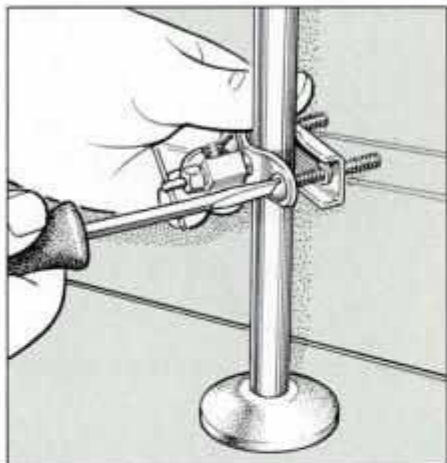
4 Make the tubing connection to the filter assembly with plastic nuts, collars and ferrules. Avoid overtightening the nuts.

ing saddle valve—identical to those used in icemaker kits. With this type of valve, you can connect the filter assembly with simple tools and without disrupting your plumbing system.

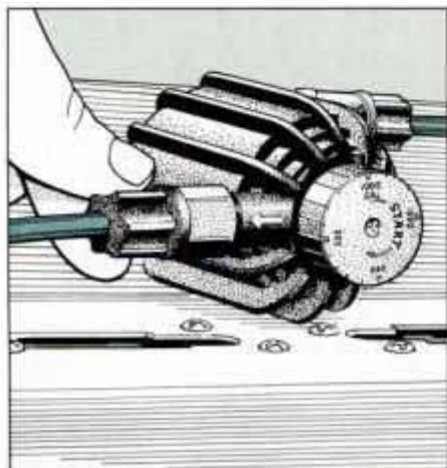
The Ametek kit consists of a filter carriage with three filter housings. The first filter housing contains a sediment filter, made of spun polypropylene. Polypropylene is bacteria resistant and is able to trap suspended solids as small as 5 microns in size. Replacement sediment filters cost around \$3.50.

The second housing contains a granular activated-charcoal filter material, which treats foul-smelling or off-tasting water, and also traps up to 95% of many volatile organic compounds. These are the carcinogenic compounds left behind by agriculture and industry. Granular activated-charcoal filter replacements cost \$9 to \$11.

The final filter contains powdered activated carbon, plus a metal-absorption resin. Together, they can



2 After opening the saddle valve to retract the self-piercing point, tighten the valve halves around the supply pipe.



5 Connect a second piece of tubing to the metered flow valve. This tubing supplies filtered water to the unit's faucet.

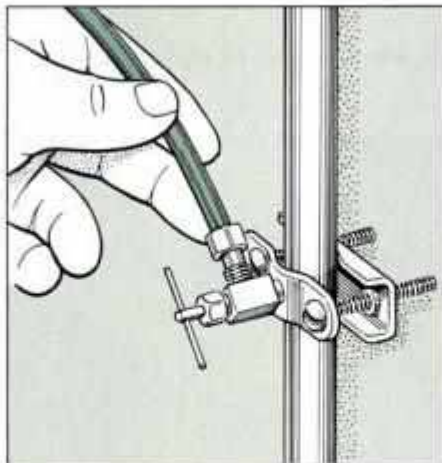
trap 97% of waterborne lead and mercury. They also filter disease-causing giardia and cryptosporidium cysts, commonly found in surface- and shallow-water sources. Replacements cost \$17 to \$20.

And most importantly, this unit has a metered flow valve. When 1500 gallons of water (roughly one year's use) pass through it, the valve shuts off until you replace the filters. As such, there's little chance of a filter becoming so saturated that it releases contaminants into your drinking and cooking water supply.

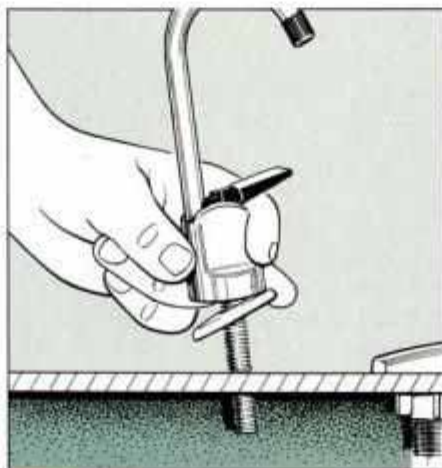
Installation

As noted, installation is remarkably easy. You won't even need to shut off the water. Begin by mounting the filter carriage on a convenient wall of the sink cabinet. Use pan head screws to secure the carriage to the cabinet so that it's at least 2 in. from the cabinet floor (Fig. 1).

With the carriage mounted, install the saddle valve on the cold-water



3 Connect the supply tubing to the saddle valve using a compression nut, ferrule and tubing insert. Then tighten with a wrench.



6 Place the trim flange on the threaded shank of the faucet and insert the shank through the hole in the sink or countertop.

supply riser that leads to the sink tap. With the self-piercing point of the valve threaded back as far as it will go, draw the two sides of the saddle bracket around the riser pipe (Fig. 2). Tighten the two screws evenly, until the saddle valve is secure and can't be turned on the pipe.

Then, trim the supply tube with a sharp knife and connect the tubing between the water supply riser and the inlet fitting of the filter.

The tubing connections are made with compression fittings, consisting of a compression nut, a tubing insert and a nylon compression ferrule. Begin each connection by first sliding the nut and ferrule over the tubing, then slide the insert into the end of the tubing to keep it from collapsing under the pressure of the ferrule. (The plastic fittings on the filter will have outer collars instead of inserts.) Then, slide the end of the tubing into the fitting and thread the nut in place. Don't overtighten the compression nut—finger tight, plus one or two full

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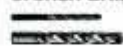
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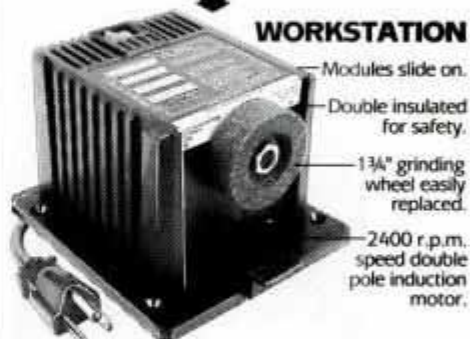


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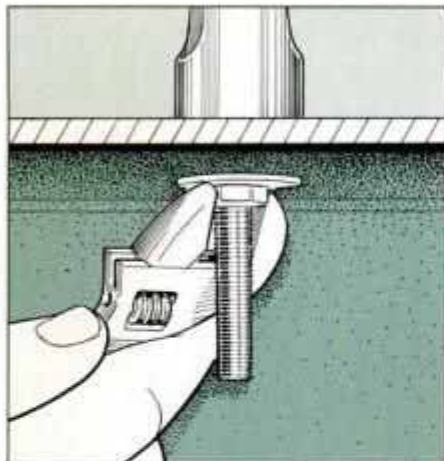


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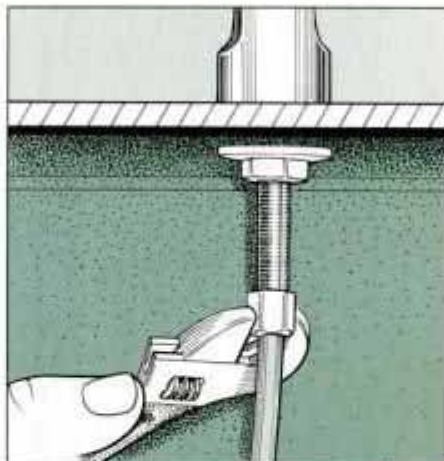
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PLASPLUGS Ultra Sharp

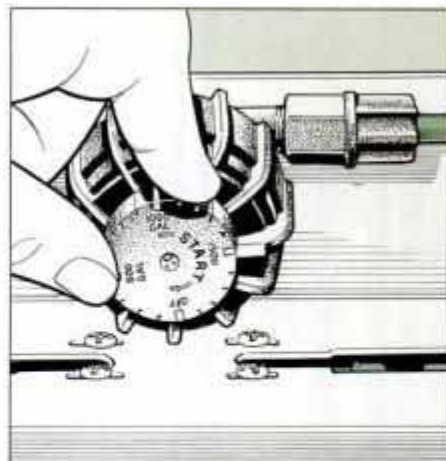
Plasplugs Inc., 780 Vassar Avenue, Lakewood, NJ, 08701. Phone: 908-901-1400.



7 To fasten the faucet, first slide a washer over the shank. Then, thread on the jamb nut and tighten the nut with a wrench.



8 Connect the tubing from the metered flow valve to the faucet shank with a compression nut, tubing insert and ferrule.



9 The metered flow valve stops the flow of water after 1500 gallons. After installing new filters, reset the flow valve.

turns with a wrench is plenty.

After attaching the tube to the saddle valve (Fig. 3), secure the other end to the filter's inlet fitting (Fig. 4). Once this is done, attach another length of tubing to the outlet of the metered flow valve (Fig. 5).

Next, install the faucet in the fourth sink deck hole. If your sink doesn't have a fourth hole, bore a hole through the countertop next to the sink and install the faucet there. You can also bore a hole through a

stainless-steel sink to mount the unit. To mount the faucet, slide the trim flange over the threaded shank and insert the shank into the hole from above (Fig. 6).

Then, from below, thread the jamb nut onto the faucet shank and tighten it with an adjustable wrench until it feels snug (Fig. 7). Finally, splice the remaining tubing between the filter's metered valve and the faucet, using compression components (Fig. 8). With all connections made, thread

the saddle valve's tap into the supply pipe until it pierces the pipe. Then, back it out to start the flow of water.

Once in use, this unit's metered flow valve will keep track of how much water has passed through the system. At 1500 gallons, the valve will automatically stop the flow of water, and it's time to replace the filters. After installing the new filters, reset the flow valve to meter the water flow for the next 1500 gallons (Fig. 9). **FM**

BOOK REVIEW

RENOVATING OLD HOUSES

• If you're looking at old houses with an eye to fixing up one yourself to keep the mortgage down, here's a book to check out before you get carried away. *Renovating Old Houses*, by George Nash, is an authoritative text that covers a complete range of old-house concerns—from evaluating the structure and estimating how much it will cost to fix to a host of techniques for solving problems with homes that have seen better days.

However, this is not your ordinary do-it-yourself manual. Nash devotes the introduction to more philosophical concerns that not only define a personal viewpoint as to how renovation should proceed, but also discuss the responsibility of maintaining a traditional structure's inherent historic value. A responsibility that, if assumed, may cost you a good deal more than a few sheets of drywall and some latex paint.

Ethics and aesthetics aside, *Renovating Old Houses* is essentially a book of useful information. You'll learn how to jack up a house and repair a foundation, as well as how to replace clapboard, rebuild cornices and install tongue-and-groove paneling. The last section of the book deals with repairing and upgrading a home's mechanical systems. *Renovating Old Houses* (\$37.95) is published by The Taunton Press, P.O. Box 5506, Newtown, CT 06470. —Tom Klenck



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HOMEOWNERS CLINIC

BY NORMAN BECKER, P.E., Contributing Editor

Sink Gurgles

My husband replaced a 15-year-old sump pump, and we now have a gurgling noise in our kitchen sink every time the sump pump goes off. The old sump pump was 1/3 hp, and the new one is 1/2 hp. The sump pit is located in our basement just below the kitchen sink. Water from the sump pit and the kitchen sink discharge into the sewer line. We never had this gurgling noise before, and we want to stop it.

MRS. FRANK L. VLEEK
LA GRANGE PARK, IL

The gurgling noise is probably the result of your sink drain not being properly vented.

Venting is very important to your house's plumbing. It serves two functions. Venting provides atmos-

pheric pressure within the drain pipes, and this prevents water from being sucked (siphoned) out of the sink traps, a condition that would allow sewer gas into the house. Venting also lets sewer gas escape into the atmosphere.

A sink trap must be connected within a short distance to a vent stack. This is usually done with a P-trap. S-traps, which were used in the early days of plumbing, are not permitted in most municipalities because they are not vented. Consequently, the water seal in the trap can be siphoned off.

When your new, more powerful sump pump discharges into the house's sewer pipe, the high volume of water rushing past the sink drain connection draws air out

of the sewer pipe and creates a negative pressure.

This negative pressure is strong enough to pull the water out of the trap, creating the gurgling noise.

You can correct this problem by installing an automatic vent valve on the downstream side of the sink trap. This valve equalizes the pressure by letting fresh air in, and closes down when the drain flow stops. Before installing one, check with your local building department for approval.

You also mention that water from the sump pit is pumped into the sewer line. Although this connection is not permitted in most municipalities, I've seen it hundreds of times while doing home inspections for prospective buyers. Municipalities often don't permit this because it introduces rainwater into the sewer line where it flows along with raw sewage to the treatment plant for processing.

Treatment plants are designed to process a certain quantity of sewage. By introducing rainwater into the sewage flow, homeowners unknowingly reduce the sewage treatment capacity of the plant. In order to treat all the sewage that is produced, additional treatment plants are built and this causes taxes to increase.

Some municipalities have combination storm and sanitary sewers and allow sump pumps to discharge into the sewer line. However, unless this is the case where you live, redirect the pump discharge line so it spills onto your lawn. Just make sure it's far enough away from your house's foundation so that the water doesn't seep back into the basement.

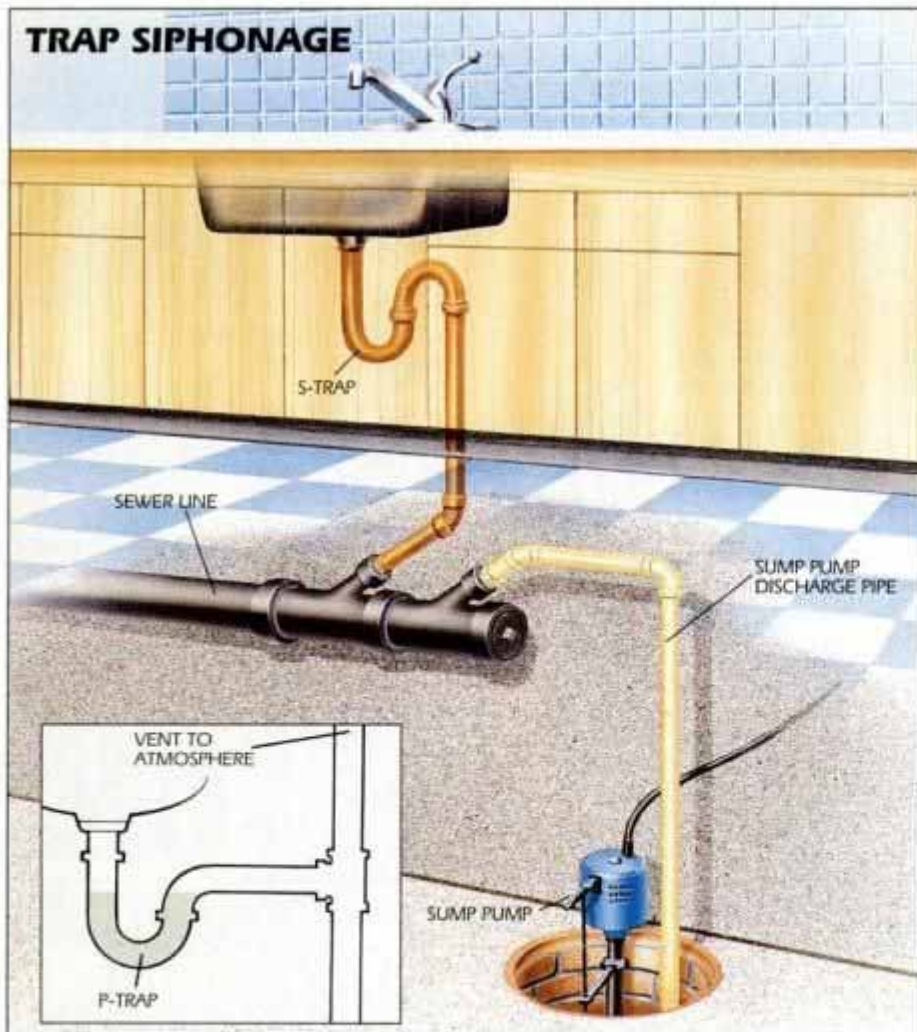
Gasoline Vapors Pose Explosion Hazard

I recently inspected two condominium townhouses in two municipalities of Westchester County, New York, with a condition that, in my opinion, is an explosion waiting to happen.

Both townhouses have a gas-fired heating system in the garage (one is a forced hot-water boiler, the other a horizontal furnace). Both appliances are about 4 in. above the floor.

A garage is a fire-hazard area be-

(Please turn to page 72)



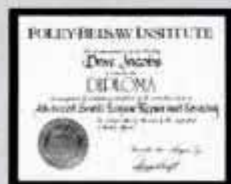
Water that is pumped out of the sump pit displaces air as it moves down the sewer pipe. Here, lacking a supply of air from the outside, the moving water creates a vacuum by the sink drain connection, which sucks the water out of the S-trap. In modern plumbing, a P-trap, connected to the atmosphere by a vent stack, prevents trap siphonage.

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only does this lead to condensation at the window's edge, it signifies heat loss and higher utility bills.

Manufacturers have improved the design of insulated glass windows to prevent this heat loss at the pane edge. They refer to these improvements as warm-edge technology. Your local window dealer can show you the specifics.

—Roy Berendsohn

cause of the presence of gasoline, paints and solvents. If spilled, paints and solvents (or leaking gasoline) can release vapors that could explode when ignited by a pilot light or a gas burner that is firing.

According to the National Fuel Gas Code (NFGC) and the New York State Building Code, gas-burning appliances located in a garage in a one- or 2-family dwelling shall be installed so the burners and ignition device are not less than 18 in. above the floor. The reason the heating units were allowed to be installed with the burners only 4 in. off the floor, and not 18 in., is because the problem fell through a bureaucratic "crack."

Condominium townhouses are not classified as one- or 2-family dwellings but as multifamily dwellings. The state building code does not specifically address the above condition for multifamily dwellings, so local code officials accepted the installations.

If this condition exists where you live, you should isolate the heating unit or build an 18-in.-high masonry wall in front of it.

Old Oil Tanks Are Wallet Busters

My 550-gallon heating tank is 28 years old and is buried in front of my house. I've heard that a leaking tank can result in wallet-busting costs, especially if contaminated soil is the result. What is the typical life span of a residential heating-oil tank? My oil-consumption records contain no evidence of leakage.

H. KARL NEIDLEIN
BRIDGEWATER, NJ

What you heard is correct. The cost for excavation, carting and dumping contaminated soil in an EPA-approved site can cost thousands of dollars. Depending on how much soil is contaminated, this can cost

in the tens of thousands of dollars and could exceed \$100,000. The fact that your oil-consumption records do not indicate a leak is misleading. Your tank could have started leaking at the rate of a gallon a year 15 years ago. A leak that small could easily be overlooked. Nevertheless, there now would be 15 gallons of oil contaminating the soil.

A friend of mine who tests buried oil tanks for leaks has found tanks that leak after only five years, although a steel tank usually lasts 15 to 20 years. Since your tank is 28 years old, you should have it tested for leakage. You might have to make several phone calls to get information on buried oil tanks. First, call your state's environmental agency.

Worth Getting

Handy homeowners will be glad to know that although Sears has discontinued its big general-merchandise catalog, it still offers its Power And Hand Tools catalog. Customers can order from the catalog shown until mid-'94. (Sears guarantees prices only until December 31, 1993.)

The 131-page catalog is loaded with useful product information, and its scope is about what you'd expect from Sears.

In it are hand tools, power tools and stationary machines for woodworking, metalworking and automotive work. Through it you can buy anything from a portable welder to a hammer to a generator.

To order a free catalog, call (800) 377-7414. Whether you want to buy or browse, the catalog is worth getting. —R.B.



DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?

Just ask Norman about it. Send your question to Homeowners Clinic, Popular Mechanics, 224 West 57th St., New York, NY 10019. While letters cannot be answered individually, problems of general interest will be discussed in the column.

Bad Element

● It's not unusual for an oven's bake element to wear out. A typical electric range burns out at least one and maybe two of these over its life span (assuming it lasts from 12 to 20 years).

To replace the element, first disconnect power to the range.

Next, remove the oven racks and, using a screwdriver or 1/4-in. nut drive, remove the two screws holding the element's mounting bracket to the oven's back. Pull out the element so you can see its black and red wires.

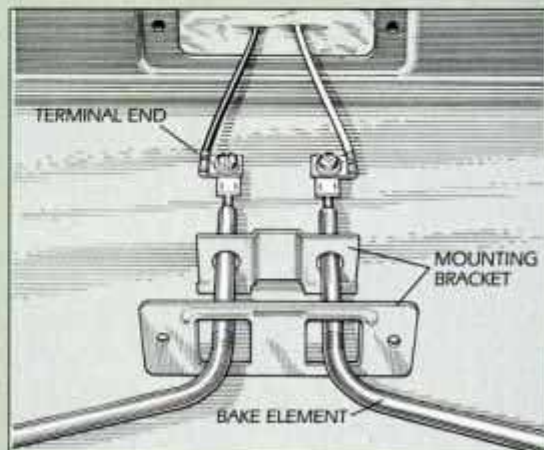
Use a screwdriver or a 1/4-in. nut drive to remove the screws that hold the wires and terminal ends to the element. Hold the terminal on the element with pliers to prevent the terminal from bending when removing these screws (and also when tightening the screws on the new element).

As you remove the wires from the element, note which color wire was connected to which terminal. Remove the old element, and install the new element and element support.

—Steve Toth



APPLIANCE CARE TIP



TOOLS

**DEMOLITION
TOOLS**

Cold steel, brute force and simple physics take on any dismantling job.

BY THOMAS KLENCK,
Associate Home Improvement Editor
PM Photos by Rosario Capotosto

● Most folks put things together to stay together. At least that's the ideal. Taking things apart, therefore, is rarely a graceful operation. And, unless you're fortunate enough to be disassembling something held together with screws or bolts, it's likely that you'll have to employ some very special tools for the job—tools designed for focusing the force necessary to separate structural components that want nothing more than to stay exactly where they are.

The interesting thing about this class of tools is that just about all of them are based on two primitive devices to amplify force—

a lever and a wedge. As such, these tools are simple, most being variations on a plain steel bar with a wedge-shaped end to get into tight places and pry pieces apart.

It's also interesting to note that the tools for taking things apart are strictly hand operated. While today's construction industry utilizes power tools for everything from sawing 2 × 4s to putting up trim, the job of taking the stuff down for remodeling or new construction is



5

standing of the particular situation.

Here are a few guidelines: If possible, always remove components in the reverse order that they were added. Wear eye protection and gloves, and wear a hard hat for major demolition and overhead work. Don't use an ordinary carpenter's hammer to drive pry bars into tight places—the hardened head may shatter. Use a hammer with a softer head that's designed for striking cold chisels or other metal tools.

The following list of tools illustrates a range of popular hand-powered bars and pullers available today.

1. Gooseneck wrecking bar—

Here's the tool that most of us look to first when there's a demolition job on the horizon. The standard gooseneck wrecking bar features an offset chisel point on one end for general levering jobs. The tapered end allows you to work the tool into tight places and the angled offset creates the fulcrum for amplifying the force applied to the opposite end. The gooseneck portion also terminates in a chisel-shaped end, but this one has a V-groove for grabbing nails and spikes. The curve creates an extra-long levering action to withdraw a nail in one stroke.

Wrecking bars are typically hexagonal in cross section and come in lengths ranging from 12 to 48 in. Most are $\frac{3}{4}$ in. thick, but the smallest may be $\frac{1}{2}$ in. thick and the larger industrial models can be $\frac{7}{8}$ in. thick. The one shown is $\frac{3}{4}$ x 36 in. and costs about \$17. Write to Mayhew Steel Products Inc., 2 Sears St. Ext., Shelburne Falls, MA 01370.

2. 2-in-1 salvage bar—Similar to the standard wrecking bar, this tool has an offset chisel end that's flatter and longer for prying into tight spaces. In addition, the offset end has a V-notch for nail pulling, plus an oval hole for grabbing on to nailheads. This bar is available in lengths ranging from 18 to 36 in. and is $\frac{3}{4}$ in. thick. The 18-in. model shown is about \$8. Contact Woodings-Verona Tool Works, P.O. Box 126, Verona, PA 15147.

3. Combination nail puller—

Although wrecking bars are great for withdrawing common nails of all sizes, they're not ideally suited for lifting an embedded nailhead from the surface of the wood. This nail

puller has a small curved head that's V-notched to grab the nail. The head is also ground to a sharper edge, making it possible to drive the puller into the wood and underneath the nailhead. The opposite end has an offset chisel point similar to a standard wrecking bar for prying apart components and general light-duty levering. The model shown is 15 in. long and costs about \$9. Write to Woodings-Verona Tool Works, P.O. Box 126, Verona, PA 15147.

4. Nail claw—

Nail pullers are also available without the pry-bar combination. This model has a curved and V-notched end similar to the unit above, and it's used in the same manner. Sometimes called a cat's paw, the tool shown is $\frac{5}{16}$ in. thick and 13 $\frac{1}{2}$ in. long. This Plumb model costs about \$12. Contact Cooper Tools, P.O. Box 728, Apex, NC 27502.

5. Stripping bar—

Here's a tool to take on some heavy dismantling. Designed to strip away the wooden forms used in concrete construction, this massive tool is a full 1 in. thick and 4 ft. long. In contrast to a standard wrecking bar, the angled nail-pulling head is perpendicular to the hexagonal shaft. This design is also available in a 42 in. length and both the heavy and lighter models are available



well to the low side of the technology spectrum.

Don't, however, let the simplicity of these tools fool you into thinking that they're inherently safe. When you consider that exerting 60 pounds of pressure on the end of a 6-ft. crowbar translates into roughly 1 ton of prying force at the business end, you acquire a little more respect for the forces that are involved.

In addition, dismantling structural assemblies carries a hazard of its own, simply because the structure loses stability as each component is removed. While it's fairly safe to say that you can remove a few shingles without worrying about your roof falling in, taking down a partition requires general construction experience along with an under-



with or without the nail claw. The stripping bar shown costs about \$33. Contact The Council Tool Co. Inc., 345 Pecan Ln., Lake Waccamaw, NC 28450.

6. Shingle ripper—Nail pullers are fine when you can get at the nail-head. But in the case of shingles, the nails are hidden from the puller's claw. The solution is this shingle ripper. To make it work, you slide the tool's head under the shingle, shift it over until you find the nail and then catch the nail in one of the notches on either side. Once the nail is caught, pry up and pull down to free the nail. While not exactly a demolition tool, a shingle ripper is handy for renovation work and repairs where only a portion of the roof or siding needs to be removed. This 26-in.-long tool costs about \$20 and is manufactured by The Council Tool Co. Inc., 345 Pecan Ln., Lake Waccamaw, NC 28450.

7. Sledge hammer—When your job requires a little friendly persuasion and a wrecking bar just doesn't suit the job, you can usually get things moving with a tap from one of these handy helpers. Sledge hammer operation needs very little in the way of explanation. Swinging a 10-pound head that's at the end of a 36-in. handle can get things moving fast—as well as cause some damage. While most models have wooden handles, this one features a fiberglass handle for long life and to make it impervious to the weather.

Although sledge hammers are generally offered in the 30- to 36-in. range, smaller versions are available as engineer's hammers and hand-drilling hammers. Hand-drilling hammers are specifically designed

for striking cold chisels, brick chisels, star drills and other metal tools. The sledge hammer shown costs about \$40. For more information, write to The Council Tool Co. Inc., 345 Pecan Ln., Lake Waccamaw, NC 28450.

8. Screwdriver-type pry bar—If you've ever used a screwdriver to pry something apart or lever something into place, you'll understand how this tool came into being. While big screwdrivers are often just the right size for the job, now there's one that's expressly intended for levering and prying. This 24-in.-long tool has a square shaft and a standard screwdriver-type handle. It's available with a bent offset tip (shown) or with a straight shank. Available in several sizes down to 7 in. long, the screwdriver-type pry bar shown costs about \$20. Contact Mayhew Steel Products Inc., 2 Sears St. Ext., Shelburne Falls, MA 01370.

9. Ripping chisel—This specialty pry bar is similar to the 2-in-1 salvage bar above, but lacks the

curved nail-pulling claw. As such, it's handy for general levering, uncrating and removing boards, flooring and siding. The advantage of the straight shank is that the tool can be struck with the appropriate hammer



to drive the chisel end into tight spaces. This tool is 18 in. long and costs about \$6.50. For more information, write to Collins Axe Co., P.O. Box 351, Lewistown, PA 17044.

10. Rippling bar—Here's a smaller variation on the large stripping bar used in concrete-form work. It has a right-angle nail-pulling head and an offset chisel-type head—both with V-notches to grab on to nailheads. The chisel head also has an oval hole for grabbing and pulling out nails. It's unique in that the right-angle end is bent on a different plane, giving the tool a shallower profile when the chisel end is in use. This 17-in. rippling bar costs about \$16. For more information, write to Cooper Tools, P.O. Box 728, Apex, NC 27502.

11. Flat pry bar—This type of tool has become the standard for homeowners and pros alike when it comes to light-duty prying and nail removal. Its small size and light weight make it ideal for interior trim chores. Based on the stripping bar design, the flat configuration along with tapered ends allow it to reach behind molding and trim without causing undue damage. This pry bar is about 13½ in. long and costs about \$11.50. Write to Mayhew Steel Products Inc., 2 Sears St. Ext., Shelburne Falls, MA 01370.

12. Small flat pry bar—This bar is a variation of the standard flat pry bar. It's ideal for removing light trim and molding and for other situations

where small nails are used. At 7 in. long, you can easily carry it in a back pocket for handling jobs too small for standard tools. The model shown is called the Wonder Bar II and costs about \$4. For more information, contact Stanley Tools, A Division of Stanley Works, New Britain, CT 06050.

13. Pinch-point crowbar—If you can't budge it with this tool, it may be time to call in the pros. At a full 5 ft. long and 1¼ in. thick at the business end, this tool packs enough leverage to move just about anything. Crowbars come in lengths ranging from 36 in. to 66 in. They're also offered in a variety of tip designs, in addition to the pinch-point type shown, such as chisel point and diamond point. This crowbar costs about \$37, and is made by Collins Axe Co., P.O. Box 351, Lewistown, PA 17044.

14. Pinch/chisel pry bar—When it comes to just plain levering, all you need is a basic pry bar. This tool features a simple bent offset chisel-type end for prying in tight spaces. The opposite end is a conical shape that aids in both levering and aligning holes. The pinch/chisel pry bar costs about \$5.75. For more information, write to Woodings-Verona Tool Works, P.O. Box 126, Verona, PA 15147.

15. Hammer-type nail puller—This nail puller is unique because it incorporates its own hammer mechanism right in the handle. To use it,

you open the pivoting jaws and place them around the nailhead. Then, repeated blows on the sliding handle drive the sharpened jaws into the wood and below the nailhead. Finally, you simply push the handle over to pull the nail. The arm at the jaw end acts as a fulcrum for levering out the nail. While this tool will damage the wood slightly, it's the best choice when salvaging material for later use. The hammer-type nail puller costs about \$47. Contact Cooper Tools, P.O. Box 728, Apex, NC 27502.

16. Bull-point chisel—While many of the tools shown are designed for dismantling wood construction, this chisel is an example of a hand tool that's appropriate for concrete and masonry. Along with the right hammer, it will work on jobs just too small or inaccessible for heavy power equipment. The bull-point chisel costs about \$15. For more information, contact Mayhew Steel Products Inc., 2 Sears St. Ext., Shelburne Falls, MA 01370.

17. Tack claw—Sometimes, what you're taking apart isn't a big deal at all, but you still need a special tool for the job. This small screwdriver-type tool features a simple bent and notched end for removing small nails and tacks. It's also handy for prying away thin moldings and other light-duty jobs. Made by Stanley Tools, A Division of Stanley Works, New Britain, CT 06050, the tack claw costs about \$5. **FM**

NEW TOOLS

GENIE'S NEW WET/DRY VACUUMS

● The new line of wet/dry vacuums from Genie features innovative design, versatility and a distinctive new color. For yard, house and workshop chores, the line includes four heavy-duty blower/vacs ranging from 6- to 12-gallon capacity (10-gallon model shown at right, about \$120).

Each blower/vac has a removable power head. When in place on the drum, the unit acts as a powerful wet/dry vacuum. Off the drum and fitted with a blower wand, the power head takes on yard cleanup. The two larger versions come with 2-speed blower control.

Don't need a blower? Genie offers dedicated wet/dry vacuums in the



same capacity range (about \$90 for the 10-gallon version). All of the units feature a unique wide-base design that improves stability. Genie vacs are available at home centers and hardware stores. Contact The Genie Co., 22790 Lake Park Blvd., Alliance, OH 44601.

—Thomas Klenck



The new Genie wet/dry vacs feature a wide-base design for stability. Power head on blower/vac can be removed (above left) to convert vac into blower (above right). Vacs without blower are also available.

CAR CARE

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

Lord Of The Rings

My mechanic says the air conditioner in my Ford Taurus quit because the O-rings leaked out all the Freon. He also says that this is a problem with most Ford cars and that in a year or so he won't even be able to buy Freon because the environmentalists have pushed it off the market. He also told me that the price of Freon has gone up 1000% in the past year. My father-in-law's pickup truck has the same problem, by the way.

I was going to replace the O-rings myself, but I can't figure out how to get the hose apart.

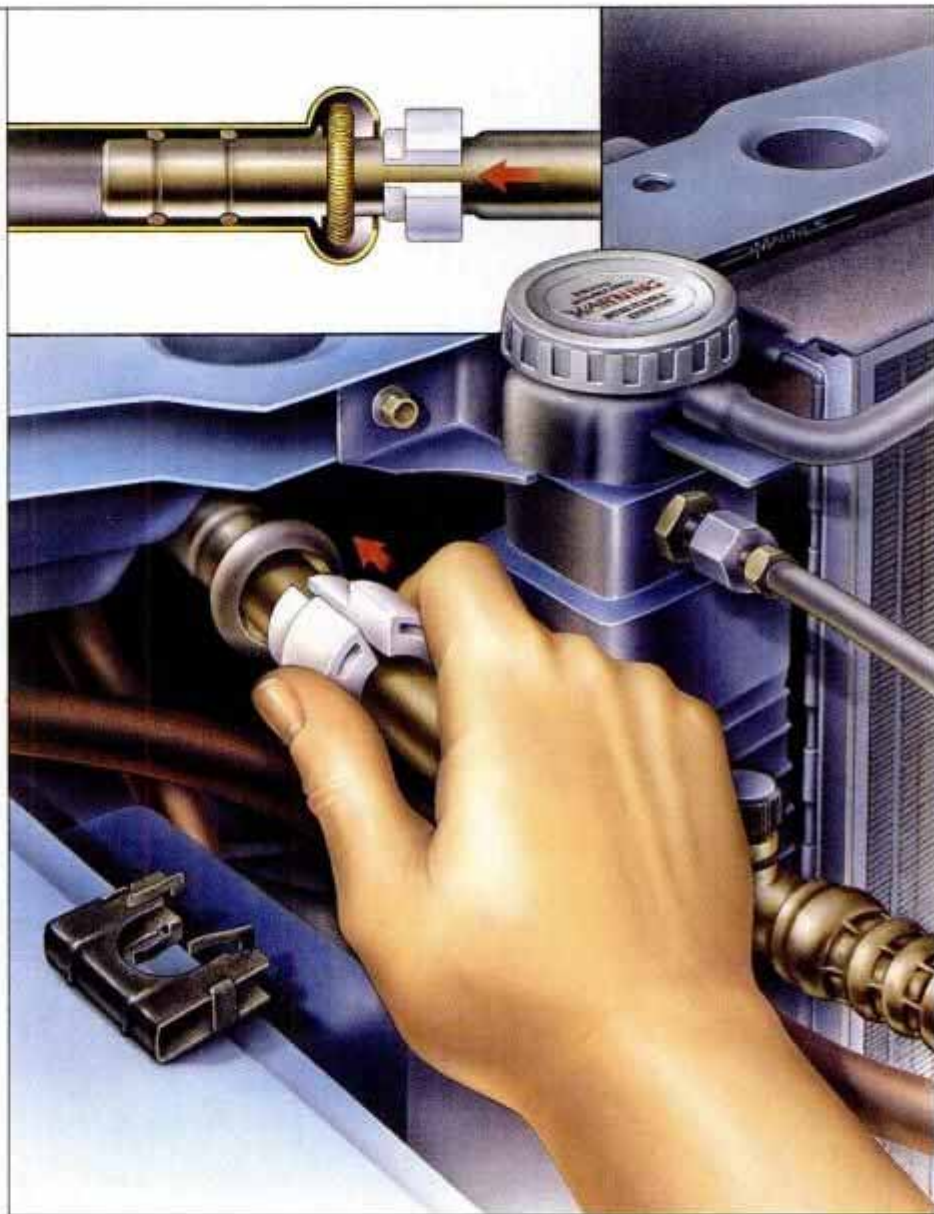
JON FOWLER
BOSWELL, IN

There is indeed a Technical Service Bulletin out about O-rings used on the a/c systems of many late-model Ford cars and trucks. Revised O-rings are supposed to eliminate any minor leaks. The dealer, if your vehicle is still under warranty, or any a/c shop—if it's not—will have the revised O-rings in stock.

But with R-12 prices already skyrocketing, and production scheduled to cease within the next 24 months, any leaking can hardly be deemed minor. Don't blame Ford for the price of R-12—federal regulations concerning the use of CFC-based compounds are the cause. There's an industry-wide cap on the amount of R-12 being manufactured, and the market value has gone up accordingly.

Changing the O-rings is actually pretty simple. The spring-lock connectors require a special tool to be disconnected. The one shown here is from a kit I picked up at the local auto parts store for about \$10. These spring-lock connectors are also used on some fuel-line connections, so you may find a set to be a nice addition to your toolbox.

But, I'm going to tell you not to change the O-rings yourself. Technically, it's not illegal to do so—if the system is completely empty of R-12. It is illegal to vent R-12 into the at-



mosphere, and for anyone except a certified a/c technician to buy R-12.

A certified technician will also have an R-12 recycling machine to suck the remaining refrigerant out of your car for reuse after the O-rings have been replaced.

Let me mention that as this issue is printing, there is no commercially acceptable substitute for R-12. Research continues, but there's nothing out there yet.

Rip Van Steering-Rack

I just bought a 1987 Buick LeSabre with 44,000 miles, and the morning after I picked it up the steering was

very stiff for about 10 ft. It's like that every morning. My mechanic says it's the aluminum box and that it will get worse. What can I do?

HAROLD LIVENGOOD
RORD CITY, PA

Your mechanic is correct. It's caused by failing seals in the aluminum steering rack, and it will continue to deteriorate until it eventually fails completely. GM had a major problem with steering-rack seals in their midsize cars during the mid-'80s, and there were a lot of racks replaced on cars even after the warranty had long expired. You may or

may not be able to get Buick to pick up all or part of the tab for this one. Ask the dealer to check for the TSB.

If not, TRW makes a replacement steering rack for about half of the cost of the GM replacement part.

Get this fixed right away, before either: you lose your steering at some critical time (not likely—the steering simply never waking up one morning is more likely, but why take chances?), or the debris from the bad seal and inner steering-rack bore chews up your power-steering hydraulic pump.

I've seen several mouse-milk preparations advertised as repairs for this problem. Just pour a can into the pump, and your problem will go away. These products claim to contain molybdenum disulfide, Teflon or some other kind of high-tech pixie dust. The failed metallic seal inside the rack scuffs the machined surface that the seal rubs against, so I can't see how adding a powdered lubricant would help. Save your money and get the steering rack replaced.

Wipeout

Recently, the wipers on my 1989 Ford Probe decided to remain at attention instead of parking when I turned them off. The dealer mechanic said the PARK contacts in the motor were fried, and the only fix was to replace the motor for \$194, plus labor.

Being the curious sort, I got to poking around under the dashboard and discovered a mysterious jumper wire that was marked SUMMER/WINTER hanging from the fuse block. There was no mention of it in the owner's manual, but I switched the wire to a second location on the fuse block labeled WIPER UP/DOWN. And the wipers immediately parked.

Apparently the second position is to allow the wipers to park a little higher in the winter to keep them from being trapped in their well by ice and snow. But for more than \$200, I can live with that all summer.

MARK MAYFIELD
WEVER, IA

The real question is whether the mechanic knew about the second PARK switch and elected not to implement your fix in an attempt to separate you from a lot of money.

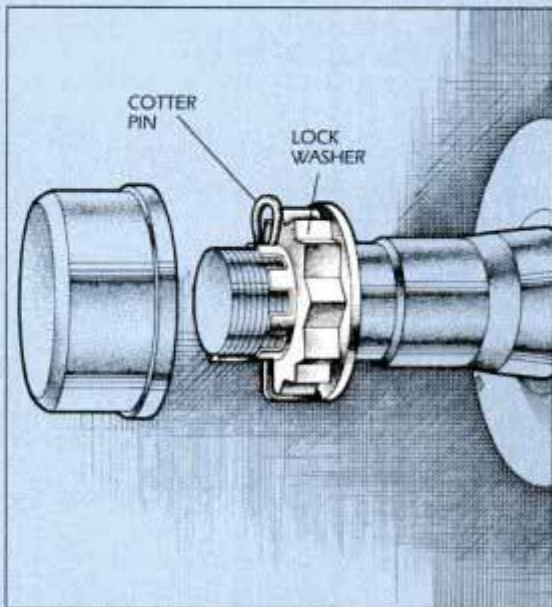
This fix also applies to the Probe's mechanical twin, the Mazda MX-6. Good sleuthing, Mark. If it were my car, I probably would have just taken the motor apart and

Welcome Back Cotter

● I had the occasion to disassemble a rear-wheel bearing that had supposedly been assembled by a licensed professional mechanic. I sincerely hope that the actual work was done by one of the inexperienced pump jockeys because the job was not done properly—which was why I was taking it apart on a Friday night by the light of a flashlight held in my teeth.

The wheel bearing had not only been adjusted incorrectly, but the cotter pin had been installed so poorly that it was grinding away at the dust cap, filling the bearing with metal shavings.

Start by using a new cotter pin. They're really cheap, okay? Adjust the bearing, and insert the pin as shown so that one leg, the shorter one, goes down over the lock washer. The longer leg goes back up over the end of the axle.



tried to repair the bad contacts in the parking switch.

Ever stop to ponder if the contacts burned out because the wiper well was filled with snow one day when you shut off the wipers and they couldn't get all the way back down?

Armstrong Power

I have a 1989 Chevy S-10 pickup with manual steering. The dealer tells me that converting to power steering would be very expensive, but as a retired senior citizen, I find it very difficult to park this truck. The truck has P20575R14 M&S tires. Can you recommend a smaller tire that would be easier to turn?

C. BOURGEOIS
ERATH, LA

No. I wouldn't recommend a smaller tire or you'll be using a tire too small for the truck's load-carrying capacity. I have three suggestions.

1. Run all four tires at the manufacturer's maximum cold inflation pressure. This will make the steering effort slightly lower. It's free, too.
2. Sell the truck and buy one with power steering. Not free, however.
3. Find a mechanic, other than

DO YOU HAVE A CAR PROBLEM?

Just ask Mike about it. Mail your question to Car Clinic, Popular Mechanics, 224 West 57th St., New York, NY 10019. While letters, faxes or phone calls cannot be answered individually, problems of general interest will be discussed in the column.

the dealer, who's willing to scrounge the right pieces from a salvage lot and convert your truck. Also, not free, but probably a lot less than buying new parts from the Chevy dealer. **PM**

SERVICE TIPS

- If your GM car or truck with a Flint-built 5.0- or 5.7-liter engine seems to be leaking from the rear crank seal or oil pan, check before tearing into it. It may be that the camshaft plug seal is weeping oil instead. You need to pull the tranny and replace the plug. How do you know if the motor was built in Flint, Michigan? The engine's serial number, stamped on the block just in front of the cylinder head, will start with the letter V.
- Have the fuel lines along the bottom of your '91-'92 Fleetwood or De Ville sagged? It's probably from snow or mud adding so much weight that the lines pull down and stay that way. There's now a cover for the lines that the dealer can install.
- Ride height of your new Lincoln Mark VIII drooping? It might be caused by water contamination of the ride-height sensor.
- Late-model Audi 80/90/100s may have leaky grommets between the reservoir and the brake's master cylinder.

SATURDAY MECHANIC

STARTER MOTOR SERVICE

BY DON CHAIKIN, Contributing Editor

● An icy rain pelts you as you open the door to your car in the nearly deserted parking lot. As you turn the key in the ignition switch, your sweet dreams of a soothing glass of Armagnac are shattered. Instead of the familiar loud whirring of the starter motor, you hear nothing. You switch on the headlights briefly—they shine brightly. You hit the horn button—it blares loudly and crisply. But turning the ignition key does nothing to get your engine to crank over even once.

Or, just as bad, the starter spins as you turn the key, but it turns so slow-

ly and feebly that there is no way it is going to get the engine to fire.

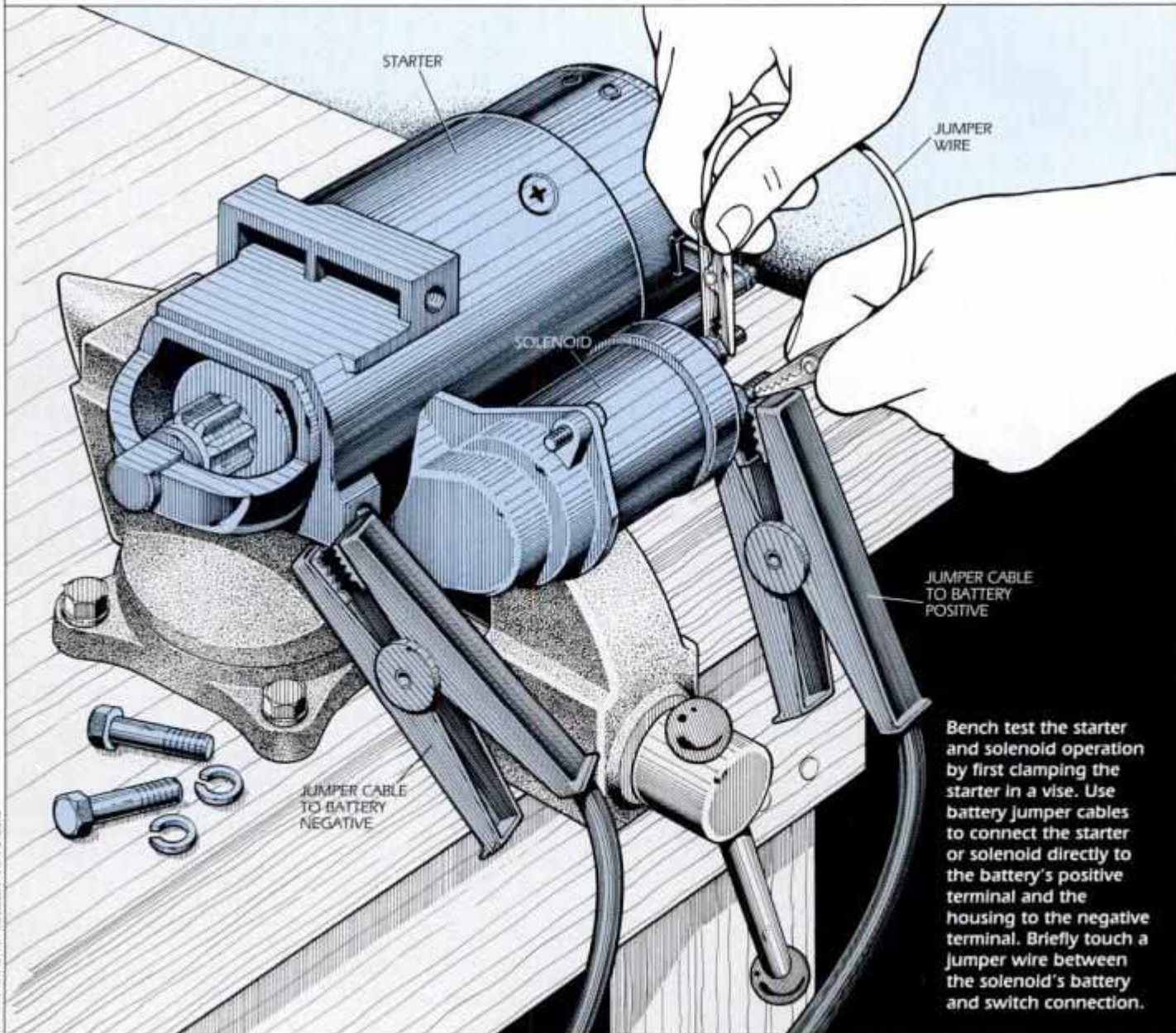
Perhaps more frustrating is the possibility that the starter motor itself runs and runs well. However, you can clearly tell that the engine itself is not being cranked.

To awaken a sleeping giant

Whether the engine in your car or pickup truck is a 50-horsepower 3-cylinder or an awesome 400-horsepower dohc 6.0-liter V12, it needs help in getting going. This help comes from an electric starter motor.

Turning the ignition key closes a circuit, allowing current to flow from the battery to a starter relay. When this relay closes, it sends battery voltage to the starter motor, or first to a solenoid, which engages the electric motor.

Before the shaft in the starter motor actually begins to spin, however, a pinion gear on the end of the motor's shaft engages with a large ring gear attached to the engine's flywheel. As the starter motor spins, the pinion gear rotates the engine's crankshaft until the engine starts.



Bench test the starter and solenoid operation by first clamping the starter in a vise. Use battery jumper cables to connect the starter or solenoid directly to the battery's positive terminal and the housing to the negative terminal. Briefly touch a jumper wire between the solenoid's battery and switch connection.

TM ILLUSTRATION BY RUSSELL J. VON SAUERS

CAR CARE

Typically, the pinion gear is about one-tenth the size of the ring gear, which multiplies the starter motor's torque tenfold to give the small electric motor the torque it needs to crank over the engine, especially when the engine is cold.

Once the engine starts and begins to run on its own, a clutch keeps the pinion gear from forcing the starter motor from spinning along with the engine. Releasing the ignition from the START position stops the starter motor and disengages the pinion gear from the ring gear.

To prevent the car or truck from

relay, bypass the starter circuit with a jumper wire at the starter's solenoid or relay.

Before proceeding, disable the ignition system to prevent the engine from starting. If you need to work underneath the car or truck to gain access to the starter, be sure the vehicle is securely raised on ramps or safety stands. Chock the rear wheels.

At the starter solenoid, briefly touch the jumper wire to the large stud to which the battery cable is connected and to the smaller connection for the ignition-switch wiring. If the solenoid engages and the starter operates, the starter circuit (ignition switch, safety switch, wiring) is the problem. If not, either the solenoid or the starter is defective.

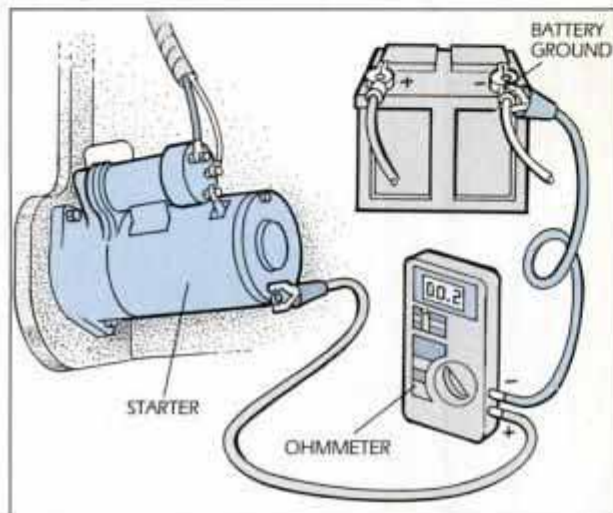
On vehicles with a separate relay, check the relay as well as the starter circuit. Specifics of the tests vary between carmakers and types of starter relays. However, in general, connect a jumper wire between the relay's battery connection terminal and the secondary terminal from the ignition switch. If the starter operates, the

key circuit is defective. If the starter does not work, check that the relay itself is not the problem. Do this by connecting a jumper wire from the battery connection at the relay to the battery or solenoid connection on the relay. You may need to use a heavy

jumper wire—a battery booster cable does fine—for this test. If the starter now works, the relay itself is bad. If not, the starter is defective.

Slowly it turns

If the starter does spin, but it only spins slowly, check the cranking voltage. Disable the ignition system so



Use an ohmmeter to check for continuity between the battery ground and starter motor housing.

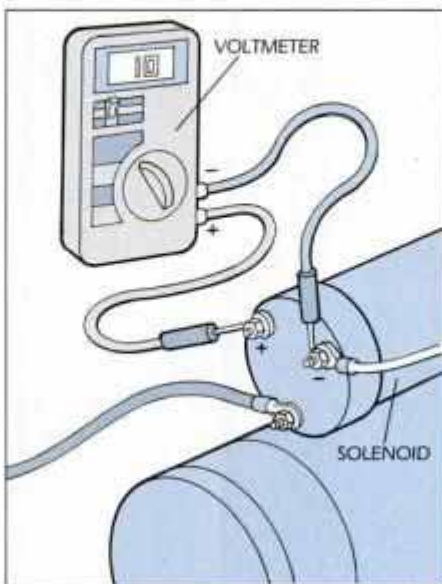
lurching forward—or backward—when the starter engages and the engine starts, most starting circuits have a safety switch. This switch prevents the starter from engaging unless the automatic transmission is in NEUTRAL or PARK. On vehicles with a manual transmission, the switch prevents the starter from running unless the clutch pedal is depressed.

Circuit check

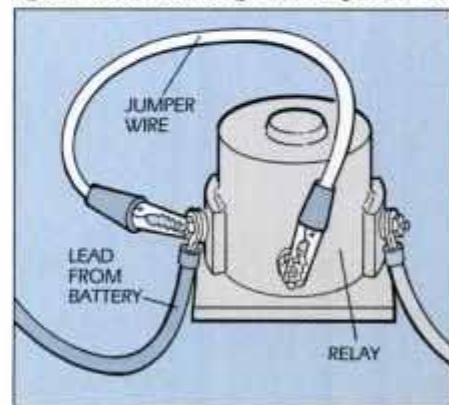
Whether the starter spins slowly or not at all, first check that it is getting power from the battery. With all circuits off, connect the voltmeter between the battery's terminals. A healthy battery should show at least 12 volts. If not, charge the battery.

Next, make sure that there's current to the solenoid on the starter or to the starter relay if your car has a separate relay between the battery and the starter. Use a grounded test light or a voltmeter to check for power at the solenoid or relay. If there is no power, check the cable connections at both ends and inspect the entire length of the cable.

If there is power to the solenoid or



This solenoid is drawing so much cranking voltage that it is clearly defective.



Bypass the ignition switch by using a jumper wire across the relay's terminals.

the engine will not start during these tests. Connect a voltmeter across the solenoid's primary and secondary terminals, and crank the engine. If the car has a starter relay, connect the voltmeter across the relay's battery and starter or solenoid connections with the positive lead at the connection from the battery and the negative lead at the connection to the solenoid or starter. A voltage reading of more than about 0.3 volts indicates that the solenoid or relay is defective.

If the reading is less than about 0.3 volts, check the cranking voltage at the starter motor. Connect the voltmeter's positive lead to the hot connection after the solenoid on the starter motor itself, and the negative to ground. Crank the engine. If the voltmeter reads more than about 9.5 volts, the starter is defective.

Next, check that the starter is properly grounded. Use an ohmmeter between the battery ground connection and the body of the starter to check for continuity. If not, there is a bad ground and an open circuit.

Stopping at the starter

If isolating the starter motor and solenoid from the circuit proves that either the solenoid or the starter motor is defective, you must remove the starter. To do this, first disconnect the battery's ground cable.

Then disconnect the battery's lead and the wiring from the key switch or relay from the starter and the solenoid. Label any wires you disconnect

(Please turn to page 83)

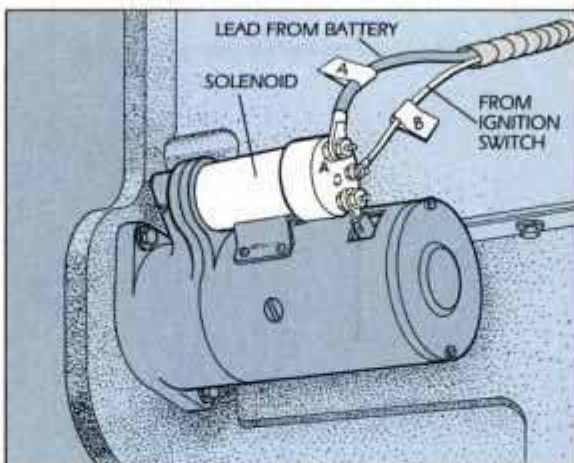
CAR CARE

and their connections to make reinstallation simpler.

Then undo the starter mounting bolts. These may go from the starter into the engine or transmission housing or they may go through the flywheel housing into the starter motor. With all the bolts removed, however, the starter motor should come right out. If it is tight, a light rap on its mounting flange with a soft-head hammer should pop the motor free. If not, look for another bolt.

With the starter off the engine, you can recheck it by clamping it in a vise and connecting it directly to a battery. Use a jumper wire to close the solenoid. If the solenoid engages and the starter spins, double check the voltage draw. If the battery works fine on the bench, the problem may be a binding between the pinion and ring gears or a mechanical problem inside the engine.

If the starter is spinning freely but the engine is not cranking, check the condition of the pinion and ring gears. Any missing or chipped teeth on either means replacement. To check the ring gear on the engine, have a helper slowly turn the engine by the front crankshaft pulley as you examine the ring gear, either through the starter's mounting hole or by re-



Clearly label the wires and connections on the starter and solenoid before removing the starter.

moving any inspection cover on the bell housing.

If only the solenoid is defective, you may be able to replace it. However, once the starter has been removed, it makes good sense to replace the starter/solenoid assembly.

Before installing the replacement starter, first make sure that the new unit's pinion gear has the correct number and type of teeth to mesh with your engine's ring gear. As you install the starter, tighten the mounting bolts in stages to be sure that the starter is square in its mounting to prevent binding between the ring and pinion gears. Then reconnect the battery

and key-switch wires. Reconnect the battery's ground cable.

Circuitry testing

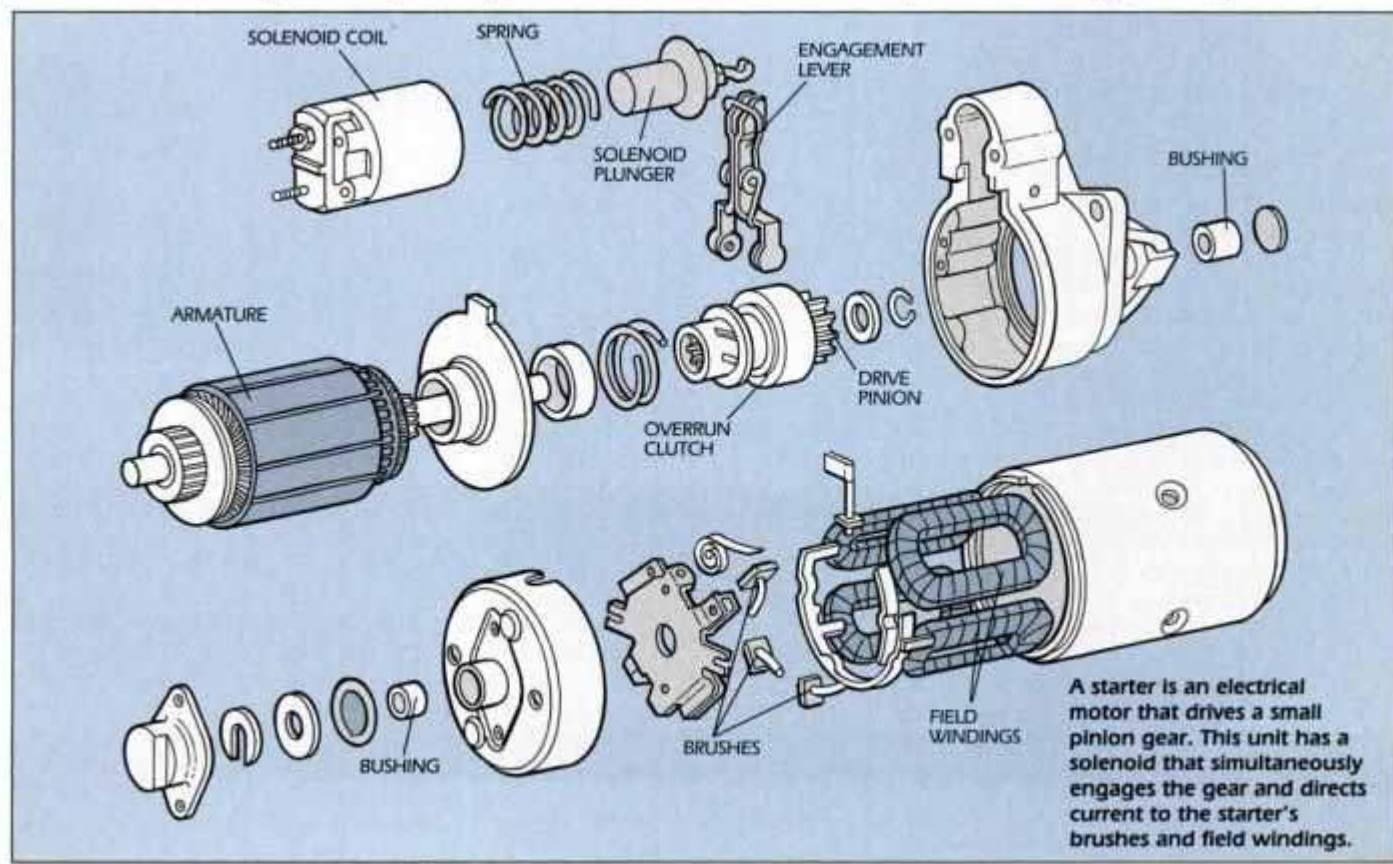
If the starter operates when you connect the jumper wire from the battery to it or its relay, the ignition switch or the safety switch may be defective.

If your car has an automatic transmission, try slowly moving the shift lever in and out of NEUTRAL and PARK as you turn the ignition key. First disable the ignition system to prevent the car or truck from lurching forward if it starts. If the starter works as you turn the key, the neutral safety switch needs to be

adjusted or replaced. If not, or if the car has a manual transmission, bypass the safety switch—usually on the clutch pedal linkage or the automatic transmission shift linkage—with a jumper wire. If the starter operates with the switch bypassed, replace the switch.

If the safety switch is good, the problem is probably in the ignition switch itself. Check the wiring to the switch. If the wiring and connections are good, replace the ignition switch.

If your car or truck is equipped with an antitheft system that has a starter lockout, check the antitheft system while making your diagnosis. **FM**



A starter is an electrical motor that drives a small pinion gear. This unit has a solenoid that simultaneously engages the gear and directs current to the starter's brushes and field windings.

MAINTENANCE BASICS

CHECKING VITAL FLUIDS

BY DON CHAIKIN,
Contributing Editor

● One of the most basic maintenance procedures is also the most important—check all of your car's or truck's vital fluids at least once every week.

Do this after you've just driven, when the fluids and components are at their normal operating temperature. For accuracy, your car or truck should be parked on a level surface.

Begin with the engine oil.

● Locate the engine oil dipstick. Many cars have only one dipstick. Others have a similar-looking dipstick for the automatic transmission.

● Pull the dipstick entirely out of its tube and wipe the oil from it using a cloth or paper towel. Careful, it's hot.

● Inspect the dipstick's bottom end. The metal stick will have markings—possibly notches, hatch marks or lines—indicating a full level and a low level. The dipstick may also indicate an acceptable area in between.

● Fully reinsert the dipstick into its tube. Remove it again.

● See how much oil is on the stick. You need to add oil only if the level is low. Do not add oil to bring the level above the full line.

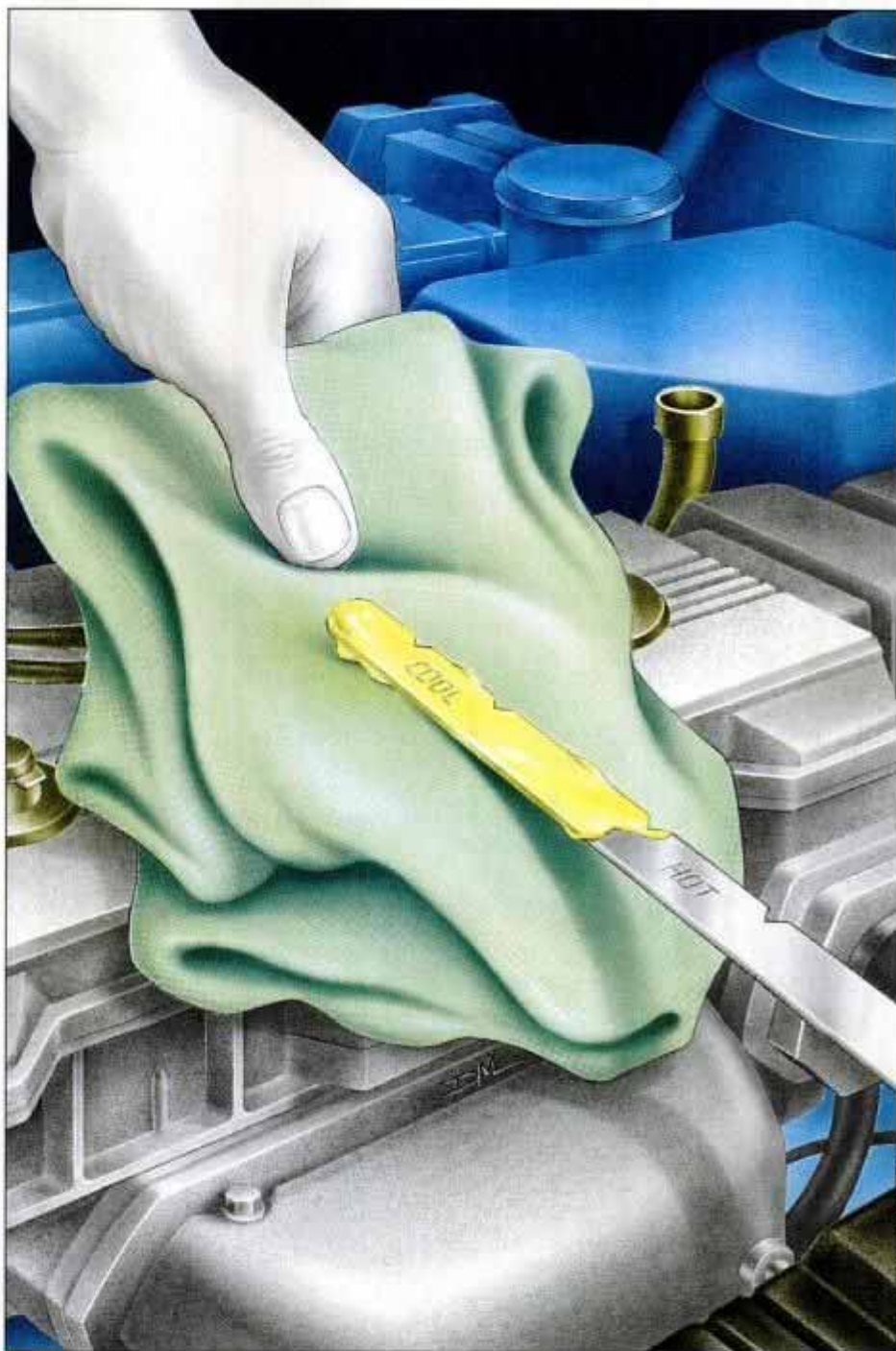
● If you need to add oil, use a name brand quality oil that meets the specifications listed in your owner's manual. Pour it through the fill cap on top of the engine. Wipe up any spilled oil and be sure the cap is on securely after you're done. Wait a few seconds to let the oil reach the oil pan, especially if the oil you're adding is cold and thick. Recheck the oil level and fully reinsert the dipstick.

Next, check the transmission oil or fluid level. Most cars and trucks with an automatic transmission have a dipstick similar to the engine oil dipstick for this purpose.

On some vehicles, automatic-transmission fluid is checked with the engine idling, on others the engine must be off. See your owner's manual.

● Remove the dipstick, wipe it clean, reinsert it fully and then pull it out to check the fluid level.

● Only add fluid if the level is low. Too much fluid can lead to shifting problems or leaks.



● With most cars, the transmission fluid gets poured down the dipstick tube. Use a long-neck funnel or a funnel attached to a length of hose.

Checking the coolant level on most cars now merely involves looking at the coolant recovery reservoir mounted to one side of the radiator.

● If your car or truck does not have a reservoir, remove the radiator cap and check the level in the radiator.

● Do not open the radiator cap until the radiator is cool to the touch or you may be severely scalded by hot, pressurized coolant.

● Add a 50/50 mix of antifreeze and water to raise the coolant level.

● If your car has a reservoir, pour the coolant into the reservoir. There is no need to open the radiator cap.

Brake fluid can be checked by looking at its level in the master cylinder's reservoir. On all modern vehicles, this reservoir is translucent—you need not open it to see the fluid.

It is normal for the brake-fluid level to go down as the disc brakes' pads wear. There is no need to keep topping up the fluid. A sudden drop in level indicates a problem—have it checked.

You can check the level of the power-steering fluid by removing the cap from the fluid reservoir. The dipstick is attached to the cap. **PM**

CAR CARE

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To help minimize the potential harm to the ecology created by your old engine antifreeze/coolant—and to reduce your maintenance chores—Prestone has introduced LongLife 460 antifreeze/coolant. Formulated to protect your engine's cooling system for four years or 60,000 miles, the new product uses a blend of

inhibitors, which offer rust and corrosion protection to aluminum and other cooling-system metals. Prestone LongLife 460 meets all current cooling-system protection standards for cars, vans and light-duty trucks. Priced at \$8.99 a gallon, from First Brands, 83 Wooster Heights Rd., Danbury, CT 06813; (203) 731-2300.



Compact Arc Welder

Whether you're a serious mechanic or just a dabbler, sometimes you just need a welder, like this Mity Mite arc welder from Schumacher Electric. The Mity Mite operates on 120-volt household current, drawing 20 amps with welding current adjustable between 25 and 70 amps. The unit can accommodate welding rods from 1/16 in. to 3/32 in. and weld metal from 18-gauge to 3/16 in. The Mity Mite features double-insulation, a molded-plastic case with integral handle and built-in storage cavity for the cables. The unit comes with a handheld mask and a brush/chipping tool. The Mity Mite costs \$99.95. From Schumacher Electric Corp., 7474 N. Rogers Ave., Chicago, IL 60626; (800) 458-6447.



Pickup Truck Rack

An overhead cargo rack for a pickup truck allows you to tote more cargo. It also handles

long items—like a canoe—which would otherwise hang out the back of the open bed. This black anodized aluminum rack from JEMB Rack Systems can hold up to 300 pounds and can be dismantled and stowed in its own case inside the truck's cab. The rack can be set up without any tools, and its length is adjustable from 2 to 8 ft. to suit the load. Roller rack pads protect the cargo and allow for easier loading. The price for the rack and case is \$295, from JEMB Rack Systems Inc., 2 Murray Rd., Essex Jct., VT 05452; (800) 272-5362.



Steering-Wheel Lock

A thief is not apt to break into your car or truck if he's not going to be able to steer it after he's started it. At least that's the theory behind the slew of steering-wheel locks, which are now on the market, including this new one from Wolo. Called On-Guard Model WB-90, this variation on the theme is made of solid, not tubular, steel. The horseshoe-shaped lock is highly visible, regardless of the steering wheel's position when installed. The unit fits all steering wheels. The On-Guard Model WB-90 costs \$39.99. From Wolo Mfg. Corp., 1 Saxwood Dr., Deer Park, NY 11729; (800) 645-5808.

Mustang Calender

This year is a big one for the Mustang. The original ponycar, which was introduced at the New York World's Fair, is 30 years old. And to celebrate the 3-decade milestone, Ford is going all out and doing it right by introducing an all-new Mustang for 1994. You can create your own year-long celebration and reminisce over all the Mustangs of yore with this 1994 Mustang calender from Whitehouse Publishing. Each page shows three months simultaneously for easy planning. Each month shows a different color photo of a different vintage and model Mustang, ranging from the original '64 up to the 1993 model. The price of this Mustang calender is \$12.95, plus \$2.25 for shipping costs. From Whitehouse Publishing Group Inc., 1500 First Ave., Suite 79, New York, NY 10021; (212) 794-4373. **PM**





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1. This distinctive grille and front end is from what truck?



A) Chevy full-size pickup. B) Ford full-size pickup.
C) Dodge full-size pickup. D) Peterbilt conventional.

2. The car designated to pace the 1994 Indianapolis 500 race is the:

A) Ford Mustang. B) Chevy Camaro. C) Dodge Viper.
D) Pontiac Firebird.

3. What car was commonly referred to as a "goat?"

A) Plymouth GTX. B) Pontiac GTO. C) Any highly modified pickup truck. D) Shelby GT350 Mustang.

4. Of the following, the rarest factory-built Corvette model produced was the:

A) 1963 Grand Sport. B) 1967 L-88. C) 1969 ZL-1. D) 1972 ZR-2.

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5. Who is the only driver to concurrently hold the Formula One World Driving Championship and the IndyCar World Championship?

A) Emerson Fittipaldi. B) Mario Andretti. C) Nigel Mansell. D) Dan Gurney.

6. Buick's last rear-wheel-drive muscle car was the:

A) Reatta. B) GSX. C) Regal Grand Sport. D) GNX.

7. Which of these cars currently offers an active suspension system?

A) Infinity Q45a. B) ZR1 Corvette. C) Lexus LS400.
D) Bentley Turbo R.

8. What did the "4-4-2" stand for on the original Oldsmobile Cutlass 4-4-2?

A) 400 cu. in. engine, 4-speed, dual exhaust. B) 400 cu.in. engine, Turbo 400 auto transmission, dual exhaust. C) 4-barrel carburetor, 4-speed, dual exhaust. D) None of the above.

9. If the cam timing is advanced from stock setting, which of the following is true:

A) The intake valve-to-piston clearance is increased.
B) The intake valve-to-piston clearance is reduced.
C) The exhaust valve-to-piston clearance is reduced.
D) Both A and C.

10. Ford Motor Co.'s second entry into the compact car field after its highly successful Falcon, was the:

A) Pinto. B) Fairlane. C) Escort. D) Comet.

ANSWERS
1. C 2. A 3. B 4. C (Only 2 were produced) 5. C 6. D
7. A 8. C 9. B 10. D.

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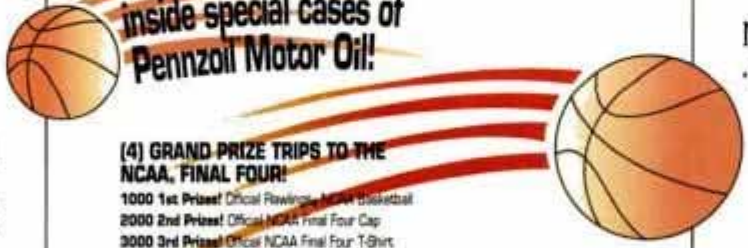
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NEW CARS



TM PHOTO BY JIM DUNNE

Buick Renews Riviera

● One look at the 1995 Buick Riviera tells you that this is something new—and different. From wheels to roof, this is an all-new design, conceived to put Buick's flagship coupe in a class with the motoring world's most advanced products.

Buick officials will tell you that the key to the new Riviera is the strength of its new unibody. They'll explain the 25 Hz of stiffness—a number that ranks among the best in the world for rigidity. This exceptional rigidity is responsible for the new Riviera's improved ride, handling and interior quiet.

Overall, the new coupe delivers luxury without excessive softness. Its new magnetically controlled variable-assist rack-and-pinion steering system is light at low speeds, slightly firmer at high speeds. Tires slap over expansion joints, but the body remains steady, almost vibration free. Road and exhaust noise are muted.

With its 113.8-in. wheelbase and 207.2-in. overall length, this is a big coupe, weighing in at well over 3700 pounds. As a result, handling is deliberate but precise. It doesn't offer sports-car feel, but then it's not intended to be a sports car. Braking, with big discs at all four wheels and standard antilock, is excellent.

Inside, you get dual airbags, seats that are carefully constructed to hold you comfortably in place, an analog instrument panel that is simple and easy to read and a roomy cabin layout that caters to both driver and

passengers. This includes rear-seat passengers—the new Riv is one of the few coupes with sedan roominess front and rear.

Outside, you see a completely new Buick design—one that draws on some of the division's recent concept cars. The compound curves let you see a different shape from each different viewing angle.

Based on consumer clinics, Buick designers expect that your initial reaction to the new shape will be either love or hate. But, they hope, the more you see of the styling the better you will like it.

Buick will offer two engine options, which in turn will help to separate the Riv's two trim levels. The



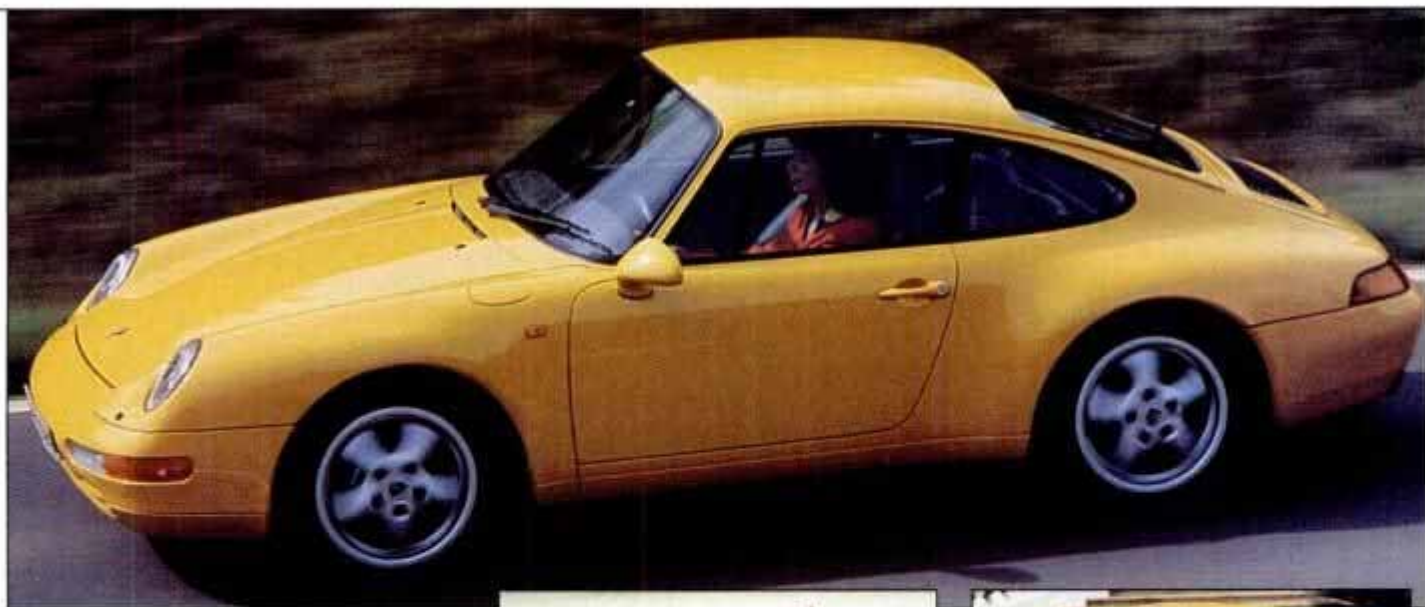
upscale model will get the supercharged version of GM's corporate 3.8-liter 3800 V6, rated at 225 hp. A normally aspirated version of the same engine—the Series II—rated at 205 hp, will power the standard Riv. Both will be mated to GM's newest 4-speed electronically controlled transmission.

Fuel economy with the super-

First Look: Nissan's New 240 SX



After the distinctive lines of the Altima sedan, Nissan's replacement for the sporty 240 SX coupe seems surprisingly subdued. Marketed in Japan as the Silvia, the new coupe is bigger, with a small increase in power from its standard 2.0-liter dohc 16-valve Four. Look for the new 240 SX to arrive in U.S. Nissan showrooms this spring.



charged engine is projected at 17/27 mpg for city/highway driving, while the Series II will be rated at 19/29. Look for 0-to-60-mph times in the low 9-second range for the normally aspirated engine and 8.1 seconds for the supercharged edition.

Buick will offer the new Riviera for sale in early summer at a price in the low \$30,000 range. —*Jim Dunne*

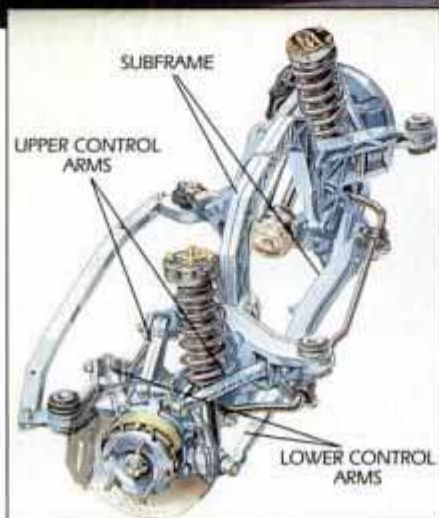
Another Porsche 911

It was 30 years ago when the original Porsche 911 debuted. That car was admittedly quirky, finicky and capable of performance far beyond the seeming limitations of its 2.0-liter engine and skinny 14-in. radials.

Porsche made its reputation as a carmaker with the 911, refining it constantly, racing it and selling race-ready versions, and then refining it more. Endurance racing in particular was its forte, fertilizing an entire industry of aftermarket look-alike slant-nose and whale-tail body panels.

The '95 911 Carrera owes nothing to that aftermarket industry. The 911 body shell underwent major revisions in '74 and again only a few years ago with the introduction of the Carrera 4 all-wheel drive. This update involved more than 1800 parts and virtually all of the outer and inner body panels. Torsional rigidity is 20% higher, for instance. Exterior styling is, well, a matter of opinion, but certainly instantly recognizable from any distance, front or rear, as a 911.

The interior is completely new, except for the familiar 5-gauge fascia, anachronistic lefthanded ignition-key placement and ample wind noise at high speed. The wind noise is in spite of flush-mounted glass and more insulation from road noise—but probably can be traced to the rain-gutter-



size drip rails running the length of the roofline. That's one panel that hasn't been changed.

Also unchanged is the original 911's relatively short 89.4-in. wheelbase, necessitated by the engine's placement well behind the rear axle. The short wheelbase makes for a choppy ride over poor pavement, especially if you order the Sport suspension option, but the excellent turn-in and responsiveness more than make up for it. Top-end stability is excellent, aided by an even larger engine-compartment spoiler that pops up at speed and automatically retracts as you slow down.

But the major factor in this new chassis' excellent manners is the rear suspension. Now there's a complete die-cast alloy subframe, isolated from the floor pan by rubber mounts, providing the locating points for a complete upper- and lower-arm assembly. Geometry includes provision for antidive, antisquat and Porsche's proprietary Weissach axle toe-in characteristics.

We had an opportunity to drive for several hundred miles through the South of France. And the suspension works—there's no denying that the



The rear of the Carrera is the big news with a redesigned suspension.

mass of the engine is still well to the rear, but the characteristic, dreaded 911 oversteer is gone, gone, gone. It took a slow corner, a lot of power and some real horsing around to get the rear end loose.

Power? Oh yes, there's now 270 horsepower, up from 247. Torque is up to 243 ft.-lb. from 228, and the torque curve is as flat as Kansas. Passing maneuvers can be accomplished in virtually any gear, making the 6-speed transaxle something of an overkill.

Porsche claims 0-to-60-mph times of 5.4 seconds, and sub-14-second quarters for the 6-speed and a tick slower for the Tiptronic versions. The claim is also made that lateral acceleration can reach 1.0 g's, certainly believable on 255/40x17 rear tires and 2.5/50x17 fronts.

Perhaps just as amazing are the brakes, with cross-drilled front rotors just a hair under 12 in., and cross-drilled rears nearly as large. They're so effective you can rush into blind switchbacks at ludicrous speeds, knowing the brakes will simply haul off all the excess velocity without any drama. And yes, there's ABS and traction control—but the car's limits are so high that you'll rarely need them.

The best news is that Porsche is committed to reducing its production costs, and the new Carrera should cost considerably less than the old one. —*Mike Allen*

AUTOMOBILES

DETROIT SPY REPORT

BY JIM DUNNE, Detroit Editor

Lincoln Continental

● For 1995, Lincoln's front-drive luxury sedan debuts with an all-new exterior, a refurbished interior and more power from a new engine. Gone is the 3.6-liter V6, and in its place will be Ford's 4.6-liter modular V8. With a whopping 50-horsepower jump over the V6 engine used in the current 1994 Continental, the 210-hp V8 will allow the

Major changes in store for next Taurus.



Lincoln to face its major competitor, the Cadillac De Ville, which currently has a 200-hp V8.

Ford Taurus

After the minor, somewhat conservative styling revisions that differentiate the current Taurus and Sable from their industry-rocking originals, Ford appears to be ready to shake up the family sedan market



Next from Chrysler will be a coupe version of the Neon.

again. This view of a prototype Taurus indicates that with the 1996 version, Ford will be taking another revolutionary and direct path to the styling of the future. Additional changes from this prototype include uniquely shaped headlights, smooth door surfaces and the familiar Ford oval in the center of the Taurus grille.

Neon Coupe

Now that the Neon 4-door sedan is in production, Chrysler is busy working



on the introduction of a 2-door version. The 1995 model coupe prototype shown here has the same rounded body lines and rear air foil at the rear as the sedan. Other than the number of doors, the major styling differences are the wide C-pillar and larger door opening on the 2-door model.

Eagle Talon

With a rounder, wider and more muscular look, the 1995 version of the Eagle Talon appears to be an all-new design. The photos of test prototypes show narrow slit headlight shapes, a high rear fender and very



Chrysler's new Diamond-Star sport coupe will be '95 Talon.

stingy front and rear overhangs which combine to provide a visual statement that's both sporty and powerful. Also noteworthy is the fact that the Talon will be the only version of this joint-venture car to be sold by

Chrysler. The Mitsubishi/Chrysler/Diamond-Star motors effort will no longer include the

Plymouth Laser, which is scheduled to be dropped.

Monte Carlo

Chevrolet will once again challenge Ford's Thunderbird when it introduces its 1995 Monte Carlo later this year. The coupe is more than a 2-door version of the Lumina, carrying the well-known Monte Carlo name. While the '95 Lumina is totally restyled, the Monte Carlo gets its own

unique treatment. Despite the sleek new look, the Monte Carlo will have a 3.4-liter V6 as its most powerful engine. Chevy brass is convinced that it won't need any more than six cylinders to compete with the Thunderbird since they feel the '96 T-Bird will also have nothing larger than a V6.

Jaguar

Look closely at the front of this prototype of a 1995 Jaguar and you'll



A new front end on this 1995 Jaguar hints that it may get a V8 soon.

see some important design changes. The round headlights, streamlined hood bulges and a thrusting grille (painted over to disguise the prototype) put a new face on the XJ12 without destroying its traditional look. Insiders say the XJ sedan and XJS coupe and convertible will soon have Jaguar's own new 4.0-liter V8 under the hood, probably in the 1997 model year.

Bevy Of Chevs

Look for a stream of new models from Chevrolet in the coming months. First will be the Lumina/Monte Carlo in the spring. Then Chevy unveils its reworked version of the S-Series Blazer (called the mini-Suburban by one publication) next summer. A new Cavalier and a Metro will debut as part of the 1995 lineup. Finally, there's the new all-steel Lumina minivan standing in the wings. The folks at Chevy are exuding optimism over the prospects for the new models.

Doors And Minivans

When Chrysler introduces its 1995 minivan lineup, it will offer them with a 4-door option. In addition to the sliding door on the passenger side, the minivans will also have a second hinged door on the driver's side. Though the fourth door will cost extra, Chrysler expects there to be a strong demand for it. One of the complaints of van drivers is the need to walk around to the passenger side when loading small packages. Yes, Ford and Chevrolet will offer 4-door options on their new vans, too. However, Chrysler will not offer an automatically operated door on its new minivans. Complexity and potential safety hazards are the most often cited reasons for not offering the convenience option. Apparently, there is some concern that once the large automatic door gets near its closing, there's no stopping it—not even by errant fingers.

A Tale Of Two Engines

Even though the 1995 Buick Riviera and Oldsmobile Aurora share GM's G-platform and have the same size engine compartments, they are apparently not equal. GM has found that it costs more to install a V8 engine in the Aurora than it does to put a V6 engine in the Riviera. It seems the bigger, longer 4.0-liter dohc 32-valve V8 requires extra time and more equipment to install at the assembly plant than does the V6. So while Aurora buyers may not know the details, they will probably be charged more for this difference. **PM**

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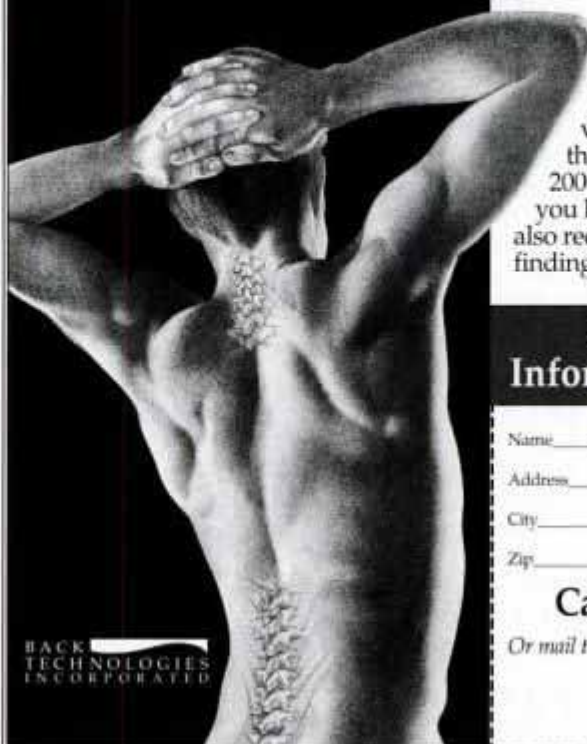


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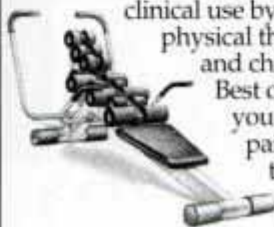
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BY GEORGE SCHAUB

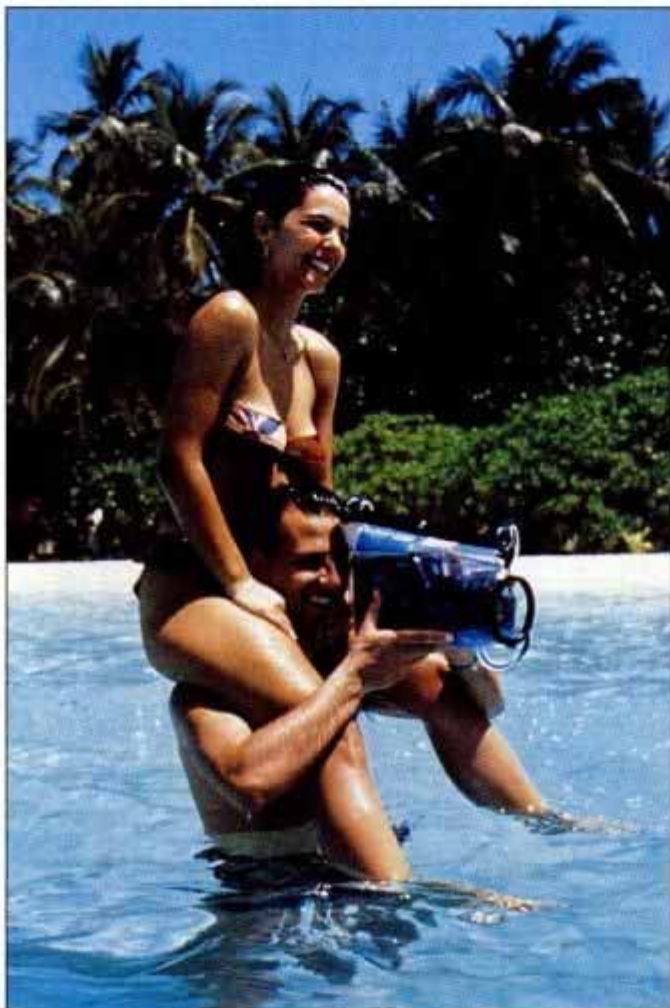
● Part of the fun of compact camcorders is that you can take them practically anywhere and they don't get in the way. But if your travels bring you to camcorder-hostile environments—whether it be rafting down the Rio Grande, snorkeling in the Bahamas, skiing the slopes of Vermont or even just hiking on a potentially rainy day—you had better take care. The electronic complexity of these miniature marvels makes them fairly fragile things, which simply don't like to get wet.

Recognizing that people don't want to leave their camcorders locked in their cars, stored in the ski lodge, or even stowed in the lower cabin of the dive boat, a number of specialty manufacturers have come up with accessories that allow for taping in the occasionally wet great outdoors and beneath the waves.

The first order of business is keeping the camcorder dry. The way in which this is done depends upon the type of activity you've planned, and how wet you intend to get. For river rafting or skiing, and even some shallow-depth snorkeling, you might consider a self-enclosed and flexible plastic housing with a glass-covered port. The housing allows you to access camera controls, either with an enclosed "glove" or with a pliable covering located adjacent to the main buttons and switches. The glass port is where you stick the lens—shooting through any old clear plastic covering would certainly give you more distortion than you want.

To optimize viewing and control, choose a housing specifically designed for your camcorder. Failure to do this may make access to control buttons, especially those that take a sharpened fingernail to activate, extremely difficult. One company, Ewa-Marine, makes such housings for virtually every popular model.

For example, its Ewa Model E-176 VST (list price: \$369) is made for the



Camcorder housings keep things dry even when it's wet.

Sony TR-style camcorders (and clones). A thick, flexible PVC plastic is molded into the shape of the camcorder, with an optical glass lens port attached to the front. Because the housings are customized to fit a specific camcorder, controls access, even for custom functions, is optimized.

The Ewa-Marine model is built to handle depths up to 30 ft.—ideal for snorkelers and even river rafters who may find themselves, like it or not, in the drink. However, keep in mind that these housings do not provide shock protection, so if the going gets rough, keep your camcorder in a hard case until you're ready to shoot. Tundra Sea King makes watertight cases (depth rated to 33 ft.), with O-rings for water protection and foam inserts for extra shock protection, in sizes that will fit any camcorder, full-size or compact. Choose the smaller case for

carrying on board or for hiking. The Model 613 (catalog price: \$83.95) measures 13.3 × 8.8 × 5.9 in. and weighs in at 4.1 pounds. It is ideal for compact and midsize camcorders.

For scuba fans who truly plumb the depths, a more rigid housing is required. The enclosure must be able to withstand the pressure of the deep as well as the occasional knock, plus it must allow for access to camcorder controls. Many of the housings on the market have double O-rings, a shock-absorbing camcorder cradle, an external microphone (for recording the song of the whales, we suppose) and feature electronic or magnetic external camcorder controls. One such model, the Amphibico Sports Capsule (list price: \$725), made for the Sony TR-200 models, weighs about 4 pounds and is depth rated to 300 ft. Hard housings for deep diving also allow you to mount lights, either on the housing or with extended brackets, necessary for getting true colors underwater.

If you just like taping in the rain, or in windblown sandy deserts, you might consider a cape-like device made with flexible PVC plastic. You literally wear this device over you, and place the camcorder lens into an optical glass port on the top front. Ewa-Marine offers these capes in various configurations (list price: \$169 to 199, depending upon camcorder design).

Dive shops and major camera stores are your best bet for picking up these and other such video accessories. If you can't find them there, try Helix, 310 S. Racine, Chicago, IL 60607; (800) 33-HELIX, or (312) CAMERAS. Its *Underwater* catalog contains a host of video accessories that can be used in hostile environments, above or beneath the waves.

Compact Impact

The trend in compact camcorders these days is to take high-end fea-



The Amphibico Sports Capsule is for scuba divers who want to make videos.

tures and added-value accessories and put them in a reasonably priced video recording kit. Such is the case with Quasar's new top-of-the-line VHS-C QuarterBack camcorder (list price: \$1399), so named, we surmise, because when held in place by the handstrap, it feels as if you're holding a football. A short list of the camcorder's features gives some indication of what's in store: full-color viewfinder, built-in digital Electronic Image Stabilization (EIS), 100:1 digital zoom, switchable wide-screen recording capability and a host of special effects—all available with an easy-access menu system.

The fun begins as soon as you snap on the QuarterBack. The first kick is the color viewfinder, especially if you've previously viewed through a monochrome screen. The lenticular screen breaks the image into small dots, à la hand-held TVs.

As soon as the QuarterBack is in play, take a run through the creative imaging controls. The ease of access is impressive—there's no double-pumping or hidden submenus to navigate. Each button brings you through the option plays, from first to last, then circles back to arrive at the original shooting scenario.

My first call was the STROBE/STILL button. Hit STILL, and the scene you have in the finder freezes and records for as long as you want. Hit the same button again and you've got strobe, a herky-jerky, old-time movie

rendition. With STROBE and ZOOM, the action gets pretty hectic. Hold the button for 3 seconds and the word "Wide" flashes in the finder—this is for recording in wide-screen format. Unfortunately, the frame itself does not show the effect.

For really long pass plays, try out the digital zoom. After zooming out to the 10X zoom position, hit the DIGITAL ZOOM button and you can use the telephoto zoom control to bring you to 20X. Hit it again and you can reach the dizzying height of 100X. Yes, the finder breaks up a bit at 100X, and mounting the camcorder on a tripod is a must for a steady shot, but that 100X range is still impressive.

Next, step into the pocket and try out EIS, though this won't help you in the 100X range. EIS can be used when walking or when riding in a car to help maintain a steadier image. It works here by cropping into the frame slightly (which records the center portion of the image) and by automatically switching the usual $1/60$ -second recording speed to $1/100$ or $1/250$ second, depending upon the lighting conditions. Note that EIS is not a substitute for fast shutter speeds for recording action—it's intended for when the shooter, not the subject, is in motion.

In short, this QuarterBack can really score. **FM**



Quasar's VHS-C QuarterBack.

HUBBLE RESCUE

(Continued from page 43)

Finally, on the ninth day of the mission, the crew will turn the telescope loose again. The robotic arm will hoist the telescope clear of the payload bay. Two astronauts will stand ready in the airlock in case of last-minute snafus—such as solar arrays or high-gain antennas that don't deploy properly. From the Goddard Space Flight Center will come a command that opens the telescope's lid-like aperture door. Then *Endeavour* will back gingerly away from Hubble.

If all of Hubble's systems check out, the astronauts can finally relax and spend the next day resting quietly before preparing for atmospheric re-entry. But while the world clamors for results, it will take 12 weeks for ground controllers to reboot Hubble before photos can be released.

Tool time

To say the least, the repair schedule will be challenging, and the environment even more so. Try changing an oil filter while wearing three layers of heavy gloves, and you get a feel for what it's like to use a spacesuit glove. What's more, many astronomers are worried about the astronauts accidentally contaminating instruments, leaving Hubble in worse shape than it is now. The astronauts themselves are extremely conscious of these concerns. "We know that just our presence out there is a threat," says Musgrave.

On the plus side, no one anticipates the effort to be as troublesome as last year's Intelsat VI satellite rescue. After all, Hubble is the "astronaut-friendly" spacecraft. The telescope sports 225 ft. of clearly marked handholds, 31 places where an astronaut can secure his or her body, easy-to-reach connectors and a fixture that the Shuttle's robot arm can grapple.

When NASA blueprinted Hubble, engineers included 92 components designed for orbital replacement and fitted with standard $1/16$ -in. double-height hex-head bolts. But because the repair list includes modules—like SADE—that weren't designed for maintenance, the toolkit has swelled to 168 pieces. These range from simple screwdrivers and right-angle wrenches to the pride of NASA's space-improvement department, the computer-controlled Power Ratchet Tool.

If the mission's accomplished, not only will the telescope be restored to its intended glory, but NASA will have scored a major victory in demonstrating in-orbit maintenance—a linchpin of the agency's space-station plans. After a year of frustration and failure, a healthy Hubble would be an auspicious start for 1994. **FM**

BOATING

DREAM BOATS

BY JOE SKORUPA, Boating/Outdoors Editor

● "Open the pod bay doors, Hal," I say to the Nautilus 3 sport cruiser at the recent Chicago Boat Show. I was gratified it didn't respond. I imagined that an outlaw computer was running amuck at the helm, which is exactly what happened in Stanley Kubrik's film, "2001: A Space Odyssey." Remember Hal, the velvet-voiced renegade computer?

Sure, this was a bit out of character for a typical boat show, but for the first time in years imagination was actually encouraged at IMTEC (the International Marine Trades Exhibition & Convention). There were handheld GPS units with navigation screens that could zoom in on landmarks the size of your house. There were jet-powered fun boats, more than a dozen new ones.

And finally, there was the Concept Craft Booth, where I contemplated the possibilities of the first futuristic fiberglass pod ever to appear at a boat show. The booth stood boldly near the main entrance, which was a fitting location. Where else would you put an exhibit intended to showcase the new vitality of an industry that hasn't exactly captured the public's imagination in the last couple of years?

The centerpiece of the exhibit was a model of the Nautilus 3 (shown on this page), which was designed and built in England by Iain Robertson, Fran Cush and Nick Talbot. This talented trio created the sleek sport cruiser while doing postgraduate work at the Royal College Of Art in London. Knowing they had a good thing on the drawing board, they entered the Nautilus 3 in the school's Transport Innovation design competition and won the top prize. Interestingly, this prize is usually given to an automotive concept car.

Volvo Penta became fascinated by the students' sketches and signed on as the project's sponsor. The students approached Volvo Penta because they were interested in powering their big cruiser with twin high-performance diesel engines fitted to



Sleek body lines and an enclosed helm give the Nautilus 3 sport cruiser a space-age appearance. Interior sketches show an equally futuristic design.

leading-edge outdrives. A pair of Volvo Penta KAD42 diesels mated to DPX Duoprop drives turned out to be the perfect match for the Nautilus 3. The turbo-powered 6-cylinder KAD42s produce a total of 460 hp (crankshaft measured) with an exceptional power-to-weight ratio. Top speed is estimated to be 50 mph.

The proposed spec sheet on the

Nautilus 3 lists a length of 40 ft. and beam of 10 ft. Weight is projected to be 22,000 pounds.

The creators of the Nautilus 3, by the way, have successfully completed their studies and have formed a design firm called the Sensation Partnership, which specializes in transport and industrial design. Inquiries should be directed to Volvo Penta North America, 1300 Volvo Penta Dr., Chesapeake, VA 23320.

The other star of the Concept Craft Booth was designed by Harry Schoell, one of boating's true visionaries. Harry is probably best known to boaters for designing the Delta Conic Hull, which has been enhancing the performance of boats made by Trojan, Larson and Infinity for years.

For the Chicago Boat Show, Harry brought a model of his Blackbird SR84, a radical

delta-wing-shaped hull that's much more than a dream boat. Harry actually built the hull a few years ago as part of an agreement with an engine builder. The plan was to use the reverse 3-point speedster to set a new speed record for diesel-powered boats. Unfortunately, the engine builder ran into financial difficulty and backed out at the last minute.



The Blackbird SR84 has a reverse 3-point hull to reduce blow-over at 150 mph.

Undaunted, Harry fitted the Blackbird with a pair of 300-hp outboards and proceeded with water tests, where he discovered that the boat performed as smoothly and efficiently as expected.

During this phase, Harry was approached by a hotshot television producer interested in using the Blackbird as a high-tech toy in a prime-time series called, "The 100 Lives Of Black Jack Savage." The show actually made it to network TV for a brief and uneventful run in the early 1990s. Yeah, I don't remember it either. The series had the same producer as the "The Hat Squad," so this guy's credentials are clearly in question.

Anyway, what's of primary interest about the Blackbird is a host of highly advanced design features. Foremost among these is its 3-point hull, a design approach that means only three points of the hull's bottom kiss the water when the boat is running at speed. What makes it a reverse 3-point design is that unlike the approach used by typical tunnel-hull dragsters or unlimited hydros, the bow is built without two sponsons or pickel forks. On boats like these, the third point of contact is found at the stern.

For the Blackbird, Harry, reverses the 3-point arrangement—on the bow there's only a single point of contact with the water and on the stern there are two.

Harry took this radical approach in an attempt to solve a major problem with offshore performance catamarans—the tendency for the lightweight bow to flip or blow over. Harry's inspiration was to build a faster, safer high-performance boat. With little air being trapped beneath the Blackbird's knife-like bow, the chances of blow-over are tremendously reduced.

The Blackbird measures 46 ft. long and 21 ft. wide. Minus engines, it weighs in at 5500 pounds. As mentioned, Harry intended the boat to be powered by twin high-performance turbodiesel engines, which produced more than 2000 hp. Estimated speed with engines like these is 150 mph.

Like the Nautilus 3, only a model of

the Blackbird was displayed in the Concept Craft Booth. Why didn't Harry bring the full-size prototype? The reason is that the former star of "The 100 Lives Of Black Jack Savage" is still in show business. It's on display in Disney World,

where it's embarked on a new career in entertainment as an exhibit in the Disney-MGM theme park.

By the way, the story behind the name of Harry's Blackbird SR84 is an interesting one. As you probably know, the world's fastest plane is the once top-secret Mach-3 SR71 Blackbird spy plane. In profile, Harry's boat actually resembles the black, razor-thin, delta-wing screamer. But why the SR84? Well, Harry's design business, Schoell Marine, is located on State Road 84 in Fort Lauderdale, Florida. And if you write to Harry there, using the zip code 33312, he'll get your queries.

Joining the Nautilus 3 and the Blackbird SR84 in the Concept Craft Booth were: 1. the GEWIS (Ground-Effect Wing In Stall) also designed

by Harry Schoell, 2. the HPCC-1 (High-Performance Cruising Catamaran) designed by Bandringa Design of Moorpark, California, 3. the T-40 Trimaran designed by Designworks, Newbury Park, California, and 4. the Yanmar Endeavor designed by Wind Warrior/Steve Schidler of San Francisco, California.

As a PM editor, I admit that I support the pursuit of innovation, especially when it occurs in boating. Unfortunately, boating has shown a tendency to preserve traditional conventions over the years and give creativity and imagination short shrift. Now, however, this may be changing. The steadfast National Marine Manufacturer's Association gave the Concept Craft Booth its full support in Chicago, and we may see it appear again at future shows.

Clearly, the automotive industry needs no convincing of the value of concept cars. Detroit has pursued a program of creating concept cars for many years. Automakers understand that these marvels of futuristic engineering not only excite public enthusiasm, but also provide designers with a great opportunity to incorporate tomorrow's ideas in today's cars. The boating industry would be wise to pursue the same path for boats. **PM**

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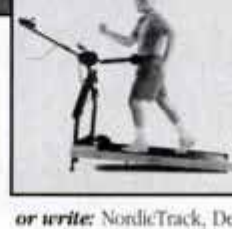
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SCIENCE

AT THE SEA'S CORE

BY GREGORY T. POPE,
Contributing Editor

● Alligators prowl beneath palms and lush fruit trees that chatter with colorful birds. Warm ocean waters lap against the shore, the humid 80° F air stirred by a zephyr.

Florida, 1994? No: Greenland, 50 million years ago.

Geologists have known for years that something threw Earth's thermostat into reverse since that era, when jungle rioted across the land of the midnight sun. The question is: Why did the Arctic turn from a greenhouse to an icehouse?

With debate over global climate change running hot and cold these days, scientists want answers. Clues lie beneath the floor of the Arctic Ocean, guarded by the very ice pack whose origin is under investigation.

Until last summer, no one had extracted geological samples from maritime latitudes so high. But today a mile and a half of Arctic seafloor core samples await analysis. These cylinders of rock, mud and stone—about the width of a man's arm—are the fruits of an unprecedented scientific expedition that came exactly 100 years after Norwegian explorer Fridtjof Nansen first ventured across the ice. Geologists believe these cores will divulge a prehistoric chronology of radical changes that the Arctic Ocean wrought upon itself—changes that then sent the mercury plunging across the entire planet.

Just as Nansen needed a custom-built boat for his expedition, the Arctic sample-recovery mission called for a one-of-a-kind vessel: the drillship *JOIDES Resolution*. Now beginning its 10th year of operation, *JOIDES Resolution* is to geologists what the Hubble Space Telescope is to astronomers, although it has proven far more robust, having spent a mere two weeks in drydock during its career.

Texas A&M University operates the 18,000-ton vessel for the international Ocean Drilling Program. Once in position, *JOIDES Resolution* can lower drill pipe as long as 6 miles to burrow into the seafloor and carve out core samples. Twelve computer-controlled thrusters and a 400-ton heave compensator keep the ship rock-steady during a drill.

On the Arctic expedition, however, geologists needed more than this

workhorse to ride out their 8-week cruise. A trail of likely drill sites lay off the eastern coast of Greenland, as far north as the island of Spitsbergen. Because ice roves capriciously in



Drillship (top) and spudding base (above).

those waters, *JOIDES Resolution* joined forces with *MSV Fennica*, a brand-new Finnish icebreaker. The drillers chartered this vessel to scout out and nudge away ice floes, while the *JOIDES Resolution* stayed rooted above a drill site.

Through August and September, the ships cruised above obscure patches of seafloor known best to Cold War submariners. At the northernmost sites—80° in latitude—the researchers expected ice floes to be drifting over about 20% of the sea. Most of the time, however, the seas were either clear as far as the eye could see or else menaced by the drifting edge of solid ice cover. The *Fennica* wasn't designed to fight off the entire ice pack. More than once the *JOIDES Resolution* had to pull up the drill string and flee an advancing sheet of ice that had been nowhere in sight the day before.

Nevertheless, when *JOIDES Resolution* docked at Reykjavik on September 24, drillers had samples of

seafloor sediment dating back 50 million years. The cores now lie like mummies in a refrigerated catacomb at Columbia University's Lamont Doherty Earth Observatory. Geologists are already lining up requests for their pieces of the rock. The cores' chemistry and mix of fossil plankton can speak volumes about the times when the sediment settled.

Researchers hope the cores will reveal a timeline of two major geological events that rerouted global ocean circulation. The first event opened up a deep-water passageway between the Arctic Ocean and the Norwegian-Greenland Sea, allowing cold, oxygen-rich water to migrate away from the poles and mingle with warm currents from the Gulf Stream. The second event opened a similar chasm between Scotland and Iceland. This freed the cold water to spill much further south.

The significance? "When those channels weren't in existence," says Texas A&M's John Firth, staff scientist on the Arctic expedition, "we had only shallow surface waters connecting the Arctic to the North Atlantic. But the deep passageways allow cold water down into the Atlantic, completely changing the circulation convection of the oceans. And ocean circulation affects climate patterns."

When the first gateway opened, temperatures worldwide began to fall gradually, ushering the polar jungle toward the equator and replacing it with temperate woodland. Geologists have theorized that the first deep passageway rifted open around 25 million years ago. Now the cores seem to verify their theories.

But the second event wrought more drastic change. As Arctic waters began tumbling south through the Atlantic, Earth lurched into its present oscillating climate system, in which ice ages alternate with milder periods such as our current time. Only when this second gateway opened did the Arctic freeze over, geologists believe, creating broad expanses of sunlight-reflecting white that exacerbate climate swings.

The timing of this second gateway has been in dispute. But the cores tell of big changes occurring 7 to 8 million years ago. Ice began rafting across the Arctic. Deep water at the southern drill sites became rich in oxygen.

Firth cautions that a second leg of drilling, scheduled for next year, is necessary to pin down the date of the second gateway. But last summer's expedition has brought home a new understanding of the link between Earth's dynamic surface and global climate change.

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LITTLE HELPERS

BY FRANK VIZARD, Electronics Editor

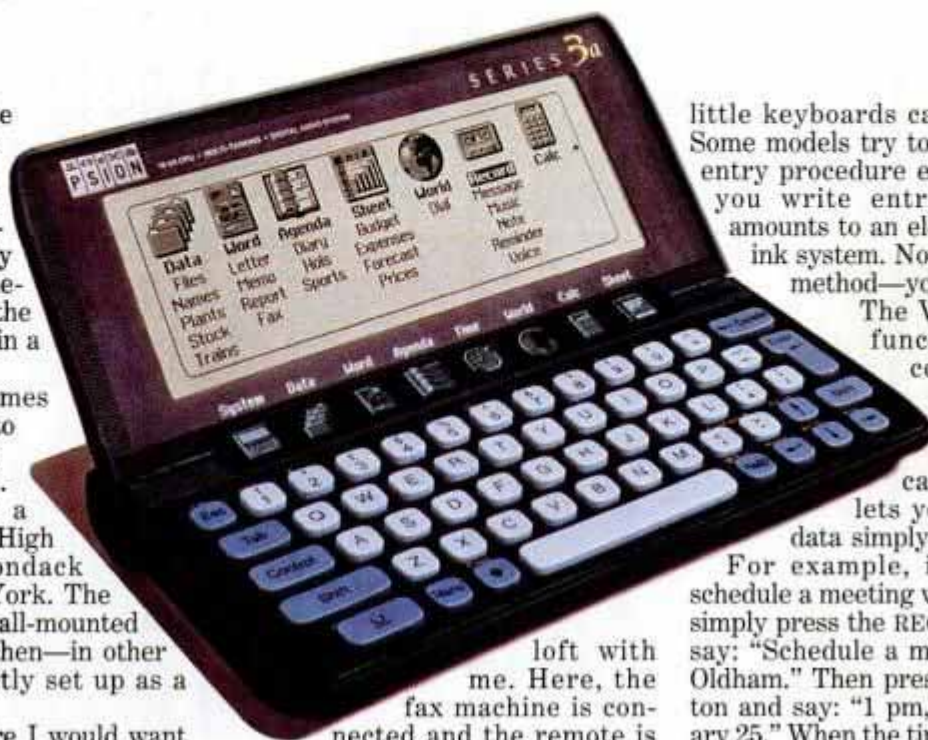
● Given the way the workplace seems to operate these days, it seems that even when you're on vacation you can't really escape the job. Sometimes all you get is the opportunity to work in a different place.

Of course, sometimes the place you need to work isn't always conducive to work. This time, I'm in a small A-frame in the High Peaks of the Adirondack Mountains in New York. The house only has one wall-mounted telephone in the kitchen—in other words, it's not exactly set up as a home office.

I quickly see where I would want the office to be though—in the upstairs loft. Hey, it's got a great view. The problem is how to get the fax machine and the cordless phone hooked up without having to run miles of telephone cord.

The solution comes from a handy little device called the Intelejack made by Phonex Corp. of Midvale, Utah. There's basically two parts to the Intelejack (\$100), a base unit and a remote unit. The telephone line plugs into the base unit as does the main phone—my cordless model, for example. The base unit is then plugged into a nearby electrical outlet.

The remote unit, meanwhile, goes up to the



loft with me. Here, the fax machine is connected and the remote is plugged into a wall socket. Like magic, there's a dial tone when the receiver is picked up. The electrical wiring in the house, thanks to Intelejack, is carrying the telephone signal to the junction box. Now I have an instant electronic workplace.

Another helpful little device that plugs into an electrical socket is the Flip Top rechargeable battery. If you're the type of person who doesn't use rechargeables because it is too much trouble to find and use a separate recharger, then the Flip Top is for you.

In the Flip Top, both the battery and the recharger are one and the same. When you want to recharge the D-size nickel-cadmium battery, you simply pull up the battery's top to expose a pair of AC blades. Recharging takes 12 hours, and it's good for about 500 recharges.

The Flip Top lists for \$13 and is made by Power Battery Holding Corp. of Bellevue, Washington. You can expect AA- and C-size battery models this year, says the company.

For many people, particularly those in business, electronic organizers are handy little tools. But sometimes, entering information via tiny

little keyboards can be daunting. Some models try to make the data-entry procedure easier by letting you write entries with what amounts to an electronic pen and ink system. Now there's a third method—your voice.

The Voice Organizer functions as a recorder, appointment calendar, reminder, phone directory and calculator, and it lets you input all the data simply by talking to it.

For example, if you want to schedule a meeting with Joe Oldham, simply press the RECORD button and say: "Schedule a meeting with Joe Oldham." Then press the TIME button and say: "1 pm, Tuesday, January 25." When the time comes, a beep will remind you of the meeting. To hear your recording, just touch the PLAYBACK button.

Now, let's say you want to record a phone number. Press the PHONE button until the first letter of the last name appears on the display. Say the name twice and then the phone number. Now press the SAVE button.

(Please turn to page 102)



Speak and the Voice Organizer will listen.



Phonex Corp.'s Intelejack uses a house's existing electrical wiring to extend the reach of telephones.

“Last February my company was in a slow period. One after another, my co-workers were being laid off ...

...I was seriously worried I would be next. One day I was asked to go to the main office. I never imagined the NRI course I took in Microcomputer Servicing would help me keep my job — but that day I wasn't given a pink slip. Instead, I got a desk with a computer and a new position! Thanks to my NRI training, I am still working today — training field personnel in computer operation. Aside from keeping me employed, it made my ego soar! Because of my new-found skills and my company's computer sophistication, we have done well in a recessed market — and I have more job stability than I ever thought possible.”

— John Ricca, Falls Church, VA

Even though NRI graduate John Ricca says he began his course to elevate himself from a “very early stage hacker” to a “late stage hacker,” and not specifically to enhance his career or job stability, having the NRI course under his belt made him that much more indispensable to his company in uncertain times. NRI's course in microcomputers helped John Ricca and thousands of others, and we can help you, too. Here's how:

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(Continued from page 48)

Garmin, for example, has several graphic screen representations aimed at land, sea and air navigation options. The Sony comes with two memory-card slots for saving waypoints or retrieving databases. Also, it's packaged with either a data-packed aviation or a marine data card.

All of the units other than the Panasonic and the Trimble are equipped with ports for outputting data to marine autopilots and plotters. The Garmin, Micrologic and Sony units have inputs for hooking up a differential GPS (DGPS) receiver—an accuracy-enhancing system that the Coast Guard is presently setting up.

The Trimble is clearly targeted to land navigators. Sold with a U.S. atlas, it's designed to tie in with maps published by the California-based Thomas Brothers Maps. And, for the benefit of photographers, it can display the time and azimuth of sunrise and sunset on any given day.

The prices of the units we tested vary, though discounts from suggested retail prices place most GPS receivers at the lower end. In a class by itself is the Sony, which offers impressive features at an equally impressive list price (\$1699). The other models can be purchased for \$500 to \$800, with the Magellan at the lower end, the Micrologic in the middle and the Garmin, Panasonic and Trimble at the \$800 end.

Among the less-expensive units, the Magellan is a good choice for non-demanding general-purpose use. It has limited but informative graphics, along with a minimal route memory. With its sophisticated marine features, the text-heavy Micrologic unit is a good value for boating and other vehicular use. Its brick-like weight and dimensions should cause backpackers to steer clear. On the other hand, the lightweight Trimble is a good choice for land use, but doesn't have the knots/nautical-miles readouts that boaters would want. In this price range, the standout model appropriate for land and sea use is the Garmin unit, which has good graphic displays at a price much lower than Sony's.

More affordable models are on the horizon. Next year, Panasonic plans to introduce a model that will have map readouts comparable to Sony's. Micrologic plans a model smaller and less expensive than its SuperSport.

The age of affordable handheld navigation is only beginning. One day soon, GPS receivers will be so commonplace that they'll be a standard accessory in passenger cars. But until that day, a GPS model in the hand is worth two in the dash.

seconds. Now, unless you're some sort of superspy dealing with an extremely compressed sound bite, this feature is virtually useless. The Series 3a organizer is very handsome and elegant. Just don't get it talking because it has very little to say.

DCC Revisited

I'm still impressed by how the digital compact cassette (DCC) is identical in sound quality to the compact disc. This impression was reinforced in using Panasonic's RQ-DP7 portable DCC player, one of the first portables available in this new audio format.

The sound quality of DCC is all the more remarkable when you remember how DCC recording is done. DCC uses a process called Precision Adaptive Sub-band Coding (PASC), which relies heavily on psychoacoustic principles.

Put simply, if the ear can't hear it, PASC doesn't record it. Secondly, if a signal is masked by stronger, adjacent signals, then PASC ignores the weaker signal in favor of the stronger one.

This bit of discrimination actually eliminates a lot of data. The end result is that DCC matches compact-disc sound quality but needs to encode only about 25% of the information to achieve it.

Still, I have my doubts about DCC's long-term success. One surprise that added to my doubts occurred using the Panasonic RQ-DP7 portable player. A little shot to the midsection induced an audible skip. While this occurs in portable CD players when they're jostled, the DCC skip was surprising in what I assumed would be a sturdier tape transport system.

Now consider the competition. Portable Mini-Disc players generally have a memory buffer so any shocks to the player are inaudible. True, DCC is a bit better in sound quality but the Mini-Disc sound is acceptable in most portable listening situations. And at a list price of \$549, the RQ-DP7 is no bargain. Perhaps the jury is still out on Mini-Disc, but DCC isn't cutting it, despite its technical brilliance.



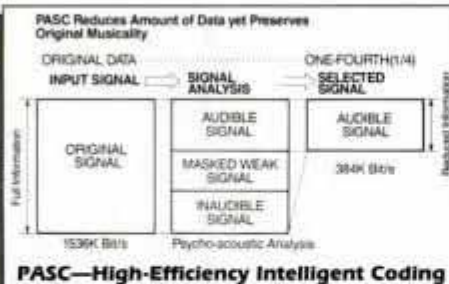
In the Flip Top, both the battery and the recharger are one and the same.

To retrieve the phone number, simply say the name and the phone number appears on the screen. Up to 400 phone numbers can be saved.

The Voice Organizer also features EDIT keys so you can alter stored information. There's a 4-megabyte memory, and the device comes with five rechargeable NiCd batteries that hold a charge for seven days, says the manufacturer. The Voice Organizer is available only through mail order from Voice Powered Technology. To order, call (800) 743-2000. List price is \$199.95.

Another new organizer now available is the Psion Series 3a, which lists for \$495 for the 256K model and \$595 for the 512K model.

The Series 3a is a nicely designed organizer with a lot of good features. However, the Series 3a overextends itself by including an audio-recording capability. Any lengthy audio recording quickly uses up the device's memory, so in practical terms audio recordings are limited to 1 or 2



DCC players rely on psychoacoustic principles.

FINISH LINE

BY JEREMY SHAW

● Although the top spots proved elusive, 1993 went into the record books as a good one for the PM/Dick Simon IndyCar campaign. When the final numbers were crunched, one member of the PM trio ranked in the IndyCar top five, the other two were in the top 20 and Raul Boesel actually led the entire pack in at least one statistical category.

The fact that the team's showing at California's Laguna Seca Raceway—the 16th and final round of the '93 PPG IndyCar World Series—was disappointing makes the season's tally that much more impressive.

Boesel's weekend in California started off badly with a broken selector fork in the gearbox, which stranded his Duracell/Mobil 1/Sadia Lola/Ford-Cosworth after he'd run only a couple of laps in the opening practice session. This in turn left him only 13th on the closely matched starting grid.

"We were playing catchup because



Raul Boesel thunders down Laguna Seca's corkscrew (above) in '93 finale. At midrace, Boesel, Jimmy Vasser and Scott Brayton ran in a 3-car train (left). Mechanical woes shortened Boesel's practice time (below).



of all the time we lost the first day," Boesel reported. "The car was improving, but we just lacked overall grip. The car was sliding too much."

Boesel's fortunes didn't improve much on race day. He battled in mid-pack through most of the event's 84 laps, and then ran out of fuel 100 yards from the flag en route to an 11th-place finish, and fifth in the season's final standings.

Teammates Scott Brayton and Jimmy Vasser also had problems in the season finale. They qualified well enough, only a couple of places behind Boesel, and all three Team PM entries were running in nose-to-tail formation during the early stages of the race. Ultimately, though, Brayton's Amway/Northwest Airlines Lola/Ford-Cosworth relinquished 13th place after 60 laps due to engine failure, while Vasser parked his

Kodalux/STP Lola/Ford-Cosworth just a couple of laps before the finish line after performing his second spin of the afternoon.

The final PPG Cup standings show Brayton and Vasser together in 15th and 16th place, respectively. This represents a particularly respectable effort for Vasser, who was obliged to sit out a total of four races due to limited financing.



Brayton was 15th in the final points tally.



Team PM leader Boesel gained some consolation by completing more racing miles during the season than any other car driver. His tally of 3542.352 miles out of a possible 3658.902—25 miles more than Mario Andretti, his nearest challenger—means that Boesel completed an impressive 96.8%.

Just as impressive, he scored points in every race but one.

Those are outstanding results by any standard, but especially so in such a competitive series. And now, with Boesel signed to a 3-year commitment with Dick Simon and ongoing support from Duracell, the stage is set for an even stronger challenge in 1994.

PM

ROCK STAR

BY CLIFF GROMER



● The train doesn't stop in Cisco anymore. It used to, when Cisco, Utah, was a uranium boom town. Now it's a bust town. Cisco used to have its own post office and its own zip code. That's when there were eight people in the town. Now there are six. Cisco used to have a gas station and a restaurant, too. But one day a long-haired biker stopped for gas and took off without paying. So the owner shot him.

The law carted the owner off to the pokey, leaving the owner's wife, Ethel, to run the business. Ethel didn't serve just anyone. The restaurant door was kept closed, and you had to knock to get in. Ethel kept a big dog that would come out and clamp its teeth around your ankle when she opened the door. If you kicked the dog, Ethel wouldn't let you in. But if you just froze and acted docile, Ethel would serve you a meal.

You know you're in Cisco because there's a "Cisco" exit sign on Interstate 70. A few miles up the interstate is Moab. That's where we got off.

Moab used to be a mining town,

too. But when the bottom fell out of the uranium market, the Moabites discovered tourism. Moab is the slickrock capital of the world. Slickrock is essentially sandstone rock formations in various sizes, ranging from large hills to small mountains. The rocks are neat to look at. But folks don't come to Moab to look at the rocks, they come to ride them.

Slickrock, you see, offers a unique challenge for hikers, mountain bikers, dirt bikers and 4-wheelers. But it's the 4-wheelers that are the real hardcore rock-and-rollers. They like to see how steep an incline they can climb without falling over backward. Or, how deep an incline they can go down without the back end coming up and over the front end. Or, how steep an angle they can roll to the side without tumbling off the cliff.

Which is why we were in Moab in the first place.

BFGoodrich recently introduced a new Radial T/A light-truck tire named, appropriately, Moab Edition. The BFGoodrich folks rented a bunch of Jeep Wranglers, shod them

with the new Moab Edition tires and pointed us toward what appeared to be a sheer rockface.

"It's a joke, yes?" we asked. "Look, just show us the dirt trail, and we'll just yank this here lever into 4wd and kick up some dust, okay?"

But they were serious.

And so began a full day's adventure of white-knuckle entertainment at speeds of all the way up to 1 mph.

One of the secrets to the Moab Edition is a new softer, or more compliant, compound that results in a grippier microtexture for a better mechanical link between tire and surface. It's hard to believe that microtexture can keep 3000-plus pounds of Jeep glued to sheer rock at gravity-defying attitudes. Greater tire-compound flexibility results from a proprietary tripolymer compound formula. Resistance to tearing and chunking on rocky terrain comes from high-structure carbon blacks, which essentially provide the matrix that holds the rubber molecules together. Tire compound aside, the Moab Edition differs visually from BFGoodrich's Radial All-Terrain and Radial Mud-Terrain T/A only by the Moab logo molded into the sidewall. The Moabs share the same two steel belts and 3-ply polyester sidewall construction as the mudders and all-terrainers. And according to the good folks at BFGoodrich, the Moabs will supply 110% of the traction capability and 90% of the tread life of the previous tires.

For those of you non-rock climbers, take comfort in the fact that the new tread compound works well in cold weather, making the Moabs an excellent tire choice for hard-packed snow. But if you're a rock fan, the Moabs are the only way to roll. **FM**



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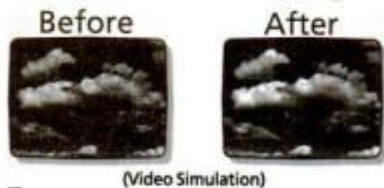
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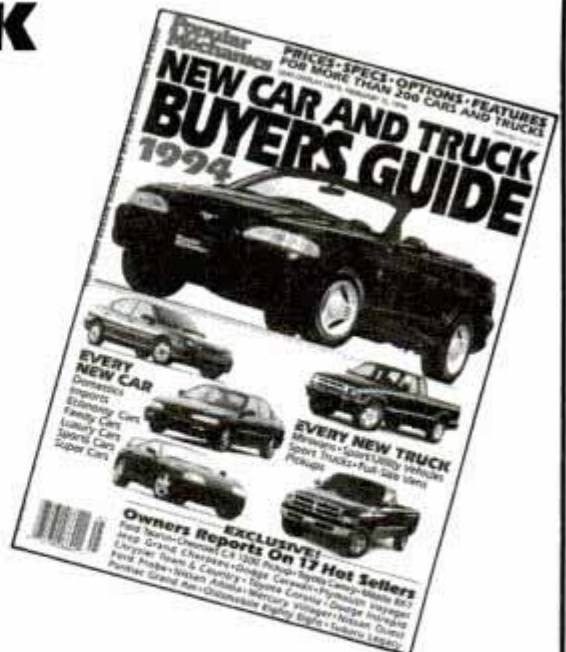
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