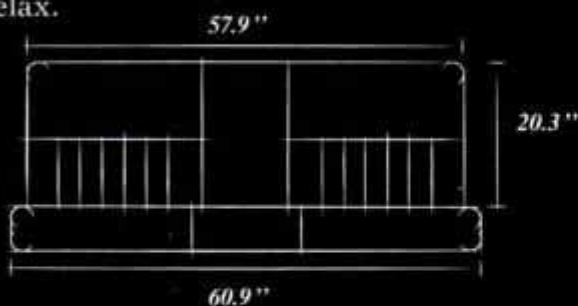


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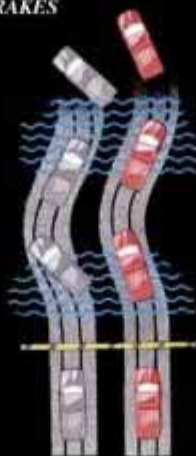
Meanwhile, you're sitting comfortably up front, as well. Like all Ram pickups, our Club offers an available six-way power driver's seat. Plus a standard center console to better organize your office on wheels.



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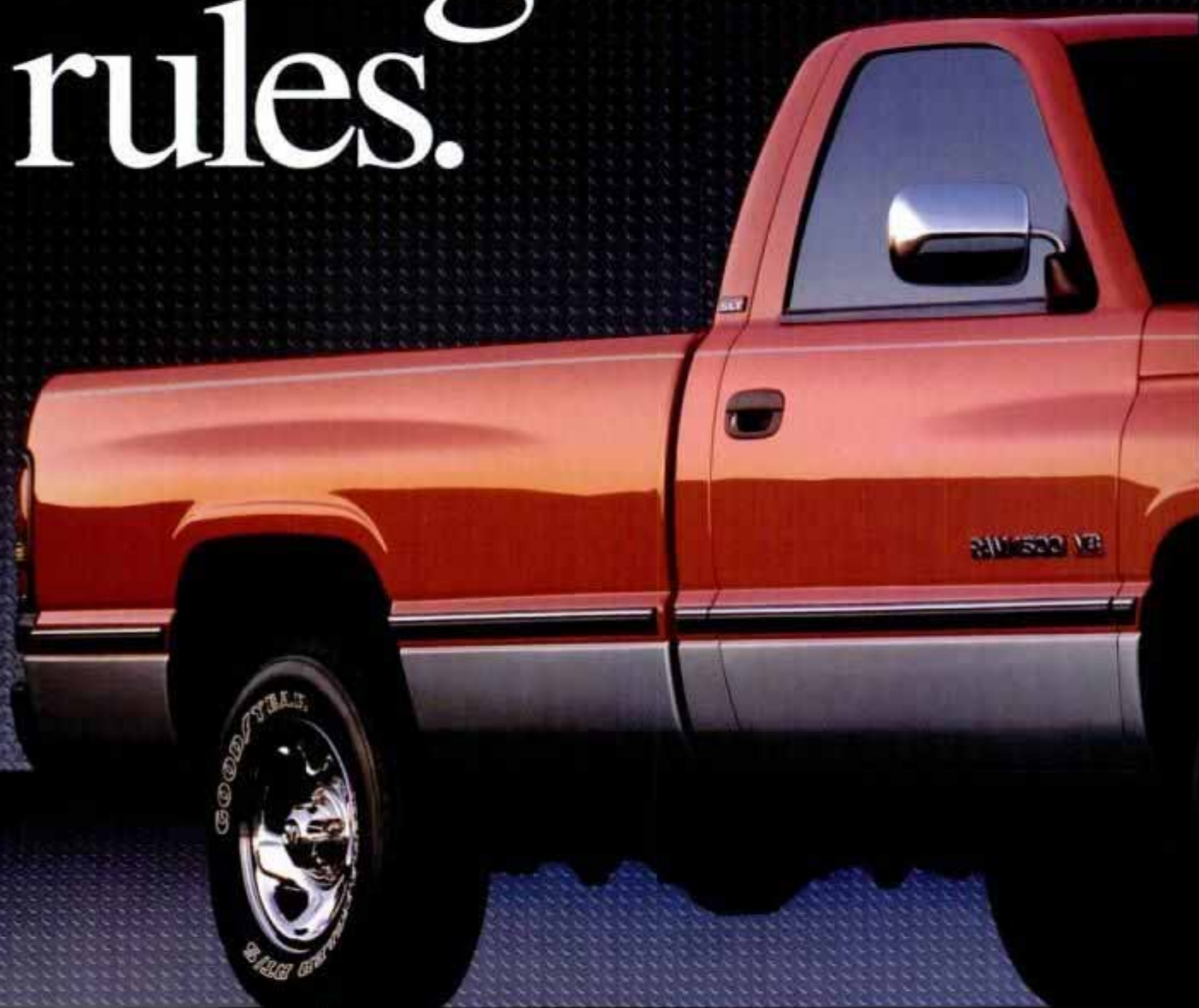
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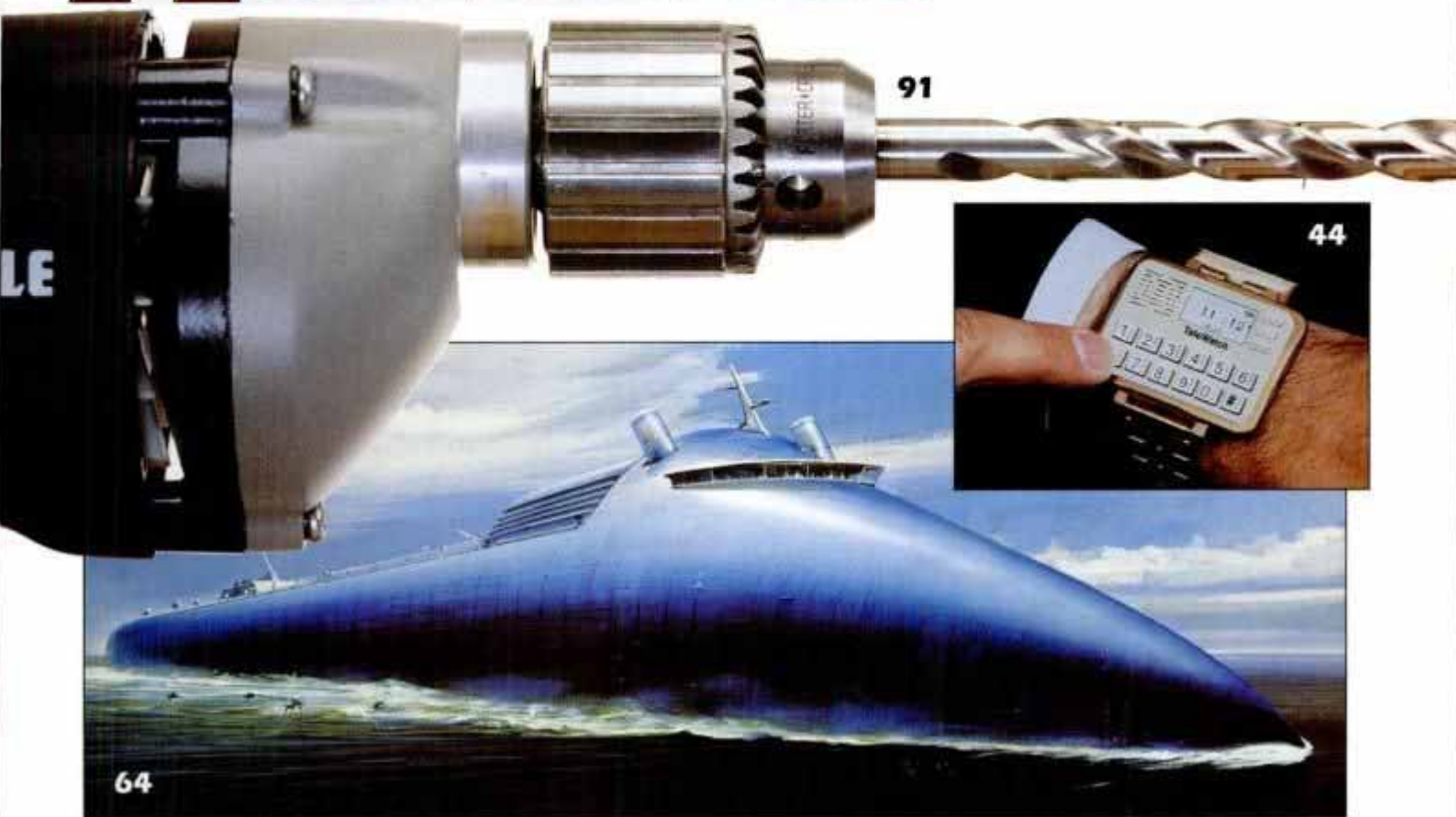
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Popular[®] Mechanics

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VOLUME 171
NO. 11



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1. What carmaker uses this emblem for one of its new models?



A) Toyota. B) Chevrolet. C) Infinity. D) Subaru.

2. The first car line to offer power steering as a general option was:

A) Cadillac. B) Lincoln. C) Chrysler. D) Duesenberg.

3. In a normally operating engine, intake and exhaust valves are opened by a cam and closed by the:

A) Rocker arm or cam follower. B) Valve spring. C) Lifter (tappet). D) Pushrod.

4. The car that paced the inaugural Brickyard 400 race at the Indianapolis Motor Speedway on August 6, 1994 was the:

A) Chevrolet Monte Carlo. B) Ford Mustang. C) Chevrolet Camaro. D) Chevrolet Corvette.

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5. American Motors was formed:

A) When Hudson merged with Packard. B) As an independent car company after World War II. C) When Kaiser was reorganized. D) When Nash merged with Hudson.

6. Buick's "Century" model was named for:

A) Buick's buying the Century Motor Car Co. B) The model being able to reach speeds of 100 mph. C) A special 50th Anniversary edition. D) The car's 100-horsepower engine.

7. The most powerful production engine ever to come out of Detroit was the:

A) Chrysler 426 cu. in. Hemi. B) Chevrolet 427 cu. in. L-88. C) Chevrolet 454 cu. in. LS-7. D) Cadillac 500 cu. in. V8.

8. The Yenko Stinger was a dealer performance-modified version of what car?

A) Corvair. B) Camaro. C) Mustang. D) Porsche.

9. Al Unser, Jr., won the 1994 Indy 500. His car was powered by what engine?

A) Ford. B) Buick. C) Mercedes-Benz. D) Chevrolet.

10. What minivan currently offers a supercharger option?

A) Dodge Caravan. B) Chevy Astro. C) Toyota Previa. D) Ford Windstar.

ANSWERS
1. B (Impala SS) 2. C (1951) 3. B 4. A 5. D
6. B 7. C (Rated 465hp, but realistically put out
490-500 hp) 8. A 9. C 10. C.

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EDITOR'S NOTES

● So what did you do on your summer vacation? If you're Don Chaikin, our Automotive Editor, one of the things you did was climb aboard an Alitalia flight to Milan, Italy, for a visit to Pirelli's Vizzola proving grounds to test drive the new Pirelli P Zero superhigh-performance radial tire. The P Zeros just happened to be mounted on new Lamborghini Diablo VT supercars, so Chaikin was forced to spend several days in the cockpit of a '95 Lamborghini careening around Italy evaluating both car and tire. Hey, it's the guy's job. His tire comments are in this issue (page 130). His car comments will appear next month. . . . While Chaikin was enjoying the Mediterranean climate, I was enjoying August in Indianapolis. And I mean enjoying. The occasion was the first ever stock car race at Indianapolis Motor Speedway, the Brickyard 400—one event that did live up to its hype. After Ernie Irvan had a tire go down less than 20 laps from the end in the Texaco Havoline Thunderbird, it was all hometown boy Jeff Gordon in the Du Pont Chevy Lumina. But as exciting as it was, the race was almost secondary to the hoopla surrounding it. Yes, it was a fun weekend and I can say I was there when history was made. . . . I can't



Chaikin in Italy.

go to Indy without visiting the Indianapolis Speedrome, a local track that claims to be the birthplace of the figure-8 stock car race. My favorite at the Speedrome is the Flagpole Race, a hilarious oval-track blowout with a twist. Each time around, you have to circle a huge tractor tire sitting on the start-finish line before proceeding to the next lap. Talk about bang for the buck—you'll see more passing, crashing, bashing and bumping in one Speedrome Flagpole Race than you will in five seasons of Winston Cup competition. Next time you're in Indy, check out the Speedrome. If you like action, you won't be sorry. . . . Every November, Steve Willson and the Home Improvement Department editors, Tom Klenck and Roy Berendsohn, take over most of the magazine and produce one of our most popular features—the annual Woodworking Guide. This year, it runs a fat 27 pages, and if you know and appreciate what a good jig can do for you in a shop, you'll cherish every word and picture in this year's Guide. If you don't know what a jig is or what it can do for you, why are you reading this? Quick, turn to page 91 and find out. Till next time.



Me in Indy.

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Joe Oldham

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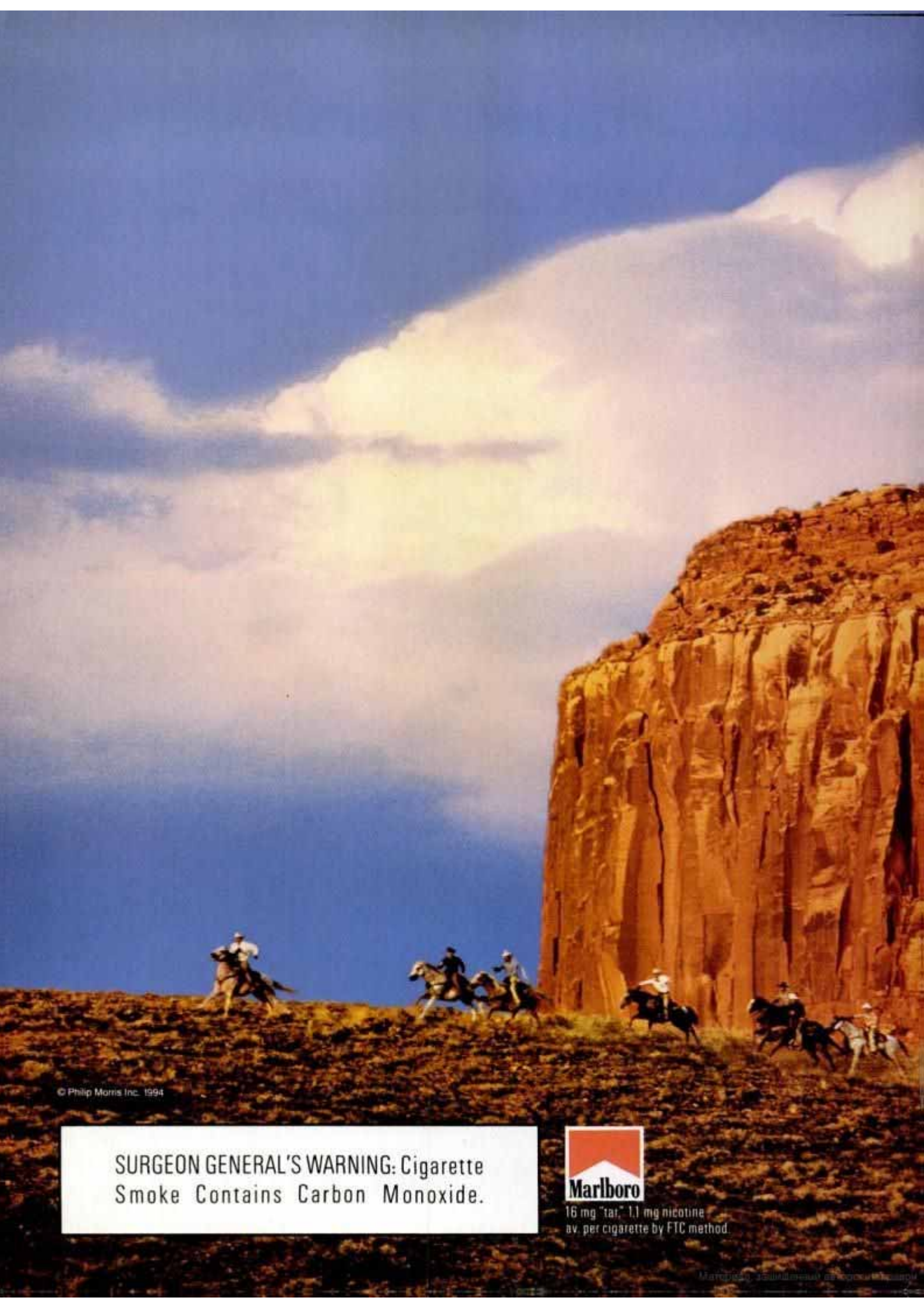
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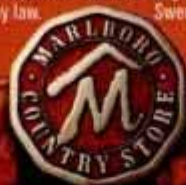
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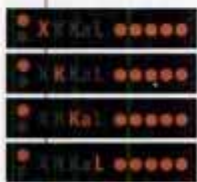
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Designed for the KGB: All steel micro-binoculars fold away to disappear into palm or shirt pocket. Yet super advanced coatings and huge 2.5 x 17.5 power yields crystal-clarity, even in low-light conditions. Hunting, sports events, concerts, nature study, or surveillance. Now get the powerful 1 1/2" long cold-war edge.

- Dual Focus KGB Micro-Binoculars #R-215 \$29.95

With case and Russian documentation, and can be used reversed as low power microscope. Hurry comrade, supplies limited.

We Deliver.

AMERICAN MUSCLE

A fully detailed automotive legend, in die-cast metal 1:18 scale, with working doors, hood, detailed engine and interior. About 10" long.



The Viper RT/10.

At 0-60 in 4.8 seconds, a 488 cubic inch V-10, and six speed tranny, it's no wonder *Car & Driver* called it "The most exciting ride since Ben Hur discovered the Chariot". At \$60,000, you may want to test drive ours first.

■ Dodge Viper RT/10 #3025R \$34.95

The math is simple. For just \$30.00 never get stuck with bogus bills.

Is your money real? Know the answer in seconds. New electronic currency tester instantly separates the trash from the cash. Sweep the sensing head over the bill. Red LED's light-up only on the genuine article. Also works on foreign currency and travelers checks. The U.S. Treasury reports an astonishing amount of funny-money in circulation. If you handle any cash at all, invest a small amount in protecting it.



■ Electronic Currency Tester #ST-008 \$29.95

Activate the world's loudest pocket-size defense system.

Your office at night, out-of-town hotel rooms, dark parking garages, or in your own car or home. Carry the passport to safety. One tug on the lanyard-pin and a ear-shattering 110db siren splits the air - driving any assailant scrambling for cover. Or, attach the included Velcro tabs, loop the lanyard over a door knob, and control a perfect door-alarm. Also trip-wire compatible for wide entrances. Requires just two AA batteries. Measures 3 3/4" x 2", slip into any pocket. Hunters, campers, joggers, kids away at school, or anyone you care about - an excellent gift.



■ Passport Personal Defense Siren #ALM-14 \$22.95



Black wire antenna boost & case included.

Sit in Your Car and Hear Inside Your House - a Quarter of a Mile Away!

The same technology used by surveillance teams and undercover police: Sub-miniature electronics amplify and transmit even whispers - right to your portable or car FM radio!

Internally powered by a 3-month micro-battery. Leave hidden and choose when to "listen in". Or hide in your pocket and secretly transmit a conversation to a friend's car or walkman! Secure and monitor offices, your home, or anywhere. You won't believe your ears.

■ Micro-Tech Transmitter Bug #K277 \$34.95

Check your local laws before using.



From anywhere in the world, listen to the sounds inside your own home.

No matter where you've installed it, call the XPS-1000 with a special code and the powerful microphone and circuitry open up the entire area - without the phone even ringing! You hear everything, with no-one the wiser. Burglars won't hear a thing, but you'll hear them. Advanced remote-monitoring technology was developed for DEA use. Now yours. Secure your house, office and family. Or, listen in on business deals, roving spouses, or intrusive guests. You won't believe your ears.

■ Phone Shadow #XPS-1000 \$129.00

Check your local laws before using phone lines other than your own.



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TIME MACHINE

90 YEARS AGO: NOVEMBER 1904



Pulling Weight

The 2-8-0 configuration made the Baldwin Locomotive Works famous. At the turn of the century, in fact, the 8-wheel-driver ruled America's freight ways. When the Australians saw how the pulling prowess of these "Consolidation"-type locomotives made molehills out of mountains, they ordered a fleet for tracks in Victoria. By way of flexing its muscles, the demo loco hauled a train of 54 cars weighing a total of 781 tons—a record Down Under.

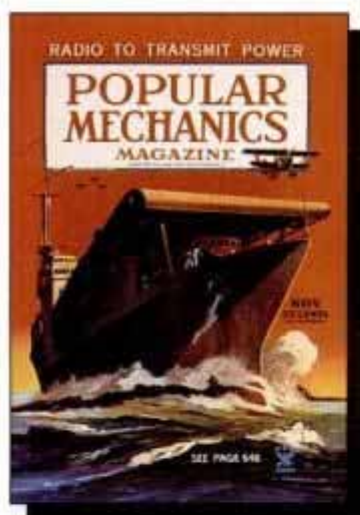
Hot Lines

When Teddy Roosevelt inhabited the White House, he often spent hours in its Telegraph & Cipher Bureau, since he refused to have a "telephonic instrument" in his private office. The bureau clattered with activity around the clock. It dispatched telegrams and cablegrams disguised in 10 different codes.

Washington's nascent phone system was wired so that the president could converse with any government official without the messages passing through the city's central office.



60 YEARS AGO: NOVEMBER 1934



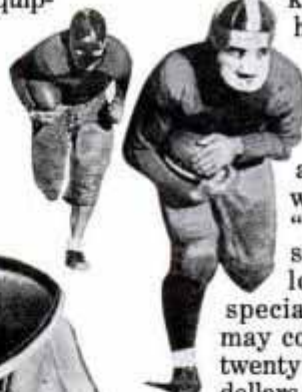
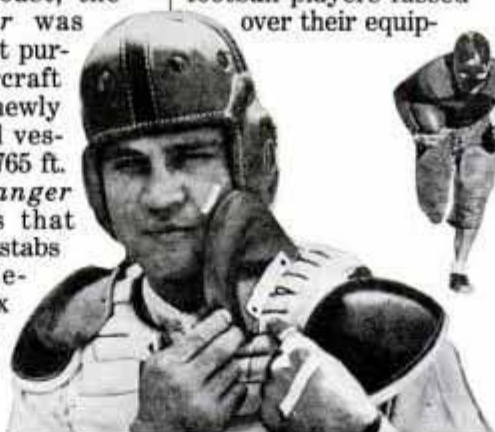
Flight Deck

Stretching its sea legs off the Maine coast, the USS *Ranger* was America's first purpose-built aircraft carrier. The newly commissioned vessel stretched 765 ft. in length. *Ranger* had features that typified early stabs at carrier design, such as six funnels that folded when aircraft were alighting.

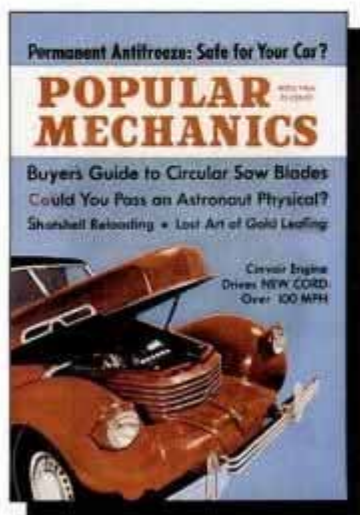
Tackle Gear

Even back in the 1930s, football players fussed over their equip-

ment. As stars tailored their own armor, padding evolved to protect knees, thighs, hips, kidneys, shoulders and head. Footwear received particular attention, and we noted that "important stars are allowed to have special shoes which may cost as much as twenty or twenty-five dollars a pair."



30 YEARS AGO: NOVEMBER 1964



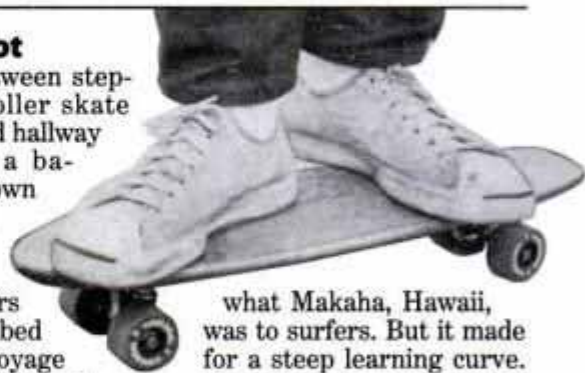
Cord Over

Like a prop from a gangster movie, the reborn Cord 810 was wheeling around Tulsa, Oklahoma. Re-engineered at the hands of Glenn Pray, the '65 Cord was 20% smaller than the '37 original and cruised on a Corvair engine. Vacuum-molding equipment shaped the rakish body from laminated plastic. Lighter and more compact than its forebear, the new Cord slalomed nimbly. But its under-the-dash gearshift bedeviled hands used to four on the floor.

Goofy Foot

"A cross between stepping on a roller skate in a darkened hallway and riding a banana peel down a greased slide"—that's how PM's outdoors editor described his maiden voyage on America's favorite new vehicle: the skateboard. As the fad fanned out from California, San Francisco's Telegraph Hill remained to skateboarders

what Makaha, Hawaii, was to surfers. But it made for a steep learning curve. New boarders adopted a knees-bent head-forward arms-out position, steering via the back foot. Nothing to it, breezed our man, before he wiped out. **PM**



Permanently Grounded



With your August cover story I thought you were trying to copy *MAD* magazine. That "car-plane" is absolutely the last thing in which I would attempt a takeoff, let alone fly. Air has a certain density that relates to gross weight, takeoff speed and square footage of lifting wing surface. Although the Air Force and NASA have produced such very fast planes as the X-15, the Stiletto and others that can fly with very small wings, those 3-ft. wings are absurd for a propeller driven aircraft. In fact, it stands too high to even get the ground-effect lift.

STEVEN A. ZIEG
YORBA LINDA, CA

These car-plane concepts are interesting engineering-wise, but can be a disaster on the noise pollution scene. As more and more ultralites, Weed Eaters, gas this, gas that are being used by a more and more crowded society, I would hope you could use the "tread lightly" concept to temper the articles. How would you like to hear Moller's engines fire up next door at 6 am?

RICHARD DARBY
MERLIN, OR

Letters are subject to editing for length, style and format.

It is unbelievable that you would lend so much credence to the impracticable Aircar. It will never get from "blacktop to blue sky," as your cover story is titled. The first pothole or speed bump will wipe out the nose gear and that'll be all she wrote.

HUBERT J. HANSON
TULSA, OK

That's what they told Molt Taylor. —Ed.

You have got to be kidding, or else there must be a shortage of topics for your cover. To put an 8-ft. wing and large body machine on your cover and expect us to believe that it will fly is totally unbelievable. Any student pilot can tell you that plane won't even get off the ground. Shame on you.

RUDY CURTIS
BY FAX

In your editor's notes, you say the most famous example of a car-plane is a resident of the Boeing Museum in Seattle. The car-plane is a resident of the Museum of Flight, located near Boeing Field in Seattle.

THE MUSEUM OF FLIGHT
KENT, WA

David Freeman's story covered everything except maybe the wing loading ratio. It's a pretty important thing in either high-aspect- or low-aspect-ratio wings. Of course, the higher the speed, the higher the wing loading ratio can be. But not many pilots wait for 250 knots to lift off. Wernicke can solve that problem in two ways. One, convert to jet power and develop a very low weight/high thrust afterburner; or two, move his entire operation to the Philippines

and take off only during typhoons.

C.F. ASHMORE
TUCSON, AZ

I cannot see how the car-plane would fly or even make it in the American market. If you want articles to be more exciting to readers, why not put some stuff in them that would be a good and practical seller in the market and benefit people?

PATRICK VINCENT
TOPEKA, KS

You mean like a car that becomes a boat when driven into water? —Ed.

As an automobile, the Aircar will need impact resistant bumpers and fuel tanks, passive restraints, pollution controls with 50,000-mile warranty and other government-mandated equipment. All of this

equipment will increase the weight of the flying machine. Additional weight and inefficiency are exacted by the hydraulic drive system. I wish Ken Wernicke good luck in his quest.

CHARLES HANSEN
TINTON FALLS, NJ

With product liability lawsuits having virtually killed the domestic manufacture of single-engine aircraft, no prudent investor would sink a bundle of money into the Aircar. Just let one clown take off illegally from a freeway, hit a power line and crash into a school bus, and anybody remotely connected with the Aircar would be sued for everything he has. Also, no one really *needs* the Aircar. We'd all like to be able to push a button on the dash and fly out of a traffic jam, but that's exactly what the

(Please turn to page 22)

Reader Project Of The Month



In 1966 when our family moved to Huron, Ohio, on the shores of Lake Erie, I promised my four young sons we'd build a boat. Armed with the January 1966 issue of *POPULAR MECHANICS* and the article "Teacup: A Basic-Basic Sailboat," we built what we felt was the best boat in the world. The boys have grown, and for the last 15 years Teacup has been in dry-dock. This summer, however, Teacup was converted into a sandbox for my grandchildren. All lines were kept authentic, and it's a delight to see Teacup "sailing" forth with a new generation of sailors at the helm.

GENE SMERCINA
HURON, OH

Aircar couldn't do, physically or legally. If there was a market for the Aircar, one of Wernicke's many predecessors would have made it. He sounds like an interesting man, but perhaps he is pursuing a solution to which there is no problem.

GORDON RICHMOND
CALGARY, ALBERTA

Congress has just passed a new law that gives much-needed product liability relief to single-engine aircraft manufacturers. —Ed.

Wernicke's Aircar may be the expected breakthrough for the commuter's vehicle. But, I wonder if it would ever pass the automotive safety standards that are required on a national scale, since it has no bumpers and the location of the gas tank was not mentioned in the article. It might require a change in design to make it legal for the road.

NORMAN BENTHIN
SIOUX FALLS, SD

Beep, Beep— Slow Down

Rebecca Day's flippantly written opening paragraphs about new radar detectors are a sad admission of America's hidden tax system—government misuse of our police officers to collect roadside revenue. Day glibly writes of ticket quotas and of authorities supplementing their expenditures to the point of dependency upon the revenues commandeered from motorists. Unfortunately, she's correct. Why do we accept this judicial banditry? We are the only Western nation to abuse law enforcement's credibility with our motoring laws. Yet we take such pride in democracy and freedom.

BARRY SYRETT
GIG HARBOR, WA

No, France does it, too. —Ed.

The article "Watch Your Back" caught my attention, particularly

when Day seemed to think that there is some kind of game going on between the speeders on the highways and the police. The sad thing is that it seems that the policy of your magazine seems to go along with the thought. What concerns me is that after volunteering to work in a hospital emergency room and seeing all of the broken-up bodies that were picked up and brought in by EMS people, I hate to see the results of accidents caused by speed. Radar detectors are the only items I can think of that help people violate a law that kills people.

THOMAS G. MEEK
WACO, TX

I hate to see all the broken-up bodies as a result of incompetents who insist on driving a car. —Ed.

Eddie To The Rescue

I grew up in Washington, not far from Seattle. During my childhood (I am now 75), Eddie Bauer was a house-

You Can't Rush Smo

SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

19 mg. "tar", 1.4 mg. nicotine av. per cigarette by FTC method.

hold name among people who knew and loved the outdoors. I remember my dad telling me how, when someone was lost or hung up on a mountain in rugged terrain, the person who would be called in was Eddie Bauer. He was not large in stature, but was terrific in his reputation for getting things done when the going was tough.

RON W. DAVIS
CHAPEL HILL, NC

Why in the world would you not have run a photo of the guy?

EARNEST P. DOCLAR
GRAPEVINE, TX

Space TV Distortion

Your August article "Space TV" was thrilling. It means so much to us Alaskans living on islands and remote areas. But after reaching DirecTV in Castle Rock, Colorado, I was informed that this program does not apply to Alaska or Hawaii. Shame on George Mannes and POPULAR ME-

CHANICS for distorting the story. Now, I have people all over the place crying because their dreams and plans have been destroyed.

H.D. "RED" BLACK
KETCHIKAN, AK

ILM By George

In the September issue, the article "Neon Cowboy" stated that the computer-generated images used in the commercial were created by Steven Spielberg's company, Industrial Light & Magic. ILM's work is seen in nearly every Spielberg film, but it's actually George Lucas's company.

SCOTT WARD
LAKEWOOD, CO

High Tide

F. Wesley Moffett Jr.'s letter in your July issue is insanity. Melting the north polar ice cap would raise the level of the oceans more than 50 ft., flooding coastal cities. For example, all of New York City would be

submerged, as would San Francisco, Los Angeles, Boston, Miami and many other cities around the world. Second, our environment would be placed in severe jeopardy. Thousands of arctic species would become extinct because of the warming in the climate of the region.

GREG SMITH
ORISKANY, NY

Truth About Merrimack

Once again, historically accepted but inaccurate information is perpetuated by improper research. In the Tech Update section of your August issue, Greg Pope refers to the "ill-fated ironclad *Merrimac*." This is a patently false statement. The correct name of the ship is the CSS *Virginia*, a converted version of the USS *Merrimack* salvaged by the Confederate forces. The "*Merrimac*," which should be spelled *Merrimack*, was never an ironclad.

ELLIOTT STOFFREGEN III
PENSACOLA, FL

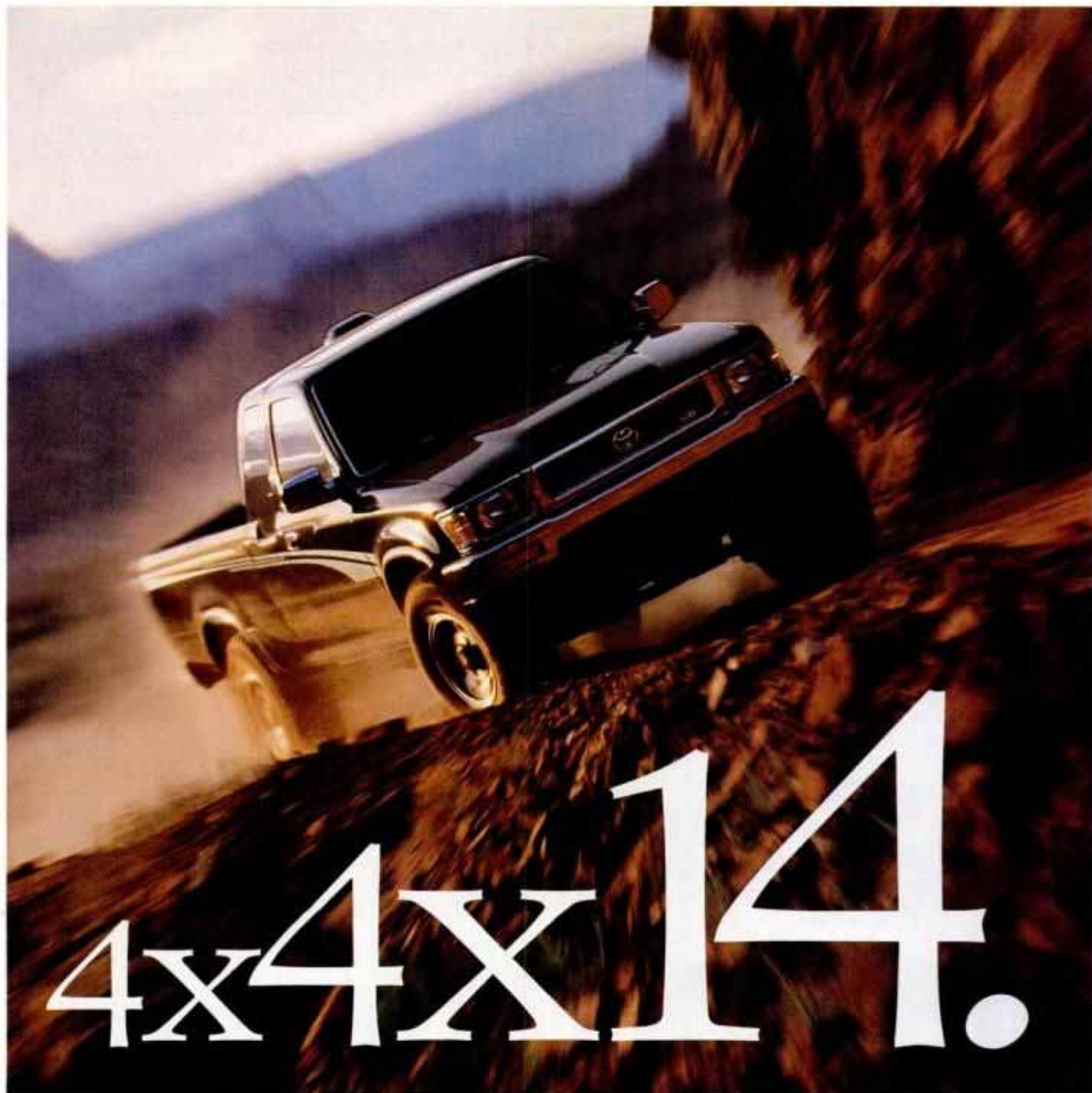
ooth



Flavor.



Winston Select



4x4x14.

No, this is not a pop quiz. And no, the answer is not 224. Fact is there's never been any question about it. Toyota has simply been the *#1 selling compact 4x4 pickup for 14 years running.** Fourteen years without missing a beat.

How has Toyota pulled off a winning streak of this duration, you ask? Well, maybe it's our rugged

stance, distinctive styling and "shift-on-the-move" 4WDemand. Maybe it's the availability of a 3.0-liter OHC V6. Or maybe it's Toyota's Hi-Trac independent front suspension. Of course it could just be Toyota's reputation for quality that propels us to one sales peak after another, after another, after another..

Toyota Trucks. You just gotta love 'em.

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TECH UPDATE

News Of Tomorrow's Technology Today



PM ILLUSTRATION BY PAUL DIMARIE

Old Tanks Bring New Life To The Sea

GULF SHORES, AL—Once they rumbled and roared in countless maneuvers, drilling for the day the Cold War turned hot. But now America's front-line battle tanks of the 1950s and '60s are becoming silent guardians of the deep. One by one they're plunging into placid waters off the Alabama coast, where officials hope they'll nurture a surge of marine life.

Starting last summer, a phalanx of state and federal agencies began deep-sinking obsolete M48s and M60s, under a program called Reef-Ex. The idea is to relieve the flat Gulf of Mexico seafloor with complex vertical surfaces that reef-dwelling life forms can encrust. Eventually, experience has shown, such artificial reefs will draw schools of valuable fish such as red snapper and amberjack.

With that in mind, Alabama has been building artificial reefs since 1953, using anything from bridge rubble to a ghost fleet of World War II

Liberty ships. But the Reef-Ex tanks ought to outlast these sunken ruins. Their thick steel armor should withstand corrosion for 50 to 100 years. Local fishermen and license-issuing states stand to reel in millions of dollars over that period, state biologists calculate.

The tanks begin their final deployment from Anniston Army Depot, where reservists first steam-clean the vehicles and strip away environmentally hostile materials—oil, ammo and so on. A tractor then drags each tank to the local railhead, where a crane hefts it onto a flatcar. At Mobile, Ala-

Retired battle tanks lie underwater, evolving into artificial reefs to attract sea life, fishermen and scuba enthusiasts.

bama, a second crane plants the tank on a barge, which then putters out to the reef zone. There, a forklift pitches the vehicle overboard. After they topple through 80-ft. waters, the tanks land right-side up in most cases.

Army Materiel Command officers applaud the program as a way to train troops in maintenance and mobilization. While, so far, 140 tanks have journeyed from depot to the deep, officials would like to expand the effort to as many as 1000 tanks per year.

Highlights This Month

- **Baby Boosters**—Smaller, cheaper rockets for probes.
- **High Beams**—Radar satellite will scan Earth.
- **Plant Lights**—New drive for machine-shop lasers.
- **Jack Of Hearts**—Plumber's plunger for paramedics.
- **Sure Shot**—Sniper's sight locks in on moving target.
- **Fly Ball**—Blimp rides on spherical envelope.
- **Ditch Digger**—Trenching machine vacuums up earth.

Editor/Writer: Gregory T. Pope
Reporters: Philip Chien, Cecilia R. Cooper,
Mike Dillon, Scott Gourley, Bob Scheier,
Suzanne Schoenfeldt

Launchers Lighten Up



WASHINGTON, DC—Small is beautiful. That's how NASA views its plans for new satellites and space probes. To loft these slimmed-down spacecraft, the aging stable of converted ICBMs—big Delta, Atlas and Titan rockets—now seems like overkill. So planners are calling for a new class of medium-light boosters, and rocket makers are scrambling to launch proposals.

The Med-Lite launcher, as NASA has dubbed it, must offer roughly half the lifting power of a Delta—5000 to 8000 pounds—at roughly half the price.

One likely candidate is Taurus 2, from Orbital Sciences Corp. The vehicle will stack two Castor 120 stages. At the top: a new upper-stage engine derived from the rocket motors for the European Ariane 5's upper stage. Strap-on boosters will lend extra oomph if necessary.

Beyond working for NASA, rockets in this category should also find jobs sending up replacement mobile-phone satellites.

Three-stage Taurus 2 will probably go after NASA's coming Med-Lite launcher contract.



Tag-Along Microsats

DULLES, VA—Like a burr that travels on a horse's leg, a tiny satellite could ride along every time a Pegasus or Taurus rocket lofts its primary payload. Orbital Sciences Corp. is offering these volleyball-size spacecraft, called PicoLabs.

Boosted with a Pegasus or Taurus payload, PicoLab stretches only 18 in. wide, including solar panels.

Weighing up to 50 pounds, a PicoLab would stow away in the avionics segment of its launch vehicle. It could either stay attached to the rocket, for short-lived space experiments, or detach. If it flies free, PicoLab extends eight solar panels and can last up to three years.

Typical payloads? The sort of space-science packages that go up on suborbital sounding rockets, such as solar-physics and radio-spectrum experiments.

Wrench Meets Vise

HOUSTON, TX—Sometimes it takes a space-station engineer



Rack wrench combines torque of crescent wrench with locking power of a vise grip.

to solve the most mundane frustrations. Take the crescent wrench, which can often strip stubborn nuts and bolts of odd sizes. McDonnell Douglas engineer Robert Gottlieb has added a side lever that, in effect, converts the worm-gear tightener into a rack-and-pinion gear to lock the wrench's jaws.

In using Gottlieb's patented rack wrench, you first tighten the worm gear. Then the squeeze lever pushes the gear—and the movable jaw—into a locked position. Plans are already afoot to manufacture the device.

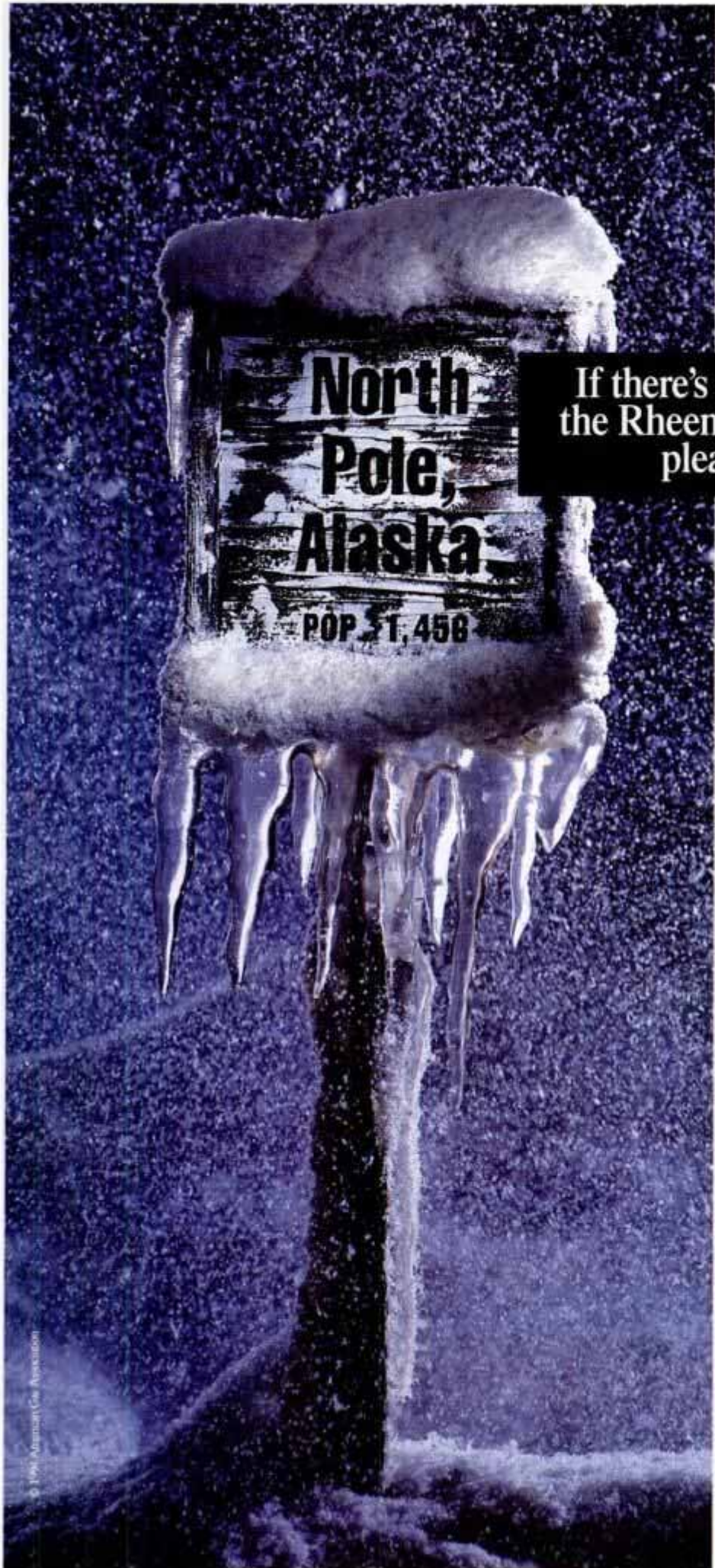
Titan Blastoff Simulator

SAN ANTONIO, TX—No one wants to take chances with the prized Titan IV solid-rocket motor upgrades for the heavy-lift vehicle's strap-on boosters. So contractors have devised a Titan simulator to test just one critical part. The component: a heat shield around the rocket motor's nozzle.

Built by Southwest Research Institute, the test rig mimics the rim of the outer rocket body and the lip of the motor nozzle. The heat shield plugs the ring-shaped gap between these two. The rig then is subjected to immense pressure changes, vibrations and heat blasts to simulate a launch.



Heat shield peeks from under rig that simulates business end of a Titan IV booster.



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Space Radar Free-Flyer

GATINEAU, QUEBEC—The United States is finally chipping in on a civilian radar satellite to probe Earth's resources. While Canada is building Radarsat, the U.S. will provide the Delta launch vehicle and a few components. Launch is scheduled for 1995.

Unlike the shuttle's Spaceborne Imaging Radar (see Tech Update, page 19, Aug. '94), Radarsat uses a conventional single-frequency radar, so it won't produce multicolor images. But it does boast several advantages. Because Radarsat will orbit for at least five years, it can map Earth's entire surface instead of just carefully picked targets. In addition, it can shift from a wide-angle view to zoom in on a 150-ft.-wide swath. In this telephoto mode, Radarsat can resolve 30-ft. objects.



CANADIAN SPACE AGENCY ILLUSTRATION

Radarsat will crank out up to 5 kilowatts of radio energy in search of natural resources.

Wheeling around Earth at a 500-mile altitude, Radarsat will take six days to loop over the entire planet. The satellite will permit long-term

studies over a specific site. Planned uses include oceanography, environmental monitoring, forestry and the search for underground oil deposits.

Get Your \$10 Radar



Livermore's \$10 radar could probe walls to spot studs or pierce fog to reveal traffic.

LIVERMORE, CA—What would you do with a miniature radar system you could buy for \$10? Don't say "stud finder" or "car blind-spot warning"—two companies have already licensed the technology for those applications.

Lawrence Livermore National Laboratory built the device to monitor laser-fusion experiments. The little sensor features a chip that sends out a flurry of pulses, each lasting less than a billionth of a second. Its receiver can be tuned to pick up radar echoes from distances ranging up to 200 ft. away.

Although its inventor assembled the device from components—costing less than \$10 in all—the radar could fit on a single mass-produced chip.

LAWRENCE LIVERMORE PHOTO

The Pleasure Seekers

ATLANTA, GA—In a quest to cure cocaine addiction, researchers are exploring the pathways of pleasure that course through the brain. The goal: a synthetic drug that can block the activity of cocaine while leaving normal pleasure responses intact.

Cocaine fastens to nerve endings, preventing the uptake of a natural pleasure chemical called dopamine. Thus trapped between nerve endings, dopamine overstimulates the nerves, triggering a high.

Chemists at Georgia Tech and Mercer University are testing drugs

that would themselves latch onto nerve endings, crowding out cocaine but letting dopamine pass. The research calls for radioactive probes on living brain tissue prepared with a special blender.



GEORGIA TECH PHOTO

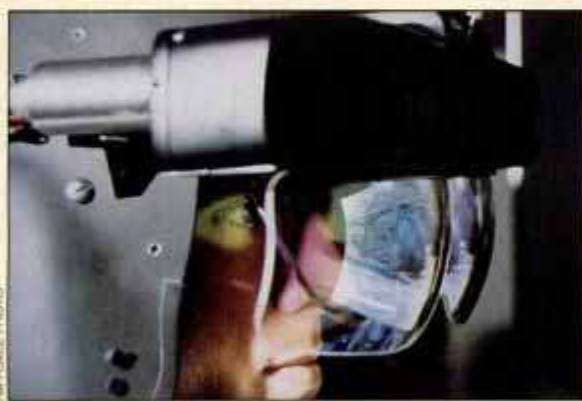
Chemists prepare brain-tissue samples to test drug that displaces cocaine at nerve endings.

Wide-Angle Night Vision

WRIGHT-PATTERSON AFB, OH—Terrain-hugging flights through pitch black will be all in a night's work for pilots of the future RAH-66 Comanche helicopter. To help them out, Army night-vision engineers have turned to their Air Force equivalents, who have come up with a Virtual Panoramic Display (VPD) helmet. The display pulls live wide-angle footage from an infrared camera on the helicopter's nose. Binocular optics project the images onto the visor with a full overlap between the pilot's two eyes. This overlap allows the pilot to enjoy depth perception that's substantially improved over current systems.

up with a Virtual Panoramic Display (VPD) helmet.

The display pulls live wide-angle footage from an infrared camera on the helicopter's nose. Binocular optics project the images onto the visor with a full overlap between the pilot's two eyes. This overlap allows the pilot to enjoy depth perception that's substantially improved over current systems.



AIR FORCE PHOTO

THE 1940 FORD DELUXE COUPE

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Shown approximately actual size of 8" in length. Photos depict our incredibly detailed replica—not the actual car!

A Meticulously Engineered Die-Cast Metal Replica of One of America's Greatest Cars.

It's no wonder the 1940 Ford Deluxe Coupe was one of the most popular cars of its day. Its unforgettable front end featured a chromed, deep "V" ribbed grille and elegant teardrop-shaped headlights that blended smoothly into gently rounded fenders. From the sleek aerodynamic roof to the sharply sloped rear end, the 1940 Ford Coupe's racy lines were a delight to the eyes.

Underneath its massive hood was the famous 221 cubic inch Ford V-8 engine. It boasted 85 hp and gave the car plenty of power for its day. Later, many were "souped up" to become "hot rods". Now, you can acquire a remarkably detailed replica of this fabled classic.

Meticulously crafted; hand-assembled!

Over 135 scale parts go into making this authentic replica in the large 1:24 scale. All the important components—the body, chassis, drivetrain and engine block—are crafted in metal and polished by hand before painting. Every single component is inspected before this replica is assembled by hand.

A Danbury Mint exclusive.

This extraordinary replica is available exclusively from the Danbury Mint. You need send no money now. Simply return the Reservation Application. The price of \$94.50 is payable in three monthly installments of \$31.50. Production of this superb, hand-assembled, hand-finished model cannot be

rushed. Reservations will be accepted on a strict first-come, first-served basis. Mail your reservation today!

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RESERVATION APPLICATION

Ford THE 1940 FORD DELUXE COUPE

The Danbury Mint
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Send
no money
now.

Please accept my Reservation Application for the 1940 Ford Deluxe Coupe. I will pay for my replica in three monthly installments of \$31.50*. My satisfaction is guaranteed. If I am not completely satisfied with my replica, I may return it within 30 days for replacement or refund.

*Plus any applicable sales tax and \$1.50 shipping and handling per installment.

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(Please print clearly.)

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Name to print on certificate of ownership
(if different from above).

Allow 4 to 8 weeks after initial payment for shipment.

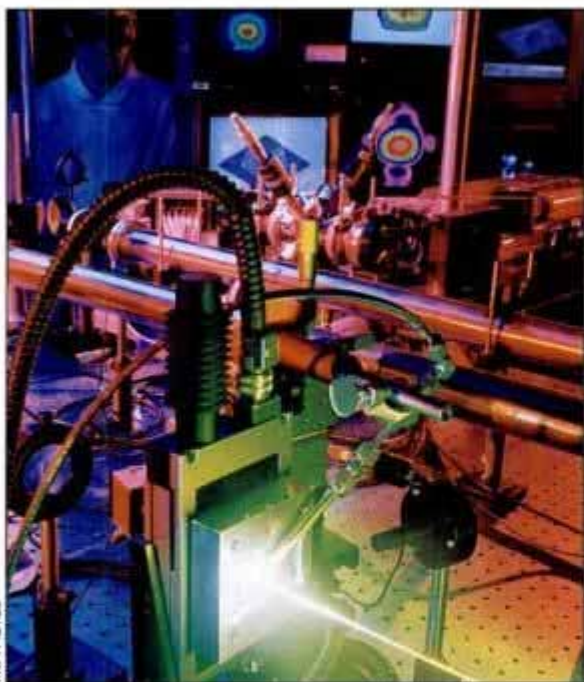
158FPB1



Both doors open smoothly, as do the hood and trunk. The front wheels turn with the steering wheel.

The Ford Deluxe Coupe trademarks are used under license from Ford Motor Company.

© 1994 MRI



TRW PHOTOS

Industrial-Strength Lasers

REDONDO BEACH, CA—Although lasers have lit up American machine shops since the 1960s, Japan and Germany now outshine the United States in selling the devices. Now 16 American companies have banded together in an effort to reclaim the lead in industrial-laser technology.

The consortium's immediate goal is a pair of precision diode-pumped solid-state lasers. One, capable of delivering 25 megawatts of short-pulse power, will specialize in precision drilling and micromachining. The other will supply 6 kilowatts of power in longer pulses for cutting, welding and heat treatment. These new devices would replace today's standard carbon-dioxide and flash-pumped solid-state lasers.

It's no surprise that defense contractors such as TRW are bringing their laser expertise into the enterprise, organized under the White House's Technology Reinvestment Program.



New TRW-led consortium hopes that faster, more precise industrial lasers will drill and weld in future factories.

Watch Your Own Heart Beat

PRINCETON, NJ—Doctors can now check the health of your ticker by viewing a computer-generated model of your heart pumping away. The 3-dimensional model derives from magnetic-resonance images (MRI), processed through a diagnostic console developed by Siemens.

The console determines the heart's contours to build the dynamic model. It then calculates heart-muscle mass, the volume of blood pumped and how much time it takes to fill and empty the heart. Cardiologists previously scratched this data out on paper.

Diagnostic console generates computer model of heart.



SIEMENS PHOTO

Chips That Won't Wilt

SCHENECTADY, NY—Silicon is a natural material for integrated circuits. But turn the heat up on a silicon chip, and it frazzles. By contrast, silicon carbide—silicon's chemical cousin—can bake all day without suffering. Could silicon carbide replace silicon for high-temperature chips?

General Electric thinks so. At the company's Research and Development Center, engineers have fabricated semiconductor devices from the heat-resistant compound. Although the researchers had to rethink the structure of components such as transistors, they've shown that foundries can

form silicon-carbide chips with existing equipment.

These micro-devices would function in searing spots inside diesel locomotives and jet engines.

Semiconductor devices fabricated from heat-resistant silicon carbide could survive inside gas-turbine engines.



GENERAL ELECTRIC PHOTOS



Plumber's Helper Gives CPR

ST. PAUL, MN—A heart-attack victim in California recently revived when a family member administered cardiopulmonary resuscitation (CPR) with a household plunger. Now a controversial device can provide the same service—active compression-decompression CPR, billed as the first significant advance in the procedure in 30 years.

The CardioPump, manufactured by Ambu International of Copenhagen, Denmark, consists of a silicone-rubber suction cup, a plastic handle containing a force gauge and a connecting stem. The device actively lifts the chest after each compression during CPR. That allows the chest cavity to act like a bellows, pumping more blood through the heart and more oxygen through the lungs with each up-and-down motion.

Last winter and spring, St. Paul paramedics field-tested the CardioPump. Cardiologists found that the device worked better than standard CPR if applied within 10 minutes of the patient's loss of consciousness. But the Food and Drug Administration has halted trials, stating that patients can't give the required informed consent if they're unconscious.



Plunger-like device provides effective CPR by actively lifting chest cavity.

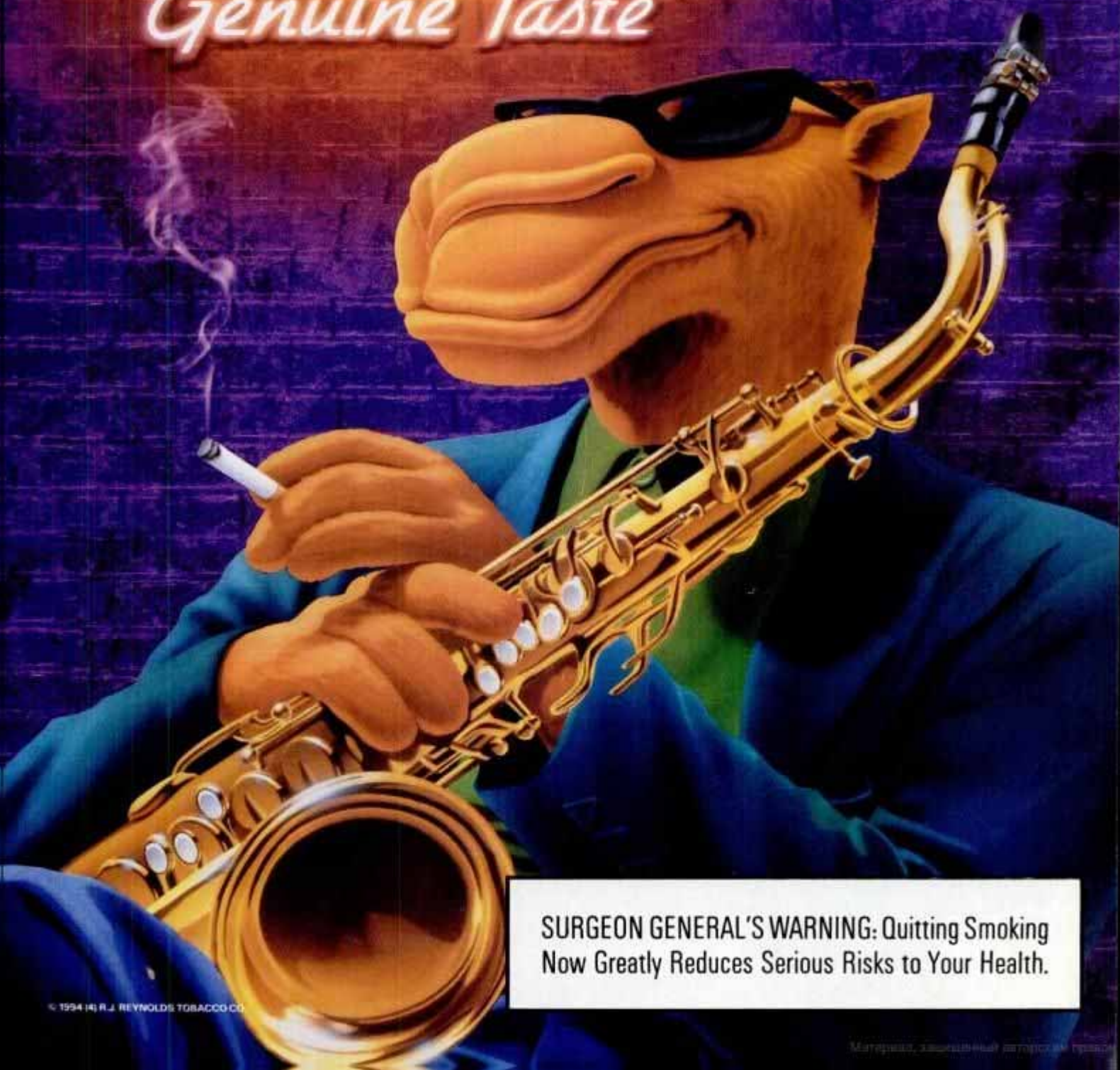
UNIVERSITY OF MINNESOTA PHOTO

11 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.
Brought to you by Camel Lights

CAMEL



Genuine Taste



**SURGEON GENERAL'S WARNING: Quitting Smoking
Now Greatly Reduces Serious Risks to Your Health.**

REAR-WHEEL DRIVE FRONT-WHEEL DRIVE ALL-WHEEL DRIVE RE

Once, rear-wheel drive was your only choice. Great for acceleration, less great on slippery, swervy roads.

Then along came front-wheel drive with its improved traction and more

precise handling. Finally someone asked, "Why not build a car that gives you the best of both?" And Subaru All-Wheel Drive was born.

WHEN PUSH COMES TO SHOVE,
ALL-WHEEL DRIVE PULLS YOU THROUGH.

While front- or rear-wheel drive systems may offer you certain benefits under certain driving conditions,



FWD



RWD

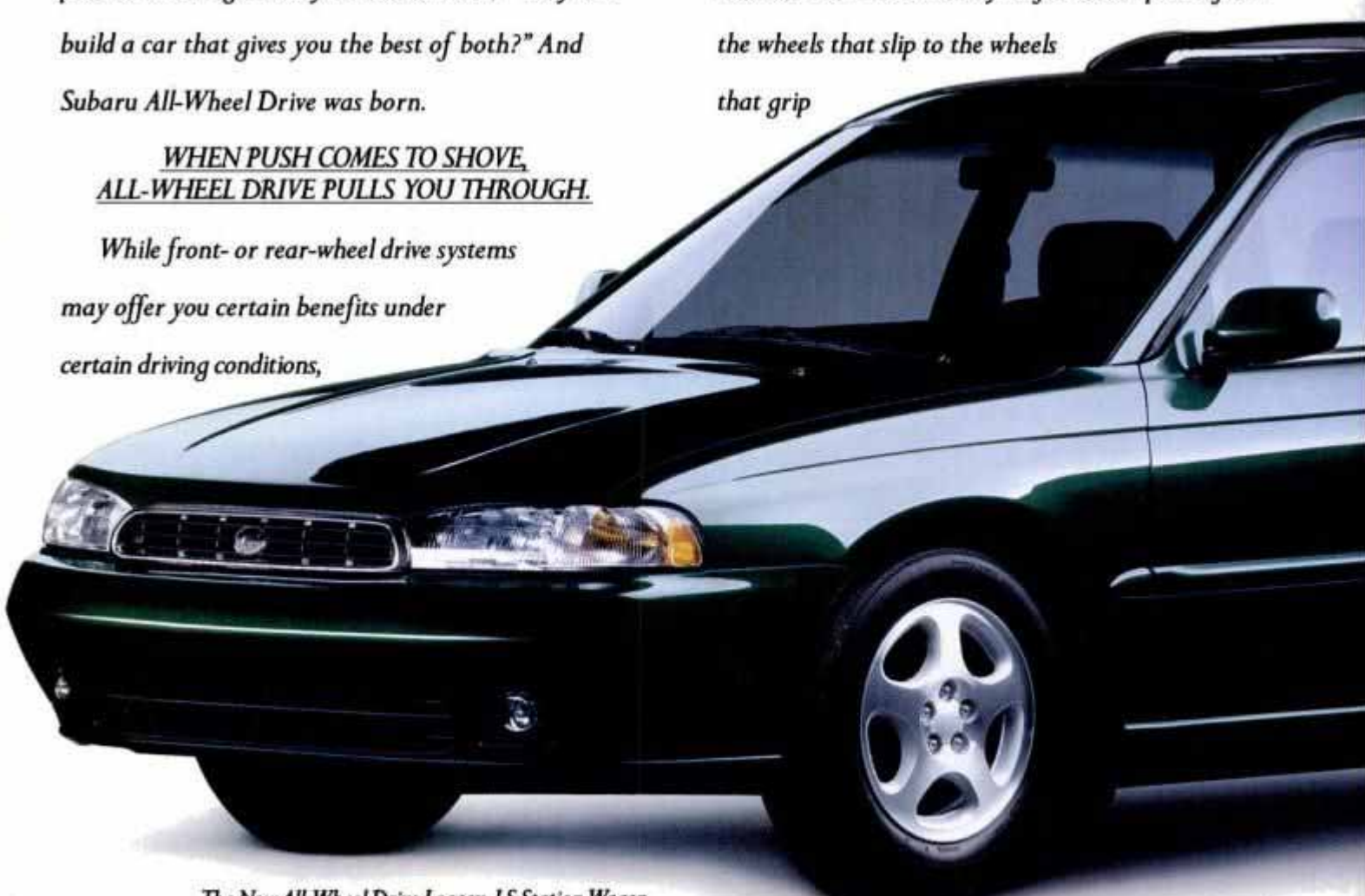


AWD

Subaru All-Wheel Drive combines front- and rear-wheel drive capabilities for maximum traction and control.

Subaru All-Wheel Drive combines the best of both. Continuously monitoring the road surface, the system distributes power to all four wheels under normal driving con-

ditions, then automatically shifts needed power from the wheels that slip to the wheels that grip



The New All-Wheel Drive Legacy, LS Station Wagon

E PUSHES A CAR. WE PULLS A CAR. SERVES JUDGMENT.

whenever conditions change (a tricky curve, a steep hill, even a sudden patch of snow). And all this happens instantaneously, in the blink of an eye.

Which means you get front-wheel drive capabilities whenever you need a pull. Rear-wheel drive power when you need a push. And full-time peace of mind all the way down the road.

SAFETY FROM EVERY DIRECTION.

We think this kind of added traction and control makes Subaru All-Wheel Drive the ultimate safety feature. But it's by no means our only one. Fact is, Subaru offers a host of safety features, from dual air bags and side-impact door beams, to available 4-channel anti-lock brakes, for greater safety at every turn.*



WHY NOT JUDGE FOR YOURSELF?

*Starting at just \$15,999,** a new All-Wheel Drive Legacy Station Wagon is surprisingly affordable. So call 1-800-WANT-AWD. Or better yet, come in and experience Subaru All-Wheel Drive for yourself. In the push-and-pull world of driving it's the only way to go.*

SUBARU 
The Beauty of All-Wheel Drive.

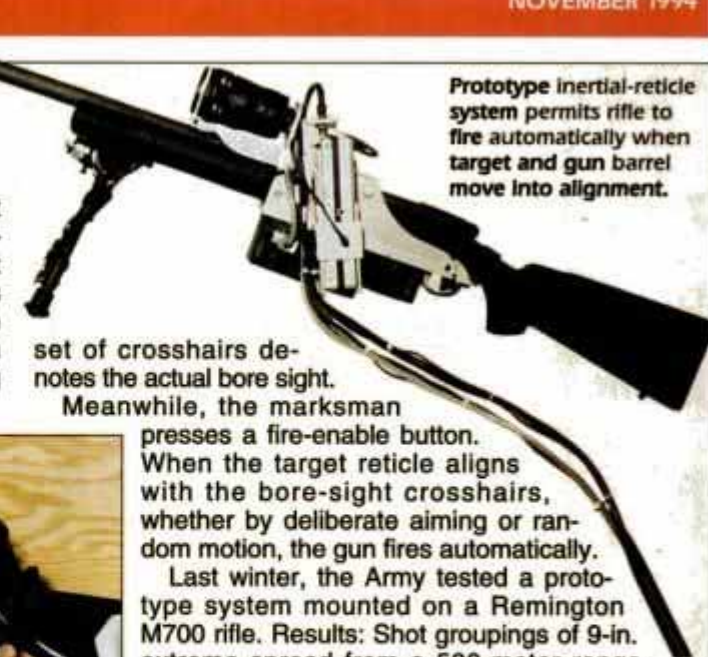
*Always wear seat belts. **Manufacturer's suggested retail price (MSRP) of the All-Wheel Drive Legacy Brighton manual transmission Station Wagon not including inland transportation, taxes, license and title fees. Dealer's actual price may vary. Pictured is the All-Wheel Drive Legacy LS Station Wagon. MSRP is \$21,455. Certain items shown are optional equipment and are available at an additional charge.

Моторола, захищений на торговельному праві

Automatic Supersight For Marksmen

ABERDEEN, MD—Even the best-trained Green Beret sniper can struggle to keep his sights on a long-distance target. To help fight the unsteadiness inherent in drawing a bead, the Army Research Laboratory has been working on a system that factors wobble into the aiming solution. The Joint Service Small Arms Program and Los Alamos National Laboratories are collaborating on the effort, known as Project White Feather.

The concept employs a video-sighting system along with three quartz rate gyros. The shooter first looks at a miniature monitor and positions an artificial reticle over the target. Guided by the gyros, which track gun motion, this reticle travels along with the target image as it jiggles across the display. A second



Prototype inertial-reticle system permits rifle to fire automatically when target and gun barrel move into alignment.

set of crosshairs denotes the actual bore sight.

Meanwhile, the marksman presses a fire-enable button.

When the target reticle aligns with the bore-sight crosshairs, whether by deliberate aiming or random motion, the gun fires automatically.

Last winter, the Army tested a prototype system mounted on a Remington M700 rifle. Results: Shot groupings of 9-in. extreme spread from a 500-meter range. Future developments will incorporate input from crosswind sensors.

U.S. ARMY PHOTOS

Factories Without Fixtures

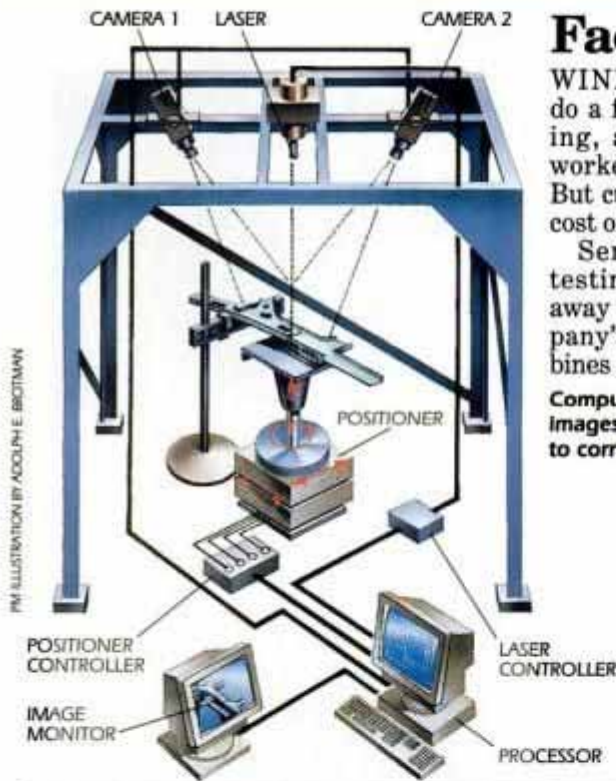
WINDSOR, ONTARIO—Robots do a fine job of painting and welding, as long as the piece to be worked is held in the right place. But customized fixtures balloon the cost of tooling for a new car model.

Sensor Adaptive Machines is testing a system that should do away with such fixtures. The company's prototype apparatus combines a laser, two video cameras and

Computer interprets laser-illuminated images and tells positioner to move part to correct position for assembly work.

a computer to control the positioning of robotic machinery.

Called stereo photogrammetry, the technique operates in near-real time. The laser highlights the target area to be photographed by the two cameras. The computer then grabs digital images and searches for distinguishing features to get a fix on the part's position. After comparing the part's actual position to the desired location, the computer commands a robotic positioner to shift the object accordingly.

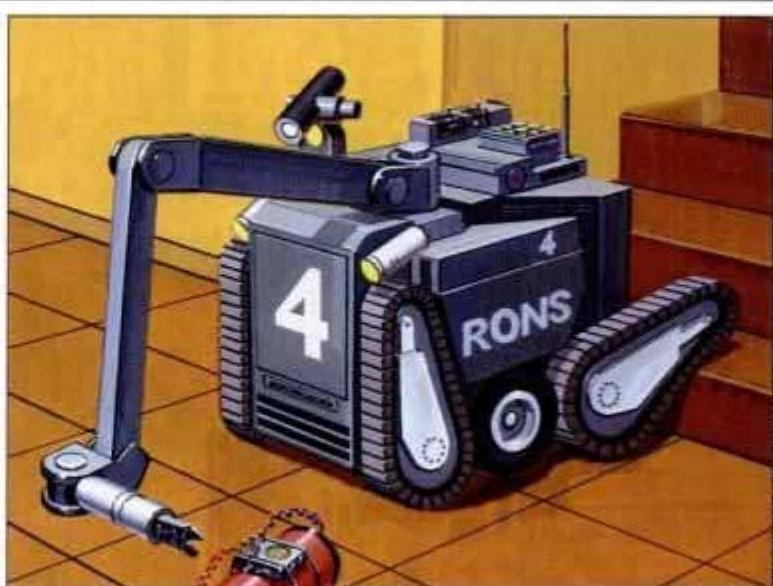


PM ILLUSTRATION BY ADOLPH E. BOSTMAN

Navy's Bomb Squad By Remote Control

COLUMBUS, OH—While bomb-handling robots may be nothing new (see [Tech Update, page 16, Dec. '93](#)), none combine the features demanded by the U.S. Navy. So the Navy's Explosive Ordnance Disposal Technical Center has tapped roboticists at Pacific Northwest Laboratory and Battelle to design the Remote Ordnance Neutralization System, or RONS. The machine is shaping up to roll on twin sets of tracks, which can lie flat to cross trenches or fold up for tight turns.

The robotic arm on RONS will have to disarm anything from a live shell to a terrorist's bomb. At its disposal will lie tools ranging from wire-cutters to waterjets. The



Navy's bomb-defusing robot uses pivoting tracks to handle stairs.

remote operator will sense the tools' efforts through a force-feedback manipulator. Commands and feedback will travel either via radio control or by fiberoptic link if radio energy threatens detonation.

PM ILLUSTRATION BY ED VANDUGROVE



1-6-94 8:07 p.m.
 Situation: Mother and two
 children in mall parking lot

The first alarm system designed to protect you as well as your car...

Revolutionary new vehicle security system is the first of its kind to focus on the safety of the vehicle driver as well as the vehicle itself.

By Charles Anton

Do you wonder why car alarms have countless features to protect your car, but nothing to protect you? After all, what's more important your car or the safety of you and your family?

Now there is a car alarm that will protect you and your family. It is the first of its kind to focus on the safety of the vehicle owner as well as the vehicle itself.

Protect yourself. It all begins with the panic button. Imagine you're walking to your car at night and a person approaches. Pushing the panic button on your transmitter lets your car come alive with a shrieking siren and flashing headlights. While the panic alarms of other vehicle security systems have a range of 100 feet, the Smart Alarm's panic alarm lets you call for help or scare away potential attackers from up to 400 feet!

Exclusive feature. Unlike other car alarm systems that begin and end their focus on per-

sonal protection with the panic alarm, that's just the beginning of the Smart Alarm. In addition to the panic alarm, the Smart Alarm also has a car finder feature. You'll never again have to wander around a dark and dangerous parking lot searching for your car. You will be able to know where your car is from anywhere within 400 feet by flashing its lights and briefly sounding the siren. You can activate and deactivate your car's headlights by remote control to light your way in a dark driveway or parking lot.

Carjacking. The Smart Alarm also addresses a growing hazard for today's motorists—carjacking. It's alarming how often drivers are hurt in their cars because they refuse to give them up to carjackers. Because of its anti-carjacking device, the Smart Alarm allows you to safely retain your car when confronted by a carjacker. This is made possible by a delayed panic alarm.

What makes Smart Alarm better?

- **Range.** Most car alarm features only work up to 100 feet away—all Smart Alarm features work up to 400 feet away.
- **Panic button.** Smart Alarm lets you call for help or scare away potential troublemakers by controlling a piercing alarm and your car's headlights.
- **Car finder.** Your car will be able to let you know where it is by flashing its lights and briefly sounding the siren.
- **Carjacking.** Its delayed panic alarm allows you to safely prevent theft of your car when confronted by a carjacker.
- **Easy installation.** Other car alarms are complicated or cost hundreds of dollars to install. Smart Alarm is inexpensive, and you can install it in just minutes.



Smart Alarm is the first car alarm that will protect you and your family.

Easy installation. Installing the Smart Alarm requires no fumbling with wires. Special Plug-In Connectors let you install the Smart Alarm without a single wire-cutter! Simply unplug the headlight connector, plug in the Smart Alarm connector, and then plug the headlight connector to the Smart Alarm. Connect the Smart Alarm to the battery cable with the special clip. In minutes, you and your car can enjoy complete 24-hour protection. Away from your car, you'll feel safer knowing that your car is protected! Near your car, you'll feel safer knowing that you are protected!

All you do is give up your car and activate the delayed panic alarm. When the assailant has reached a safe distance and is no longer a threat to you, a deafening 120dB siren and flashing lights will force him to flee your car, letting you recover it safely.

Vehicle protection. Smart Alarm's current sensor triggers the siren if the trunk or any of the doors are opened while the alarm is armed. To supplement the current sensor, a shock sensor triggers the siren when it detects a blow to your car. Together, these sensors provide your car with blanket protection.

An adjustable shock sensor prevents the siren from being triggered, eliminating false alarms. You can also adjust the shock sensor and the siren with your remote control at any time you choose. The siren's tone and volume can be adjusted to six separate tones. As a result, you'll never confuse it with any other alarm. You can also customize the siren, making it louder in noisy neighborhoods and quieter in more peaceful neighborhoods.

Risk-free home trial. With the Smart Alarm, you get a complete "No Questions Asked" 30-day money-back guarantee. If it's not everything we say, just return it for a full refund. The Smart Alarm is also backed by a two-year warranty. Your order will be shipped UPS in seven to ten working days.

The Smart Alarm Car Alarm..... \$99 \$8 S&H

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 For fastest service call toll-free 24 hours a day

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To order by mail, send check or money order for the total amount including S&H (VA residents add 4.5% sales tax.) Or charge it to your credit card, enclosing your account number and expiration date.

COMTRAD INDUSTRIES

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Beachball Is Blimp

NEWMARKET, ONTARIO—The cigar shape of a traditional blimp may go up in smoke if a Canadian company's efforts pan out. A 43-ft.-dia. sphere is now flying as the prototype for a concept launched by 21st Century Airships.

No steering rudders or altitude-changing flaps protrude from this airship's envelope. Instead, the pilot varies thrust from two outboard engines to turn left and right. To move up and down, vanes mounted behind the powerplants assume different angles.

In addition, the gondola is tucked away inside the sphere. Large tinted windows in the envelope provide panoramic visibility.

For lofting and landing the craft, the company needs only two ground workers. A 10-passenger version is now in the works, but the



Stubwing-mounted engines and vanes allow blimp to assume spherical shape. Gondola is carried inside.

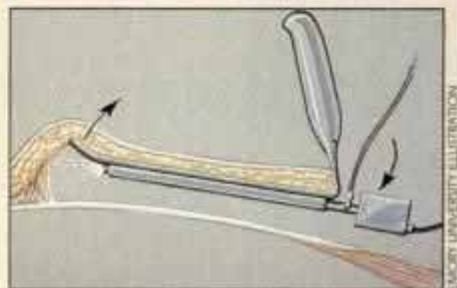
company believes the technology could lead to advertisement blimps shaped like the products advertised.

New Face Of Plastic Surgery

ATLANTA, GA—Scarring has always been a scare for patients about to undergo plastic surgery. But physicians at the Emory University School of Medicine and elsewhere are now adopting the endoscopic tools that have revolutionized other procedures.

Endoscopes are thin, retractable instruments that slip below the skin through small incisions. A tiny camera accompanies the instrument, feeding images back through a fiberoptic cable.

The devices allow surgeons to open pockets under the skin. These cavities allow them free movement to insert implants or transform physical structures. Post-operative scars are much smaller and less painful.



Endoscopic instrument opens cavity below the skin, guided by a TV camera.

Hybrid Saturn Gets High Marks

COLLEGE PARK, MD—Not only do Saturns turn heads among car buyers, but a converted Saturn SL2

ran rings around its rivals at last June's Hybrid Electric Vehicle Challenge in Southfield, Michigan.

University of Maryland students stripped the car of its engine and installed a power-assist system.

Under the hood, an elec-

tric motor and a small internal-combustion engine (lifted from a Geo Metro) both transmit power to the drive axle. The Geo engine, tweaked to run on methanol-gasoline, drives the car most of the time, while the

electric motor kicks in for peak acceleration. If the motor's batteries run down, the motor can turn into a generator, powered by the Geo engine, to recharge them.



Hybrid Saturn uses a Geo engine to recharge batteries for its power-assisting electric motor.



School Bus Teaches EV Tech

BURBANK, CA—School buses are natural platforms on which to study electric-vehicle technology. They ply limited routes in the morning and

afternoon, with a siesta to recharge their batteries, if necessary. Because they also run much quieter than diesels, kids' chatter should drop in volume, to the relief of drivers.

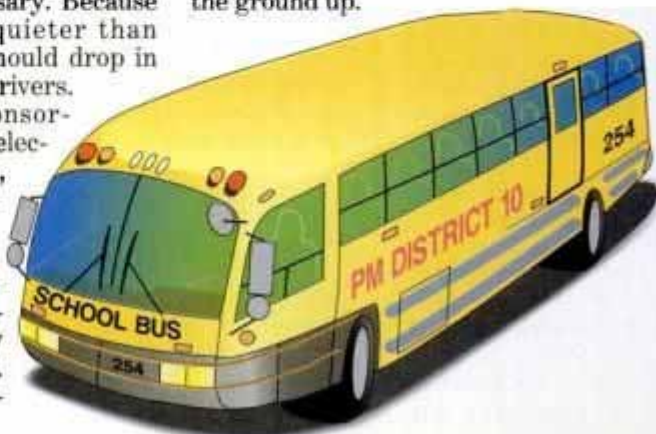
The CALSTART consortium is nurturing three electric school buses. One, retrofitted from an existing vehicle, now carries 66 schoolchildren in Santa Barbara. The bus packs 110 kilowatt-hours of battery capacity and has a 50-mile range. A second has been con-

verted to work Santa Maria-Bonitas.

The Specialty Vehicle Manufacturing Corp. is designing the third from the ground up.



Converted electric school bus (above) previews all-new vehicle (right).



(More Tech Update on page 42)

Other Schools Say Their Computer Repair Training Is The Best... At NRI, We Let Our Graduates Do The Talking:

"Just two years after finishing the NRI training in microcomputer servicing, I set up my own company. I contract myself out to several computer retailers as their service technician. I have control over my future and total confidence in my business"

V. Bender, Calgary, Alberta

"I recommend NRI to anyone looking for a change, success, and real challenge. The Action Learning Kits allow you to build on what you studied in the lessons - no better way exists to learn how to troubleshoot and service computers!"

R. Buda, Tenley Park, IL

"No doubt, the excellent back-up of your staff was a significant factor in my swift completion of my micro-computer repair training. Their helpfulness, either by phone or by letter, was nothing short of amazing."

J. Preusker, Angston, SA, Australia

Thousands of Successful NRI Graduates Are Proof of the Quality and Effectiveness of NRI Training

NRI's been successfully training people for new electronics careers for more than 80 years. Regardless of your previous experience, you can succeed with NRI, too.

Experience First-Hand the Intricate Electronics Inside Today's Computers

NRI's highly acclaimed Discovery Learning Method - the learn-by-doing approach that gives you first-hand experience with the intricate electronics behind microcomputers - is the most effective way to learn a new skill. You start with NRI's Discovery Lab - a complete breadboarding system that lets you design circuits, modify them, and then diagnose and repair faults.



You then go on to build a state-of-the-art 486sx/25 MHz Intel-based computer from the keyboard up. You install the power supply, 3.5" floppy drive, 200 meg hard drive, and Super VGA color monitor. This powerful system, which also features a Pentium overdrive-ready motherboard and today's most sought-after peripherals - CD-ROM drive, sound card, and speakers - is all yours to train with and keep.

What's more, you perform diagnostic tests using the professional-level Ultra-X R.A.C.E.R. plug-in card and Quick Tech software, all included in your course.

Plus, NRI training includes fully integrated software packages - MS-DOS 6.21, QBasic, and Microsoft Works - and skill-building interactive projects to give you complete confidence in a wide range of applications.

Train in the Privacy of Your Own Home

No prior experience necessary - with your personal instructor and NRI's team of technical specialists behind you every step of the way, you learn at your own pace - no classroom pressures, no night school, no need to quit your present job until you're ready to make your move.



Take Advantage of Today's Money-Making Opportunities in Computer Repair

The Department of Labor forecasts over 220,000 jobs for computer service technicians by the year 2005. With the right training and skills, you can cash in on this wide-open opportunity. Only NRI prepares you so thoroughly for a full- or part-time job as a computer service technician - even a business of your own!

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The Delicate Ditch Digger

COLUMBUS, OH—Gashing a gas line with a backhoe blade is an excavator's worst nightmare. But a new trenching technology that does away with blades should ease diggers' minds.

Battelle and Concept Engineering Group developed the machine for the Electric Power Research Institute. Called the Soft Trencher, the vehicle extends an excavation head that shatters hard soil by firing supersonic air jets into the ground. A vacuum system removes the soil as it becomes airborne. As it works, the vehicle rolls continuously, opening deep trenches as fast as 1 ft. per minute. The operator can either perch on the driver's seat or run the machine via remote control.

Conceived to aid the burial of power-transmission cables, the Soft Trencher suits urban areas where underground utility lines lurk in abundance.

Soft Trencher breaks up earth with air jets, then vacuums loosened soil without harming buried pipes.



BATTELLE PHOTO

Hot-Water Weed Boiler



AQUA HEAT TECHNOLOGY PHOTO

Environmentally friendly weed killer sprays hot water instead of herbicides.

Developed by Aqua Heat Technology, the machine runs water through a stainless-steel, diesel-fueled heater that hikes the temperature to 210° F. As the tractor chugs along at between 1 and 4 mph, applicator booms squirt the hot water where it's needed.

FRIDLEY, MN—Instead of spewing herbicides that might ultimately taint groundwater, a tractor-pulled device sprays hot water to wipe out weeds.

The sprayer is well suited to Florida's citrus groves, where it was invented, but it could also control vegetation on roadsides and golf courses. The scalding water may also disrupt the life cycles of insect pests. Operating costs run about \$20 per acre.

Wasteland Workhorses

CALGARY, ALBERTA—Seeking ways to work over its messy nuclear sites, the U.S. Department of Energy recently has been looking over a versatile family of little construction robots. Called the HazHandlers, the 10-ft.-long radio-control vehicles come from Robotech Industries.

Each HazHandler rolls on a modified all-wheel-drive Bobcat chassis, propelled by a 40-hp diesel. The vehicle can wield a wide range of attach-



ments, from a bulldozer blade to a barrel grappler to a 7-axis manipulator arm.

Supported on a shoulder harness, the control panel sports joysticks and a TV

screen that receives images from a camera on the HazHandler. The operator can run the vehicle from as far away as 1000 ft.



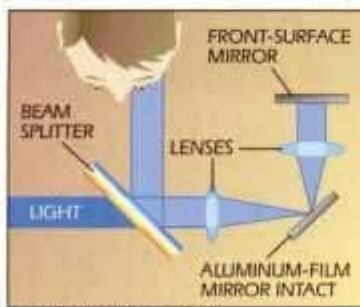
ROBOTECH INDUSTRIES PHOTO

Remote-control HazHandler can accept a variety of standard tools to work where humans dare not tread.

Sight Beats Lasers

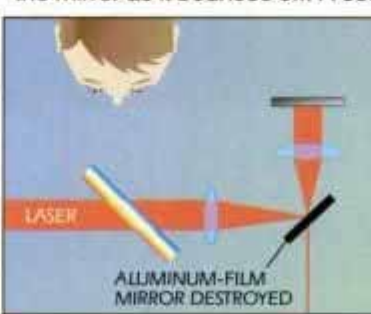
OAK RIDGE, TN—Blinding lasers will be an unpleasant reality on tomorrow's battlefields, and the Army is already scouting for ways to protect its troops' vision. Tank-Automotive Command, for example, has had Oak Ridge National Laboratories design a laser-defeating viewfinder for armored vehicles.

The optics involve mirrors and lenses. Light enters through a prismslike



PM ILLUSTRATIONS BY KURT NOVAK

beam splitter. A lens then focuses the beam on a replaceable mirror made of a thin aluminum film. If the light is a laser beam strong enough to damage eyes, it will vaporize the mirror as it bounces off. A second mirror reflects the light



back to the same spot on the thin-film mirror. But if the thin-film mirror is damaged, it can't ricochet the beam back along the view path to the viewer's eye.

Laser destroys mirror in viewfinder and can't reach the eye, but normal light bounces through.

SURGEON GENERAL'S WARNING: Smoking By Pregnant Women May Result in Fetal Injury, Premature Birth, And Low Birth Weight.

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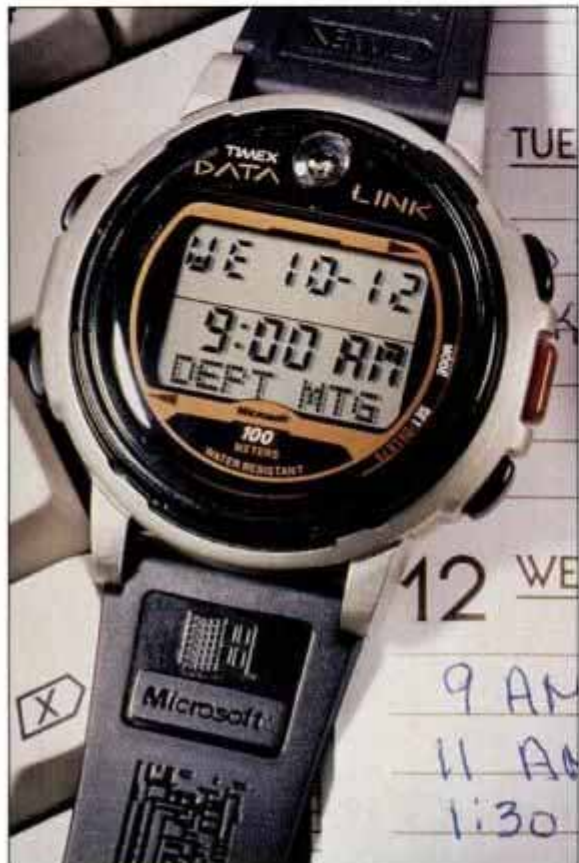
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*Based on manufacturers' list prices.

15 mg. "tar",
1.1 mg. nicotine av. per
cigarette by FTC method.

More Than Just Time

BY FRANK VIZARD, Electronics Editor



● It used to be that the only things you could put on your arm were a tattoo and a timepiece. The tattoo, of course, is still an option, but now there are a number of new watches available that tell more than just the time.

Among the more high-tech entries is Timex's Data Link. Developed in conjunction with software giant Microsoft and chip-maker Motorola, the Data Link allows you to easily transfer information from your computer to your watch. Specifically, you can transfer appointments, phone numbers, addresses, to-do lists and other information from time-management programs like Microsoft's *Schedule+* for Windows.

Transferring the information is fairly simple. Just point the watch at the computer monitor from a distance of about 1 ft. A sensor on the watch face reads the data as flashing lights, similar to the way bar-code scanning works. In about 20 seconds, the Data Link stores up to 70 entries. No

wires or cables are required.

Programming software is included with each Data Link watch and the whole package lists for \$130. Most standard watch features are also included. It even sports an Indiglo night light so you can find out where you're supposed to be even when you're in the dark. One drawback, however, is that the Data Link doesn't work with laptop computers because they don't have a strong enough light source in their screens.

While the Data Link might be the watch to have during the work week, the Vertech Alpin from Avocet is the watch to have for activities that involve going up or down something other than the corporate ladder.

Based on use in the Adirondack Mountains of upstate New York, the Vertech Alpin accurately measures vertical ascents or descents, whether it be summertime hiking or wintertime downhill and cross-country skiing. Measurements can be made in feet or meters up to an altitude of 60,000 ft.—a claim not tested for lack of a plane. Measurements can also be made for total, maximum and average rates of ascent or descent for the day, week or year. There's also a built-in stopwatch if you want to time performances.

Another handy feature is a weather mode that displays barometric pressure and trends as well as the temperature. Accuracy was confirmed after



Measuring the heights you climb.

being caught in a thunderstorm while mountain biking—should have looked at the watch a little sooner!

The Vertech Alpin is also a good aid for map reading. Combined with a compass, it's relatively easy to determine your location, almost exactly. It should also be noted that the display is easy to read and the colored function buttons are easy to use even when wearing gloves. List price for this watch is \$120. Avocet is headquartered in Palo Alto, California.

Meanwhile, turning a watch into a telephone is the aim of MicroTalk Technologies of Minneapolis, Minnesota. The TeleWatch basically puts a cordless phone on your wrist. Included in the package are a base station that can support up to four TeleWatches, and two nickel-metal-hydride batteries for about \$350.

The 10-channel TeleWatch features a scrambling circuit for privacy, speed dialing and an intercom mode. The buttons also are large enough that the average person doesn't have to use a pen or pencil to dial a call.

The TeleWatch is reminiscent of a similar product developed by Panasonic last year. While kudos are warranted, eliminating the keypad is clearly the next step to be taken—something that should occur as soon as voice-activation technology improves.

MicroTalk says it's working on a cellular wristphone as its next product—a device that would go beyond a cordless phone's limited range. Now that would be something to talk about. **PM**



MicroTalk's TeleWatch is a cordless phone on a wrist.

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Scramjets Get Serious

BY GREGORY T. POPE, Science/Technology Editor



And so NASP officials, led by new director Col. Robert Heaps, have reined in their ambitions over the past 12 months. They've been closing up shop on structural materials, skin-cooling techniques, guidance electronics and other subsystems. And they've returned to the program's root. That's the engine: the supersonic-combustion ramjet, or scramjet.

Project engineers assert that the scramjet remains the pivotal technology that will make or break hypersonic flight, which begins above Mach

5. So unless Congress surprises them with extra money, officials will focus all their funds on propulsion. Their new aim is to flight-test the fastest air-breathing engine ever built—"but without the hook of a multi-billion-dollar aircraft," as Heaps puts it.

To that end, a new program is rising from the ashes of NASP—the Hypersonic Systems Technology Pro-

gram, or HySTP for short. As if to jump-start HySTP, recent wind-tunnel tests have supplied the most stringent tests yet of scramjet design. The site: NASA's Langley Research Center, where a cadre of engineers has been experimenting with scramjet technology for nearly three decades. The scramjet: the Concept Demonstration Engine, or CDE (see "Scramjet Countdown," page 20, Dec. '93).

The CDE lays claim to the title of biggest scramjet yet. But since scramjet design overlaps into classified realms, elements of the CDE are unrevealable. Unless you possess clearance, you won't see the engine's nozzle, for example, or its internal flow path.

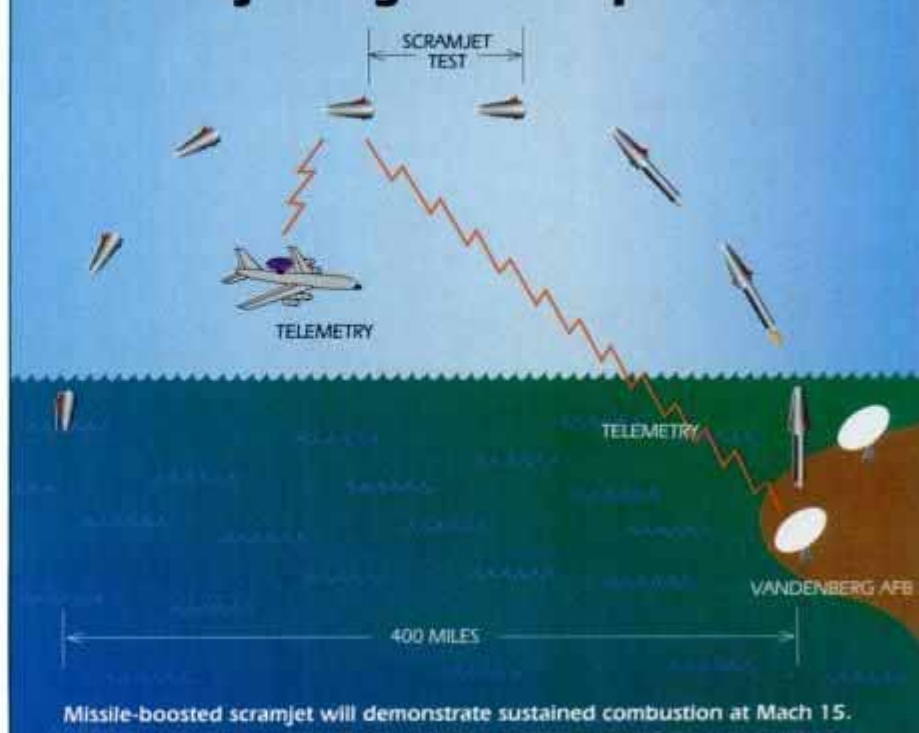
Nevertheless, the CDE is revealing a lot about the physics of a working scramjet. Until recently, the scramjet picture had appeared a disjointed mosaic. Data have collected piecemeal from computer simulations, miniature models wind-blasted in miniature tunnels, and full-scale tunnel tests of nozzles and fuel injectors. Now researchers have a realistic engine with which to "validate design tools."

Last July, Langley engineers fired

● Which comes first, the world's fastest engine or the world's fastest plane? This chicken-and-egg dilemma is still awaiting resolution. For years, the Air Force and NASA thought they could beat the problem the way they've met dozens of aeronautical challenges—with an X-plane. In this case, the X-30, or National Aero-Space Plane (NASP), would streak into orbit in a single bound. On the way, its engines would gulp down thin air at speeds previously unimaginable. The engines and the aircraft would be so tightly integrated that each would show the feasibility of the other. Egg and chicken would thus arrive simultaneously.

But after soaring for years as the Air Force's showpiece technology effort, the NASP program has fallen on hard times. Last year, Congress threw the brakes on the project—after more than \$1.5 billion had flowed into the aircraft's development.

Scramjet Flight Test Operations



up the CDE with hydrogen fuel dosed with a hypergolic compound called silane. This additive serves as a spark plug, igniting spontaneously when it meets oxygen. At press time, the CDE had run for 18 seconds in a Mach-6.8 windstream—just a little faster than the X-15 rocket plane's all-time speed record. Testers found they could clamp off the flow of silane after ignition and still sustain combustion. Pressure sensors buried inside the engine affirmed that the combustion was taking place in a supersonic flow of air—the hallmark of a scramjet.

"We know scramjets basically work," says Bob Faulkner, NASP deputy program manager at Pratt & Whitney, which built the CDE. "But how well do they work to get the maximum efficiency out of them?"

In search of fuel economy, the CDE is also demonstrating the split-injection scheme developed by Pratt & Whitney and Rocketdyne. As the jet ramps up toward Mach 6, fuel injectors spray hydrogen deep in the engine. But once velocity climbs into the hypersonic regime, air molecules begin flashing through the flow path at supersonic speed. So the rear injectors shut down and a second set of injectors—closer to the front—take over. The switch ensures that the hydrogen spends enough time in the engine to mix with air and then burn.

Engineers have looked forward to proving this concept in an engine as big as the CDE. In a small-scale scramjet model—its flow path shorter—the swift-moving air and hydrogen can simply blow out of the engine's rear before they have a chance to mix. Scramjet designers suspect that fuel-air mixing will be easier in a larger engine, and they hope the CDE data will erase all doubts.

As the CDE tests draw to a close, however, a hole yawns in the scramjet database. "The big question that remains," says Heaps, "is how efficiently the scramjet can operate at Mach 10 to 15 conditions. We can't duplicate that on the ground." That unknown, in part, moved Congress to scuttle the X-30's development. No scramjet has seen sustained combustion at high Mach numbers.

To surmount that hurdle, officials are pushing to launch little scramjets out over the Pacific Ocean. Sawed-off intercontinental ballistic missiles, such as surplus Minuteman II or Peacekeeper vehicles, would accelerate the engines to Mach 15.

But engineers are already thinking ahead to the problems of flight-testing an engine without an airplane.

In particular, the HySTP scramjet won't have an aircraft's underbelly stretched out ahead of it. On an X-30,

that surface would act as a long engine inlet, compressing air as it rushes toward a bank of scramjets. What's more, the thin layer of air that hugs the surface would pick up turbulence as it travels the length of the underbelly. Without turbulence, this boundary layer could easily veer off from the vehicle's surface and miss the engines altogether, choking off combustion. To sidestep this problem, the free-flying scramjet will sport a strip of material in front of the engine aperture. The spoiler will trip the airflow artificially into turbulence.

"We're not trying to duplicate X-30

conditions," explains Heaps. "We just want a scramjet that runs." He adds that the HySTP engine also won't have to transfer air-friction heat into its fuel to raise its temperature, as the X-30 would. Because the scramjet needn't reach all the way to orbit, it won't have to warm up its fuel to get the maximum kick from combustion. "We'll still get a good test," Heaps insists.

How quickly HySTP gets airborne will depend on funding, which at press time was itself up in the air. But scramjet flight tests look like an inevitable step before a manned hypersonic plane ever takes wing. **PM**

*It's what you don't know
that will surprise you.*

The Space Shuttle

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Why do they wrap it
in butcher paper?

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the alligators off
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Ultimate Ski Boat Test

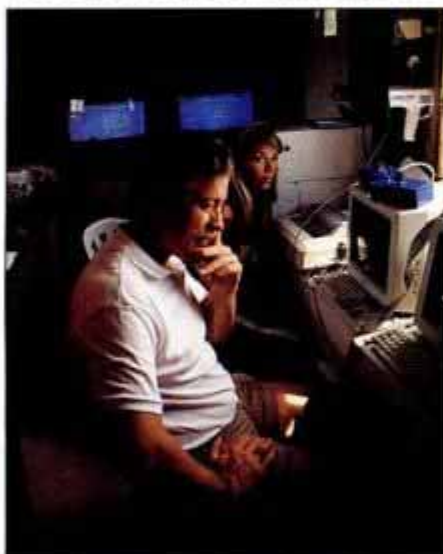
BY JIM YOUNGS



PHOTO BY DOUG DUKANE

• Inboard tournament ski boats have the most specific duty cycle in all of boating. As a result, they tend to look alike and possess similar performance characteristics. However, the differences between boat models can be considerable to serious amateur and professional skiers. So much so that the integrity of competitive events can be compromised if a towboat strays from a set of exacting standards.

To make sure this doesn't occur, the American Water Ski Association (AWSA), which is based in Winter Garden, Florida, has developed strict towboat criteria. It enforces these cri-



Inside the tech trailer, computers with custom software monitor dual radar-gun readings and plot acceleration curves.

teria by conducting an independent evaluation of boats—perhaps the toughest set of tests carried out in boating. The AWSA conducts this evaluation once a year, and issues a thumbs-up or thumbs-down recommendation for each participating boat.

After passing a set of 10 rigorous tests and becoming AWSA-certified, a boat is approved to be used at all AWSA-sanctioned tournaments. The goal of the tests is to guarantee that each pull behind every approved towboat is consistent for skiers in all disciplines.

To achieve AWSA certification, a boat must meet the following standards:

• **Power and Acceleration.** A boat must achieve a minimum acceleration of 36 mph in 250 ft. or less while pulling a skier. The test involves using a fiberglass drone, which simulates the drag of a 165- to 170-pound slalom skier from a deep-water start. Two fixed radar guns measure the towboat's velocity with a readout every one-tenth of a second as the driver accelerates pulling the drone. The radar readings are monitored by computers located in a tech trailer on shore, which generate acceleration curves. To maximize radar results, each test boat is fitted with a metal target standing 4 ft. above the cockpit sole.

• **Barefoot Power and Acceleration.** This test requires a live skier and minimum acceleration of 45 mph in 700 ft. or less.

• **Slalom Course Centerline Deviation.** This one determines if a towboat is capable of being driven straight through the center of a slalom course with a skier pulling hard for the buoys. Three different drivers pull several skiers who slalom at various line lengths. A computer-assisted tracking device is employed to trace the boat's path through the slalom course and record the boat's lateral movement. The measuring device uses photographic images to obtain the measurements. The computer documents the path and calculates its average and maximum centerline deviation. A towboat can't exceed an average of 4.7 in. from the centerline.

• **Jump Course Centerline Deviation.** Like the slalom course test, this test uses a computer-assisted tracking device to measure the boat's ability to be



Fiberglass drone simulates a 165- to 170-pound slalom skier. Metal target in boat improves reading of radar signal.

driven in a straight line through a jump course. To pass, a boat can't deviate more than 9.4 in. from the centerline.

• **Sound Level.** During course-deviation testing, sound-level measurements are taken from shore. A boat must not exceed 75 dB for passes at 34 mph and 36 mph.

• **Handling and Maneuverability.** Each boat must be able to make a figure-eight pattern with diameters of 75 ft. at both 17 mph and 26 mph. Each boat is also required to make two 180° turns at 36 mph within a 150-ft.-dia. course. Barefooting evaluations in this category require a boat to make a series of turns at approximately 45 mph.

Aside from these hard-data tests,

the AWSA test committee relies on comments from test skiers who ski behind each boat. These comments add up to recommendations in the following areas: Slalom Spray, Slalom Wake and Tricks Wake. If every skier independently agrees that these characteristics have a significantly negative effect on skiing, then the boat may be disqualified.

Another set of subjective evaluations is based on comments from the test drivers. These are recorded under the heading Driveability. Drivers evaluate each boat's engine, layout, controls and instrumentation—all of which should not negatively affect a driver's ability to provide smooth, consistent pulls within required tolerances. If each driver independently agrees that a boat's driveability has a significantly negative effect on a skier's performance, then the boat may be disqualified.

The final AWSA evaluation area is for Engineering, where every boat is examined and analyzed to determine if the design hinders its performance. Officials look for potential hazards and problems in ergonomics and practicality. If a problem surfaces and a manufacturer can't correct it on the spot, the boat may be disqualified.

To gain approval for pulling kneeboarders, the AWSA relies on comments from test kneeboarders, who make two passes behind each boat and evaluate wake width, table and rooster tail.

For 1994, only 28 boats, representing 14 manufacturers, received AWSA certification. As noted, the AWSA evaluations are probably the most rigorous independent tests performed in boating. Boats that pass muster earn the right to boast of their accomplishment, and most do so in prominent advertising and marketing campaigns.

Few independent boat testers can match the AWSA's rigorous test criteria. More significantly, none can equal its state-of-the-art equipment. The typical boat test that appears in most boating magazines and this one involves using a radar gun, a stopwatch and a fuel-flow meter. The radar gun and fuel-flow meter provide objective, reliable data, but the stopwatch is somewhat problematic because it relies on human motor skills.

Several frequently performed boat tests use a stopwatch, including acceleration, time to plane and time through a handling course. Each of these tests measures important performance characteristics. To collect data for these tests, the stopwatch operator has to make two subjective decisions: when to click the stopwatch on and when to click it off.

In tests of less than 10 seconds,


such as time to plane and acceleration, operator error can approach 10%. Operator error can be even greater in acceleration runs, which typically take much less than 10 seconds. This is true because, in addition to clicking the stopwatch, the tester must determine exactly when the boat crosses the targeted speed (for example 25 mph or 30 mph).

In future boat tests, PM will eliminate much of this problem by using the new Stalker radar gun and computer software package, which continuously records acceleration data in memory (see "The Relentless Pursuit


Of Accuracy," page 85). A printout of this data on a speed-time graph reveals an acceleration picture far more detailed and accurate than anything possible with a stopwatch.

Unfortunately for boating, much of the marvelous test equipment used on automobiles is unsuitable for the marine environment. Accelerometers, timing lights and most photo/video test equipment simply will not work on the water, but the technology is improving. The AWSA deserves a lot of credit for establishing benchmark marine-testing criteria that the rest of us can try to emulate. **PM**


(Pick One)




A) Endurance



B) Strength




C) Nutrition



D) All of the Above

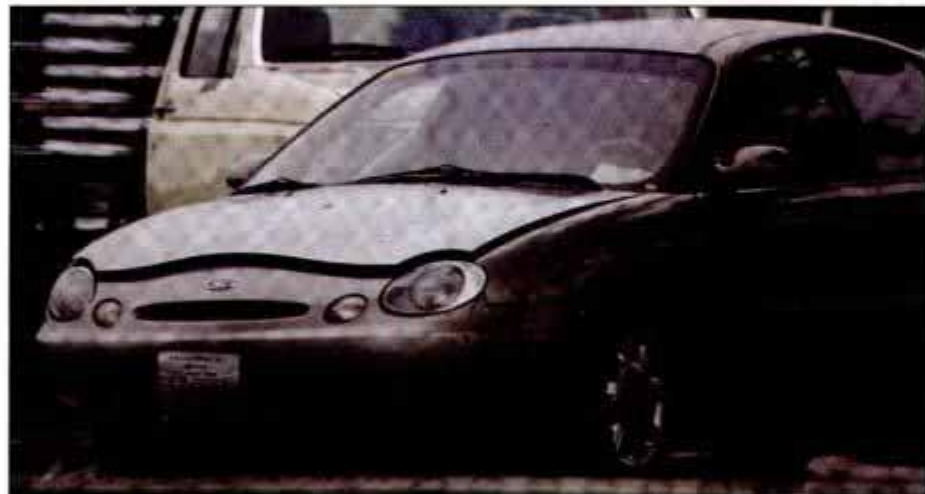
Mayo Clinic Sports Health & Fitness CD-ROM combines Mayo Clinic's medical expertise with interviews of professional athletes from the ESPN archives. You'll find information on general fitness, anatomy, nutrition, exercise and more. Or, consult with the "Personal Trainer" to develop a personal fitness program. So if you're looking for a well rounded approach to health and fitness, there's only one right answer - Mayo Clinic Sports Health and Fitness.

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IVI PUBLISHING

Detroit Spy Report

BY JIM DUNNE, Detroit Editor



Ford's Next Taurus

• Whenever the nation's best seller is going to be replaced by a new version, both the anticipation and the security are high. Despite Ford's efforts to



Escort shows a rounded roofline and pillars, similar to Neon.

hide the new car, we can still see enough of this prototype to recognize it for what it is, the undisguised front end of the 1996 Taurus. Telltale items include the rounded headlights and the oval grille opening, which are becoming more and more of a Ford trademark. In addition to the new styling, the Taurus will benefit from some drivetrain changes borrowed from the new Continental.



Next Chrysler minivans have more snout, rounded lines.

Escort And Beyond

Major styling changes are also in store for Ford's highly successful Escort subcompact. This photo of a partially masked early prototype of the 1997 model shows the extent of the changes. Despite the camouflage, you can readily see that soon-to-be ubiquitous Ford oval grille opening. The car shows a strongly rounded roof profile, which is in keeping with other new small-car shapes. In addition to the change in look, the new Escort may

also change its market segment, moving up in class to a position closer to the Contour. Ford reportedly is planning another small car that would sell for less than this Escort. Stories around Detroit have Ford planning a new sedan, dubbed "Helios" by insiders. The subcompact would fill a niche below the Escort, and should sell at a price that would compete with small imports. Ford will save money on Helios development by using parts of the Escort in its design. Like the current Escort, you can expect much of the technical design for the new Escort and the Helios to be performed by Mazda, Ford's Japanese partner.

Van Of Many Doors, But No Remote

Despite the disguises, this is clearly recognizable as the next generation of minivan from Chrysler, due for the 1996 model year. Though Chrysler plans a 4-door option for its '96 minivan, the doors will be strictly hand operated. Chrysler engineers say the demand for a remote-control, self-powered door is not a big need voiced by their current van buyers.

Adjustable Pedals

You've seen them on concept cars and race cars for years. Now, it looks like you'll finally see them in production cars: Pedals that can be adjusted in position to fit the leg length of the driver will be on the road within two years. That's the schedule a couple of car companies are following. The adjustments are easy to understand. The pedal's adjustment is a power one, covering a 4-in. fore-aft range, and combined with the memory settings for power seats and the steering wheel can individualize the seating position for any driver. Chrysler reportedly will be first to the market with the pedals, probably in the Viper.

Van Wars

Chrysler is not the only company developing its next generation of vans. GM is hard at work on the replacements of its Chevrolet and GMC vans.



Coming soon, a strong new Chevy van.

These will look less alike than in years past, but will still share engineering details and essentials. Knowing the importance of the rear-wheel-drive van as a tow vehicle—both for recreational and business use—GM is ensuring that its vans are up to the task. This Chevy was caught during a hot-weather trailer-towing durability test.

(Please turn to page 52)

**"I'm going to the bathroom
more than ever.
I wonder what's wrong
with me."**



Your urinary symptoms may be caused by a condition called benign prostate enlargement or BPH. BPH is not cancer and does not lead to cancer, although the two conditions can exist at the same time. Remember, only a doctor can

evaluate your symptoms and their possible causes.

Today, symptomatic BPH can be treated by your doctor in several ways. The options are monitoring the condition with regular checkups, surgery, or oral medicines. One oral medicine is

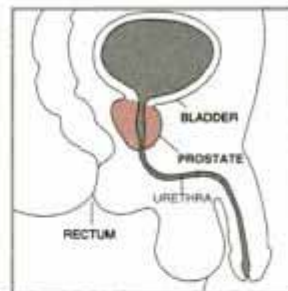
Is this you?

	Yes	No
Do you get up more than once or twice a night to urinate?	<input type="checkbox"/>	<input type="checkbox"/>
Do you often have sudden, uncontrollable urges to urinate?	<input type="checkbox"/>	<input type="checkbox"/>
Do you have a hesitant or slow urine stream?	<input type="checkbox"/>	<input type="checkbox"/>
Do you have a frequent need to urinate?	<input type="checkbox"/>	<input type="checkbox"/>

If you answered yes to even one question, tell your doctor.

PROSCAR, the only prescription medicine for the treatment of symptomatic BPH that can shrink the prostate.

PROSCAR works by blocking a hormone that can cause the prostate to enlarge. *But it is important to know: PROSCAR doesn't work for everyone. Although the prostate may shrink, there may not be an improvement in urinary symptoms. However, in clinical studies with PROSCAR, some men have seen an improvement in their urinary symptoms after 2 weeks. Others have found that PROSCAR took up to several months to help them.* Because all men are different, you and your doctor will need to determine how PROSCAR is working for you.



The prostate surrounds part of the urethra, the tube that carries urine from the bladder. As the prostate enlarges, it can squeeze the urethra and cause urinary problems.

If you have any urinary symptoms, see your family doctor or a urologist soon, and ask about PROSCAR. For free information to help you discuss your symptoms with your doctor, call 1-800-363-5494.

For the treatment of symptomatic BPH

PROSCAR[®] 5mg
(FINASTERIDE)

The only medicine that can shrink the prostate.

PATIENT INFORMATION ABOUT PROSCAR® (Prah-s-car)
Generic name: finasteride (fin-AS-tur-eyed)

PROSCAR is for the treatment of symptomatic benign prostatic hyperplasia and for use by men only.

Your doctor may prescribe PROSCAR if you have a medical condition called benign prostatic hyperplasia or BPH. This occurs only in men.

Please read this information, as well as the leaflet which accompanies your medication, before you start taking PROSCAR. Also, read the leaflet each time you renew your prescription, just in case anything has changed. Remember, this leaflet does not take the place of careful discussions with your doctor. You and your doctor should discuss PROSCAR when you start taking your medication and at regular checkups.

What is BPH?

BPH is an enlargement of the prostate gland. After age 50, most men develop enlarged prostates. The prostate is located below the bladder. As the prostate enlarges, it may slowly restrict the flow of urine. This can lead to symptoms such as:

- a weak or interrupted urinary stream
- a feeling that you cannot empty your bladder completely
- a feeling of delay or hesitation when you start to urinate
- a need to urinate often, especially at night
- a feeling that you must urinate right away.

Treatment options for BPH

There are three main treatment options for BPH:

- **Program of monitoring or "Watchful Waiting".** If a man has an enlarged prostate gland and no symptoms or if his symptoms do not bother him, he and his doctor may decide on a program of monitoring which would include regular checkups, instead of medication or surgery.
- **Medication.** Your doctor may prescribe PROSCAR for BPH. See "What PROSCAR does" below.
- **Surgery.** Some patients may need surgery. Your doctor can describe several different surgical procedures for BPH. Which procedure is best depends on your symptoms and medical condition.

What PROSCAR does

PROSCAR lowers levels of a key hormone called DHT (dihydrotestosterone), which is a major cause of prostate growth. Lowering DHT leads to shrinkage of the enlarged prostate gland in most men. This can lead to gradual improvement in urine flow and symptoms over the next several months. However, since each case of BPH is different, you should know that:

- Even though the prostate shrinks, you may NOT see an improvement in urine flow or symptoms.
- You may need to take PROSCAR for six (6) months or more to see whether it helps you.
- Even though you take PROSCAR and it may help you, it is not known whether PROSCAR reduces the need for surgery.

What you need to know while taking PROSCAR

- **You must see your doctor regularly.** While taking PROSCAR, you must have regular checkups. Follow your doctor's advice about when to have these checkups.
- **About side effects.** Like all prescription drugs, PROSCAR may cause side effects. Side effects due to PROSCAR may include impotence (or inability to have an erection) and less desire for sex. Each of these side effects occurred in less than 4% of patients in clinical studies. In some cases side effects went away while the patient continued to take PROSCAR. Some men taking PROSCAR may have a decrease in the amount of semen released dur-

ing sex. This decrease does not appear to interfere with normal sexual function. Rarely, some men have reported breast swelling and/or tenderness or allergic reactions such as lip swelling and rash.

You should discuss side effects with your doctor before taking PROSCAR® (Finasteride) and anytime you think you are having a side effect:

- **Checking for prostate cancer.** Your doctor has prescribed PROSCAR for symptomatic BPH and not for cancer—but a man can have BPH and prostate cancer at the same time. Doctors usually recommend that men be checked for prostate cancer once a year when they turn 50 (or 40 if a family member has had prostate cancer). These checks should continue while you take PROSCAR. PROSCAR is not a treatment for prostate cancer.

- **About prostate specific antigen (PSA).** Your doctor may have done a blood test called PSA. PROSCAR can alter PSA values. For more information, talk to your doctor.

• A warning about PROSCAR and pregnancy.

PROSCAR is for use by MEN only.

PROSCAR is generally well tolerated in men. However, women who are pregnant, or women who could become pregnant, should avoid the active ingredient in PROSCAR.

If the active ingredient is absorbed by a woman who is pregnant with a male baby, it may cause the male baby to be born with abnormalities of the sex organs. Therefore, any woman who is pregnant or who could become pregnant must not come into direct contact with the active ingredient in PROSCAR.

Two of the ways in which a woman might absorb the active ingredient in PROSCAR are:

Sexual contact. Your semen may contain a small amount of the active ingredient of the drug. If your partner is pregnant, or if you and your partner decide to have a baby, you must stop taking PROSCAR and talk to your doctor. If your partner could become pregnant, proper use of a condom can reduce the risk of exposing her to your semen (discuss this further with your doctor).

Handling broken tablets. Women who are pregnant or who could become pregnant must not handle broken tablets of PROSCAR.

PROSCAR tablets are coated to prevent contact with the active ingredient during normal handling. If this coating is broken, the tablets should not be handled by women who are pregnant or who could become pregnant.

If a woman who is pregnant comes into contact with the active ingredient in PROSCAR, a doctor should be consulted. Remember, these warnings apply only if the woman exposed to PROSCAR is pregnant or could become pregnant.

How to take PROSCAR

Follow your doctor's advice about how to take PROSCAR. You must take it every day. You may take it with or between meals. To avoid forgetting to take PROSCAR, it may be helpful to take it the same time every day.

Do not share PROSCAR with anyone else; it was prescribed only for you.

Keep PROSCAR and all medicines out of the reach of children.

FOR MORE INFORMATION ABOUT 'PROSCAR' AND BPH, TALK WITH YOUR DOCTOR. IN ADDITION, TALK TO YOUR PHARMACIST OR OTHER HEALTH CARE PROVIDER.



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DETROIT SPY REPORT

(Continued from page 50)

Anchored Seats

Look for newer car designs to anchor the front seats more firmly to the floor. A firmly attached seat can act as an anchor for seatbelts—something already done in some expensive Mercedes-Benz models—and also as the solid base needed for side airbags. In addition, if the seats are anchored firmly enough, large side bolsters can be built into the cushions, which can help hold you tightly in place when a car is hit from the side.

Then They'll Be Three

The Big Three American automakers will have similar full-size 4-door sport/utility vehicles on the road within two years. GM will be out first with the 1996 Chevy Tahoe/GMC Yukon, which you can expect to see in dealerships as early as late this winter or early next spring. Ford will have its still-unnamed 4-door Bronco ready for 1996½. And Chrysler is working on a 4-door sport/utility version of its popular full-size Ram pickup that should be in showrooms in 1997. GM hopes to expand the market for the big rigs in a niche just below its Suburban. Ford and Chrysler hope the market is there, because they plan to target the same niche.

Aurora At Cadillac?

Word around Detroit is that GM management's first choice for the Aurora was really Cadillac, not Oldsmobile. But apparently the management team at Olds stepped in front of the folks from Caddy and grabbed the Aurora. The bosses at GM agreed on two solid reasons for giving the Aurora to Olds instead of Cadillac. For one, Olds needs a fresh new flagship to change its dowdy image. For another, Cadillac doesn't need a standout car like Aurora to steal sales from the successful and more expensive Seville.

An Electrical Short

Looks like there might be a real short circuit ahead in the electric-car calendar. As of right now, it looks like none of the auto companies can meet California's demand for electric-car sales in 1998. At that time, each of the big carmakers is required to offer 2% of its cars with totally nonpolluting, so-called "zero-emissions" engines. That realistically means electrics. The trouble is, who will buy those vehicles? The combination of the electric cars' high prices and their short drive range on a battery charge are major problems that automakers have not solved. The time is getting short—automakers must commit for production within the next 12 months, or they'll miss the 1998 deadline. **FM**

Import Spy Report

BY MIKE ALLEN, Associate Automotive Editor



A Carbon Copy It's Not

● Italian exotic manufacturer Ferrari ups the ante late this year with this Barchetta supercar, which replaces the F40. Barchetta means literally "bathtub," and this open car is shown with its removable hardtop in place. Like the F40, the Barchetta will be produced in limited quantities to meet international racing regulations for production-based sports cars.

The carbon-fiber chassis is ignited by a 500-plus-hp 4.5-liter 60-valve 12-cylinder engine. As is common practice on Ferrari Formula One cars, the 6-speed transmission will probably be mounted transversely behind the longitudinally mounted engine. Expect to trade a check for about 400 grand for a set of keys.



The XJS Convertible and Coupe replacement is due in 1996.

Kia Grows Up

Korean manufacturer Kia, still trying to gain a lasting toehold in the U.S. market with precious little more than a smattering of dealerships on the West Coast, apparently feels the need



Mercedes C-Class wagon has a unique niche in the midsize family-car market.

to supplement its subcompact and 4x4 with a larger compact-size sedan. We spotted this prototype being tested at Lotus Engineering in England. (Lotus does engineering development work for many automakers.) Kia uses many Mazda drivetrain components, so this 4-door sedan might well have 626-based powertrain pieces.

Son Of E-Type

Or more recently, the XJS. Code-named X100, here's the spiritual successor to the Jaguar XKE and direct replacement for the XJS Coupe and Convertible. Due sometime in 1996, on the heels of a new XJ6 saloon, the new 2-door is part of current-owner Ford Motor Co.'s 5-year plan to bring Jaguar to the end of the century with a completely new product lineup.

Powered by a 4.0-liter V8 built by Ford in Wales for Jaguar, there will be both soft- and hardtop versions. The photo is of a disguised prototype undergoing wintertime testing at an undisclosed location, probably somewhere in a desolate section of northern Scandinavia.

Yuppies Go Home

Here's a well-turned-out C-Class Mercedes-Benz estate car or, as we know it, a station wagon, slated for introduction fairly soon, if the fact that it was seen on public streets without camouflage is any indication. Styling seems a little less conservative than the sedan—if it's possible to think of a station wagon as being anything but conservative. We predict this vehicle will see widespread utilitarian use in Europe and the



Kia compact sedan will supplement Sephia.

Middle East, where Mercedes-Benzes are the taxicabs and delivery cars of choice, and widespread use here in the United States as a very trendy grocery-getter. How well it bucks the trend for upscale small families to move from cars into minivans or sport/utility vehicles remains to be seen. Of course, rumors persist that the German automaker is hedging its bets by working on an upscale minivan, as well as the soon-to-be-built-in-the-United States sport/utility vehicle.

E-Class Benz

Slated for introduction sometime this winter is the new E-Class Mercedes-Benz, replacing a chassis that was first seen in 1984 and now is long overdue for a change. With the introduction last year of the compact C-Class sedan, the bread-and-butter (toast points-and-caviar?) Mercedes-Benz E-Class has started to look very dated on the showroom floor. Styling will be more modern, with oval headlights and a more sloping, rounded look. The wheelbase is longer, and that translates into more interior room.

PM



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INSIDE TOMORROW'S INFOHOME

Every room will be a doorway leading onto a superhighway of entertainment and information.



BY GEORGE MANNES; PM Photos by Michel Tcherevkoff

• You step out of the shower and say, "Phone, dial weather." In response, a 5-in. screen by your shaving mirror quickly displays the news that today will be unseasonably warm. Scratch the overcoat, you think. Meanwhile, another message blinking at the bottom of the screen alerts you that your usual road into town is closed because of a tractor-trailer accident.

Watching television that night, you pick up the

remote control when a commercial break comes on and click on a special menu that shows you how much energy your family is using. You notice that the stereo system in your daughter's room has been on for 48 hours out of the last 48. "If you won't turn it off, I will," you mutter, punching a few buttons. Now it's off between midnight and 6 am, seven days a week, and during school hours, too.

BEDROOM

A bedside connection to the information superhighway comes via a screen phone transmitting voice and visuals. Alternately, an information appliance combining a TV, phone and computer could be used.

That weekend, you're replacing the brake pads on your car. You're out in the driveway with a portable TV monitor. In the basement of your home, a CD-ROM player is spinning a disc titled *Fix Your Taurus* and is transmitting it to your TV. You follow the moving video's step-by-step instructions, using a greasy remote to play, pause and repeat the action.

Awash in electronic data, this house we've described could be dubbed the InfoHome. And it's closer to reality than you think, according to people working to bring it to life. Spurred by companies' hopes to sell new services based on cheaper, more powerful computing, these technologies and others could easily enter your household in the next two to five years.

If one word has served as the buzzword of information technology over the past few years, that word is convergence. Three items in the home are going to converge: the television, the telephone and the computer. The most simplistic visions of convergence portray these different devices morphing into one all-powerful black box in your living room: a box that does your spreadsheets, displays Nick At Nite and lets you dial up Grandma on the video phone. The future probably won't be that simple, however.

What exactly will be in the InfoHome by the end of the decade? Let's take a tour of the house and see.



In the bedroom

The bedroom of the near future may be electronically anchored by a product of convergence that is just arriving. While the second TV in the bedroom is almost a staple, the cutting-edge bedroom is likely to have an information appliance similar to new computers now available from Compaq and Packard Bell (see "The Information Appliance," page 61). Some of Compaq's and Packard Bell's new computers come with a built-in television tuner so you can take a "Baywatch" break while looking at your computer screen. These computers also have a modem, a microphone, speakers and software that let the computer double as a speakerphone. But a desktop computer, while taking on some of the features of a phone or a television, can't quite

replace them. Unlike a really useful phone, you can't cradle a computer on your shoulder as you walk around the kitchen preparing dinner. And if you really want to enjoy yourself, sitting in an office chair and staring at a 14-in. monitor is no substitute for stretching out on the couch to watch a 50-in. projection TV.

Just as these computers take on some of the features of telephones and televisions, though, expect overlap among all types of infotechnology in the home of the future. Televisions will acquire some of the intelligence of computers and the 2-way communications ability of telephones. Phones, in turn, will integrate video and computing power.

The bedroom, alternatively, might have a telephone with a 5-in. screen as its most distinguishing characteristic.



LIVING ROOM

While your home may be connected to a variety of outside networks offered by cable, telephone or satellite, one Smart TV would integrate them into a manageable system. It would also let you check in with the local utility.

It's a descendant of the P-100 Screen Phone, which Philips Home Services started selling to the general public earlier this year. At the heart of the phone is a communications standard developed at Bellcore, the Baby Bells' research lab, called Analog Display Services Interface (ADSI), which lets visual information be transmitted along with voice conversations on an ordinary phone line. What this means in practical terms is that the phone's readout can guide you through phone calls the way an automatic teller machine leads you through all the steps necessary to withdraw cash from your account.

Screen phones won't just change how you make or receive calls, but also change the nature of the call itself. When you call your discount broker's automated stock-quote line, you don't hear the prices of the mutual funds in your portfolio, you see them. And when you phone an amusement park to plan a family trip, you won't be subjected to a recording that says: "To hear our hours of operation, press One. For ticket prices, press Two. For group sales, press Three. . ." and so on. Instead, the moment you call, all the choices are laid out for you at once on the screen. You read, and then you push the appropriate button.

Meanwhile, AT&T is working on a family of phones due next year that, like the Philips phone, are intelligent screen-based devices. Code-named the Sage Project, AT&T's effort should culminate in three categories of phones, according to Eric Sumner, product vice president for AT&T's

Home Systems unit. Some will work in conjunction with a TV set, others will be integrated into a PC display and others will be stand-alone phones with their own screens.

Sumner suggests that the phone won't even need you to make a call—you could simply program it to dial up weather information each morning, for example, or to display traffic information only if there's news about your usual commuting route. Because faxing has become so prevalent, AT&T's phones will be able to store faxes electronically for later recall. "Fax messages will be treated just like voice messages are today," Sumner says. Printing out the fax will be an option, he says. The new phones could retail for \$100 to \$300, depending on their features.

Inside the living room

The next stop on the tour is the living room, where a quasi-familiar box atop the television set enables reception of cable TV channels. But cable system operators such as Time Warner and Tele-Communications Inc. (TCI) plan to beef up set-top boxes with computing power that will make them the gateway for a wide variety of advanced services. The current generation of set-top boxes are at the level of old Commodore 64 computers, says Larry Miller, vice president of marketing for *TV Guide On Screen*, an electronic version of the magazine planning to be one of the services coming in through the box. It won't be

long, though, says Miller, before set-top boxes have the computing power that's now in a \$12,000 workstation. When that happens, you won't be interacting with your TV with the help of text that looks like a drab VCR menu, you'll be watching 3D animation.

Though the main purpose of your living room TV is to entertain you, if major companies have their way, you'll be using it to lower your utility bill. Collaborating on a TV-based energy management system are cable operator TCI, software developer Microsoft, and utility Pacific Gas & Electric—all giants in their respective fields. The management system is designed to give homeowners real-time information about their energy use so they can conserve the money spent on power. This is a more attractive alternative than making customers wait until they get their monthly bill, when it's too late to do anything about how much power they're using.

The specificity of the information accessible through the TV is remarkable: You can learn how much it costs to run a certain appliance, how many hours that appliance has been running and what percentage of your electric bill is generated by that appliance. The TV will also give you control over appliances, allowing you to raise your thermostat, for example, from 70° to 74° during the summer or schedule your swimming pool's pump to operate at an hour of the day when you'll be charged an off-peak price for electricity.



As different industries attempt to build an interactive highway to family residents, a home may find itself hooked up to several networks at one time: cable, telephone, satellite, land-based broadcast and even CD-ROM. Each network, potentially, would have its own particular set-top box that plugs into the television. "But the consumer isn't going to want a set-top box for every unique interactive service," says Lou Lenzi, design general manager for Thomson Consumer Electronics, maker of GE and RCA home entertainment equipment and a company noted for its emphasis on design. Product designers at Thomson have come up with a prototype "Smart TV" with enough built-in computer intelligence to hook into all of these interactive services without the need for additional hardware.

To make your life easier when you leave the InfoHome, you can take your living room remote control on the road with you, says Philip Anderson, associate professor of business administration at Dartmouth College's Amos Tuck School. You'll be able to customize your intelligent remote the way computer users customize their computers today by rearranging the electronic desktop and programming special keyboard shortcuts. Anderson paints an intriguing picture: Your

personal remote "remembers your preferences, it remembers your settings, it remembers things like your credit card number, [and] how loud you like the volume to be." If you pull out your remote to control a hotel room TV, "Voilà," says Anderson. "All of your preferences follow you around. You don't have to reinvent the wheel."

The expected proliferation of interactive networks and databases could be overwhelming to home users. "If you wander out onto the Internet, it's easy to get lost," points out Lucian Hughes, a researcher at the management and technology consulting group Andersen Consulting. "There's too much stuff." To organize network services in an entertaining, intuitive way, the company has devised a navigation system called Interactive World—a pictorial gateway to online services that looks reassuringly familiar, not cold and futuristic. Interactive World starts as a view of a pleasant town, complete with a school, a clubhouse, a shopping street and even your own home. At all levels, navigating is a visual process, Hughes says.

For example, Hughes speculates that if you wanted to go shopping at, say, J. Crew in Interactive World,

you'd find yourself by a cabin in a rural landscape with people walking by. Click on one of those people, and that person would stop and show you the J. Crew clothing that he or she is wearing.

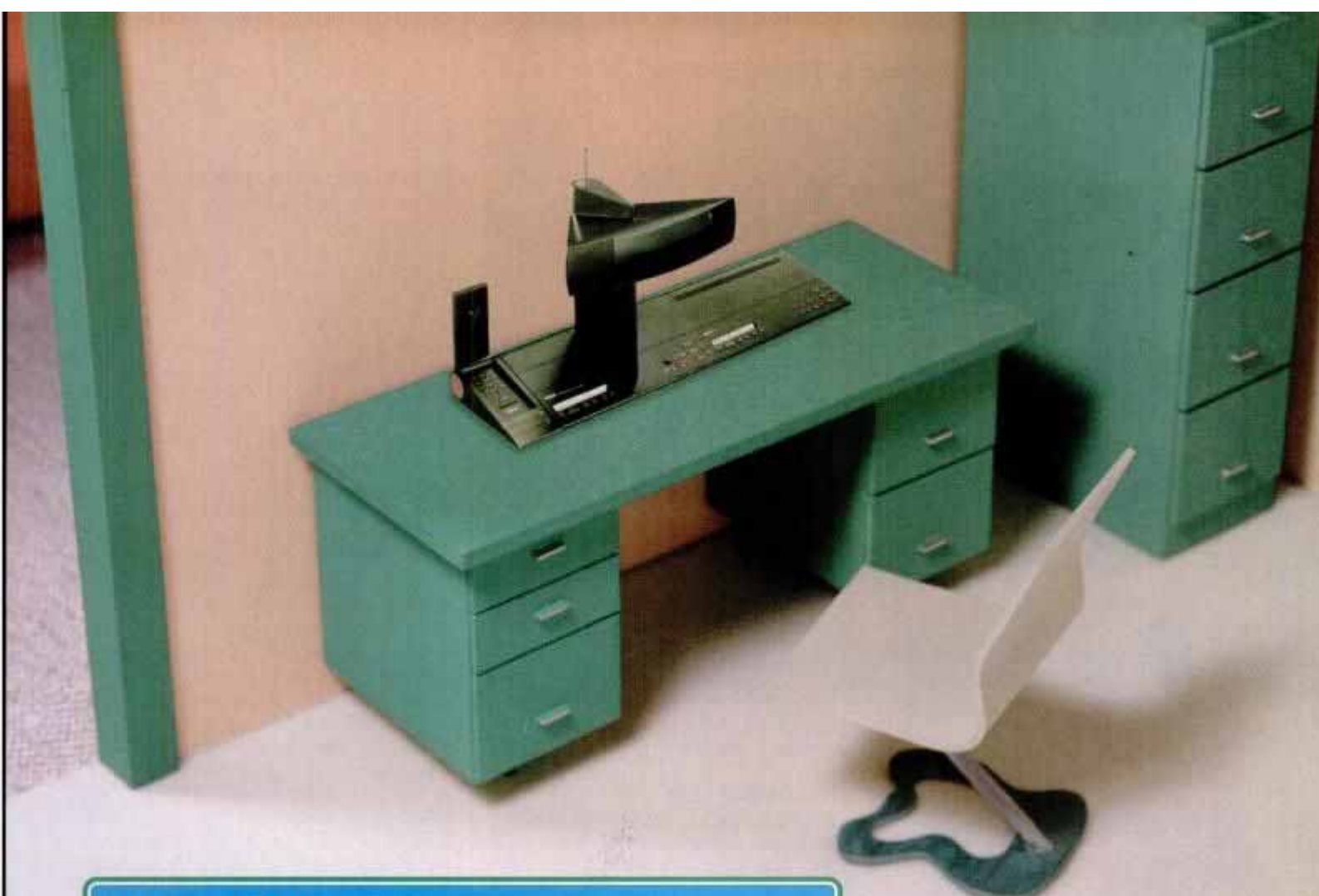
Inside the kitchen

From the real and virtual living room, we go to the kitchen, where a smaller TV sits on the counter hooked into a high-capacity network. What you're most likely to use here is ShopperVision, a service that lets you go grocery shopping on TV. Scheduled to debut in Time Warner's experimental cable system in Orlando, Florida, this fall, ShopperVision promises to not just let you see a product on display, but also electronically pull it from the shelf and turn it around. That way, you can examine the nutritional information on a box of cereal or see how long it takes to prepare a dish. After you've made your selections, your groceries can be delivered to your door.

ShopperVision illustrates a key point about the InfoHome—that the convenience inside requires a lot of work outside. For the Time Warner

KITCHEN

Home-Based Assistants mounted under the cabinet could access a network for a recipe or order groceries. These prototypes from Thomson Consumer Electronics even let you see who's at the door.



HOME OFFICE

One vision of the home office sees a desktop command center that integrates a wireless telephone, two video screens, a VCR, fax machine, copier, scanner and computer. Chances are everything will respond to voice commands.

pilot to work, someone will have to go through a Winn-Dixie grocery store and an Eckerd drug store, taking pictures of each of 27,500 different items on their shelves. That's expected to take two months.

As part of their effort to explore what devices consumers might want in the future, product designers at Thomson have come up with what they call Home-Based Assistants (HBAs) for processing information in the home. "It's a PDA for the home," explains Lenzi, referring to Personal Digital Assistants such as the Apple Newton. Two prototype HBAs are designed to hang under a kitchen cabinet just like present-day TVs, microwaves and other kitchen appliances. One model, built around a 6-in. touchscreen, can serve as a speakerphone, answering machine, audio CD player and CD-ROM display device. The other includes a built-in camera for use as a video telephone.

Inside the home office

In the home office, the computer won't be affected just by the addition of a TV tuner and a built-in phone. On the horizon is the chance to hook into

computer networks and online services at a rate that's staggering in comparison to current telephone modem performance.

Performance Systems International (PSI), a company that sells access to the Internet, has started offering an Internet connection to homes in Cambridge, Massachusetts, through the network of cable operator Continental Cablevision. The peak data rate, using the cable network and a special Zenith modem, is 500 kilobits per second—more than 30 times faster than the 14.4-kilobit modems commonly sold today. Access for businesses is as much as eight times faster still, at the rate of 4 megabits per second. And 10-megabit access for the home is within reach, according to Steve Schoffstall, PSI's director of sales and marketing.

At this rate, you wouldn't have to buy your child the Encyclopaedia Britannica yearbook and have it sent in the mail, says Schoffstall. "I can have them send it to me over the 'net'—not just text and pictures, but video clips, too. The bottom line is that all the programmers in the world today have been programming based on the fact

that all people have 2400- or 9600-baud modems," he says. If families had higher-capacity modems, "all the applications that they do today would get better."

At Thomson, product designers have come up with a gadget that Lenzi calls "our attempt to clean up the home office." Looking something like a periscope on a Martian spacecraft, the device includes a video phone with two side-by-side 5-in. TVs—one for seeing the person at the other end, the other for checking how you look. Built into the prototype is an 8mm-format VCR for presenting prerecorded material during a video phone call or taping the conversation. The unit integrates a speakerphone that doubles as a wireless telephone, communicating with the base via an antenna on top of the periscope. The device also features a combination fax machine/scanner/copier/computer.

You can expect that the computer, as well as other devices in the home, will respond to voice commands just like HAL from "2001"—or, more optimistically, like a computer from "Star Trek: The Next Generation." Already, phone companies including AT&T, Sprint and US West offer different types of voice-recognition calling, with the intelligence that does the



DEN

An editing device would allow you to access educational programming and create multimedia reports. Such a device would be an accessory to an information appliance.

recognizing built into the network.

"I think we're closer than most people realize," says Bob Stearns, vice president, corporate development, at Compaq Computer. "A complete-vocabulary, unaided-speech recognition with a natural response from the machine—I think that's more like 15 years from now," he cautions. "But we're only three years away from very inexpensive voice-recognition products that can follow fairly simple voice commands from anybody."

The same technology could be built into actual phones, too. "We believe that the next thing will be voice-recognition commands, where I just walk to my phone and say, 'Call home,'" says Gerrit Schipper, chief operating officer of Philips Home Services.

Meanwhile, AT&T Bell Labs is working on technology that would make it simple for people to take advantage of complex communication networks. Called HuMaNet, for "Human-Machine Network," the system under development uses a computer-controlled microphone built into a conference room to pick out commands uttered by a particular speaker. In the real world, it's important that such a system be a "robust recognizer," rejecting extraneous noise and voices, says David Berkley, head of acoustics research. "It would be very annoying if you couldn't use this while running the washing machine."

One possible solution? Acoustic

jewelry, says Berkley, that could serve as a wireless microphone.

Inside the den

Near the end of our tour is the den, where you can sit and play with a CD-ROM-based player hooked into a TV set or built into the set itself. Actually, CD-ROM players will be all over the InfoHome. "There are going to be some that are going to be used for entertainment on top of the TV set, and there are some that are going to be used in your office, and some in your kitchen and some in your bedroom," predicts Norm Bastin, executive vice president of software publisher Compton's New Media.

You can also expect higher-density storage capacity on each disc and faster speeds for pulling data off of a disc. The game player might have a 5-disc magazine containing your daughter's favorite games. And executives at 3DO and CD-I developer Philips expect that you'll be able to use their machines as a gateway to telephone or cable networks for entertainment and information. They would be following a path blazed by Sega, which is scheduled to offer networked options soon.

And perhaps assuming there is an information appliance in place, the den might also be a place where children can do their multimedia homework. Thomson's designers have come up with a device that would let students assemble a successor to the venerable book report: a "multimedia report" made of video, a voice-over, and other audio and on-screen text. The "entry-level" machine uses current magnetic-tape technology, Lenzi says, meaning

users won't have to wait around for a recordable CD-ROM.

The InfoHome network

There's one last part of the InfoHome that we haven't seen: the network that links some or all of these devices together. Today in your home you have a telephone junction box and a lot of ports throughout the house into which you can plug a phone, points out Compton's Bastin. In the future, "you'll have a little mini file server sitting down in your basement. You can load up a hundred CD-ROMs into a changer and plug in anywhere in the home—whether it's in the kitchen or the kids' bedroom or wherever—and you'll have access to this information."

Compaq's Stearns has a similar view: Households will link to information networks via an inexpensive computer resembling those servers that function as the heart of today's computer networks. "From that server, you'll be able to distribute what's on the line to various kinds of devices in the home."

That means, says Stearns, having a big-screen entertainment display in the living room and a computer geared for ordering goods in the kitchen. "And you might also have mobile devices that you could take out in the back," he says. If you were building a deck behind your house, "that mobile companion device could be helping you in talking to a library of instructional material that sits in a computer on a server in the home."

And the information network wouldn't be limited just to phones and computers and TVs—it could comprise everything in your household that plugs into the wall, toasters and blow-dryers included. The developing CEBus standard for communication among devices in the home—the technology that Pacific Gas & Electric is using in its test—gives manufacturers the opportunity to put microprocessors in appliances so they can talk to one another through your home's electrical wiring. You could have a VCR manufactured by one company that, when you insert a tape, automatically turns on a TV manufactured by another company and a surround-sound amplifier made by a third. You could have a vacuum cleaner that shuts off when the phone rings or the doorbell chimes. You could have lights that turn on and off in a semirandom fashion when you're away on vacation.

"It sort of boggles the imagination when you think about how this might evolve," says Jim Vander Mey, chief executive officer of Intellon, a company making CEBus equipment. "If nothing else," he laughs, "all the clocks on all the appliances could be kept in sync."

PM



THE INFORMATION APPLIANCE

One machine houses a computer, television, stereo, fax, telephone and CD-ROM player. It's what every well-dressed home will have—soon.

BY STEPHEN A. BOOTH, Contributing Editor
PM Photo by Michel Tcherevkoff

- *"Yo, Ma! You left the computer off the hook again. You children heard me. No PC until you finish your chores."* *"Hey, Buster—you deaf? I said turn that computer down!"* *"Young lady, you get off that modem right this second!"*

"Honey, are you sure you set the lockout code for the WoopiBare Hotline? Those kids are too quiet up there..."

Welcome to the age of the information appliance. It took 10 years for the personal computer to work its way from the office to the home, but the leap from

THE INFORMATION APPLIANCE

home office to family room will occur by Christmas if Compaq Computer and Packard Bell have anything to do with it.

In a departure from the industrial-strength stack of components that has characterized computers to date, each company is introducing a stylish mono-coque appliance that combines data processing functions with communications utilities and audio/video entertain-

ment sources. In plain talk, that's a one-piece computer with all of the following built in, and often more: 14-in. high-resolution color screen; cable-ready TV tuner; compact-disc player for music CDs or multimedia CD-ROMs; high-fidelity stereo speakers and amps; phone/fax modem to swap talk, data, documents or use online services; and a smart answering device to run the switchboard while you're away.

Among IBM-compatible multimedia PCs, Compaq's Presario 500 and Packard Bell's Spectria are the first of this all-in-one type. They're likely to enjoy plenty of flattery in the form of imitation soon.

After color TVs, home PCs are the biggest-selling consumer electronics items in the United States (some 8 million last year). With computers already in a third of all American

households and spreading at a clip of 10% or more yearly, it won't be long before mothers complain about fingerprints on the PC as though it were a refrigerator, or when fragments of exploded bubble gum litter the keyboard instead of the telephone mouthpiece.

Although the Compaq and Packard Bell entries have the concept of an all-in-one info-appliance in common, and similar pricing in the \$1500 to \$2500 range, Presario and Spectria each have unique features, both functionally and cosmetically.

Compaq's Presario 500 keeps a low profile. The oyster-white 15-in. cube

is so discrete that it won't look any more out of place in a bedroom or family room than the ubiquitous second TV. Its Panasonic-made loudspeakers are inset behind grilles just below the screen, but don't be fooled by their modest appearance. They use a ported, bass-reflex design that packs a lot more bass than most tabletop TVs. Clarity in the treble and mid-range is superb, too.

In contrast to Presario's coyness, Packard Bell's Spectria goes out to greet the room it's in and makes what interior-design types call a statement.

The first thing you notice is the speaker columns flanking the screen. Packard Bell calls this the amphitheater look, and there is a bit of classical Greek architecture here. The speakers curve around at the rear and follow the sculpted, wavy contours of the Spectria chassis: This is one computer that looks as good in profile as it does nose-on. There's a bit of Southwestern styling at work, too.

Spectria gets its 2-tone bodywork from detachable color accent panels.

Teal, azure and sahara (terra cotta to classicists) are options, to complement your room decor or even your mood.

Inside The New Compaq Presario 500



But even the standard-issue, pop-off slate panels do wonders to break up the monotony of the typical PC.

Color is more than window dressing for Spectria. It serves a function, too, namely on the connectors for the keyboard and mouse. This might not seem like too much heavy lifting on an all-in-one computer, but Packard Bell now supplies color-coded connectors for all of its many computers, some of



Color-coded connectors make Spectria installation easy.

which have multiple components to hook up. This is a smart move that makes setup easier.

Multimedia power

Both Presario and Spectria are multimedia PCs, meaning they have a CD-ROM drive to play software programs that combine audio, graphics, photos, video and text on compact discs. These are double-speed drives that move graphics quickly from the disc to the screen. Standard music CDs are no problem, of course.

Multimedia PCs have soundcards built in to process digital audio for their stereo amplifiers and speakers. What makes Presario and Spectria act like home music centers is pop-up screens that display controls found on a typical stereo system. You use the computer's mouse controller to program tracks from the CD, as well as adjust volume and balance. Equalizer-style sliders let you customize tone from bass through treble.

In CD-handling, Presario has a neat feature usually found in the most expensive audio components. Whenever you place a new CD in the drive, the computer memorizes the title, artist, song names, track order and playing times. Besides creating a computer file of your CD collection, this library of information means you can program the PC to play songs in whatever order you choose, automatically, any time you insert that CD. Compaq says it would take about 8000 CDs to exhaust Presario's memory.

Spectria doesn't have CD-jukebox memory, but it does have an FM radio

tuner on board, with all the station presets and identification displays you've come to expect in home and car tuners. Neither computer has AM, but both have television—if you want it. This is to say, there's a built-in TV tuner in some but not all Presario and Spectria models.

In their basics, the TV boards are similar: They tune in VHF, UHF and cable stations. Each tuner board displays the program in a window on your PC screen—it's like having a 5-in. color TV for close-up viewing.

Presumably, you'll open the TV window to monitor momentous events while you're pursuing another project on the PC. But when it's third down and goal, Presario's zoom feature lets you fill the screen with the game. This zoom is done digitally, so the picture's a little rough and pixilated. But it's certainly viewable.

Another digital feature on the Presario is freeze-frame. You can, for example, create a stop-action still of the quarterback sneak (the audio continues). If you decide to make a hobby of video editing with your PC, say, from your camcorder movies, this feature would let you incorporate TV images in your productions. For the record, Presario has a video-output jack so you can copy your production onto a VCR.

Phone work

Telephony is a strong point with both Presario and Spectria. Each has a built-in answering center with more than enough personal voice-mailboxes for the whole family. For example, a caller would get an initial greeting, then be asked to press a certain number to leave a message for a specific individual or box. A phone-status screen displaying all the boxes would alert you to messages.

There's no cassette to run out of tape or take forever to rewind—both outgoing greetings and incoming messages are stored in the PC's spacious hard-disk memory. You'll hear them through the PC speakers, but you can

retrieve them from afar, too, just like with a regular answering machine.

With Presario, you can talk through the computer, too. A speakerphone is built in (the microphone's under the screen) and it's one of the finest you'll hear. Compaq uses AT&T's True-Voice microprocessor, so there are no annoying echoes or delays, and its full-duplex operation means the party at the other end isn't interrupted when you begin to speak.

Befitting an appliance, finding your way around the many features of Presario and Spectria isn't much tougher than working a microwave oven. Both use the Microsoft Windows operating utility but simplify it with their own on-screen graphic interfaces. Compaq's MediaPilot and Packard Bell's Navigator not only guide you step by step, but are always at hand to offer help or answers.

Powerplants

We've left powerplants for last, because under the hood these machines are comparable.

Each uses Intel's 486 processor. Presario offers one flavor, the 486SX2 running at a fast 66 MHz (megahertz). It's mated to 4MB (megabytes) of RAM (random-access memory), which you can upgrade to 64MB at a cost of about \$200 for each 4MB. Standard memory storage is an ample 420MB hard disk. Spectria is available with five versions of the 486. Entry level is the 486SX at 25 or 33 MHz. Midline is the 486SX2/50-MHz chip, and the heavy machinery uses the 486DX2 at 50 or 66 MHz. RAM is 4- or 8MB,



Spectria's color accent panels complement a room's decor.

depending on the processor. Hard-drive storage begins at 340MB.

Like Presario, Spectria's RAM can be upgraded to 64MB. Since RAM is the workbench where your PC juggles multiple assignments simultaneously, you ought to up the ante to 8MB. Cool multimedia CDs are getting hungrier for RAM, and you don't want to run out of countertop space for your appliance.

FAST FREIGHTER

Radical new hull design gives the next-generation cargo ship luxury-liner performance.



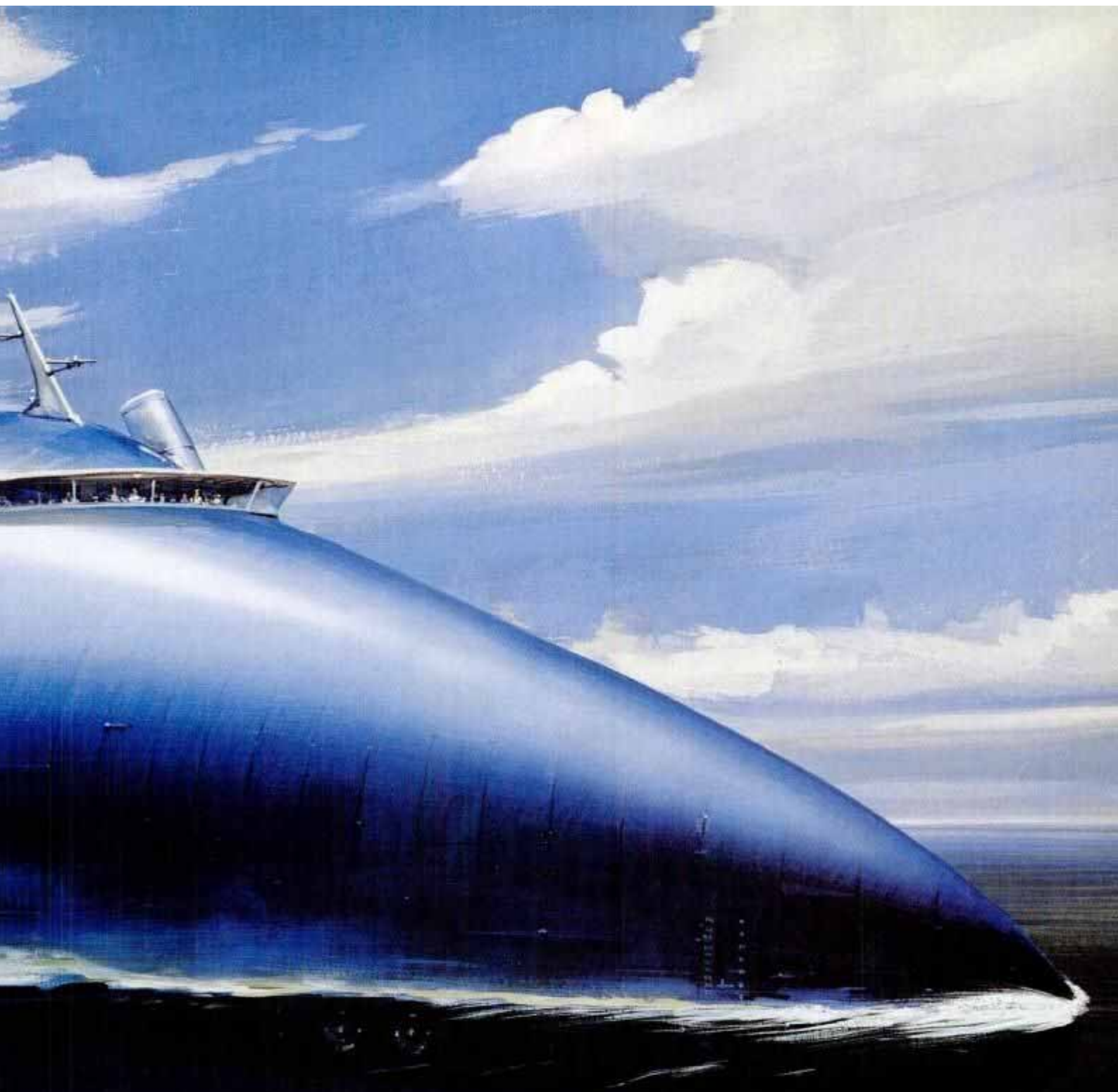
BY CLIFF GROMER, Contributing Editor; PM Illustration by John Berkey

● Forget the Love Boat. The future of shipping lies in rapid delivery of cargo, not romance under the stars. The next-generation freighter will be twice as fast as today's ships, and will look like something Darth Vader would fit right into at the helm. A concept vessel designed by the Kvaerner Masa-Yards, in Turku, Finland, the Euro Express RoRo 225 promises to revolutionize sea shipping and make it more competitive with alternative transport modes.

Present-day freighters operate at a tepid 15 to 20 knots, which is the most efficient speed range to optimize the cargo/fuel-capacity balance. More speed from these vessels is possible, but not practical. Today's cargo ships also suffer from relatively long loading and unloading times, exacerbated on occasion by the need to change the cargo-handling equipment because of a diverse load.

Starting with a clean sheet of paper, the folks in Finland went back to basics and looked at the three major ways of supporting a ship and its cargo. Displacement vessels—those riding through the water—are supported by static lift that is generated by the displaced water. Boats such as hydrofoils—a common design of fast passenger vessels—rise out of the water on dynamic lift. Air-cushion vehicles use powered static lift, and hybrid designs combine two or even all three lift forces. In all these cases, lift-system efficiency is evaluated with a drag/lift ratio—the same as is used to judge the performance of an airplane wing. Drag/lift is more appropriately called resistance/weight when applied to ships, where weight is equivalent to displacement.

Not surprisingly, displacement-hull ships show a rapid increase in resistance with increasing speed. But



they have one big advantage, which was the deciding factor for the Finns: When displacement increases above 2000 to 3000 tons, displacement-hull ships need less power than alternative designs, all of which require substantial muscle to lift such weight.

To achieve speeds in the 30-knot range, however, displacement ships require a narrow hull, which minimizes resistance. What's more, length must be at least 200 meters to prevent the ship from rising out of the water and planing. Riding on the surface, rather than plowing through the water, the ship would tend to follow the contour of the waves. In bad weather, this would make for handling—not to mention stomach—problems. So RoRo 225 designates the ship's length—a lanky 225 meters (738 ft.) long.

Having settled on the displacement category, the designers also had to consider hull options, which

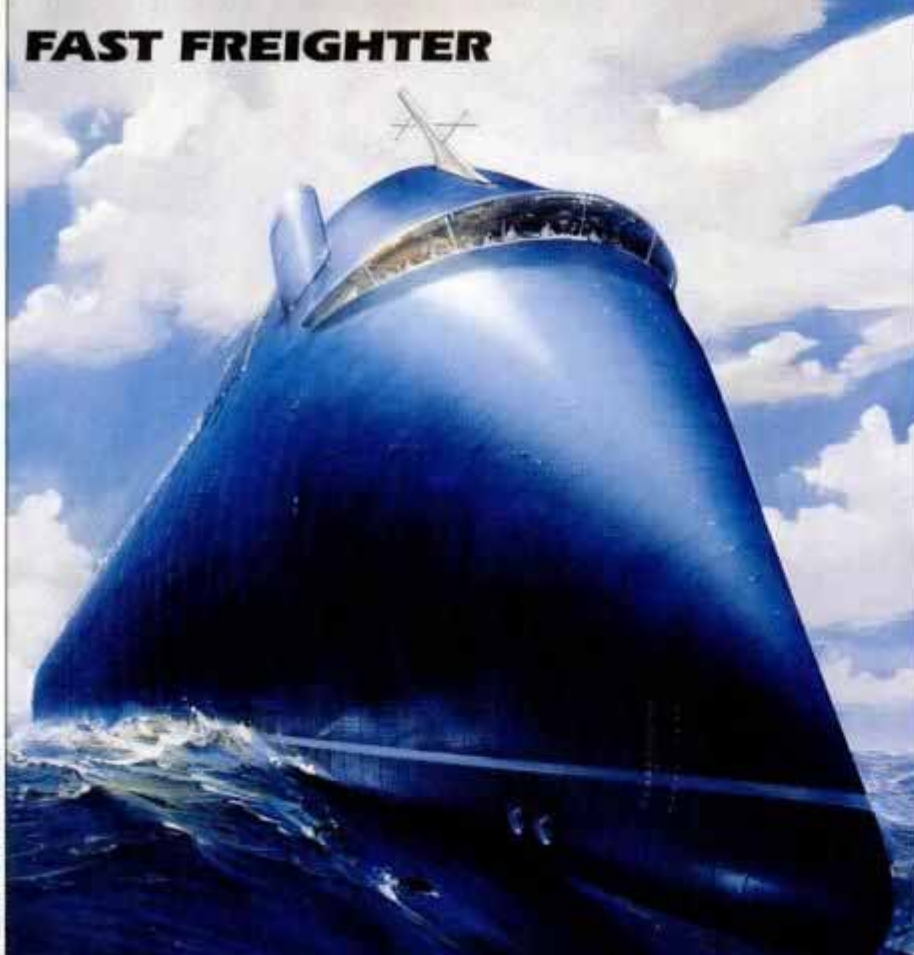
include monohull, catamaran and trimaran shapes. Model tests showed that the propulsion power for the same displacement decreased as the hull shapes became more slender, because resistance fell off. But the catamaran and trimaran designs demanded higher power levels than the monohull with the similar slenderness ratio. So the monohull design got the nod.

Frontal attack

Bow design is as critical to performance as overall hull shape. Conventional freighters use a wide, fairly flat bow, primarily to carry payload. Subjected to the heavy slamming loads generated by blasting through waves, the bow area requires heavyweight construction.

But the Euro Express saves considerable weight and cuts drag, with its wave-piercing bow design. The ship slices, rather than slams, through the waves.

FAST FREIGHTER



The tubelike hull shape is built like an aircraft's monocoque fuselage for strength and reduced drag.

Needle-nosing the Euro's bow helps inject the ship through the waves, but there's a flip side: The bow is too narrow to carry cargo, which means less payload. Even so, the forward area is put to good use by housing the new, efficient twin General Electric gas-turbine generators, which each produce 55,000 horsepower.

Conventional ships usually locate the primary powerplant amidships, driving the propeller directly through a reduction gear in a unit power design. But the Euro Express breaks up and separates powertrain components by using a separate electric motor to drive the prop through a reduction gear. The prime power sources (the gas-turbine generators) are located in the bow, and the electric prop motor, aft. The loss in driveline efficiency, versus direct drive, is only about 5% to 6%. This is offset by having an unobstructed midship cargo area, as unit drive systems can intrude into payload space.

Beyond filling otherwise vacant real estate, the Euro Express power arrangement lends seakeeping ability. Conventional freighters sometimes mount the prime power source up on the weather deck, as the bow area is used for cargo. But this raises

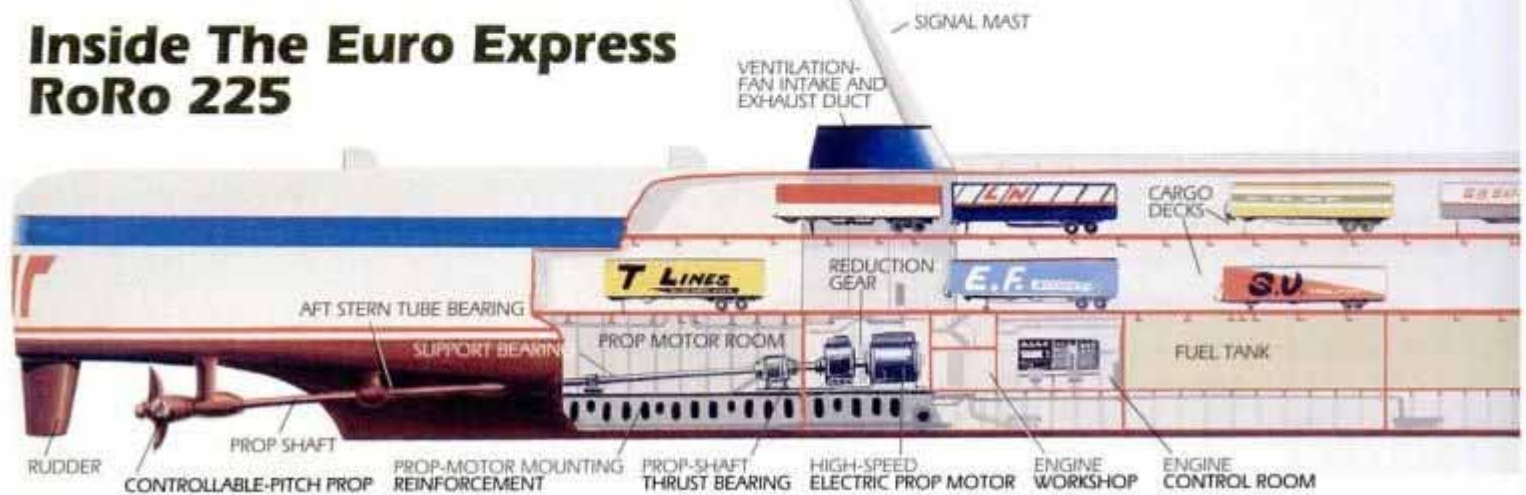
PH ILLUSTRATION BY JOHN BENNETT



A 1/40-scale model Euro Express underwent development in a test tank to determine power requirements and seakeeping ability, or how the ship behaved in simulated rough-sea conditions.



Inside The Euro Express RoRo 225

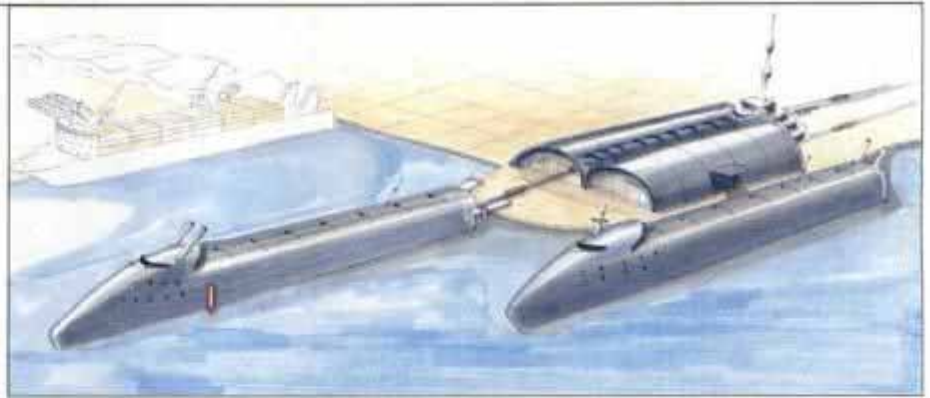


the ship's center of gravity and adversely affects stability. In contrast, the Euro Express mounts the heavy components low in the ship.

Much of the Euro's weight savings comes from building the hull from lighter-weight, ultrahigh-tensile steel that is about 50% stronger than conventional steel. While high-tensile steel requires different welding techniques, shipyards can still use the same welding equipment as they do when building ships with conventional steel. They simply adjust the speed and current output of existing welding machines, to maintain the steel's fatigue strength.

Although high-tensile steel is being used to build bridges in the U.S., it cannot now be used in American shipbuilding since there are no standards for it in place by the American Bureau of Shipping Classifications. That needn't stop overseas shipyards from using the metal, however.

The Finns saved even more weight by designing certain structures, such as crew quarters, from fiberglass. A common material in pleasure boats, fiberglass is usually unacceptable in large commercial vessels because of the toxic fumes created when it burns in confined areas. But using fiberglass on the open deck areas minimizes the fume problem. Overall, compared to the same vessel built with conven-



Simpler docking facilities are required for the Euro Express, which ties up at the rear.

tional steel, the low-fat Euro Express enjoys a 20% weight savings, which allows double the payload capacity compared to the same ship built with conventional steel.

Tales from the dockside

Efficient underway, the Euro Express offers other advantages over current cargo ships dockside. Highly maneuverable with twin props, rudders and bow thrusters, the Euro Express can dock without the need for tugboats. Both conventional freighters and the Euro Express use multilevel cargo decks, but that's where the similarity ends. The standard way a freighter takes on cargo is via crane through the upper deck into the main hold. Forklifts and other equipment then distribute the cargo to other

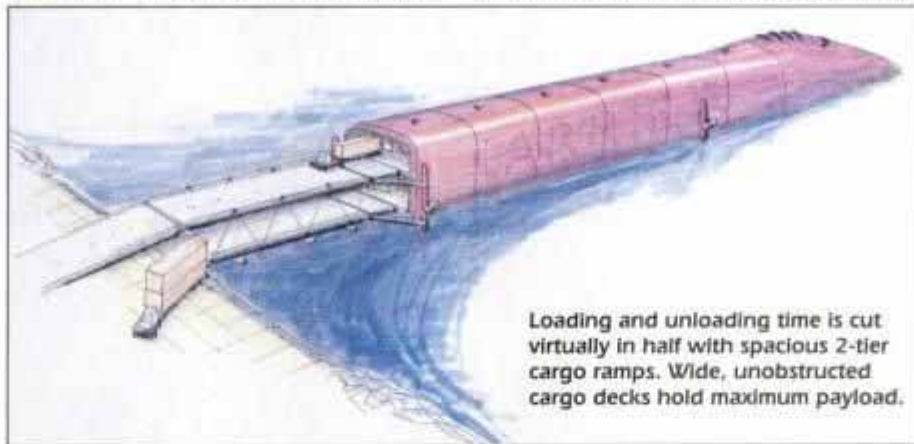
levels via an internal ramp system.

By contrast, the Euro Express loads its cargo via the rear of the ship through its upward-opening stern gate. Separate loading ramps lead from the dock to each cargo deck and eliminate the internal ramp system. RoRo has nothing to do with oars—it's short for roll-on, roll-off. Trucks or cargo transporters drive right into the ship and simultaneously load each cargo deck. Loading and unloading time is cut virtually in half.

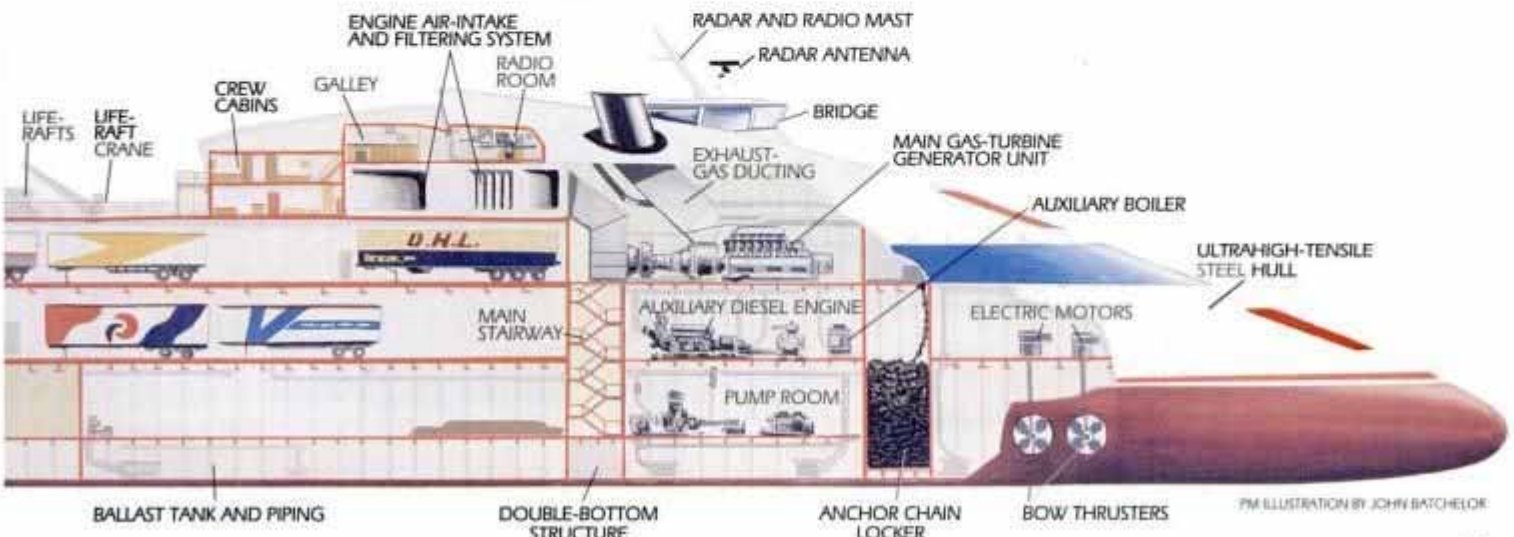
Because of this stern-loading arrangement, port facilities for the Euro Express would require a different setup than for conventional freighters. The shore facilities would be simpler and less costly, because a side-loading dock with cranes isn't even required. The Euro Express would back into a stern tie-up, the way passenger ferries do today. A separate securing link would hold the bow fast, and the stern ramps would be secured to the cargo decks.

Simplified docking also lends itself to an automated mooring system, which would reduce time in port even more.

Fast freighters will most certainly be a reality by the year 2000. While more than one design no doubt will be competing for the business, the Kvaerner Masa-Yards, with their Euro Express RoRo 225, looks to be a fast finisher. **PM**



Loading and unloading time is cut virtually in half with spacious 2-tier cargo ramps. Wide, unobstructed cargo decks hold maximum payload.



PM ILLUSTRATION BY JOHN BATCHELOR



KNO

SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

100's, 16 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.



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HONDA ACCORD

A true Japanese-American hybrid.

BY MICHAEL LAMM,
Contributing Editor
PM Photos by George Olson

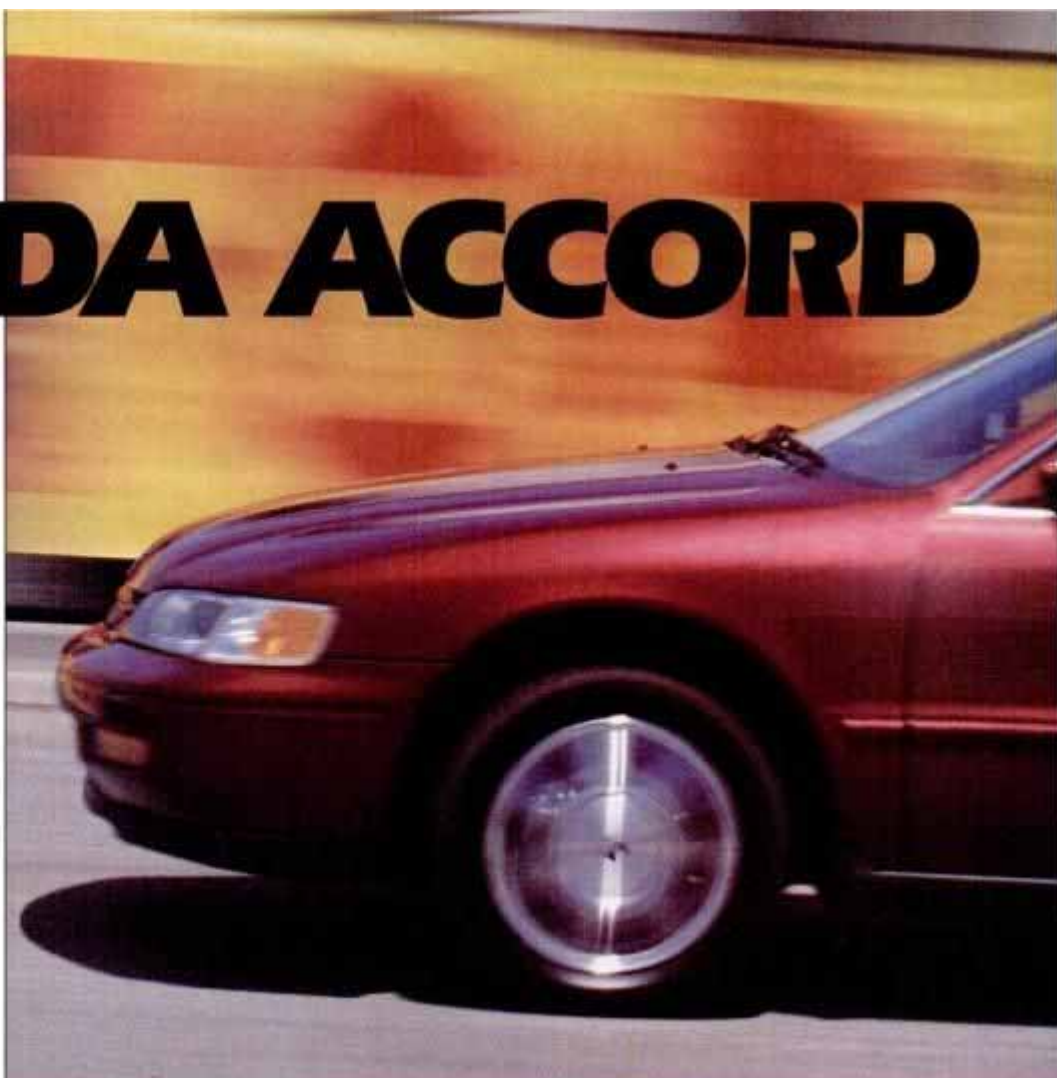
● Honda has sold more than 7.5 million Accords since the nameplate first appeared in 1976. In 1990, the Accord sent the domestic industry reeling when it became the best-selling passenger car in the United States. Then, just to prove it was no fluke, the Honda maintained the No. 1 spot for three seasons, through 1992. Since then, the Accord has continued to outsell every car but its arch rival, the Ford Taurus. And each year that sales battle has been going down to the wire.

Since 1982, Accords have been built in the United States, in Marysville, Ohio. This current-generation Accord—the fifth—contains about 80% American-sourced parts, roughly the same as the Taurus. Based on its popularity as well as its content, the Accord is now about as American as apple pie.

The Accord spans a broad price spectrum. The base DX coupe stickers out at just over \$14,000 and the top-

of-the-line EX 5-door wagon goes for about \$23,000. With a coupe, sedan and wagon in that price range, the Accord butts heads not only with the Taurus (and Sable) but now with the new Ford Contour/Mercury Mystique as well as a myriad of other domestic and imported models.

Some of the Accord's competition include Chrysler



SUMMARY OF HONDA ACCORD OWNERS REPORTS*

Total miles driven	1,145,510	Poor	0.0	Noises and rattles	7.3	Repair it yourself?	
Average miles driven	4938	Braking:		Lacks interior space	7.3	No	100.0%
Purchase price:		Excellent	70.0%	Engine not powerful enough	6.7	Yes	0.0
Average	\$18,632	Good	29.1	Poor vision to rear	6.1	Dealer repairs satisfactory?	
Range	\$14,900-\$23,616	Average	0.8	Suggested changes:		Yes	69.0%
Why did you choose the Accord?		Poor	0.0	No changes	13.4%	No	31.0
Previous ownership	47.7%	Overall performance:		More powerful engine	13.4	Dealer service opinion:	
Styling	22.1	Excellent	68.1%	Bigger trunk opening	8.7	Excellent	57.0%
Reliability	19.4	Good	38.1	More comfortable seats	7.6	Good	38.8
Reputation	18.9	Average	0.8	Less car noise	6.4	Average	2.4
Good price/value ratio	13.1	Poor	0.0	Workmanship opinion:		Poor	1.8
Quality	10.8	Control layout:		Excellent	74.1%	Dealer sales policy:	
Model choices:		Excellent	65.1%	Good	24.1	Excellent	47.2%
Top-line Accord EX	49.0%	Good	32.8	Average	1.7	Good	45.0
Midline Accord LX	48.1	Average	1.3	Poor	0.0	Average	6.1
Base Accord DX	2.9	Poor	0.9	Front seat comfort:		Poor	1.7
Body style choices:		Instrumentation:		Excellent	65.5%	Number of vehicles owned:	
4-door sedan	93.4%	Excellent	65.4%	Good	31.9	This vehicle only	23.3%
2-door coupe	6.6	Good	32.9	Average	1.7	Two vehicles	50.0
5-door wagon**	0.0	Average	0.9	Poor	0.8	Three vehicles	18.3
Avg. mpg, city/hwy:		Poor	0.9	Rear seat comfort:		Four or more	8.4
5-speed manual	25.4/30.3	Driver sightlines:		Excellent	36.8%	Principal driver:	
4-speed automatic	24.6/30.2	Excellent	65.5%	Good	52.7	Female	58.7%
Transmission choices:		Good	28.4	Average	9.1	Male	37.4
4-speed automatic	74.2%	Average	5.2	Poor	1.4	Equal	3.8
5-speed manual	25.8	Poor	0.9	Overall comfort:		Age distribution of owners:	
Engine power:		Specific likes:		Excellent	59.9%	Under 29	15.2%
Excellent	53.8%	Styling	46.6%	Good	36.6	30-49	42.2
Good	40.3	Handling	43.8	Average	3.5	50-plus	42.6
Average	5.5	Comfort	26.0	Poor	0.0	Based on your experiences, would you buy a Honda Accord if you had it to do over again?	
Poor	0.4	Riding qualities	17.8	Any mechanical trouble?		Yes	77.1%
Handling:		Performance	16.3	No	87.1%	Maybe	19.9
Excellent	75.5%	Specific dislikes:		Yes	12.9	No	3.0
Good	23.6	No complaints	10.6%	What type of trouble?			
Average	0.8	Uncomfortable seats	7.8	(Too few replies to tabulate)			

* Percentages might not equal 100% due to rounding up or insufficient data. ** Not available at time of survey.



Corp.'s LH sedans, the Toyota Camry, the Nissan Altima, the Mazda 626, the Mitsubishi Galant and many General Motors models.

Short menu

For better or worse, Honda markets the Accord without any factory options. Accords come in three series: DX, LX and EX. The base DX gives you a goodly amount of standard equipment, including dual airbags—but not, for example, air conditioning. If you

want air, you've got to order the LX or EX. For antilock brakes, you have to order the EX. And you can't get a DX with a/c nor an LX with ABS or a power moonroof. So you're buying packages, not individual options, and some of the owners we surveyed said they didn't particularly like that.

Other carmakers let you order ABS or power door locks or cruise control on any model, even the least expensive. And that might be one reason only 2.9% of our respondents bought the DX series. The majority (49%) went for the \$20,000-plus Accord EX.

At present, the Honda offers two versions of the 4-cylinder Accord engine, though a V6 is due any day now. Both Fours displace 2.2 liters, and have twin

cams, 16 valves, dual balance shafts and aluminum blocks. The big difference is that the EX version comes with Honda's VTEC variable-cam technology, which controls valve lift and duration. In the Accord EX, VTEC plus better manifolding and air injection result in 5 more horses (130 hp versus 125 in the DX/LX). The VTEC Four also gives greater fuel economy and stronger low-rpm torque. Owners praised their cars' 25- to 30-mpg thriftiness, but 13.4% noted that they'd like more power for merging, passing and climbing hills.

That tallies with the fact that almost half of our readers ordered the Accord EX with the punchier VTEC motor.

Most Honda Accord buyers had owned the marque before, and that's the

main reason nearly half (47.7%) chose one again. A New York teacher confided that this was his 12th Honda. The Accord coupe had just become available when we sent out our questionnaires, and the wagon was still a gleam in the dealer's eye, so we can't report on those two body styles. The Accord sedan, though, pleased the vast majority in terms of comfort, ride, sightlines and silence. "Bigger than it looks," observed an Ohio market researcher. A few owners grumbled about seating, saying they'd like better or different



Most everyone loves the dash and controls.



Many felt the car needs a stronger engine.

HONDA ACCORD



Swoopier than before but still conservative, the Accord's styling is appreciated by most and offends few. Appearance was not a major buying factor, however.

EDITORS REPORT

An American-Made Japanese Icon

● The Nikon camera. The Sony television set. The Seiko watch. The Honda Accord. As much—perhaps more—than anything else, these four products totally reversed the connotation of that once laughable label, “Made In Japan.”

With enviably high quality at affordable prices, these products helped stamp the Japanese as solid manufacturers. And cars wearing the Honda nameplate helped launch the assault on our auto industry (an assault from which Detroit is finally recovering).

But a funny thing happened along the way: The Accord lost its “Made In Japan” label, replacing it with a “Made In The USA” one. And hardly anyone who's owned an Accord has complained. In fact, thanks to its solid sales success across the breadth and depth of the country and the fact that it is built in our heartland—southern Ohio—the Honda Accord has become a familiar and very American car. It's also an American car that boasts a reputation for the same high quality that its Japanese-manufactured siblings enjoy and its American-made brethren strive for.

The curious part of all of this is that despite the Accord's familiarity as an “American” car, it's really quite different from American sedans.

For one thing, the Honda engines—the two Fours and the soon-to-be V6—deliver a very high-revving, narrow band of power. As amazing little engineering gems as these powerplants are, they do not deliver gobs of

grunting torque, and the torque that's there is farther along the rev range than it is in your standard-issue, relatively big-bore domestic sedan engine. Yet, fewer than 7% of our respondents complained about a lack of power. More than power, the Accord cries out for more tractability and a broader torque band, especially to help the automatic cope with around-town driving and freeway passing. Hopefully the new V6 will fix this.

The Accord is also distinctly different from most family sedans in the amount of room to be found inside the car, as well as in how much room the car takes up on the road. The fact is, the Accord is smaller, inside and out, than most of the cars against which it competes. But only about 7% of our survey respondents felt that the car was too tight a fit. However, long-legged drivers and front-seat passengers find themselves wanting just another inch or so of rearward travel for those front seats.

Like the interior, the trunk—and its opening—is on the small side, making the loading and carrying of American-size cargo (like that large-screen Sony TV) difficult to impossible.

Yet, despite its obvious Japanese roots, the Accord does pay excellent homage to the American-sedan ideal with its quiet, comfortable—almost cushy—and well-isolated ride. It's not that difficult to see how this well-made, carefully engineered sedan has assimilated itself into our culture.

—Don Chaikin

lumbar support, both front and rear. The lack of lumbar support became especially noticeable on long trips.

Solid quality

Lest there be any question about the quality of a “Japanese” car made in Ohio, 98.2% of those surveyed rated workmanship good to excellent. Fact is, 74.1% gave it a flat-out excellent rating, not bad in anyone's book. And a number of owners cited Honda's reputation for durability. A retired military man from Colorado boasted that his 1982 Accord has logged 180,000 miles without any major engine work. “Uses maybe 2 tablespoons of oil between 3000-mile changes,” he noted.

Most owners like the Accord's styling but weren't overwhelmed by it. Some called it sporty, and others used the word “classy.” Short drivers said they had a little trouble seeing over the upward-sloping rear parcel shelf and high decklid. Others mentioned that the trunk opening wasn't large enough.

The sun visors didn't impress anyone: cheap looking and feeling, and ineffectual, and the lighted vanity mirror was on the “wrong” side. A Kentucky mom hoped Honda might offer more dark-colored interiors, as in the past. “For soccer and baseball families like mine, this light interior demands constant nagging and cleaning.”

Not many new Accords required dealer service during the 4938 miles our average owner had put on his or her car, and not enough consistent problems cropped up to be statistically significant. The little things that did go wrong were infrequent and minor, like automatic antennas icing up and not going down all the way. Dealer sales policies got good marks, as did dealer service. However, a few drivers complained about the high cost of parts and service. And then we got the old gripe about the high price of the car itself.

Our questionnaires went out during wintertime, and drivers in snowy areas praised the Accord's handling on slippery surfaces. The EX's anti-lock brakes helped a lot, according to those who needed them.

By and large, then, the Accord continues to please the faithful and new buyer alike. Many owners in our survey had young, growing families, so they couldn't be sure they'd opt for a 4-door sedan as their next purchase. Nearly 20% said they weren't sure they'd buy an Accord again, not because of any dissatisfaction with the car but simply because they'd probably be ready for something larger, like a minivan, next time.

PM



WINGS OF MERCY



A new flying eye hospital promises sight for the needy and medical skills for the developing world.

BY WILLIAM GARVEY; PM Photos by Brian R. Wolff

● **Fact:** More than 42 million people in the world are blind. For most of those people, proper treatment can cure their blindness or could have prevented it.

Fact: 90% of the world's blind live in developing countries where resources are lean and eye-care services lag behind those in richer, industrialized nations.

Fact: The situation is tragic and worsening.

The obvious solution to these problems is to get modern ophthalmologic care where it is most needed. Far less obvious is how to accomplish that goal and to make up-to-date eye care a permanent reality in regions where it does not now exist.

Enter Orbis, an eye-care teaching hospital on wings. A nonprofit operation dedicated to fighting blindness worldwide, Orbis travels to virtually any country whose ophthalmological society extends it an invitation. The aircraft touches down with a full complement of staff doctors, nurses and technicians, as well as a revolving group of practicing ophthalmologists. During each 3-week mission, this volunteer faculty provides hands-on instruction to the local medical community.

The value of an Orbis visit is inestimable—what is a blind child's first glimpse of her mother worth?—but it comes without charge. Not a nickel.

Orbis began in 1982 with a converted Douglas DC-8 donated by United Airlines. In a dozen years, that air-



Orbis's mid-fuselage operating room doubles as a learning theater for eye surgeons, who can watch through picture windows.

craft provided training for 28,000 doctors and nurses and restored the sight of 18,000 patients in 70 countries. Then the oldest DC-8 in operation, it has now retired to a museum in China. And it's been succeeded by a McDonnell Douglas DC-10 unlike any other.

The new aircraft embodies mechanical contradiction. A teaching hospital, it is also a jumbo jet. Crammed with gear, it accommodates crowds comfortably. It contains highly advanced, supersensitive devices, yet it is virtually self-sufficient, able to function at its peak in the most desolate places.

Satisfying those contradictions required more than three years for planning, design, stripping, overhaul, manufacture and installation. The Orbis conversion—



The audiovisual room produces videos to teach new procedures, while satellite-communications dish serves Orbis in remote locations.

a \$10-million job for which the Orbis International organization is still raising money—took place at Mobile Aerospace Engineering in Alabama.

The gleaming new jet emerged last spring. Today, the flight deck and forward fuselage seem unchanged from its airline days. The cockpit is crisp but standard. Behind it, the passenger compartment looks like a typical coach configuration. But first impressions can be misleading: This is not the 4:30 shuttle to Washington.

First-class education

The passenger cabin is actually a high-tech interactive classroom. Up front lies a presentation area for large-screen film, slide or chalkboard visuals. To record lectures, video cameras stud the cabin's walls. In addition, several TV monitors provide for live and taped broadcasts. And while the monitors show an ongoing eye operation, the seated attendees can use the cabin's microphones to converse with the surgeons.

Immediately aft of the classroom is the audiovisual room. Here, Orbis personnel monitor and direct the aircraft's 17 cameras, all broadcast-quality Sony Betacam SPs. Videotape plays an invaluable role. The staff has created a library of more than 150 tapes on eye surgery and treatment, which it distributes during each mission.

Re-engineering an airliner to carry a welter of electronics wasn't easy. The wiring alone weighed so much that engineers feared it might overstress the floor. Consequently, during the plane's conversion, the bundles were split with some supported by the floor and the rest suspended from the ceiling.

Continuing aft along the single port-side aisle, you next encounter the laser/exam room. Here, physicians can diagnose diseases such as cataracts, trachoma, glaucoma and river blindness. Doctors can often rectify the disorders using the aircraft's argon, YAG and solid-state lasers. As in all the rooms aboard the aircraft, video cameras record procedures and transmit them to the classroom.

Moving farther rearward, you come to the jet's multifunction conference room. When Orbis arrives, it invariably attracts media and VIPs (everyone from Mother Teresa to Fidel Castro toured the old DC-8), and this is where the heavy hitters are briefed on the DC-10.

On-board operations

Back in the aisle, you'll move all the way down to the rear of the aircraft.

There, a doorway on the left opens into another large room. Three gurney beds jut out from the right wall. Each is surrounded with heart/blood-pressure/temperature monitors, intravenous trees, oxygen ports and similar post-operative patient gear.

If you've ever had surgery, this is familiar turf:



Welcome to the recovery room, albeit with a long row of airliner windows. Here, patients are prepped for surgery. Then the gurneys wheel forward through swinging doors into the substerile area, where medicines are prepared, surgical utensils are sterilized and doctors scrub.

Continuing forward, more swinging doors lead into the operating room. Planted between the wings—the most



The exam room features stereo microscopes and lasers, while patients receive pre- and post-operative care in aft recovery room.



The classroom is the heart of the Orbis mission, where traveling ophthalmologists share knowledge with local physicians and nurses.

stable part of the aircraft—the room rests on reinforced flooring. And it's as advanced as any ophthalmological OR you'll find on the planet.

At the center of the room is a Zeiss operating microscope, employed for such procedures as corneal transplants. The room is festooned with cameras (including one within the microscope) that transmit the proceedings onto monitors. Picture windows permit VIPs and others to view the medical procedures without crowding into the operating theater and compromising sterility.

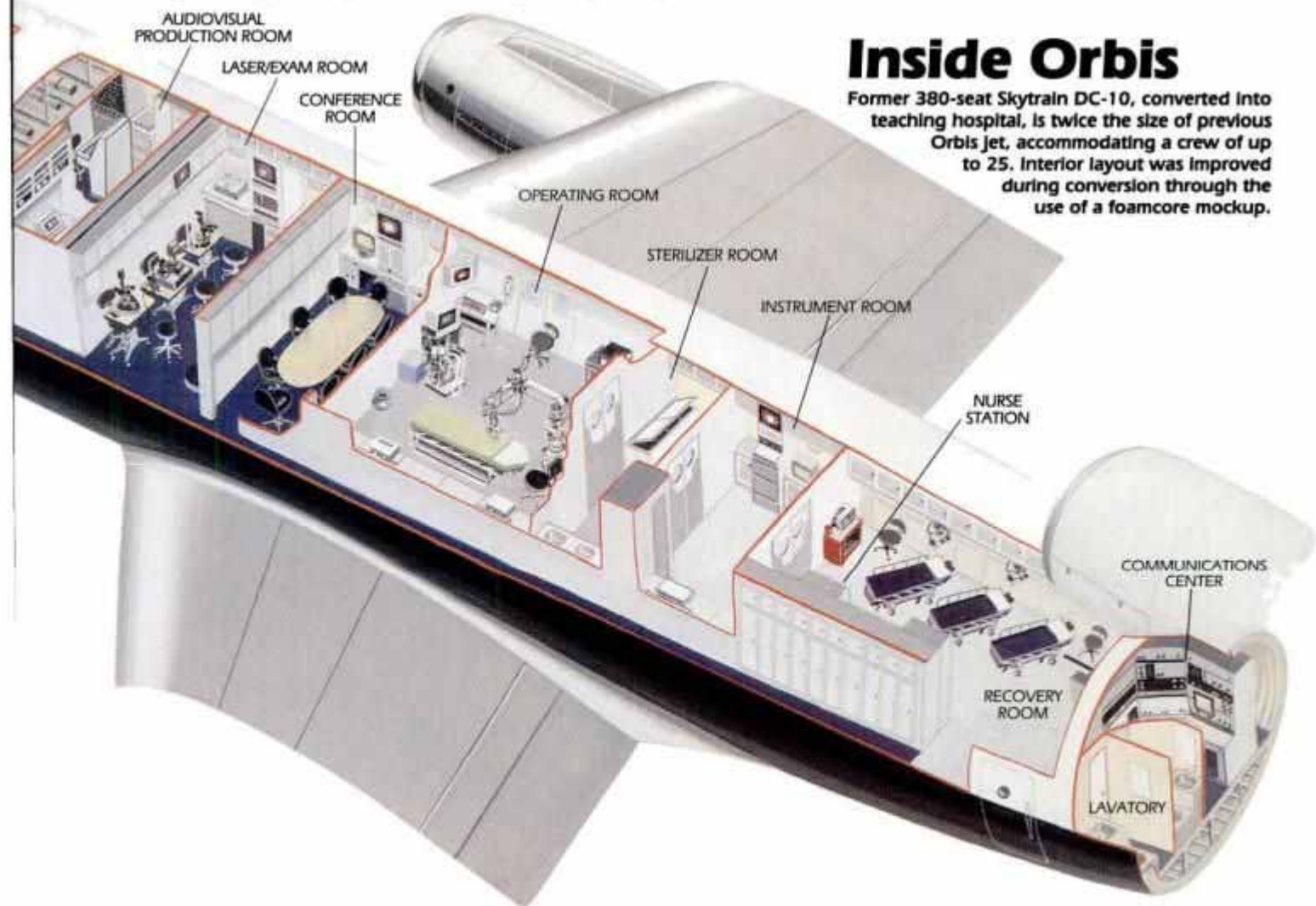
Meanwhile, belowdecks in the cargo hold are six standard LD-3 containers, modified specially for Orbis. Three of them house diesel generators—two for electricity and one for air conditioning—which deploy on the ground when necessary. The aircraft can also plug into any local power source.

Much more than a collection of mechanical components, however, Orbis represents the best of humanity: It encompasses technical genius as well as selfless assistance to relieve suffering among strangers.

The \$14-million purchase price of the DC-10 was covered by donations from FlightSafety International founder (and Orbis's unpaid chairman) A.L. Ueltschi, Hong Kong businessman Y.C. Ho and one anonymous contributor. But to keep flying, Orbis depends exclusively on the generosity of those who can give—money, material, services or time. If you'd like to learn more about Orbis's work, or if you're interested in contributing in some way, contact Orbis International, 330 W. 42nd St., Suite 1900, New York, NY 10036. **FM**

Inside Orbis

Former 380-seat Skytrain DC-10, converted into teaching hospital, is twice the size of previous Orbis jet, accommodating a crew of up to 25. Interior layout was improved during conversion through the use of a foamcore mockup.





A split personality: The Aquastrada Delta keeps company with sports cars and sport boats. Shift-on-the-fly capability enables the Delta to engage the jet pump with the push of a button while rolling down the launch ramp.

AQUASTRADA

Fast on land, fast in the water. This new car-boat is what the Amphicar should have been.

BY JOE SKORUPA, Boating/Outdoors Editor
PM Photos by George Olson

● To a kid in the early 1960s, the Amphicar was the coolest car in town. Well, one of the coolest. Remember the Amphicar? It was a little convertible import (called a foreign car back then) that ran on land and water. It performed neither operation well, but it caused quite a stir when driven down the launch ramp and into the water.

Today, the West German-built Amphicar is a curious footnote in automotive history. It ceased production in the 1970s, but the dream of a dual-medium vehicle has never died.

There have been several attempts to build a better Amphicar in recent years. Two that come to mind are the French-built Hobbycar and the German-built Amphi-Ranger—neither of which made much of a splash.

The most recent entry has a better shot at succeeding. It's called the Aquastrada Delta, an amphibious vehicle built by a group of entrepreneurs from Northern California. Like a typical Silicon Valley skunk-works project, the model tested for this story is a proof-of-concept vehicle that's been assembled on weekends and nights by a dedicated team of gearheads. Heading up the team is designer Gary Gere, a staff engineer at Sun Microsystems.

Gere began the Aquastrada project with a simple idea: Instead of building a car with marine capability, build a car that's really a boat.

This is a completely different approach than that taken by Hans Trippel for the Amphicar. The Amphicar was not only underpowered for the road (with its 43-hp 1.2-liter 4-cylinder Triumph engine), but it had a top speed of about 5 mph in the water. For an old road-racer like Gere, any vehicle worthy of a wrench has to be fast. In this case, fast on land and fast on water.

To accomplish this feat, Gere started with a truck engine—a marinized 351-cu.-in. 245-hp Ford Windsor block. To this he mated a Ford C6 truck transmission. From here, things get creative.

The Amphicar achieved marine

propulsion by running two prop shafts out of the transfer case. Steering was controlled (suggested, really) by using the front wheels as rudders.

Gere improves on these systems by using a Dominator jet-pump engine instead of props. This not only delivers impressive thrust, but swivels from side to side to achieve true marine steering.

Power is delivered to the jet pump through a Ford Bronco 4wd transfer case, which is installed upside down. The shaft normally used for 4wd gearing now runs to the jet



Ford truck engine, transmission and transfer case comprise the powertrain.

pump. At the push of a button, the Delta goes from 2wd to jet drive, or both. For steering, a standard rack-and-pinion unit is fitted with cables that run to the jet pump. The result is that steering on land and water is accomplished by using the same wheel.

Externally, too, the Delta is a different animal than the Amphicar. The body is basically a standard fiberglass hull made with a layer of foam coring for stiffness and a shallow-V bottom for improved tracking and getting up on plane.

Without doubt the crowning achievement of the Delta is a retractable sus-

pension that pulls the wheels up and into the hull. This system accomplishes its unique feat by using split axles and a sleeve-and-rail structure connected to the suspension mounting arms. Pneumatic servo units pull the suspension arms inward, which has the effect of raising the wheels into dedicated compartments. In this position, seals make the wheel wells watertight.

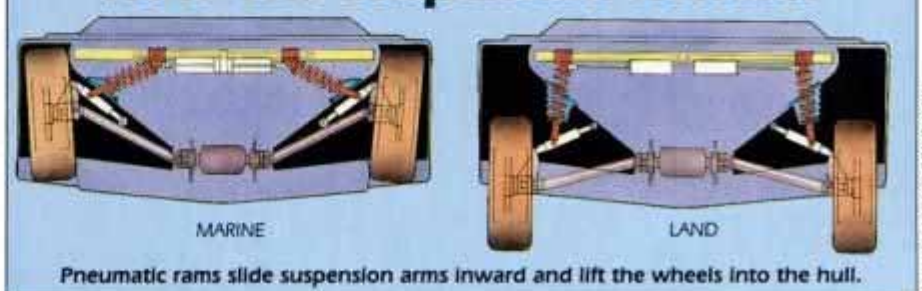
The Delta had no trouble maintaining passing speed on the freeway south of San Francisco. On the water, it was able to plane and keep up with sport boats on a busy recreational lake. Performance is estimated to be 100 mph on land and 45 mph on water for production vehicles.

Much will change when the Delta moves into production models in the coming months, but the specifications are projected to be as follows: weight: 2830 lb., length: 222 in., width: 93 in., wheelbase: 139 in., ground clearance: 10 in., draught: 6 in., free board: 30 in., retail price: \$25,000 to \$35,000.

For anyone interested in finding out more about the Delta, contact Bei Ming Wang, president of Aquastrada, at 25 E. Carmel Valley Rd., Carmel Valley, CA 93924, or call (408) 644-8091.

Interestingly, I came across an Amphicar in Seattle on a recent trip. The owner called it one of the best-preserved models in the country. He said, "I drove it last year. It ran great. Would you like to buy it?" Being polite, I said, "Not right now. Maybe later." "It may not be here later," he added. "There's nothing like it." Nothing except the new and improved Aquastrada Delta, but I didn't have the heart to tell him. **PM**

How The Suspension Retracts



PM ILLUSTRATION BY RICH CARBONE



NIGHT HAWKS

An elite squad of cops tests the latest in infrared night vision on America's mean streets.

BY ABE DANE, Senior Correspondent; PM Photos by Roy Attaway

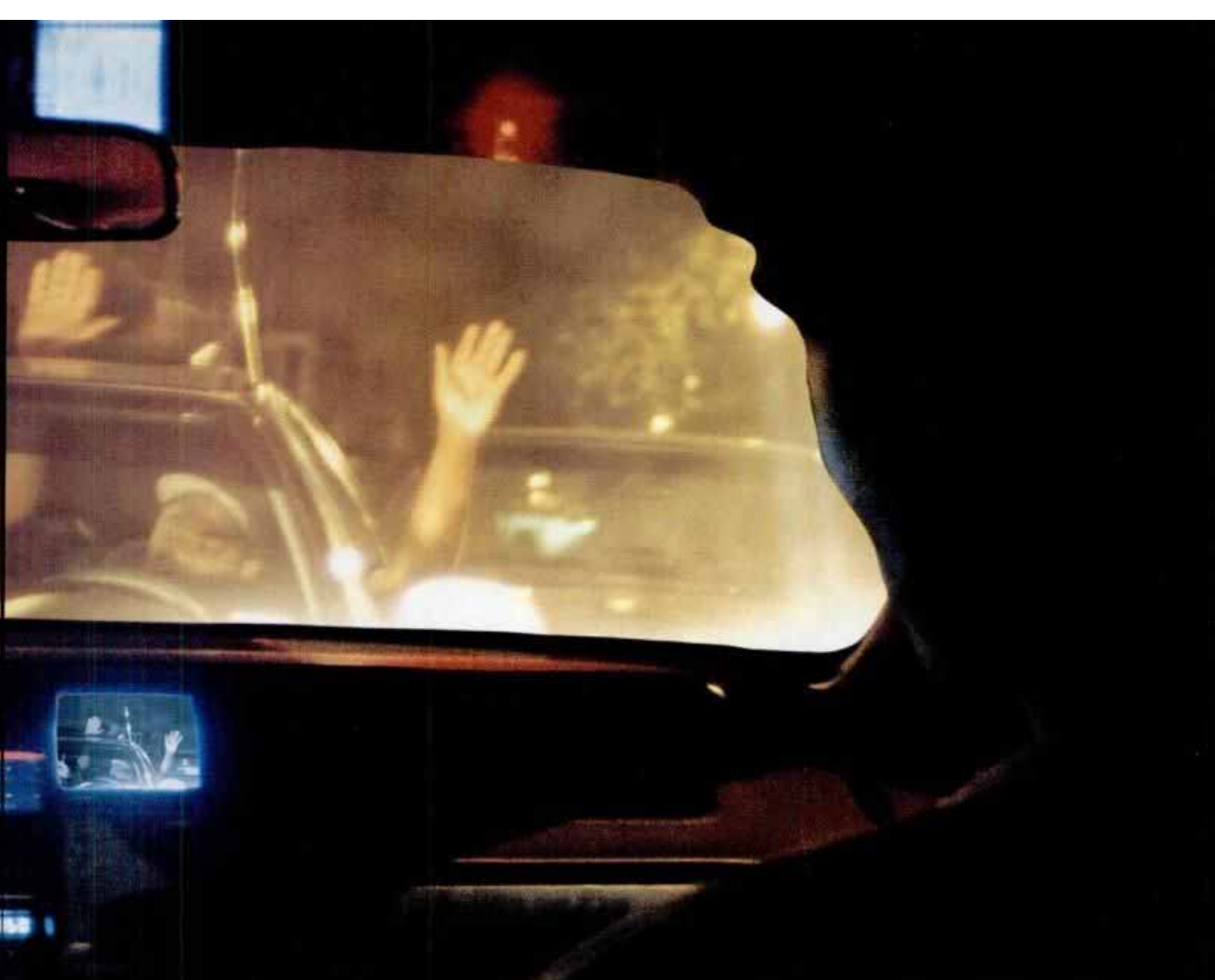
• "Go with your instincts!" is all Officer Umar Abdul Hakeem needs to say into the radio of his unmarked Chevy Lumina. Seconds later, a banged-up little Buick veers across the darkened street ahead, cutting off the white Oldsmobile we've been tailing. Another unmarked unit pulls alongside, and we chirp to a stop behind the Olds to box it in.

The driver's got just about enough time to think "What the...?" before flashlight beams converge on his face and car doors fly open all around him, issuing flack-jacketed men in dark blue polo shirts bearing the words Police T.A.R.G.E.T. Team. Smith & Wesson 9-millimeters are unholstered, keys yanked from the ignition, and one of the neighborhood's biggest heroin dealers is spread-eagled against the side of his car. No high-speed chase. No shootout. No time to even think about it.

What we've just witnessed is a routine traffic stop—as interpreted by an elite group of Newark, New Jersey, cops trained to fight crime in one of the country's toughest urban battlegrounds. Years on these streets have taught them that a car in suspicious hands must be treated like a loaded gun. "This is where a lot of cops get hurt or killed," says Hakeem.

Tonight we're patrolling the West District, and it's pretty much business as usual here. Crack dealers work the street corners and projects. Car thieves pitch brand-new Acuras and BMWs into spiraling donut skids and joyride through the narrow, potholed streets. Here and there a shot is fired—out of rage, out of fear, out of hopelessness.

It's business as usual for the T.A.R.G.E.T. Team, too—prowling undercover, relying on street-honed instincts and wolf-pack teamwork to spot



Moving aggressively to box in suspects before they know they're being tailed is a trademark tactic of Newark's T.A.R.G.E.T. Team.

trouble, pick the moment, then strike overwhelmingly.

The only thing different about this 7 pm-to-3 am tour—and the reason PM is riding along—is a peculiar turret-like device clamped to the roof of Hakeem's car. Based on military night-vision research, this prototype infrared camera represents one of the Cold War's more promising spinoffs. Tonight, Officer Hakeem is going to see these streets—the same streets he grew up on—as he has never seen them before. And for a guy with his job description, seeing can be the key to survival.

Special ops cops

"Look at them like the Special Forces," says Newark Police Director William R. Celester, who oversaw the T.A.R.G.E.T. Team's formation two years ago. The Green Beret analogy is

more apt than you might think. When T.A.R.G.E.T. (Tactical Auto Recovery Group and Enforcement Team) first hit the streets, Newark led the nation in auto thefts. Conditions in some neighborhoods bordered on anarchy, as car thieves literally dared marked cruisers to give chase. The crisis called for commando tactics.

Twenty-five men, handpicked from a department of 1200, were put under Detective Lt. Barry Colicelli and given special training in pursuit driving, unarmed combat and the use of M16A2 assault rifles. They also developed some tactics of their own. "One thing about T.A.R.G.E.T., we always work as a group," says Colicelli. "Everything we do, it's one big army."

Now, two years later, car thefts are down 36%, and Newark is out of the top-10 cities nationwide—a turn-



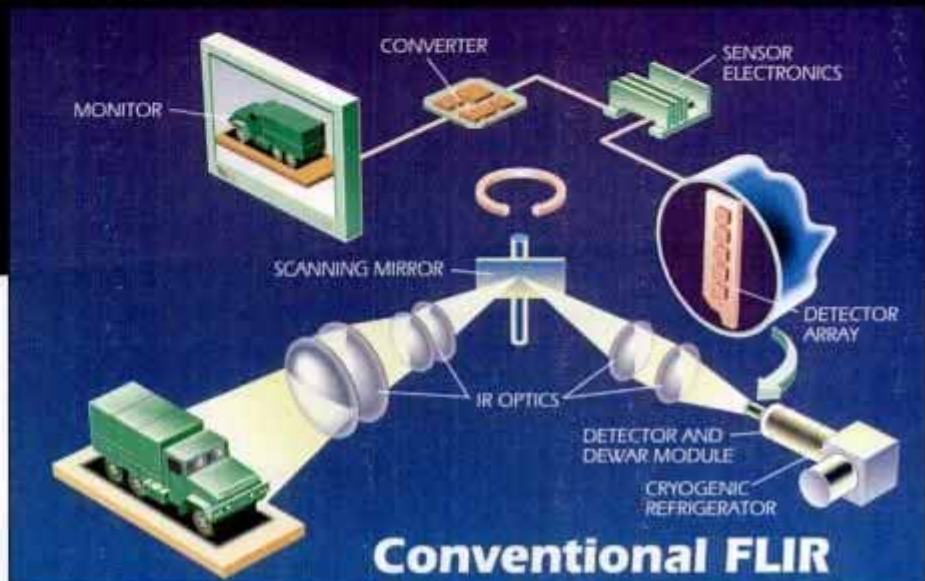
Top: Sgt. Michael Parris (right) briefs Officer Hakeem before they hit the streets. Above: Nightsight sits atop temporarily mounted pan-and-tilt mechanism.

around Celester credits largely to T.A.R.G.E.T. But things will be far from quiet in the West District tonight. Before we even leave the squad room, reports come in of a silver Mazda RX-7 that's tried to run down two cops, and of a stolen \$75,000 Porsche last seen headed our way.

After roll call, T.A.R.G.E.T.'s motley fleet of family cars departs police headquarters and blends into traffic. Their vehicles show the effects of flat-out driving on cratered streets—and the occasional ramming by a desperate felon. But inside Hakeem's Lumina, a dashboard monitor transforms the gritty landscape into a ghostly scene like something out of a fighter cockpit.

The sum of all FLIRs

The resemblance is not coincidental. The source of the images—a Nightsight FLIR (Forward-Looking Infra-Red) camera manufactured jointly by Hughes Aircraft and Texas Instruments—operates on the same principle as FLIRs on night-fighting aircraft, tanks and attack helicopters. All work by reaching up into the infrared



Earlier FLIRs required cryogenic cooling, a scanning mirror, and complex optics and electronics. Nightsight's BST detector uses a far simpler system.

band of the spectrum, where anything warmer than absolute zero radiates a detectable heat signature.

These longer, more penetrating wavelengths set FLIRs apart from the more familiar image-intensification (I^2) systems, such as night-vision goggles, which merely amplify visible light. Unlike I^2 systems, FLIRs can see in total darkness. Bright lights

won't dazzle them, and they can see through smoke, fog and sometimes even foliage. The Nightsight, however, does all this for less than a tenth the cost of a typical military FLIR.

That's because its tiny barium-strontium-titanate (BST) detector module is far less fussy about its operating conditions than were earlier types. For example, the mercury-



Top: T.A.R.G.E.T. searches for drugs and weapons after sweeping a car-wash parking lot in the West District. Nightsight detected one suspect as he tried to get rid of his stash. Far left: Stopping a car full of burly young men is one of an officer's least-liked situations. No one relaxes until all are out and frisked. Left: Sample Nightsight image shows how clearly body heat shows up, regardless of light levels.

cadmium-telluride detectors in most military systems can't pick up subtle variations in heat without being refrigerated to hundreds of degrees below zero. Also, the detector elements typically lie in a single-file strip, so that a precise and rapidly moving mirror must scan the scene over them one thin slice at a time. The resulting complexity boosts the price of a traditional FLIR above \$30,000.

By contrast, Texas Instruments' BST modules operate at normal outside air temperatures. Boasting uniquely heat-sensitive dielectric properties, BST can be formed into capacitors that translate tiny changes in temperature into changes in voltage. Tens of thousands of these capacitors, microfabricated into an array the size of a postage stamp, create pictures that—if not as sharp as those from high-end cooled systems—are still remarkably clear. And because the array is 2-dimensional, no scanning mirror is needed. Total system cost: on the order of \$6000.

Heat in the night

While darkness gathers over Newark, the Nightsight's dashboard display provides an undimmed window into the gloom. Hakeem twiddles a joystick mounted between the Lumina's front seats, and the camera pans over a strange world, where cars—their engines, tires and tailpipes aglow—float by on luminous cushions of heat.

Already this evening, the sighting of a silver RX-7 that matches the transit officers' report has sent T.A.R.G.E.T. and other units flying off in pursuit. Hakeem doesn't take time to hang his siren and chase light out the window.

He just takes off, flogging the little Lumina for all it's worth, leaning on the horn through red lights, and sending photographer Roy Attaway and me bouncing out of our seats and diving after loose equipment.

By the time we arrive, marked cruisers have already pulled the RX-7 over, so we head to our assigned area to hunt for stolen cars.

The T.A.R.G.E.T. mission has broadened in recent years, but bagging car thieves is still its bread and butter. "Initially, our advantage is being in the unmarked car," says Hakeem as we roll through the West District. But he adds, "In this city, with the things that we do, it doesn't take long for an unmarked car to get burnt."

Although not invisible, we can usually get close enough to judge whether a car's probably hot. Sometimes the tipoffs are subtle: As we pass one street corner Hakeem points out the body language of a crowd. All seem focused on a young man who stands by the open door of a car, as if he's showing it off. Other times the signs aren't so subtle, like cars racing two abreast the wrong way down a one-way street.

This is Hakeem's first time out with the Nightsight, and although it'll take awhile to work it into his routine, unexpected possibilities are soon apparent. The first real use comes after members of the team stop a car and one of the occupants makes a dash for a nearby tenement. They tackle him and find a small automatic pistol in his pocket. Has it been fired? Holding the weapon in front of the Nightsight shows it to be cold.

Later in the evening, while search-

ing a dozen young men lined up against a car-wash wall, they find a bag of cocaine on the ground. There's no way to trace it. But back in the Lumina, Ron Harrison, a Texas Instruments technician who came out to install the prototype camera, saw one of the youths let it slip from his hand and kick it away. Body heat lingering on the tiny bag made its path plainly visible on the Nightsight.

These situations highlight the camera's heat-seeking capabilities, but T.A.R.G.E.T. members expressed enthusiasm for its potential as an all-round night-vision tool as well. In sprinting, fence-scaling foot chases, suspects are often lost in dark alleys or weed-choked vacant lots.

Two such escapes occurred the night we rode along. But the technology will become more effective as officers learn to rely on it as they now do their guns and radios. "I could see it working real good," says Officer David Letts. "We've got to be creative in how we're going to use it." Letts, who tested the Nightsight the night before we arrived, also pointed out that a camcorder-like handheld unit would offer far more flexibility, particularly in foot chases. TI says such a system is in the works.

At the end of the shift, eight suspects sit handcuffed on the squad-room floor, and two stolen cars sit recovered in the lot. Bleary-eyed officers attend to post-arrest paperwork. The Nightsight prototype will move on to the next test site tomorrow, after only three days with T.A.R.G.E.T. But Colicelli has already decided he wants one. "The Cold War has been good for police departments," he says. **PM**



BEYOND AIRBAGS

If you're a political figure or corporate executive, your car has to stop bullets and be a rolling bomb shelter.

BY PAUL EISENSTEIN; PM Photo by Brian R. Wolff

• Fragments of glass and metal have fused into a mushroom-shaped plug, a spider's web of cracks weaving out from the jagged hole to the corners of the glass. From the back side, a layer of polycarbonate balloons in a mirror image of the violent entry wound punched nearly through the 2½ in. of glass by a .50-caliber slug.

In the dark world of terrorism, a muzzle flash may be the only warning. And an armored car may be the only defense. But diplomats and heads of state aren't the only ones worried. Whether in New York City or Sarajevo, Rio de Janeiro or Beirut, the nightly news is filled with stories of bombings, kidnappings, carjackings and assassinations.

So government officials, ranking corporate executives and, in ever-increasing numbers, average motorists are turning to O'Gara-Hess & Eisenhardt (OGH&E), the world's leading specialist in discretely armored automobiles.

The firm's offices are hidden down a small side lane in the gentle, rolling countryside outside Cincinnati. At first glance, the 100,000-sq.-ft. plant could pass for a car thief's chop shop.

Dozens of top-dollar automobiles fill the factory floor in various stages of disassembly. In one corner, a worker is gingerly polishing a Mercedes-Benz 600SEL sedan. "Try to open the door," suggests OGH&E's president, 36-year-old Bill O'Gara. It takes both hands and one's feet planted firmly on the ground to budge it. A closer look tells you why: The ½-in. factory glass has been replaced by "transparent armor," a thick 5-ply sandwich of reinforced glass and polycarbonate sheeting weighing more than 80 pounds. And then there's the "opaque armor," a super-strong dual-hard steel or composite, reinforcing the door's sheetmetal.

OGH&E vehicles like this one have saved countless lives in hot spots such as Belfast, Beirut and Sarajevo. The company has armored the limousines of every U.S. president since Harry Truman. And it provided the vehicles that were used to ferry government leaders



at a Group Of Seven economic summit in Tokyo.

O'Gara, a handsome soft-spoken family man, deals in a world where assassins and terrorists have access to a frightening cornucopia of guns, explosives and other deadly weapons. And there's no single solution for all of them. Armor that can stop a slug from an AK-47 assault rifle may melt like butter when hit with a .556 bullet from an M16. And explosives require a completely different kind of protection. "There

are limits to what we can do," O'Gara concedes.

So designing the safest possible vehicle requires a fair degree of armor alchemy.

The first rule in this business is obscurity. Never stand out in a crowd. While OGH&E armors some of the world's most expensive automobiles, it frequently advises clients to choose more mundane cars. A pair of Dodge Spirits on the factory floor will soon be delivered to a client in Latin America, where they'll



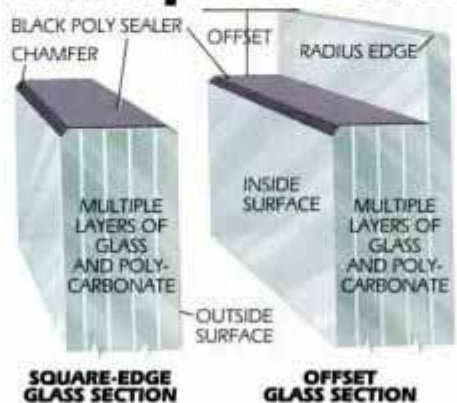
easily blend in with the local traffic.

The next step is to assess the danger a client faces. In Detroit, for example, the car-jacker's weapon of choice is a Saturday night special handgun.

Turning security assessments into armor is the job of Chuck Williams, OGH&E's top ballistics expert and the modern equivalent of the king's sorcerer. But instead of consulting a musty book filled with arcane incantations and spells, Williams relies on a slick, custom-designed computer program. "The database," he explains, "presents a list of suitable armors, how much of each we'd need and what the cost would be. It also scores them, taking into account their weight, thickness and cost."

Today, Williams is working on a Cadillac. He maneuvers the mouse attached to his 486 PC and taps a couple of keys. On the first screen, he enters the security assessment—the owner might face a close-up assault by a handgun, or a long-range attack by a sniper using a high-powered rifle—then flies through a series of additional screens. Ten minutes later, the computer spits out a lengthy analysis. Since cost is no object for this particular client, the opaque armor chosen is

Bulletproof Glass



Different glass is used depending on application, but both offer equal protection.

a lightweight but extremely expensive composite borrowed from the military.

By the time the conversion is completed, in four to six months, the car will also be equipped with an explo-

Fully armored Caddy appears deceptively stock, save for lower stance.

sion-resistant gas tank and run-flat tires. Special inserts will allow the wheels to keep rolling at high speeds for up to 50 miles even if the tires are shot out.

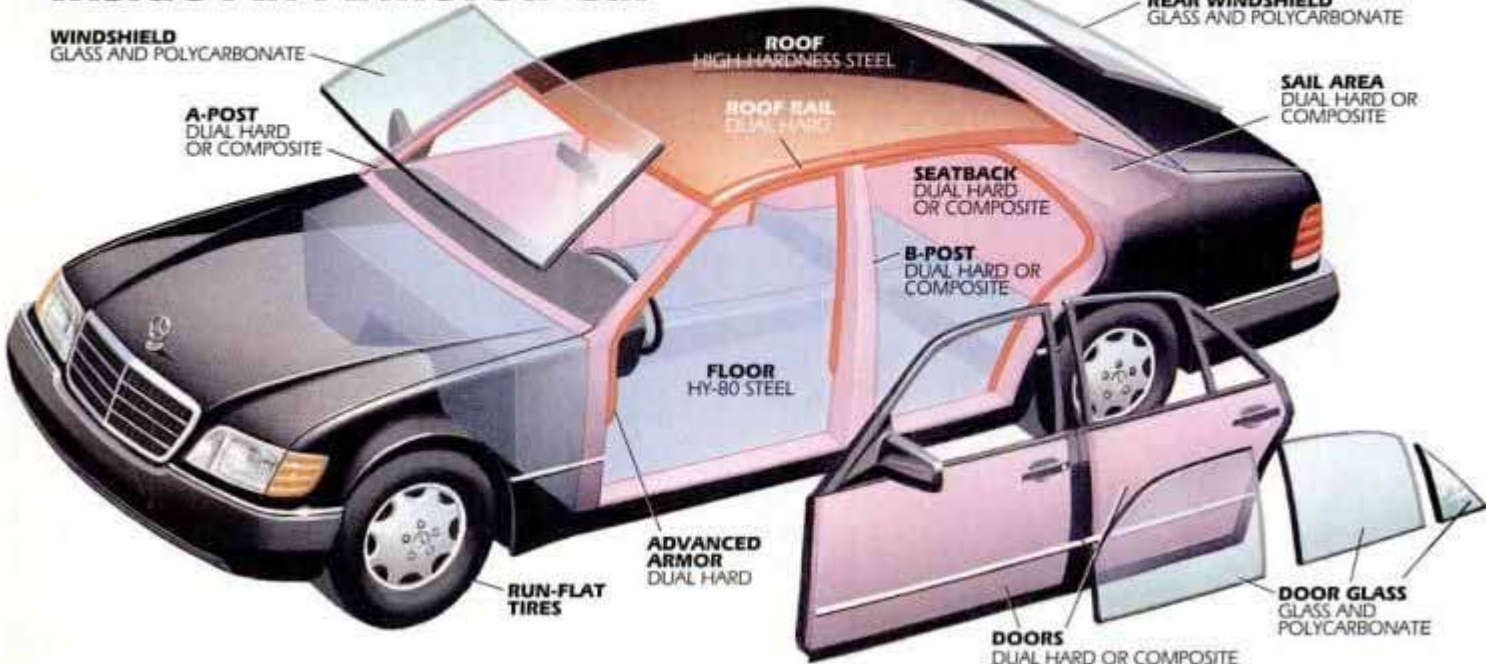
For the casual viewer, one of the biggest surprises is the wide variety of armor available. There are ceramics, reinforced plastics, aluminum alloys and steel. Each material has its own particular characteristics. Some are good at stopping bullets. Others are better for stopping bombs, by providing a little "give" to absorb the blast.

Often, Williams will recommend using two or more materials in an armor sandwich designed to resist several different threats. New materials are constantly becoming available, and OGH&E is currently evaluating some super-hard composites originally developed by the Soviet Army.

Whatever the material, it has its limits. And armor doesn't work quite the way most of us imagine, cautions O'Gara. "Unlike in the Batman movies, where bullets just bounce off, the glass is actually self-sacrificing. When it defeats a projectile, it shatters, just like normal glass. That's

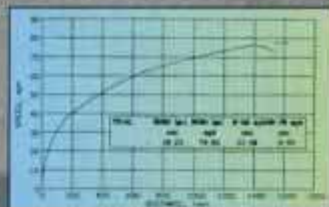
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Inside An Armored Car





THE RELENTLESS PURSUIT OF ACCURACY



PM jumps into the next century with cutting-edge automotive test equipment.

● It sounds like a glamorous, exciting life, doesn't it—especially if you're a gearhead (*Gearhead*: someone who likes cars and trucks, and things mechanical, more than a normal person does. See also *motorhead*, James Dean.). I mean there's a steady diet of absolutely fresh cars lined up for us to drive as we see fit. We even get paid to go to the racetrack and flog a steady stream of someone else's vehicles as hard as possible. Not.

Well, at least not completely. Track testing is hardly the fun-filled afternoon you might think. And you might think differently

BY MIKE ALLEN,
Associate Automotive Editor
PM Photos by Roy Attaway

after spending a few 95° F afternoons standing around in the middle of a black asphalt racetrack.

We test cars for good reasons—and that means that we have to expend a lot of time and effort to make sure we give you accurate, consistent results. We don't reprint the numbers the manufacturers give us. We also do some tests that the car companies and even other magazines don't, because we think you, the reader, might make a more informed buying decision because you've read POPULAR MECHANICS.

This isn't one of the car-buff



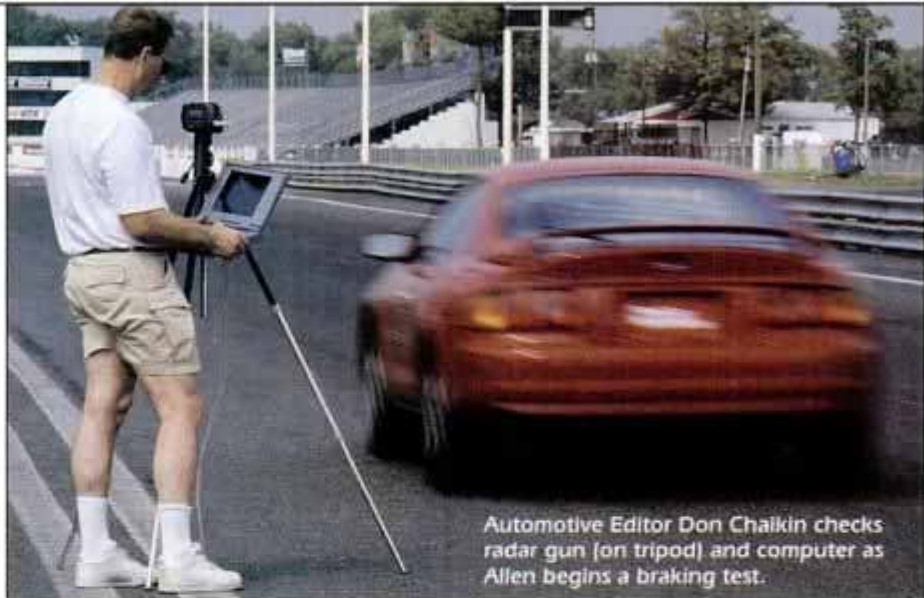
Test driver Allen checks computer before a run.

PURSUING ACCURACY

books, with an endless procession of "Yet Another Red Car" gracing the cover. So we rarely report on things like top speed, and we rarely talk about the economics and politics of the car industry. We think you're buying PM because you want to make the most intelligent, best informed decision you can when you go to buy a new car or truck. If you would rather be reading about the unusual vehicles owned by the rich and famous, you'd be reading some other magazine.

Comparison testing

To help give you the information necessary for that buying decision, we compare the same makes and models you are likely to be considering in any given market segment. We perform our comparison testing by first driving all of the vehicles for several days, generally from Los Angeles or New York City, where we pick them up, out to the racetrack (Los Angeles County Raceway in Palmdale and Willow Springs in Rosamond, California, or Englishtown Raceway Park in Old Bridge Township, New Jersey). The next few days are devoted to ad-



Automotive Editor Don Chaikin checks radar gun (on tripod) and computer as Allen begins a braking test.

ditional driving and photography. We recruit drivers from all walks of life, usually trying for some knowledgeable car crazies as well as ordinary citizens. When the vehicle is a family sedan or minivan, we sometimes will arrange for one of our drivers to be a parent with a child small enough to require a child safety seat. All of the

drivers cycle through all of the cars on a rotation schedule. (Please don't call, fax or write our office volunteering to be a test driver—the waiting list is already infinite.)

Then, every driver fills out a questionnaire about every vehicle. There are a number of specific questions to answer about the vehicle's handling,

Straight-Line Testing

● For many years we've done our acceleration and brake testing with a fifth-wheel-based system custom-built for PM by engineer and racer Paul Van Valkenburgh. While the results have been more than adequate, the system is difficult to readily attach to some vehicles. Data reduction after making an acceleration pass took several minutes, making for some long days at the track.

More recently, we evaluated a Datron Corevit optical system. This uses a photocell sensor to look at the texture of the pavement passing under the car. Digital processing turns the velocity of the texture into a count that corresponds to the speed of the vehicle. This sensor head

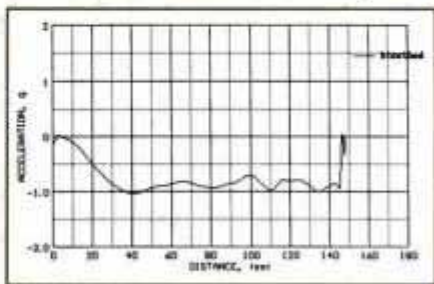
sends data to a laptop computer inside the vehicle, which uses Datron's software to provide the numbers we print. It's also an expensive and cumbersome system, filling an entire steamer trunk with pipes, clamps, wires and big suction cups.

Most recently, we've acquired a Stalker radar gun from Radar Sales. The Stalker is nothing short of amazing. Mounted on a tripod near the end of the dragstrip—which means there's no need to transfer the test gear between test vehicles, mandatory with fifth-wheel systems and the Datron—it provides velocity information free of dropouts long before you can tell if the car has begun moving. Through a cable to a laptop computer, it records velocity information more than 30 times per second, recording it all on disk. Within a few seconds of the end of the run, it provides a graphic snapshot of the acceleration, including quarter-mile time and speeds, as well as 0-60 times.

A dragstrip's timing lights allow the car to move forward as much as a foot before tripping the photocell's light beam, depending on how far the car rolls forward after you've crept forward into the staging beam. Drag racers call this foot "rollout," and it has a profound effect on the elapsed time numbers. The 1320-ft. length of the strip begins after the rollout. To confound the issue, the finish-line speed is actually an average of the vehicle's speed for the last 66 ft. of the strip, because the light beams there are 66 ft. apart and don't actually measure the speed of the vehicle as it crosses the line. The algorithm in our computer software replicates this as accurately as possible. —M.A.



Datron Corevit optical sensor reads the texture of the road surface. The unit is more cumbersome than the radar gun.



Graphic representation of a brake test actually records pulsing of ABS and the stopped car's rocking on its suspension.



Radar gun provides accurate info over the length of the strip.

interior, and a dozen or more other things we consider salient. There is also room on the questionnaire for comments and impressions.

Your mileage may vary

We fill the tanks on all of the vehicles as soon as we pick them up, periodically as we drive them and again just before returning them to the manufacturer. The mileage number we print is an average of highway miles, track testing, touring back roads to photo locations and fighting traffic into and out of the big city. We think it's an accurate estimate of the kind of

mileage you'd get driving the same car yourself in a real-world situation.

Black and round

Tires are very important to a vehicle's performance, and we have been known to replace the tires (with duplicates of the original-equipment tires—no ringers) before or even during the course of our testing if they're not up to our standards. Occasionally, another journalist will have abused a set of tires before the vehicle was given to us. Sometimes we'll just—in spite of our best efforts—flat-spot a tire enough to affect test results, and sometimes we simply have a flat tire.

We set tire-inflation pressures to the high end of the vehicle manufacturer's recommended inflation range. We do it the right way—first thing in the morning before the car has moved, before road and internal friction add heat and raise the pressure.

We use a high-quality tire gauge that's periodically calibrated, and it remains in our case of test gear between test dates.

The fun part: dragstrip testing

We always test all the cars on the same day, with the same driver at the same track, and in as short a period of time as feasible to reduce the effect of temperature changes (cars have less horsepower at higher air temperatures, and the asphalt of the dragstrip is generally slipperier as it heats up in the sun). We'll go back and retest the first few cars to confirm that there's no degradation in times, and average some times together if necessary.

At the strip, we take three separate measures of each car's acceleration: from 0-60 mph, through the standing quarter mile and from 40-70 mph. Our test computer is able to record both the 0-60-mph time and quarter-mile time and speed on the same run. (Some really slow vehicles won't make 60 mph in the quarter mile, however, so we keep the computer running past the strip's timing lights.)

The 40-70-mph acceleration times give you an appreciation for a realistic passing exposure time. We hold a steady 40 mph at the beginning of the run, and cars with automatic transmissions are left in Drive. Cars with manuals are downshifted to the best gear—because when you're trying to pass a beer truck that's slogging along at 40 mph on a country road, that's probably how you'd do it. Most vehicles require an upshift during the pass.

Bringing it to a halt

Antilock braking has made our 60-0-mph testing short, sweet and un-

(Please turn to page 137)

Turning Corners

● We used a photocell-based system to provide accurate timing for years, but it involved lugging to the track two suitcases full of lights, photocells and timers, as well as 800 ft. of wire and four deep-cycle 12-volt car batteries.

Now we put the timing equipment inside the car. Essentially nothing more than an electronic stopwatch with a 40-lap memory, our Unipro Racing Lap-timer 4000 from World Dynamics Corp. has a photocell sensor mounted in some convenient place to look at right angles to the car's path. We've found attaching the sensor to the mirror with some Velcro to be convenient, especially if the mirror swings away easily. The sensor can also look through the window glass, so on some vehicles we mount it to the dashboard or the passenger seat's head restraint.

Mounted on tripods next to the track are small infrared transmitters, each emitting a modulated signal. Whenever the photocell passes by a transmitter, the timer is toggled. The transmitters have a range of about 50 ft., making it unlikely that we'll damage either the car or transmitter by running off-course while probing the outer limits of some vehicle's handling envelope.

To get data while driving the slalom course from both directions without moving the sensor for every pass, we simply set up four transmitters, two on each end of the course. We always run the slalom course in both directions, to minimize the effect of minor variations in pavement slope and wind direction. For the skidpad testing, we set up transmitters inside and outside the circle, to avoid the need to move the sensor. When we're finished making our runs, we simply step through the times in the timer's memory and write down the pertinent data.

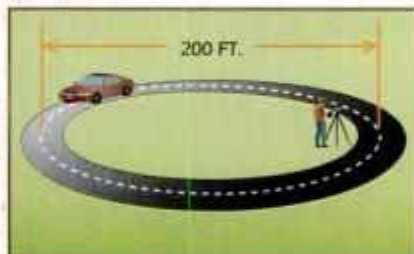
The raw times collected at the track are reduced to the miles-per-hour and g-force numbers printed in the magazine. All it takes to make those reductions is some simple algebra. —M.A.

SOURCE LIST

Datron Technology Inc.: (800) 832-0732
Radar Sales: (612) 557-6654
World Dynamics Corp.: (800) FASTLAP



Super-accurate timing for skidpad (left) and slalom (below) is provided by compact photocell timers developed for racers to check lap times. An in-car sensor (top) is triggered each time it passes a tripod-mounted transmitter (above). The sensor is connected to an electronic stopwatch (above, center), which is mounted to the dash. Again, setup time for the compact system is minimal, accuracy is maximum.





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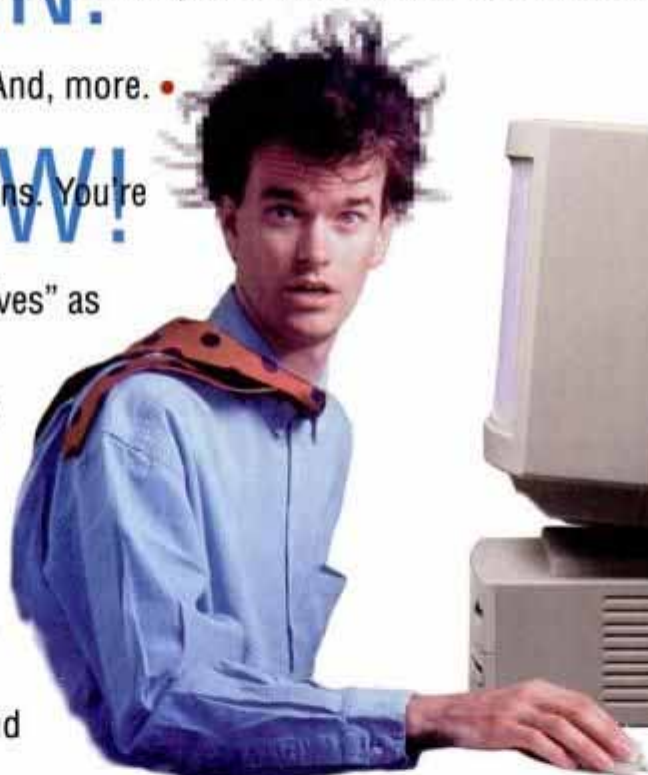
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SPECIAL SECTION

WOODWORKING GUIDE

Power Tool Jigs

Here are seven great ways to make your three most-used power tools more accurate, more versatile and a lot more fun.

- **Circular saw jigs for straight and accurate crosscuts**
- **Drill jigs that give your portable tool drill-press precision**
- **Router jigs for surfacing and edge trimming**

Making Power Tool Jigs

*Here's how to make your tools work better—
with accessories that you build yourself.*

BY THOMAS KLENCK, Associate Home Improvement Editor

● Imagine drawing a straight line. Better yet, go ahead and draw one—freehand. Pick up a pencil, put the point on a piece of paper and move the point across the paper as straight as you can. Now, take a good look at your line. Is it really straight, straight enough, or is it downright crooked? Of course, you could practice drawing straight lines, and, after awhile, you may see an improvement. No matter how good you get, though,

the odds are your lines will never be perfect. And, whether you like it or not, no two will be the same.

The solution, of course, is to use a ruler. Because a ruler is made perfectly straight, you can draw as many lines as you like, each one as accurate as the next.

A ruler, of course, is a tool. But it's a very distinct and important kind of tool. It doesn't cut, or join material, and it supplies no extra power to get the job done faster. Its value lies in its ability to constrain an activity so that it can be reproduced over and over again with consistency and accuracy.

In woodworking, tools of this nature are used all the time. When they're used in conjunction with tools such as saws or drills, they're called jigs. And, like the ruler, their purpose is to constrain the action of the tool so that it performs its role consistently. The accuracy is built into the jig.

Sometimes, jigs are built right into the tool you buy. A table saw's fence and miter gauge are jigs, and the ball-bearing pilot on some router bits is a form of jig that works in concert with the stock edge to guide your cut uniformly.

While some jigs can be bought—such as doweling jigs and router fences—most woodworkers make their own.

Custom-made jigs have sev-

eral real advantages over making do with what's available. First of all, you can make a jig to suit a specific repetitive job, such as cutting decorative tops on picket fence slats or tapering a set of table legs uniformly. Second, you can build the jig when you need it, usually out of a few scraps of wood left over from your last project. Also, making your own jigs is a fascinating creative exercise that brings you in touch with your tools and how they help you get the job done. By combining jigs with a power tool, you multiply the tool's usefulness and become involved with tool design and construction. Finally, your finished work will be a greater source of pride because your toolmaking skills and inventiveness play as important a part as do your woodworking skills.

While many jigs are specific tools unique to one job only, there are some woodworking tasks, like crosscutting and boring straight holes, that occur in just about every project you take on. To this end, we're offering a set of jigs that you can make yourself, and that provide increased accuracy and consistency for the most common operations. As a basis for our jigs, we've chosen three of the most popular portable power tools—a circular saw, a drill and a router.

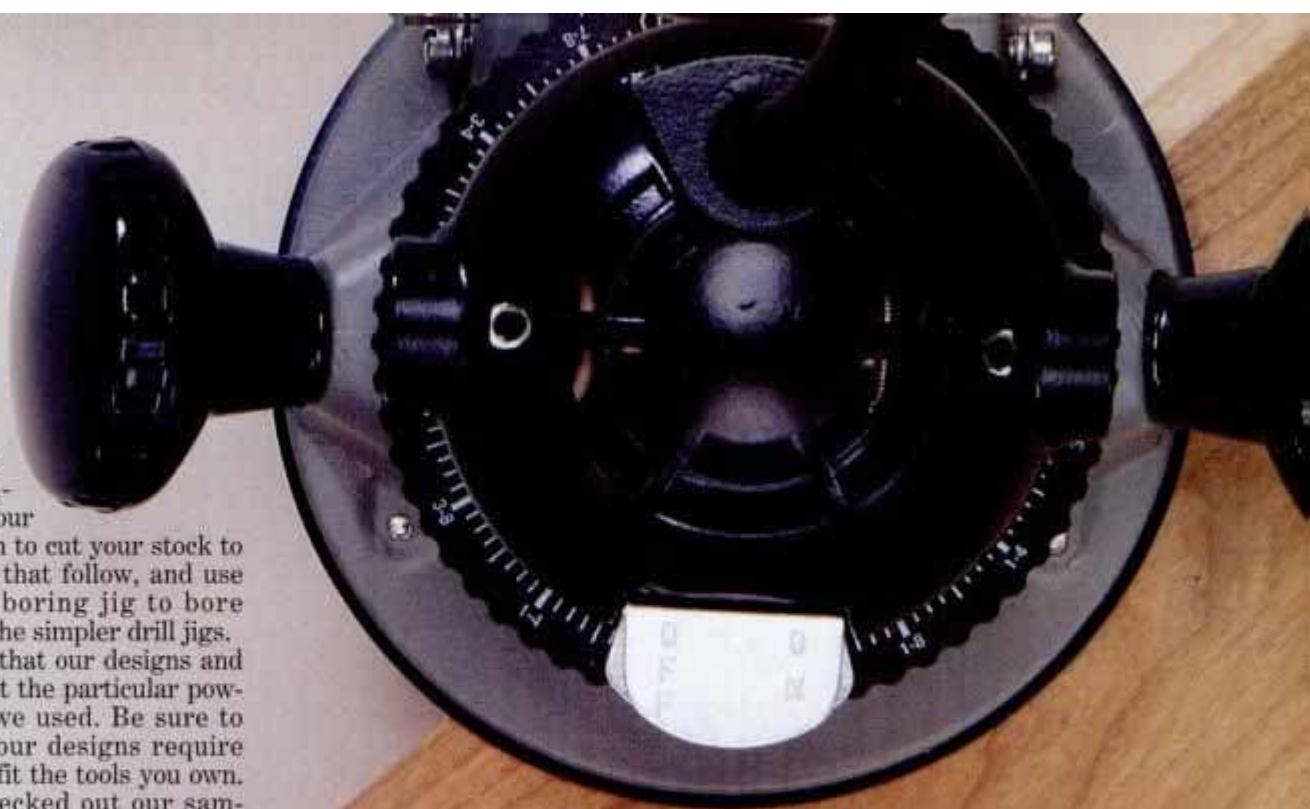
All of our jigs are made from ordinary birch plywood, combined with a few small pieces of hardwood or softwood. In addition to ordinary bolts and screws available at any hardware store, we've incorporated special knobs that make the jigs easier to adjust and use. These are available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374. The bushings for our self-centering drill jig are available from Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601.

Our jigs range from sophisticated to simple. Each one, though, is de-



signed to make a basic operation go a little easier. In fact, you may even find yourself using the first jig you make to help build the next. For example, you can use our crosscut platform to cut your stock to size for the jigs that follow, and use the horizontal boring jig to bore aligned holes in the simpler drill jigs.

Keep in mind that our designs and specifications suit the particular power tool models we used. Be sure to check to see if our designs require modifications to fit the tools you own. After you've checked out our sampling, we're sure your own creative juices will start to flow and you'll discover new uses for some of the design features that we've implemented. By designing and using jigs, you realize the full potential of your power tools—right in your own shop. **FM**



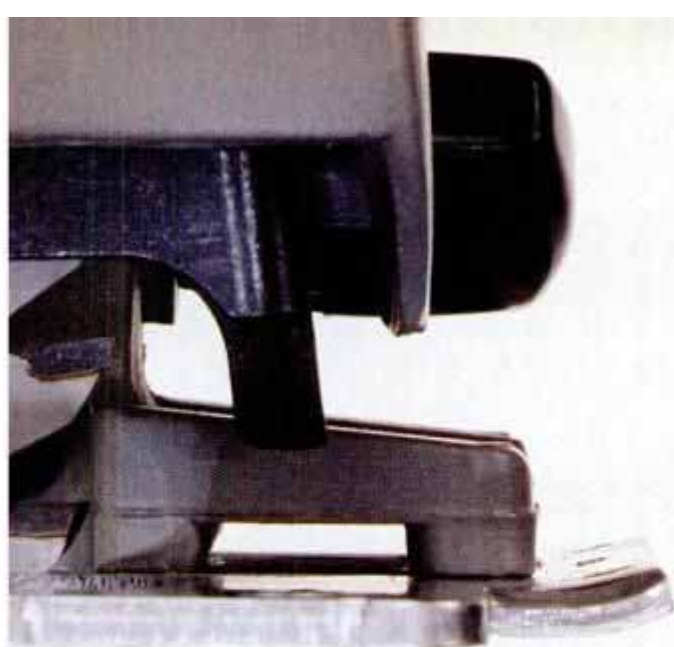


WOODWORKING GUIDE

Circular Saw Jigs

Circular saws are about crosscutting—cutting to length and at a precise angle. Here are two jigs that make the job faster and more accurate.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO, Contributing Editor



Adjustable Crosscut Jig

A portable jig that gives your circular saw stationary-tool accuracy.

● When you bought your portable circular saw, you probably thought that you had *the* tool for basic woodworking chores. Then, you saw the pros with the chop saws—power miterboxes that cut with fraction-of-a-degree accuracy and production-line consistency.

Well, there is another solution. Our crosscut jig is designed to do just about anything a standard power miterbox will, with a few extras just for fun. It will cut miters from 45° left to 45° right, and handle stock up to 1½ in. thick.

Plus, its large capacity means you can work panels as wide as 16½ in.—a figure that compares well with full-size radial-arm saws. Our jig dimensions fit the Porter-Cable 8¼-in. saw (model No. 368-1). If you own a different saw, you'll have to modify the jig to suit your baseplate size and blade location.



Building the jig

Start by cutting the plywood base to size, and then glue and nail the 1 × 4 base frame members in place. Position the middle frame member so it straddles the kerf position. Next, cut the stock to size for the guide rails and support blocks, and secure the support blocks from beneath with screws (Photo 1). While the support

blocks may be made out of hardwood or softwood, use hardwood for the guide rails. Cut the rabbets in the rail members (H, J and K) as shown in Detail 2 on the drawing.

After attaching the support blocks to the base, temporarily screw the narrow rail assembly (G and H) in place. Locate the miter-fence pivot point by first measuring the distance



1 After assembling the jig base, use glue and screws to attach the guide rail support blocks to both ends of the base.

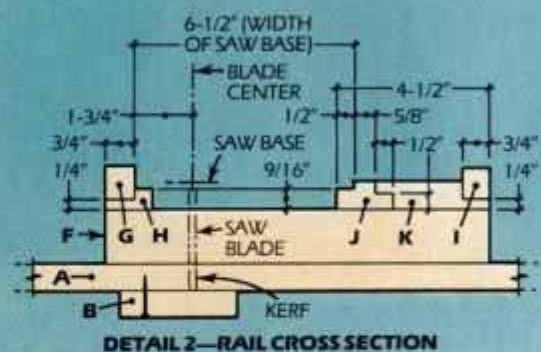
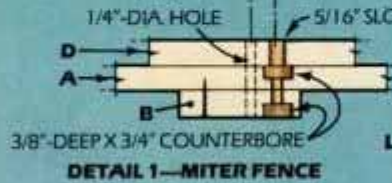
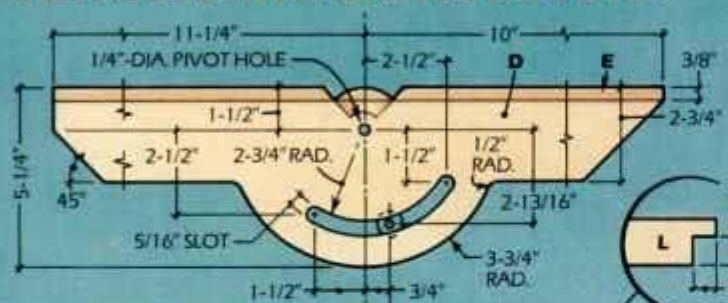


2 Mark kerf by measuring saw blade-to-base edge distance from left guide. Place pivot on kerf, 8 in. up from base edge.

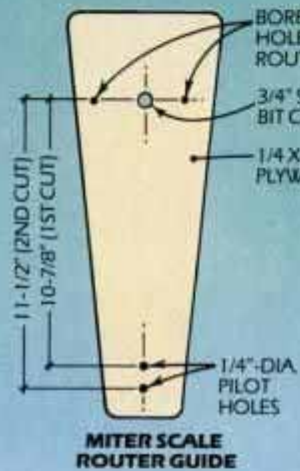


3 Use your saw to position right guide rail accurately. Then, bore pilot holes and attach right rail assembly with screws.

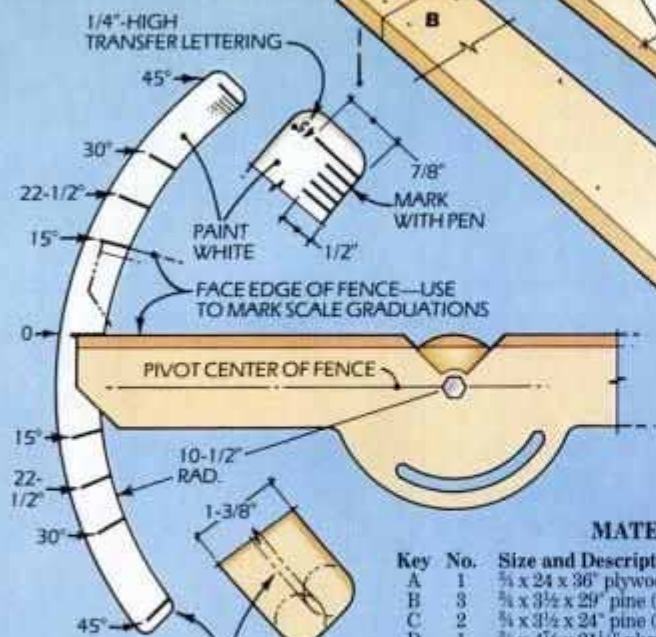
ADJUSTABLE CROSSCUT JIG



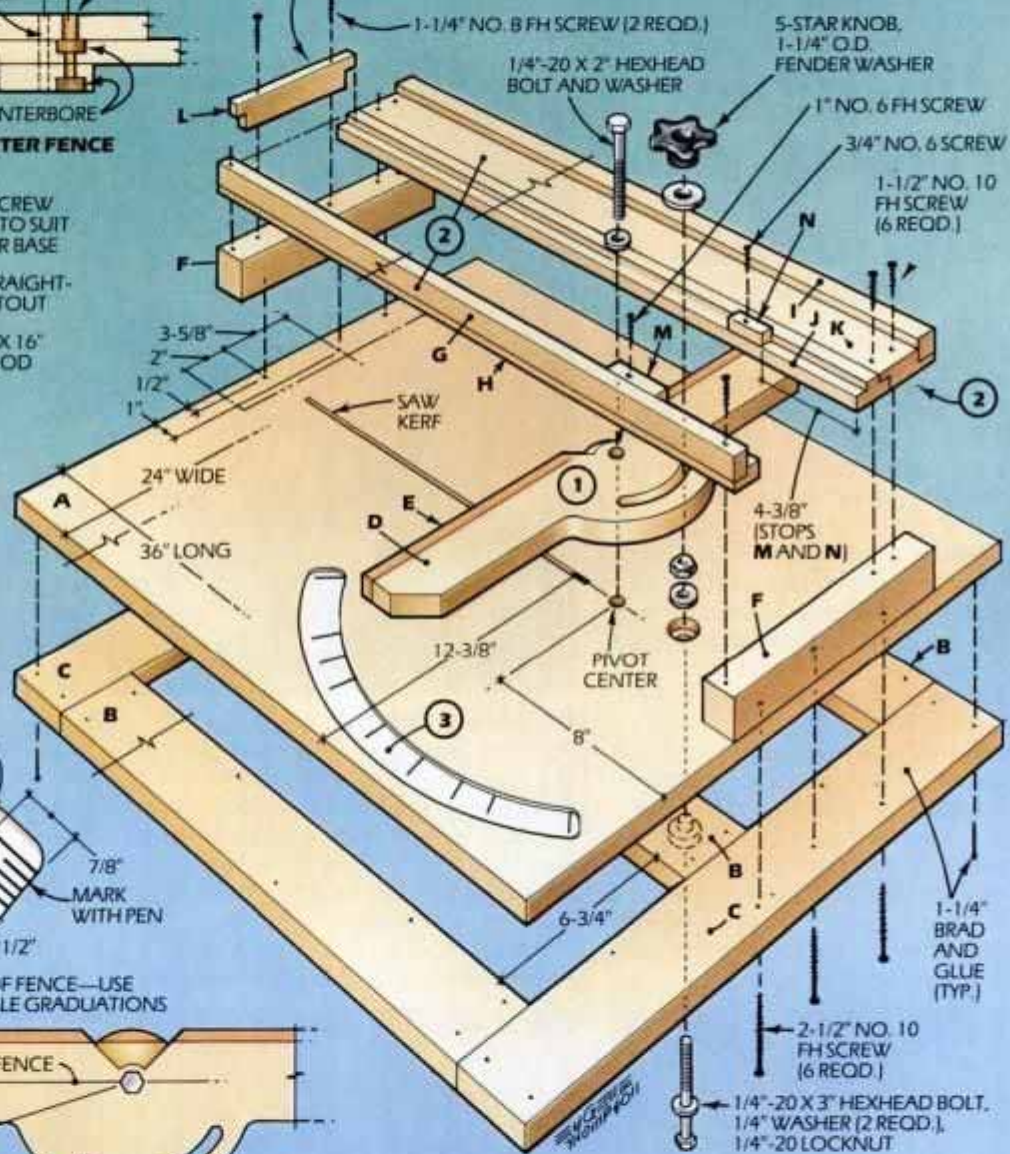
DETAIL 2—RAIL CROSS SECTION



MITER SCALE ROUTER GUIDE

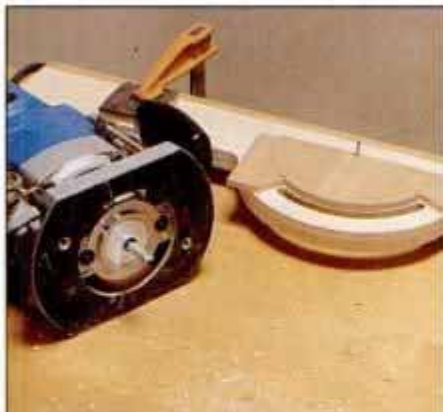


DETAIL 3—MITER SCALE



MATERIALS LIST—ADJUSTABLE CROSSCUT JIG

Key No.	Size and Description (use)	L	1	1/2 x 3/8 x 6 1/2" hardwood (rear stop)	
A	1	3/4 x 24 x 36" plywood (base)	M	1	3/4 x 1 1/8 x 25" hardwood (left stopblock)
B	3	3/4 x 3 1/2 x 29" pine (base support)	N	1	3/4 x 1/2 x 15" hardwood (right stopblock)
C	2	3/4 x 3 1/2 x 24" pine (base support)	Misc		1/4"-20 x 3" hexhead bolt; 3/4"-20 locknut; 3/4" washers; W-20 x 2" hexhead bolt; 3/4" No. 6 fh wood screws; 1" No. 6 fh wood screws; 1 1/2" No. 10 fh wood screws; 2 1/2" No. 10 fh wood screws; flat white spray paint; 3/4" transfer numerals; glue; satin spray varnish; satin polyurethane varnish. 3/4"-20 5-star knob (No. 71548) available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374.
D	1	3/4 x 4 1/2 x 21 1/4" plywood (pivoting fence)			
E	1	3/4 x 3/4 x 21 1/4" hardwood (trim)			
F	2	1 1/2 x 1 1/2 x 11 3/4" hardwood (rail support)			
G	1	3/4 x 1 x 36" hardwood (left rail guide)			
H	1	3/4 x 1 1/2 x 36" hardwood (left rail)			
I	1	3/4 x 1 x 36" hardwood (right rail member)			
J	1	3/4 x 1 1/2 x 36" hardwood (right rail guide)			
K	1	3/4 x 3 1/2 x 36" plywood (right rail base)			



4 After roughing out the curved slot in the fence, use a router, straight bit, guide bushing and template to finish the slot.



5 Use a shopmade guide to rout the recess for the miter scale. Guide has two pivot centers to rout recess in two passes.



6 Mask the area surrounding the miter-scale recess and apply flat white spray enamel. You could also use a paintbrush.



7 Install the fence and use it to mark the graduations in the recess. Use a protractor clamped to the fence to measure angles.



8 To make the kerf in the base, first clamp two temporary support walls to the rails. Lower the saw and move it along the rails.



9 Install stops to limit forward travel of saw. Make blade-clearance cut in fence by repeating cuts through fence pivot range.

from the edge of your saw's base to the center of the blade. Then, measuring from the inside edge of the narrow rail assembly, mark the blade center position on the jig base. Use a square and rule to locate the blade position (Photo 2). Bore the pivot hole 8 in. from the adjacent base edge as shown.

Position the wide rail assembly and lay your saw on the rails. Adjust the wide rail so the saw slides freely without excessive side play, and screw the rail to the supports (Photo 3). Then, remove both rail assemblies.

Miter fence and scale

To build the miter fence, first glue a hardwood strip to the edge of a $\frac{3}{4}$ -in.-thick plywood board that's slightly larger than the overall size of the fence. Lay out the cutting lines as shown, and mark the pivot hole. To make the curved slot, first bore $\frac{5}{16}$ -in. holes at each end of the slot and then use a sabre saw to rough out the slot. Install a $\frac{5}{16}$ -in. straight bit in your router and attach a template guide bushing to the base. Cut a template for the curve that's dimensioned to suit your guide bushing's offset. Tack the template to the miter fence and

trim the slot with the router (Photo 4).

Rout the $\frac{1}{2}$ -in.-deep recess for the miter scale by first mounting your router to the shopmade miter-scale router guide shown in the drawing. Use a $\frac{3}{4}$ -in. straight bit in the router. Bore two pivot holes in the guide—one 10 $\frac{1}{2}$ in. from the router bit center and the other 11 $\frac{1}{2}$ in. from the bit center. Then, make two overlapping passes—one from each pivot center—to form the 1 $\frac{3}{8}$ -in.-wide recess (Photo 5). Mask the area around the recess and spray two coats of flat white enamel paint (Photo 6).

To lay out the scale graduations, first install the miter fence and tape a protractor to the fence so it's aligned with the pivot center. Use a $\frac{1}{4}$ -in.-thick strip to raise the protractor above the pivot bolt head. Then, place a wood block on the base so one corner nearly touches the protractor while lying precisely on the blade centerline. Using the corner of the block as a reference point, rotate the fence 1° at a time and trace a line on the scale recess (Photo 7). After applying transfer-type numerals, coat the graduations with satin spray varnish.

Bore and counterbore the hole for

the lock-knob bolt and locknut, and install the fence and the guide rails. Cut and install the rear stop. Then, lock the fence at 0°.

Final touches

To make the saw kerf in the base, temporarily attach two boards to the rails to form high walls. Fully extend the circular saw blade, raise the blade guard and lash it in place. With the rear of the base against the rear stop and the saw tilted so the blade clears the base, turn on the power and slowly lower the saw until it rests on the rails (Photo 8). Stop the saw and unlash the blade guard. Then, turn on the power and make a slow pass to complete the kerf. Stop the kerf at the point where the fence meets the base. With the saw at this point, install the two forward stopblocks.

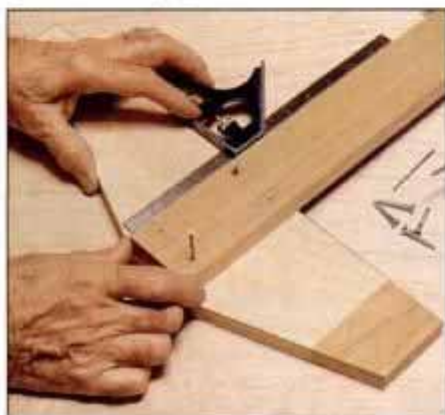
To cut the blade-clearance recess in the fence, simply run the saw up to the stopblocks while adjusting the fence through its range (Photo 9).

Finish the crosscut jig by first removing the guide rails and the pivoting fence. Then, apply two coats of satin polyurethane varnish to the components, and reassemble the jig.

T-Square Guide

It aligns the cut and guides it square—it's that simple.

The most common chore for a circular saw is a square crosscut. However, this jig does more than simply guide your saw square. Because the crossmember—the piece that rests on the stock edge—is initially longer than necessary, it's cut off the first time you use the jig. From then on, this



1 After boring the pilot holes in the guide rail, tack the pieces together and align them with a square.



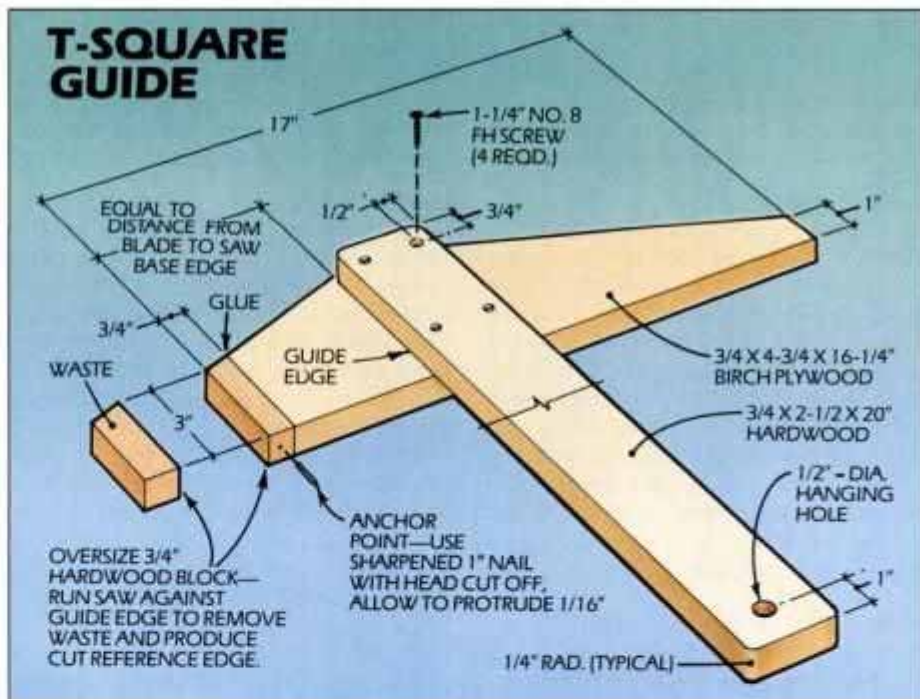
2 Remove the hardwood block excess by making a cut with your saw. The cut edge now indicates saw kerf position.

trimmed end provides a precise kerf indicator for your saw and blade. Our dimensions suit the Porter-Cable 368-1 saw we used. However, you can easily adapt the design to any model.

Making the guide

First, cut $\frac{3}{4}$ -in.-thick plywood to length and width for the crossmember. Then, glue a piece of $\frac{3}{4}$ -in.-thick hardwood to the saw-blade end.

Measure the distance from the



blade to the motor side of the saw base. Then, mark the position of the guide rail a distance from the hardwood end slightly greater than the blade-to-base edge distance.

Cut the crossmember profile as shown. Then cut the hardwood guide rail to width and length. Bore pilot holes in the guide rail, but not yet into the crossmember. Then, tack-nail the pieces together. Use a square to accurately position the components, and

then add another nail to hold the pieces in place while the screws are added (Photo 1). Finish the job by boring a hanging hole as shown.

Make a cut to remove the excess on the hardwood block (Photo 2). Check your first test cut for square and adjust the jig if necessary.

Of course, this type of jig isn't confined to 90° cuts. You can easily make versions that handle repetitive mitered cuts, as well.

The New Mazda Truck

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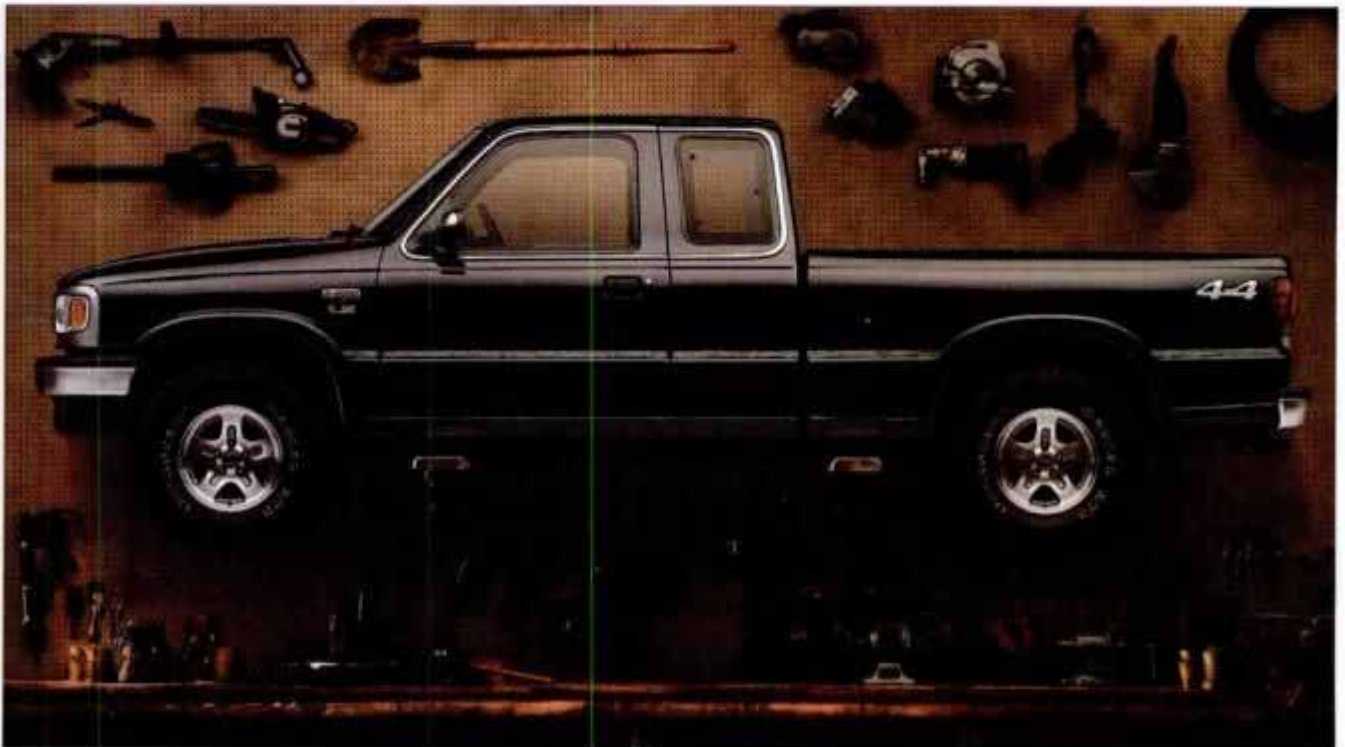
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Rear track (inches) (4x2/4x4)	57.3/57.3	53.9/56.1	54.5/54.5 56.3/56.3 (V6)
Basic warranty (years/miles)	3/50,000	3/36,000	3/36,000

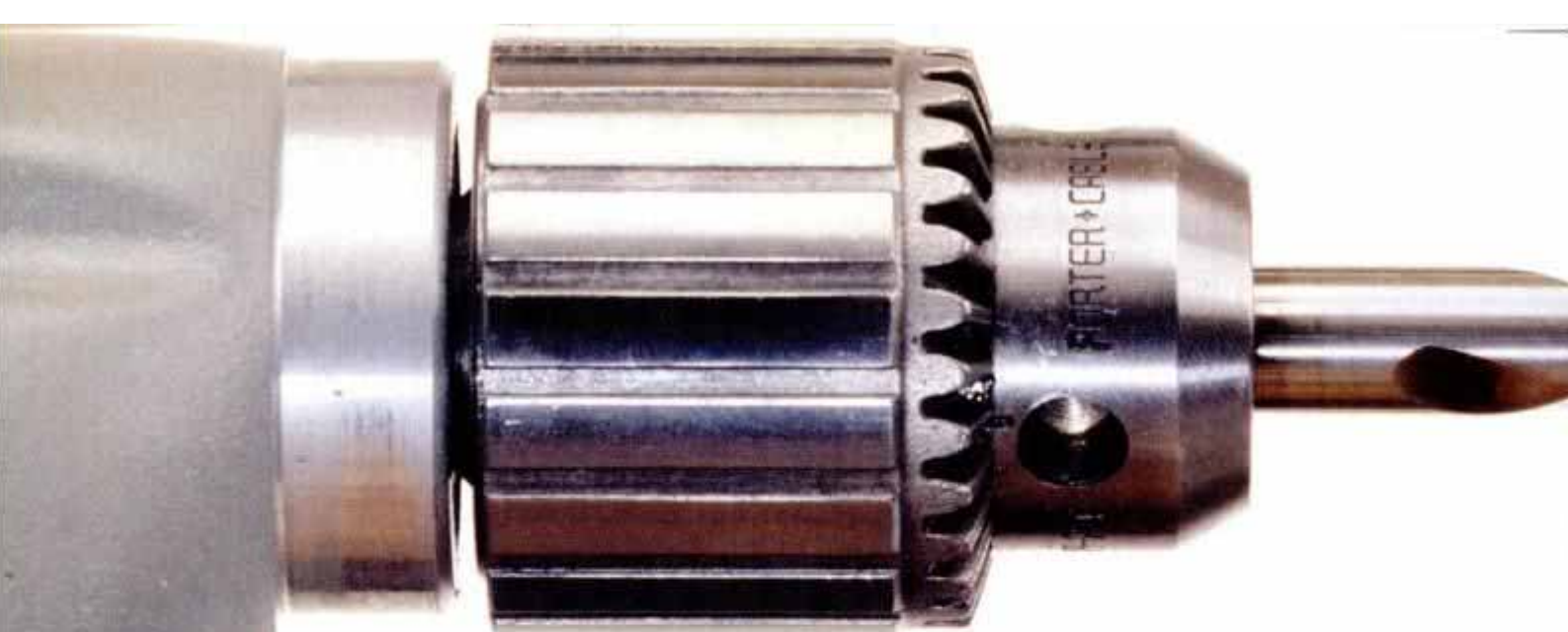
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WOODWORKING GUIDE

Drill Jigs

It's easy to bore a hole. But putting it in the right place is another thing. These three jigs help you get it right the first time.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO, Contributing Editor





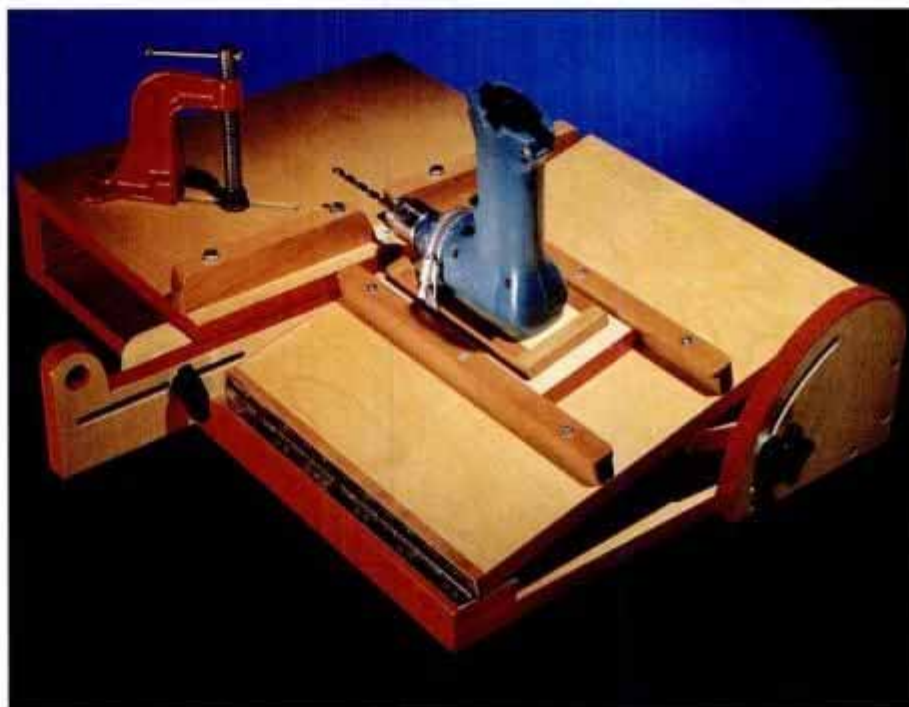
Horizontal Boring Jig

A jig that handles work even a drill press would balk at.

● The portable power drill is probably the single most useful and popular power tool. Everyone owns one. The fact is, boring a hole is one of the most basic woodworking operations.

However, there are many times when the eyeball method of hole alignment just isn't good enough for the job at hand. Of course, the pros turn to a drill press at these moments. Much of the work a drill press routinely handles, though, can be accomplished with a simple drill jig that holds the drill and bit at a consistent and controllable position in relation to the work.

Our horizontal boring jig is designed to handle a range of chores. In addition to simply boring aligned holes for screws and bolts, it's particularly well suited to doweling and preliminary waste removal in mortising—two woodworking jobs that standard



drill presses aren't designed for. In our jig, a portable drill is mounted on a sliding carriage that pivots on a hinged platform. The pivoting action permits positioning the bit up to 3 in. from the bottom edge of the work. To keep the drill firmly and accurately

mounted on the carriage, we use a custom-molded bed—an ideal solution because it easily suits the contours of typical drill housings and makes the jig suitable for any make and model of drill. The carriage dimensions we show will accommodate most drills. If



1 Align bit squarely on temporary bit-support block and tack cleats on each side of bit. Bit is aligned with base centerline.



2 Install bit in drill and tape chuck so it won't turn. Then, clamp bit to support block to suspend drill housing over base.



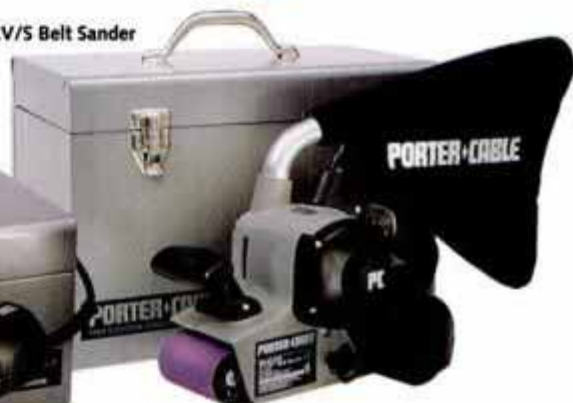
3 With bit clamped and drill handle vertical, nail enclosure strips around drill housing to contain filler that will support drill.



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9352V/S Belt Sander



97335 5" Random Orbit Sander
97336 6" Random Orbit Sander

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4 Remove drill and fill area with Durham's Water Putty or a similar compound that sets hard but can be sanded smooth.



5 Cover drill housing with plastic wrap and set the drill in the soft putty. Clamp bit firmly between cleats on support block.



6 After putty has hardened, remove drill and sand the surface flush with enclosure strips. Contoured recess holds drill securely.

your drill is large, you may have to modify the size of the drill carriage.

Drill carriage

Start by building the drill carriage, because you'll use it later to bore accurate holes in the other components. Cut the plywood carriage base to width and about 6 in. longer in length than shown (about 13 in.). Then, cut the 1/8-in.-thick edge banding to match the length of the long side edges and glue the edge banding to the plywood.

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7 Align hose clamp with the section of the housing that affords the best grip. Then, mark the base for the clamp notches.



8 After sawing edges of hose clamp recess, use a chisel to remove the rest of the waste on the bottom of the drill carriage.



9 Use the drill carriage to bore accurate holes in the platform support piece. Guide carriage against strip clamped to bench.

To make the custom drill-housing bed, first install a $\frac{3}{8}$ -in.-dia. bit in your drill. Then measure the distance between the top edge of the bit and the highest point on top of the housing. Add about $\frac{1}{8}$ in. to this measurement and cut a 4-in.-sq. block to this thickness.

Draw centerlines along the top, down both ends and around the bottom of the block. Temporarily nail the block near one end of the carriage base so it's aligned with the base centerline. Remove the bit from your drill and place it on the block centerline. Cut two small wooden cleats, $\frac{3}{4} \times 3$ in. long and just shy of $\frac{3}{8}$ in. thick. Butt each cleat securely alongside the centered bit. Then, nail the cleats to the block (Photo 1).

Reinstall the bit in the drill and wrap tape around the chuck and housing to keep the chuck from turning. Place a scrap block over the bit and clamp the bit between the cleats (Photo 2). In this position, the drill is cantilevered over the carriage base, with a $\frac{1}{8}$ -in. space between the housing and the base. Then, add the $\frac{1}{2}$ -in.-sq. enclosure pieces, as shown, to suit your drill (Photo 3).

Remove the drill from the carriage base and cover the housing with clear plastic wrap. Stretch the wrap, press it to the housing so it covers smoothly and apply tape so it doesn't come off. Mix up a relatively soft batch of Durham's Water Putty (available at most hardware and paint stores), pour it into the enclosure and level the top (Photo 4).

Carefully place the drill into position with the housing seated in the putty and the bit clamped firmly in the channel between the cleats (Photo 5). Using a square as a reference, check that the drill handle is vertical. Allow the putty to set overnight. Remove the drill and sand flush the top

of the molded enclosure (Photo 6).

Return the drill to the molded bed and determine the best location for the hose clamp (Photo 7). Then cut the hose clamp notches in the base sides and around the bottom as shown (Photo 8). Finally, cut the base carriage to the finished length as shown in the drawing on page 102.

Platform and table

Cut the plywood jig base to 16×24 in. Then, cut the $2\frac{1}{4} \times 12$ -in. cleat (B) and

secure it to the jig base with glue and nails as shown. Next, cut a $12 \times 14\frac{1}{4}$ -in. plywood board for the tilting platform (D1), and add the $\frac{3}{8} \times \frac{3}{4}$ -in. strip (D2) on one end to receive the hinge. Cut the assembly to $15\frac{1}{2}$ in. long by trimming the opposite end. Cut a 12-in. length of $1\frac{1}{16}$ -in. continuous hinge. Attach the hinge first to the hardwood strip on the tilting platform and then to the cleat on the base, taking care to align the hinge properly with both components.

(More Woodworking Guide on page 106)

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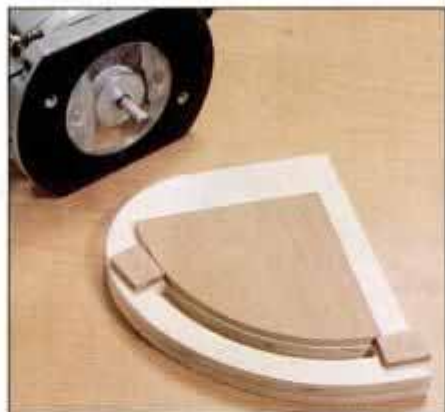
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10 Secure platform support hinge with one screw. Check alignment with base and tilting platform. Install remaining screws.



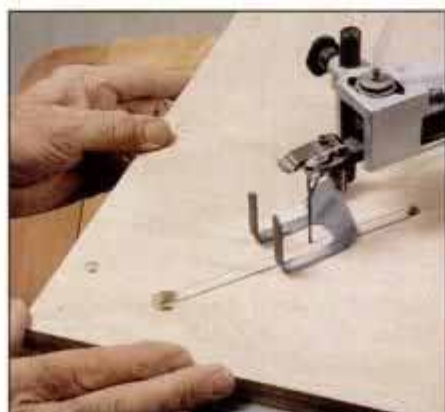
11 After using a sabre saw to rough cut the bracket slot, trim to finished shape with a router, guide bushing and template.



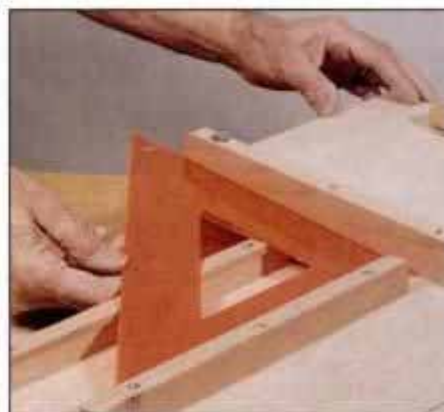
12 Use a wingnut to install hanger bolt in platform support hole. Bolt goes through bracket slot and locks platform.



13 Tack rabbeted carriage guides to tilting platform and check for alignment. Then, secure guides with screws.



14 Bore holes at ends of hold-down clamp adjustment slot in base. Then finish cutting slot with a scroll saw or sabre saw.



15 Temporarily secure fence, and use a drafting triangle to align table squarely with carriage guides on tilting platform.

Next, make the smaller tilting platform support board that fits under the tilting platform. First, glue $\frac{3}{8}$ - and $\frac{1}{2}$ -in.-thick strips to each long edge of a 6 x 12-in. plywood board. After the glue is dry, use a router to round one corner of the $\frac{1}{2}$ -in.-thick strip with a $\frac{3}{8}$ -in. rounding-over bit.

You can use the drill carriage to bore perfectly aligned holes in each end of the support board for the hanger bolt and the $\frac{1}{4}$ -in.-dia. steel pin. First, clamp a straight guide strip to your bench so it's aligned with the edge. Then, align the support board with the bench edge, shimmed to the correct height for a centered hole. Install your drill in the carriage, then place the carriage against the guide strip and bore the holes (Photo 9).

Attach the hinge to the support board, and then attach the assembly to the jig base with a single screw through the hinge at one end. Align the support board with a square, and use tape to secure the other end of the hinge to the jig base (Photo 10). Rest the tilting platform on the support board, and test the assembly by tilting the support board upward to raise the tilting platform—the rounded



16 After making sliding support, install and check action. Curved edge supports platform pin at shallow height settings.

edge should remain in contact throughout the swing. Adjust the free end of the hinge, if necessary, and install the remaining screws.

Cut the upright corner brackets to size and temporarily join them with screws. To scribe the precise position of the curved slot, first whittle the end of a short pencil so it fits into the hanger bolt hole in the support board end. Then, butt the side bracket (F) against the side of the base while advancing the end bracket (G) until it

touches the pencil. Hold the bracket in position and tilt the support to scribe the line. Disassemble the corner pieces and use the drill carriage to bore $\frac{5}{16}$ -in.-dia. holes at each end of the arc. Draw the slot outline and use a sabre saw to cut the slot. You can also use a router, guide bushing and template to trim the slot (Photo 11), as described in the crosscut jig story starting on page 95. After the slot is cut, use a wingnut to install the hanger bolt into the hole in the support board (Photo 12). Make and install the rabbeted hardwood carriage guides as shown (Photo 13). Make both guides in a single length of stock, using a router or table saw to cut the rabbet. Then, cut the finished piece to produce the two 12-in.-long guides.

Cut the fixed table (M) to size and use a router to make the $\frac{1}{8}$ -in.-deep x $\frac{3}{4}$ -in.-wide groove for the fence. Then, lay out the clamp slot as shown by marking the centers of the end holes. Bore $\frac{1}{8}$ -in. pilot holes at these centers and counterbore the $\frac{5}{8}$ -in.-dia. x $\frac{3}{8}$ -in.-deep recess from the bottom side of the table as shown. Rebore the pilot holes from the top with a $\frac{7}{16}$ -in. bit. Finish the slot with a sabre saw or

(More Woodworking Guide on page 109)

scroll saw (Photo 14). Next, make the 2-piece fence out of a single piece of hardwood. Cut this after the table has been accurately positioned and fastened. Then, cut the table support pieces from 2 x 4 softwood and bore the 1/4-in.-dia. hole in the forward support for the hanger bolt as shown. Attach the supports to the jig base.

Use the sliding carriage and drill to bore four 1/8-in. pilot holes through the fence stock at the bolt locations. Then, remove your drill from the carriage, position the fence and continue the holes through the table. On the bottom of the table, bore 1/8-in.-deep x 3/4-in.-dia. counterbores for the Tee-

nuts. Then bore out the 1/8-in. table pilot holes to 5/16 in. and install the Teenuts. Switch to a 1/4-in.-bit and re-bore the pilot holes in the fence.

Temporarily attach the fence and place the table in position on the supports. Use a square or drafting triangle to accurately align the table so the fence is square with the carriage guides (Photo 15). You'll have to tilt and lock the platform to allow the triangle or square to contact both the fence and the carriage guide. When the table is aligned properly, tack-nail it to the rear support and bore screw pilot holes. Then, remove the fence and bore screw pilot holes in the fence

groove for securing the table to the forward support. Permanently secure the table to the supports with screws. Cut the fence into two pieces to create an opening for the drill bit.

Lay out the sliding support on 3/4-in.-thick hardwood stock and use a sabre saw to cut the shape. This piece helps support the tilting table at shallow height settings. Bore the finger-pull hole and lay out the slot so it's aligned with the hanger bolt hole in the forward table support. Cut the slot with a sabre saw or scroll saw after boring holes at the slot ends. Finally, install the sliding support and the T-knob and hanger bolt (Photo 16).

Hole Spacing Guide

To position holes correctly, don't measure, use this jig.

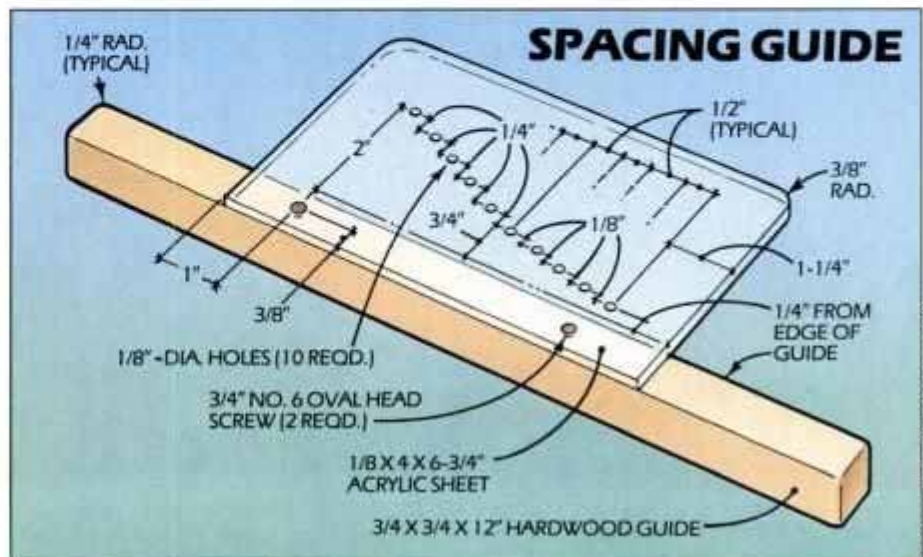
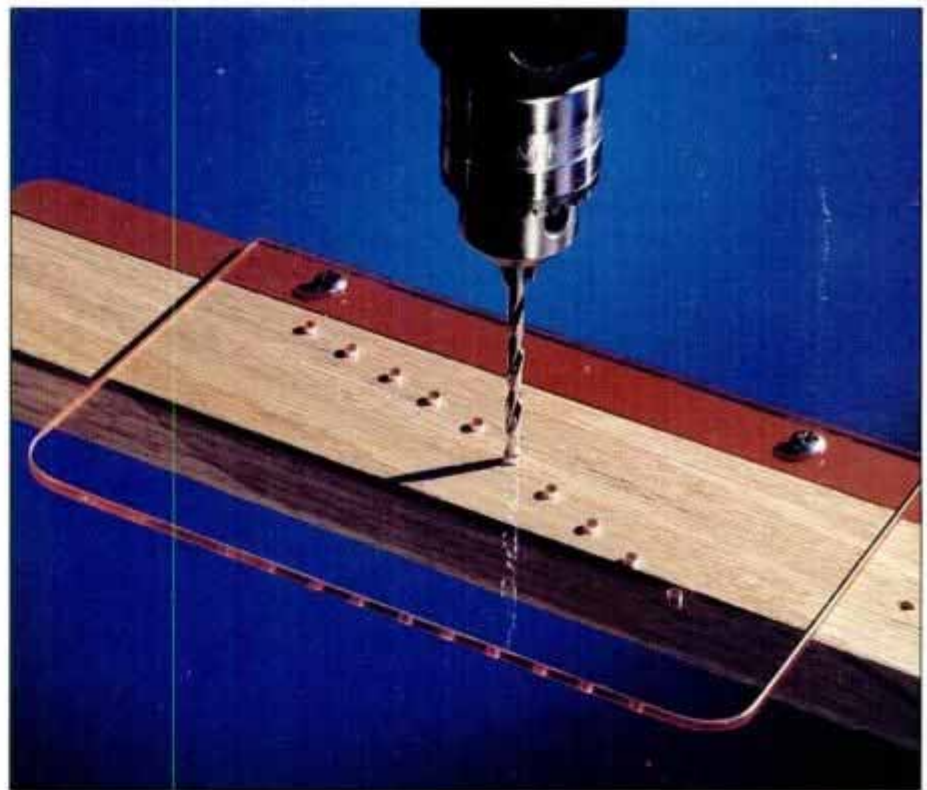
This jig aids in boring screw pilot holes, shelf pinholes and any other series of holes that must be placed at a uniform distance from an edge.

To make the jig, first cut a piece of acrylic sheet to size. Then, tape a piece of paper to the sheet and mark the hole centers. Clamp a backup block to the work, and use a brad point bit to bore the holes. We used the horizontal boring jig to do the job (Photo 1). Attach the sheet to a hardwood guide strip with two wood screws as shown in the drawing.

The hole spacing and diameter we show in the illustration produce a general-purpose jig that's useful for boring pilot holes. You can easily vary the dimensions to suit specific applications that require a larger hole size or different spacing.



1 We used the horizontal boring jig to make this spacing jig. Change the hole diameter and spacing to suit application.



Self-Centering Jig

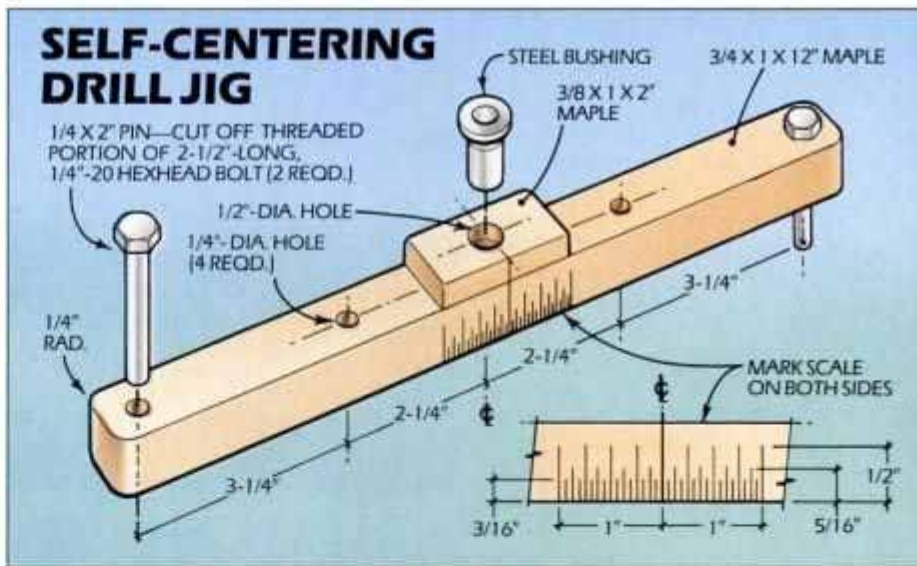
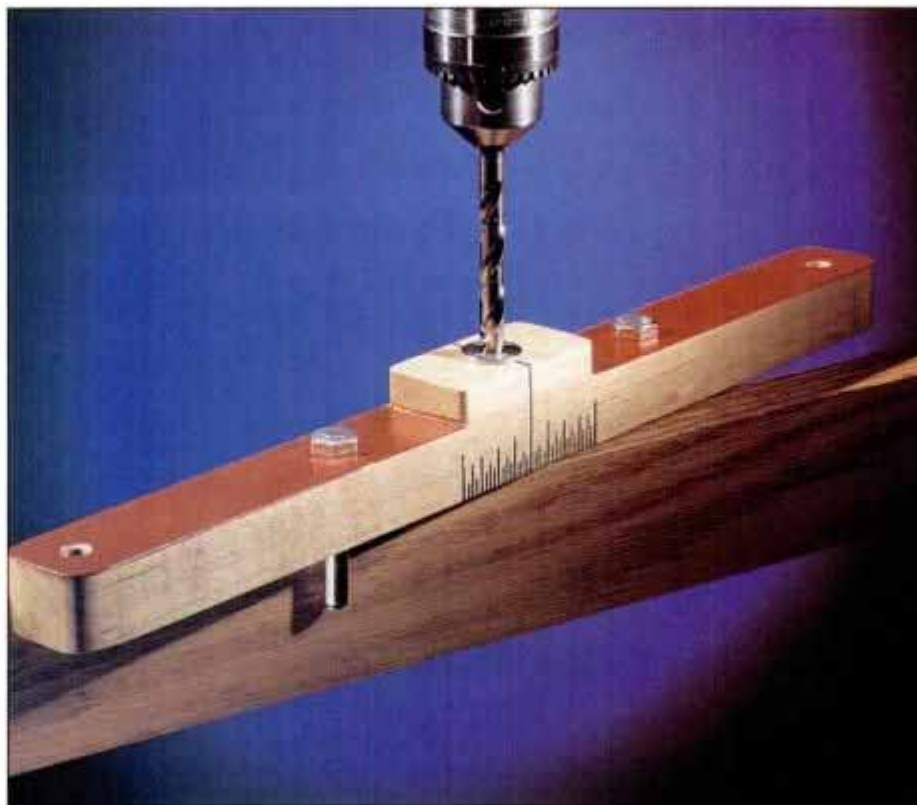
No matter what your stock thickness, this jig centers holes every time.

If you've tried to position centered holes by measuring the thickness of the work and dividing in half, you know that the holes rarely fall exactly where you want them. This jig automatically centers holes regardless of stock size. To use it, you simply place it diagonally over the work and turn it to bring the pins on each end in contact with the workfaces. Our design features two sets of pinholes to handle thick and thin stock. The graduations drawn on the jig aid in aligning the hole with a mark on the face or edge of the workpiece.

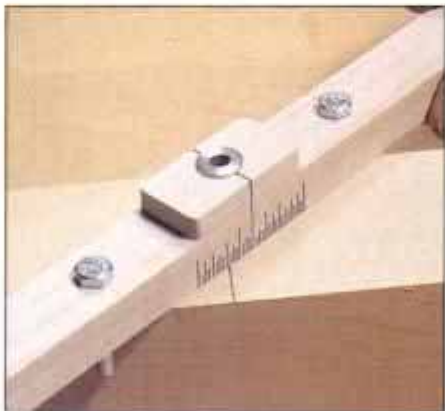
To make the jig, cut the hardwood parts to size and glue the small block to the center to hold the bit bushing. Then, accurately lay out the hole centers and bore the holes on the horizontal boring jig or a drill press.

Use a fine-point felt-tip pen to draw the graduations on both sides of the jig as shown (Photo 1). To make the pins, cut off the threaded portion from 2½-in.-long, ¼-in. bolts. Steel drill-bit bushings are available in ¼-, ⅜- and ½-in. sizes from mail-order suppliers. One source is Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601.

To align the jig with a centerline marked on the workpiece, simply line up diagonally opposed graduations with the centerline (Photo 2). Then, with a bushing that matches the bit installed in your drill, insert the bit in the bushing and bore a perfectly centered hole (Photo 3). **PM**



1 Use a black fine-point pen to mark the graduations. Make sure the graduations on each side are aligned accurately.



2 To position jig with layout mark on workpiece, align similar graduation marks on opposite sides of jig.



3 To use jig, install steel bushing to suit bit. Place jig over the work and bring the pins in contact with the workfaces.

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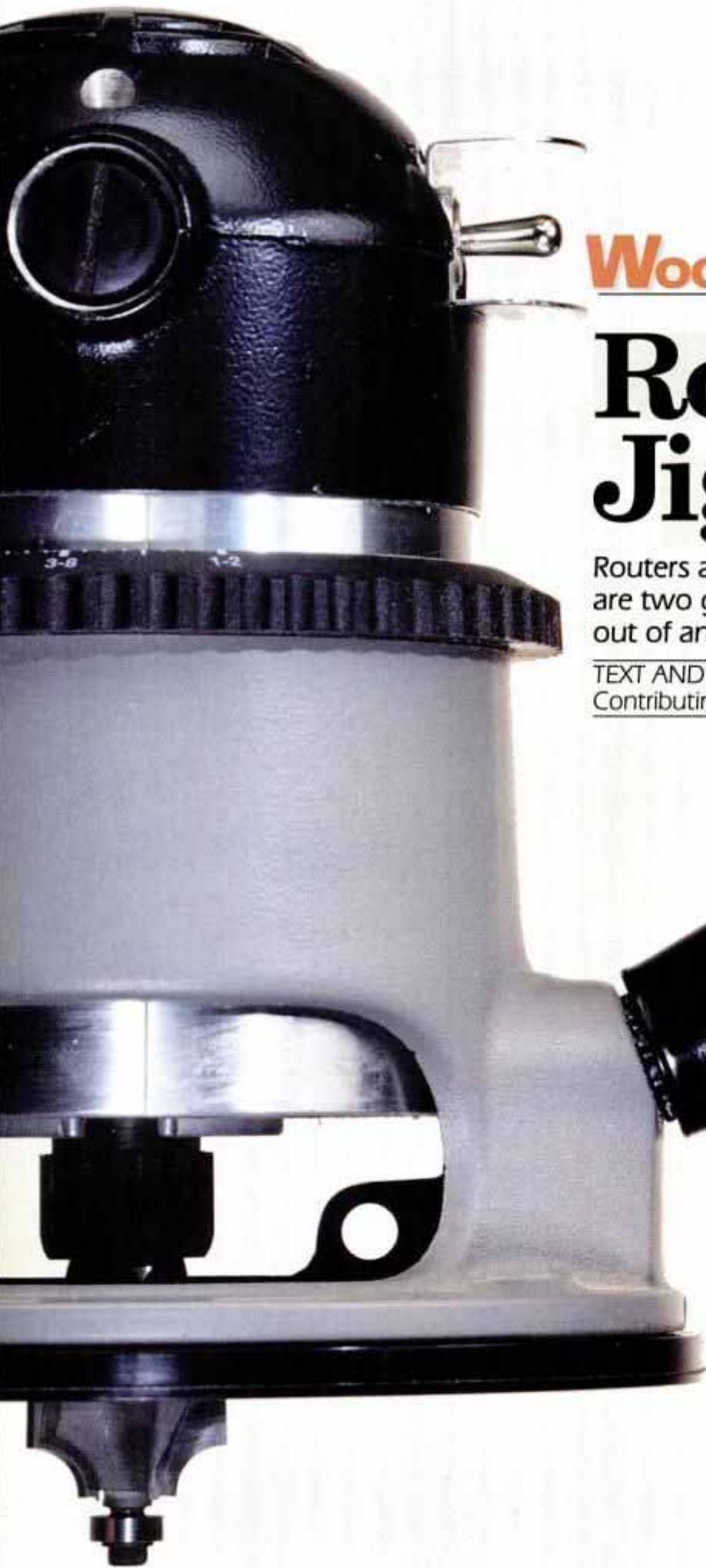
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WOODWORKING GUIDE

Router Jigs

Routers and jigs go hand in hand. Here are two great jigs for getting the most out of any router.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO,
Contributing Editor





Surfacing Jig

If you don't have a planer and a jointer, here's how to get your router to true and thickness your stock.

● Experienced woodworkers know that there's more to building than cutting lumberyard stock to length and width. Sometimes the two or three standard thicknesses just won't work. And other times, the wood is cupped or warped to the point that it's unusable. If you own a router, however, you don't have to live with either of these problems. In conjunction with this surfacing jig, your router will level rough or warped stock, and trim it to the thickness that's right for your job.

The jig is comprised of two L-shaped tracks that hold the work. An adjustable carriage that holds the router rides on top of the tracks. In operation, the router, equipped with a large-diameter straight bit, moves across the work on its carriage while the bit levels a strip across the surface. After each pass, the carriage is moved along the L-shaped tracks for the next pass.

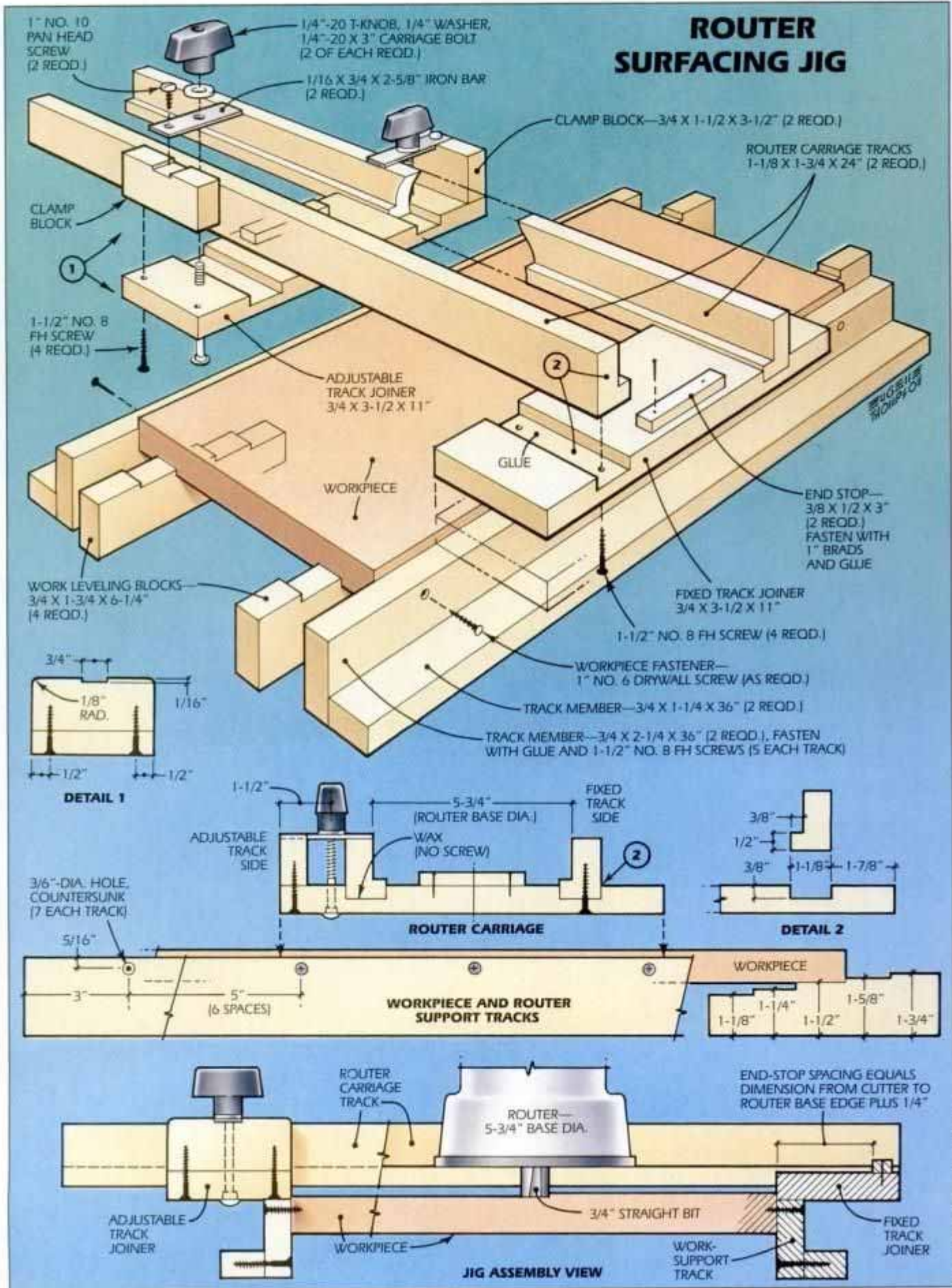


1 Make the carriage tracks and place them on the track joiners. Adjust spacing and then mark for joiner dadoes.

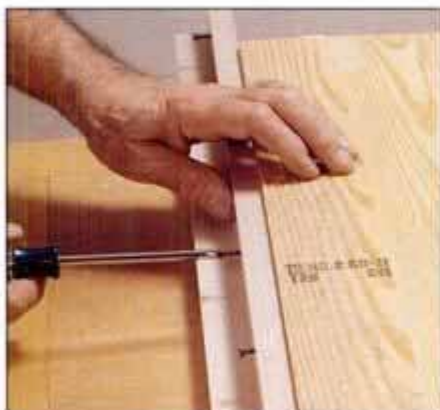


2 After the dadoes have been cut in the joiners, secure one joiner with glue and screws. Opposite joiner is adjustable.

ROUTER SURFACING JIG



TM TECHNICAL ART BY EUGENE THOMPSON



3 Use drywall screws to secure the work to the tracks. Stepped blocks shown in the drawing (left) hold work at correct height.

We dimensioned our surfacing jig to handle work up to 18 x 30 in., but its capacity can be modified by changing the size of the carriage and the length of the tracks.

Begin by cutting the stock for the carriage tracks and the track joiners to size. You can use your router to cut the track rabbets, but a table saw is faster. Make each rabbet in two passes—the shallow cut first, followed by the deep cut that removes the waste.

The dadoes in the joiner pieces are

positioned to suit the size of your router base. To ensure accurate placement, set the tracks parallel to each other on the joiner pieces and space them so the router fits in between (Photo 1). You can use your router to cut the dadoes, or a table saw equipped with a dado blade.

Attach one end of each track to one joiner piece with screws (Photo 2)—the other joiner is adjustable. Cut the clamp blocks for the adjustable joiner to size, and use a sharp chisel to shape the recesses for the 1/16-in.-thick iron clamping bars.

Then, attach the clamping blocks to the adjustable joiner with screws. Bore the holes through the clamping bar as a guide, bore a corresponding bolt hole through each end of the joiner. Install the bolts and T-knobs. Make and install stops on the joiners that limit router travel. Set these back 1/4 in. farther than the router-base-to-cutter distance so the cutter travel extends past the work edge.

To make the tracks, rip the track



4 Position router carriage over L-shaped tracks and lock sliding joiner. Then adjust bit depth for shallow cut.

members to width and assemble both L-shaped pieces with screws and glue. Then, bore and countersink the holes for the drywall screws that hold the stock.

To install the workpiece, first make four stepped leveling blocks as shown. Use these to support the work while the L-shaped tracks are screwed to the work edges (Photo 3). Then adjust the carriage to fit over the tracks, tighten the clamps and set the bit depth for the first pass (Photo 4).

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Edge Guide

A better fence design for moldings, rabbets and dadoes.

Of all the jigs that you can buy or make to enhance your router, a basic edge guide, or fence, is the most essential. Considering its usefulness, however, it's surprising that many routers don't come with one—you have to buy it as a special accessory.

Actually, you don't have to buy one, you can make it yourself. Our edge guide is based on an oversize clear-acrylic baseplate with a pivoting fence that's adjusted at one point.

Construction

Begin by cutting a sheet of 1/4-in. acrylic plastic to 12 in. square. Leave on the protective paper. You'll use this for marking layout lines.

You can cut the curved edge free-hand with a scroll saw, band saw or sabre saw, but it's best to use a stationary tool equipped with a simple pivoting jig to guide the cut. First, bore a small nail hole at the baseplate pivot point. Then, drive a nail



through this hole into a board clamped to the scroll saw or band saw table. Align the hole with the front edge of the scroll or band saw blade.

Remove your router's baseplate, place it on the acrylic sheet and trace

the screwholes and central router-bit hole (Photo 1). Use a 2-in. hole saw to bore the center hole. Then, bore and countersink the screwholes.

Cut the fence to size and bore the pivot hole with a 1/4-in.-dia. bit. To



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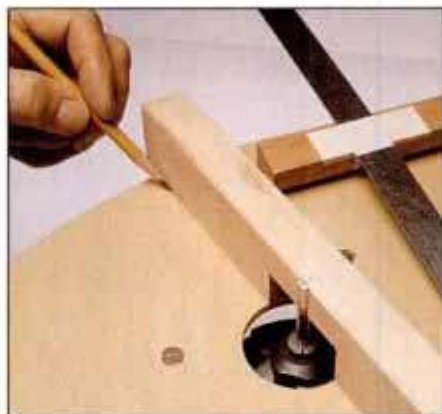


RESULTS ARE IN. RUST & LIME STAINS ARE OUT.

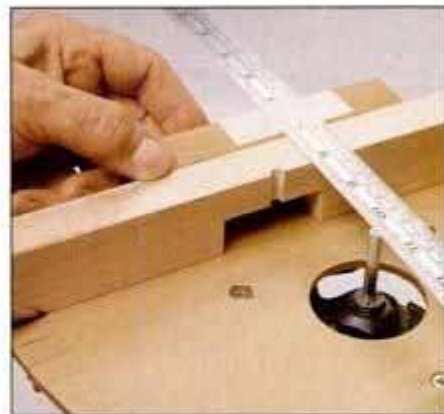
Iron Out is America's favorite rust & stain remover. All Out Bath & Kitchen Cleaner removes lime, soap & hard water deposits without scrubbing. Both are guaranteed to perform satisfactorily or your money back. Now at your favorite store or call 1-800-654-0791.



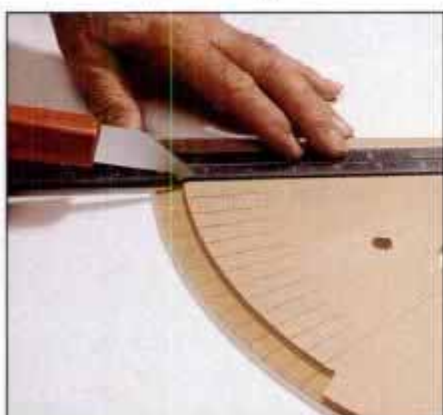
1 Remove the base from the router and use it to mark the screwholes and the router-bit hole on the acrylic sheet.



2 Install a 1/4-in. rod in router and attach router and fence to the new base. Seat rod in half hole to find zero mark.



3 Tape a block to a finely graduated rule. Pivot fence while aligning rule graduations with rod center to locate base graduations.



4 Peel away a 5/8-in.-wide strip of protective paper at the arc edge. Then, continue graduation lines by scribing on acrylic.

bore the 1/4-in. half hole, first mark the hole location. Then, clamp a piece of scrap wood to the face of the fence and use the seam between the two pieces as a centerline for the hole.

Shape the clamp recess by first boring a 1/2-in.-dia. hole into the end as

shown. Then, remove the remaining waste by boring a 5/16-in. hole and finishing the slot with a sharp chisel.

Attach the router and fence to the new baseplate and secure a 1/4-in.-dia. alignment rod (cut from a bolt) in the router collet. Glue a piece of paper to the end of the alignment rod and mark centerlines on the end.

Tape a rule with fine graduations to a small block of wood to act as a square. Align a whole number on the rule with the inside edge of the block.

To make the zero mark on the baseplate, align the fence so the alignment rod is seated in the half hole (Photo 2). Subsequent graduations are marked in 1/4-in. increments. However, they are offset from the original zero mark by 1/8 in. to align with a similarly offset index mark on the fence.

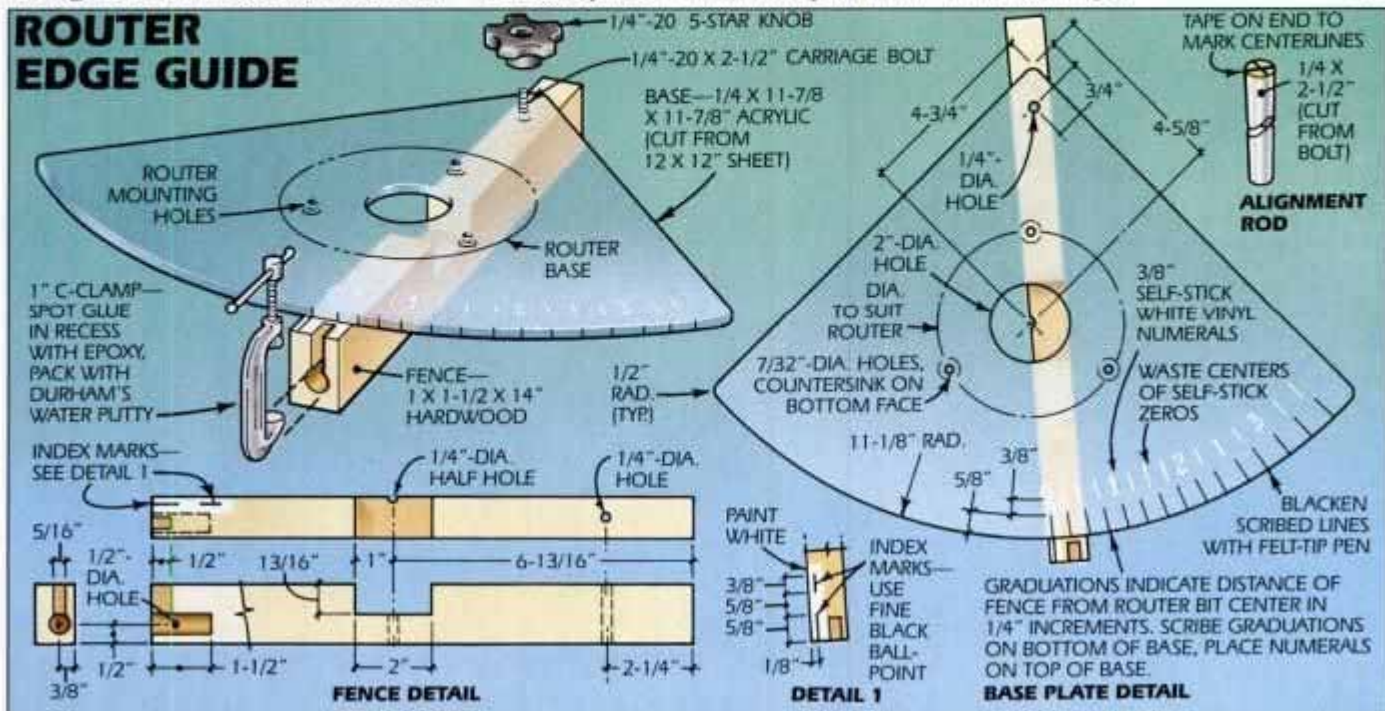
Using the shopmade square, pivot the fence 1/8 in. from the alignment rod center and mark a 2-in.-long line on the baseplate. From this position,

mark lines on the baseplate that indicate fence positions as you move it in 1/4-in. increments (Photo 3).

Peel away a 5/8-in.-wide strip of the protective paper from the arc edge. Use a rule and a plastic-laminate scoring tool (available where laminate is sold) to scribe a line at each graduation (Photo 4). Then, ink the scribed lines with a black felt-tipped pen, and wipe away the surplus ink with an alcohol-dampened cloth.

Peel away the remaining protective paper. Use 3/8-in. self-stick vinyl numerals, available at stationery and art supply stores, to designate each graduation. To create bars between the numerals, use the waste centers from the zero self-stick numerals.

Fill the clamp recess with Durham's Water Putty, then firmly seat the clamp in the recess. Paint a white spot on the fence end, and mark the index line on the white spot 1/8 in. from the fence edge. **FM**



THE FUTURE IN HOME SECURITY IS HERE... AND AFFORDABLE TO EVERYONE!!!

The application of space-age technology applied to over three years of intensive engineering and development in the U.S., Scotland, and the Far East has resulted in a major breakthrough in home security, the GT7900 (The Snitch). Guardtech Industries has combined the best features of the most advanced security systems currently available at any price. The GT7900 is user installable, utilizes passive infra-red and R.F. technology, and is completely portable. Set-up takes just minutes. The Snitch is the only system of its type ever developed.

Now every homeowner, apartment resident, college student and small business owner can have the protection and peace of mind of a professional security system for only \$249.00 or 3 monthly payments of \$83.00 — 5 to 10 times less than outdated hard-wired systems that have fewer features.

Three components work in concert to bring Americans true, affordable security. The brain of the GT7900, the "Snitch", is the Base Console. The Base Console utilizes state-of-the-art microprocessors to perform a myriad of functions, until now unheard of in the "Snitch's" price range. For example, the Base Console has a built-in digital communicator and is therefore able to interface with any U.L. approved monitoring facility. In addition to the loud alarm siren, it has a chime mode that lets you know when someone enters or moves about a room...excellent for alerting you when small children get out of bed at night and, coupled with the "silent alarm" option and monitoring, it is excellent for small businesses, alerting police of an attempted hold-up. Working in conjunction with the Base Console is a passive infra-red Motion Detector called the SN794. The SN794 incorporates the world's first 360° portable means of motion detection. One Motion Detector can accurately cover an open area up to 1400 square feet. The system can accept a total of four Motion Detectors which will allow total coverage of up to 6000 square feet.

Another remarkable feature of the SN794 is its ability to go from 360° of coverage to 90°. This is accomplished through the use of the supplied blockage Shutters. The Shutters will allow you to walk around freely in the same room as the Motion Detector without disturbing its protective beam. Wireless technology means that the Motion Detector does not need to be in the same room as the Base Console. In fact, it has a 100 foot range.

To operate the system, all that is necessary is Guardtech's SR804 Keychain Remote Control. Unlike complicated alpha-numeric keypads on other systems, the SR804 is a wireless Remote Control which will Arm, Disarm and even trip the Panic function with the push of a button. With a range of over 100 feet, it can Arm and Disarm the system upon exit or entry of the home even through walls and doors, thereby minimizing the customary entry and exit delays associated with keypad type systems. The GT7900 can accept up to 8 Remotes so every member of the family can carry one.

What better gift for Christmas than the peace of mind that the "Snitch" will bring to your loved ones, friends, business associates, or that college student.

If you are not completely satisfied with your GT7900, and the peace of mind it will give you and your family, we will refund your complete purchase price, if it is returned within 30 days of purchase.

To inquire about installment payments on your credit card, please call the Toll FREE number at the bottom of this ad.

MAIL TODAY TO:
Guardtech Industries, P.O. Box 19665, Portland, OR 97280-0665

Please send me the item(s) below. I understand that if I am not completely satisfied I can return them within 30 days for a full refund of the purchase price.

	How Many	Sub Total
Complete System \$249.00 plus \$12.95 for Shipping & Handling		
Additional Motion Detectors \$79.95 each plus \$8.95 each S & H		
Additional Remote Controls \$24.95 each plus \$5.95 each S & H		
TOTAL ENCLOSED OR CHARGED (AZ residents, please add sales tax)		

PLEASE PRINT CLEARLY:

Name _____

Address _____

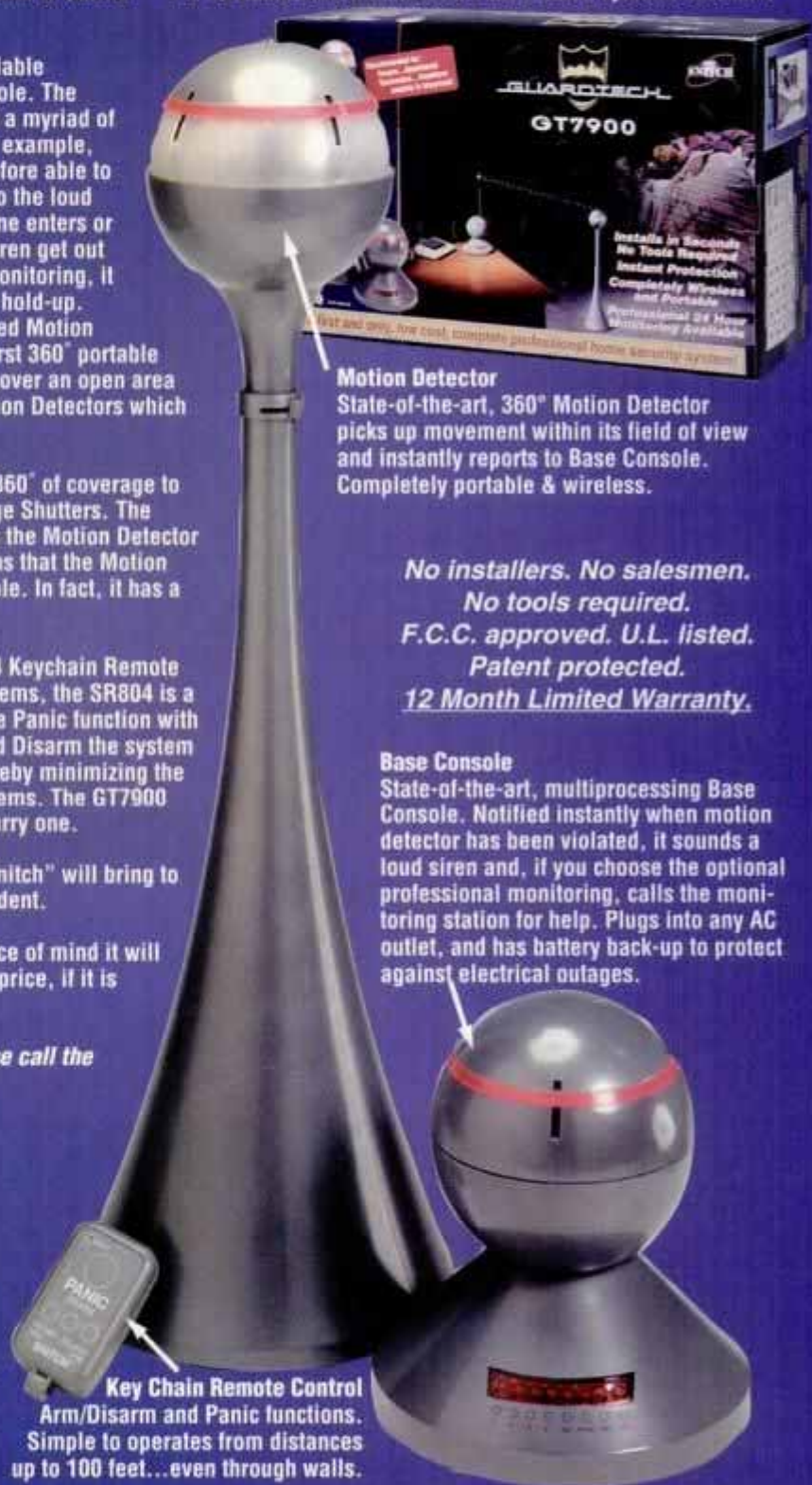
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Motion Detector

State-of-the-art, 360° Motion Detector picks up movement within its field of view and instantly reports to Base Console. Completely portable & wireless.

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No tools required.
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CAR CARE

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

Caught In The Crossfire

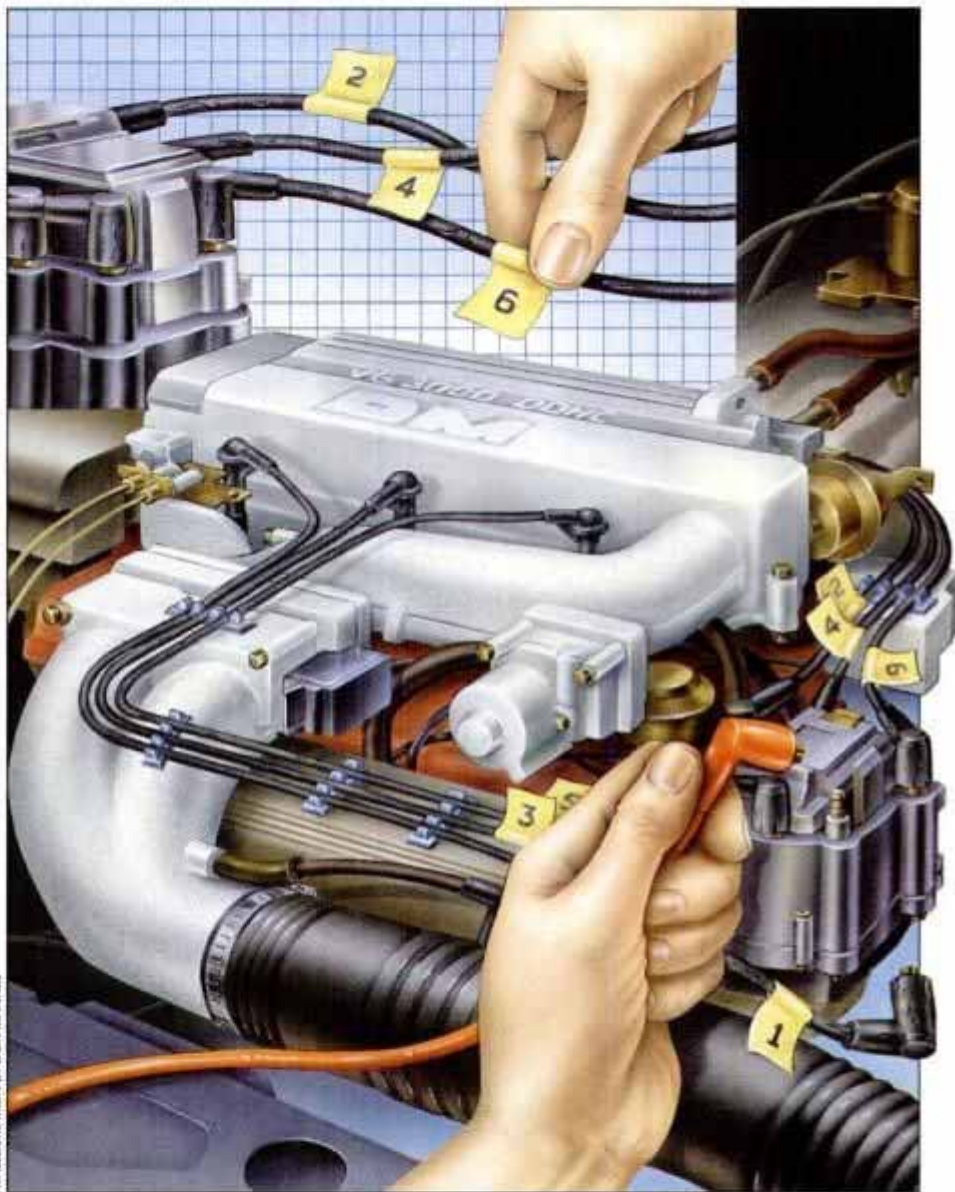
My 1984 Buick Regal has developed a misfire. It was hard to start and got really crummy gas mileage, so I took it to a mechanic for a tuneup. After I got it back, it ran better, but it still had a lumpy idle and a high-speed misfire. I opened the hood one evening, and there were little blue arcs all over the plug wires. So I bought a set of spark plugs at the discount store and put them on. Now the car is much easier to start, the high-speed misfire is gone—but there's still an occasional misfire at almost any speed, including idle. Sometimes it's almost like a little cough and a stumble. The mechanic says I have to pay him almost \$200 to clean my fuel injection.

DAVID PAYSTON
TAOS, NM

First off, \$200 is too much for cleaning a throttle-body injector. This can be accomplished in 10 minutes with a can of aerosol carb cleaner and a shop rag, followed by a can of injector cleaner in the fuel tank.

The problem you have now is the plug wires. Avoid el-cheapo brand universal plug wire kits, and get a set of wires specifically cut for your engine. The reason you have a misfire is because of crossfire between cylinders, caused by inductive coupling of the high-voltage signal between two adjacent wires. The cylinder that's getting the wrong signal fires on the wrong part of the combustion cycle, and hiccups exhaust gas back into the intake manifold.

Car manufacturers take great pains to dress the wires to prevent this. When you replace plug wires, replace them one at a time, be sure the new wire is exactly the same length as the old one, and be sure it's routed through all of the original little cable standoffs in the original location. This ensures that there's adequate insulating space between wires to cylinders near each other in the firing order.



PH ILLUSTRATION BY DON WAPNES

Long Dry Spell

I have a motorhome that always runs really well, but after it sits for a few days I have to crank the engine for an excessive amount of time before it will start. The engine is a carbureted Ford 460 V8, and there's an electric fuel pump mounted near the tank.

JOSEPH SELLARS
TAVARES, FL

In spite of the electric fuel pump, you're not getting fuel to the carb until the engine has been turned on for a while. Fuel simply drains back into the tank after a few days in spite of the check valve in the pump.

You could try turning the key to the ON position for a few seconds before cranking the engine over. This will let the pump run. However, better motorhomes have an interlock that won't let the fuel pump run unless the engine is spinning, whether the spinning is from the starter motor or the engine simply running after it's been started. That's to keep the pump from pumping away after the motor stalls and running down the battery, or—worse yet—feeding a fire in an unattended motorhome.

In your case, I'd rig up a bypass switch to feed 12 volts to the pump circuit. Steal the 12 volts from a cir-

CAR CARE

cuit that's only on when the ignition is, and use a momentary switch—just turn the key to ON, hit the switch for 10 seconds until the fuel line and carburetor float bowl fill with fuel, and then start the engine.

Box Versus Card

I want to work on my own computer-controlled, fuel-injected car—I've taken the plunge and dropped almost a hundred bucks on the factory shop manual for the ignition and fuel-injection systems. Now that I've read them, I find that I need an analyzer box that I have to buy from the dealer for more than my 10-year-old car is worth. The discount auto parts emporium down the street sells a black box that it claims will do the same thing. I smell a rat, because the store only wants \$29.95, not the \$1000 or more the genuine Chevrolet part would cost.

JOHN SAWSAWER
MENOMINEE, MI

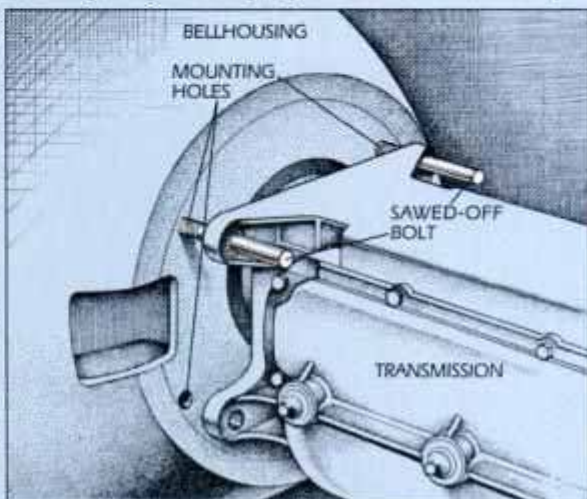
Well, it's not exactly a rat, John, but you're correct that the blister-pack wonder they want to sell you doesn't have the same capabilities the GM Tech One tool does. Surprise, surprise, surprise. The Tech One scan

Threaded Pair Of Hands

● There I was, bench pressing the manual transmission on my new, er, old pickup after transplanting in a new clutch and flywheel (towing uses up clutches pretty quickly, you see). And, as usual, I was working alone in the wee small hours. So, lying on a creeper under the truck, I've got this cast-iron-cased trans lying on my chest, in preparation for hoisting it straight up and onto the back of the bellhousing.

Fat chance. I can get it up there, but I need at least two more hands to hold it there while I turn the bolts finger-tight. Dangling the trans from the input shaft is likely to bend something that's supposed to stay straight.

I extricated myself, and went through the scrap hardware drawer. Finding a pair of long bolts with the right threads, I hacksawed the heads off—although threaded rod would do. If you thread the long bolts or rod into a couple of mounting holes, you can hang the tranny from them while you use one hand to start the real bolts in the other holes.



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tool has its own internal computer and actually has a dialogue with the car's ECM (Electronic Control Module) computer, and gives you a read-out of trouble codes as well as a lot of information from the ECM's sensors.

Obviously a gadget that costs less than a plate of sushi here in Manhattan can't do that. There are several of these types of boxes on the market. They basically consist of a box with a connector that mates with the ALDL (Assembly Line Diagnostic Link) connector, just like the Tech One. These units have a switch mounted in the box that simply shorts two wires in the ALDL harness. This causes the ECM to go into a mode that flashes a light or buzzer on the box in a coded sequence. That's your trouble code, generated by the ECM when it finds a malfunction in the engine's sensors. Look up the code in the manual that comes with your bargain wonder box and you'll have a good idea of what's wrong with your car.

What they don't tell you is all you need is a small piece of wire to short the same two terminals to make the ECM flash the CHECK ENGINE light on the dash in the same code. And you've got the factory manual—with the trouble codes in it and more—so you don't really need the box's manual. Others may find the \$30 a good

investment, mostly for the manual—which may or may not be very good.

I have a credit-card-size alternative in my toolbox. It's called Code Card. It has, in very fine print, the trouble codes for almost every GM car since 1983, except Cadillac. The card also has a couple of metal pins sticking out of it that you push directly into the ALDL to force the ECM into diagnostic mode. Better yet, it's only \$4.95. Send cash or check and an SASE envelope to

Dept. PMCC, Engine Control and Monitoring, 101 First St., Suite 365, Los Altos, CA 94022. Ron Patrick at Engine Control tells me he's working on a Code Card for Ford and Chrysler as well—but they're not ready yet. Stay tuned. **PM**

DO YOU HAVE A CAR PROBLEM?

Just ask Mike about it. Mail your question to Car Clinic, Popular Mechanics, 224 W. 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.

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SERVICE TIPS

- Nissan no longer recommends using fuel-injector cleaners with most of its vehicles. Starting in 1991, the carmaker gradually switched over to pintleless-type injectors, which aren't as likely to get clogged from carbon and varnish as pintle-variety injectors are. Check with your dealer to see if your car or truck uses pintleless injectors before using a liquid injector cleaner. Use of such cleaners may corrode the injector coil and do no good in the process.

- If your Saturn (any year, any model) has been exhibiting a minor weepage of engine coolant, GM suggests you try adding a special cooling-system sealant pellet to the system and running the engine for 30 to 60 minutes to plug the leaks. The pellets are available from your dealer under part No. 21007224.

- Toyota has released a new brake pad for '92-'93 Camrys that should reduce any groaning or grinding noise from the front brakes. They're completely interchangeable with the older pads.

NEW PRODUCTS

IMPROVE YOUR CAR

Cable Keeper

Battery jumper cables are a blessing when you need them, but a curse when they're spread out in a tangled mess. In many cases, it can take more time to straighten out the cables than to actually hook them up. The Cable Keeper removes the tangled-cable curse by winding and storing cables neatly in a compact case. Special insulation keeps the cables flexible down to -40° F. Available in a wide range of lengths and gauges, the cables work with top- or side-post batteries. Cable Keeper prices range from \$19.95 to \$44.50, and are available at Wal-Mart stores. Contact: Cable Keeper Corp., 5201 Branson Rd., Poteau, OK 74953; (800) 748-6369.



Wiper Wipers

Ever turn on your wipers and it's smear city instead of a nice, clear windshield? Now, you can tape special strips to the base of your windshield that clean your wiper blades every time your wipers pass over them. The strips remove the debris and oxidized rubber particles that cause streaking. The Clean Sweep strips cost \$14.95 for two 20-in. strips and are available only from the manufacturer: Cleartec Corp., P.O. Box 571, Abington, PA 19001-0571; (215) 947-5582.

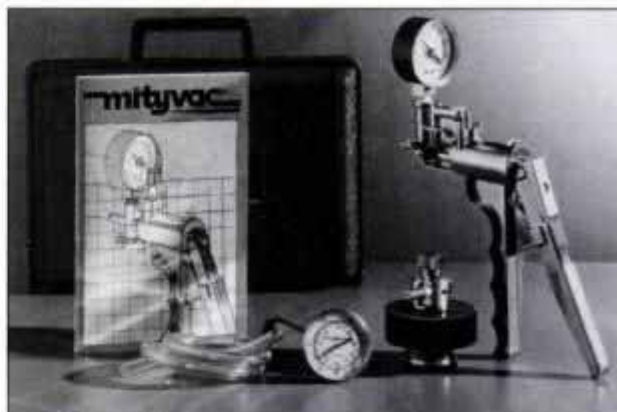


Easy Rollers

Significant breakthroughs in tire technology do not occur that often, so Michelin's new XSE technology, or "Green X" tires, is real news. The new tires reduce rolling resistance by up to 35% over other tires, while improving wet-road traction. In the process, the XSE technology does not adversely affect wear. Compared with tires that offer similar performance except for rolling resistance, Green X tires would boost a vehicle's fuel efficiency by about 5%. Installed now as original equipment on Hondas, Mercedes-Benzes and BMWs, Green X tires will be sold through replacement tire outlets, and will be available in early 1995. Contact: Michelin Tire Corp., P.O. Box 19001, Greenville, SC 29602; (803) 458-6443.

Cooling System Tester

A mighty hiss, a cloud of steam and a hearty, "Oh, no." Cooling system failure strikes again. You've got a better chance of not being part of this picture if you check your cooling system on a regular basis. And Mityvac's Cooling System Test Kit with its vacuum/pressure pump is a big help. The drill is simple: Insert the temperature probe into the adapter and install it on the radiator. The pump pressurizes the system so you can check radiator-cap pressure relief points, as well as the precise temperature the thermostat opens, the operation of temperature sensors for cooling fans and the integrity of hoses and connections. The kit returns the pressurized coolant to the cooling system, eliminating loss. The test kit lists for \$159.95 at auto parts stores. From Mityvac Automotive Products Div., Neward Enterprises Inc., 9251 Archibald Ave., Rancho Cucamonga, CA 91730; (909) 987-8975.



Pickup Storage Bag

Pickup trucks are made for hauling items large enough to stay put in the bed. But what about smaller items or things like bags of groceries? A quick stop or a sharp turn, and you have your eggs and apples bouncing off the truck bed walls. Sak-It-All is like a trunk for your pickup. A waterproof bag made from a strong polypropylene fabric temporarily stores and protects items that would otherwise spill or roll around the bed. Available in five universal sizes, the bag rolls up for storage behind the seat when not in use. Prices range from \$110 to \$130. It's made by Vehicle Specialty Products Inc., 13 Hampshire Dr., Hudson, NH 03051; (800) SAK-IT-ALL. **PM**



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SATURDAY MECHANIC

PREPPING YOUR CAR FOR PAINT

BY JOHN DECKER

● Junior has asked to borrow the keys for his big date on Friday. So you reach into your pocket for the keys to your pickup, traditionally his weapon of choice for cruising with the big guys. But this time he demurs—Betty Sue thinks the truck is too nasty-looking, and he'd prefer to use Mom's car.

After the shock of rejection wears off, you stroll out and examine the pickup. After all, when a teenager thinks your truck needs cosmetic improvement, it's time to pull off the blinders and think about a little bodywork.

Painting is for pros

Prep work aside, automotive painting couldn't be easier. With a little experience, spraying an entire car should only take about 20 minutes.

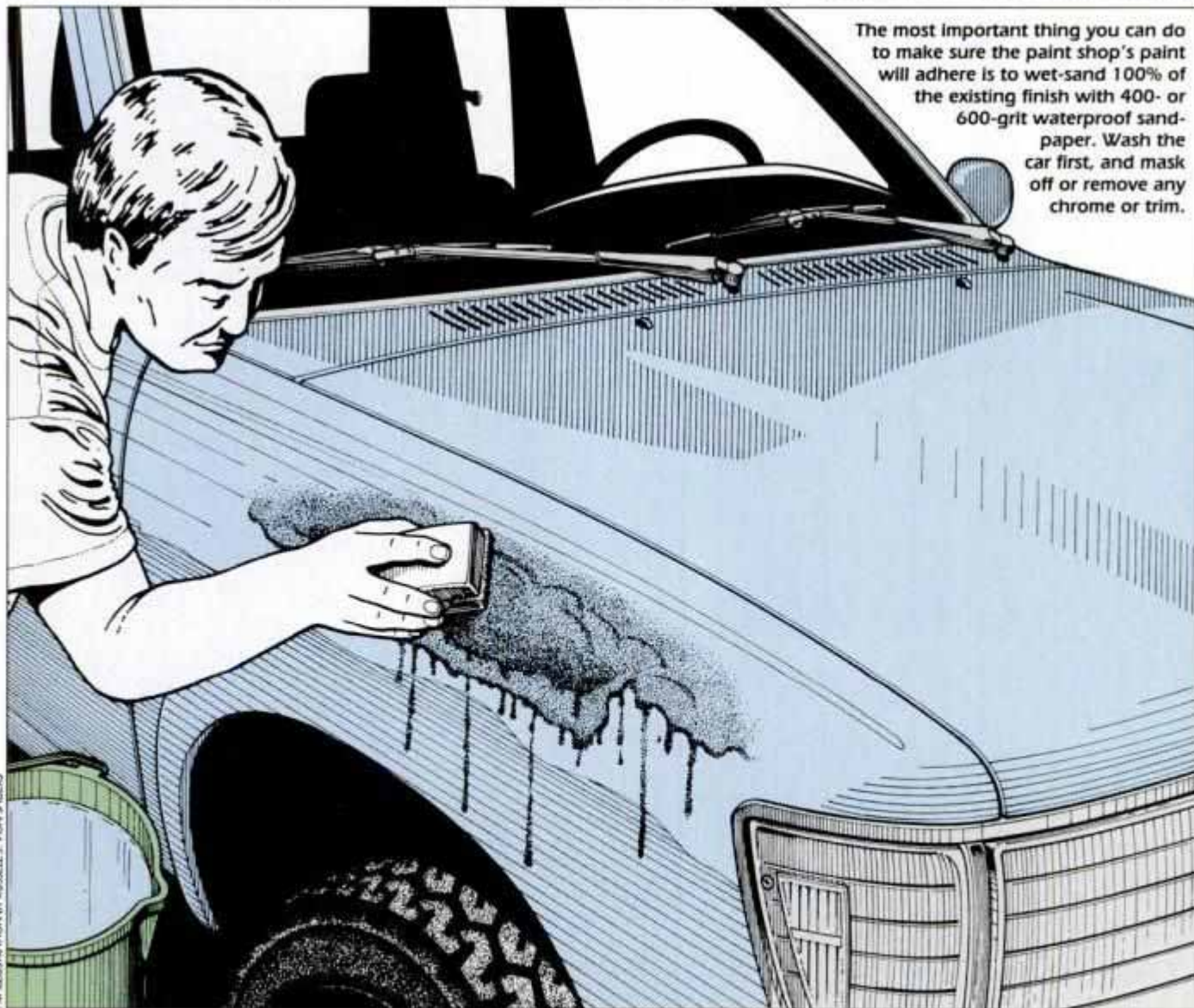
All you need is an air compressor and a spray gun. Oh yeah, you'll also need a \$30,000 downdraft spray booth (with baking cycle), a supplied-air respirator and a real knack for smoothly flowing on paint without runs, sags or orange peel.

There's the rub. You may have a compressor and spray gun, but even large body shops can barely afford the

other stuff. And when you consider that chain refinishers such as Earl Scheib and Maaco can do an adequate job of painting your current ride for \$150 to \$300, it makes sense to leave paint work to the pros.

Besides, for absolutely optimum results, 90% of a good paint job is not in the painting anyway, it's in the pre-painting preparation. And you can do that yourself.

As you might guess, budget paint jobs don't include a whole lot of prep work. For \$149.95, Earl Scheib's preparation includes machine sand-



The most important thing you can do to make sure the paint shop's paint will adhere is to wet-sand 100% of the existing finish with 400- or 600-grit waterproof sandpaper. Wash the car first, and mask off or remove any chrome or trim.

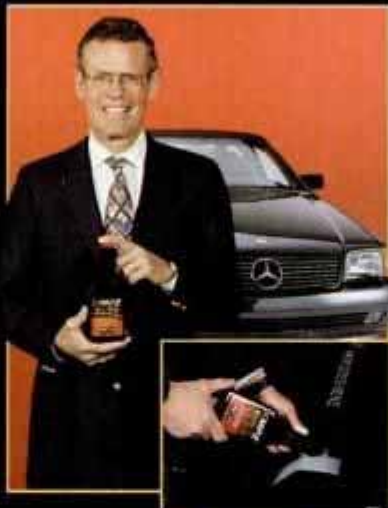
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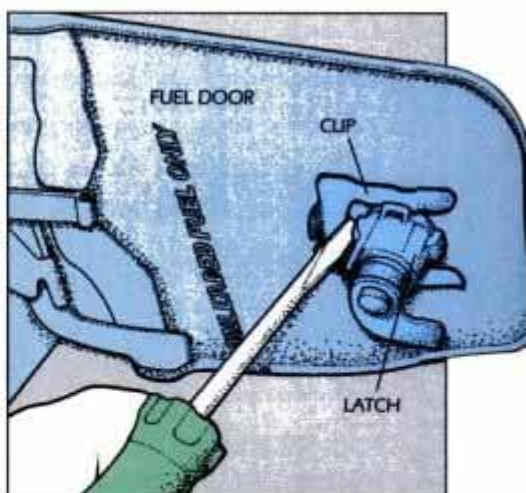
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CAR CARE



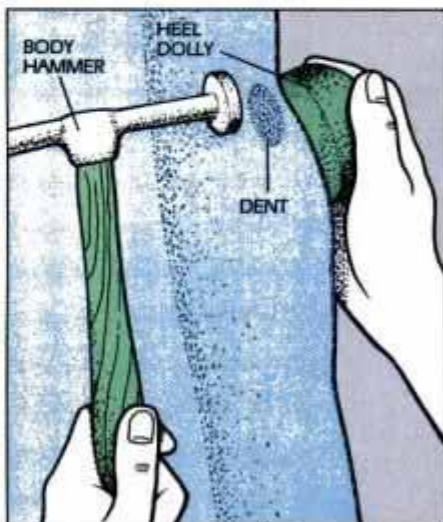
Remove as much of the hardware and trim as you can, instead of masking.

ing, chemically cleaning the body, spot priming areas that need it and masking over things that aren't supposed to be painted—like the windows. At some cut-rate shops, chrome and badges are negotiable. Any necessary bodywork costs extra.

Doing your own light bodywork such as fixing small dents and door dings or repairing rusty areas (see "Repairing Body Rust," page 101, June '94) can save you a lot of money and help ensure the quality of the finished job. You can also greatly improve the quality of a budget paint job by removing and sanding under items that the painters would normally mask over, such as badges and assorted trim. But don't start sanding and dismantling your car first. A body shop will be much more receptive to your plan if you let them know what you're going to do ahead of time.

Paint prep primer

Unless you really hate the color of your vehicle, you'll save yourself work



Use a body hammer and dolly to smooth out minor dents. Take your time.

CAR CARE

and aggravation if you plan to keep it the same color. Among other things, you can avoid the hours of prep work and extra expense of painting doorjamb and the underside of the trunklid and hood. You also avoid the chance of unpainted spots rearing themselves unexpectedly.

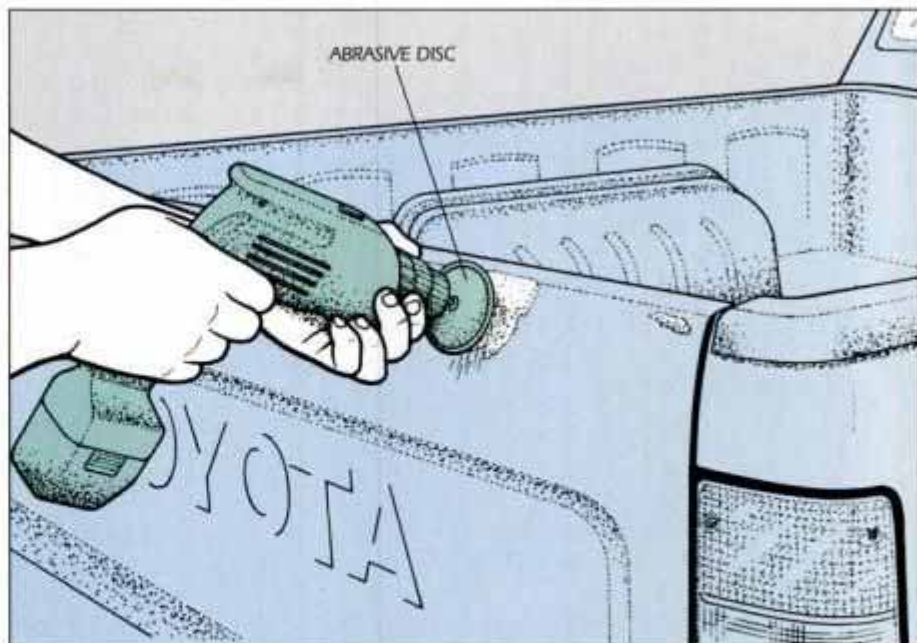
Start your paint prep by taking your vehicle to a do-it-yourself car wash. Pressure washing the engine, doorjamb, wheel wells and other under-body areas will help to ensure a dust-free paint job later. Cleaning the vehicle's outside will prevent you from sanding into the paint-finish-ruining dirt and grime.

Nothing makes paint stick better or last longer than a thorough sanding. Paint needs a microscopically rough, craggy surface to latch on to—professional painters call this effect “tooth”—or the new paint will eventually loosen and fall off the old paint. Sanding large painted surfaces is easy. Problems crop up around areas like badges, antennas, bumpers and door mirrors. That's because no matter how careful you are, it's impossible to remove all traces of shine where the part meets the body. And paint that is applied next to a part instead of underneath causes a paint ledge to form, where dirt, water and ice start prying away. Sooner or later, the paint comes loose. After that, paint-peel is just a car wash away.

The only effective way to keep paint from peeling is to remove each part and sand under it. To have a body shop remove all these pieces can cost hundreds of dollars in labor—which is why the discount shops mask off all those parts. You can remove them yourself, however, and make a discount paint job look like a top-dollar custom paint job and have the paint finish last years longer. It's not practical to remove the windshield, rear window and door glass. But you can remove items that are common starting points for peeling problems, such as lock cylinders, door handles, luggage racks, radio antennas and rearview mirrors.

Take it all off

To remove these parts, it's best to consult your vehicle's factory shop manual, but here's some general procedures. Make sure the window is rolled up, then remove interior door hardware such as the armrest, window crank and inner handle, then pry (or unscrew) the inner panel off the door. Lock cylinders are usually held in place with a spring clip. Door handles and mirrors are usually held



Grind all the paint and rust out of dents and creases before applying body filler.

by small bolts. The radio antenna, hood emblems and body badges are other places where paint can peel. Usually, it's not necessary to completely remove the antenna. Simply loosen the top retaining nut that holds the antenna in the body, mask the antenna shaft and lower the antenna

into the fender or quarter panel. Hood emblems unbolt from under the hood. On older vehicles, badges and letters are mounted through holes in the body and fastened with spring nuts. On newer vehicles, these parts are often fastened with double-sided foam tape and are easily pried off with

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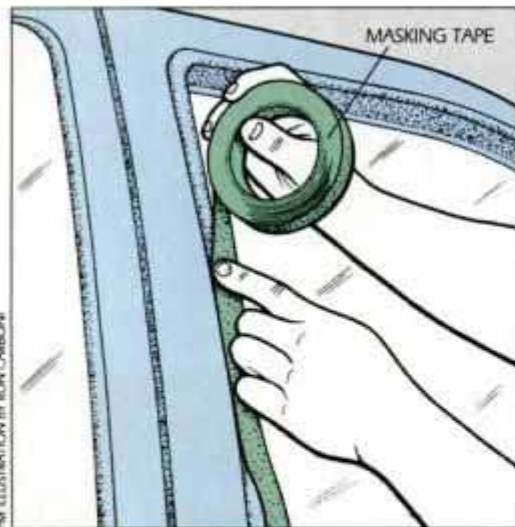
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Use fresh masking tape to carefully mask all the body trim on the entire car.

a 1-in. putty knife. If necessary, some time under a heat gun will help convince the adhesive to let go.

Of course, you'll also want to remove all large brightwork, such as chrome bumpers, the grille, headlight doors and taillight bezels. Once everything is removed, dents and dings can be repaired.

But before you start, make an honest assessment of your abilities. Your

vehicle is going to end up at a body shop, right? It might make sense to leave those big dents and rust holes for the pros.

Smooth 'n' fill

For smaller dents that you can reach from behind, use a body hammer and dolly to tap the dent out. To avoid over-stretching the metal, start at the outer edges first and work to the center. Pound down any high spots in the dent, then use a 36-grit sanding disc in a portable drill to remove all traces of paint and primer, and to also help prepare the surface for plastic filler.

Mix the filler and hardener according to the instructions on the can, then, working in one direction, apply the filler to low areas using a plastic squeegee. Plastic filler hardens in two stages. First, it hardens to a consistency approximating that of cheddar cheese and remains that way for a few minutes—exactly how long depends on how much hardener you've added and the ambient temperature and humidity. During this critical time, you can use a perforated Surform file—commonly called a

“cheese grater” by the pros—to file away large portions of the filler until it's level with the surrounding area.

After filing, the filler will cure to its full hardness and it can be machine sanded smooth with 100-grit paper. Check the contour of the repaired area with your hand. Gently tap down high spots in the filler with the hammer and then refill these areas, file and sand again. Now the area is ready for primer. In addition to providing a surface for paint to adhere to, primer allows you to build up the area so it can be finish-sanded smooth.

Don't waste your time using lacquer primer from a spray can. These primers are very heavily thinned so the paint can easily pass through the can's miniature nozzles. The result is that primer buildup is minimal. Two-part polyester primer-surfacers, such as Marson's Poly-Fill, are by far the easiest to use and give the best surface buildup. Mix the hardener and primer according to the directions, then spray on two or three coats. Once the primer hardens, machine-sand the primer with 180-grit sandpaper to remove heavy scratches and small waves in the body. Then wet-sand the repair with 400-grit paper.

FROM FRONT...



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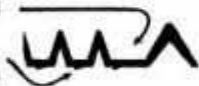
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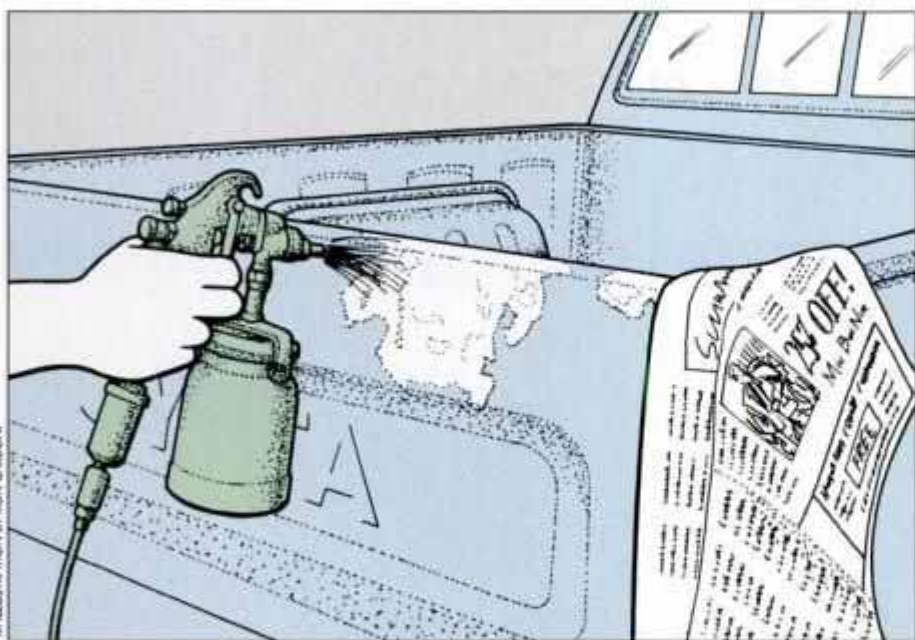
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CAR CARE



PM ILLUSTRATION BY RON CARBON

Prime and resand the areas you've worked on, then sand again before painting.

Sand, sand, sand

After all dents and dings are repaired, the whole body should be sanded. The object here is exactly the opposite of what you normally try to do to your car's finish—you want to remove every trace of shine from the body. To do that, wet-sand the entire vehicle

using 400-grit waterproof sandpaper. Flood the area with plenty of water while you sand, and don't forget to sand all the areas from where you removed parts. Feather-edge nicks and scratches, paying particular attention to chipped areas around door edges and rocker panels.

Once there's no more shine on the body, wash the vehicle with warm soapy water, rinse it and let it dry. You'll be amazed at how much shine there still is.

Before you hit these areas with the sandpaper again, spot prime any feather-edged areas as well as any areas where you've sanded through to the metal. After the primer has hardened, wet-sand these areas and the leftover shiny areas with 400-grit paper, then repeat the wash and rinse.

Still have some shiny spots? Guess what. Do it again!

Getting to the shop

While the body shop can mask the large areas that shouldn't be painted, like the windshield and the rear window, it pays to run the first layer of masking tape yourself around areas that are immediately adjacent to the body, like the trim around the windshield and rear window, since you can take the time to be extra careful.

Since a well-prepped car is devoid of just about everything that makes it legal for driving on the street, such as mirrors, headlights and taillights, you should seriously consider having your car towed to the shop. **PM**

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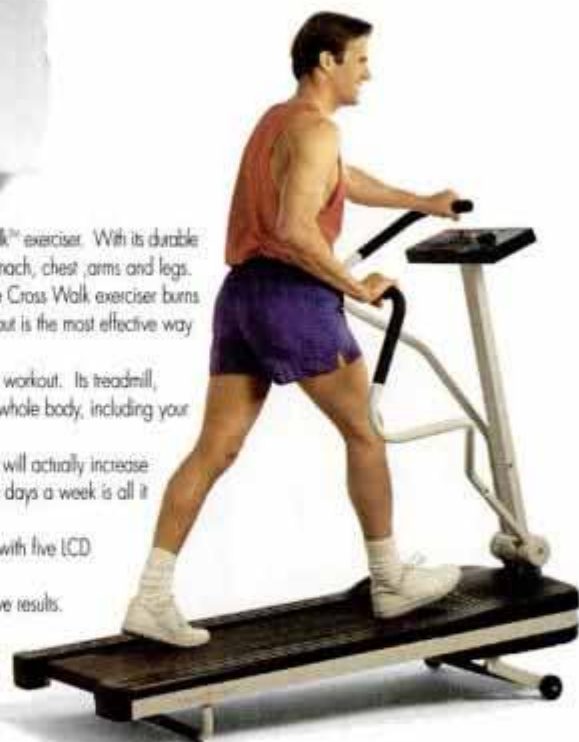
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Singing In The Rain

BY DON CHAIKIN, Automotive Editor



● If the only roads you ever drove over were always nice and dry, you could safely get around on a set of racing slicks. But since all of this Earth's roads are attached firmly to our imperfect and uncertain-weather reality, you had better have some tread on those tires if you expect to make it to your destination.

In fact, when the rain is falling with enough ferocity to cover the road with even a thin layer of standing water, you may suddenly find yourself, your car and its nifty high-zoot performance tires suddenly without traction, riding atop the water, not the road.

This situation, known as the dreaded "aquaplaning," is usually not one that you'd like to endure unexpectedly.

Under the right circumstances, however, such as the controlled confines of a test track, aquaplaning can be an educating—and even fun (like a roller coaster is fun)—experience. A close examination of the photo atop this page will reveal that the front wheels of the BMW are cocked strongly to the left.

Trust me, the vehicle is going straight ahead. The front tires have totally lost contact with the road. However, if this were to happen on a freeway offramp at rush hour, it would be no fun whatsoever. It would be very attention grabbing, indeed, as in terrifying.

Different strokes

Ironically, while tires have been getting better and better, improving

the typical vehicle's handling, ride and fuel economy, the potential for aquaplaning to occur has grown. You see, more and more vehicles are shod with lower-profile, wider tires than their predecessors. The wider the tire, the greater the possibility of water getting trapped beneath its center.

Tire designers and engineers have been addressing this, and there are several notable high-performance wet-weather tires available from various manufacturers. The latest weapons to be developed for the wet-handling wars are from Pirelli.

The well-known Italian tiremaker has a new rain tire aimed at your average family car, the P400 Aquamile, as well as an interesting new refinement to its P Zero system, designed for the high-performance end of the market.

P Zero

Since the P Zero system is the more innovative of the two, let's look at that first.

The newly configured P Zero system now offers two different tires, one to be used on the front wheels of rear-



Tread is different on Direzionale (left) and Asimmetrico (right).

wheel-drive cars, and the other for the rear wheels of rear-drive cars or for all four corners of front-drive cars.

The theory behind this concept is that since the front tires of a rear-drive car need concentrate only on steering, those tires can be designed specifically to ensure directional stability, particularly in the wet. The rear tires can be designed to get the power down.

Pirelli calls the front tires of this dual-tire system P Zero Direzionale. The power-to-the-road tires are labeled P Zero Asimmetrico.

Pirelli recommends that the Direzionale be used *only* on the front wheels of rear-drive cars. These tires are totally new and have been created specifically to resist aquaplaning and to deliver a high steering response, even in the wet. The Asimmetrico tires are a refinement over the previous P Zero tire, and have been engineered to provide a high level of power transmission—wet or dry—as well as reduced noise. The new P Zero system is quieter than the previous system and comes with an added bonus: a 15% reduction in rolling resistance over the older system.

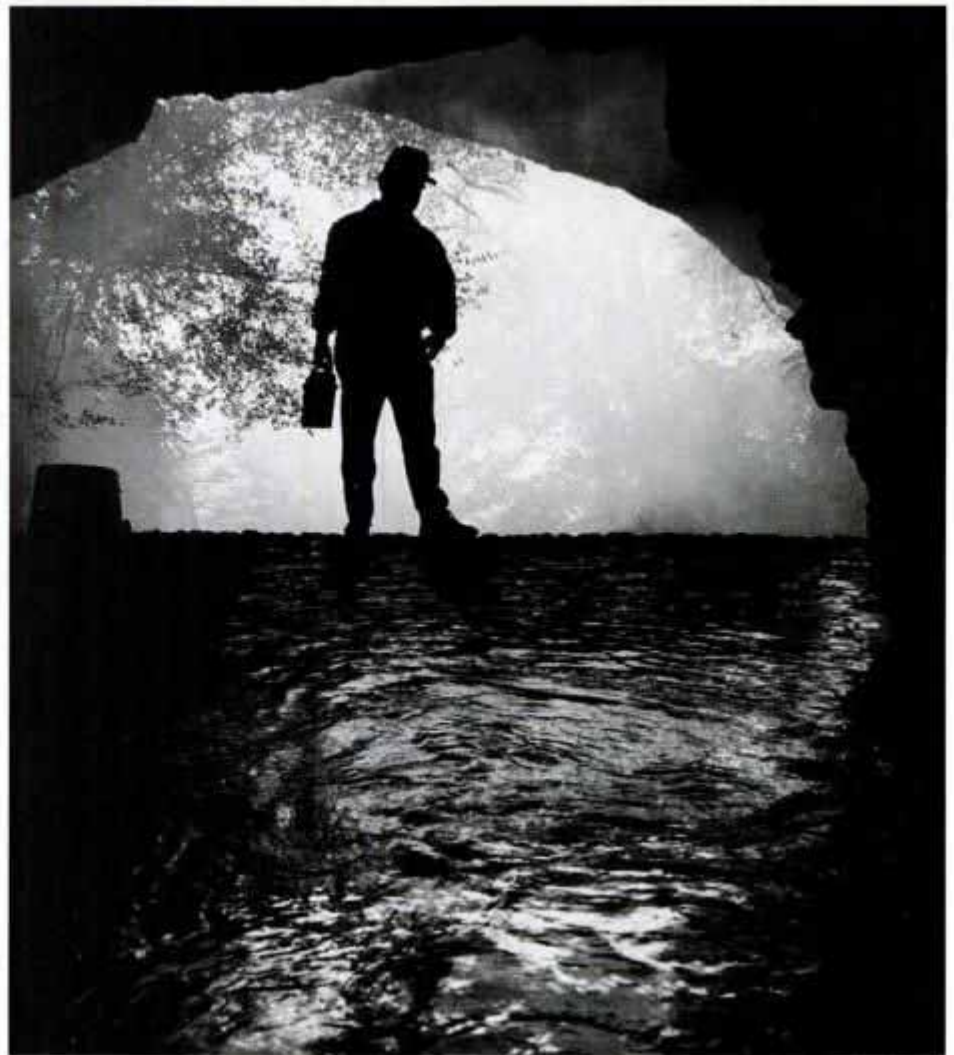
The reduction in rolling resistance is largely attributable to the tires' tread compound. The compound has a fairly high silica content, which is blended with carbon black and a proprietary bonding agent. The result is a compound that has a good high-temperature stability, wet grip and an increased resistance to wear as well. This compound is shared by both the Direzionale and Asimmetrico tires. The differences between them lies not in the compound of the tread but in the pattern on those treads.

The Direzionale tread is distinguishable by wide longitudinal channels running around the center of the tread and the arrowhead-shaped blocks on both sides of the center channel. The arrow-shaped tread blocks are separated by deep, wide grooves that carry the water from the center channel out to the edges of the tire. As the tire's name suggests, this tread pattern is effective when mounted on the proper side of the car.

The Asimmetrico tread pattern is unique with its two distinct patterns. One half of the tread has arrow-shaped blocks, like the Direzionale, for water dispersal. The other half of the tread features large longitudinal strips for adhesion. The shoulders of the tire have wide blocks for improved cornering. The Asimmetrico also is a directional tread.

While the overall effect of the full system on a rear-drive car is quite astounding and instantly noticeable on a wet road, providing quicker and more

(Please turn to page 132)



Wouldn't a smooth sip of Jack Daniel's taste good about now?

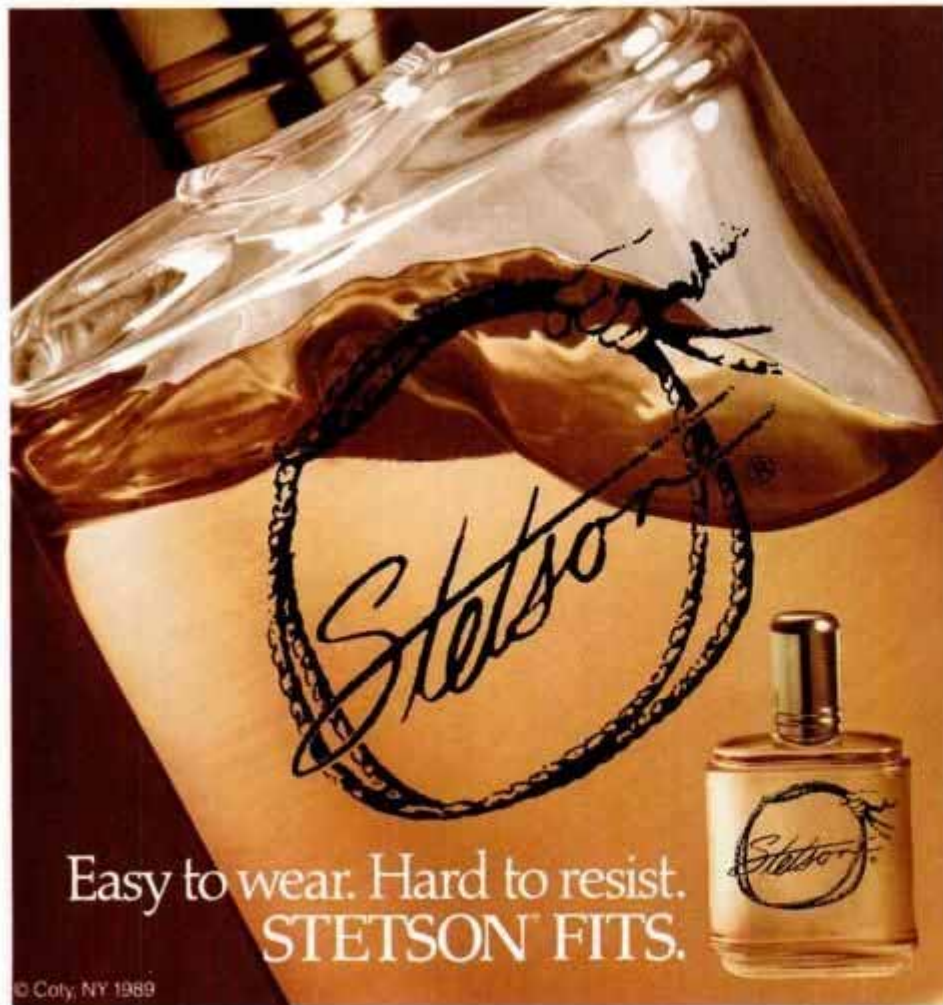
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TIRE TECHNOLOGY

(Continued from page 131)

accurate steering response and improved grip, in the dry, a system with four Asimmetrico tires will actually provide more grip than the split system. And, as noted above, the split system is specified only for rear-wheel-drive cars.

The P Zero system is available in 50 sizes—from P185/55ZR15 all the way up to P285/30ZR20—with prices commensurate with size.

Aquamile

The new P400 Aquamile series is really at the other end of the spectrum from the P Zero. The Aquamile is Pirelli's



Blocky tread with wide grooves defines the new Pirelli P400 Aquamile rain tire.

latest offering for folks looking for a solid tire that's affordably priced and offers long life, a quiet ride and exceptional wet performance.

One glance at the tread pattern tells much of the Aquamile story. For wet performance, three grooves run through the tread. They channel water away from the tread so the rubber stays in contact with the road.

As opposed to the tread pattern, the tire's inherent longer life is not something that you can easily see. But Pirelli guarantees it—the P400 Aquamile is backed with an 80,000-mile warranty. Pirelli officials claim long life is a fact of the tire market today.

And while you might not be able to tell that the tire delivers a quiet ride by looking at it, you can tell as soon as you take a test drive. On an excursion through Italy, the Aquamile exhibited almost nonexistent hum or hiss. Even with windows open, tire noise was not a distraction. Pirelli engineers credit a tread design that pits two tread noises against each other. One noise partly cancels the other, so you end up with less than what either makes by itself.

The Aquamile line includes sizes from 13 through 16 in., with aspect ratios of 60, 65 and 70 to fit a very wide spectrum of cars. **PM**

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Desktop Power To Go

BY STEPHEN A. BOOTH, Contributing Editor

● This fall's crop of portable computers deals another blow to the invisible chain that keeps people tethered to a desktop PC. And while liberating people to compute just about anywhere is their main attribute, a fringe benefit of the new mobile wonders is the amount of desk space they free up. When you can get the power and functions of a conventional PC from a 6-pound package no bigger than a loose-leaf binder, you've got to wonder why, except for price, anyone would want a desktop model at all. Some new portables even have multimedia to go.

What all these new laptops have in common is 486-class microprocessors for powerplants. But what the pace-setters hide under the hood is Intel's 486DX4, smoking at 75 MHz. Until the 100-MHz version arrives, this chip is the fastest you can pack in a portable. And until Intel's Pentium 54C hits the streets, it's the most powerful.

Most of these new mobile models can give most desktops a run for their money. Intel 486DX2s running at 50 MHz predominate. These laptops are now up to speed in other areas where there used to be some compromise. For example, standard-issue random-access memory (RAM) is at least 4MB (megabytes) and sometimes 8MB. In most cases, 200MB is the entry level for

hard-disk memory storage. Built-in phone modem for voice, data and fax is no heavy lifting. Ditto for mouse- or trackball-like controller. Keyboards are he-man size, sloped like desktop models but with comfortable wrist-rests and, better yet, the keys have up/down travel for feedback close to the real thing.

Despite all the muscle—and the color display screens—these new laptops are fuel-efficient. They achieve battery life in the 4-hour range by a mix of intelligent power-management within the PC and new nickel-metal-hydrate (NiMH) or improved nickel-cadmium (NiCd) batteries. Some of the new portables give you the option of installing a second battery in the modular bay vacated by the standard 3.5-in. floppy-diskette drive.

Mod squad

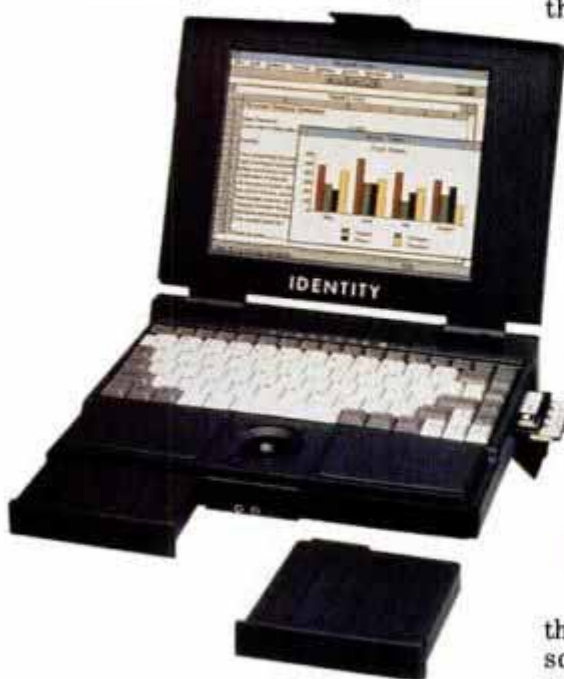
This modular approach to portable computers is another attraction of these desktops with handles. Besides the battery-diskette swap, some of the PCs offer a choice of liquid-crystal display (LCD) screens—say, dual-scan color or active-matrix color.

For the record, so-called passive dual-scan displays are less costly than active-matrix, in which each picture element on the screen is controlled by its own transistor. Passive LCD screens ignite their pixels by relaying signals along horizontal and vertical lines. The dual-scan approach makes for sharper and more quickly drawn images than used to be the case with passive LCDs. They look pretty good, in fact, and you ought to give them a nice, long look.

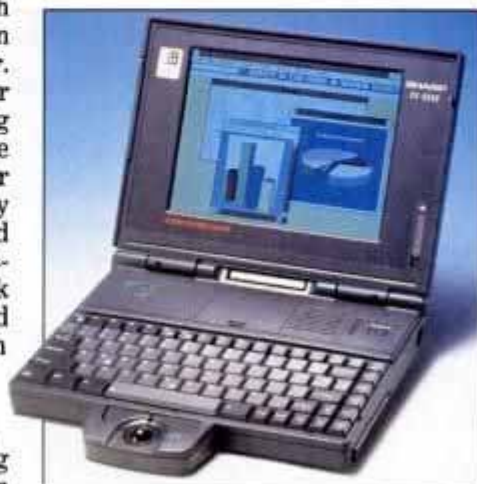
When you do, you'll find the telltale difference between dual-scan and active-matrix is viewing angle. You have to view a dual-scan LCD from directly in front of the

screen. Viewed from even a slight angle, the image seems to vanish. Active-matrix provides a wider angle of view. So, if you expect groups of people to view a presentation, as in a business meeting, stick to active-matrix.

Presentations increasingly call for multimedia—video, audio, graphics and text, often recorded on a CD-ROM. Many of the new laptops now have video processors on board, and 16-bit digital audio cards for CD-quality sound. The latter's a welcome jump from the 8-bit squawkers that



Identity offers roll-your-own laptops.



The PC-8660 is a new entry from Sharp.

were the best to be had even a year ago. You might not be conducting multimedia conferences with your portable, but it's nice to know you can get decent sound and pictures from your computer game when you want to kick back and relax.

For those who do want light-and-magic shows for the road, Zenith and Texas Instruments offer multimedia-ready notebook PCs—and portable CD-ROM systems.

Zenith's Z-Star EX portables have a Cyrix-made 486DX2/50-MHz processor as standard issue. Beyond this, the line takes a modular approach for screens and memory. Prices start at \$1799 for 9.5-in. monochrome display, 4MB/RAM and 200MB hard drive. Dual-scan color ups the ticket to \$2499, while \$3699 gets you active-matrix color, 8MB/RAM, 340MB hard-disk storage and two NiMH batteries.

Another \$499 buys the Z-Player, a 2-pound multimedia center with double-speed CD-ROM player, stereo loudspeakers and a 16-bit soundcard. It runs on AC or DC, which brings us to the power adapter for the Z-Star EX. It's a small cube that slides into either of the PC's two battery slots. Once installed, it'll charge the on-board battery while it powers the computer.

Texas Instruments (TI) designed its Portable CD-ROM system (\$899) as a docking station for its Travel-Mate 4000M line of PCs. Otherwise, it's similar to Zenith's, and it comes with its own NiMH battery. Digital 16-bit soundcards are built into the computers—as is Intel's Indeo real-time video software. This gives you the ability to create multimedia programs of your own.

The TravelMates come in four basic configurations—all of which have upgrade options. Monochrome and passive-color versions (\$2399 and \$2799) mate Intel's 486SX/25-MHz chip to 4MB/RAM and 120MB hard drive. The same chip and RAM anchor an active-matrix color model with 200MB storage (\$3799). The monster high-end model in TI's lineup packs Intel's 486DX4/75-MHz processor. With active-color, 4MB/RAM and 340MB drive, it costs \$5899.

Yet another monster truck comes from AST Research, whose Ascentia 900N comes with a DX4/75 or DX2/50 engine. Color screen options include 9.5-in. or 10.4-in. active-matrix, or 10.3-in. dual-scan. Depending on the microprocessor, standard RAM is 4MB or 8MB.

Storage tanks come in 340MB or 510MB capacities, and these hard drives are removable, so you can swap them with a desktop PC or even bank your data in your safe deposit box.

AST boasts 4 to 8 hours of battery

life and credits its smart power-management system, which monitors the user's work habits and adjusts the laptop's performance for the greatest efficiency. Prices for Ascentia start at \$3399. That price includes a lot of programs that work behind the scenes to speed up and embellish video and other jobs. Also in the tab is a generous amount of applications software, including software and trial subscriptions to the America Online, CompuServe and Prodigy networks.

Canon, Samsung, Sharp and Toshiba have built new field offices, too. Like top-of-the-line 486-based desk-

tops, two Canon models use DX2 chips running at 66 MHz. Another is rated for 50 MHz, as are the Samsung, Sharp and Toshiba entries.

In keeping with the modular trend, Canon's Innova Book series offers an a la carte menu of screens and memory. An entry-level Innova Book 150C, with dual-scan color, 250MB storage and DX2/50 chip, costs \$2399. A DX2/66-based model 150CT goes for \$3599 with active-matrix color display and 340MB hard drive.

Sharp's PC-8660 (\$3999) and Toshiba's Satellite T2400CT (\$4099) are

(Please turn to page 136)



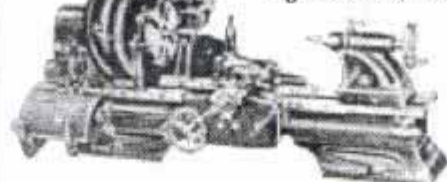
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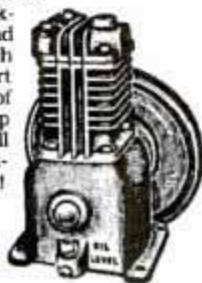
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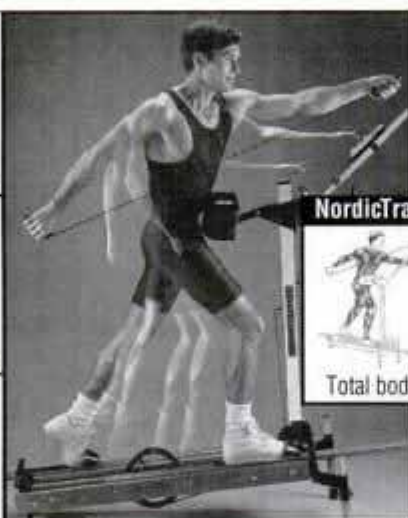
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COMPUTERS

(Continued from page 135)

configured similarly to Canon's 150CT. So is Samsung's NoteMaster model S3945T (\$3999), though standard RAM is 8MB. It used to be that you could assume most active-matrix color LCDs came from a Sharp or Toshiba factory, but no more. The NoteMaster's 9.4-in. screen is Samsung-made, a new venture for the Korean company that should give it some cost advantages over PC makers who use Japan-sourced LCDs. That flat-panel color screen in portable PCs accounts for much of their higher price versus comparably featured desktop models with CRT color monitors. For example, a loaded DX2/66-based desktop with 14-in. color CRT can be had for under \$1500. There is a price for freedom.

Even the mail-order computer companies have gotten into the mobile-muscle act. Dell has resumed selling portables after a year-long leave of absence to retinker its line. The company's top-shelf Latitude XP series starts at \$3199. If the cosmetics seem a bit like Apple's slick PowerBook machines (see "Finger-Pointing Laptops," page 120, Sept. '94), don't be surprised. Apple's former develop-



Toshiba's Satellite models sport a modular look.

ment chief now works for Dell.

Perhaps the most impressive of the new notebook PCs comes from Gateway 2000, (800) 846-2000. That's because the direct-sale company's HandBook DX2/50 (\$2499) ain't a notebook at all—it's a 3-pound sub-notebook that measures less than 10 x 6 in. and just 1.6 in. thick.

This HandBook teams the DX2/50 chip with 8MB of RAM and a 250MB hard drive. The 8-in. screen is monochrome. Subs don't have room for 3.5-

in. floppy-diskette drives, but Gateway supplies an external one gratis. Also included in the price are two NiMH batteries, a carrying case and lots of on-board software. The NiMH batteries are the type that plug directly into an AC outlet for recharging—no charger to lug around. Gateway's HandBook line starts at \$999 for a 486SX/25-MHz model with an 80MB hard drive.

As modularity goes, you can't get more roll-your-own than with the Select Series of portables from Identity Systems, (800) 723-8324. It's kind of like buying a custom-made suit, because you design your own PC in a retail store. Then the retailer sends the order to Identity, which ships it to you within four days.

Inside the store, you'll find an Identity Select kiosk displaying the base components and options. You check off your choices on an order form, helped if need be by store personnel or an Identity phone rep.

Identity's \$1799 entry-level system is a 486SX/25 with 4MB/RAM, 128MB storage, 9.5-in. mono LCD and NiCd battery. You can trick it up any way you like, for example, to NiMH-fueled DX2/66 with dual-scan color, 8MB/RAM and 524MB hard drive. Cost: \$3499. Happy trails! **PM**

complicated. We simply cruise along at 60—as indicated by our testing equipment, not the vehicle's speedometer—and stand on the pedal. We've tried using threshold braking in comparison, and managed to reduce the ABS's braking distance by less than 5 ft. once in a half-dozen passes. The cost in flat-spotted tires, gray hair and time involved isn't worth the effort.

We don't test for brake fade anymore. We stopped when we rarely found a car that had any appreciable loss in braking capability. Modern cars' brakes simply don't fade under normal circumstances.

Dizzy yet?

We also use the smooth, straight and long dragstrip to do our slalom. Slalom testing is probably the most fun thing we do, and at the same time gives us more information about a vehicle's handling. We tell you the speed we can negotiate our slalom course. It often takes more than a dozen passes in each direction to feel confident that we've gotten a representative pair of times. It's necessary to work up to the best times gradually. Beyond the raw numbers, we learn important lessons about a vehicle's turn-in, transition from right-to-left cornering and overall handling manners. It's not unusual for the fastest vehicle to be the best-handling—but it's not necessarily so. Sometimes the fastest is also an evil, guard-rail-eating handful at the limit.

Our other controlled test of a car's roadholding ability is on the skidpad. We conduct this test with as much dispatch as possible, since skidpad testing is so abusive to tires. We'll take half a lap of the 200-ft. circular course to get the car settled, a complete lap for the photocells to register the elapsed time, and then straighten out the wheel immediately to unload the tires. Skidpad testing has been known to destroy a set of tires in a second lap, because of the intense internal heat generated in the rubber. A lap of the skidpad takes 12 to 13 seconds in most cars. Two laps will heat up the outside front tire's tread so rapidly that rubber comes off in chunks. We've seen steel wire from the tire's belt poking out of tires so abused—so we're careful not to do that.

The lap times of the skidpad testing are converted mathematically to g-numbers. The higher the g-force generated, the faster a car can go around a corner. Conversely, the higher the g-force, the more margin for error a driver will have when making an evasive maneuver or coming up on a slow freeway exit unexpectedly. The numbers we report for any vehicle are generally between 0.6 and 0.9. That

means that the car is cornering at 60% to 90% of the force of gravity, g being defined as exactly the force of gravity. Some high-performance cars can hit 1 g on a good day, and some racing cars, such as Indy or Formula One cars with ground-effect chassis and wings, can reach as much as 3 g's at high speeds.

Like slalom testing, skidpad testing tells us subjectively about a car's manners at the limit. Some cars are well-mannered, and track around the painted 200-ft. circle with only minor excursions of the steering wheel and throttle. In a perfect world, and on a

perfectly level and consistent skidpad, skidpad testing is a steady-state affair. In the real world of weathered, frost-heaved asphalt skidpads, there are constant corrections to be made. Some cars are nervous at the limit, requiring the test driver to saw constantly at the wheel and add and remove throttle to remain astride the thin yellow line. Again, the fastest—i.e., the stickiest—car may or may not be the easiest to drive at the limit. Generally, there is a reasonably wide spread in the handling capabilities and characteristics of the vehicles in a single comparison test. **FM**

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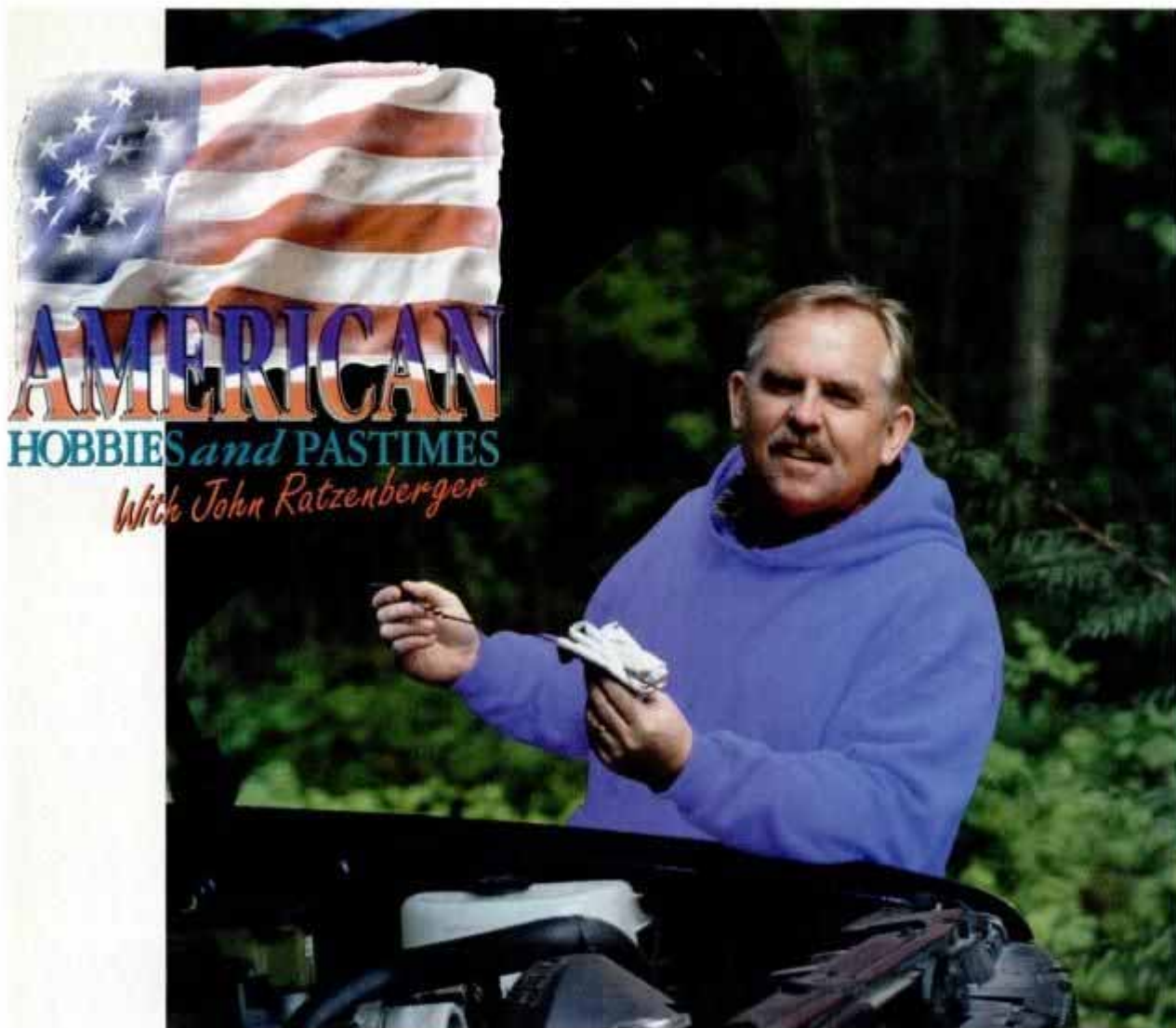
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Though O'Gara prefers to design defensive systems, some customers insist on adding offensive capabilities. An innocent-looking GMC Suburban nearly ready for delivery is equipped with a pair of front and back tear-gas launchers. Another GMC is outfitted with gun ports.

O'Gara and two of his brothers bought the company back in 1982. Since then, he estimates, he's made sales calls in at least 46 countries. Clients are likely to call him almost any hour of the day, and Arab sheiks have been known to fly into Cincinnati for midnight meetings. OGH&E expects to roll out at least 200 to 250 "Fully Armored Vehicles," or FAVs, this year, with the typical price tag running upward of \$100,000. But the company is looking for ways to cut that price.

Back in 1985, OGH&E tried to market its first Personal Security Vehicle, the PSV-1, targeted at the average American motorist. While potential customers might have been worried about crime, they were made even more nervous by the price tag, and the company dropped the unsuccessful project two years later. But the daily news diet of car bombings, car-jackings and other automotive crimes is taking its toll.

"Every time those stories run, our phones begin to ring," says O'Gara.

OGH&E recently introduced a more refined personal-security vehicle, dubbed the PSV-2. Call it "Armor Lite," if you prefer. The window glass is only about 0.6 in. thick, and the steel and reinforced-plastic opaque armor enclose just the passenger compartment. Still, that's enough to stop a slug from a 9mm handgun or an Uzi. The conversion costs \$40,000 to \$70,000. To really catch on with the masses, though, O'Gara believes he'll have to find a way to cut the price to less than \$10,000 for a PSV-2. He'd also like to develop a more limited protection package, probably offering just bullet-resistant glass, in the \$3500 range.

When a vehicle pulls into the O'Gara plant, it is virtually disassembled. "We do everything by hand," says John Verkamp, a shop-floor veteran, as he carefully bends and grinds

a new window frame for a Lincoln Town Car. "That's one of the most expensive things on the car. This door is darn near two days' work."

With dual-hard steel, individual panels must be fitted, then removed and sent out to be heat-treated. But that causes warpage, so the panels need to be refitted. Door hinges must be replaced with customized components able to stand up under the extra load. Often, OGH&E has to replace the entire suspension system.

Sometimes, the company also upgrades the engine in order to pull the extra load—an FAV can weigh 2000

to 3000 pounds more than the factory-spec vehicle.

There are nearly a dozen Humvees at the O'Gara-Hess & Eisenhardt factory. Ironically, they're parked in a circle around a dusty Cadillac stretch limousine. The limo belongs to Saddam Hussein, long an OGH&E customer when Iraq was considered a friend of the United States. "I lost two customers the day he invaded Kuwait," O'Gara shrugs. Thanks to Desert Storm, the Kuwaitis are again in the market for armored autos. It's likely the Cadillac won't be returned to Iraq until Saddam Hussein is driven from power. **PM**

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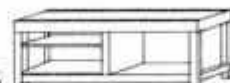
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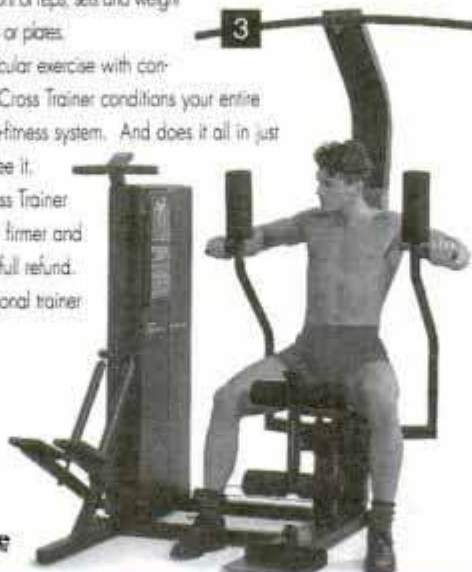
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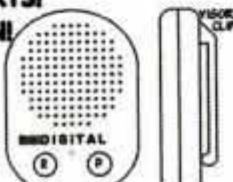
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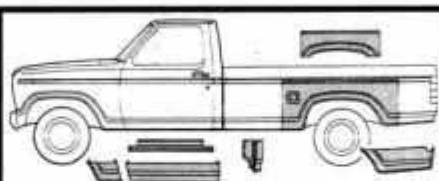
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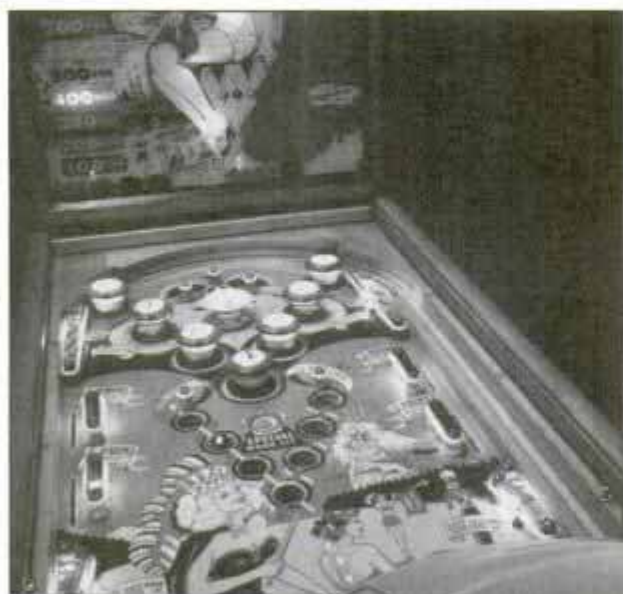
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