

NOVEMBER 1995

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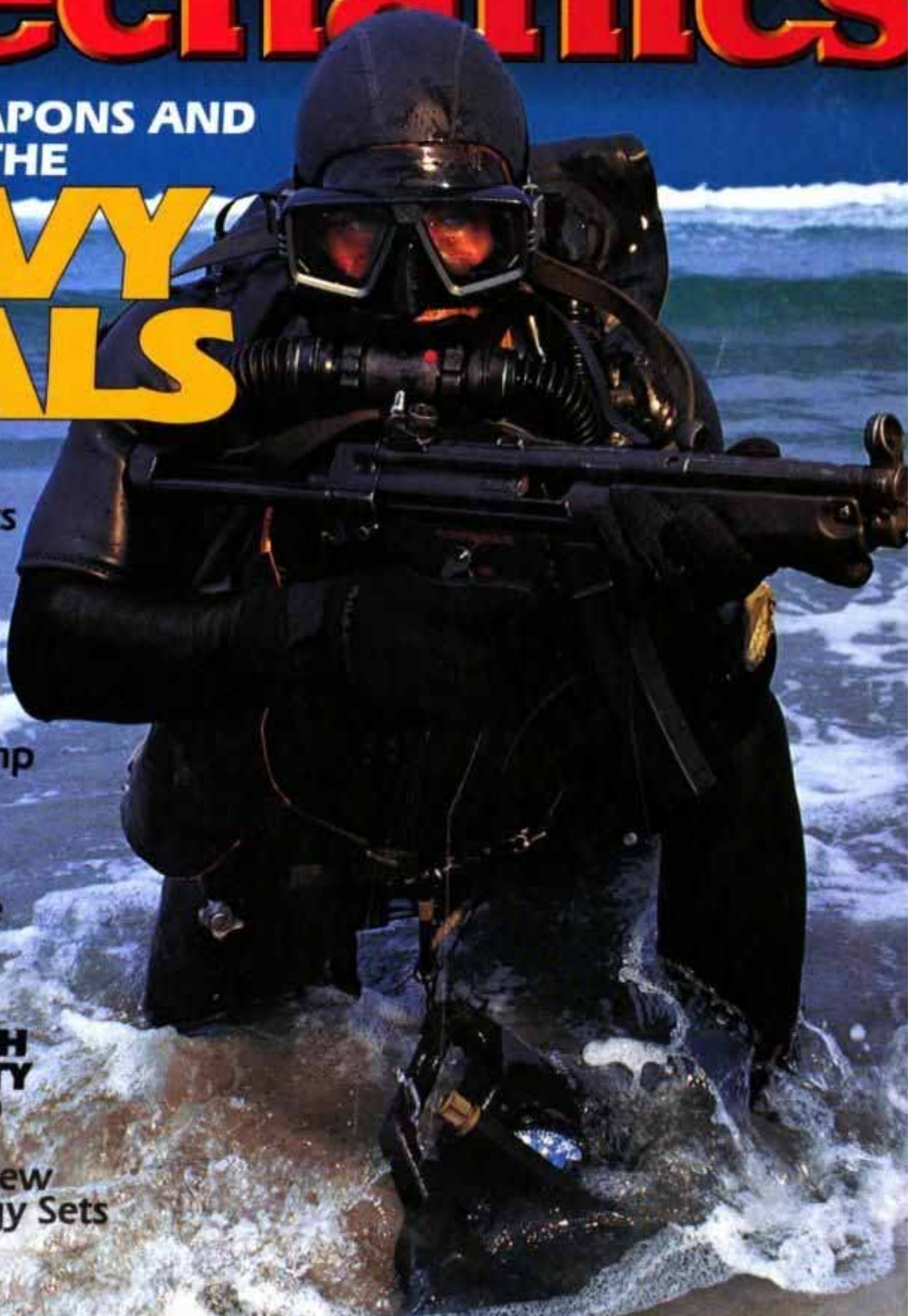
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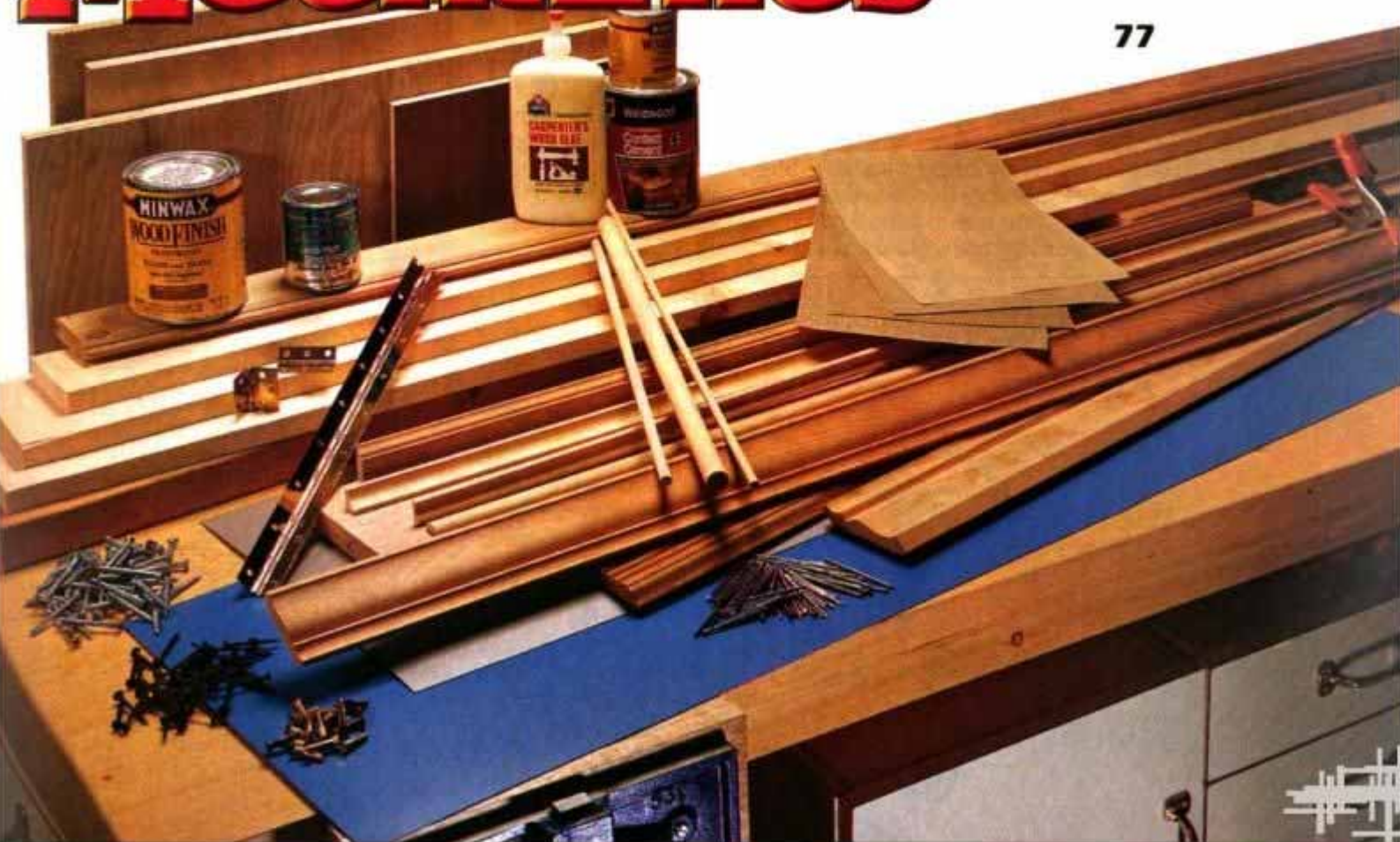
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EDITOR'S NOTES

● Longtime readers will know that our November issue traditionally carries a giant special section devoted to home woodworking. This year is no exception. If you're a woodworker, Home Improvement Editor Steve Willson and Associate Editors Tom Klenck and Roy Berendsohn have delivered in spades. Thirty-three pages of tools, tips and techniques. And no less than four great projects you can build out of common woods. No special tools are required, either. Long-



Ro at work on our knockdown coffee table project.

time readers will also know the work of Contributing Editor Rosario Capotosto. You'll find his byline on all four of our project articles. He's the guy who built each piece, then wrote the text and even photographed the step-by-step instructions. For 20 years we've referred to Ro as our master craftsman. He's been that and more. In fact, it's generally conceded that Ro is arguably the best woodworking journalist alive. I don't know what we'd do without him. ... When I assigned the development of this month's cover story to Science/Technology Editor Greg Pope, I couldn't help thinking about the movie of a few years back starring Charlie Sheen. As it turns out, the real-life Navy SEALs story is even better than "Navy SEALs," the movie. Between the exotic weapons used by this elite force and the incredible tactics they sometimes employ, truth blows away fiction. For the whole real-life story, turn to page 51. ... **Television is so pervasive** in our daily lives, we no longer even think about it. It's just there. Part of the fabric. That is, until we have to buy a new one. If you're currently in the market for a new set, you will be astounded when you walk into your local Nobody Beats The Wiz or Circuit City store. TVs no longer just show you a picture. They do other things. Things you wouldn't believe. Like turn into a phone or a computer. And the picture! The clarity of the picture itself is now on a par with what you see at the movies. This last development is relatively new and, naturally, we have the story for you. Check page 62 for contributor Rebecca Day's report. ... **The Chrysler minivan** in Caravan, Voyager and Town & Country guises has been the benchmark vehicle for all other automakers since the first day Chrysler put its minivan on the market. It has clearly been the best, winning every comparison test ever conducted. But now there's an all-new Chrysler minivan. And everyone is asking the question, How good is it? If you want to know if it's as great as its predecessor, read "Target: Chrysler," beginning on page 56. Till next time.

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Joe Oldham

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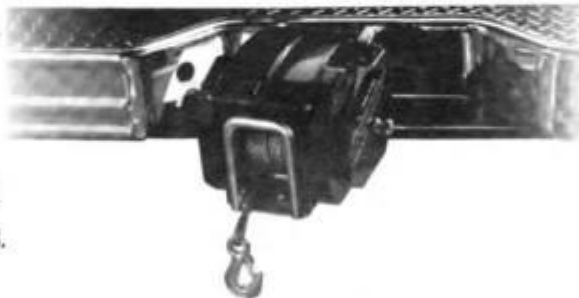
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Guns Versus Rights, Redux



Heartiest congratulations on your politically incorrect article about the Colt .45. The story was extremely interesting, and the illustrations were excellent. Truthfully, this gun is a piece of mechanical equipment just like an automobile. When used correctly, both can be a pleasure. Used incorrectly, both can be deadly.

HAROLD G. COHON
MORTON GROVE, IL

When I picked up a copy of your magazine at my local store, I didn't realize POPULAR MECHANICS would be such a refreshing voice in a world of "publishing correctness." Thank you for the excellent article on the Colt .45. You've just earned a subscription from a new reader.

JEFF BORGENS
RENTON, WA

I particularly enjoy the editorial attitude that seems commonplace in your magazine, and totally lacking in most mass-market rags. Keep writing good articles like the one on the Colt .45. As long as you continue upsetting the apple cart for folks like Alex Friedmann, I'll keep on subscribing.

LEE BRIDGES
KANSAS CITY, MO

Thank you for your comments directed toward the convicted criminal now enjoying the institutional hospitality of the Tennessee state penal system. It may be somewhat premature, but Alex Friedmann's rehab doesn't appear to be progressing. Blaming some-

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

thing or someone else for one's criminal behavior isn't responsible. It's reprehensible. Mr. Friedmann did accurately provide an undeniable fact that this country is dangerously exposed to "a growing population of criminals." Add to that the facts that municipalities at all levels fail to protect citizens, that the law gives only lip service to restitution and that punishment is referred to as the "P" word by too many progressive politicians. "Correctional institution" is a misnomer. Let's have more positive articles on guns.

THOMAS D. TUKA
NEW GALILEE, PA

Despite the fact that Friedmann is serving time for armed robbery, you should listen to him. He has more intelligence than you. There are a reported 218 million guns in our society today. In spite of this outrageous number of weapons, we still live in the most violent and dangerous society on the planet. If we could somehow get rid of the simple-minded like yourself, we might be able to turn the corner on gun violence and ultimately revert back to a civilized society.

DON D. CASTLE
FREMONT, CA

Could part of the problem be that most of the guns

are in the hands of the bad guys? —Ed.

Your response to Alex Friedmann can be characterized as stupid. If the answer to the blood and terror created by the proliferation of guns in this society is to arm every American, would we really be any safer? I doubt it.

JOHN LEAHY
VIA INTERNET

Only criminals and tyrants have reason to fear the armed citizen. We know which group Alex Friedmann belongs to. Is there yet another group who

would not want people to defend themselves against criminals? Perhaps they make even more money from crime than even the criminals. If there is such a profession, maybe they should be more closely regulated, instead of being allowed to regulate themselves.

BILL SHAMBLIN
WEST END, NC

Bravo! Your reply was refreshing to see in a mainstream magazine that doesn't deal strictly with the subject of firearms.

RICHARD MONCKTON
WEST LEBANON, NH
(Please turn to page 14)

Advertisement



STANLEY

Reader Project Of The Month

This cabin may remind readers of the drawing featured in "Affordable Log Homes" (Home & Shop Journal, page 67, Feb. '94). I built it, using conventional materials, to the same dimensions and profile shown in the article. I customized the plans by adding a 4 x 12-ft. shed bathroom. The cabin was prefabricated in my shop at home and transported to its mountain site in West, Texas. My largest project from PM promises the most enjoyment.

TERRY GARCIA
FORT WORTH, TX

If your project is chosen as Reader Project of the Month, you will receive a Stanley Home Improvement Kit, complete with hand and decorating tools, and an electric stapler/naïler, valued at more than \$200. For your project to be considered, please send a clear, color photo and brief description to: Reader Project of the Month, Popular Mechanics, 224 W. 57th Street, New York, NY 10019.



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Thank you for the historical perspective on the Colt .45. I second your response to Alex Friedmann.

EDWARD BINDER
ATHOL, NY

I'd like to make this pledge: For each letter you run from someone who is canceling a subscription because of your gun coverage, I will extend my subscription by another year or purchase a gift subscription. Stick to your guns, folks.

ANDY KOSSOWSKY
PERTH AMBOY, NJ

I like your attitude. Keep up the fight to keep our rights.

ROGER J. WILLARD
CONESTOGA, PA

One thing I admire about POPULAR MECHANICS is that you aren't afraid to print both sides of an issue. Part of our heritage is the right to voice our opinions on controversial matters. If you don't like guns, you don't have to own them. If you don't agree with my opinion, you have the right to voice your own. And if you don't like such articles in this and other publications, turn the page.

ARLEN ARCHER
VIA INTERNET

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G. STANTON
SOUTHBANK, BRITISH COLUMBIA

I always look forward to your excellent coverage of military weaponry because of its historical significance and high-tech nature. Unlike the new breed of politically correct, effete snobs, I certainly never think you are trying to glorify violence.

BRUCE BRANTLEY
PITTSBURGH, PA

You have just made my day. I am a 72-year-old retired USAF officer, as well as a retired university professor. I served my country in WWII, Korea and Vietnam. My father gave me my first "gun" (a Daisy BB gun) instructions when I was 6. In addition to detailed handling information, I was advised that the BB gun's handle would be worn out on my buttocks if I ever pointed the gun at anyone or an unauthorized target. The gun still has its handle. I had been ill for a few weeks. Then, I read your reply to Alex Friedmann. Now, by golly, I'm a well man. Keep up the good work.

WILLIAM T. HEMPHILL JR.
MONROE, LA

A gun is a mechanical, inanimate object, much as is an electric drill. Despite what an irrational minority says, a gun does not make a criminal. I look forward to being kept up-to-date on all types of equipment and technology in POPULAR MECHANICS each month.

C.E. ROSE
AUBURN, CA

As an officer in the U.S. Army and a proud, responsible owner of firearms, I applaud you. It is pleasant to see a magazine of your magnitude and circulation not scared by the anti-handgun mob, and willing to print unbiased articles on such a subject.

SHEA W. SHERBERT
TACOMA, WA

Great article about the Colt .45. It was interesting to learn the history behind this great pistol. It's too bad some readers will skip over the article simply because it's about a gun. If they actually took the time to read the story, they might learn something about this weapon that undoubtedly saved many American lives.

ERIC L. EDWARDS
SANTA CLARITA, CA

The Colt .45 article was fantastic. Thank you for giving the American people a true American magazine.

MICHAEL KRAWCZYK
OMEGA, WI

Run whatever ads and articles you want. It is my choice whether or not to read them, or buy the products.

CHARLES TILLERY
COALGATE, OK

Your magazine is a shining example of the First Amendment alive and at work in America today.

STEVE FOX
BORING, OR

I cannot understand the logic of demonizing the weapon and not the individual person who actually commits the violent act. Millions of decent, law-abiding citizens own guns for hunting, recreational target shooting and self-protection, and never harm anyone. It has probably never occurred to those who oppose firearms that people were murdering one another for thousands of years before guns were invented. Articles on firearms technology are just as legitimate as the rest.

RON WHITTAKER
LITCHFIELD PARK, AZ

I commend you for having guts enough to publish articles that other magazines would never print.

F. DONALD WILSON
NEW RIVER, AZ

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Engines don't die from old age. They wear out. And in terms of wear, the most grueling kind of driving is stop-and-go driving. ● It's so severe it creates deposits inside your engine that can cause wear and friction, robbing your engine of performance and shortening its life. ● That's why there's TM8, a new engine treatment with Teflon from Valvoline. TM8's 8 friction-fighting ingredients chemically bond to moving parts, protecting your engine even at start-up. In fact, under high operating temperatures, motor oil treated with TM8 offers twice the protection. ● And that's about as far as you can get from an early grave.



Because driving is more stop than go.

 Another high-performance product from The Valvoline Company.
A Division of Ashland Inc. © 1995

TIME MACHINE

90 YEARS AGO: NOVEMBER 1905



Flying Machines

Engines that careered through the sky promised to revolutionize transportation, but at century's dawn they had yet to rise. In the meantime, crowds gathered along the White River in Indianapolis to enjoy the next best thing. An aerial tramway, erected to aid construction of a new bridge, sent steam engines soaring across the water. Daredevil engineers frequently straddled their machines during the ride, drawing wild cheers from spectators.

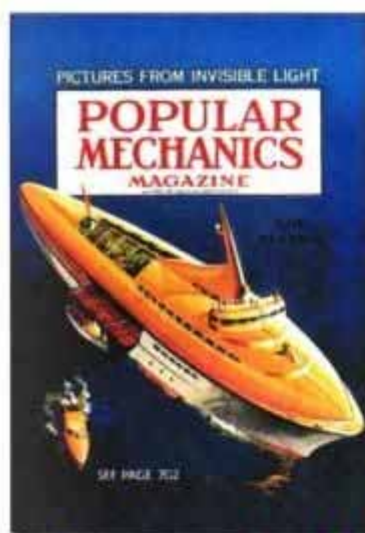
Electric Bus

Seeking to replace the horse-drawn stages that plied New York City's Fifth Avenue, an unusual streetcar was making regular trips between Washington Square and 88th Street. The vehicle was America's first hybrid-electric bus.

Beneath the driver's seat, a gasoline-fueled 45-hp generator sent power to two electric motors, which turned the rear wheels via sprocket chains. A bank of batteries supplied electricity to start the generator and furnish lighting. The fare? One dime.



60 YEARS AGO: NOVEMBER 1935



Ship Shape

Naval architects were getting caught up in the aerodynamic design wave of the 1930s. For example, noted industrial designer Norman Bel Geddes modeled a 230-ft. seafaring yacht after the great clippers of the sky. Thoroughly streamlined, the ship would have sailed a 10,000-mile cruising radius. Even its lifeboats were tucked away inside the superstructure. In an emergency, landing platforms would fold out to deploy the smaller vessels.

Track Star

Defying streamliners, the original blunt-faced Super Chief was ready to haul transcontinental rail travel into the diesel age. Built by Electromotive, the new locomotive chugged on two 900-hp V12 engines. The Santa Fe rewrote the record book by running Super Chiefs between Chicago and Los Angeles in 39¼ hours. The 100-mph trains would soon offer the palatial Pullmans that made them favorites among the Hollywood set.



30 YEARS AGO: NOVEMBER 1965



Small Wonder

Cheap gas and a public taste for luxury had fattened the American car. Suburban arteries were clogging with 4000-pound juggernauts carrying one person and a bag of groceries. Hoping to thin traffic, designers at the Illinois Institute of Technology blueprinted pint-size vehicles that made VW Beetles look like Lincoln Continentals. They also created the Suburba-car, a mini-chassis for which PM readers were challenged to design a body.

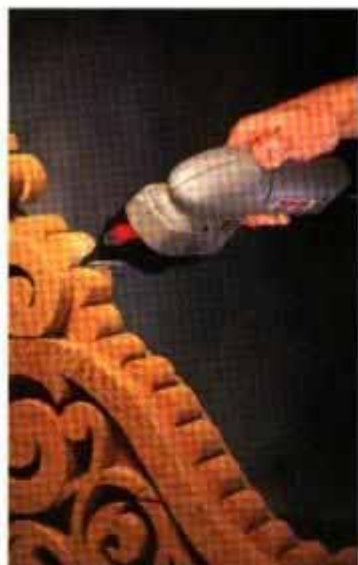
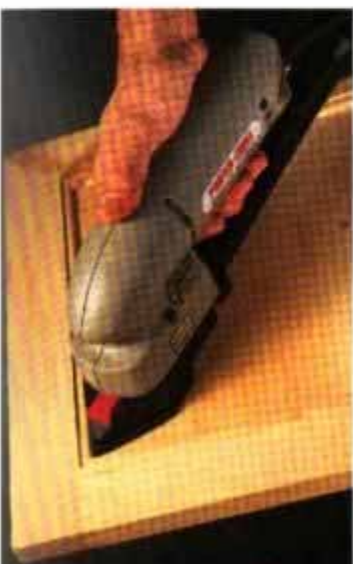
High Road

Taking a different approach to the traffic problem, Westinghouse was testing a novel rapid-transit system. In Pittsburgh's South Park, driverless trolleys circled quietly around an elevated guideway. They hugged the track with small horizontal guide wheels that rode a central I-beam. The advent of the computer made automated transport thinkable. San Francisco had al-

ready jumped on the bandwagon by launching construction of its Bay Area Rapid Transit system. **PM**



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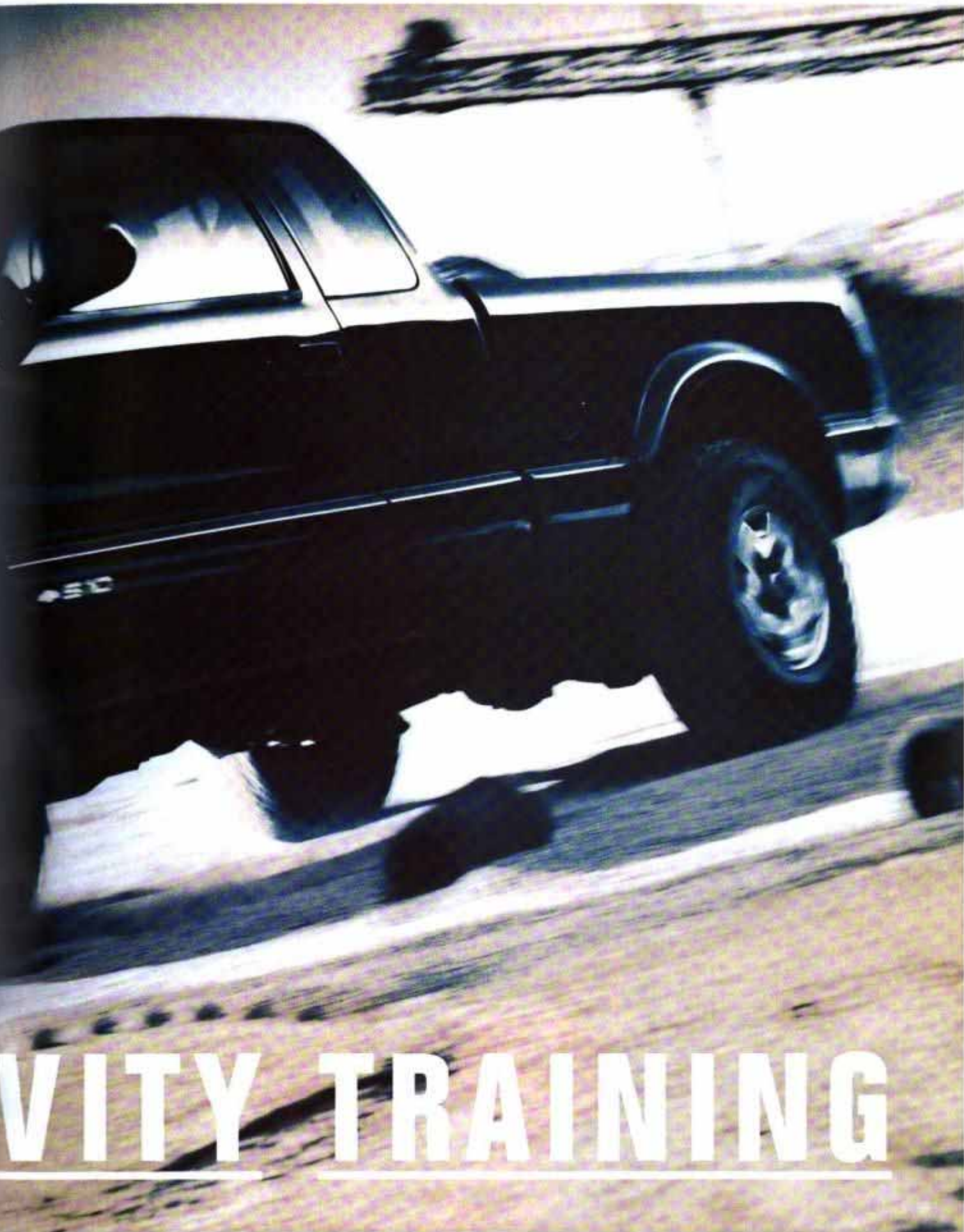
Porter-Cable is proud to be a co-underwriter of The New Yankee Workshop and The American Woodshop on public television.

It's rude. Has a bad attitude. And those are ZR2's good points. It looks like its gene pool was stocked with sharks. The Chevy S-Series ZR2 goes wherever it wants and does whatever it wants. Because ZR2 has the biggest V6 there is, the Vortec 4300. It has an on/off-road suspension, Bilstein shocks and fat, oversized tires to go four-wheeling on any road. Or no road at all. Well, what do you expect from a truck that just wants to have fun? Hey — you got a problem with that?

Chevy S-Series
LIKE A ROCK

A black and white photograph of a Chevy S-Series ZR2 truck driving on a road. The truck is shown from a low angle, moving from left to right, with motion blur on the wheels and background to convey speed. The truck's front grille and headlights are prominent.

FLUNKED SENSI



VITY TRAINING



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WILD DOG CIGARETTES

It's a long, long time since we've seen a man in a suit and hat. It's a long, long time since we've seen a man in a suit and hat. It's a long, long time since we've seen a man in a suit and hat.



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

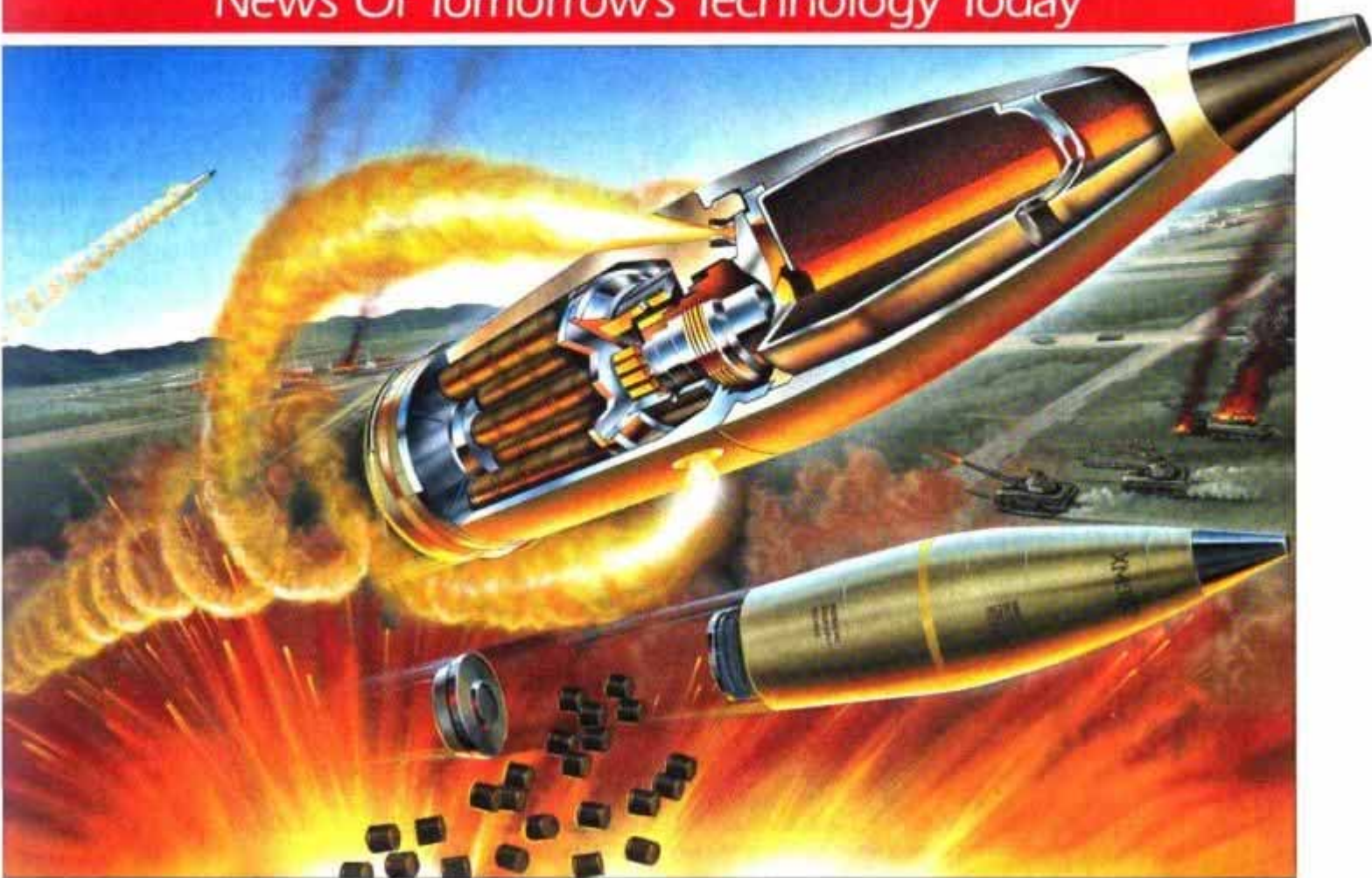
11 mg. "tar", 0.9 mg. nicotine av. per cigarette by FTC method.

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TECH UPDATE

News Of Tomorrow's Technology Today



Hybrid Artillery Rounds To Go The Extra Mile

PICATINNY ARSENAL, NJ—Field artillery has long been called “the last argument of kings.” And throughout history, munitions makers have strived to let their kings conduct that argument at longer and longer distances. Most recently, they’ve aimed their efforts squarely at the artillery projectile, stretching its range with two techniques. Base-bleed assemblies produce gases to fill the low-pressure spaces that form behind flying rounds. That reduces drag. Meanwhile, rocket-assisted projectiles simply boost themselves to greater ranges.

Now, under a new experimental 155mm ammunition program designated XM982, the Army is seeing if a single projectile can incorporate both technologies. The hybrid design has been dubbed “front-wheel drive,” because the rocket propulsion lies forward of the round’s payload. This positioning opens room for a base-bleed assembly at the rear.

After being shot from its gun, the XM982 projectile flies for 15 seconds. Then, an internal timer ignites a rocket motor with three nozzles just behind the nose of the round. Once the round sails over its target, a fuse detonates a second charge that blows off the back of the projectile, expelling submunition grenades.

An inductive coil is used to set the timer automatically. The coil will wrap around the barrel of the Army’s next-generation field artillery system (see [Tech Update, page 22, May '92](#)), now called Crusader. For current weapon-

Boosted by front-mounted rockets, extended-range XM982 projectiles release a rain of anti-armor submunitions.

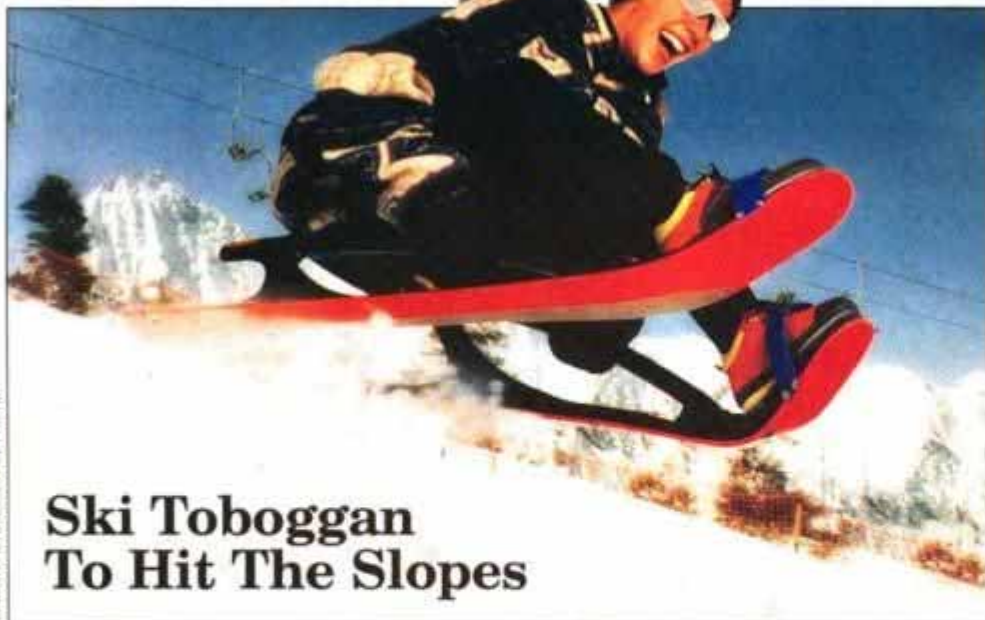
ry, gunners could set the timer manually with a handheld wand.

Olin Ordnance, Talley Defense Systems and Motorola have been working on the project for about nine months. The biggest challenge: shielding internal components from the rocket blast, which reportedly runs about 5000° F. The blazing exhaust spirals around the spinning projectile, threatening the timer and fuse. The ultimate goal is a range beyond 25 miles.

Highlights This Month

- **Winter Fast**—Ski toboggan for lightning slaloms.
- **Powered Lift**—Rocket platform boosts payload.
- **No Hands**—Coast to coast in a robotic car.
- **Light Fantastic**—Trillion-watt laser zaps records.
- **Engines Of Change**—Magnetic trains on track.
- **Slow Riders**—Hypersonic jets learn to crawl.
- **Cold Comfort**—Cryogenic suits for firefighters.

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



Ski Toboggan To Hit The Slopes

Skikarting combines the speed and agility of skiing with the comfort of sledding.

NOTTINGHAM, ENGLAND—Snowboarding appears to be a runaway success. Can the new Alpine sport of Skikarting be far behind?

Unveiled last year, the Skikart yokes two independent skis to a flexible saddle. You sit down and slip your feet through stirrups at the front of each ski. Body English controls the vehicle. By shifting your weight from side to side and edging the skis' front ends, you can turn, slow down or stop.

Injection-molded from a composite of plastics, the little toboggan resists damage while providing built-in shock absorption. Test runs aboard the prototype reveal a flair for high-velocity (up to 40 mph) slalom.

Racing-boat maker Raymond Sims has tooled up to begin manufacturing Skikarts, which should be ready to ship to distributors by this winter.

Bloodhound Of Chemical Warfare

WASHINGTON, DC—Alerting our troops to chemical-weapon attacks, an ultrasensitive toxin detector may soon fly aboard an unmanned air vehicle. No bigger than a shoebox, the Surface Acoustic Wave Chemical Agent Detector (SAWCAD)



Hunter unmanned air vehicle would carry SAWCAD chemical-weapons sensor.

can sniff out particles numbering only a few parts per trillion. The Naval

Research Laboratory led in the development of the device.

SAWCAD features an array of piezoelectric surfaces thinly coated with different polymers, each engineered to bond with a particular chemical agent. When a toxic agent contacts the coating, it disrupts an acoustic wave that's constantly beamed across the surface. The disruption has a characteristic signature that reveals the type and amount of toxin encountered.

Aggies' Electric Hot Rod

COLLEGE STATION, TX—Rightly or wrongly, electric cars have a reputation for anemic performance. But not the battery-powered Porsche 959 replica built at Texas A&M University. The 2600-pound car can dash from 0 to 69 mph in 9 seconds and boasts a top speed above 100 mph.

Assembled from a kit-car model, the vehicle showcases a controller that can pull as much as 2400 amps

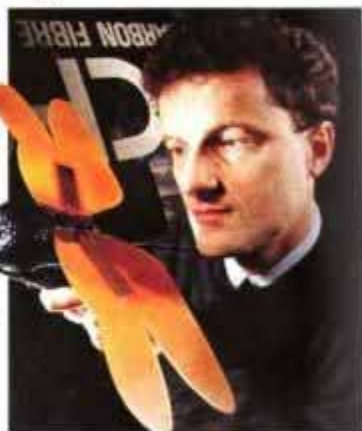
of current from 12 lead-acid batteries. Built by DAX Industries of Houston, the control system draws a continuous current of 1000 amps—twice the norm for electric-vehicle controllers. Of course, there's a tradeoff for the car's peppy pickup: Its range is no greater than 40 miles. On the plus side, the controller, which draws electrical energy in staccato bursts, prolongs battery life by allowing the cell to recover between pulses.



Electric Porsche replica does its namesake proud with high-current control system.

Robotic Dragonfly

FARNBOROUGH, ENGLAND—Will future missiles swoop nimbly through the air like giant predatory insects? Flight control via smart materials (see [Tech Update, page 30](#), Sept. '95) may make that possible. Aplytly enough, a mechanical dragonfly is demonstrating these materials, which alter their shape in response to a voltage. The bug was built by engineers at the Structural Materials Centre of Britain's Defence Research Agency.



Animated by smart materials, dragonfly previews missiles that maneuver with organic grace.

The artificial insect vibrates its wings, cocks its head and flexes its tail menicly—all without the use of motors. Instead, piezoelectric ceramic strips and shape-memory alloys do the work, swiftly and silently.

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ADD TO YOUR TOOL COLLECTION, NOT YOUR BATTERY COLLECTION.

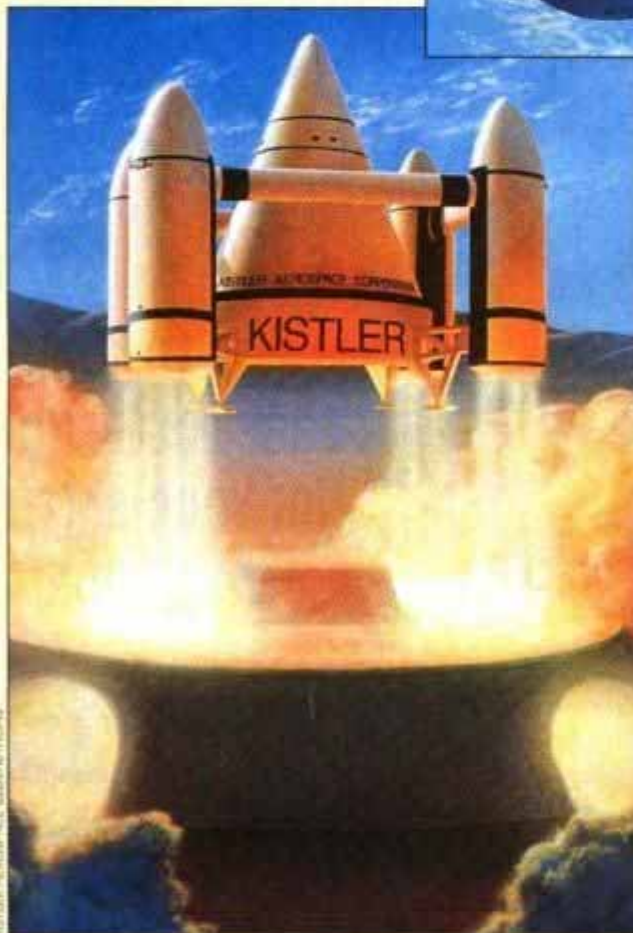
Introducing VersaPak™ from Black & Decker. Ingeniously designed cordless tools, all powered by interchangeable batteries. So you don't have to buy new batteries and a charger every time you buy a new tool, which saves you money in the long run. To learn more about VersaPak, please call 1-800-762-6672.



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Rocket On A Four-Poster

KIRKLAND, WA—It's been a rough year for new rockets. Lockheed's LLV-1 (see Tech Update, page 22, May '95) failed in August. The Pegasus XL (see Tech Update, page 16, Sept. '94) failed—for the second time—last June. Last August, the Conestoga never even made



Kistler launch system would mate conical second stage with rocket-powered launch-assist platform.

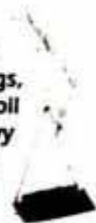
it off the launch pad. All were billed as key steps toward inexpensive access to space.

Nevertheless, Kistler Aerospace Corp. hopes to buck the trend with a radical plan to build a fully reusable 2-stage launch system. The company has tapped Bert Rutan's Scaled Composites to fabricate a proof-of-concept demonstrator called the K-0.

The Kistler design calls for a rocket-powered launch-assist platform—a "flying bedstead"—to hoist the overall system to a medium altitude. A conical delivery vehicle would then blast from the platform, complete the trip to orbit and release its payload—a satellite weighing up to 5000 pounds. Subsequently, both platform and delivery vehicle would fire rocket engines to make separate powered touchdowns, the latter coming down on a soft landing pad.

Kistler hopes to loft the K-0 in early 1996, staging test flights in Mojave, California.

Steered via GPS readings, giant parafoil carries heavy payload to precision landing.



Pinpoint Paradrops

YUMA, AZ—Aiming to keep cargo-aircraft crews out of harm's way, the Army is developing a precision airdrop technique for heavy equipment. The system combines a huge parafoil with guidance apparatus that steers the payload by tugging on the canopy's trailing edges. The electronics that govern this action include a Global Positioning System receiver and a wind gauge.

The goal: landing a 42,000-pound payload within 30 ft. of a target, after being dropped from 25,000 ft. up and 12 miles away.

Crash-Fire Truck Is Top-Flight

MUSKEGON, MI—The Air Force now owns a firetruck to match its state-of-the-art aircraft. Air bases are fielding the P-23 Aircraft Rescue and Fire Fighting (ARFF) vehicle, made by Teledyne Vehicle Systems and Emergency One Inc.

The P-23 is the only commercially available ARFF truck with an all-wheel-drive independent suspension system—critical for responding to accidents in rugged land surrounding an air base. With 15 in. of wheel travel, the suspension can handle high-speed turns on runways, as well as adverse terrain.

Inside the air-conditioned cab, four firefighters operate turret hoses by remote control. Although firefighters can hook up to the vehicle oxygen system, the



The Air Force's P-23 ARFF truck can hit 70 mph on runways and 35 mph off-road.

two rear seats feature cutaway backs that let occupants wear air tanks and spring into action more quickly.

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and worldwide number-one ratings prove it:

Auto Bild, April 1993, Germany

Automobile Magazine, December 1994, USA

AutoWeek, February 25–March 4, 1994, Germany

AUTOtronic Magazine, April 1994, USA

Wei Hong Enterprises, 1994, Taiwan

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Shuttle's O-Pump Is OK

KENNEDY SPACE CENTER, FL—The space shuttle's new Block 1 main engine debuted flawlessly this past July.



Ceramic bearings get A-OK sign after first flight of shuttle's Block 1 main-engine upgrade.

And a postflight inspection of its upgraded oxygen turbo-pump (see Tech Update, page 19, Jan. '94) revealed nothing to worry engineers. Especially encouraging was the condition of the silicon-nitride ball bearings—the first ceramic bearings ever flown in a cryogenic rocket engine.

Next spring, the shuttle *Endeavour* will blast off with all three engines improved to Block 1 status. The Block 2 engine, featuring a new hydrogen pump, won't fly until September 1997.

The Mechanical Watchman

WESTMINSTER, MD—Don't try breaking into an Army depot unless you want to tangle with MDARS-E. That's short for Mobile Detection, Assessment and Response System-Exterior, a patrol robot geared to spot you from 300 ft. away. The vehicle, under development for the Army



MDARS-E will guard ammo depots and warehouses.

by Robotic Systems Technology, keeps a lookout with forward-looking infrared and Doppler radar.

About 7 ft. long, MDARS-E runs 12 hours at a time on an 18-hp diesel. Along with its intruder detectors, the robot packs navigation sensors that permit unsupervised patrols. It could also check inventories with a microwave-tag reader.

Driving With No Hands

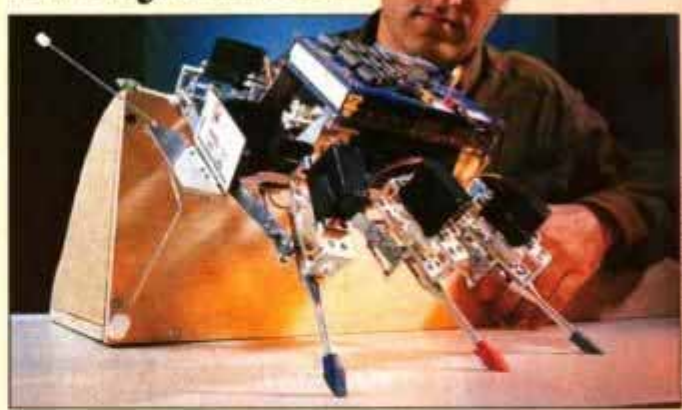
PITTSBURGH, PA—Last summer, two roboticists drove a 1990 Pontiac Trans Sport 2800 miles without laying a finger on the wheel. They rode aboard Navlab 5, the latest self-navigating vehicle from Carnegie Mellon University. The trip was an unprecedented demonstration of smart-car technology.

While previous Navlabs (see Tech Update, page 16, Nov. '88) carried heavy racks of computing power, the Pontiac runs on a notebook workstation



Navlab 5 drove 2800 of 2850 miles with autonomous steering system engaged.

Robot Bugs Everywhere



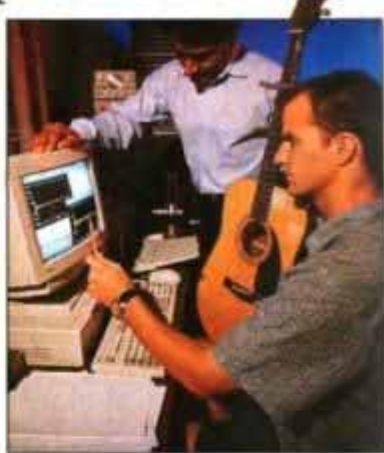
TICINO, SWITZERLAND—At University of the West of England, robot demonstrates artificial-intelligence trends. Insect robots are conquering the world. Across Europe, Japan and the United States, roboticists are junking traditional control systems in favor of biology-inspired behavior. Credit the Artificial Intelligence Lab of the Massachusetts Institute of Technology for exerting influence.

Two technologies are hot right now, according to attendees at a recent autonomous-robot conference. Neural networks (see also page 28) are coming on strong as robotic brains. Gaining equal momentum are genetic algorithms—software packages that refine themselves by applying principles of natural selection.

Good Cheap Guitars

ATLANTA, GA—What makes a good guitar sing, and a bad guitar croak? A set of subtle vibrations that emanate from the instrument's front plate. In a well-crafted acoustic guitar, these vibrations ring out undamped.

But Georgia Tech engineers have developed a simple device that can make any cheap guitar sound rich. The key component: a piezoelectric strip that modifies the upper-plate vibrations. The researchers now are developing a control scheme with which musicians can customize the sound.



Georgia Tech engineers analyze vibrations altered by piezoelectric material on guitar's upper plate.

that plugs into the cigarette lighter. The computer receives imagery from a video camera and controls a servo motor that turns the steering wheel. Autonomous lane-keeping was its job. The passengers manned brake and accelerator.





We
thought of
everything.

Chapter Six



This highly technical device helps us record, identify and eliminate undesirable sounds.

Caravan's sleek new shape reduces wind noise. So does the extra sealing we put in the doors—including the available driver-side sliding door.



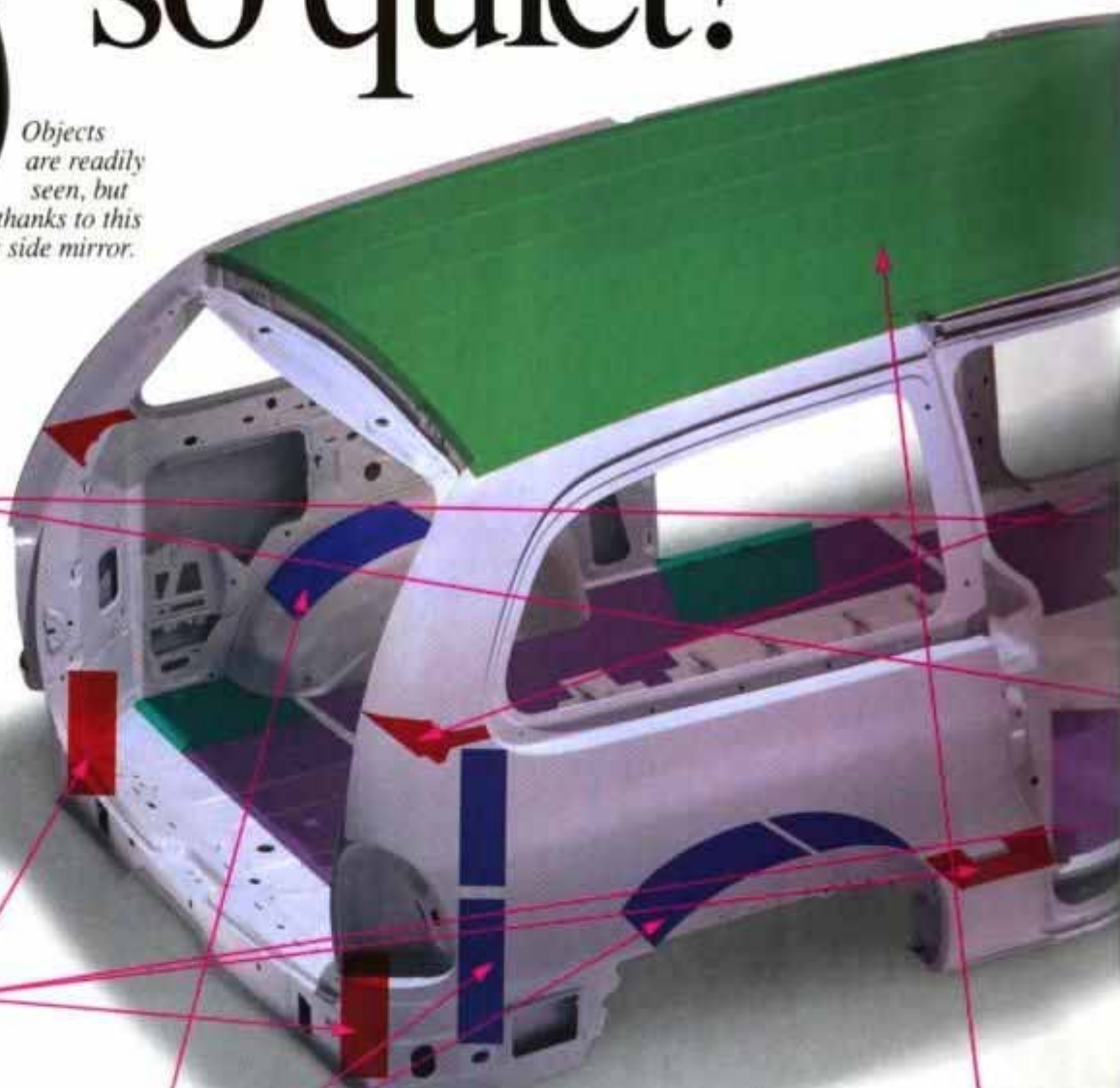
What makes the new Caravan so quiet?



Objects are readily seen, but wind noise is barely heard—thanks to this large, but very aerodynamic side mirror.

Objects are readily seen, but

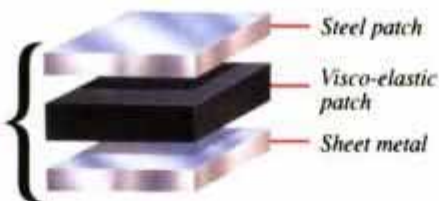
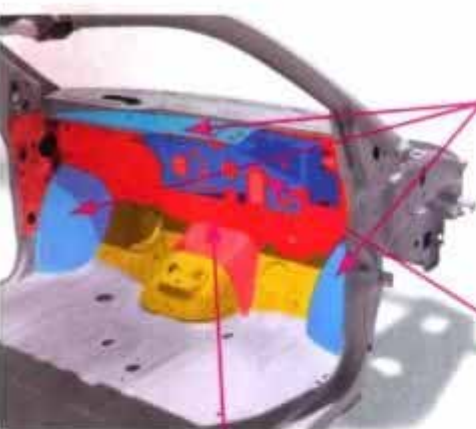
To help keep noises and vibrations out of the passenger cabin, we bake sheets of sound-deadening mastic onto the floor.



These carefully placed sound baffles are road blocks for road noise.

Sound-absorbers are placed in select cavities where noises can reverberate.

A foam panel inside the roof helps absorb outside noise before they get to you.



We place visco-elastic material on select areas of sheet metal and weld a steel patch over it. During paint-baking, the substance expands and bonds to the steel. The result: a highly effective sound-deadener called a patch constrained layer.

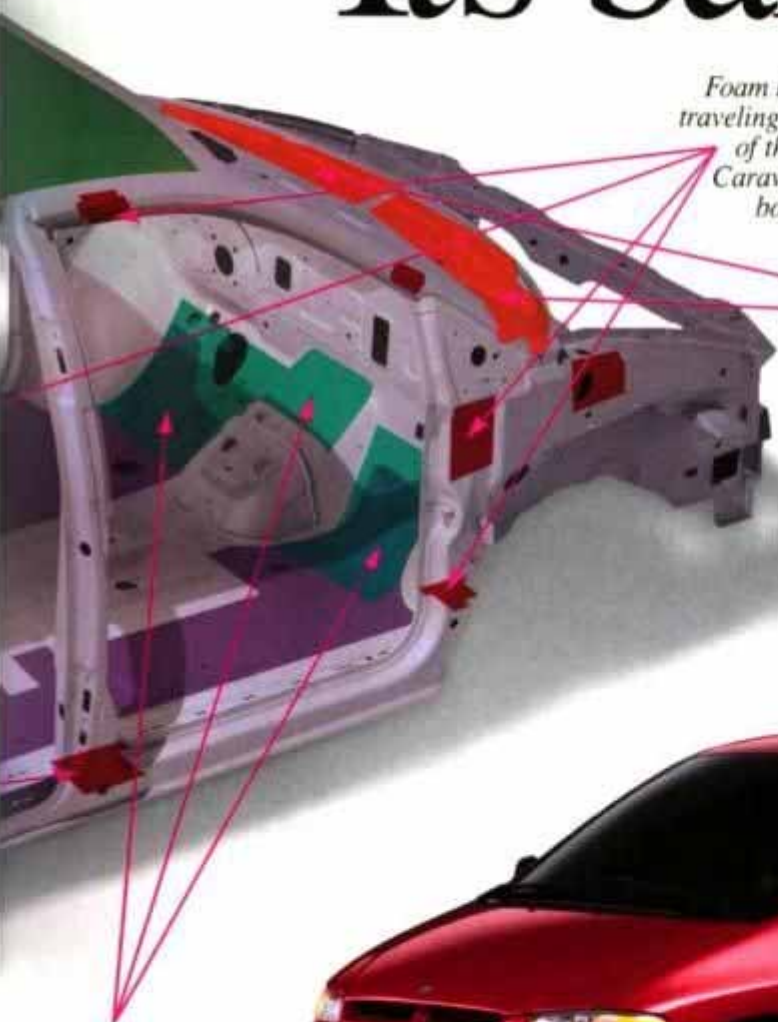
A double-layer dash silencer, composed of a vinyl barrier and 3/4-inch foam pad, is another way we contain noise.

On the engine side of the dash panel, a triple-layer silencer helps prevent noise from entering the passenger cabin.



Perhaps the best way to appreciate the quietest Caravan ever is with the new Infinity Acoustic 10[®] speaker sound system it offers.

It's baffling.



Foam baffling, which stops noise from traveling through body cavities, is just one of the secrets behind the quietest Caravan ever. Caravan's super-rigid body construction is another.

The sound-blocking materials used here are applied to the inner door panels, as well.

We offer carpeting that's backed by three layers of sound insulation.



Strategically placed visco-elastic material significantly reduces road noise.



The New Dodge Caravan





We think you'll agree, we thought of everything. But if you can think of anything else you'd like to know, call 1-800-4-A-DODGE. And we'll send you all kinds of information.

The New Dodge Caravan



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Light Heavyweight Champ

ROCHESTER, NY—The world's mightiest laser? Hand the title to Omega, the ultimate in ultraviolet light. Upgraded over the past four years, the machine now surpasses Nova, the huge laser at Lawrence Livermore National Laboratories (see "To Beam Or Not To Beam," page 44, Oct. '94).



World's most powerful ultraviolet laser, Omega, can uncork 60 trillion watts in a billionth of a second.

Omega sprawls across an area the size of a football field, at the University of Rochester. The laser unleashes a foot-long shaft of light that packs more power than the entire U.S. electrical grid. This ultraviolet bullet then splits into 60 beams.

Because Omega is a nuclear-fusion laser, its beams converge on a pellet of hydrogen fuel, heating and compressing it to duplicate the conditions inside the Sun.

Although Omega won't generate sustained fusion energy, it will set the table for the National Ignition Facility, a 192-beam system that will be under construction late this decade.

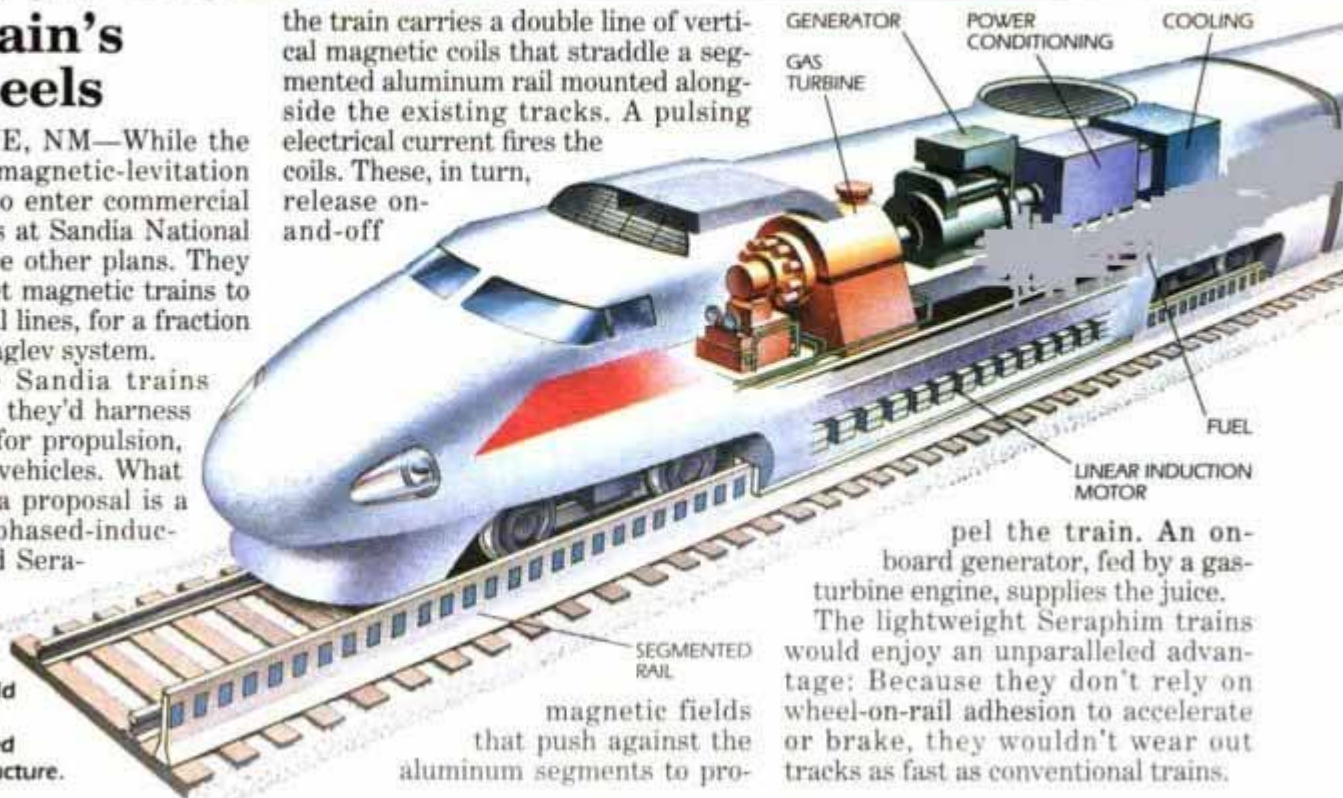
Supertrain's Mag Wheels

ALBUQUERQUE, NM—While the world waits for magnetic-levitation (maglev) trains to enter commercial service, engineers at Sandia National Laboratories have other plans. They think they can get magnetic trains to run on today's rail lines, for a fraction of the cost of a maglev system.

Although the Sandia trains wouldn't levitate, they'd harness magnetic forces for propulsion, just like maglev vehicles. What drives the Sandia proposal is a segmented-rail phased-induction motor, called Seraphim for short.

In the Seraphim scheme, Seraphim train would use magnetic forces to zip along modified existing rail infrastructure.

the train carries a double line of vertical magnetic coils that straddle a segmented aluminum rail mounted alongside the existing tracks. A pulsing electrical current fires the coils. These, in turn, release on-and-off



magnetic fields that push against the aluminum segments to pro-

pel the train. An on-board generator, fed by a gas-turbine engine, supplies the juice.

The lightweight Seraphim trains would enjoy an unparalleled advantage: Because they don't rely on wheel-on-rail adhesion to accelerate or brake, they wouldn't wear out tracks as fast as conventional trains.

Hypersonic Hyperbrain

NASA PHOTO

HAMPTON, VA—Gone is the X-30. Gone, too, is the HySTP proposal (see "Scramjets Get Serious," page 46, Nov. '94), a victim of NASA's funding cuts. But hypersonic researchers, who crave speeds beyond Mach 5, are still pushing to get something off the ground. A 100-in. scale model named LoFlyte may be their best hope at the moment.

Built for Accurate Automation

waverider (see Tech Update, June '93) sculpted for flight between Mach 4 and Mach 5. LoFlyte won't get to those speeds. Instead, it will use a flight-control system called AAC and based on a neural network.

Much like the human brain, the network is a collection of nodes wired to crunch huge amounts of data at once. Such a system

Olympic Torch Is In Hand

ATLANTA, GA—City officials are racing to prepare for the 1996 Summer Games. Not only must the Olympic facilities be ready, but Atlanta needs to also field a torch for the relay and flame-lighting ceremonies. Fortunately, Georgia Tech's mechanical engineers have drafted a fitting flameholder for the



Motormouth Taste Tester



MOUTH MACHINE duplicates chewing conditions in the cause of food-flavor science.

ITHACA, NY—In their relentless quest for better-tasting food, chemists at Cornell University have built an artificial mouth. The blender-size device mixes food with artificial saliva, spinning its blades at 30 revolutions per second. Meanwhile, a copper-coil water jacket warms the mush to body temperature.

The point? To unlock flavor molecules that humans taste through the nose's "back door"—the nasopharynx, which leads to the olfactory organ. How food tastes can depend strongly on these so-called retronasal aromas.

Once released by the motormouth, the aroma compounds pass through a gas chromatograph for identification. So far, the mouth has savored mints, raspberries and grape beverages. Next on the menu: high- and low-fat foods.



MARLBOROUGH, MA—Raytheon Corp. and Chicago's Regional Transportation Authority have unveiled the design for personal rapid transit (PRT) vehicles (see Tech Update, page 17, Dec. '93). The 4-passenger carriage made

its debut inside a PRT station mockup erected in Rosemont, Illinois, where the first revenue system is planned.

PRT calls for dozens of automated, computer-switched vehicles that zip nonstop to passengers' destinations, bypassing intermediate stations. The initial 3-vehicle test track, now under construction in Massachusetts, will be operational by this time next year.



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X-Plane's Excellent Farewell

EDWARDS, CA—It's hard to upstage Russia's daring MiG-29 and Su-27 routines at the Paris Air Show, but that's just what the X-31 did. The first X-plane ever to perform at an international air show, the U.S.-German jet hushed the crowds with a daily display of post-stall bravura. Sadly, the performance may be the curtain call for this extraordinary aircraft.

The maneuvers included several

rapid rolls and directional shifts while the airplane bellied through the air at a 70° angle of attack. One 90° heading change was termed the Mongoose, a playful counterpoint to the Su-27's signature Cobra maneuver. In another breather, called a Herbst turn, the X-31 pulled a 150° heading change during a sharp left bank. All were managed with the aid of thrust-vectoring paddles. These engine-nozzle devices allow

After a showstopping Paris performance, X-31 is loaded into Air Force Reserve C-5 for transport back to California.

carefree flight at angles that send other planes tumbling into aerodynamic stall.

The hardest-working X-plane ever built is now history—at least until the end of this year. After the air show, the ground crew removed its wings and palletized the aircraft. Now in storage at NASA's Dryden Flight Research Center, the X-31 awaits a decision on its ultimate fate.

Tech-Nomad Of The High Seas

SAN DIEGO, CA—Remember that guy who sold his house and rode around the country on a 580-pound, electronics-festooned bicycle called Behemoth? Well, Steven K. Roberts is back, and this time he's riding the waves.

Roberts is converting a 30-ft. folding trimaran (a Corsair Marine F-31 prototype) into the Microship, a floating arsenal of computer power. A network of a dozen Motorola processors on board monitors everything from bilge pumps to security sensors to equipment-bay pressurization.

To support a roving freelance lifestyle, the Microship packs a workstation, an audio/visual console and extensive telecommunications gear to hook up everything to the Internet. Staying connected no matter where they roam on the boat, Roberts and cohort Faun Skyles will each carry a pressurized backpack housing a notebook computer, a GPS receiver and a cellular phone.



Riddled with processors, Microship will be the world's smartest sailboat.



NOMADIC RESEARCH LABS PHOTOS

each carry a pressurized backpack housing a notebook computer, a GPS receiver and a cellular phone.



Hot Fire, Cool Suit

BOULDER, CO—Launch-pad firefighters will soon get relief with a unique protective suit, in which the breathing air doubles as a body-cooling system. Aerospace Design & Development is tailoring the Super Critical Air Mobility Pack (SCAMP) for the Air Force's Wright Laboratory.

SCAMP replaces a standard scuba backpack with a cryogenic dewar. This pressure bottle stores air at supercritical conditions—chilled to -321° F but still gaseous. Unlike air compressed to a liquid

state, the cold vapor will flow to the firefighter even when he or she is horizontal or upside down.

To reach a breathable temperature, the cryogenic air absorbs heat from antifreeze that circulates through the protective ensemble. The chilled antifreeze keeps the firefighter cool.



SCAMP provides 1 hour of breathing air plus body cooling in a single 25-pound package.



AEROSPACE DESIGN & DEVELOPMENT PHOTOS



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delivers comes from our advanced electrode design (our engineers worked overtime on this one). So, to a car that has been around the block a few times, they help bring back that new car feel. Sound too good to be true? That's just the kind of response we were looking for. To find out more, call 1-800-ACDelco.

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Tele-Screen™ Phone Protector eliminates unwanted calls. Harassing calls, sales calls, any call you wish. Incoming calls are greeted by a voice prompt: "Thank you for calling. Please enter the four-digit pass-code." Your phone rings only if the caller enters the correct code. Voice prompt repeats and if no code is entered, the caller is automatically disconnected! Use the keypad to change the code, or de-activate the unit. It's like having an unlisted phone number when you want it unlisted. Like during study,

meal-time, romantic evenings, or when you only want calls from those you gave your password to. Also secures fax and modem lines!

■ Tele-Screen™ #TS-300 \$44.95

Installs easier than an answering machine, with its own AC power pack. Rings once to let you know it's working. Un-TeleScreened extensions will regular ring.



Own a piece of history from the cold war.

From Red October to the brutal battlefields of Afghanistan, the all steel "Commanderski" watch was a badge of honor. Emblazoned on its white Russian face is the hammer, sickle, and red star of the USSR's glory days. CCCP is highlighted below. Made in the original factory outside Moscow, before the break-up. Now yours. Adjustable steel band. 17 jewels. Shock, dust, and water-proof. Accurate to seconds per month. Own the last of a genuine cold-war treasure. Get yours and get to your next party meeting on time, comrade.

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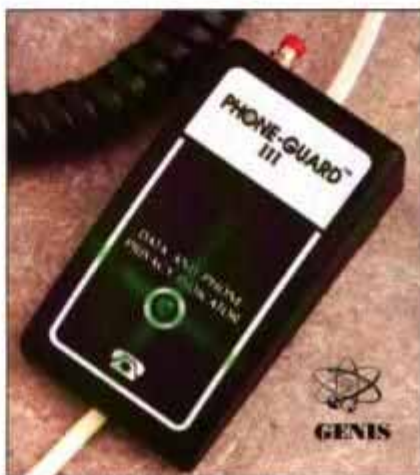
THE NEXT GENERATION

Straight from the year 2368 AD. Command your TV with the next generation in universal remotes.

Set your Phaser to TV, VCR, or even cable. Press a button. With Star Trek sound effects, you change channels, volume, mute or power up. As you key in each command, the Phaser fires with a deep ruby glow. Now go where no remote has gone before. From the on-going mission, direct to you. App. 9". Computable with all major components and brands. Want to try one risk-free? Call now and make it so.



- Star-Trek Next Generation, Type II Phaser Remote #2378 \$39.95



New Phone-Guard III keeps your calls private. And more.

If during a phone conversation you see the green light go out, someone has activated a phone tap or picked up an extension. Press the red button to resume your conversation, now talking with caution. And when Phone-Guard is installed on all your extensions, the extension you pick up automatically disconnects the others! No more running to turn off the answering machine. LED light also tells you - before you pick up - if the line is in use. In effect, Phone-Guard is like a mini phone system, protecting your faxes or modems from

interruption, saving you steps, and most of all, insuring your privacy. Measures just 3 1/2" x 2" x 1" and phone-line powered, requires no batteries.

- Phone-Guard III Privacy Module #PNG-300 \$49.95

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Transform your dashboard lighter into a traveling power-plant.

Run any tool or appliance from your car, truck, boat, or camper. Full 100V AC power from your vehicle's 12V battery. A miracle of modern technology - in a 5" x 4" package. It works by duplicating the complex "sine-wave" of AC power. Now you can recharge power tools on the job, watch TV while camping, access your laptop PC, or just plug in a lamp and read under the stars. Completely safe for both your car and your appliances. Even when the car is off. Automatic alarms won't let you drain the vehicle's battery, or overload your appliances. Now enjoy all the convenience of full power-to-go.

- PC140 Power Invertor, single receptacle, delivers 140 watts continuous power, 200 watts peak power. #PC-140 \$49.95
- PC300 Power Invertor, dual receptacle, delivers 300 watts continuous power, 500 watts peak power. #PC-300 \$89.95

GRIP. CUT. SAW. PRY. FIX. OPEN.

Stop lugging around your heavy tool box. With one tool you can now: loosen and tighten bolts. Fix a leaky faucet. Cut rope, wire, or wood. Tie a fly. Clean a trout. Pry open a paint can. Tighten a bike cable. Adjust a friend's carburetor. Or just kick back and slice an orange for your kids.

Unlike plastic handle imitations, Plus-Pliers 100% steel construction wipes clean after each use. Slotted handle gives you a tough grip - under the sink or in the rain. Best of all, it closes down to just 5 1/2 inches, so you can take it anywhere. Includes belt holster. Slip it over your car visor, and be prepared on the road, too. Lifetime warranty.

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14 tools in one!

"Truth is, I just don't much need to drag around my old rusty tool box anymore."
- Fireball Smith, Vermont handyman

New electronic Bodyguard™ uses touch-technology. Scares the bejezuz out of intruders.

Hang one inside your door. The tiny red LED lets you know it's armed. Before an intruder even turns your doorknob, Bodyguard rips out a staggering siren, alerting you and sending thugs scurrying for easier pickings. Bodyguard also protects file cabinets, desks, pool gates, or your car. Outside, take it hiking, jogging, or on your next errand. In the event of trouble, click a switch and the siren shrieks. A ruby-strobe provides even more protection. Or switch it to red-lens flashlight for key locating, car map-reading, or starlit strolls. Measures 5" x 2 1/2" x 3/4", and requires just one 9v battery. The Bodyguard. Get two - one for home or travel, and one for someone you care about.



■ Electronic Bodyguard Portable Alarm System #DA-36 \$19.95

Take on saber-tooths, woolly mammoths, and your next chores, too.

Discover the knife your ancestors used in the last ice age. Some things just can't be improved. 30,000 years ago, the clan leader who created such wondrous tools was master of his world. Today, on Oregon's Great Basin each is painstakingly flaked from pure translucent obsidian - the volcanic glass forged in the very furnaces of the earth itself. Sharp enough to shave a buffalo, each is sinew-wrapped to genuine crown stag antler. The result? Nine inches of unsurpassed beauty, history, and power. On your loin-cloth, under glass, or skinning your next task, behold the knife that survived evolution itself.



■ Great Basin Obsidian Knife #OBS-220 \$89.95

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

Can also be used reversed as low power microscope. Includes Russian documentation. Hurry, comrade, supplies limited.



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Asia Spy Report

BY SCOTT OLDHAM, West Coast Editor



1996 Toyota 4Runner

By summer, Toyota will begin restructuring its line of sport/utilities. The Land Cruiser will most likely become the Lexus LX 450. Everyone expects the LX 450 to cannibalize Land Cruiser sales, so the Toyota's cruising days are probably over. Since the Cruiser is already pushing \$50,000, it should feel right at home at Lexus dealerships.

The 1996 4Runner will grow larger and more expensive to fill the vacancy in the Toyota lineup. Prices should be about \$30,000 to \$40,000. In these photos, the new truck doesn't look much different from the very popular present-day model. Based on the improved chassis of Toyota's new Tacoma pickup, the '96 4Runner will be longer and wider. It will also share



This bigger and more expensive 4Runner will fill the hole left by the Cruiser's defection to Lexus.

The Next Q

Speaking of sport/utility vehicles, Infiniti dealers will start receiving the company's first this spring, a still-unnamed version of the Nissan Pathfinder. But more significant for Infiniti, the marque's flagship sedan, the Q45, goes back to the land of rocks and trees. That car's successor will be called simply the "Q"—its new V8 engine displaces only 4.1 liters, and "Q41" doesn't have the right cachet. The Q is based heavily on the new Nissan



Infiniti's flagship, the Q45, will be replaced this spring by this car.

the Tacoma's powertrains, which blow away the current 4Runner's weak-kneed 4-cylinder and 150-hp V6. The new truck will come with a standard 150-hp 2.7-liter Four. Power-hungry buyers can order up an optional 190-hp 3.4-liter V6 that makes 220 ft.-lb. of torque. Both engines will be available with either a 4-speed automatic or a 5-speed manual transmission.

After the 4Runner moves up a

rently sold only in Japan. That will mean rear-wheel drive, a 270-hp V8 and a 4-speed automatic. Expect the Q to be more like its main competitor, the Lexus LS 400, with which the Cima's conventional styling is right in line. Pricing shouldn't rise too far over the present Q45's base-line of \$52,400.

notch on the Toyota food chain, the new RAV4 will take its old slot at the bottom. You can expect to pay about \$19,000 for a 4-door RAV, and about \$15,000 for the 2-door.

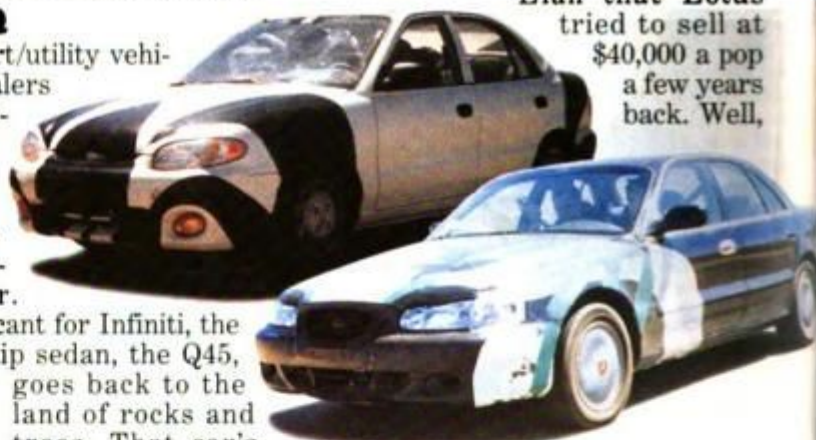
1997 Hyundais

With all the action going on at Kia (see below), the folks at Hyundai have been hopping to stay atop the Korean industry. Hyundai will unveil new noses for both its midsize Sonata and its recently introduced subcompact Accent this spring. While the new beak on the smaller Accent seems to be more conservative than the car's current styling, the Sonata's new facade looks like something from outer space. The Accent gets a more standard grille opening and conventional amber foglamps under the bumper, which replace the current car's radically scooped air openings. Coming, too, is a convertible version of the Scoupe replacement.

Kia Sports Car

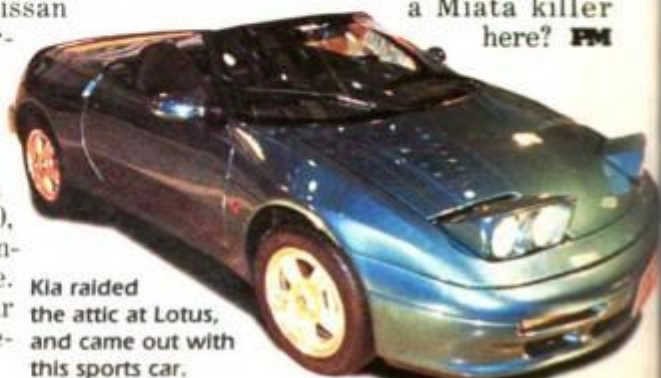
Shown at the Seoul auto show, the Kia L96 is actually the front-wheel-drive

Elan that Lotus tried to sell at \$40,000 a pop a few years back. Well,



Hyundai will update its capable Accent and Sonata sedans with new looks in '97.

Kia has bought the tooling from Lotus, and added Kia badges, its own 5-spoke wheels and a 1.8-liter 135-hp 16-valve Four. Plans right now call for 2000 to 6000 units annually, and only for the Korean market. But do we see a Miata killer here? **PM**



Kia raided the attic at Lotus, and came out with this sports car.

TREAD LIGHTLY ON PUBLIC LANDS.
BUT STOMP ALL OVER THE COMPETITION.



In a recent battery of tests, the Tacoma 4x4 climbed straight to the top of the heap. Of course, we're not surprised. As the #1 selling compact 4x4 pickup since 1980, Toyota is 15 years ahead of the competition.*

Tacoma's available 190-horse engine is more powerful than any standard V6 in its class. And when it comes to acceleration, this Toyota takes top honors.** Combine that with class-leading ground clearance and a state-of-the-art suspension system and you'll understand how the Tacoma 4x4 could not only climb over the rocks, hills and mud holes we threw at it, it also ran straight over the competition.

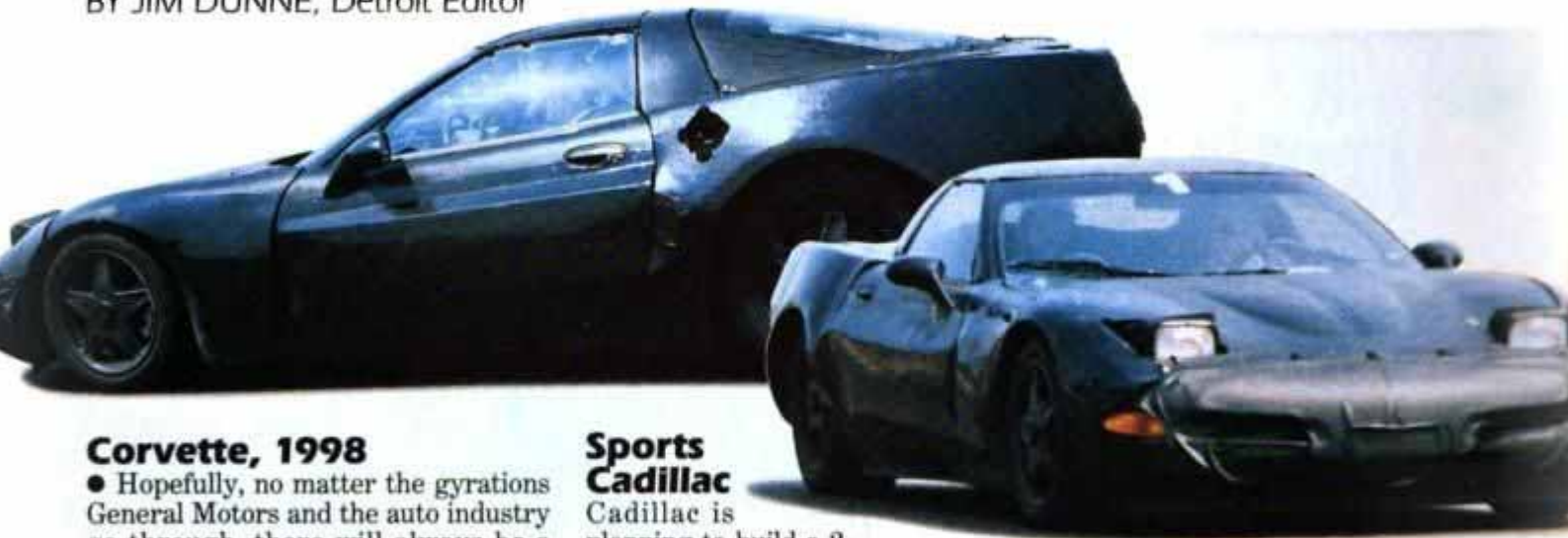
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©1995 Toyota Motor Sales, U.S.A., Inc. Buckle Up! Do it for those who love you. Toyota reminds you to Tread Lightly!® on public and private land. *R.L. Polk & Co. 1980-1994 **USAC-certified acceleration tests of 1995 Tacoma 4x4 3.4L Xtracab automatic vs. similarly equipped Ford Ranger and Chevrolet S-10 with optional V6.

Моторное, защищенный двигатель, стальной

Detroit Spy Report

BY JIM DUNNE, Detroit Editor



Corvette, 1998

● Hopefully, no matter the gyrations General Motors and the auto industry go through, there will always be a Corvette—and there will always be people who want one. For those of you who are concerned that America's sports car is hovering near the brink of extinction because the current model is going to be laid to rest next year, worry no more. Here's a look at its replacement.

The cladding in the form of fake panels on the sides of this prototype hides the true line of the fenders and doors, but you still can see that this is one wide, low, serious car. Look carefully and you'll note the lower cowl and hoodlines that help give the car a sort of European look. The lines at the rear of the body flow into the tops of the four taillights. A new styling touch is the indentation that starts at the engine vent in the front fenders and extends the length of the doors.

Powertrain details begin with a V8. An engine tooler in Europe is putting the finishing touches on a new V8 assembly line for the '98 Corvette.

Interestingly, that very same engine line will also build truck engines. Insiders say the line will produce iron blocks and heads as easily as aluminum ones.

Sports Cadillac

Cadillac is planning to build a 2-seat convertible that will compete with the small sportsters coming from Mercedes, Porsche and BMW. As yet unnamed, the new vehicle will promote Cadillac's image as a producer of world-class luxury cars. While still in the planning stages, it is rumored

the new coupe will share parts with Corvette. If it does, look for a V8 Northstar engine and rear-wheel drive.

Entry-Level Caddy

There's no speculation about the newest Cadillac sedan. It's the Catera, which is heavily based on the Opel Omega from GM in Europe. The car was formally introduced in Frankfurt recently. Don't think of it as just another rebadged corporate car like the ill-fated Cimarron J-car. The Catera is a well-done European luxury sedan that Cadillac brass hopes will get younger, less-traditional buyers into its showrooms.



At a Cadillac dealer near you soon: the Catera.

that the price will be on the low side of Cadillac's lineup, perhaps in the \$30,000 to \$35,000 range. Also talked about is a rear-drive chassis, and some version (maybe a V6) of the Northstar engine. If GM execs give the go-ahead, look for this car in showrooms no sooner than 1998. You can bet the house that Cadillac's proposed coupe will not be named Allanté. What you can speculate on is whether

1997 Dodge Dakota

Chrysler insiders told us the 1997 Dakota would look like the baby brother of the Dodge Ram. Look closely at the photos of this Dakota prototype and you'll see what they mean: the same 2-level grille and aggressive front fenders. Chrysler is taking aim at Ford's Ranger as its top competitor in the compact pickup market. This Dakota prototype was escorted by a Ranger, as the two ran a series of comparative road tests. **FM**



Though it's tough to see here, Dodge's Dakota pickup is beginning to take the shape of its successful big brother, the Ram.

PM HOTLINES

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We're trying to make it easier for you to communicate with us. Here are four ways you can do it.

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Your written letters are always welcome. If we think your letter would be interesting to other readers, we might even print it in our Letters column (unless you request that it not be printed). Send your letter to one of our editors, who are listed by department on the masthead in the front of the magazine next to Editor's Notes. Our address is: Popular Mechanics, 224 W. 57th St., New York, NY 10019.

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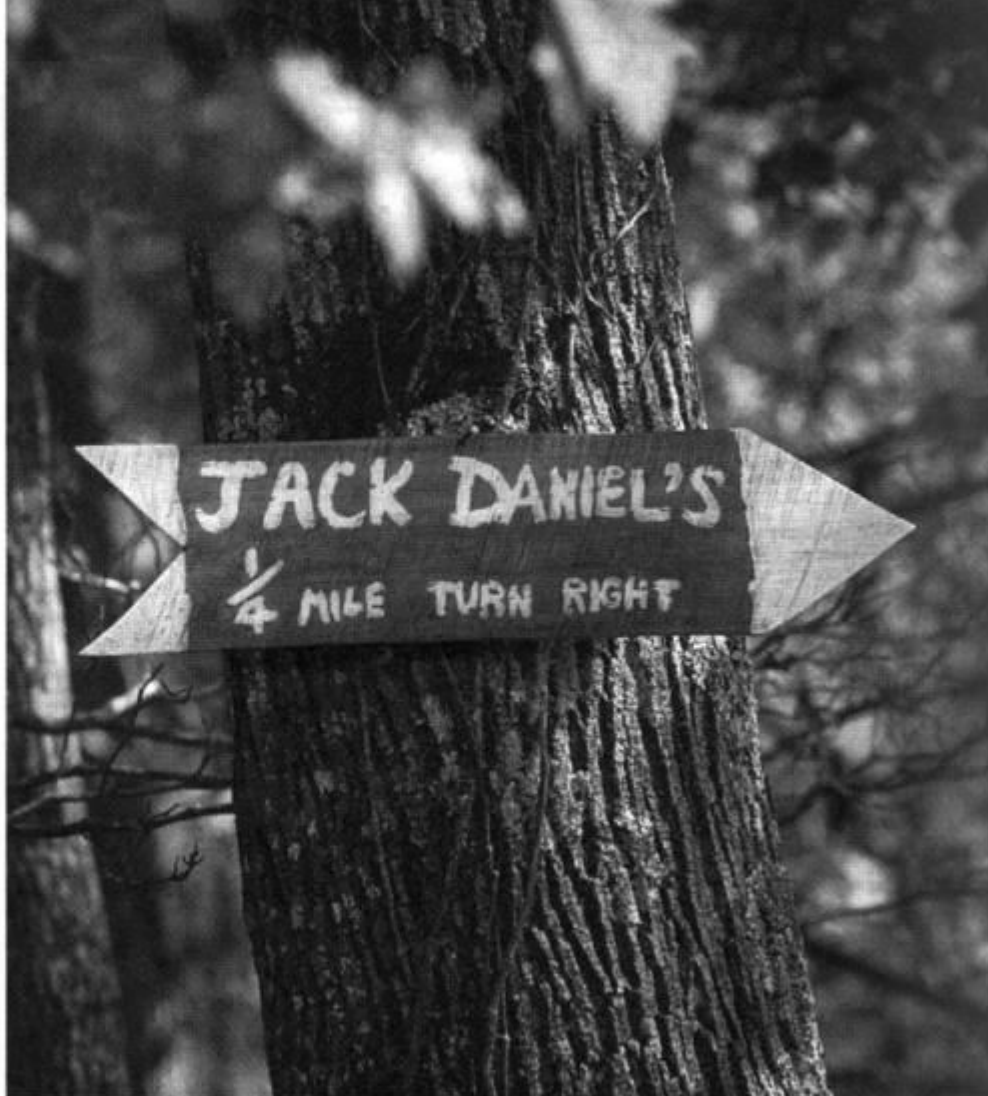
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To get to Jack Daniel Distillery, take I-24 to Route 55 and follow the signs to Lynchburg, Tennessee.

THIS SIMPLE SIGN, weathered by time, will point you in the direction of America's oldest registered distillery.

In fact, it will take you right to our front door. And when you arrive, we'll show you around and explain the oldtime way we've made our whiskey since 1866. There's nothing fancy or modern about our signs, but folks seem to like them. (You might say the same about our Tennessee Whiskey after a sip.) We hope you're thinking about visiting Jack Daniel Distillery soon. If you are, just follow the signs.

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Placed in the National Register of Historic Places by the United States Government.



New Technology Improves Sleep Quality

Chances are, you need better sleep. Thanks to advances in sleep surface technology, now you can get it!

America has become a nation of the chronically sleep-deprived. The Better Sleep Council reports that over the past 20 years, we Americans have added around 158 hours, or nearly an entire month each year, to our job schedules. That's not to mention the time we spend working hard to care for our families and homes. Sleep deprivation is caused by both lack of time spent sleeping and poor quality sleep. Sound familiar? Then you owe it to yourself to read on!

SLEEP DEPRIVATION CAN BE DANGEROUS

According to the AAA Foundation for Traffic Safety, sleep-deprived drivers are vulnerable to "micro-naps" lasting four or five seconds—plenty of time at highway speeds for a fatal crash to occur. Disrupted sleep and sleep disorders cost American businesses billions of dollars annually in lost productivity, industrial accidents and higher medical bills. Lack of sleep also was implicated in the Exxon Valdez oil spill, the space shuttle Challenger disaster and the nuclear accident at Three Mile Island.

Loss of sleep during the night is responsible for increased vulnerability to illness, a tendency to nod off at work the next day, and even loss of creativity and clarity of thinking, say British researchers. Power tools can become dangerous weapons in the hands of someone who is not well rested. And almost everyone is familiar with the physical aches and pains that occur because of poor quality sleep.

DO YOU NEED MORE SLEEP, OR JUST BETTER SLEEP?

On the average, most adults require seven and a half to eight hours of sleep per night, and a full cycle including deep sleep is required for us to feel adequately rested in the morning. Any number of factors can interfere with

deep, nourishing sleep—including cigarette smoking, worry, a noisy environment and physical discomfort.

Air-cushioned support has been proven to positively affect all three factors that determine the quality of sleep: spinal alignment, pressure points and physiology.

We try remedies from pain medication and sleeping pills, to chiropractic care and self-relaxation techniques in order to get better sleep and rid ourselves of morning aches and pains. But new sleep surface technology offers a simpler solution for many people who toss and turn.

THE FIRST REAL BREAKTHROUGH IN SLEEP SURFACE TECHNOLOGY IN OVER 100 YEARS

Even if you just bought a new bed, you may be sleeping on an antiquated surface! Developed a century ago, innerspring mattresses can create pressure points that interfere with total relaxation. Waterbeds made a big splash in the '60s, but even those labeled "firm" can produce a hammock effect, which can cause the spine to curve unnaturally. Fortunately, a new technology has come through test after test with flying colors: Select Comfort Air Sleep Systems™.

The Select Comfort adjustable firmness mattress uses air which distributes body weight more evenly and provides better support.

While it looks like a traditional mattress on the outside and even fits standard sheet sizes, the Select Comfort mattress is completely unique on the inside. Air is captured inside innovative "I-beam" chambers that contour to the body, provide proper spinal support, reduce pressure points and evenly distribute weight for better sleep.

What's more, each side of the Select Comfort adjustable firmness mattress is independently adjustable—with a remote hand control that digitally tells you the

firmness level that's perfect for you. And, you can let air in or out to change the mattress firmness, depending upon how your body feels each night. This is essential for couples, because two people of different shapes and sizes cannot sleep on the same surface and both be as comfortable as they should be to achieve the best possible sleep.

MADE-IN-MINNESOTA QUALITY

Select Comfort adjustable firmness mattresses are manufactured in Minneapolis, Minnesota, and tested for comfort and durability by independent laboratories. Well on its way to becoming a worldwide leader in state-of-the-art sleep systems, Select Comfort currently is the fastest growing company in America's bedding industry, and has earned 22 U.S. patents.

LIGHTWEIGHT AND EASY TO SET UP YOURSELF

The Select Comfort adjustable firmness mattress is so lightweight, it can be delivered via UPS in one carton. Following the simple instructions, one person can set up the system at home, usually in 30 minutes or less. An attached electronic air pump fills the mattress with the right amount of air, and then hides out of sight under the bed. Dual controls allow each sleeping partner to adjust the sleep surface to their desired firmness.

TRY SELECT COMFORT AT NO RISK FOR 90 NIGHTS

Thousands of people from coast to coast already own a Select Comfort adjustable firmness mattress. You can try one, too, protected by a "No-Risk 90 Night" guarantee and up to a 20-year limited product warranty. Call our sleep consultants and ask them about your particular sleep needs. They can answer all your questions and help you better understand how you can benefit from a Select Comfort adjustable firmness mattress.

For a free brochure and introductory video, call 1-800-831-1211, Ext. 4612.

Sleep Better, Feel Better!

Frustrated With The Quality Of Your Sleep?

Do you toss and turn at night? Can't seem to find a comfortable position? Does your back ache when you awake? These are signs that your metal coil mattress or waterbed isn't supporting you properly and isn't right for your body. Select Comfort can help you sleep better with a revolutionary mattress that's so comfortable and supportive, it's recommended by the many doctors who use our product.

Sleep Better On Air

A Select Comfort adjustable firmness mattress doesn't rely on springs or water. Instead, it supports your body on a cushion of air. Air is better because it gently contours to your body's shape and keeps your spine in its natural alignment. And that lowers the tension in the surrounding muscles. So you can sleep comfortably in any position and wake feeling great!



With Select Comfort, you each get exactly the firmness you need.



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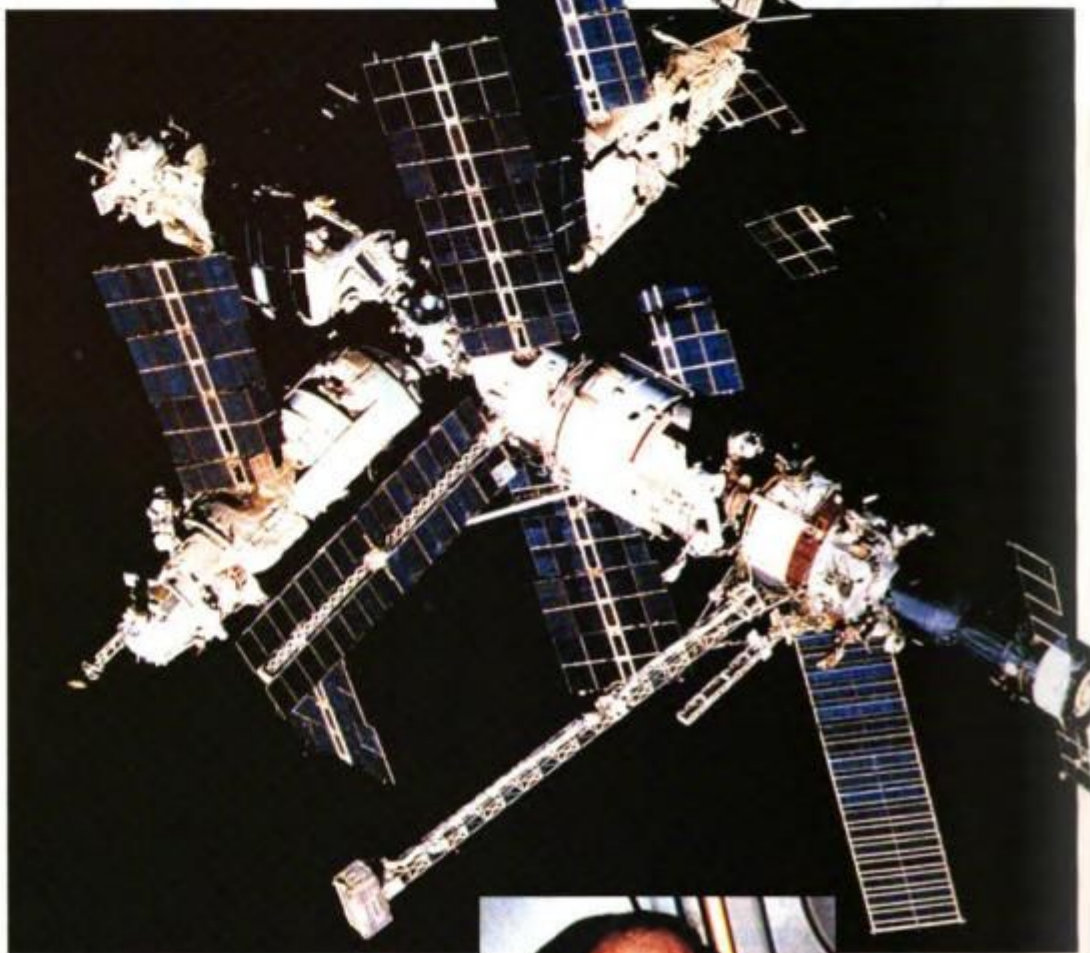
BY PHILIP CHIEN

● Last winter, Norman Thagard bought a round-trip Delta Air Lines ticket from Houston to Moscow. As it turned out, he had to hand in the return portion for a refund, because he came home via a 115-day lay-over in low Earth orbit.

On March 14, 1995, Thagard and two Russian cosmonauts were boosted into space in a Soyuz rocket vehicle. On July 7, they touched down at Kennedy Space Center aboard the shuttle *Atlantis*. The crew became the only space travelers to go up on one vehicle and come down on a completely different one. More important, Thagard returned with perspective on the kind of long space-station sojourn that the Russians have been doing for years—something American astronauts must master quickly. Thagard spoke recently with PM contributor Philip Chien about his experiences.

PM: Can you compare a shuttle launch to a Soyuz launch?

Thagard: Actually, they're very similar. I'd say a Soyuz launch is more comfortable. The spacesuit is lighter than the shuttle suit, and your cushion is form-fitted. The g-forces are about the same. You're only there for two days—it's such a short period



Thagard set a new U.S. spaceflight record by spending 115 days in *Mir*. Although he got there aboard a Soyuz rocket, American astronauts will visit via shuttle in the future.

of time there's no problem living on board, although it's a very small space. There's no heater, so you're eating food designed to be eaten cold. Typically, cosmonauts take enemas before launch so most folks never have to use the bathroom.

PM: What were your initial reactions when you entered *Mir*?

Thagard: The first thing I tried to do was notice any particular smells—and there were none. The atmosphere was clean-smelling, and I didn't notice any particulate matter in it. *Mir* has the look of a station which has been up there for nine years. On the other hand, I give *Mir* very high marks for habitability—it was very comfortable and roomy.

PM: What are the cleanliness and hygiene like aboard *Mir*?

Thagard: Not bad, because at least once a week people go through and wipe things down. We had heard reports about mold on *Mir*. I didn't see that when I was there. The STS-71

crew noticed an odor when they arrived. Maybe I had gotten used to it by that point, but I didn't notice anything. We collected surface samples including bacteria and fungi off the dining table, handrails and other places. The largest samples were about the size of a poker chip after five days of growth.

PM: There's been a long-standing rumor about cockroaches aboard *Mir*.

Thagard: Never saw any. I think in the course of that period of time I would have seen them if they existed.

PM: Can you tell us about any problems you had with the food on *Mir*?

Thagard: We did have a problem with food. Because of the science require-



Thagard got to compare U.S. space-exercise gear with that in the *Mir* gym.

ments, the food designated for us was all bar-coded so you could keep track of everything you ate. The problem was not that the food was blah, as reported in the press—a statement I never made. The problem—in all our cases—was that there was a substantial portion of the food that we would normally not eat. I just don't eat canned fish. My basic problem was that I didn't want to unilaterally abrogate the scientists' desire to have everything I ate recorded, so I stuck to eating the bar-coded food supply. But since one-third of it was stuff I didn't eat, I wound up losing 17½ pounds.

The food thing was not Norm Thagard's personal problem. I want to stress that. The bar-coded food supply was just not satisfying anyone. [Cosmonauts] Vladimir [Dezhurov] and Gennady [Strekalov] decided it was not reasonable to lose weight and ate freely from the non-bar-coded stocks. I chose to stick with the scientists' desire, and lost weight.

PM: *Can you compare the American lower-body negative pressure (LBNP) suit with the Russian Chibis suit (devices used to counteract the biomedical effects of weightlessness)?*

Thagard: The Chibis is operationally more friendly. It's much easier to doff and don, and the setup times are shorter. In the case of somebody like me who lost weight, the Chibis suit didn't hold pressure as well as the LBNP device. But for Vladimir and Gennady, the Chibis suit was fine.

PM: *How different are the American and Russian exercise machines?*

Thagard: In the case of the bicycles, the feel was the same. For the treadmills, the Russian one has both powered and unpowered modes, and some exercise protocols called for powered runs. I thought the U.S. treadmill worked very well, but I did have some ideas for improvements. It has a liquid-crystal display very close to the eyes, and I couldn't read it without my glasses. And normally you wouldn't want to wear glasses while you're jogging. The other thing is that the *Mir* treadmill requires a harness, and the suspension is two points—one on each side of the user. I found that to be better than what we have on our treadmill, which suspends us fore and aft, and your heels tend to strike the aft harness-attach point.

PM: *What kind of language problems did you have?*

Thagard: The thing the language barrier does is that you don't try to convey subtleties of language. You just don't. And since one of the most important things is to retain good crew relations, you have a great tendency to stay away from anything controversial. For instance, if Gennady and

Vladimir might discuss the events in Chechnya, I would stay completely out of those conversations.

PM: *How long did it take you to readjust to being in gravity?*

Thagard: Immediately. I don't know why I adapted back to gravity so quickly. I do know that my experience was different from my shuttle flights. Normally, the first night after a shuttle flight while lying in my bed, I would feel as if I was floating, or that the bed was tilted. And I did not experience that after this 115-day flight. In fact, as I lay in bed that night, I felt that I was lying in a bed on Earth.

But, in general, things were pronounced after 115 days. The initial feeling of heaviness was worse, and my balance was significantly worse than after a shuttle flight.

PM: *Overall, what would you do differently in future flights?*

Thagard: The two recommendations I made were, No. 1, get in there and have some say in picking out your food! And, two, just make sure you have enough to do up there, because if you're reasonably busy with meaningful work, all other problems from a psychological standpoint will take care of themselves. **PM**

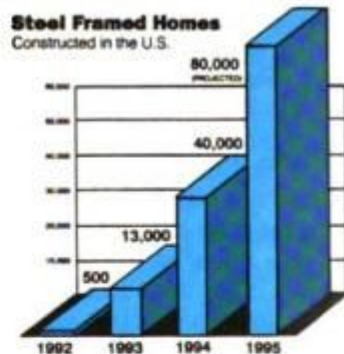


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Eye Control

BY FRANK VIZARD, Electronics Editor



● Imagine controlling a machine just by looking at it.

Forget imagining. It's here now.

In a development that may have far-reaching implications, Canon has developed a camcorder that lets you control many of the machine's functions with your eye. Just look through the viewfinder and you can turn menu items on and off with a glance.

Canon's eye-control technology is the result of research measuring the curvature of the eye and pupil size, done by its medically oriented Optical Products Division. The new technology has been adapted for use in the company's ES5000 camcorder.

Before using the eye-control system, it must be calibrated to the user's eye. This takes just a few seconds, as all that's involved is looking left, right, up and down while the system measures your eye movement. The ES5000 has three eye-control settings, so one could be used for operation with glasses and the second for use without glasses. The third setting could be set aside for a semiregular guest user.

What's happening in these few seconds is amazingly complex. Twin light-emitting diodes (LEDs) illuminate the eye with harmless infrared beams. The position of the beams and the image of your eye are reflected through a dichroic mirror, pass through a condenser lens and then form an image on what Canon calls a BASIS sensor. From the information now supplied by the sensor, a microprocessor calculates the rotation angle of the eye relative to the center of the LED beams. And the more you

use the camcorder, the more accurate the system becomes at following your eye.

As applied by Canon, there are two basic uses for the eye-control system. The more important of the two is focus control. When you're recording, all you have to do to keep the subject in focus is keep your eye on it. The benefits of this system

Being able to switch back and forth between subjects—even if one is in the foreground and the other is in the background—with a simple shift of the eye is amazing as well.

The eye-control system's other use is as a function controller. These functions are visible as a menu in the corner of the viewfinder. To turn them on or off, you simply stare at them for 2 seconds. At first blush, it seemed the functions that benefitted the most from eye control were auto fade, white balance setting and record on/off.

There are actually seven eye-control switches available, clustered in a variety of menus manually accessed using a selector atop the camcorder. These include a wide variety of digital special effects and mixing modes that can be used to enhance your video production.

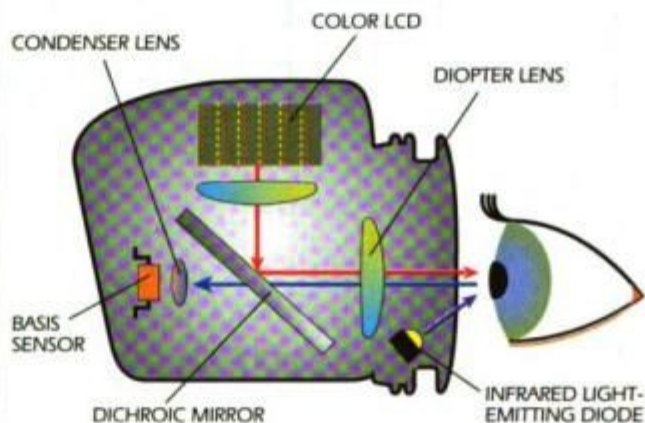
With a list price of \$2200, the ES5000 isn't the least expensive camcorder available, but it's certainly among the coolest and most responsive.

What may be even more exciting are the

other potential applications this eye-control system may have, since the infrared beams at its heart can be amplified for greater range. Imagine such a system on a computer, for example.

That would be worth a look. **FM**

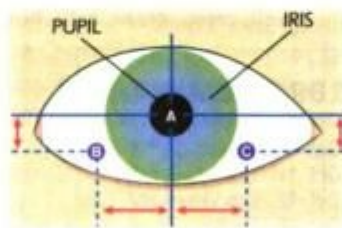
How The System Works



Canon's ES5000 camcorder operates with a glance.

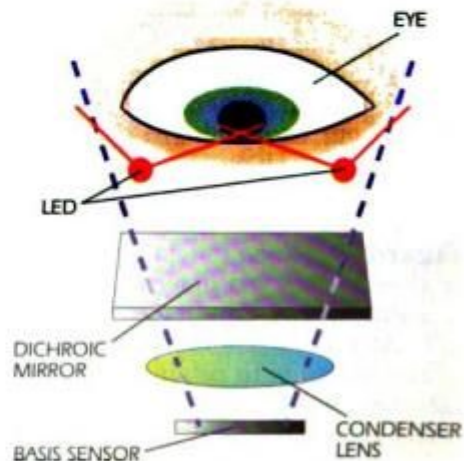
become quickly apparent as you follow a moving object from a distance to the foreground at an angle. The eye-control system reacts faster than a conventional autofocus system, so the image remains properly focused at all times.

Front View



Twin LEDs illuminate the eye with infrared beams. The positions of the beams and an image of the eye reflect through a mirror and lens onto a sensor. Based on the sensor's data, a microprocessor calculates the eye's rotation angle (A) relative to the center of the beams (B or C).

Overhead View



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Trophy Time In Tarpon City

BY JOE SKORUPA, Boating/Outdoors Editor



Coast with Boca Raton on the Atlantic Coast. To help prevent further confusion, here's an easy way to tell them apart. In Spanish, Boca Grande means "large mouth," and refers to the wide pass (or mouth) that leads from Charlotte Harbor to the Gulf of Mexico. Boca Raton, on the other hand, means "mouth of the rat," and refers to something that's been lost in the mists of time and is probably best forgotten.

As noted, Boca Grande is not only a town but also an offshore pass. In July, when I fished the

● Baseball great Ted Williams often refers to tarpon as one of the big-three game fish. Rounding out the triumvirate are marlin and salmon. Williams told me about the big three a number of years ago in Florida. Not surprisingly, we were fishing. And because I heard it from him—a legend with both a baseball bat and a fishing rod—it's pretty much gospel to me.

What the big three have in common is they are all formidable tackle-straining fish. Each has an indomitable fighting spirit. And all share a tendency to produce acrobatic airborne displays. In short, they are spectacular adversaries.

No doubt, there are other wonderful fish—cutthroat trout, steelhead, permit and giant bluefin tuna, to name a few. As a matter of fact, Williams and

I were casting for bonefish, another much-prized catch, when we had our discussion. Like all devoted anglers, Williams is a multi-species fisherman.

Since that memorable trip, I've spent many hours on the water hunting two of Williams's big three—marlin and salmon. But during that time I've never made a concerted effort to go after tarpon. So, when a call came last spring from John Charvat, then-president of Brunswick Marine, inviting me to fish the world's richest tarpon tournament, I looked at my calendar and said, "Well, except for several iron-clad business meetings and family commitments that can't be broken, my schedule is open. I'll see you in Boca Grande."

Many people confuse the Floridian town of Boca Grande on the Gulf

Boca Grande Chamber of Commerce Tarpon Tournament, the town had a population of several hundred people. The pass, on the other hand, had a population of several thousand tarpon, sometimes called silver king. Numbers like these make Boca Grande a very popular place with fishermen.

The world's richest tarpon tournament (\$100,000 for first place, \$40,000 for second and \$25,000 for third) is an unusual affair. For one thing, it's held after prime tarpon season—typically from the middle of May to the end of June. By staging the annual 2-day event each Wednesday and Thursday after the Fourth of July, the Chamber of Commerce creates a busy week during a time that would otherwise be slow.

Another unusual aspect of the tour-



Integrated outboard bracket (above) is a first for a Bayliner Trophy. Another first is the aft hawse pipe (left) that distinguishes the tall, well-conceived gunwales. The generous console unit (far left) is a Swiss Army knife of utility.

namment is that all competing boats (which pay a \$3000 entry fee, plus \$125 per angler) position themselves virtually gunwale to gunwale along a drift line 3/4-mile long and several hundred yards wide. Tournament rules permit boats to roam a larger area, but few stray off the drop-off line. Fortunately, the fleet is limited to only 60 boats and the fish are plentiful. During a good year, as many as 100 tarpon are caught and released.

According to veteran anglers, the event I attended turned out to be one of the two worst on record for size and number of fish caught. About a dozen fish were brought to boat, and the winner weighed just 123.6 pounds.

During the height of tarpon season, silver kings frequently weigh 160 to 180 pounds. Some even top the 200-pound mark.

I was part of a Brunswick tournament team of about 16 fishermen who competed on four large center-console boats—a Trophy 2503, Robalo 25, Sea Ray Laguna 24 and Wahoo 2600. For two days we stalked Boca Grande Pass, but as with most of the other competitors, the finicky tarpon ignored our well-presented hooks set with squirrel fish (sand perch), blue crabs, shrimp and artificials.

While we never hooked a silver king, we saw hundreds rolling on the surface. Every so often, a group of 20 would rise from the bottom, break the surface at the apex of a high-speed arc and immediately dive back down. Why do they do this? Amazingly, tarpon can breathe air. Naturally, they have gills to process oxygen from water, but they also possess the ability to breathe surface air when they desire, a trait that makes them one of the most unique game fish in the world.

While the Brunswick team didn't catch a single tarpon and never came close to winning any prize money for the not-for-profit Fish America Foundation, we did pull in enough dolphin, cobia and grouper to keep things interesting.

Between rotations in the fighting chair, I used my time to take advantage of a unique opportunity. One of the boats in the fleet was a new '96 model that featured a complete makeover—the Bayliner Trophy 2503.

While it's not exactly true that Bayliner has recycled the bottoms of its pleasure-boat or cruiser hulls for the Trophy series of saltwater fishing rigs, it's not far from the truth. In recent years, many hull modifications have appeared on Trophy cabin and center-console boats. But what's different about the hull on the 2503 center console is that it was created specifically to be a wave-busting, fish-fighting offshore battlewagon.

(27 ft. 3 in., including the outboard bracket) is the compartmented fiberglass grid that's bonded to the hull and cored with marine plywood and expanded foam. This strong, sophisticated, unbond design is an evolutionary replacement for Bayliner's well-known Alaskan cedar stringers.

Riding through storm-whipped seas during the first morning of the tournament, the hull's sharp 21° dead-rise sliced comfortably through the chop. Nothing rattled or banged. The 2503 also provided a dry ride, thanks to a generous flare forward, deep freeboard and wide reverse chines that flung spray away from the cockpit.

Of the built-in features and components on the 2503, there were many standouts, including: a bait well that's mounted above the deck in the base of the pedestal seat, a high freeboard all around for maximum offshore protection, a large center-console unit that's a Swiss Army knife of utility, a cockpit large enough to fit two fighting chairs, a beamy deck (overall beam is 8 ft. 6 in.) that permits plenty of walking space around the wide console unit, a head located beneath the hinged console, a built-in tackle box and bait station at the transom and a standard aft bench seat to comfortably accommodate passengers during nonfishing excursions.

In many ways, the 2503 (base price \$26,095) is Trophy's first truly aggressive offshore fishing boat, and as such it sets a new standard.

In a way, this boat represents something of a quality problem for Bayliner. The remaining models in the Trophy line are scheduled to be retooled to match the 2503, and when they are, Trophy will compete head-to-head with high-end Robalo models. What happens then? The only thing Bayliner can do at that point is retool the Robalo line, and, according to my sources, that process is already in the works. Overabundance of quality is a problem Bayliner and fishermen should encounter more often. **FM**

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As such, it incorporates a number of Bayliner firsts.

The 2503 is the first Trophy with an integrated outboard bracket to improve performance, increase fish-fighting space in the cockpit and reduce running noise. The bracket also enables designers to install a full transom for cockpit protection while backing down or while running in a following sea. A nice touch in the transom area is Trophy's first hawse pipe, which leads to a snag-free aft cleat. There's also a deep, molded-in aft sump area that enables the pump to drain the bilge bone dry, whether or not the boat is rocking in swells.

Another first on this lengthy boat



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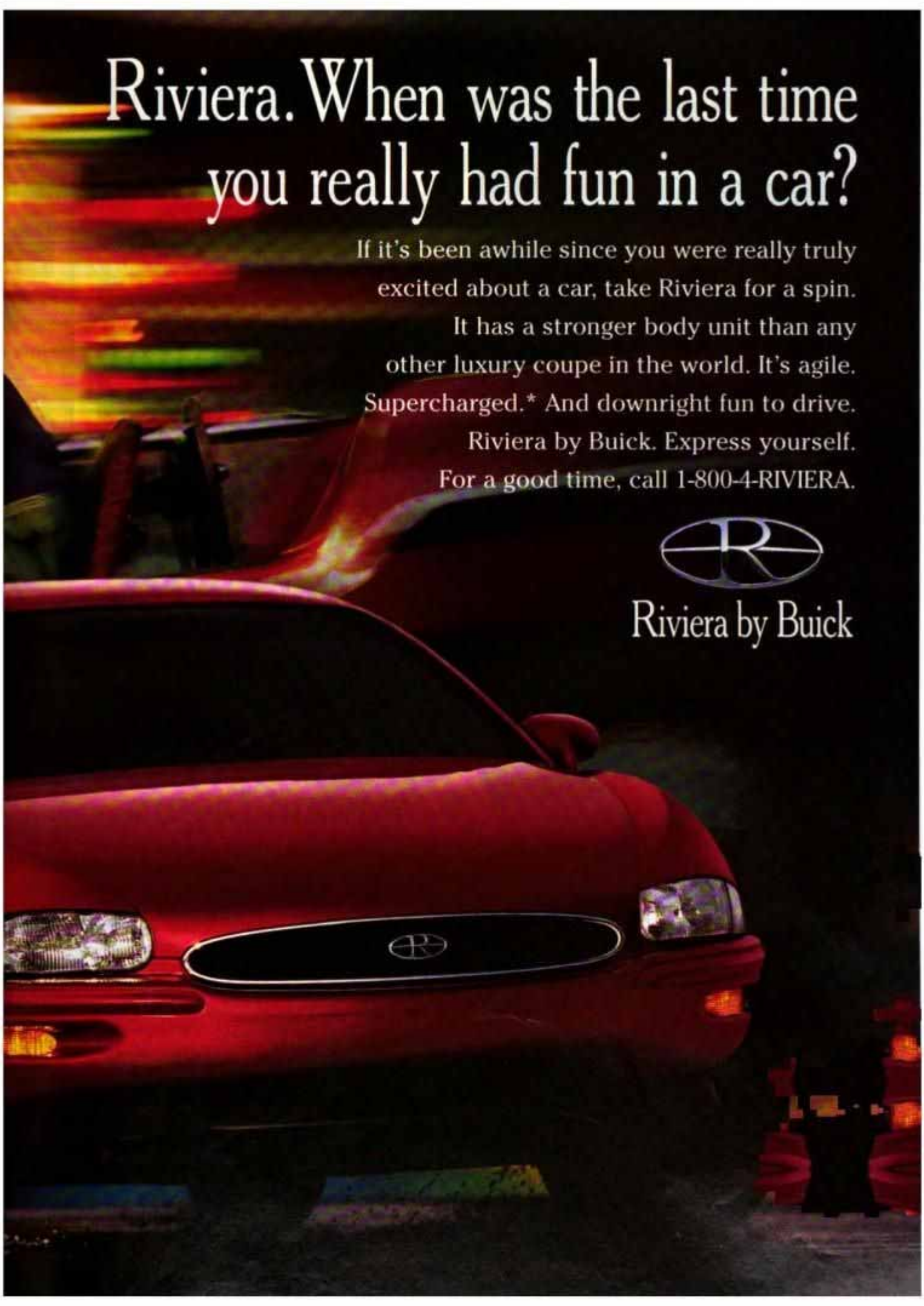
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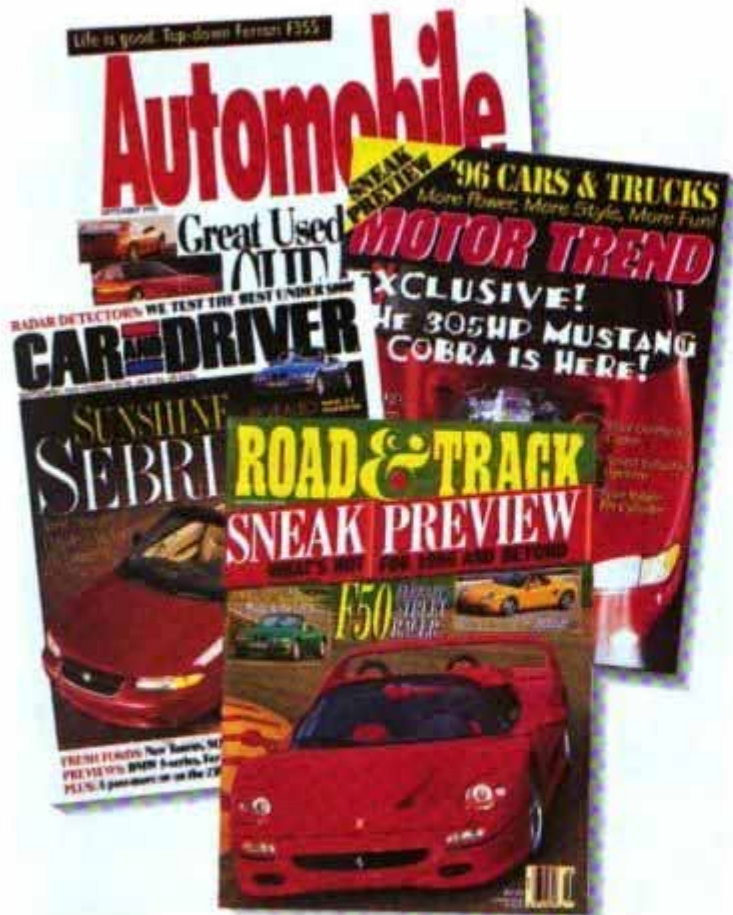
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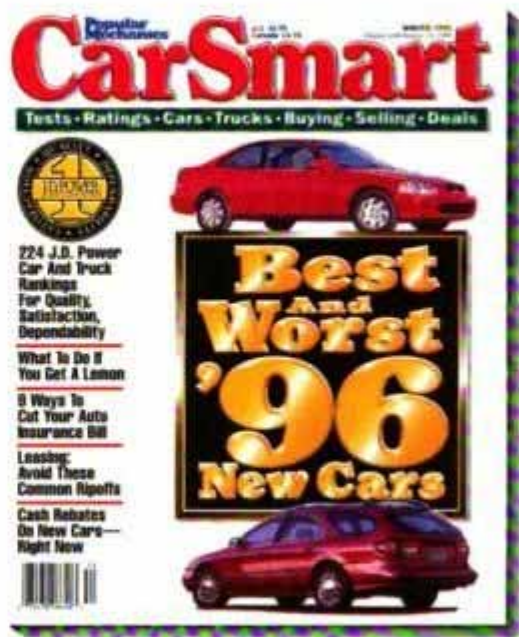
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SPECIAL WEAPONS AND TACTICS OF THE NAVY SEALS



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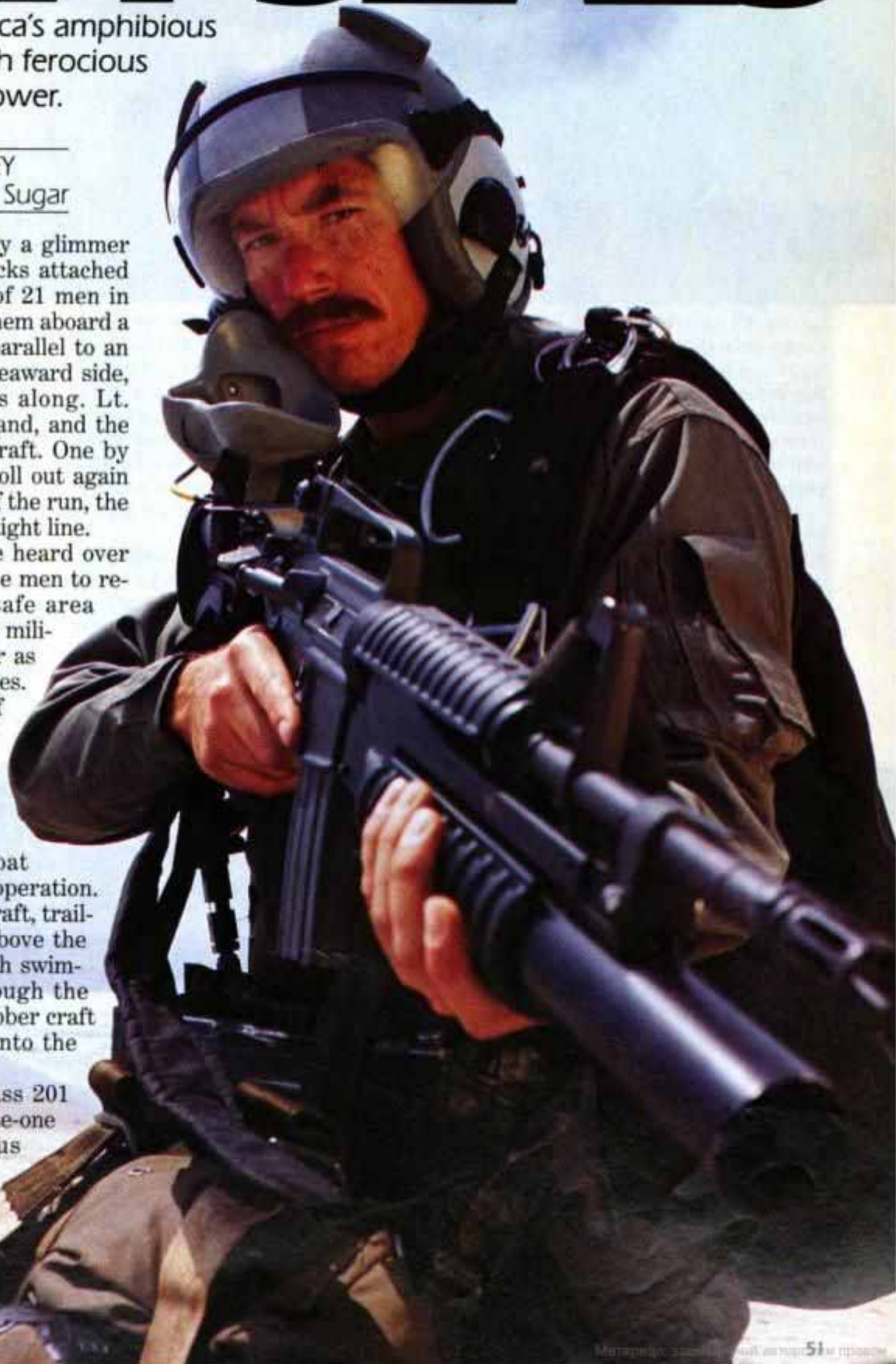
BY SCOTT GOURLEY
PM Photos by James A. Sugar

● It's well after dark, and only a glimmer shines from chemical light sticks attached to the masks and left hands of 21 men in scuba gear. We're riding with them aboard a patrol launch that sweeps in parallel to an unlit coastline. Lashed to its seaward side, a small rubber craft bounces along. Lt. Michael Massa barks a command, and the men tumble into the rubber craft. One by one, at 25-yd. intervals, they roll out again into the sea spray. At the end of the run, the green lights glow in a long, straight line.

Massa raises his voice to be heard over the engine roar. "We train these men to regard the water as the only safe area there is. Everybody else in the military trains to regard the water as a danger area—even the Marines. The advantage for us is that if we are pursued, or tracked, or chased or being shot at and we retreat into the water at night, the bad guys aren't going to follow us."

As he speaks, the patrol boat circles to begin the recovery operation. Two men perch in the rubber craft, trailing a large elastic lasso just above the water. As the vessels pass, each swimmer throws his left arm through the loop and is flung aboard the rubber craft before vaulting immediately into the larger boat.

We're watching BUD/S Class 201 complete its eighth week of phase-one training at Naval Amphibious Base Coronado, California. Squatting on the boat's transom, the men are exhilarated. They're getting their first taste of combat.





SEAL Team Five rehearses aerial cast and recovery from cargo bay of CH-46 helicopter. Team members seize rope ladder as it drags through water at 5 mph.

tactics. Of an original class of 120 students, only these 21 have made it this far. Each has months of further training before the coveted SEAL trident emblem is pinned to his uniform. But they've already learned the meaning behind the SEAL motto: "The only easy day was yesterday."

Indeed, as the Cold War becomes yesterday's news, the SEALs—special-warfare commandos of sea, air and land—have stepped up to heightened responsibilities. In today's military climate of hair-trigger instability, special-operations personnel are being called upon more than ever before.

That's just fine with Rear Adm. Raymond C. Smith, who heads Naval Special Warfare Command. Smith is the Navy's top SEAL. "It's a great time for us," he says. "We've got great new craft coming on line, new guns, upgraded scuba gear. We're well funded, so our government has put great faith in us. And we've got to keep doing things right."

After speaking with us, Smith, age 53, leads a group of SEALs-to-be through a brutal physical-training class of his own devising. But he marvels at the quality of individuals who apply for SEAL training. Competition is fierce just to sign up for the Basic Underwater Demolition/

SEAL, or BUD/S, program.

BUD/S includes the infamous Hell Week, during which students train continuously for six days with a total of 4 hours of sleep. After nine weeks of conditioning, BUD/S students focus on diving and land-warfare techniques.

BUD/S graduates attend the 3-week Army Airborne School at Fort Benning, Georgia. They then join a SEAL team for another six to 12 months of on-the-job training.

Special delivery

This training stresses insertion and extraction, critical routines that SEAL teams practice relentlessly. Off the California coast, we watch from a safety boat as SEAL Team Five conducts aerial cast and recovery with a CH-46 Sea Knight. Slowing to 5 mph, the big naval helicopter stoops low as SEALs launch a small rubber boat out of its rear cargo door. The commandos then hurl themselves into the water.

The CH-46 soon wheels in a wide circle, and the recovery drill begins. From the rear ramp trails a rope caving ladder. Each SEAL must grab the ladder and quickly clamber into the cargo bay. The operation is hair-raising, as prop-wash water sprays our boat and a 6-ton assault chopper looms 5 ft. above the waves. Yet this is actually one of the gentlest ways to move SEALs in and out of the water.

Besides commercial climbing gear,



For underwater demolition missions, SEAL uses LAR V apparatus. Chest-mounted oxygen rebreather permits limpet mine to be strapped to his back. For navigation, Tac Board combines compass, depth gauge and watch.

team members utilize a Spie rope with integral ring attachments that can hoist up to 10 men at a time. In addition, SEALs have discarded older rappel lines in favor of a thicker so-called fast rope. Describing aerial insertion with these 50- or 90-ft. cables, Petty Officer 1st Class Chris Hinkle says, "All we need for equipment are gloves and a helmet. We grab the line and go. Our hands are the only attachment we have. About halfway down, you start squeezing your heart out to slow down. If you do it right, when you get to the bottom, your gloves are smoking."

SEALs must master parachute in-

sertion as well. Standard static-line jump operations are conducted with the MC1-1B 35-ft.-dia. round parachute. For drops from higher altitudes, SEALs free fall with the MTIXS rig, a 370-sq.-ft. chute oversized to buoy an extra 60 to 120 pounds of gear. Jumps from above 13,000 ft. require the use of the Twin-53 oxygen bottle.

Once they hit the water, of course, SEALs are in their element. SEAL frogmen are famous for the LAR V rebreathing apparatus that allows them to swim without leaving surface bubbles. For missions below 30 ft., divers strap on a mixed-gas rebreather.

Currently, mixed-gas operations are taught only at SEAL Delivery



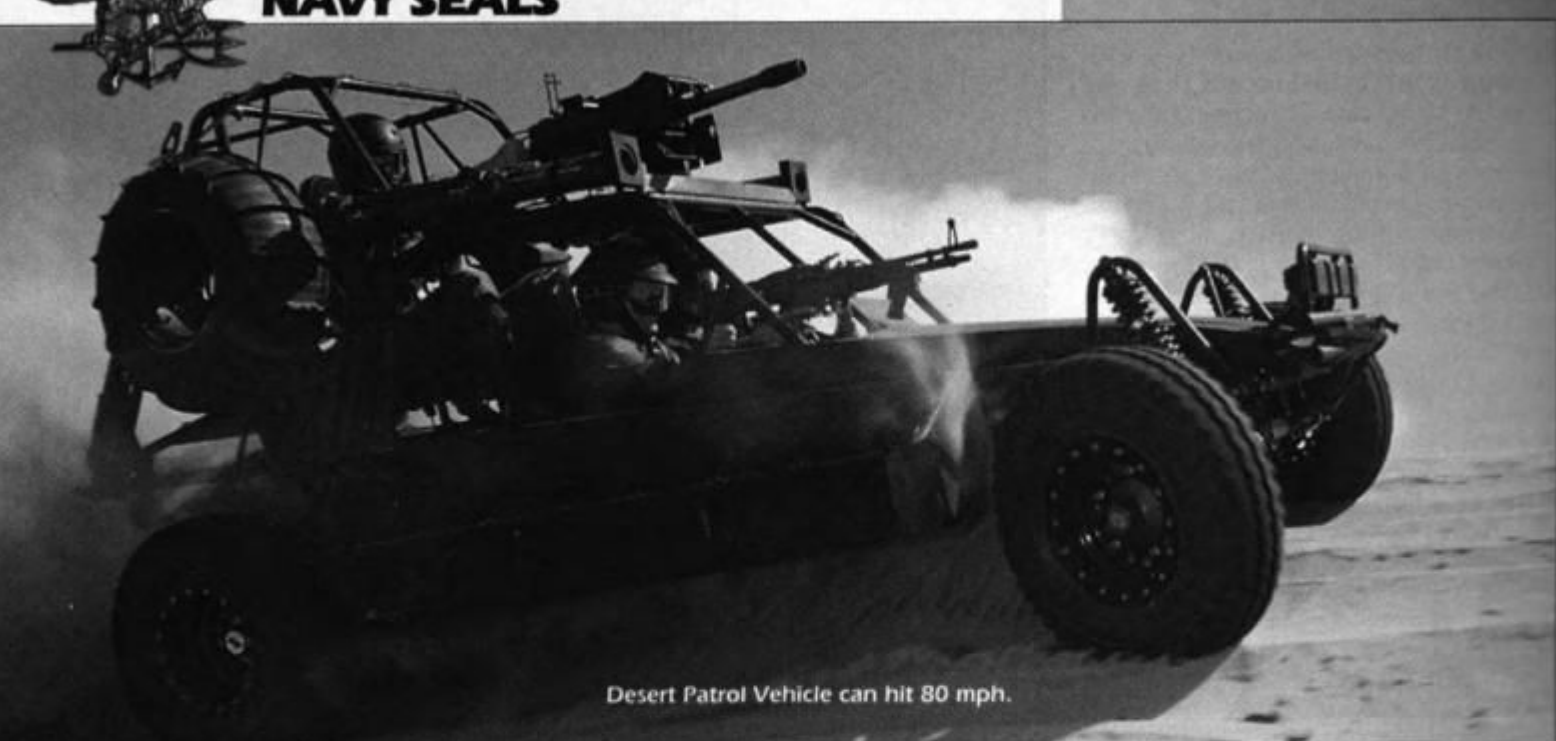
U.S. NAVY PHOTO BY LT. CLAUDE MIKE WOOD



Combat swimmers get a ride on SEAL Delivery Vehicle Mark VIII (top), while surface approaches often involve small rubber craft such as this Zodiac.



Originally fielded for counter-terrorist operations, High-Speed Boat can top 50 mph.



Desert Patrol Vehicle can hit 80 mph.

Vehicle (SDV) units. The SDV Mark VIII—known to SEALs as the Eight Boat—is a submersible that carries combat swimmers and their cargo inside a fully flooded compartment. The vehicles launch and return to dry-deck shelters installed on host submarines. Inside an Eight Boat, the only vision comes from obstacle-avoidance sonar and standard Doppler radar.

Meanwhile, free-swimming frogmen carry a so-called Tac Board, which combines compass, depth gauge and watch. SEALs will soon navigate with the MUGR, a Miniature

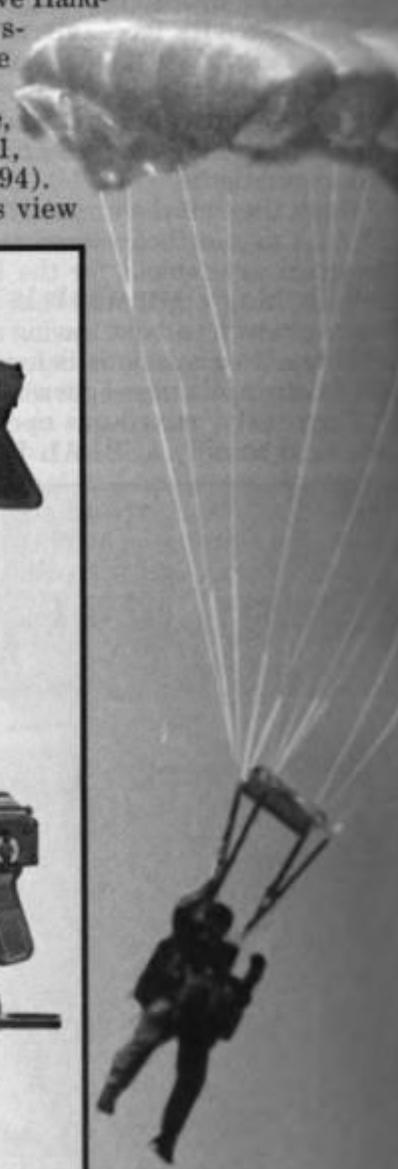
Underwater GPS Receiver with a floating antenna.

Gun points

As they rest between insertion drills, members of SEAL Team Five tell us about their weapons—the perfect mix of high firepower in low-profile packages. Compact enough to facilitate underwater movement, the 9mm MP5N submachine gun is a popular weapon. Although one of the older rifles in the inventory, the M14 also wins praise from SEALs for its long-range accuracy. Some covert scenar-

ios require the use of the Chinese Communist Type 56-2 assault rifle, characterized by team members as a “great over-the-beach gun,” if also “a spray-and-pray weapon.”

SEALs also carry a variety of pistols, soon to include the .45-cal. Offensive Handgun System (see Tech Update, page 31, June '94). SEALs view



SEAL FIREPOWER



M88
.50 CAL.
MAX.
EFFECTIVE
RANGE:
3000 YD.



REMINGTON 870
12 GA.
MAX. EFFECTIVE RANGE: 50 YD.



H&K MP5N
9MM
MAX. EFFECTIVE
RANGE:
100 YD.



CHICOM TY56-2
7.62 x 39MM
MAX. EFFECTIVE RANGE:
300 YD.



M14
7.62MM
MAX. EFFECTIVE RANGE: 800 YD.



handguns as secondary weapons, however. "To be realistic," says one member, "if you're in a combat environment where people are out there with assault rifles and heavy machine guns, your [stuff] is pretty weak if you're out there with a handgun. A handgun would typically be used for escape and evasion, which means that everything's gone to hell."

For close-quarter battle, SEALs often rely on the Remington 870 pump shotgun, firing 2 $\frac{3}{4}$ - and 3-in. magnum shells. When targets lie at longer range, sniper operations call for such weapons as the McMillan M88, a single-shot rifle that fires a huge 700-grain projectile—with a muzzle velocity near 3000 fps.

"It's a beast," comments Petty Officer 2nd Class Scott Canaan. "You



SEAL operations call for a spectrum of equipment—from high-altitude parachute gear, to alpine and desert uniforms, to stealthy amphibious-approach apparatus.

fire it and somebody knows they're getting shot at."

One result of combat experience in the Persian Gulf has been a new regional focus for the six standard SEAL teams. SEAL Team Three, for example, is equipped for Southwest Asia and is the only team with the Desert Patrol Vehicle, or DPV.

This 2x4 Chenoweth vehicle carries three. Powered by a 2165-cc gasoline

engine, it can reach 80 mph. Gussets and bracing on the frame, coupled with high wheel travel, provide a surprisingly smooth cross-country ride. Three weapons stations—two forward and one rear—can accept the Mk.19 grenade launcher, M2 .50-cal. machine gun and the M60 7.62mm gun. In addition, two AT-4 anti-armor missiles are carried on the upper cage, while side baskets provide space to hold Stinger surface-to-air missiles.

As the DPVs of SEAL Team Three snarl across the sands, they seem to capture the aggression, enthusiasm and fearlessness that mark Naval Special Warfare Command. These land vehicles also symbolize the SEALs' expanded range of tasks and capabilities. "There's more to being a Navy SEAL nowadays than just being a great combat swimmer," says Smith. "It's no longer like it was years ago. Special Operations—the Green Berets and the Rangers and us—are held to a higher standard." One they seem to be meeting.



Tac Board and Miniature Underwater GPS Receiver



AN/PEG-1 laser target marker can be remotely activated.



TARGET: CHRYSLER

As Chrysler replaces its minivan with a whole new model, the competition zeros in on the new benchmark.

BY DON CHAIKIN, Automotive Editor; PM Photos by Greg Jarem

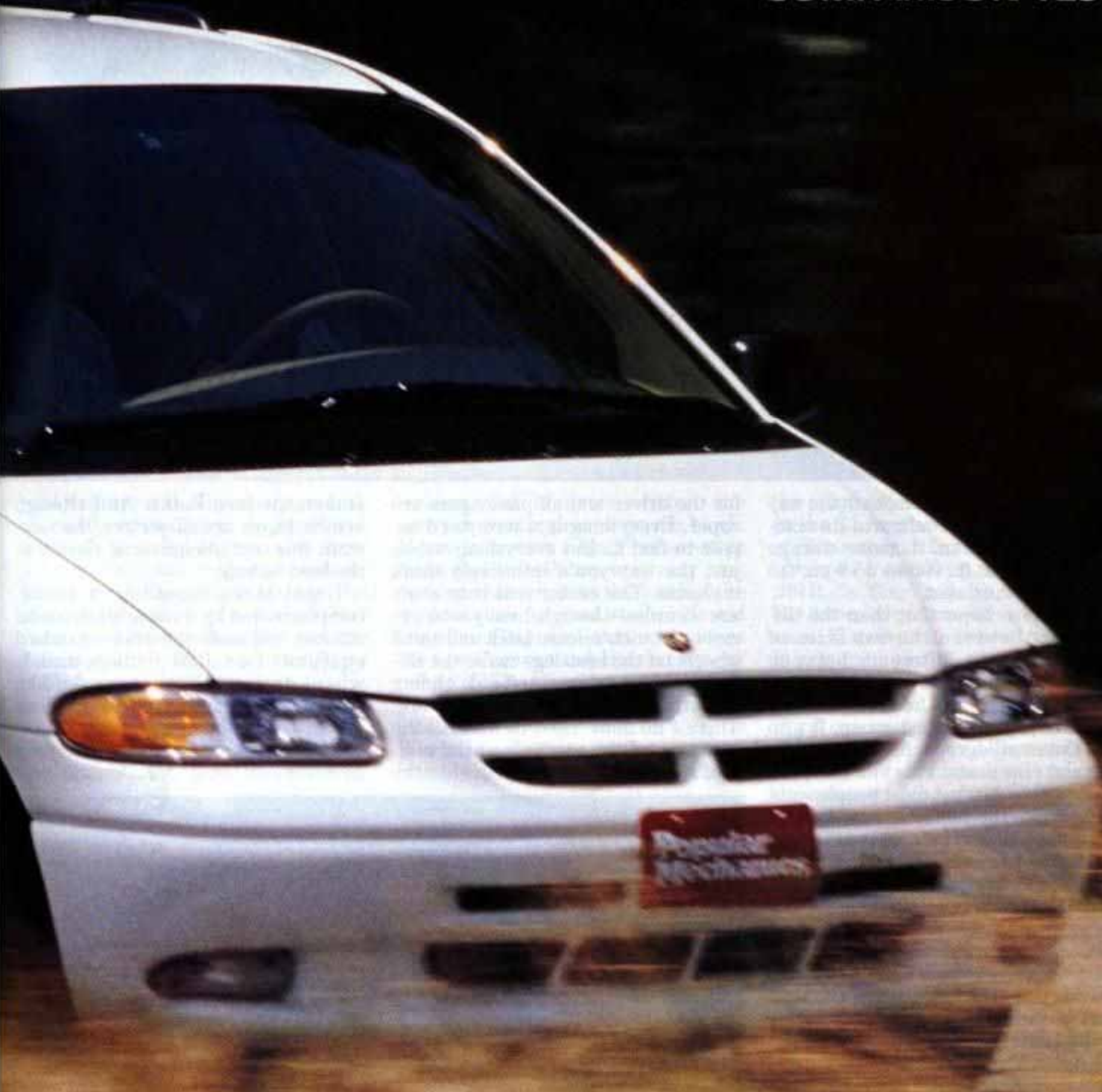
• The year was 1984, and perhaps George Orwell was right—maybe Big Brother was watching us. But Orwell could not have predicted that we would be watching “The Cosby Show” and “The A-Team.” Nor could he have predicted that we’d be flocking in droves to Dodge and Plymouth dealers to test drive the brand-new Caravan and Voyager minivans.

Maybe the size and formula of the new vans evoked fond recollections of the Volkswagen MicroBus in the collective memory of the grown-up generation of

mid-'60s flower children. Or maybe it was the simple appeal of an easy-to-drive, easy-to-park and incredibly practical family vehicle. In any event, the Chrysler Corp. was off and running to a huge and initially unchallenged lead. And every automaker in the world took aim at it with minivans of their own.

And while Chrysler had the advantage of being first, these competitors had the advantage of seeing what people didn't like about the original.

Now, Chrysler has totally redone its minivans from



DODGE GRAND CARAVAN ES

the wheels up, attempting to again widen the gap between itself and the competition. So we've taken the latest from Chrysler and put it up against the best of the rest. We were unable, however, to include either a Mercury Villager or its near-twin Nissan Quest because they were unavailable at the time of our test.

Dodge Grand Caravan ES

The original Caravan and Voyager defined this category when introduced as '84 models. Quite simply, they redefine it now as '96 models. The designers and engineers at Chrysler took what most people liked about the minivans and made it better. They took what many people said they didn't like and threw it away. With the introduction of the new Chrysler minivans, the competitors are once again scurrying to catch up.

The new minivan still comes with one of three badges—Dodge, Chrysler or Plymouth—and a long- and short-wheelbase version. Soon after the new year, there will be all-wheel-drive models. For this test, we opted for the most popular version, a Dodge in Grand Caravan form. The "Grand" in the name denotes that it's the long-wheelbase version.

The only other minivan that offers a choice of regular or king-size is the Ford Aerostar. While the Aerostar's extra length is all in the extra 15.4 in. of overhang aft of the rear wheels, the difference between long and short versions of Chrysler's minivans is the 6 in. of wheelbase and 13.3 in. of overall length.

Although it would have to pass up a parking space that the shorter version could slide into, the Grand Caravan has 26.1 cu. ft. more cargo space. When three



FORD WINDSTAR GL

rows of seats are in place, as in the way the typical family configures its minivan, there's 7.8 cu. ft. more storage space (23.7 cu. ft. versus 15.9 cu. ft.) behind the third seat.

But more important than the differences between the two sizes of Caravans is the difference between the Grand Caravan and everything else. This van has the most interior space of any in our test group. It also has the most legroom in both the center and rear seats. This van has been designed to do what most people want it to: make the family happy. Lots of room for kids and pets and stuff.

It also keeps its driver happy. A look at the test results reveals that the Caravan was at the head of the handling pack—fastest and most competent through the slalom and tied with the lower, smaller Honda Odyssey on the skidpad. The Caravan was in the middle of the pack as far as acceleration, but very near the top of the braking order.

Power for the new Caravan is from one of four engines, running from a 150-hp dohc inline Four to three different V6s—an sohc 3.0-liter, a 3.3-liter and the 3.8-liter we tested.

The Caravan was also the quietest in the group while cruising—a real testament to the strides Chrysler is making in silencing its vehicles. But perhaps more important than the raw data is the seat-of-the-pants data.

All of our test drivers most enjoyed driving the Caravan. Despite the Caravan's Grand size, it feels small and nimble from behind the wheel. The handling is sharp and crisp, the ride smooth and controlled. The improvements to handling and comfort in this latest Caravan over its predecessor are immediately noticeable and great.

So are the differences in looks and clever appointments. The ergonomics

for the driver and all passengers are super. Everything is where you'd expect to find it, and everything works just the way you'd intuitively think it should. The center and rear seats are simple—though heavy—to remove. A quick-release latch and small wheels on the seat legs make the difference. The optional left-side sliding center door is a stroke of brilliance. There's no more need to walk all the way around the van to load the middle. A safety interlock prevents the

smart, modern looks. And though vehicle tastes are subjective, the Caravan was our unequivocal choice as the best looking.

Great looks, handling and ride, complemented by a thoughtful, useful interior and such important standard equipment as dual airbags and 4-wheel antilock brakes, make the new Grand Caravan our unanimous choice—period.

The downside—there's always a downside—is cost. Our Caravan was



FORD AEROSTAR XLT EXTENDED

door from opening when the fuel-filler door is ajar. Other than the Honda Odyssey, which has hinged doors, the Chrysler products are the only minivans on the market with a driver's-side center door.

And the grooves for the sliding doors are neatly hidden in the bottoms of the side windows. All the windows on the Caravan are bigger than before, which adds to the pleasure of being inside it. The increased glass area also contributes to the van's

easily the most expensive minivan in the group. But, hey, if you want the best, you've got to pay for it. We would, if we were buying one.

Ford Windstar GL

While the Chrysler Corp. has three different brand-name minivans (in two sizes and choice of front-drive or all-wheel drive) to sell you, the Ford Motor Co. has three totally different minivans to offer. One of them is the Mercury Villager, and it's a



CHEVROLET LUMINA LS

joint venture with Nissan, whose dealers sell it as the Quest. As noted earlier, due to model changeover, there were no Villagers or Quests available for us at the time of our testing. But you can get a good idea of what those vans are like by checking out the Summer 1995 edition of our sister publication, CARSMART.

The other two vans are available at your Ford dealer, and we tested both of them. One is the truck-based Aerostar and the other is the still relatively

looking of all minivans—before the new Caravan appeared on the block. It was born with a MacPherson-strut front and twist-beam axle rear suspension that put it at the head of the minivan class for comfortable ride and crisp handling. But that was before the new Caravan and Honda Odyssey moved in. The Windstar is fun and rewarding to drive, and still darn near passenger-carlike to ride in. The Windstar's platform, in fact, borrows heavily from the Taurus's, which

the uplevel Windstar LX and optional on the GL, our tester, has bumped the engine's output from last year's 155 horsepower to 200 hp and from 220 to 230 ft.-lb. Yes, Virginia, you can't help but notice the effects of all those vitamins. Thanks to its serious advantage in power to weight, the Windstar is now more than 2 full seconds quicker to 60 mph than its predecessor. It was third quickest in this group, behind only the supercharged Toyota Previa and the Chevrolet Lumina. It was also the quietest of the group when simply sitting and idling.

Ford has also tried to entice buyers away from awd Caravans by giving the Windstar a traction advantage of its own—an all-speed traction control. This option selectively applies braking force to either of the front-drive wheels as needed if the sensors detect that one is beginning to slip.

Like the Caravan, the Windstar comes with dual airbags and 4-wheel ABS. But unlike the Caravan and the Odyssey, the Windstar offers no passenger door on the driver's side. And in the battle of interior space, the spec sheets show the Windstar with 144 cu. ft. of it, which is less than the 146.2 claimed by the standard Caravan, and a steamer-trunk less than the 172.3 cu. ft. of the Grand Caravan. This is an interesting state of affairs considering the Windstar is longer than the Grand Caravan on a longer wheelbase.

The Windstar is priced right about where the Caravan is, though our modestly equipped GL tester cost less than our fully loaded Caravan ES.

Honda Odyssey LX

The Odyssey gives away a lot to all of the others in this group in terms of size and power. But it comes with something that none of the others can offer—a Honda badge on the hood.



GMC SAFARI SLT

new front-wheel-drive Windstar.

When Ford was developing the Windstar, its engineers and designers took a long, hard look at the Caravan and paid that seminal design much homage. After all, the Windstar's entire raison d'être is to entice folks out of a Caravan or Voyager and into a Ford.

So, for starters, the Windstar was born with a modern-looking, handsome, nicely rounded body. To many eyes, the Windstar was the nicest

strongly contributes to the van's distinctly un-vanlike ride and handling. A check of the test data shows that its abilities on the skidpad and through the handling course closely follow those of the Caravan and Odyssey.

No doubt miffed that the Windstar's lead in looks and handling were so short-lived, the Ford folks decided to pump up their minivan for '96. The Windstar now offers the most powerful engine available in any minivan. The 3.8-liter V6, which is standard on



TOYOTA PREVIA DX

And don't underestimate the value of that little chromed "H."

With a readymade legion of deliriously happy Accord owners, Honda has a waiting market for this Accord-based minivan. And make no mistake, as the Taurus begat the Windstar, the Odyssey is born of the Accord.

The Odyssey has about 6 in. more wheelbase than the Accord and a shade more track. The upper and lower wishbone suspension is much like the one found on every Accord. The Odyssey's rear suspension is somewhat unique due to the van's need for maximum cargo space, including a flat floor.

Of course, Honda's engineers chose—as they usually do—to go their own route with that flat floor and cargo volume. Like the more conventional competition, the Odyssey is available with either a 3-person split-back bench seat, which folds against the front seatbacks, or two removable bucket seats in the center row. How-

ever, the third seat is a 2-passenger bench that doesn't come out. Instead, the seat folds up into the van's floor.

For now, the Odyssey still shares the Accord's 2.2-liter 4-cylinder engine, which is tuned for 140 hp and 145 ft.-lb., and 4-speed automatic transmission front-drive powertrain. There's V6 help coming, but, for now, the Odyssey suffers from a power deficiency. The van just doesn't feel as strong as you would like it to, particularly off the line. Once at speed, it's capable of keeping up with and passing most traffic. At the track, the Honda posted the slowest times to 60 mph and through the quarter-mile. It took the second longest amount of time to get from 40 to 70 mph.

Tipping the scales at about 3500 pounds doesn't help the Odyssey's acceleration any. Though it's the lightest van in this test, the Odyssey suffers from the worst power-to-weight ratio.

So while performance may not be

what you've come to expect from the company that brought you the CRX, Acura NSX and generations of superbikes, the interior accommodations are. The quality of the cloth and plastic in the Odyssey are top-drawer. All the seams match. Nothing squeaks. Nothing rattles. Nothing feels like it's about to lose its mortal coil as soon as your kids have at it. The controls feel light, yet sure. But despite the solidity of it all, the Odyssey is not as quiet as you might have thought it would be. Part of the noise, no doubt, is due to the little 4-banger working overtime to keep up with the V6-powered big dogs.

Since the Odyssey is younger than all of the competition, except the newly revamped Chryslers, it was equipped with all the modern necessities when it was created. That means that every Odyssey has dual airbags, 4-wheel disc antilock brakes, a/c, power windows and door locks, cruise control and more. Despite the equipment list,

SPECIFICATIONS AND DIMENSIONS

MANUFACTURER/ MODEL	BASE PRICE/ PRICE AS TESTED	ENGINE DISPLACEMENT (liter/ci)	ENGINE HP, NET/ TORQUE (ft.-lb.)	DRIVE LAYOUT (engine/ wheels)	ENGINE/ TRANSMISSION TYPE	WHEELBASE/ LENGTH (in.)	TRACK FRONT/REAR (in.)	WIDTH/ HEIGHT (in.)	HEAD-, LEG-, HIPROOM, F/C (in.)	HEAD-, LEG-, HIP- ROOM, R (in.)/MAX. CARGO VOL. (cu. ft.)	CURB WEIGHT WEIGHT/HP RATIO (lb./hp)
Chevrolet Lumina LS	\$17,595/ \$23,823	3.8/ 231.0	170 @ 4800 rpm/ 225 @ 3200 rpm	front/ front	ohv V6/ 4A	109.8/ 191.5	59.2/ 61.4	73.9/ 65.7	39.2/40.0/55.5 39.0/36.1/55.2	37.8/36.8/41.7 112.6	3516/ 20.7
Dodge Grand Caravan ES	\$24,205/ \$27,985	3.8/ 230.5	166 @ 4300 rpm/ 227 @ 3100 rpm	front/ front	ohv V6/ 4A	119.3/ 199.6	63.0/ 64.0	75.6/ 68.5	39.8/41.2/57.7 40.0/45.9/61.2	38.5/39.8/49.6 172.3	3949/ 23.6
Ford Aerostar XLT Extended	\$22,980/ \$24,400	4.0/ 245.0	155 @ 4000 rpm/ 230 @ 2400 rpm	front/ all	ohv V6/ 4A	118.9/ 190.3	61.5/ 60.0	72.0/ 74.0	39.5/41.4/NA 38.1/38.8/NA	37.5/38.8/NA 167.7	4076/ 26.3
Ford Windstar GL	\$19,590/ \$22,180	3.8/ 232.0	200 @ 5000 rpm/ 230 @ 3000 rpm	front/ front	ohv V6/ 4A	120.7/ 201.2	64.3/ 63.0	75.4/ 68.0	39.3/41.8/57.6 38.9/39.2/61.0	38.1/35.3/48.7 144.0	3733/ 16.7
GMC Safari SLT	\$20,658/ \$27,201	4.3/ 262.0	190 @ 4400 rpm/ 260 @ 3400 rpm	front/ all	ohv V6/ 4A	111.0/ 189.8	65.1/ 65.1	77.0/ 75.9	39.2/41.6/64.9 37.9/36.5/50.9	38.7/38.5/55.8 170.4	4308/ 22.7
Honda Odyssey LX	\$23,215/ \$23,709	2.2/ 131.6	140 @ 5600 rpm/ 145 @ 4600 rpm	front/ front	sohc 16V I4/ 4A	111.4/ 186.7	60.0/ 60.8	70.5/ 64.7	40.1/40.7/53.3 39.3/40.2/53.1	37.5/34.0/40.9 93.5	3472/ 24.6
Toyota Previa DX	\$22,818/ \$26,371	2.4/ 148.7	161 @ 5000 rpm/ 201 @ 3600 rpm	mid/ rear	dohc 16V s/c I4/ 4A	112.8/ 187.0	61.6/ 61.2	70.8/ 68.7	39.4/40.1/56.9 38.9/36.6/64.4	37.8/36.3/57.4 152.3	3755/ 23.3

1. Times from a steady-state 40 to 70 mph. 2. Best speed achieved while weaving through eight cones 100 ft. apart. Speeds provide index of transient response.

the Odyssey doesn't cost too much in the scheme of things, and our LX tester was below the midpoint of this group in pricing. Every Odyssey also comes with four hinged doors, more like a wagon than a minivan. It may also be closer to a wagon than a minivan as far as space is concerned, too.

The Odyssey is the shortest—both in height and overall length. It also has the least amount of cargo space—a mere 93.5 cu. ft. So if you've got more to carry than some more people, you might find that despite all that it has to offer, the Odyssey just isn't big enough.

Chevrolet Lumina LS

Your Chevrolet dealer has two totally different minivans to offer you. One is the front-drive Lumina, which shares its platform and composite-body-on-steel-frame body with the Pontiac Trans Sport and Oldsmobile Silhouette, and the other is the rear-wheel (or all-wheel) Astro, which shares its drivetrain and truck-derived platform with the GMC Safari. We've selected a Lumina to represent GM's front-drive minivans and a Safari to fly the rear-drive flag.

Unfortunately, when the time came to get down to it and kick tires, Chevrolet could not supply us with a '96 model with the more potent 3.4-liter V6. So our acceleration numbers are based on the 3.8-liter, which gives away 10 hp to the smaller motor. As it is, the Lumina was still the fastest of the vans down the track, getting to 60 mph and through the quarter-mile in less time than any of the others. However, since the 3.4-liter gives up 20 ft.-lb. in torque to last year's 3.8-liter, and reaches both max horsepower and max torque at higher engine speeds, the performance—including passing time—is probably pretty equal between the two.



Otherwise, the Lumina for '96 is really very much the way it was in '95, putting it in the middle of the pack as far as its handling, braking and comfort. It still has the long sloping windshield covering that mile-deep dashboard.

And it still offers the least amount of cargo space of any of the vans in this group, save the Odyssey. However, the Lumina does offer great flexibility for using that cargo space. For one, the permutations and combinations permitted by the individually folding and removable seats for the second and third rows should keep all the kids and pets happy in their personal space. And the Lumina, along with its Pontiac and Oldsmobile siblings, is still unique in the industry in its offering of the optional power sliding side door. It is a terrific convenience to open and close that door by simply pressing a button.

However, the Lumina is showing its age and becoming unique in the

market by offering only a driver's-side airbag. On the plus side, though, every Lumina is equipped with anti-lock brakes. The Lumina also has the very large benefit of price—it has the lowest base sticker of any of the vans we tested.

Toyota Previa DX

While rumors fly that there's a new front-drive minivan based on the Camry on its way in a year or so, the rear-drive Previa soldiers on. Actually, the Previa is also available with an all-wheel-drive All-Trac option. However, the DX that we tested had its power going to the rear wheels only.

While there's a choice of drive with the Previa, there's no longer a choice of engine. All Previas for '96 have a supercharged dohc 2.4-liter inline Four. They all also have a 4-speed automatic, though the All-Trac and the rear-drive models have different

(Please turn to page 125)

TEST RESULTS

DRIVING RATIO (gear)	TURNING CIRCLE (ft.)	WHEELS/TIRES	BRAKE SYSTEM FRONT/REAR (in.)	FUEL ECONOMY (MPG EPA city/hwy.) PM test	ACCELERATION 0-60 MPH (sec.) 1/4-MILE (sec./mph)	PASSING ¹ ACCELERATION 40-70 MPH (sec.)	BRAKING 60-0 MPH (ft.)	700-FT. ² SLALOM MPH	200-FT. ³ SKIDPAD (lateral g)	SOUND LEVELS IDLE/ACCEL/60 MPH (db)
rack & pinion/17.6:1	43.1	15 x 6-in. alloy/205/70R15	disc/drum ABS 10.94-in. vented/8.86-in.	17/25 19.8	10.2 17.3/79.1	8.3	152	54.3	.75	53.6/77.4 70.8
rack & pinion/17.5:1	39.5	16 x 6.5-in. alloy/215/65R16	disc/drum ABS 11.1-in. vented/9.8-in.	17/24 16.2	10.8 17.7/76.2	9.3	133	57.5	.82	57.5/78.2 69.2
rack & pinion/variable	42.4	14 x 5.5-in. alloy/215/70R14	disc/drum, rear ABS 10.28-in. vented/10-in.	16/22 18.6	11.0 18.0/76.9	9.1	172	51.6	.75	53.0/80.1 71.9
rack & pinion/16.1:1	40.3	15 x 5.5-in. steel/205/70R15	disc/drum ABS 10.87-in. vented/9.84-in.	17/24 (est.) 18.2	10.7 17.6/76.5	9.0	149	56.0	.78	51.6/79.0 70.9
circulating/4.0:1	40.5	15 x 6.5-in. alloy/215/75R15	disc/drum ABS 11.57-in. vented/9.5-in.	15/19 17.5	11.2 18.0/74.9	10.0	153	52.0	.77	54.0/80.4 72.4
rack & pinion/17.1:1	37.6	15 x 6-in. steel/205/65R15	4-wheel disc ABS 11.02-in. vented/11.02-in.	20/24 22.5	11.4 18.2/75.8	9.4	135	56.3	.82	53.3/80.5 71.4
rack & pinion/18.6:1	37.4	15 x 6-in. steel/215/65R15	4-wheel disc ABS 10.6-in. vented/11.4-in. vented	18/22 18.2	10.3 17.5/77.7	8.7	130	55.7	.76	53.7/79.0 70.8

3. G-force generated during steady-state travel around a 200-ft.-dia. circle. Number is an average of best clockwise and counterclockwise.

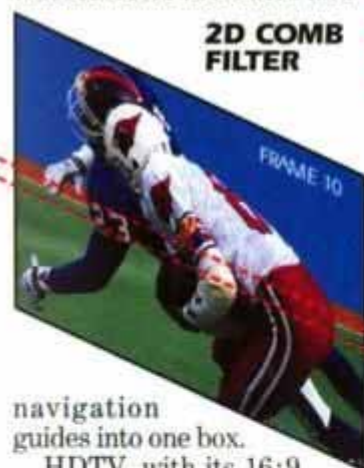
PICTURE PERFECT

New image-conscious TVs let you tune in a picture more precisely than ever before.

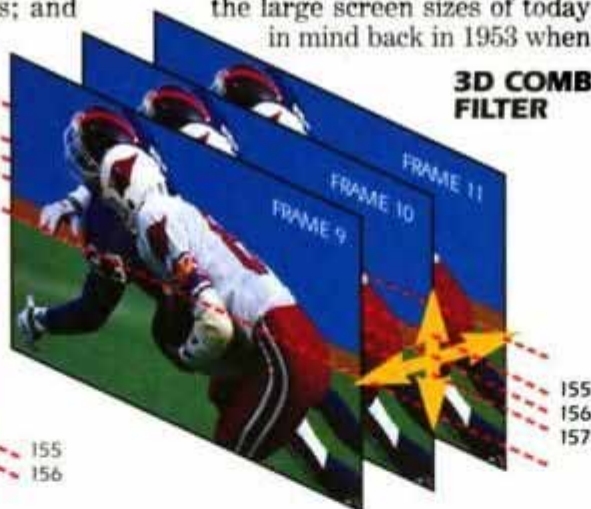
BY REBECCA DAY

● Your TV is starting to show signs of age, and you're debating whether to spring for a new one or hold out for the high-definition TV you've been hearing about. Wait for HDTV, and you're looking at 1997 at the earliest, limited viewing material, a slim selection of sets and steep prices carrying a premium of \$2000 or more over the cost of a standard TV.

Shop now, and you'll find the broadest range of TVs ever offered: screen sizes ranging from 9 to 80 in.; new digital chassis; filtering schemes that produce sharp, detailed pictures; and feature packages that bundle elaborate sound systems, videocassette recorders and



2D COMB FILTER



3D COMB FILTER

Sony's new 3D comb filter—used to eliminate dot crawl and color distortion—compares preceding picture frames, not just the preceding scanning line.

navigation guides into one box.

HDTV, with its 16:9 aspect ratio (compared with 4:3 for current NTSC TVs), may not be available yet, but companies including JVC, Toshiba, RCA and Pioneer are selling widescreen TVs that are the shape of TVs to come. The widescreen sets have been around for a couple of years now, and although the cinema-screen look isn't widely popular just yet, manufacturers are hoping that the increasing availability of movies and other material in the letterbox format will make them more appealing to TV viewers.

Widescreen TV is also expected to get a boost from new technologies. Next year's 5-in. digital videodiscs

will have variable-aspect-ratio capability to show widescreen movies. Widescreen capability is also built into the Digital Satellite System, and some premium movie channels have suggested that they might deliver widescreen movies in the future.

Hot pictures

The National Television Standards Committee (NTSC), responsible for developing the U.S. standard for TV broadcasting and reception equipment that is still in use, didn't have the large screen sizes of today in mind back in 1953 when

the standard was created. As TV technology developed and competition intensified, manufacturers have altered—not without controversy—certain aspects of the standard in the interests of picture quality.

Color temperature, for example, is a hotly debated topic among TV reviewers and experts these days. Although the NTSC specifies a color temperature of 6500° K, many TV makers are setting levels much higher so that the sets are brighter on heavily lit retail floors. Purists argue that the hotter settings degrade the picture and distort the colors to un-



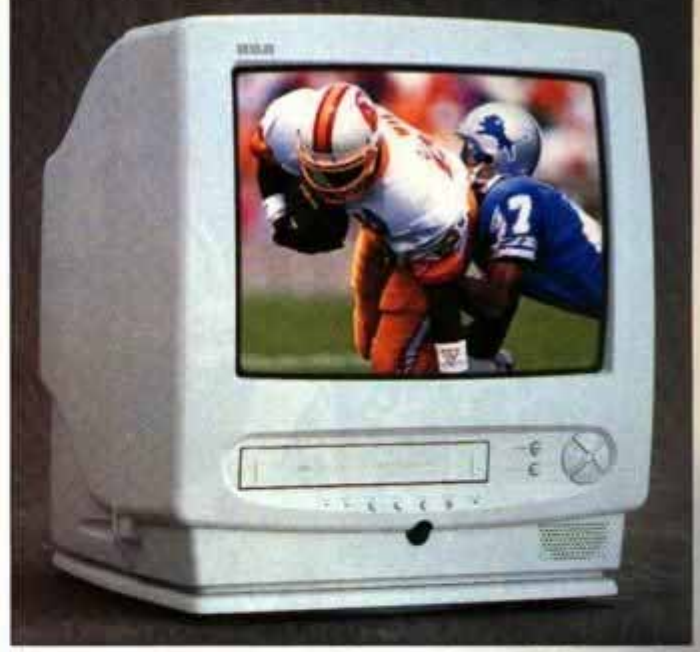
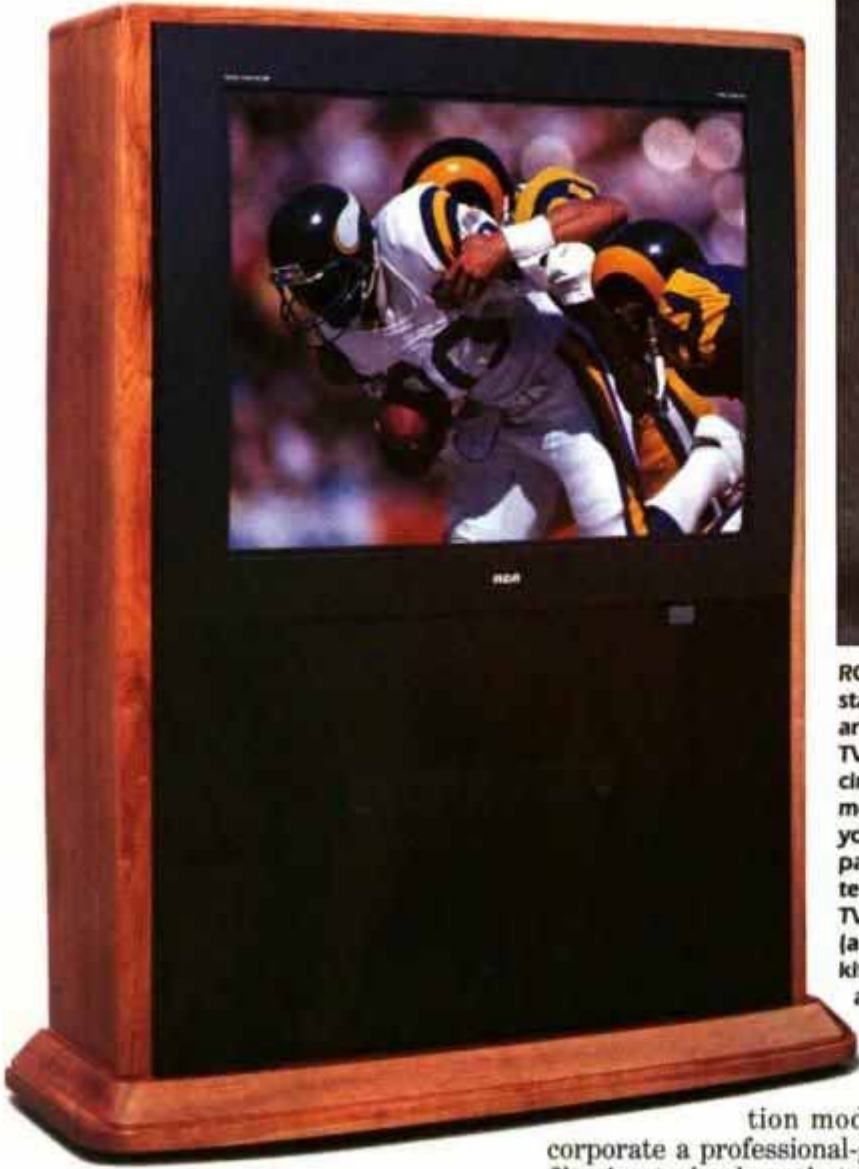
realistic levels. Marketers argue that the hotter pictures sell.

Now, in an effort to satisfy both purists and the bottom line, some manufacturers have started offering user-



The new XBR² Trinitron from Sony is so jammed with electronics they need a separate component to house it all. The access box, shown here under the monitor, can be hidden away and operated via remote control. Linking the two is a 36-pin computer-style connector. The separate access box allows the monitor to be sleeker in design so it fits more easily into corners, for example. The 32-in. monitor fits into the same space required for a standard 20-in. TV.





RCA is making statements at the big and small ends of the TV spectrum. Advanced circuitry on the 35-in. model (left) lets you fine-tune subtle parameters like color temperature. The 13-in. TV/VCR combination (above) is designed for kitchen use and features a remote control with a washable membrane coating.

The new Sony 3D filter takes the process one step further. When the picture is motionless, the 3D filter compares lines not only with those immediately above and below but also with lines in adjacent frames. When there's motion, this technique would create more problems than it would solve, so the system reverts back to 2-dimensional operation, processing consecutive lines only within the same frame. The 3D system can combine both interline and

selectable color-temperature settings.

RCA is offering color-temperature control in its upscale ProScan series of rear-projection and direct-view TVs, and 10 models in Toshiba's new line of TVs feature color-temperature control. You can run them at 10,000°, 8500° or at NTSC-standard 6500°.

Sony's new Videoscope and XBR² lines also offer color-temperature adjustment in three settings: high (9500°), medium (8500°) and NTSC (6500°).

"NTSC provides a warmer setting," says Diane Kilroy, director of television marketing at Sony. "The lower setting allows colors to have wider range and be more realistic. All broadcast facilities are specified to NTSC standard." At the same time, she notes, the typical American consumer prefers the bluish-white look of a higher temperature setting rather than the yellowish-white of the NTSC-specified setting. Now there's a choice.

Sony's XBR² direct-view and Videoscope rear-projec-

tion models also incorporate a professional-grade comb-filtering technology that the company has dubbed 3D Digital. Like the 2-dimensional comb filters that have become standard in many of today's TVs, the new filter first separates color (chrominance) signals from black-and-white (luminance) signals. It then compares consecutive horizontal scanning lines to prevent much of the dot crawl and bleeding of colors that plagued early television sets.

interframe processing simultaneously for pictures that combine moving objects on still backgrounds. The results, Sony says, are better vertical, horizontal and diagonal resolution, minimal dot crawl and bleeding, and reduced video noise.

A broader palette

Sony has also dipped into its professional monitor technology for the Bi-CMOS processor—basically an electronic version of a painter's palette.

The Bi-CMOS circuit, which processes digital and analog information simultaneously and very efficiently, allows engineers to digitally control 11 picture parameters to create 270 million picture combinations. The 11 parameters are in the areas of brightness and contrast, sharpness and color, which were not previously adjustable at the factory (color temperature is



This TV has legs! Goldstar's new 13-in. model is conscious of its looks, and wears a "Fashion TV" label just in case you miss the point. It's nearly as pretty as its picture. The tuning control uses a jog/shuttle approach.



Toshiba's 56-in. 16:9 widescreen projection TV works as the centerpiece of any movie enthusiast's home theater. And it has the sound to go with it—68 watts of sonic power and a Dolby Pro Logic surround-sound decoder. The 20-in. CF20E40 (right) is one of the first models with Toshiba's new digital chassis. In addition to delivering more accurate picture detail, the TV reportedly uses 20% less energy.



the only user-adjustable parameter).

"They're all things that in the past were either just on or off," says Jim Davis, marketing manager for consumer TV products at Sony. "Now we have 16 steps of control, which will make the picture even sharper, and the realistic color will come across better. In the past, it was at the whim of the chip."

Other companies are also turning to digital technology to improve the picture. Toshiba's I²C Digital Chassis, for example, uses microprocessors to continuously monitor and adjust key television functions.

High-tech is evident in big projection TVs as well. This year, Hitachi has incorporated an automatic digital-convergence function called Magic Focus in all of its projection-TV models. In the past, to align the red, green and blue tubes perfectly for accurate color reproduction, users had to laboriously adjust on-screen crosshair patterns. Magic Focus sets up and converges a 256-screen pattern automatically in 2½ minutes. This can be a welcome

convenience if you plan to move the television from one side of the room to the other or use nonshielded speakers—moves that can disturb the convergence of the sensitive tubes.

Go to the videotape

One of the fastest-growing segments of the TV business is the TV/VCR combo. Once considered a low-end solution combining the worst of both worlds, TV/VCR combos are stepping up in size and performance. Panasonic's new PV-M2765 joins the Toshiba CV27D48 and the RCA T27204BC in a select category: 27-in. TVs with built-in 4-head VCRs.

Even more niche-oriented is RCA's 13-in. T13017WH KitchenVision. As its name indicates, it's specifically targeted for the chef of the family. The white 2-head TV/VCR combo is sold with a cooking tape and recipe cards to underscore its place in the home.

Channel blockers

One of the hot political footballs surrounding TV technology has been

congressional debate over mandatory inclusion of the "V" chip in TVs. This chip would allow parents to block out programs they don't want their children to watch.

The V chip may soon be mandatory in all TVs, but in the meantime, manufacturers are incorporating their own parental-control features in certain sets. These operate on a channel-by-channel basis rather than program by program. Fisher, for one, includes a block-out feature in four new TVs, including the PC-5531 31-in. model. Parents can restrict access to up to three channels for a total of 9 hours. Hitachi's Child Lock feature lets users block out an unlimited number of channels, any of which can be reinstated by the activation of a code.

Now just add some fresh popcorn, comfortable seats and no ticket lines, and you may find yourself staying home a lot more often when you go to the movies.

FM





THE NEW NEWS 'PAPER'

Get your daily news—and more—online.

BY GEORGE MANNES. PM Illustration by Dan Fell

● If you don't like the way a newspaper covers a story, it's usually too late to do anything about it. By the time you read it, the story is over and done with. But earlier this year, when reporter Lydia Lum filed stories about a trip to China for Houston Chronicle Interactive, the people who read her articles could put in requests for what they wanted her to cover. HCI, an electronic offshoot of the *Houston Chronicle* published on the Internet's World Wide Web, forwarded reader e-mail to Lum while she was still in China. So when one reader asked for more pictures of Chinese elders and kids, Lum—armed with a laptop computer, a digital camera

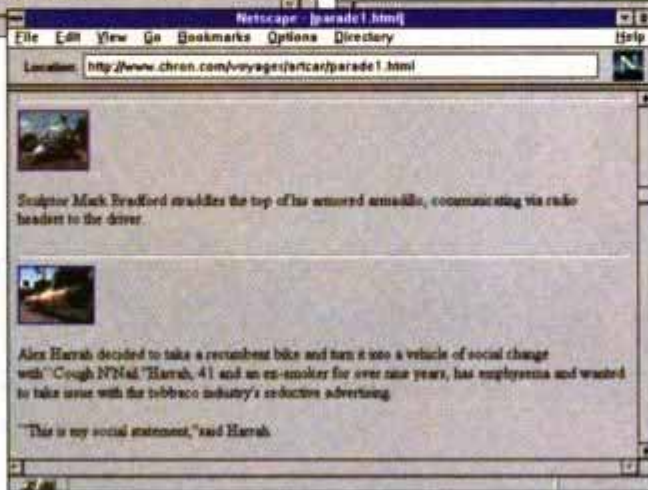
and a modem for sending picture and text files back to the United States—responded with six snapshots of Chinese children. In short, readers of the electronic newspaper (owned by The Hearst Corp., parent of POPULAR MECHANICS) weren't just writing letters to the editor—they were becoming the editors themselves. Such reporter/reader interaction is just one of the promises posed by electronic versions of newspapers now going online around the country in a stampede that is as thunderous as a printing press churning out copies of the late edition. About 100 daily papers in the United States and Canada—from well-known journals like *The New York Times* to lesser-traveled products like *The Beloit Daily News* (in Wisconsin)—are publishing electronic editions, according to Randy Bennett, director



You can go from CBS News...

of new media for the Newspaper Association of America, a trade organization. That figure is triple the number of online papers published one year ago. Bennett expects the number of electronic newspapers to double again within the next year. And, to a lesser degree, television news groups are venturing online as well.

For newspapers, the economics of online editions looks promising. Traditionally, to get the news to their readers, they have to print, say, a few hundred thousand copies and truck those papers all over town. But everything changes if they publish electronically, using the World Wide Web or some other medium of computer communications. Then, all they have to do is create a single copy of the newspaper and put it on a computer. With the



... to actually following a reporter.

help of a modem, readers can just drop into the virtual printing press and pick up the paper themselves.

For now, though, profits are mostly theoretical, even though some papers are already charging for subscriptions and selling advertising space on their online incarnations. The Gate—a joint venture of the *San Francisco Exam-*

... to the local news...

iner and the *San Francisco Chronicle* that appears on the World Wide Web—is still “kind of a research-and-development project,” explains manager John Coate. One of the questions yet to be answered, he says, is how to make a profit, “or at least have the project make its own way.”

Despite the obvious inconveniences of an online newspaper—you can't roll it up and take it with you—the inherent strengths of computers can make electronic editions much more useful than their paper parents.

One key advantage is inexpensive storage. Though it might be senselessly expensive for a newspaper to publish certain information with each edition, electronic newspapers can keep that same information close at hand rather cheaply. Stories worth referring back to can be saved indefinitely rather than being put out on the curb with the next day's recyclables. For example, in a series that ran from 1989 to 1994, the *Chicago Tribune* profiled 263 unincorporated suburbs of the city. All of those stories can be easily retrieved from the electronic newspaper on America Online, making it an invaluable resource for anyone moving to or within the Chicago area. Articles and recipes from the paper's Wednesday Food section remain online for several weeks.

Making this storage capacity even more valuable is the computer's ability to quickly search through large databases. Like several other online newspapers, the TimesLink service that the *Los Angeles Times* operates through a gateway on Prodigy lets users comb through several years' worth of articles. Compared with going to a local library, looking up an item in a paper index and spooling



The *Chicago Tribune* lets you look online for your next job.

through back issues on a microfilm reader, an online search through local news items is fast and convenient.

Putting this feature to frivolous use, one can ransack the *Los Angeles Times* for information about a favorite Hollywood star. For example, a quick search for mentions of "Gabor" over the first half of 1995 yielded about 25 articles, one of which—the obituary of Eva Gabor—contained the intriguing revelation that she was known as "the most down-to-earth of the Gabor sisters."

On a more serious note, *The News & Observer*, in Raleigh, North Carolina, put a searchable database on its Nando.net Web site related to a proposed school re-districting plan. If users typed in their address, the Nando.net computer retrieved a list of the elementary, middle and high schools a child at that address would have to attend. Clicking on the name of the high school called up a profile of the institution, complete with the name of the principal and the average percentage of students who make it to school each day.

Another potential application is searching through a newspaper's classified section. If a person looking for a home wants only a 3-bedroom house with a fireplace, he or she can cull listings that meet those criteria.

While one of a computerized newspaper's advantages over a printed paper is the length of time it can hold onto information, another is the speed with which it can update it. The Associated Press newswire—a



NandoNext runs articles for teens written by teens.

part of CompuServe's basic service, and also available through electronic papers such as TimesLink—feeds readers world, national and business stories throughout the day. Access Atlanta, the online creation of *The Atlanta Journal & Constitution* available through Prodigy, includes a service that updates statistics from

Local TV goes on the Web.

sporting events on virtually a play-by-play basis.

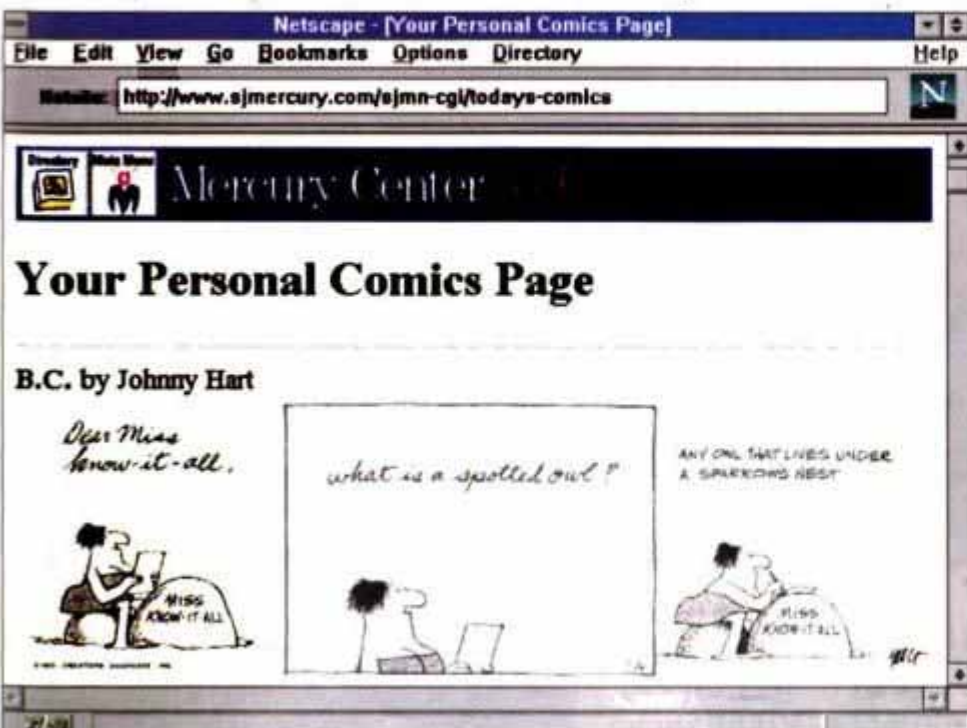
While vast quantities of additional information can be worthwhile, simply reformatting stories that have already appeared in a printed paper can increase their impact. For example, when Houston Chronicle Interactive ran a story about a Web site called Babes On

The Web, the HCI Web site seamlessly linked readers to the WWW pages mentioned in the story. All readers had to do was click on the highlighted "Babes On The Web" text appearing in the body of the text, and they would jump right there. Clicking on the reporter's byline called up a pre-addressed e-mail form for sending comments directly to the *Chronicle* writer.

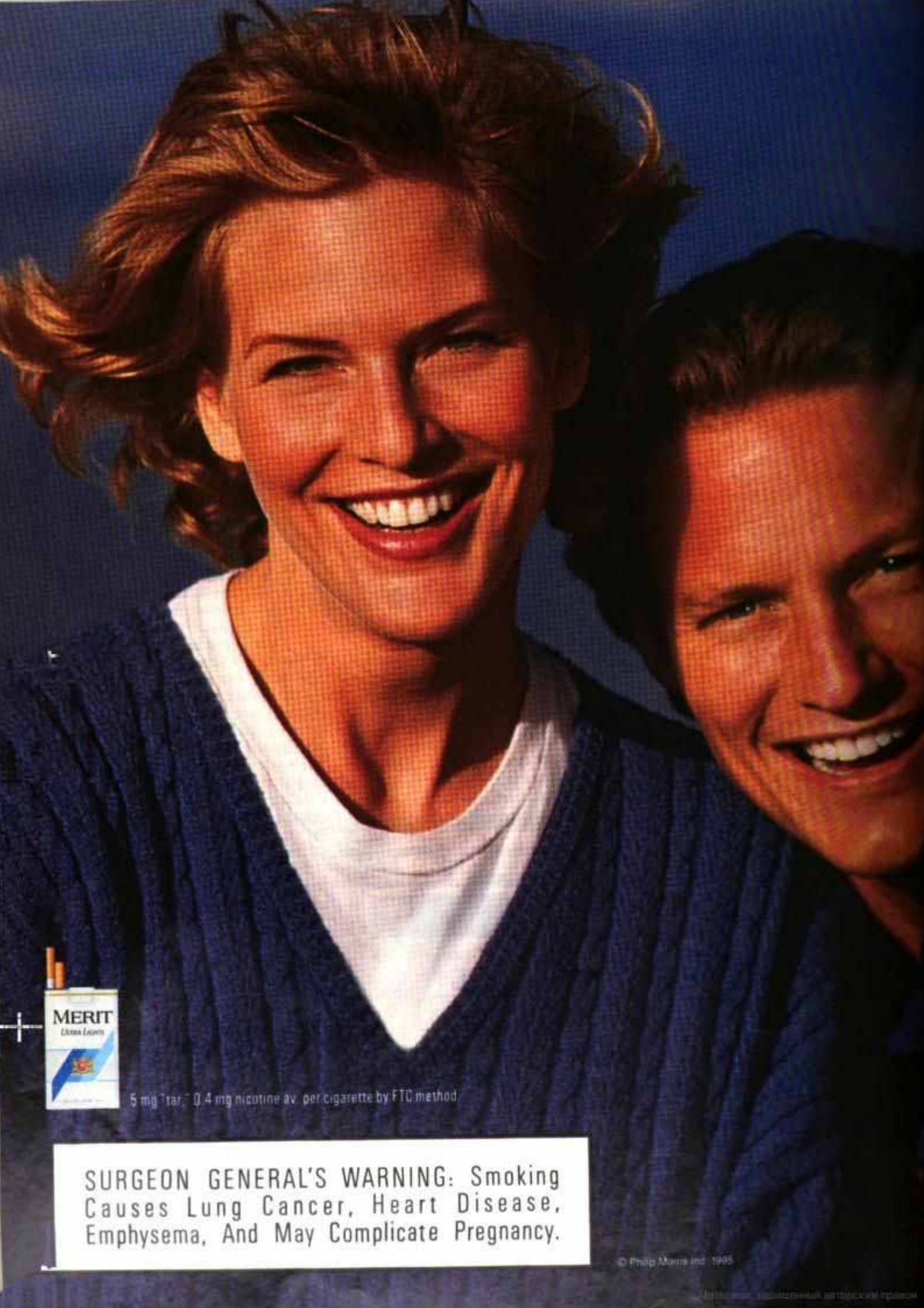
Plans are also being made to link the editorial content of different newspapers. A mention of the New York Knicks basketball team in your local paper, for instance, could be linked to a New York paper providing more extensive coverage.

One last convenience of electronic publishing is that it makes it easier for out-of-towners to read the paper. Unless you're looking for, say, *The New York Times*, it sometimes can be very difficult to lay your hands on a paper from a city across the country. But whether a paper is reachable via the Web, a major online service such as Prodigy or a phone call to a stand-alone bulletin board, electronic distribution makes it quickly available to any computer in the world that has a modem attached to a phone line. That makes electronic newspapers

(Please turn to page 126)



It may be a new medium but comics are still popular no matter where you find them.



5 mg "tar," 0.4 mg nicotine av. per cigarette by FTC method.

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

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CHEVROLET LUMINA LS

LONG-TERM

The Sun sets on half of our fleet—the other half soldiers on.

Chevrolet Lumina LS

● Since the mystery repairs were completed on our test Lumina LS (see last report, July '95), this car has been sweet. So sweet that we're sorry this is our last report.

The Lumina made four trips between New York City and Detroit in the past three months, never taking more than 10 hours to complete the trek. This is proof positive that GM powertrain engineers got the dohc 24-valve 210-horsepower V6 just right, and the platform suspension development team did even better.

Now if the seat guys could only get it right—

TEST SUMMARY: CHEVROLET LUMINA LS
 Report number: 4
 Total miles driven: 17,240
 Miles driven since last report: 7165
 Average fuel economy: 21.7 mpg
 Worst observed fuel economy: 16.2 mpg
 Best observed fuel economy: 26.1 mpg
 Maintenance/repair costs: oil and filter change, \$35

we feel there's still too much lumbar. The Lumina is one of the great values of our time. We wish we had a nickel for every BMW driver we blew off in our under-\$20,000 Lumina.

Yes, we're sorry to see this one go. But it won't be going too far—one of our staffers is buying it.

—Joe Oldham

Lexus LS 400

After spending time behind the wheel of our long-term LS 400, it's easy to see how Lexus has skyrocketed to the top of the surveys in just a few years of existence. This car is simply so solid, so quiet, so comfortable and so luxuriously elegant.

This car's handling is sure and confidence-inspiring—it corners much faster than you would think a luxury

TEST SUMMARY: LEXUS LS 400
 Report number: 3
 Total miles driven: 10,112
 Miles driven since last report: 6708
 Average fuel economy: 20.2 mpg
 Worst observed fuel economy: 18.2 mpg
 Best observed fuel economy: 28.0 mpg
 Maintenance/repair costs: scheduled 7500-mile service

sedan could. And when you stomp the accelerator pedal, the transmission shifts down as the engine and the car speed up—in a hurry.

But regardless of its very impressive performance, its overwhelming attraction is its unbelievably quiet and silky smooth interior. All you hear is a private concert—compliments of the super-convenient in-dash compact-disc changer.

—Deborah Frank



LEXUS LS 400



VOLVO 850 TURBO WAGON

TEST CARS

Volvo 850 Turbo Wagon

I'll come clean: I am a sucker for Q-ships. So I was predisposed to our Volvo. Plant your right foot and feel that turbo spool up. The 222 hp, the redline and the next gear come up before you can say "Clarence Ditlow." Add the comfortable, European luxurious interior, which has scads of room for four and the pallets of vital stuff from your local warehouse club, and folks, you have one very winsome wagon.

Okay, that said, it must be noted that after spending 7500 miles behind the Volvo's wheel, you also notice its ride. It is harsh. So much so that the comfy interior is constantly rattling and thumping. The tires are also a bit of a problem—a chance encounter with a Lincoln Tunnel pothole produced a fist-size bubble on the sidewall of the left front. Volvo replaced the tire under warranty at the first service. The company is putting different tires on the car for '96.

Other complaints: The 850 has day-

GMC SONOMA SLS



time running lights. This means that you can't sit there waiting for your chili dogs at the old Weenie Beanie listening to the stereo without fear of running down the battery as those lights burn away with your dogs.

—Don Chaikin

GMC Sonoma SLS

When a car's tenure comes to an end, the ritual of cleaning out the glovebox often turns reflective. Since we drove our Sonoma 25,000 miles in 12 months, there was a lot to reminisce about: the now-faint stain on the carpet from the Big Gulp of Dr. Pepper

(the cup holders are too small), the speeding ticket stuffed in the glove compartment—dig that 195-hp V6 engine.

A surprise was the usability of the rear seats. As long as the ride is short, this is a 4-passenger vehicle.

Problems were few. The wimpy Uniroyal Tiger Paw tires give up early in the turns. And the odd spotted design on the cloth seat upholstery started to take on a psychedelic quality.

TEST SUMMARY: VOLVO 850 TURBO WAGON

Report number: 2
Total miles driven: 7746
Miles driven since last report: 6634
Average fuel economy: 20.3 mpg
Worst observed fuel economy: 16.7 mpg
Best observed fuel economy: 22.9 mpg
Maintenance/repair costs: scheduled 5000-mile service, \$31

TEST SUMMARY: GMC SONOMA SLS

Report number: 4
Total miles driven: 24,911
Miles driven since last report: 6567
Average fuel economy: 20.2 mpg
Worst observed fuel economy: 14.2 mpg
Best observed fuel economy: 23.6 mpg
Maintenance/repair costs: scheduled 21,500-mile service, \$185.79



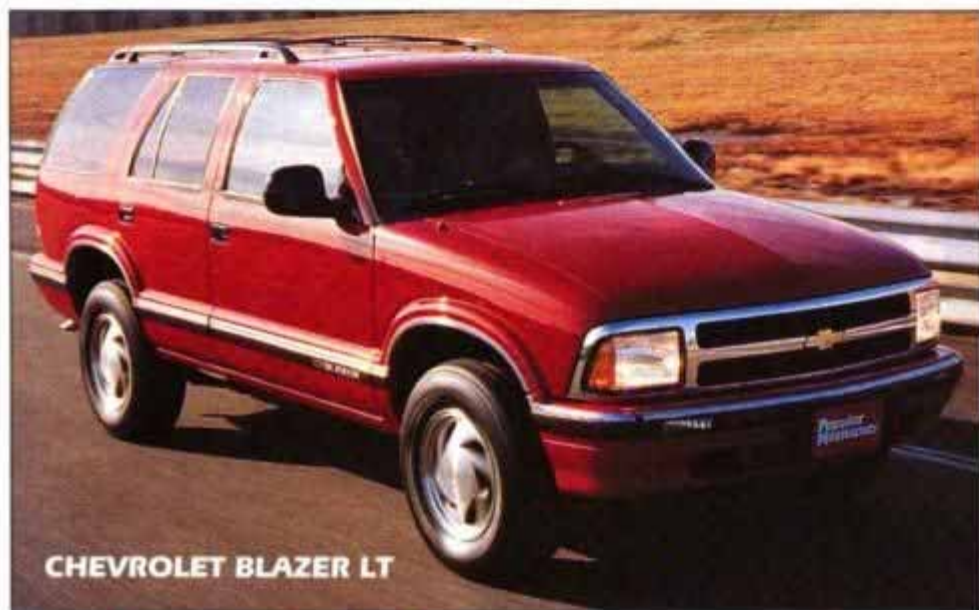
HYUNDAI SONATA GLS

These few annoyances aside, we couldn't have asked for a more solid or reliable vehicle. —*Scott Oldham*

Hyundai Sonata GLS

Our Sonata is home, back at Hyundai Central. And, in looking back, what

Over the course of the year, there were really few injuries to the Sonata. Other than our early tire and windshield-wiper woes, the problems were limited to lost hubcaps, a rear window that stuck in the up position and a left brakelight that went out.



CHEVROLET BLAZER LT

TEST SUMMARY: HYUNDAI SONATA GLS

Report number: 4
 Total miles driven: 16,475
 Miles driven since last report: 4217
 Average fuel economy: 22.7 mpg
 Worst observed fuel economy: 16.1 mpg
 Best observed fuel economy: 33.2 mpg
 Maintenance/repair costs: scheduled 12,000-mile service, 1 qt. of oil, one bulb, two hubcaps—\$136

impressed us most was the combination of excellent performance and a solid, rattle-free ride in a car that costs less than \$17,500—signed, sealed and delivered. Add the Sonata's full complement of convenience and comfort equipment and you have a family sedan that out-values just about any competitor. Even at test's end, we were startled by the space inside each time we climbed into the Sonata.

Our only disappointment is with the car's fuel economy—we just felt that a Hyundai would do better than 22.7 mpg. —*Jim Dunne*

Chevrolet Blazer LT

No one will admit they did it. But what happened was, around the 7000-

TEST SUMMARY: CHEVROLET BLAZER LT

Report number: 3
 Total miles driven: 13,076
 Miles driven since last report: 6401
 Average fuel economy: 16.6 mpg
 Worst observed fuel economy: 11.6 mpg
 Best observed fuel economy: 16.9 mpg
 Maintenance/repair costs: repair damage, \$67

mile mark, someone driving our long-term Blazer hit a pothole about the size of Bryce Canyon and damaged the left front suspension and steering components, and actually buckled the left front fender.

Our Blazer was off the road for eight days at Future Chevrolet in Aberdeen, New Jersey. When it rolled out, the vehicle was like new. Our compliments to Future.

Other than the hard body shot, life for our tester has been peaceful. It has spent most of its nine months the way most Blazers spend time—serving as a suburban do-it-all vehicle. Go to the supermarket. Pick up the cleaning. Get the son home from college.

The Blazer has been reliable, comfortable, utilitarian, luxurious, uneventful. Which is all we would want it to be if it was really ours. Except for a rather thirsty V6—but we love the power—we don't have a single complaint about our test Blazer. And that, in itself, is a compliment. —*J.O.*

Ford Contour SE

Commuting into Manhattan tends to add a lot of wear and tear to a test driver's backside, the car's stereo and the motor in the driver's window (toll-booths)—but not a lot of odo miles.

Our Contour hasn't been used for long trips. So apparently it's being used for commuting, shopping and running around to do various errands. And that's with plenty of other vehicles at our testers' disposal. So we like it. One amazing thing we've noticed is the consistently high mileage numbers it cranks out in urban cut-and-thrust



FORD CONTOUR SE

PHOTO: JEFF COOPER FOR POPULAR MECHANICS
 BOTTOM PHOTO: JEFF COOPER FOR POPULAR MECHANICS



OLDSMOBILE AURORA

TEST SUMMARY: FORD CONTOUR SE

Report number: 2
 Total miles driven: 6647
 Miles driven since last report: 6620
 Average fuel economy: 23.1 mpg
 Worst observed fuel economy: 17.8 mpg
 Best observed fuel economy: 25.1 mpg
 Maintenance/repair costs: none

traffic. Another is the remarkably smooth shifting of the 5-speed manual transaxle. Normally, we avoid manual transmissions in vehicles



PLYMOUTH NEON HIGHLINE

that are used for everyday 4-ft.-at-a-time jousting with taxicabs and delivery trucks in Manhattan—but the Contour's clutch is light and the V6 engine's torque curve goes right down to idle. The engine also runs like a freight train right up to redline, once the traffic clears.

So far, we've had exactly zero in the way of defects, not so much as a squeak or hiccup.
 —Mike Allen

Oldsmobile Aurora

At 15,775 miles, we had a by-the-book servicing performed on our Aurora at a cost of \$67. That seemed reasonable to us. What was not reasonable was the wind leak around the driver's window, which was not fixed by the dealer and has gotten worse.

It's these kinds of little annoyances that can grow larger than life and drive you nuts. They can also turn you off to an otherwise enjoyable car-ownership ex-

perience. Happily, this was not the case with our Aurora. We still love the car. Too bad the dealer wasn't up to the performance level of the car. This isn't a big deal. It's just so annoying in an otherwise great car.

This is our last report on the Oldsmobile Aurora. We've had the car in our test fleet for a year, and we've clocked just under 25,000 miles on it in that time. We can honestly say

TEST SUMMARY: OLDSMOBILE AURORA

Report number: 4
 Total miles driven: 24,446
 Miles driven since last report: 8776
 Average fuel economy: 19.7 mpg
 Worst observed fuel economy: 13.6 mpg
 Best observed fuel economy: 26.8 mpg
 Maintenance/repair costs: \$67

that every one of those miles was a driving pleasure.

Every time we put the gas pedal to the floor and heard those dual exhausts growl, we felt good. We felt better when we bent the Aurora through a tight curve. We felt best, though, just driving normally in the Aurora, enjoying the leather seats and the sound system, and knowing that those extraordinary performance capabilities were there beneath our right foot and connected to the steering wheel any time we wanted to call on them.

These capabilities consistently allowed our Olds Aurora to perform as well as, or better than, competitors costing tens of thousands more—both in track tests and side-by-side comparisons on road.
 —J.O.

Plymouth Neon Highline

Say bye to Neon. Our test Neon is gone, and we were sorry to see it go. It spent the final three months of its
 (Please turn to page 125)



NISSAN MAXIMA SE

Toilet Replacement

Double Flushing and Clogging

Six months ago I replaced the toilet in my house and have since experienced nothing but problems, ranging from flushing it twice to using a plunger to clear the bowl. The children do not want to use the toilet because the bowl is dirty, and my wife is tired of cleaning it. The salesman that sold me the toilet told me it was one of the better models on the market, and that it was going to consume less water. Right now, I don't think we have saved a nickel on water, and we're sick and tired of the day-to-day maintenance. I thought about putting my old toilet back in, but I threw it away. Is there anything I can do?

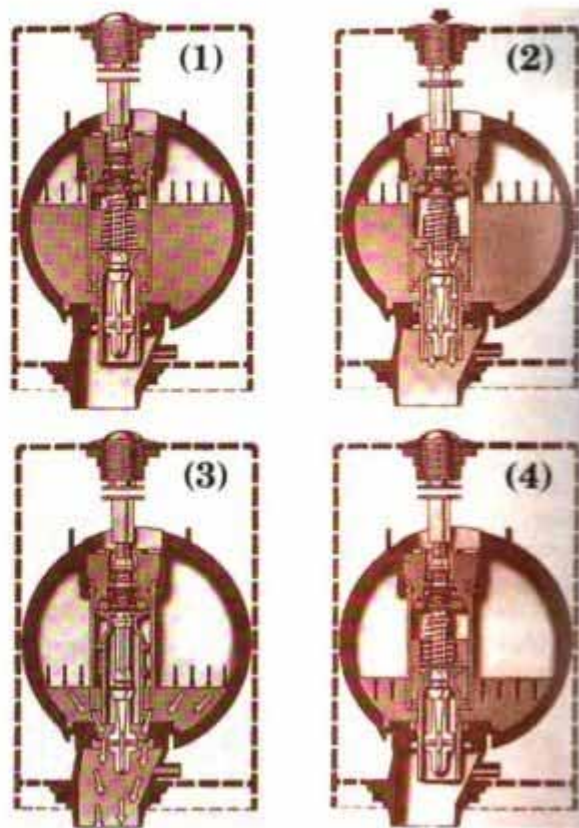
G.K., Larchmont, NY

Your problem is that you installed a gravity-type low consumption toilet when you needed a pressure assist type. When the government ordered toilet manufacturers to start making fixtures that use only 1.6 gallons per flush, they cut by over half the amount of water used to move waste. In your case, gravity is insufficient to get the job done, and that's why you are experiencing things like double flushing and stoppages. You can no longer simply buy a toilet based on style and color: you must also consider performance. Pressure-assist toilets use the water supply line pressure to "turbo-charge" the 1.6 gallons of water, thus increasing the toilet's performance.

For example, the pressurized

HOW PRESSURE ASSIST TOILETS WORK

The pressure-assist unit has a self-contained vessel that is located inside the toilet in place of the flapper and ballcock that you'll find in gravity toilets. The vessel traps air, and as it fills with water, uses the water supply line pressure to compress the trapped air inside. When the vessel is fully charged and ready to be flushed, the air and water pressures are equal (1). The pressure vessel has a valve cartridge, which discharges (2) when the unit is activated. This action opens the main valve (3) and the compressed air forces the water into the bowl. Instead of the "Pulling" or siphon action of a gravity unit, pressure units actually "push" the waste out. This vigorous flushing action cleans the bowl as well — something a gravity unit just can't accomplish. After the bowl empties, waste is carried through the drainline at the crest of a "turbo-charged wave of water." The valve (4) closes, and the tank begins its refill cycle.



system forces waste down the drain at 70 gallons-per-minute (GPM) — a rate that is 3-times that of gravity models. This powerful flushing action does a more thorough job of extracting waste, reducing the need to double flush and virtually eliminating bowl stoppages. These units also have the same amount of water in the bowl as your old unit, which means all together, the pressure assist toilet will perform better than your older unit and needs no more cleaning than your older one.

In addition, there are fewer moving parts, so the unit is actually easier to service than gravity toilets. Some units carry up to a two-year warranty. By the way, these pressure-assist toilets have been used in residential, multi-family and apartment/condo applications for a number of years, so they have been proven in the field.

Many manufacturers offer them, so make sure you ask if the toilet you are buying uses pressure or gravity.

© 1995 Sloan Valve Company

Installing Pressure Assist

A pressure-assist toilet installs exactly like a gravity-type toilet. The difference is how it works (see illustration above). Pressure-assist toilet manufacturers offer their units in a variety of colors and styles to fit virtually every home style. These companies also offer some help in selecting between gravity and pressure assist technologies. However, you may find it more beneficial to write directly to the leader of pressure-assist vessels for toilets: Sloan FLUSHMATE. More manufacturers use FLUSHMATE in their pressure-assist toilets

than any other brand. The company offers a free brochure entitled, "How to Choose the Right Toilet: Why Pressure-Assisted, Low Consumption Toilets Belong in Your Home." To get your brochure, write to: Sloan FLUSHMATE, 10500 Seymour Avenue, Franklin Park, IL 60131, or call 800-875-9116. You can also get additional product information if you want by either calling the toll-free number and asking for more technical information, or by writing directly to me at the above address. — Paul DeBoo



Woodworking Guide

Home Woodworking



Getting Away From It All In The '90s

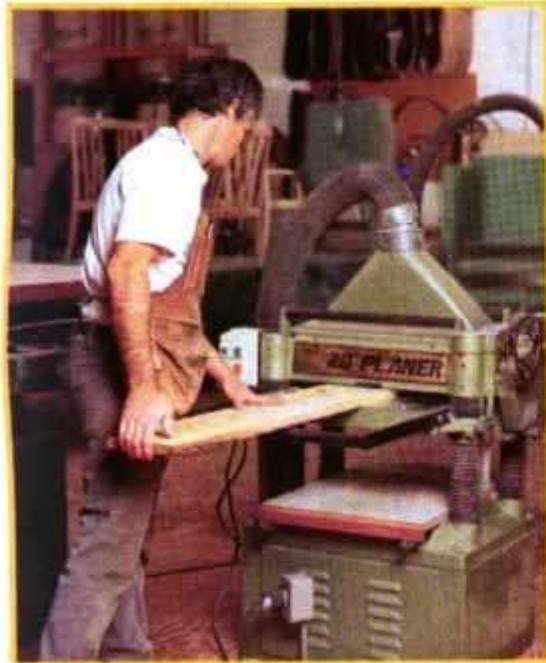
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Al Rosen

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Real Projects For Real Home Workshops

Creativity and resourcefulness combine to produce spectacular work from humble beginnings.

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

For some of us, it's nestled on one side of the basement. For others, it has taken over the garage. For a few lucky ones, it's in a building set away from the

house. It's the home workshop.

Paradoxically, this isn't the place you go to work—it's where you go to get away from work. In fact, it's really a place of recreation. Not recreation in the usual sense, but true recreation—the act of regeneration, a rebirth of purpose and a renewal of the mind and spirit.

For many of us, though, having the tools, space and a few extra hours still leaves out one ingredient—something to build. And while there's no ideal project, those of us with home workshops have a few things in common that shape the kinds of projects we tackle.

First, the project should be relevant. For homeowners, this often means a creation that enhances the home environment—something that you and your family will live with from day to day. Second, the skills involved must be within an acceptable range. If the project is too simple, it turns into just another job—too complex, and it might not get finished. Last, the tools

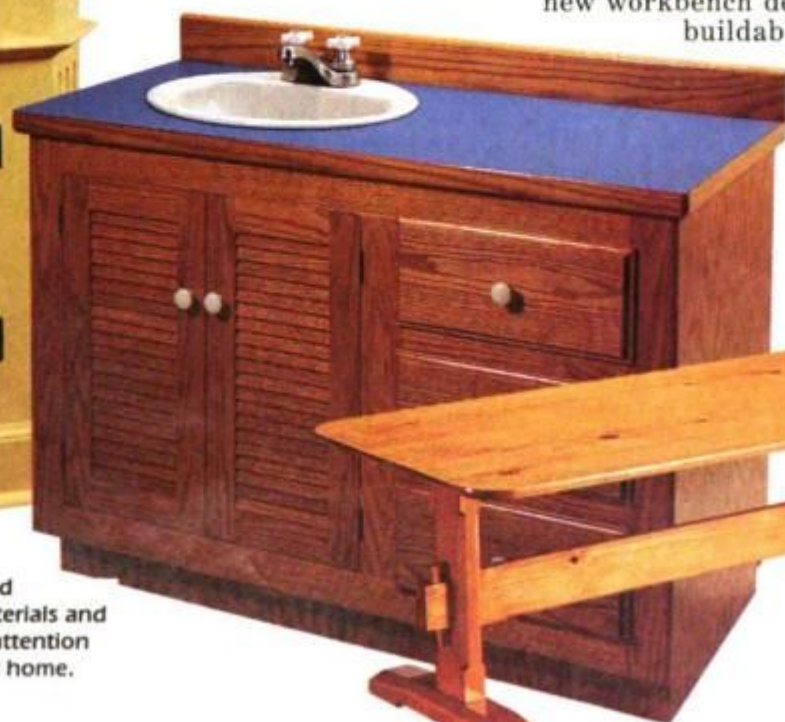
and materials must be easily accessible, both in availability and price. To these ends, we've devoted this year's Woodworking Guide.

Our first project, the corner cupboard, is the most ambitious. Its elegant and traditional appearance belies an underlying simplicity in construction details. On a more modest scale, our coffee table is designed to provide a tasteful focus for any living room—it even knocks down for storage in a closet. While our last project—a bathroom vanity—may seem a little mundane, we've gone the extra mile in detailing without sacrificing workmanlike construction.

In case you haven't noticed, lumberyards and hardware stores are slowly giving way to outsize mass merchandisers. What used to be available only to professionals can now be purchased right off the shelf in the same way you buy your weekly groceries. For a brief tour of the marketplace, check out "Raw Materials" (page 80) and "Tooling Up" (page 84).

And finally, we couldn't close this year's Woodworking Guide without a project just for the workshop—a new workbench design that's both buildable and practical.

However, don't do too good a job on it, or you may be tempted to leave off the vise and put the bench right in the center of your kitchen. **PM**



Our corner cupboard, bathroom vanity and coffee table are built with easy-to-find materials and affordable tools. Solid craftsmanship and attention to detail make them ideal additions to any home.

Raw Materials

One-stop shopping comes to woodworking. Here's what's in store.

BY NEAL BARRETT; PM PHOTO BY ROSARIO CAPOTOSTO

It used to be that if you wanted to assemble materials for a furniture or cabinet project, you had to visit a minimum of three or four suppliers—your local lumberyard, the corner hardware and paint stores and maybe even the closest tool supply outlet. Today, however, with the coming of the home-center mega-stores, you can get everything you need for almost any project at just one location. And, while this may remove some of the romance from your woodworking pursuit, it can also remove much of the frustration of tracking down a long list of materials. Here's a quick tour of what a woodworker can expect to find on a stroll through the cavernous aisles.

Wood

The foundation of most woodworking projects is some type of solid lumber. While a typical home center won't carry the same selection of species and grades as a specialty lumberyard, you can expect to find a reasonable assortment of both softwood and hardwood stock.

For general millwork, pine lumber is still the most popular material. Pine is most often stocked in the No. 2 Common grade, which allows quite large and plentiful knots, although they must be solid. Some stores will also carry Select grade pine with tiny pin knots that are hardly visible.

Select pine is the material of choice for pieces of elegant design that must have a smooth, unblemished surface. But the use of Select grade lumber comes at a considerable price, since its cost is about 2½ times more than that of Common grade.

For pieces that have a rustic design, the knotty appearance of Common pine can be a real plus. And, by buying a little extra material, you can often cut around the worst knots and end up with a very suitable piece for much less money.

Pine lumber is available in sizes ranging from 1 × 2 to 1 × 12, with lengths from 4 to 16 ft. Sometimes, 5/4 stock (1½-in. actual thickness) is carried in the same grades, widths

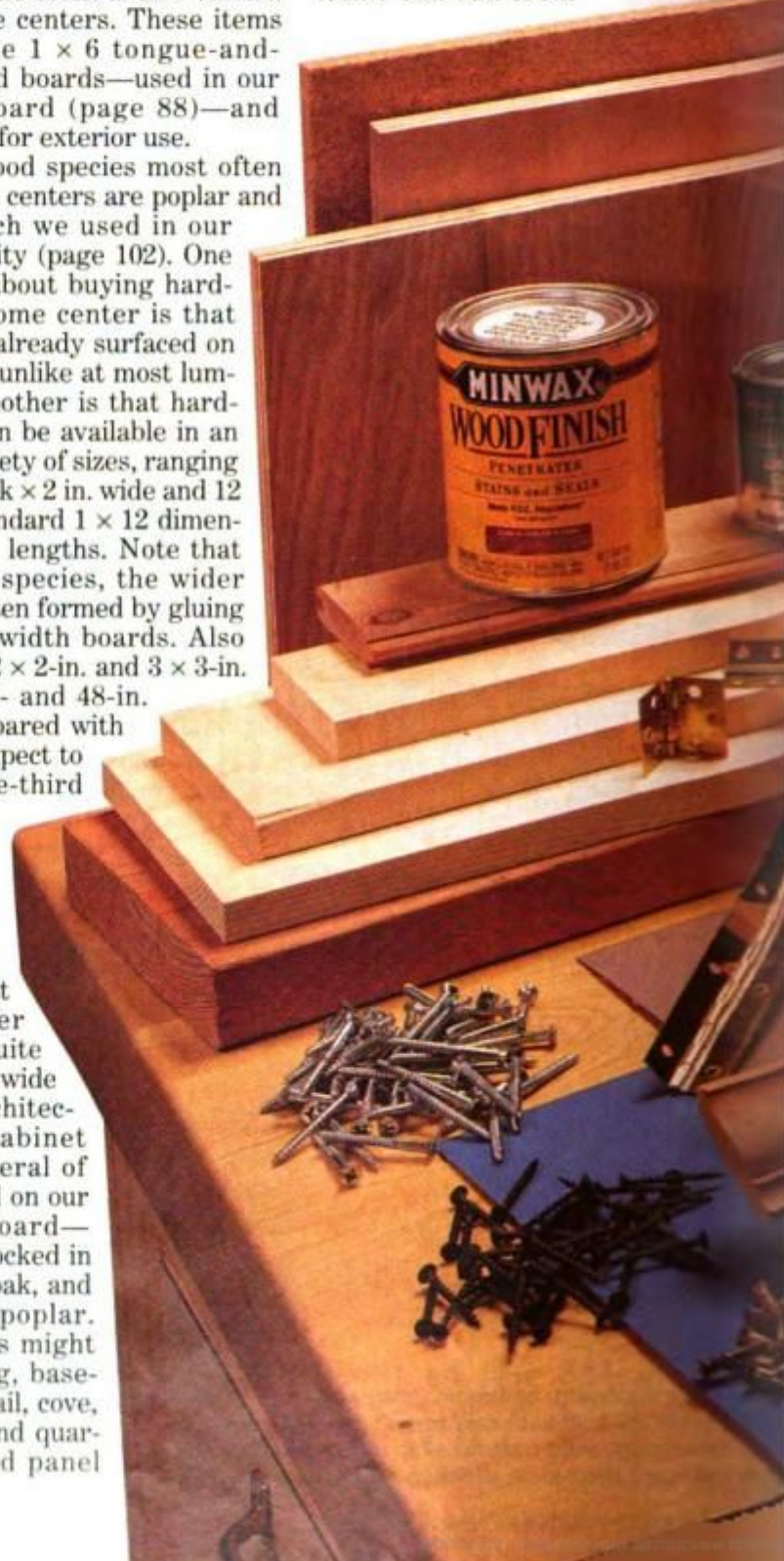
and lengths. It's easy to make the thicker pieces that are often needed in woodworking projects by simply gluing together thinner pieces, as we did in our coffee table project (page 94).

Specialty pine stock is also carried at many home centers. These items might include 1 × 6 tongue-and-groove beaded boards—used in our corner cupboard (page 88)—and shiplap siding for exterior use.

The hardwood species most often found at home centers are poplar and red oak, which we used in our bathroom vanity (page 102). One nice feature about buying hardwoods at a home center is that they are sold already surfaced on all four sides (unlike at most lumberyards). Another is that hardwood stock can be available in an incredible variety of sizes, ranging from ¼ in. thick × 2 in. wide and 12 in. long to standard 1 × 12 dimensions in 10-ft. lengths. Note that in hardwood species, the wider lengths are often formed by gluing up narrower-width boards. Also available are 2 × 2-in. and 3 × 3-in. squares in 36- and 48-in. lengths. Compared with Select pine, expect to pay about one-third more for poplar and twice as much for red oak.

The selection of moldings found at a home center also can be quite impressive. A wide variety of architectural and cabinet profiles—several of which we used on our corner cupboard—are usually stocked in pine and red oak, and occasionally poplar. These profiles might include casing, baseboard, chair-rail, cove, crown, half- and quarter-round and panel

moldings—all in different sizes. One particularly useful item, with many project applications, is ¼-in.-thick lattice stock, usually sold in 1¾-in. width. Costs for these millwork items can run from



20 cents/ft. to \$5/ft., depending on size, species and complexity of the profile.

Dowel stock is most often found in either birch or maple, with some centers stocking red oak as well. Available sizes range from $\frac{3}{16}$ - to $1\frac{1}{4}$ -in. diameters in 36- and 48-in. lengths.

If your woodworking project calls for construction lumber—like our workbench on page 110 does—you can expect to find a complete range of sizes, from $2 \times 4 \times 8$ s to $2 \times 12 \times 16$ s. Most often, a general construction

grade will be carried, but sometimes an economy grade will be substituted. Check that the grade offered is suitable for your intended use. Economy-grade material is generally not appropriate for use in structural applications.

Panels

Most home centers carry a good selection of manufactured panel products. The standard size for panels is 4×8 ft. in $\frac{1}{4}$ -, $\frac{1}{2}$ - and $\frac{3}{4}$ -in. thicknesses. At many centers, however, you can find panel stock in various precut sizes as well, from 1×2 ft. up to 4×4 ft. Panels are available in construction grades, made of fir or pine veneers, and cabinet grades, with poplar or lauan veneer cores and lauan, birch, red oak or poplar face veneers. These more expensive hardwood panels are typically used for cabinet and furniture parts, although they find uses in architectural applications as well. Such panels are ideal alternatives

to laminating smaller boards when the surface appearance isn't crucial.

In addition, flakeboard and medium-density fiberboard (MDF) panels are available in full sheets and cut sizes. These composite materials are extremely stable and flat, though quite heavy, and make excellent substrates for plastic laminate. You might also find melamine-covered flakeboard panels. Melamine is a thin, hard plastic surface that is permanently bonded to the flakeboard. It is most often used as an interior surface for kitchen and bathroom cabinets, since it's washable and relatively inexpensive.

The more complete home centers also carry a limited selection of plastic laminates. Plastic laminates (Formica, Nevamar and WilsonArt) are the most widely



available brand names) are frequently installed in kitchen and bathroom cabinets and on countertops. They can, however, be effectively used as a surfacing material on furniture and as a durable shop worksurface. For instance, we used laminate on the top of our bathroom vanity and on several parts of our workbench. These materials are manufactured in literally hundreds of different patterns and colors, and it is beyond the scope of a home center to stock more than a representative sample. But you can often special order a particular color or pattern, giving you many options to explore. Standard sizes for plastic laminates range from 25 x 97 in. up to 60 x 144 in., but the sizes available will vary with the supplier.

Paints and coatings

The paint department is where many home centers really shine. You are likely to find a remarkably complete selection of paint and wood-finishing products, as well as the tools for their application. For opaque finishes, oil- and latex-based paints are the standard materials. For stained work, you will find oil-based stains and water-based dyes, as well as combination dye-varnish products (known as gel stains). Clear finishes include shellac, oil, brushing lacquer and varnishes, both oil-based and polyurethane. There are also new water-based clear finishes available that claim less environmental damage and personal hazard potential in their use than many traditional finishes.

Although the variety of finishes might seem confusing, the truth is that many of these products won't be an appropriate choice for your project. Shellac, for example, can be tricky to apply, has a limited shelf life and offers only average surface protection for your project, especially against water or alcohol damage. Oil finishes, though quite attractive on some hardwoods, also offer reduced protection. These products do have their uses, but for most do-it-yourself projects, you'll find that a polyurethane varnish or water-based finish is the easiest to use and is the most resistant.

Fasteners

When it comes to fasteners, you will again find a wide selection of items. Nails come in many styles and sizes. For general construction use, common nails are the traditional choice, with flat heads and thick shanks. Coated nails are of the same configuration, but they have thinner bodies and are covered with a resin that makes them hold better than their common counterparts. This type of nail is also less likely to split the lumber when it's used near an edge.

For trim- and cabinetwork, use finish nails. These nails have a small, round head with a dimple in the top to facilitate setting them below

styles, sizes and materials. For most woodworking projects, traditional wood screws are a reasonable choice. These screws are classified by material, length, gauge of the body and type of head. Phillips and slot head styles are available, as well as oval, round and flat head configurations.

If the fastener head will not be seen, a drywall screw is a better option in many cases. Drywall screws have thinner shanks, finer threads and sharper points than wood screws. They tend to drive easier and are less likely to split wood than the fatter wood screws.

For metal fastening, self-tapping screws are the best choice. These screws have sharp points and hardened shanks with threads all the way from the head to the tip. They come in both flat and pan head varieties, with the option of either a slot or Phillips head.

Hardware

In the big home centers, you can get lost in the hardware department for hours. If you make it past the fastener section, you still have lots of hinges, nuts, bolts, washers and knobs to browse through before you're done. The selection of nuts and bolts will include the basic machine bolts in all sizes and nearly every length, plus the washers, lockwashers, capnuts and locknuts to go with them. Usually, you'll also find a nice selection of carriage bolts and lag-screws in most lengths and diameters.

You're also bound to encounter a wealth of specialty items, from glass-mirror hangers to picture-frame mounting devices and much more. There should be dozens of sizes and varieties of screw-eyes and screwhooks as well.

The hinge selection should be similarly comprehensive, including standard butt hinges and overlay door hinges for cabinetwork. And you can usually find small specialty hinges for fine furniture work. Finally, the deep variety of drawer and doorknobs and pulls can be enough to make anyone dizzy. If you start to feel overwhelmed, don't worry. Just step outside to get a breath of fresh air and then come back for more. **PM**



the surface of the wood.

Exterior work requires nails that will not rust, so either aluminum or galvanized-steel nails should be used. These nails come in many configurations, from common and finish styles to specialty nails such as ring-shank siding nails, roofing nails and spiral nails, designed specifically for use with pressure-treated lumber.

The size of the nail is designated by a "penny" number, varying from 2-penny (2d) at 1 in. long, up to 60-penny (60d) at 6 in. long.

Screws are the fasteners of choice for many projects. They, too, are available in a wide assortment of



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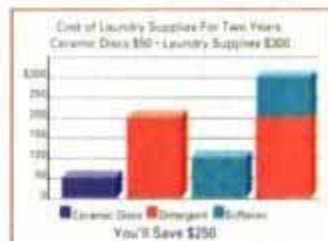


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Portable power tools

For cutting wood, there are two basic power tools—the circular saw and the sabre saw. Circular saws are designated by the maximum blade diameter they can handle. Because of this tool's heritage as a construction saw, where most lumber tops out at 1½ in. thick, you'll find 7¼-in. saws the most prevalent. There are smaller ones available for trimwork and larger ones to handle heavier stock. If you can afford to own only one, the 7¼-in. is the best all-around choice.

In terms of design, circular saws come in two flavors—worm drive and spur gear (sometimes called sidewinder). While the worm-drive design is a favorite in many areas of the country for construction, the spur-gear type is lighter, generally easier to handle and a better choice for fine work.

When it comes to notching, curve cutting and making irregular holes, it's time to switch to a sabre saw. Often called a jigsaw, this tool has a straight, reciprocating blade. While it's not as accurate as a circular

saw for straight cutting, when equipped with a sharp blade, it's very effective for curved cuts.

Some sabre saws come with a pivoting blade that's controlled by a front knob on top of the housing. While this scrolling feature can help with a lot of tight, intricate curve cutting, it's otherwise unnecessary. On the other hand, one feature that's definitely worthwhile is orbital action. Orbital sabre saws have a mechanism that thrusts the blade back and forth in line with the cut as the blade moves up and down. The degree of orbiting action is controlled by a dial. At maximum orbit, the saw will cut almost as fast as a circular saw, although the accuracy of the cut will not be as good.

You may also come across a heavy-duty contractor's saw called simply a reciprocating saw. If your work includes serious home remodeling, this may be a tool to own. With it, you can cut through nearly anything—as long as you don't need to be too precise.

Drills are designated by the maximum bit diameter that will fit in the chuck. For most applications, a ⅜-in.



drill is a good bet. Also, make sure your choice has variable speed and is reversible. With these features, your drill becomes a driver as well.

Larger 1/2-in. drills and hammer drills are also available. In addition to having more power, a 1/2-in. drill will accept up to a 1/2-in. shank bit. Hammer drills are designed for masonry. Because they also have a normal drilling mode, they're useful as dual-purpose tools.

For intricate joinery, molding and trimming, most power-tool enthusiasts turn to routers. These pint-size

portable milling machines come in two configurations—standard and plunge. A standard router will cut moldings, dadoes, rabbets, mortises and tenons, while a plunge router is far better for mortises and other cuts that are completely enclosed. Routers are designated by the router bit shank diameter that they accept, with 1/4 and 1/2 in. being standard. Routers are also rated by horsepower—and it pays to buy as much power as you can afford. A router is the easiest tool to convert to a stationary machine. Mounted in a router table, you have a small shaper

that's capable of very accurate work.

When it comes to finishing, most home woodworkers start with a random-orbit sander. This tool removes stock almost as fast as a belt sander, with results that are comparable to the better finish sanders. If you need to work into square corners, turn to a standard orbital sander or detail sander. Detail sanders, with their small triangular pads, are especially good at cleaning and smoothing tight, confined areas. Belt sanders are designed for removing material fast. They can be unruly and require care to avoid removing too much stock.

Power planes have straight blades mounted in a spinning cutterhead. They'll do a great job of taking that extra 1/8 in. off the edge of a door. Because they cut so fast, however, it's easy to plane off too much.

Until recently, your list for must-have portable power tools would now be complete. But today, you need one more—a plate joiner. This specialized tool does one thing—cut the slots for joining wood with small wooden plates, or biscuits. Fortunately for home woodworkers, this once high-end professional tool is now offered at prices nearly everyone can afford.

Cordless tools

While you probably don't need a cordless drill, once you get one, you'll never want to be without it. Today's offerings range in power up to 12 and even 14.4 volts, and they'll do just about anything your corded version will. In addition, owning both corded and cordless drills cuts time dramatically when it comes to combination driving and hole-boring chores.

For light-duty screwdriving, cordless screwdrivers are great time-savers. Sanders and small circular saws also have recently appeared as battery-powered versions.

Benchtop tools

Stationary benchtop tools provide precision and power without the space and budget requirements of full-size machinery. Benchtop circular saws come with all the features of floor models—tilting arbor, miter gauge and rip fence—plus you'll get a bigger blade. A benchtop drill press takes the eyeballing out of hole boring and is a handy tool for starting mortises and drum sanding.

For curved cutting and resawing, benchtop band saws do a lot of work for a small price. And for tight, intricate cutting, check out a scroll saw.

Radial-arm saws and power miterboxes are both used for fast crosscutting. The radial-arm saw has the edge for large workpieces and can be set



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up for ripping. On the other hand, a power miterbox is far more portable, making it the best choice for moldings, miters and other fine work.

A combination disc/belt sander goes a long way in speeding up small-part edge and face sanding, and it will even handle preliminary tool sharpening. Oscillating drum sanders are best at edge smoothing on curved work.

A bench grinder is indispensable for reshaping plane iron and chisel bevels as well as for touching up steel circular saw blades. You'll also find it useful for modifying any of the various metal components that go into your woodworking projects.

Hand tools

Although there have been a few innovations, your home center's stock of woodworking hand tools isn't that different from what the hardware store of 25 years ago offered. Handsaws for ripping have largely disappeared, replaced by fast-cutting saws with teeth, inspired by Japanese toolmakers.

Specialized saws such as coping saws and backsaws are both requirements for the well-equipped shop. And keyhole saws allow you to hand-cut enclosed holes when necessary.

Professional shops will have many sizes of hand planes, but you may find

only one or two models at your home center. These—the smooth plane and jack plane—when kept sharp, will probably handle most jobs you encounter. And a small block plane is handy for end-grain work and trimming tight areas.

One hand tool that hasn't been successfully replaced by a power tool is the wood chisel. Although these can be bought separately, a set of four, in widths from 1/4 to 1 in., is a good investment. It even pays to have a few extra on hand just for rough work.

When it comes to hammers, small workshops rarely require a heavy one—a 16-ounce claw hammer will do just fine. And, although you'll find multibit screwdrivers economical, a set of single screwdrivers in the common tip designs is a good investment.

Important measuring and marking tools include tape measures, folding rules, try squares, framing squares, bevel gauges, marking gauges and straightedges. And don't forget some clamps—no shop ever has enough. Sliding bar clamps and handscrews are best for general work, while pipe clamps handle larger assemblies.

Blades and bits

If you're in the market for a new power saw because your old one doesn't

cut that well, don't buy the new one—at least not until you've tried a new blade in your old one. And, unless you're handy at sharpening and blade maintenance, buy a carbide-tipped blade—it will last longer. Sabre saw blades are designed for the material they're cutting. For most woodworking, a hollow-ground blade will perform the best.

Most drill-bit makers offer twist drills with a split point or some variation on this principle. These premium bits are easier to start than ordinary twist drills and definitely worth the extra cost.

For large holes, you'll find spade bits and an assortment of augers. Flat spade bits are a good choice because they're inexpensive and can be easily sharpened or resized if necessary.

Router bits are available in a seemingly endless variety of profiles. The important ones for joinery are the straight bits, and they come in a variety of diameters. Your molding bit set should also include quarter-round (rounding-over) and cove profiles. Router bits are made out of high-speed steel or have carbide-tipped cutting edges. Like with saw blades, carbide-tipped bits last longer and are a more than worthwhile addition to your home workshop. **PM**

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Corner Cupboard

Architectural woodworking at its best—from stock moldings, plywood and pine.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO,
Contributing Editor

Woodworkers are a very inventive bunch—they have to be. As cabinetmakers, they take over where the architects and the builders leave off, designing and constructing all the intimate spaces that make up a home. From bookcases to kitchen counters, it's the cabinetmaker who transforms raw wood and hardware into useful, tasteful and appropriate spaces. More than just a technician, the traditional cabinetmaker solves storage problems creatively and with an eye for aesthetic detail. And, throughout the history of woodworking, certain designs have survived. The classic corner cupboard is just such a creation.

Our version retains many of the visual elements of cupboards built in the 18th century, including fluted sides, frame-and-panel doors and beaded tongue-and-groove back paneling. It's also trimmed with classic moldings for just the right period look. However, whereas original pieces had handcut moldings, you can buy the ones we used right off the shelf. In fact, our entire piece is made from readily available lumber and plywood. And, in keeping with traditional architectural woodworking, our corner cupboard is designed to be painted to match the rest of the woodwork in the room.

Case Construction

Begin by cutting 1 × 4 stock to length for all of the 3½-in. frame members. Rip 1 × 6 stock to 4¼ in. for the wider plinth frame pieces. Mark all of the square half lap joints for the vertical and horizontal frames, and code the pieces with letters so you won't get them mixed up.

Build a router lapping jig by securing two 16-in.-long 1 × 6 boards to a worksurface so they're 3½ in. apart. At one end of the space between the 1 × 6s, secure a 6-in.-long 1 × 4 stopblock between the boards. Then place the first workpiece between the 1 × 6s and against the stopblock. Measure the distance from the edge of your router's baseplate to the cutting edge of a ¼-in. straight bit, and use this dimension to locate the four guide strips that will limit the router's path to the size of the half lap joint.

With the bit set for a ⅜-in.-deep cut and the workpiece butted against the stopblock, shape the half lap while moving the router within the four guide strips (Photo 1). To cut the angled half lap joints in the horizontal frames, first lay the parts together and mark the 45° joints. Then, build similar jigs for these pieces and rout the half lap joints.

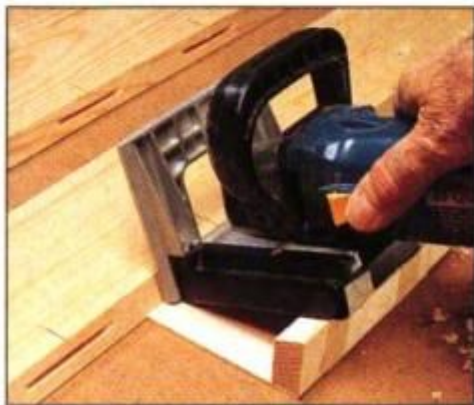
Apply glue to the mating surfaces of all the joints,



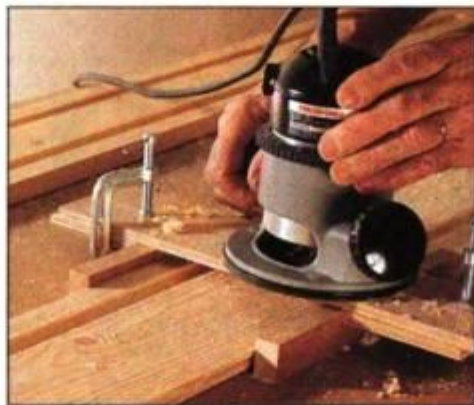
1 Rout the half lap joints with a straight bit. Hold workpiece in a jig that has guide strips to confine the cut to the lap area.



2 After planing one edge of the case sides and stiles, use a circular saw to cut 22½° bevel. Use a straight strip to guide saw.



3 Cut the plate joint slots in the beveled edges of the case sides and stiles. Build a jig to hold the joiner at 22½° if required.



4 Use a corebox bit and router to make the stopped flutes. A shopmade carriage supports router in correct position.



5 Attach L-shaped pieces to side to facilitate clamping side to stile. When the glue has cured, scrape away excess.



6 After back frames have been assembled, secure the beaded paneling with glue and screws driven from the back of frame.

assemble the pieces and then drive four ¾-in. nails from each side of each joint. Double-check that the frames are square and set them aside until the glue dries.

Crosscut the boards for the upper and lower case sides and stiles to finished length. Then, plane one edge of each board straight and smooth. Adjust your circular saw for a 22½° bevel and tack a straightedge guide strip to each piece to cut the beveled edges (Photo 2), and plane smooth.

Mark the joining plate locations and cut the slots with a plate joiner. If your plate joiner fence can't be set for

the angled edge of the work, construct a 22½° platform jig to hold the joiner square to the edge (Photo 3).

Before joining the case sides to the stiles, install a ¾-in. corebox bit in your router and cut the stopped flutes in the sides. Use a router fence to make the cuts, as shown. If you don't have a router fence, mount your router to a shop-built sliding carriage (Photo 4). Set the fence to make the two outer flutes first, then reset it for the middle flute. Rout the blind half laps at the top of the upper case stiles and at the top and bottom of the lower case stiles.

MATERIALS LIST—CORNER CUPBOARD

Key	No.	Size and description (use)
A1	2	¾ × 3½ × 41¾" pine (plinth frame)
A2	4	¾ × 3½ × 29½" pine (plinth frame)
B1	1	¾ × 4¼ × 30¼" pine (plinth back)
B2	1	¾ × 4¼ × 29½" pine (plinth back)
C1	2	¾ × 4¼ × 6½" pine (plinth front)
C2	1	¾ × 4¼ × 36" pine (plinth front)
D1	4	¾ × 3½ × 26" pine (back frame)
D2	5	¾ × 3½ × 29½" pine (back frame)
D3	5	¾ × 3½ × 28¾" pine (back frame)
D4	4	¾ × 3½ × 50" pine (back frame)
E1	1	¼ × 24½ × 28¾" plywood (back panel)
E2	1	¼ × 24½ × 28½" plywood (back panel)
F1	2	¾ × 3½ × 40¾" pine (frame)
F2	4	¾ × 3½ × 28¾" pine (frame)
G	12	¾ × 5½ × 50" pine (back panel)*
H1	1	¾ × 2¼ × 30¾" pine (rail)
H2	1	¾ × 2¼ × 30¾" pine (rail)
H3	1	¾ × 2¼ × 30¾" pine (rail)
I1	1	¾ × 2¼ × 50" pine (doorstop)
I2	1	¾ × 1 × 30" pine (doorstop)
I3	1	¾ × 1¾ × 30" pine (doorstop)
J1	1	¾ × 26½ × 26½" plywood (shelf)
J2	1	¾ × 28 × 28" plywood (top)
J3	1	¾ × 28 × 28" plywood (shelf)
J4	1	¾ × 28 × 28" plywood (shelf)
J5	1	¾ × 31¾ × 31¾" plywood (counter)
J6	1	¾ × 28½ × 28½" plywood (bottom)
K	1	¼ × ¾ × 12" pine (edge band)**
L	4	¾ × ¾ × 5" pine (spacer)***
M1	2	¾ × 6 × 26" pine (side)
M2	2	¾ × 6 × 50" pine (side)
N1	2	¾ × 4¾ × 26" pine (stile)
N2	2	¾ × 4¾ × 50" pine (stile)
O1	2	¾ × 1 × 26" pine (cleat)
O2	2	¾ × 1 × 50" pine (cleat)
P	1	¾" × 5" pine quarter round (trim)**
Q	1	¾ × ¾ × 10" pine cove (trim)**
R	1	¾ × ¾ × 5" pine cove & nose (trim)**
S	1	¾ × 1¾ × 5" pine (cleat)**
T	1	3½" × 5" pine crown (trim)
U1	2	¾ × 1¾ × 12¾" pine (top door rail)
U2	2	¾ × 1¾ × 13¾" pine (top door rail)
U3	3	¾ × 1¾ × 35" pine (top door stile)
U4	3	¾ × 1¾ × 20¼" pine (lower door stile)
V1	2	¾ × 2¼ × 12¾" pine (lower door rail)
V2	2	¾ × 2¼ × 13¾" pine (lower door rail)
V3	1	¾ × 2¾ × 35" pine (top door stile)
V4	1	¾ × 2¾ × 20¾" pine (lower door stile)
W	1	¼ × ¾ × 22" pine lattice (beading)**
X	2	¼ × 9¼ × 17" plywood (door panel)
Y	2	½ × 9¾ × 31¾" glass (door glass)
Z	1	15' glass retainer, No. 27078***
AA	2	¾ × 1 × 1¾" pine (latch block)
BB	2	magnetic latch
CC	2	pair H hinges, No. 76067†
DD	4	knob, No. 76117†
EE	As reqd.	1¼" drywall screw
FF	As reqd.	1½" drywall screw
GG	As reqd.	2" drywall screw
HH	As reqd.	2½" drywall screw
II	As reqd.	No. 20 joining plate
JJ	As reqd.	No. 0 joining plate
KK	As reqd.	1¼" finishing nail
LL	As reqd.	¾" finishing nail

* 1 × 6 beaded tongue and groove.
** Overall quantity indicated, cut to length as reqd.
*** Cut to fit.

† Available at The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374.
Misc: Glue, ½"-rad. half-round router bit (part No. TF82102, available at Trendlines, 135 American Legion Hwy., Revere, MA 02151), paint.

To join the sides to the stiles, first make a set of L-shaped clamping brackets (Photo 5). Cut the upper edge of the short leg of each bracket at 45°. Apply glue to the plate joints and along the beveled edges. Clamp the brackets to the case sides, and draw the sides to the stiles with bar or pipe clamps.

Next, glue and screw together the two rear frame subassemblies to create the back corner frame for the upper and lower cases. Cut to length

12 50-in. pieces of 1 × 6 beaded tongue-and-groove pine. Then, starting at the corner of the upper case frame, attach the boards with glue and screws driven from the back of the frame (Photo 6). Rip the last board on each side to exact width before installing. Follow this step by adding the 3/4 × 1-in. cleats, as shown.

Cut to size the plywood shelves, the upper case top, lower case bottom and counter with a circular saw and plywood blade. Use a sabre saw to finish the long notch on each back edge of the counter. Use a 3/8-in.-dia. corebox bit to rout the 3/16-in.-deep plate grooves in the three upper shelves.

Temporarily clamp the top and the three shelves to the upper case back assembly. Tack triangular blocks to the panels to provide clamping surfaces (Photo 7). Then, bore screw pilot holes for attaching the panels to the back assembly.

Remove the shelves, add the edge banding and attach the spacer blocks, as shown. Reassemble the shelves and

back with screws and glue. Mark the exact position of the upper face rail and install. Finally, bore countersunk pilot holes for installing the side/stile subassemblies and install with glue and screws (Photo 8).

Join the triangular lower case frames to the rear frames with screws and glue (Photo 9). Attach the 1/4-in. plywood panels with glue and nails.

Screw and glue the case bottom and shelf to the assembly, and add the face rails (Photo 10). Finally, secure the side/stile subassemblies.

Miter the ends of the plinth face pieces and slot for plate joints. Then, screw and glue the plinth backs to the triangular frames. Add the long front face piece, and finish the assembly by attaching the ends (Photo 11).



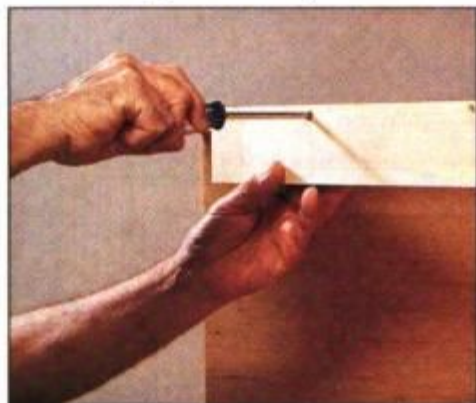
7 After cutting shelf panels, tack triangular blocks to corners and clamp panels to back assembly. Bore screw pilot holes.



8 Join shelves to back with screws and glue. Then, apply glue and install side and stile assemblies with countersunk screws.



9 Use screws and glue to join the triangular lower frames to the back frames. Bore pilot holes to avoid splitting the wood.



10 After the lower case frame and back panels have been assembled, add the rails that go across the top and bottom.



11 Use plates to join the plinth face pieces. Join the long piece to the plinth frame first, then add the short endpieces.

Doors And Trim

Rip the beveled cornice support cleat to size with a 45° bevel on one edge. Then, use a simple wood miterbox to cut the 22½° miters at the exact length. Next, glue and nail the cleats to the case top.

To cut the compound cornice miters, place the stock in the miterbox and tilt it at a 45° angle so its top edge is on the base of the miterbox and the back edge rests against the back of the miterbox. Cut the long section first. Then, cut the miters for the case sides to exact length. Attach the crown molding with glue and finishing nails (Photo 12).

Miter the remaining trimpieces to exact length, and install with glue and finishing nails (Photo 13). Set all nails below the surface, fill and sand smooth. After the molding has been

installed, secure the plinth to the lower cabinet section with 2½-in. screws. Use 2-in. screws to attach the counter to the upper case, and then attach the upper case to the lower case with

1½-in. screws driven up into the bottom of the counter.

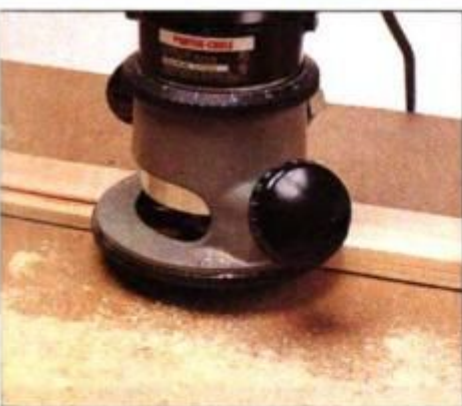
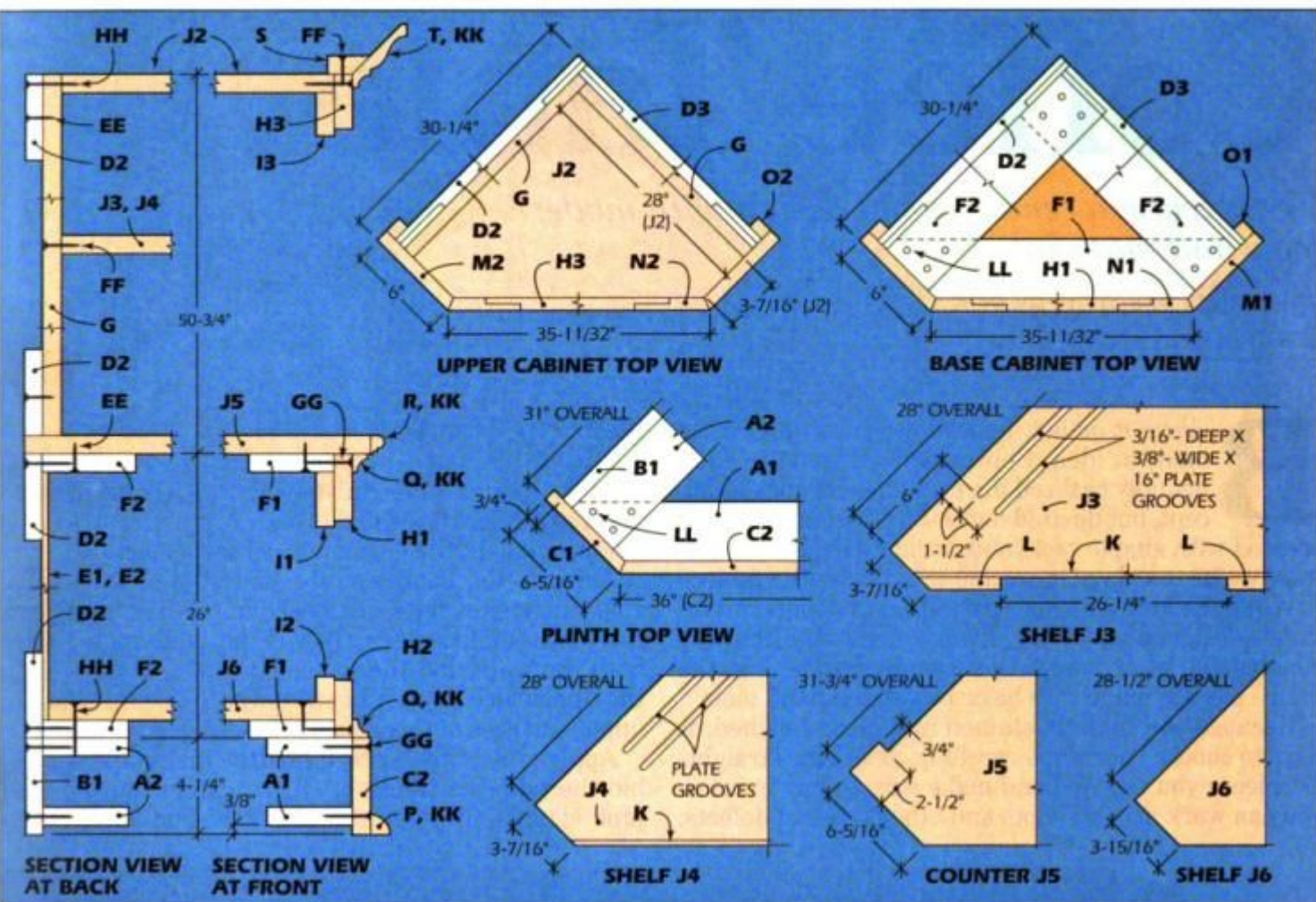
Cut the door rails and stiles from 1 × 3 stock. Use a router to shape the half lap joints. Then, use a 1/8-in.



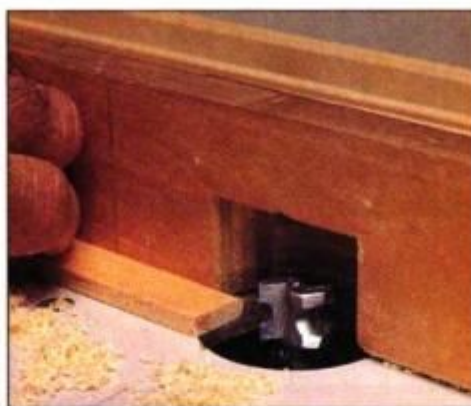
12 Attach the long crown section first. Miter the endpieces to exact length, and then glue and nail to cleat. Set nails and fill.



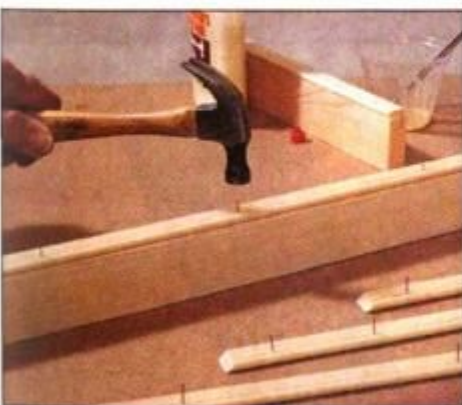
13 Miter remaining molding to length, and install each profile, long piece first. Use glue and finishing nails.



14 Use a router with a piloted slotting bit to cut the slots in the upper door frames for the plastic glass-retaining strips.



15 Make the beading from 1/4-in. lattice. Cut the round edge with a 1/8-in.-rad. half-round bit mounted in a router table.



16 Nail and glue the beading to the door-frame pieces. Then, cut glass and door overlapping rabbets with a router and straight bit.



17 Clamp upper doors in place and shim to achieve equal clearance all around the frame. Then, install the H hinges.

slotting cutter to rout the stopped grooves in the upper doors for the glass-retaining strips (Photo 14). Set up your router table with a 1/8-in.-rad. half-round bit, and round one edge of the 1/4-in.-thick pine lattice for the door beading (Photo 15). Use the miterbox to cut the lattice to length. Then, attach the beading to the inside perimeter of the upper door frames—and along the opening edge of the upper and lower left doors—with glue and 3/4-in. brads placed near the outer face of the door (Photo 16). Rout the rabbet for the glass, and square the corners with a sharp chisel. Then, rout the overlapping rabbets along the door-opening edges, as shown.

Install the glass, cutting the plastic retaining strips to exact length with a knife, and glue the 1/4-in. plywood panels in the lower doors. Finally, shim the doors, mark the hinge and knob screw locations and install the hardware (Photo 17).

To finish the cabinet, remove the glass and disassemble the sections. Apply one coat of latex primer, tinted to the final color, followed by one finish coat of paint. We used Sherwin-Williams Birdseye Maple Latex Satin House and Trim Paint. After it's dry, reassemble the cabinet.

PM

Coffee Table

We interpret a centuries-old design with modern tools and materials.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO,
Contributing Editor

Believe it or not, knockdown furniture isn't a modern idea. Centuries ago, woodworkers not only realized the usefulness of such a concept, but devised novel solutions that could be created with simple tools and without the fancy hardware we have today. One example is the trestle table.

While the idea isn't new, our coffee-table interpretation is designed to suit any living room of the '90s. It's constructed of ordinary 1-in. Common pine, and the entire piece is made with basic power and hand tools.

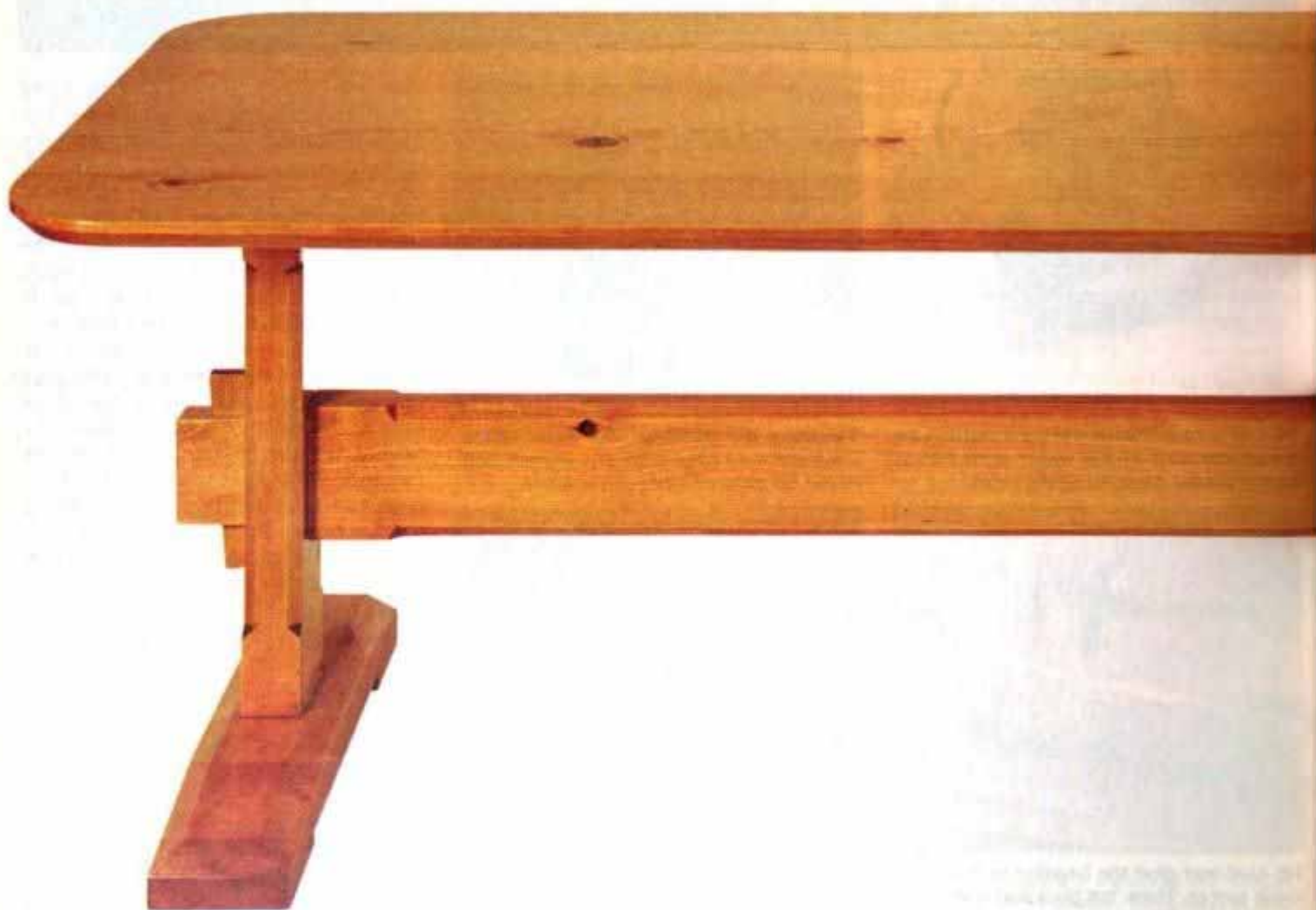
Because the table is stained and clear-finished, it pays to choose your wood carefully. Select the straightest pieces you can find and make sure to buy extra so you can work around knots and other types of defects.

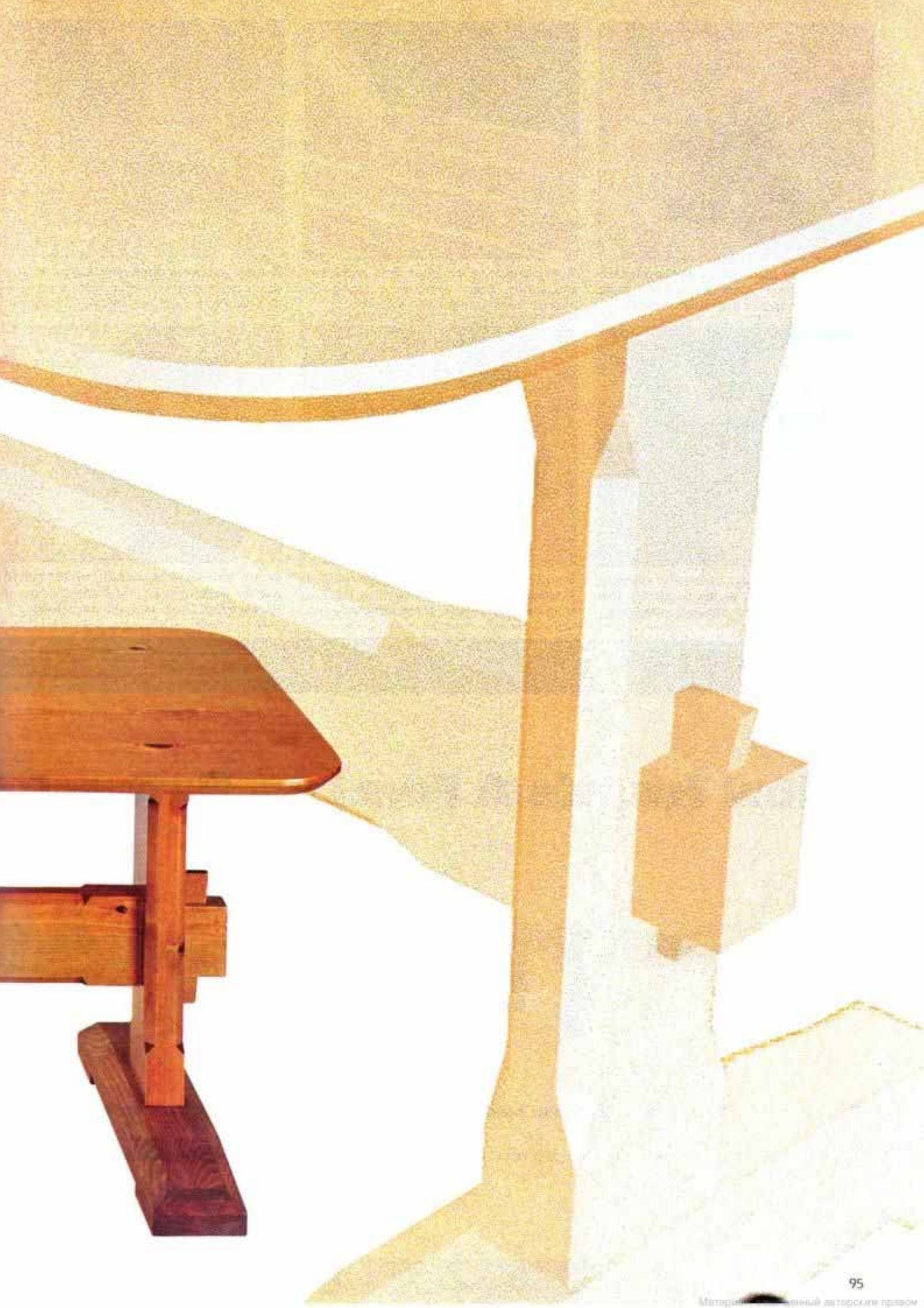
Making The Top

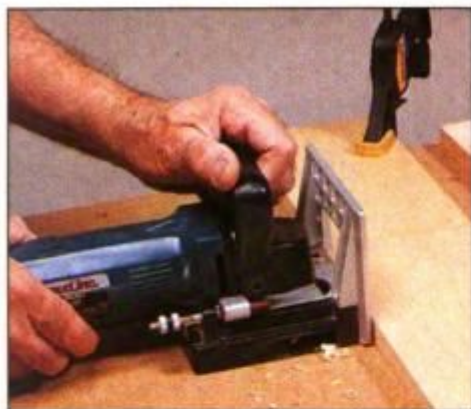
Use your circular saw to crosscut five 1 x 6 boards slightly longer than finished length. Then, rip the boards oversize in width, using a straight strip as a guide, and joint the edges with a hand plane.

Arrange the boards so the direction of the annual rings alternates from one board to the next and mark the plate-joint centers. To cut the plate slots, place both the work and the joiner on a flat surface. Keep the upper face of each board down to ensure that the upper surfaces of the pieces will be aligned (Photo 1).

Apply glue to the slots, insert the plates and assemble the tabletop (Photo 2). Then clamp the top with pipe clamps. To keep the top from buckling, clamp



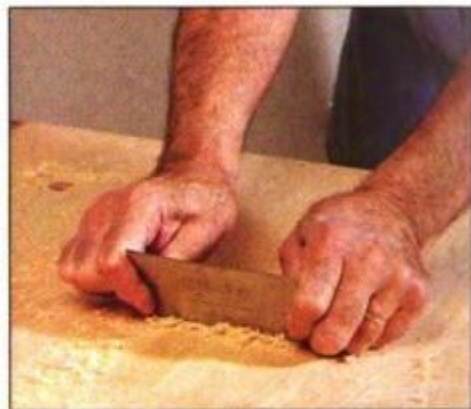




1 Place both plate joiner and workpiece on a flat surface. Mark and cut the plate slots in the edges of the tabletop stock.



2 Apply glue to the plate slots and insert the plates. Then, apply glue along the boards' mating edges and assemble.



3 After removing dried excess glue with a sharp paint scraper, use a cabinet scraper to level and smooth any misaligned joints.



4 Use a circular saw to cut the tabletop to exact length and width. Guide the saw with a straight board clamped to the top.



5 Cut the 3-in.-rad. rounded corners with a sabre saw and circle-cutting jig. Cut from the bottom side of the tabletop.



6 Use a router and piloted chamfer bit to cut the bevel around the bottom edge of the tabletop. Then, sand the top smooth.

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2 × 4s across the boards. Place wax paper under the 2 × 4s to prevent them from becoming glued to the top. After the glue is dry, use a paint scraper to remove the excess, and level the joints with a cabinet scraper

(Photo 3). Smooth the top with a belt sander, followed by a random-orbit or pad sander. Then, cut the tabletop to exact length and width (Photo 4).

To cut the radius at each corner, attach a circle-cutting guide to your

sabre saw and set the pivot point 3 in. from each edge on the underside of the top. Then, make the cuts (Photo 5). Finish by routing the chamfer around the lower edge of the tabletop (Photo 6) and sanding the top smooth.

Making The Beam

Build the 1½-in.-thick trestle beam by first cutting two 48-in. lengths of 1 × 4 stock. Temporarily nail the two boards together to establish alignment holes. Then, use a rule and square to lay out the mortise locations (Photo 7). Separate the boards and carry the lines across the mating faces of the workpieces.

Cut a tapered mortise template out of ¼-in. plywood to exactly match the size and shape of the finished tapered mortise. Then, tack this into position on one of the beam halves. Install a ¾-in.-dia. straight bit in your router, and measure the distance between the bit edge and the router base edge. Cut a cardboard spacer strip to match this dimension. Use the cardboard spacer to align the router guide strips on each side with the plywood mortise template (Photo 8). Then, adjust the bit depth to ¼ in., remove the template and make the cut. Follow by routing the remaining ends of the two

beam halves in the same way. Before gluing the boards together, apply a coat of sealer to the slots. Also, apply a coat of paste wax to the shoulders of the slots to help repel glue. After the glue is dry, cut off the waste.

To form the beam tenons, first lay out the shoulder cuts on the ends of

the workpiece. Clamp two ¾ × 1½ × 14-in. boards to each face of the beam at one end to provide a wide, stable base for the router. Space guide strips with the cardboard spacer, adding approximately ½ in. extra to the length of the tenon. Tack the strips to the beam and make the cut (Photo 9).



7 With the beam halves nailed together temporarily, use a square to lay out the wedge mortises on the beam edges.



8 With plywood mortise template tacked in place, use a cardboard spacer to position router guide strips on one beam half.

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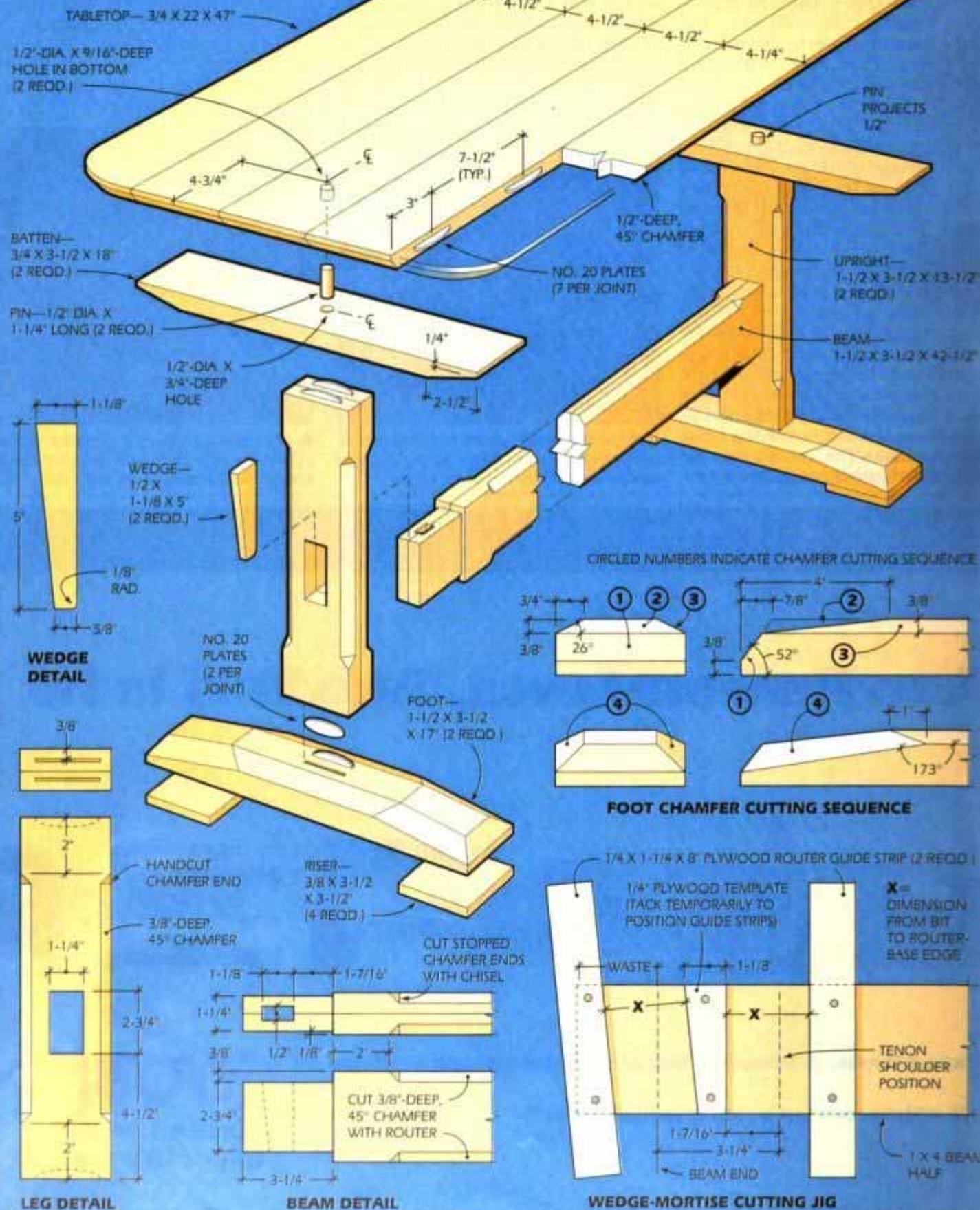
r tools either cost too much or do too little.

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TRESTLE COFFEE TABLE

17" HIGH X 22" DEEP X 47" WIDE

NOTE: BASE MEMBERS ARE MADE FROM 1 X 4 PINE.
TABLETOP IS MADE FROM 1 X 6 PINE



PHOTOGRAPH BY BRUCE HANCOCK

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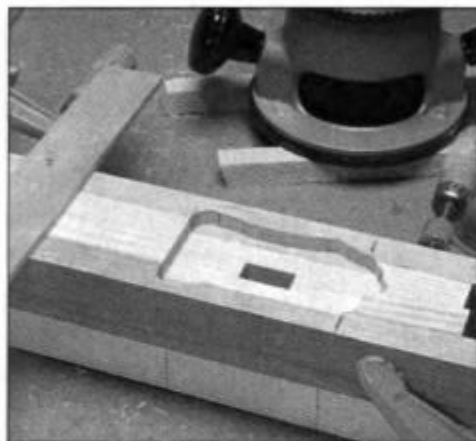
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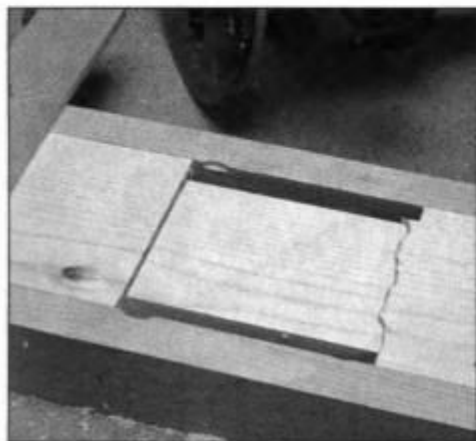
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9 With the beam halves glued, clamp strips to sides and tack guide strips to edge. Then, rout edges of beam tenon.



10 Repeat the process on the faces of the beams to finish the tenons. Make tenons slightly longer than finished length.

After finishing the top and bottom shoulder cuts, repeat the process to make the broad cheek tenon cuts (Photo 10).

Make the leg and feet blanks by gluing together pieces of 1 x 4 stock. Prepare the pieces oversize in length, and drive a few nails in the waste areas at the ends to keep the assemblies from shifting when they're glued and clamped. Plane the edges after the glue has had time to dry.

Legs And Assembly

Lay out the leg mortises, and bore 3/4-in. holes at the ends of each mortise. Remove most of the waste with a sabre saw.

Cut a thin cross-section slice from the end of the beam tenon. Align this on the leg mortise outline and nail plywood strips around it to make a template frame. Install a template bit in your router. This bit has a pilot bearing above the cutting edges. Make the first cut with the bearing aligned with the plywood frame. Then, readjust the bit so it's guided by the first cut and finish the mortise. Square the edges with a sharp chisel (Photo 11).

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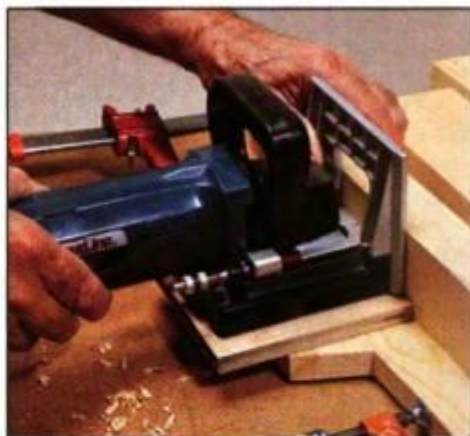
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11 Use a router, template and straight bit to trim the leg mortise to exact length and width. Then, chisel the corners square.



12 After marking slot centers on the feet, shim the plate joiner to make cuts. Follow by cutting matching plate slots in leg ends.



13 After cutting foot end bevel with a handsaw, use a sharp block plane to trim the rough-sawn surface smooth.



14 Use a sharp bench plane to cut long bevels along the top edges of the feet. Then, mark and shape compound bevels.

Cut the feet and battens to exact length and plane to width. Mark the feet blanks and battens to indicate the leg face positions. Then, mark centerlines across the pieces. With a foot resting on edge on a flat worksurface, shim the plate joiner to cut a slot centered $\frac{7}{16}$ in. above the leg face position. After making the first slot in one of the pieces, raise the joiner with an additional $\frac{5}{8}$ -in.-thick shim and cut the second slot.

Cut the corresponding slots in the leg ends (Photo 12). Make the first set of slots with the joiner and stock laying on your bench. Raise the joiner with the $\frac{5}{8}$ -in. shim for the second set of slots.

Mark the feet ends for the first bevel cut, as shown in the drawing. Make the cut with a handsaw, and plane the bevel smooth (Photo 13). The next step is to mark the sloping face bevel and shape it with a hand plane. Follow by planing the long-grain bevels (Photo 14), and shape the compound bevel.

Rout the stopped chamfers, and trim the bevel ends flat (Photo 15). Then, join the legs, battens and feet.



15 After routing the stopped bevels on the beam and legs, use a sharp chisel to cut flat, triangular facets at bevel ends.

Make the beam wedges, and assemble the table base. Use a drill guide to bore a blind $\frac{1}{2}$ -in. hole in each batten. Place dowel centers in the holes, align the top and press to transfer the batten hole locations. Glue a $\frac{1}{2}$ -in. dowel in each batten.

Finish the project with Minwax Wood Conditioner, followed by two coats of Minwax Colonial Maple Stain and three coats of Minwax Clear Semi-Gloss Polycrylic Finish. **FM**

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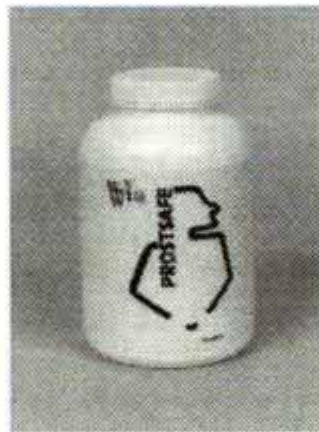
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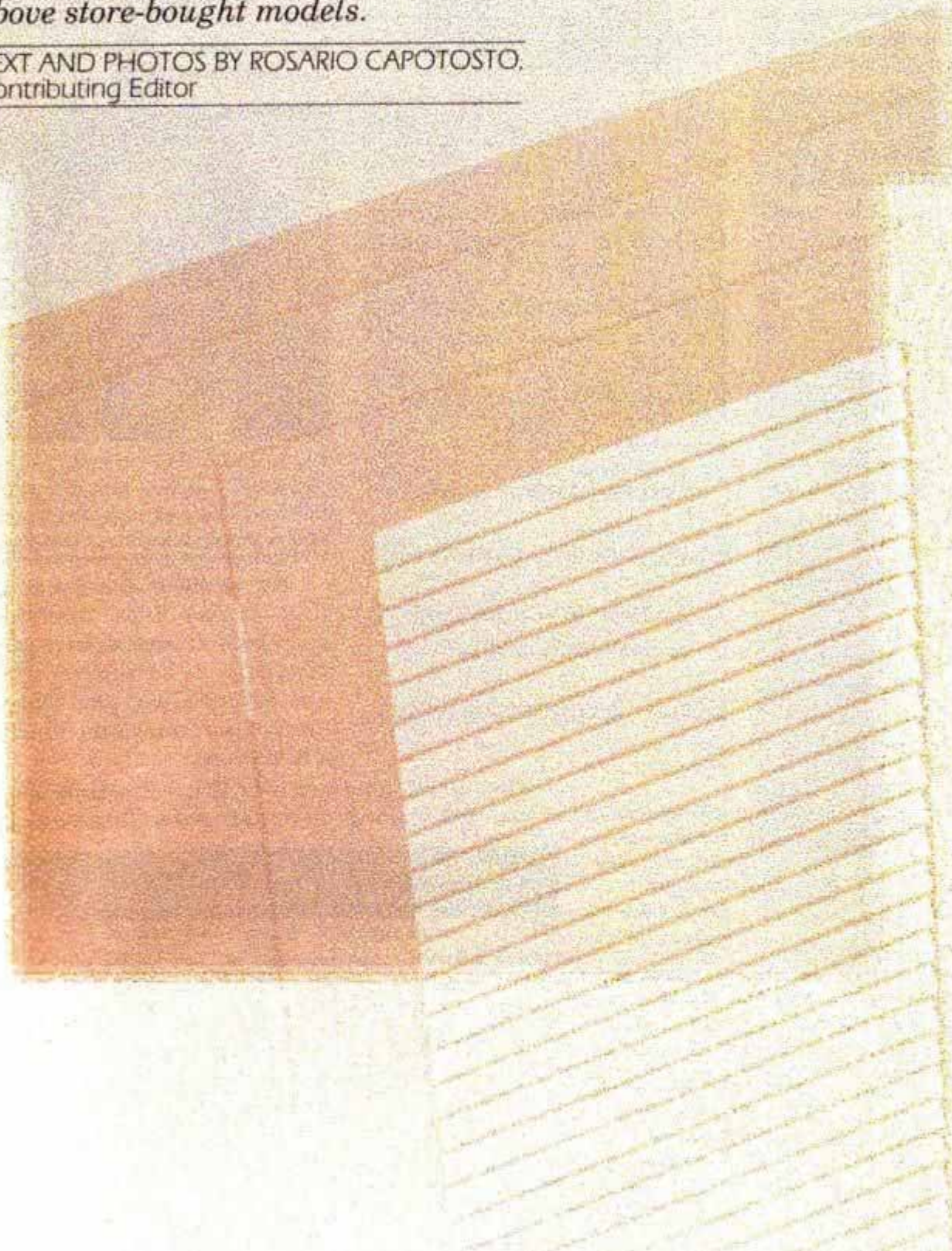
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Bathroom Vanity

*Solid cabinetwork and attention to detail
place this vanity head and shoulders
above store-bought models.*

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO,
Contributing Editor



When it comes to fine home woodworking, the bathroom is probably the last place in your house you think of. However, there's no reason to ignore it.

With a few free weekends, you can produce cabinetry that's better than just about anything you can buy in stores. Plus, you can build what you and your family want and need rather than settling for what's commercially available.

Our bathroom vanity features solid oak and oak-veneer plywood construction, louvered doors and an easy-to-install plastic laminate countertop. The basic construction details are designed for fast, simple assembly, and they can be easily modified to suit your specific requirements. The simple but sturdy drawers are mounted on readily available drawer tracks, and the handsome louvered doors are made with a router jig that we'll show you how to build.

Case Construction

Begin by marking the cutting lines for the case sides, divider, floor and base pieces on the back face of an oak plywood panel. Install a smooth-cutting plywood blade in your circular saw and tack a wooden straight-edge in place to act as a guide when making the cuts.

Switch to a combination blade to cut the solid stock to size for the face frames, doorframes and drawer fronts. Note that the door stiles are cut 6 in. longer than the finished length shown in the Materials List. Use a T-square cutting guide to ensure square cross-cuts. When ripping the relatively narrow rails and stiles, tape the workpiece to a plywood panel, edge to edge. Then, clamp a straightedge ripping guide to the plywood and make the cut. Rip the oak pieces slightly oversize, and smooth the edges with a hand plane. When the oak case pieces are done, cut the pine rear ledger to size. Code each panel and board to indicate





1 Place both joiner and work on a flat surface. Use a plate joiner to cut the plate slots for joining the case pieces.



3 After marking for frame-to-case plates, lay frame on bench to cut slots. Use guide strip to locate divider-stile slots.



5 After the floor and divider have been joined with plates, glue and screw the pine rear ledger to the cabinet divider.

adjoining members so you won't get the parts mixed up. Then, butt adjacent members and mark the joining plate locations on each pair of pieces. On face frame pieces and adjoining plywood parts, mark the plate locations on the two end stiles only—the floor and divider plate slots will be marked after the frame and case have been assembled.

To cut the slots, place the workpiece and plate joiner on a flat surface. Be sure to place all workpieces finish-



2 To cut centered slots in the face frame pieces, place the oak components in a jig that also holds the joiner in position.



4 Cut the notch for the rear ledger on the rear upper corner of the divider. Then, apply glue and secure divider to floor.



6 Apply glue to the side panel slots for joining to the floor and ledger. Use face frame to keep case square while clamped.

side down to avoid misalignment due to stock thickness variations (Photo 1).

To cut the slots in the ends of the face frame members, construct a jig to center the joiner relative to the work. Position a 1 x 2 on each edge of the workpiece. Center your plate joiner across the ends of the three pieces, and mark the joiner base width on the 1 x 2s. Then, notch the ends of the 1 x 2s at the marks, return them to the workpiece and tack a small piece of 1/4-in. plywood to the

MATERIALS LIST—OAK VANITY

Key	No.	Size and description (use)
A	1	3/4 x 3 1/2 x 44 1/2" pine (rear base)
B	1	3/4 x 3 1/2 x 17 1/2" pine (center base)
C	1	3/4 x 3 1/2 x 44 1/2" plywood (front base)
D	2	3/4 x 3 1/2 x 18 1/2" plywood (side base)
E	2	3/4 x 3/4 x 3 1/2" oak (corner)
F	4	1 1/2 x 1 1/2 x 3 1/2" pine (corner cleat)
G	1	3/4 x 20 1/2 x 46 3/4" plywood (bottom)
H	1	3/4 x 20 1/2 x 27 1/4" plywood (divider)
I	2	3/4 x 20 1/2 x 28 1/2" plywood (side)
J	1	3/4 x 5 1/2 x 46 3/4" pine (ledger)
K	2	3/4 x 2 1/2 x 41 3/8" oak (cabinet rail)
L	2	3/4 x 3 x 28 1/2" oak (cabinet stile)
M	1	3/4 x 3 x 23 1/2" oak (divider stile)
N	2	3/4 x 2 1/2 x 15 1/4" oak (drawer rail)
O	6	3/4 x 1 1/2 x 20 1/2" pine (track blocking)
P	3	3/4 x 1 1/2 x 20 1/2" pine (track blocking)
Q	2	3/4 x 3 1/2 x 47 3/4" pine (cleat)
R	3	3/4 x 1 1/2 x 14 1/8" pine (cleat)
S	1	3/4 x 21 3/16 x 48" particleboard (countertop)
T	2	3/4 x 1 1/2 x 21 3/16" oak (trim)
U	1	3/4 x 1 1/2 x 49 1/2" oak (trim)
V	1	3/4 x 22 3/16 x 49 1/2" laminate (surface)
W	1	3/4 x 3 1/2 x 49 1/2" oak (backsplash)
X	6	3/4 x 5 1/2 x 13 3/8" pine (drawer end)
Y	6	3/4 x 5 1/2 x 20" pine (drawer side)
Z	3	3/4 x 13 3/4 x 19" plywood (bottom)
AA	3	3/4 x 7 x 16" oak (drawer front)
BB	4	3/4 x 2 1/4 x 23 3/4" oak (door stile)*
CC	4	3/4 x 2 1/4 x 7 1/8" oak (door rail)
DD	40	3/4 x 1 x 7 1/8" oak (louver)**
EE	1	1 1/2 x 1 1/2 x 4 1/2" pine (stopblock)
FF	2	magnetic catch
GG	2	pair hinges**
HH	5	drawer/door pull
II	3	20" side-mount drawer track set
JJ	As reqd.	1 1/2" finishing nail
KK	As reqd.	No. 0 plate
LL	As reqd.	1 1/4" No. 8 fh screw
MM	As reqd.	1 1/2" No. 8 fh screw
NN	As reqd.	2" No. 8 fh screw

* Finished size shown, cut 6" oversize in length.
 ** 2" No-Mortise hinge (part No. HHG 26026) and 1/2"-rad. half-round router bit for louvers (part No. TF82102) available at Trendlines, 135 American Legion Hwy., Revere, MA 02151.
 Misc: Glue, sandpaper, Minwax Colonial Maple Stain, Minwax Clear Semi-Gloss Polyurethane Finish.

1 x 2s that straddle the work (Photo 2).

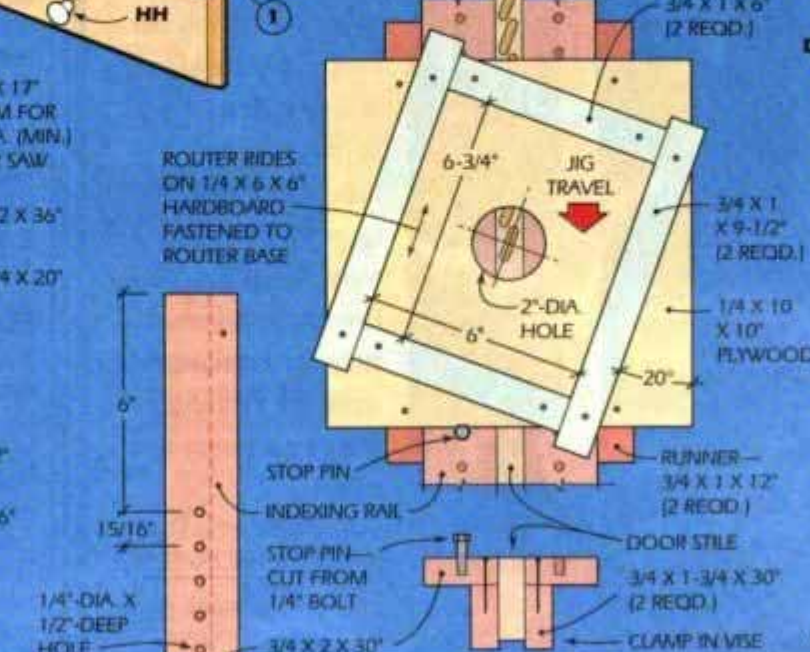
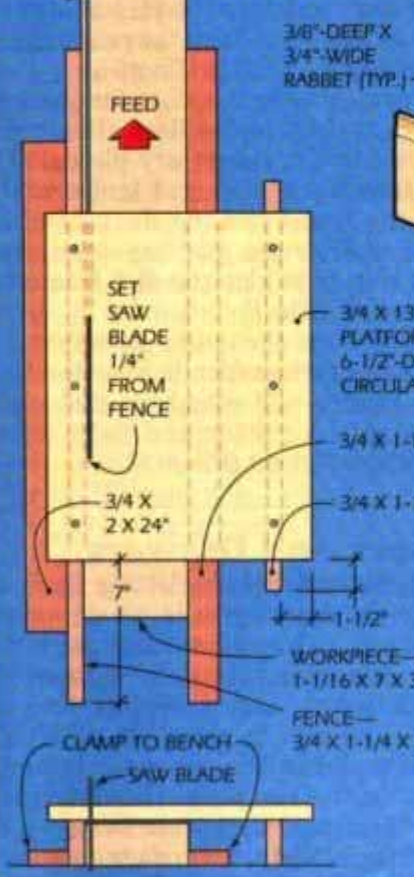
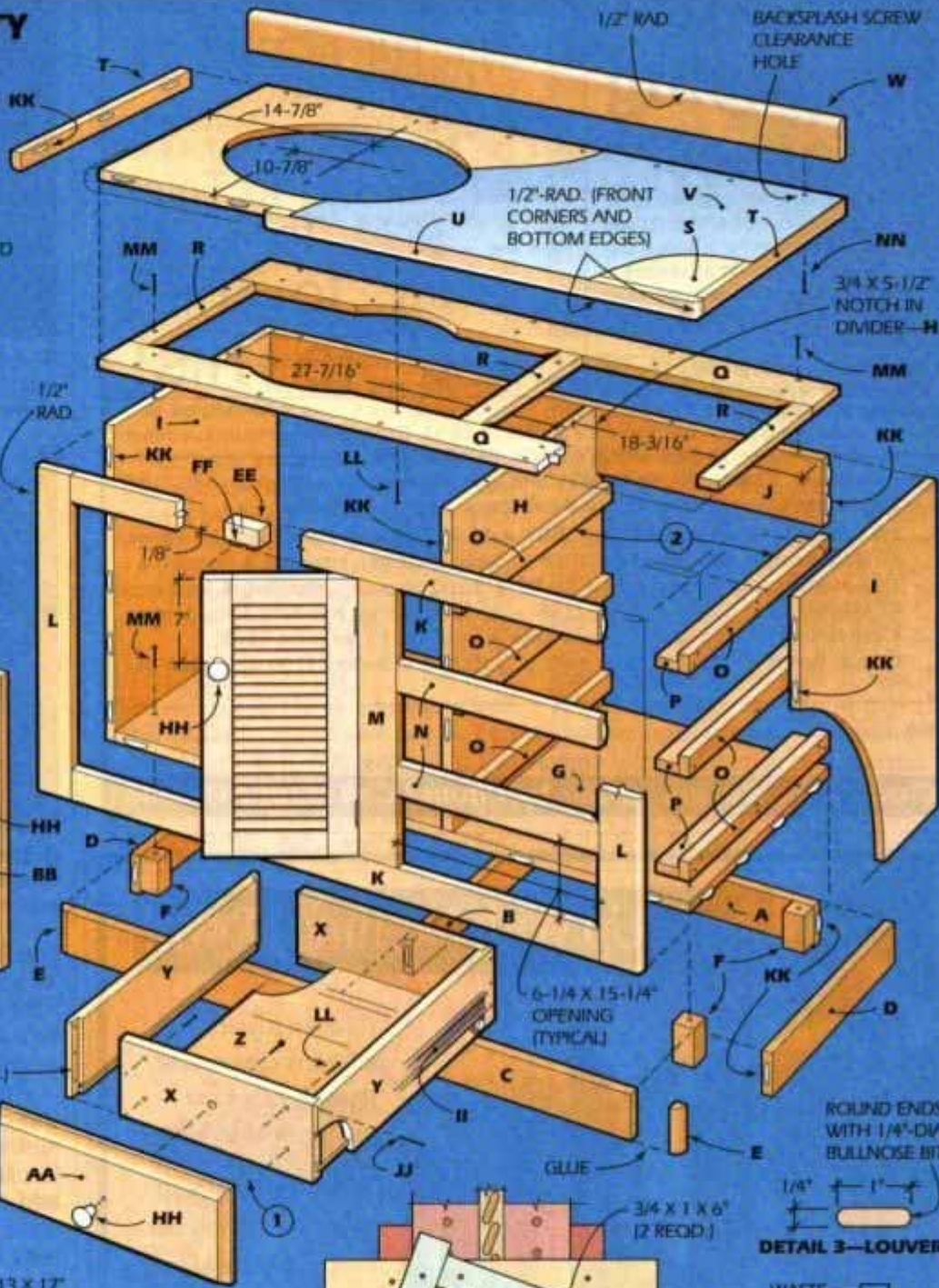
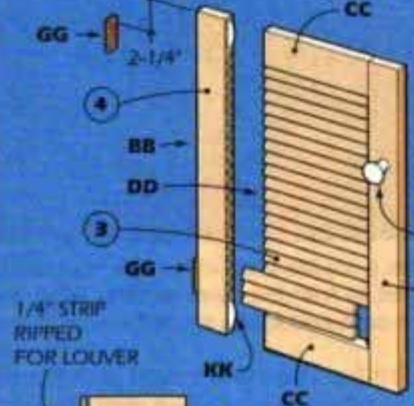
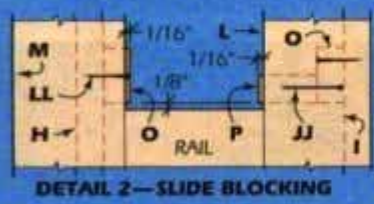
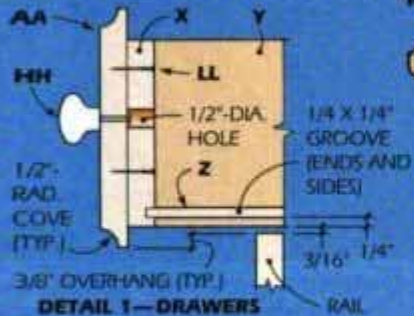
The face frame is assembled in two stages. First, apply glue to the plate slots in the divider stile, drawer rails, right end stile and the corresponding slots in the top and bottom long rails. Don't apply glue to join the left stile to the top and bottom rails. Then, install plates in all the slots and assemble the frame. Clamp the top and bottom rails to the divider stile. Follow this by clamping across to tighten the right end stile joints and the drawer rail joints. Double-check that the frame is aligned properly. When the glue has dried, join the left stile to the top and bottom rails with glue and clamps.

To locate the plate slots for joining the face frame to the cabinet, first insert dry plates in the four cabinet panels and temporarily assemble the sides, floor and divider. Align the face frame over the case panels and mark the centerlines for all the slots. To cut the divider-stile slots, clamp a strip to the stile's rear face to provide a reference guide for the joiner (Photo 3).

Before you assemble the case, use a sabre saw to cut the notch in the

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Woodworking Guide



7 After the glue has dried on the case assembly, glue the face frame in place and clamp. Use cauls to distribute pressure.



8 Use a router and ½-in.-rad. rounding-over bit to trim the case corners. Sand the entire case and frame smooth.

divider for the rear ledger (Photo 4). Then, apply glue to the divider and floor slots and draw the pieces together with screws. Attach the rear ledger with screws and glue (Photo 5).

Apply glue to the slots for joining the case sides to the floor (Photo 6), and assemble. Insert dry plates into the face frame slots and temporarily add the frame to keep the assembly square. After the glue has dried, the next step is to glue the face frame to the case (Photo 7).

Then, sand the entire assembly—a random-orbit sander is best for the face frame—and round the case corners with a router and ½-in.-rad. rounding-over bit (Photo 8).

Doors And Drawers

To build the door-stile slotting jig, first make the indexing rails, as shown in the drawing. Use a doweling jig to bore ¼-in.-dia. holes, ½ in. deep and spaced 15/16 in. apart along the centerline of each ¾ × 2 × 30-in. strip (Photo 9).

Next, build the router carriage. Because the two door stiles are mirror images of the other two, you'll need to rebuild the carriage to angle the cuts in the opposite way after the first two stiles are slotted. At the cen-

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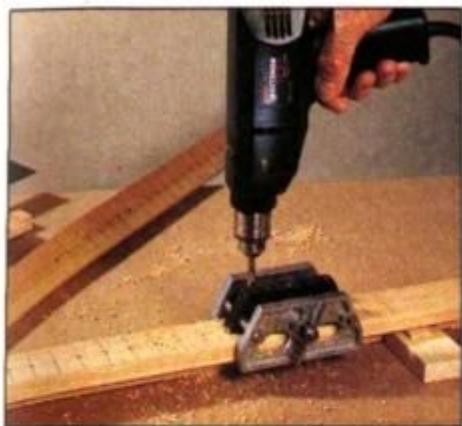
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9 Begin the door-stile slotting jig by making the indexing rails. Bore $\frac{1}{4}$ -in. holes spaced $\frac{1}{8}$ in. apart along the centerlines.



10 Clamp work between rails and butt jig against stop pin. Move pin after each slot. Reverse jig after two stiles have been cut.



11 Align the rails with the louver slots on the stiles. After marking the work, cut the stiles to length and cut joining plate slots.



12 If you don't have a table saw, mount a circular saw on jig and pass work underneath. Have a helper at outfeed side.

the door plate joints (Photo 11).

It's best to rip the $\frac{1}{4}$ -in.-thick louvers on a table saw. If you don't have access to one, you can do the job with a circular saw by first building the louver ripping jig shown in the drawing. Mount this to a piece of hardboard, and secure it to your bench with clamps (Photo 12).

To use this jig, have a helper stand at the outfeed side of the saw as you feed in the wood. When most of the cut is made, have your helper draw the workpiece through from the outfeed side. When done, smooth the lou-

ver faces with a cabinet scraper.

Mount a $\frac{1}{8}$ -in.-rad. half-round bit in a router table, and adjust the fence so that when both edges are rounded, the louver width is 1 in. (Photo 13). Make test cuts on scrap first. Next, round the edges of the oak stock.

Stain and finish the louvers. Then, glue two rails to one stile of each door. When the glue is dry, apply slow-setting hide glue to the remaining plate joints of one door and install the louvers in a stile. As you bring the frame together, shift each louver so it rests in slots on both sides (Photo 14).

ter of the 10-in.-sq. carriage base, draw centerlines angled at 20° and cut the 2-in.-dia. hole. Add the guide frame pieces centered around the 20° centerlines. Attach the runners, spacing them so a stile with an indexing rail on each side will be centered beneath the carriage.

Center and attach a 6 x 6-in. hardboard base to your router. On the first stile, mark the approximate position of the first slot. Clamp the stile between the indexing rails, and place the carriage over it so the carriage is centered at the slot mark. Insert a $\frac{1}{4}$ -in.-bolt stop pin in the nearest hole on the indexing rail, and butt the carriage against the pin. To ensure that the jig won't slip, tack a small nail into the indexing rail at the opposite end of the carriage.

With a $\frac{1}{4}$ -in. straight bit installed, place the router in the carriage frame, tilt it so the bit doesn't contact the work and turn on the router. Lower the bit and guide the router in the frame to make the slot. Then, move the stop pin and repeat the process. After 20 slots have been cut in two of the stiles, reverse the guide frame and complete the other stiles (Photo 10).

Cut all stiles to length so that the slots are aligned, and cut the slots for

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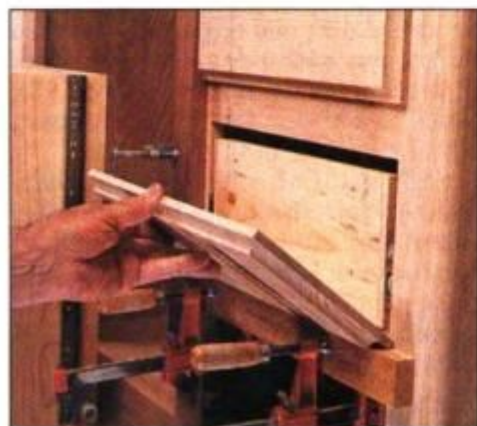
13 Use a 1/8-in.-rad. half-round bit and router table to cut louver edges. Set fence to produce finished 1-in. louver width.



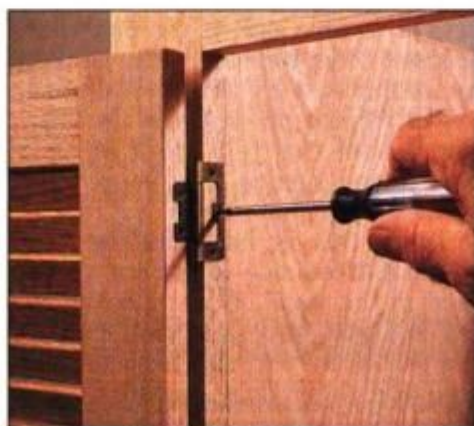
14 Assemble frame with louvers installed in one side. Draw stiles together and lift louvers into opposite slots.



15 Use a router and 3/4-in.-rad. cove bit to trim the drawer fronts. Scrap pieces clamped to edges prevent splitting.



16 Clamp a strip below each door opening to help position drawer fronts. Use partially driven screws to mark pilot holes.



17 Position the louvered doors and mark the screw pilot holes for the hinges. Then, install the doors and check for a good fit.

Then, clamp and repeat the process on the other door.

Cut 1 x 6 pine to size for the drawer sides and ends. Rout the end rabbets on the sides and the groove for the drawer bottom. Assemble the drawers with glue and finishing nails.

Use a 3/4-in.-rad. cove bit to trim the drawer fronts (Photo 15). Install the drawer blocking and tracks. To align the fronts, first drive screws from inside each drawer so the points just protrude. Then, use cleats clamped below each front to hold them in place. Press the fronts toward the drawer to transfer the screw locations (Photo 16). Finally, install the doors (Photo 17).

Final Steps

Cut the oak backsplash and particleboard countertop to size. Trace the sink pattern on the top panel, and use a sabre saw to make the cutout (Photo 18). Cut the oak trimpieces to size, join them to the panel with plates and round their edges with a 1/2-in.-rad. bit, as shown. Attach the countertop cleats and spacers to the cabinet. Place the top in position and bore the screw pilot holes from underneath. Remove the top, and bore the pilot

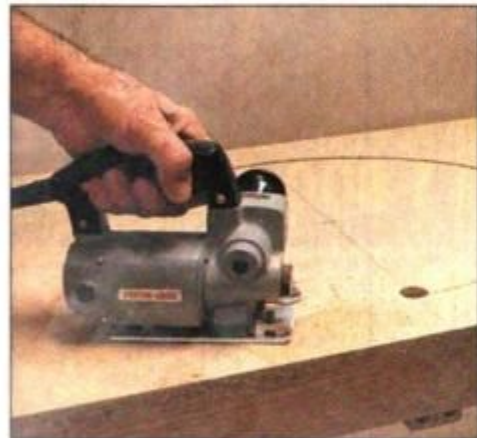
holes for attaching the backsplash. Then round the backsplash, as shown.

Cut the laminate oversize, and apply contact cement to it and the top panel. Place spacer strips on the countertop, and position the laminate on the strips. Pull out the strips one at a time as you press the laminate in place.

Use a router and flush-trimming bit to trim the excess laminate and the sink cutout (Photo 19). Then, slightly bevel the outside edges with a bevel-trimming bit or a flat smooth mill file.

Build the cabinet base by attaching the oak plywood members to the top panel. Then add the quarter-round oak corners, as shown.

We finished the cabinet exterior surfaces, base and backsplash with Minwax Colonial Maple Stain followed by three coats of Minwax Clear Semi-Gloss Polycrylic Finish. Protect the interior panels with one coat of finish. Before installing the backsplash and sink, apply a bead of silicone caulk to the mating surfaces (Photo 20). **PM**



18 Trace the sink cutout pattern on the particleboard top panel. Then, follow the outline with a sabre saw to make the cut.



19 After the laminate has been glued to the top, bore a starter hole and rout the cutout with a flush-trimming bit.



20 Apply a bead of caulk around the cutout before installing sink. Also apply caulk under oak backsplash before securing.



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Bonus Workbench

The most fundamental woodworking tool is built, not bought. Here's one specifically designed for home workshops.

TEXT AND PHOTOS BY
ROSARIO CAPOTOSTO,
Contributing Editor

The focus of any wood shop is the workbench. It's where everything happens—from layout to joinery, tool sharpening to storage. It is the primary tool for woodworking. More than that, it is a project in its own right—one that sets the stage for everything else you build.

Our bench is designed to suit the needs of the home woodworker. Its simple but sturdy construction utilizes lumber and hardware that you can find at any home center or lumberyard (see drawing on page 112). In addition to the basic bench assembly, our design features two main storage cases—one with drawers and the other with a door, shelf and sliding shelf unit that's perfect for holding boxes of hardware and finishing supplies. We've left a space above the cases to provide access for clamping work to the benchtop. At the bench ends, you'll find two shallow cases with fold-down doors. Perforated-hardboard backs and door-mounted toolracks make these great places to store often-used hand tools.

Best of all, this workbench can be customized to fit your needs. You can build it without the storage units, or simply add the cases that suit your collection of tools.

Construction

With the exception of the rabbets, dadoes and grooves in each drawer—and the rabbet in the front panel of the sliding shelf unit—the entire piece is constructed with simple lap and butt joints.

Begin by making the leg pieces out of 1 × 4 and 1 × 6 pine. Mark the pieces so you don't get them mixed up, and cut the rail notches with a sabre saw. Assemble the



legs with screws and glue. Counterbore the screw pilot holes, cover the screwheads with plugs and trim them flush. Round the outer corner of each leg with a $\frac{1}{4}$ -in.-rad. rounding-over bit.

Cut the 1×4 rail pieces and join the inner and outer rail halves with glue and finishing nails. Bore the lagscrew holes in the upper rails before assembling the bench. Then, join the rails to the legs with screws and glue. Cut and install the rail trimpieces.

Make the top from nominal 2-in. lumber. Use dowels and glue to assemble each top and bottom half, then glue the halves together and sand the top smooth. Round the upper edges and corners, and bore the holes for the vise.

Attach the top to the base with the lagscrews. Then, nail the shelf cleats to the lower rails and fit the plywood shelf.

Glue $\frac{1}{4}$ -in. edge banding to the visible edges of the plywood parts, and cut the panels to exact size. Note that the center case is $\frac{1}{16}$ in. shallower than the drawer case to allow for the thickness of the plastic laminate on the back of the door. All three doors are laminated on both sides to prevent warping, while the drawer fronts are laminated only on their outer faces. Assemble the cases with glue and nails. When building the drawer boxes and sliding shelf unit, check that the side clearance matches that required by the drawer slides you're using.

To build the end cases, first add the end-case cleats to the rail edges, followed by the strips that are nailed to the inside leg faces. Then, fit the perforated hardboard backs.

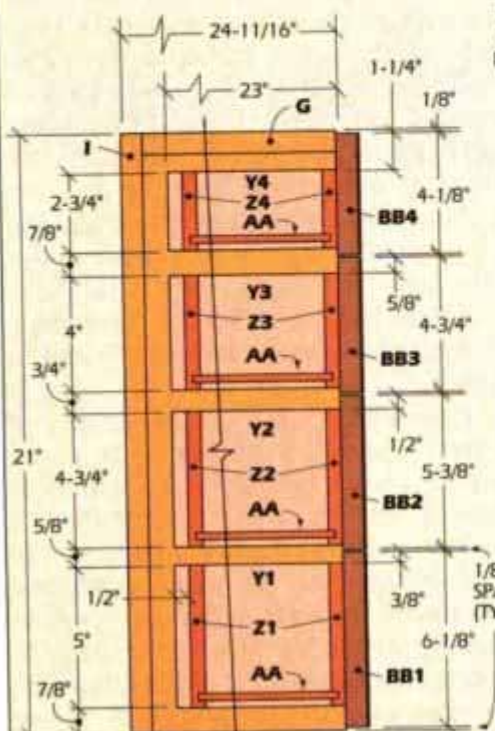
To finish, round the corners of the doors and drawer fronts. Install the doors with strip hinges and attach the drawer fronts with screws driven from the inside. After the handles and end-case chains are secured, mount the vise using a spacer that leaves the vise jaws $\frac{1}{2}$ in. below the top.



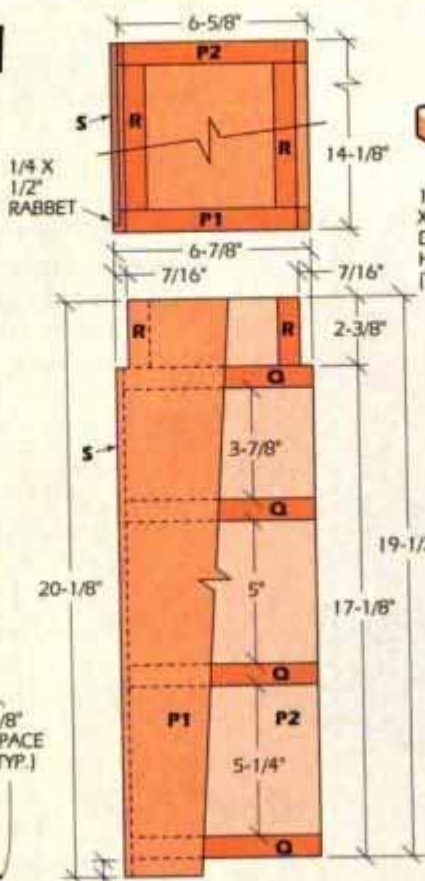
Packed with features, our home-shop workbench will hold all your tools in space-saving, easy-to-access storage modules. And, because the cases are independent, you can customize the design to suit your needs. The compact bench is ideal for limited home-workshop spaces.

WORKBENCH

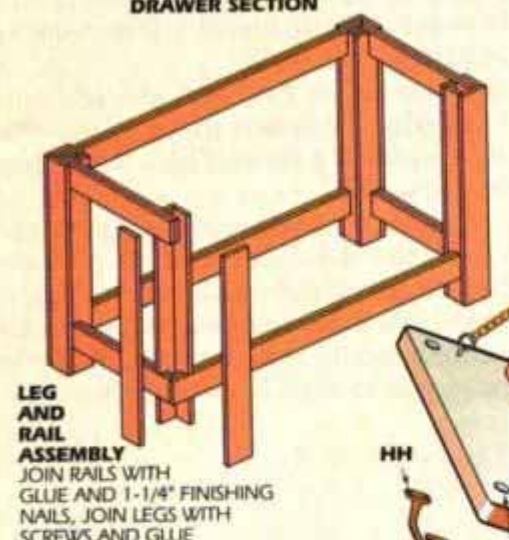
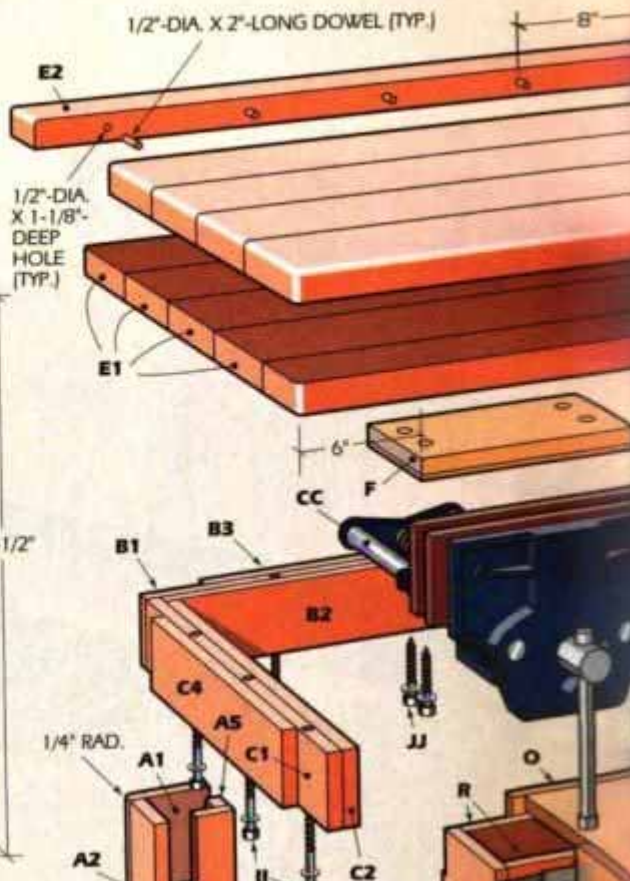
28" WIDE X 35" HIGH X 58" LONG



DRAWER SECTION



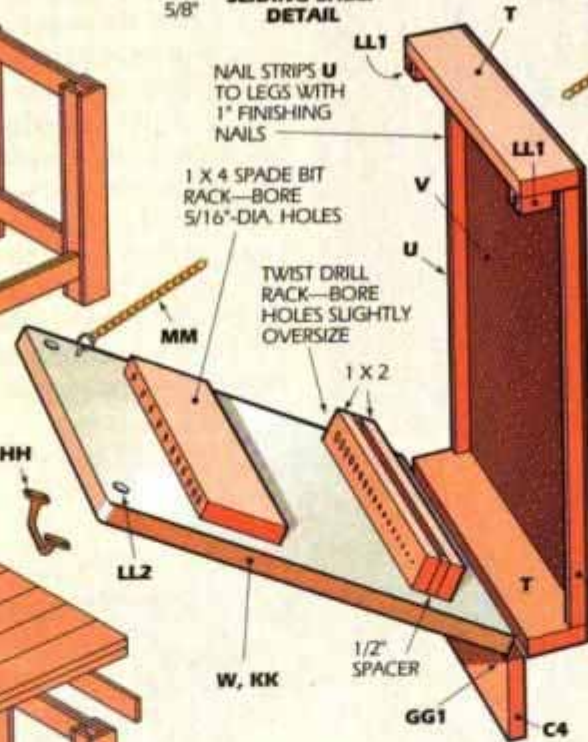
SLIDING SHELF DETAIL



LEG AND RAIL ASSEMBLY
JOIN RAILS WITH GLUE AND 1-1/4" FINISHING NAILS, JOIN LEGS WITH SCREWS AND GLUE



BENCH ASSEMBLY
ATTACH TOP WITH LAG SCREWS, GLUE AND NAIL TRIM AND SHELF



NAIL STRIPS U TO LEGS WITH 1" FINISHING NAILS

1 X 4 SPADE BIT RACK—BORE 5/16"-DIA. HOLES

TWIST DRILL RACK—BORE HOLES SLIGHTLY OVERSIZE

1 X 2

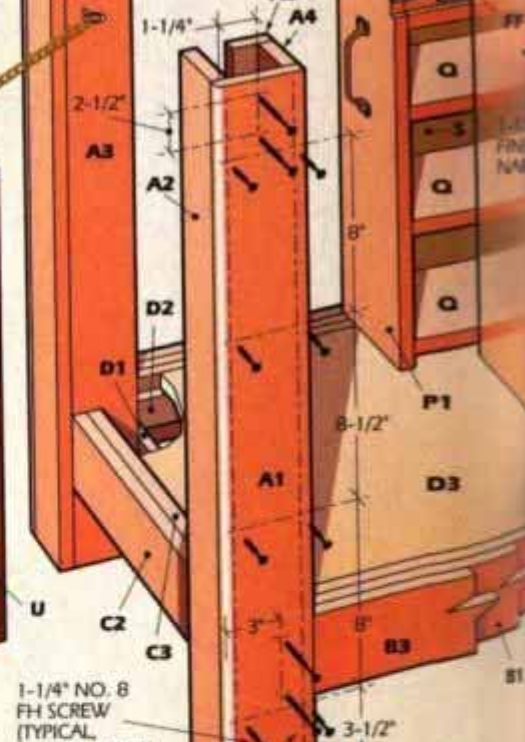
1/2" SPACER

1-1/4" NO. 8 FH SCREW

2-1/2" NO. 8 FH SCREW

1-1/4" FINISHING NAIL

REAR LEG SECTION

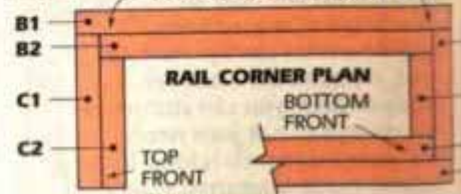


1-1/4" NO. 8 FH SCREW (TYPICAL LEG MEMBERS)

2-1/2" NO. 8 FH SCREW (TYPICAL LEG TO RAIL)

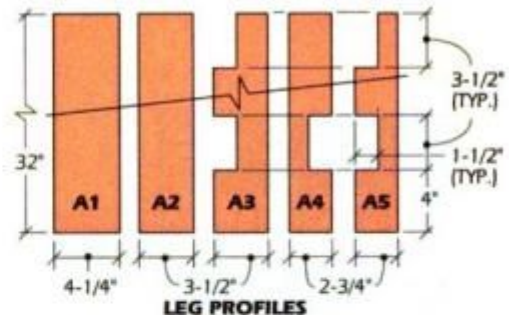
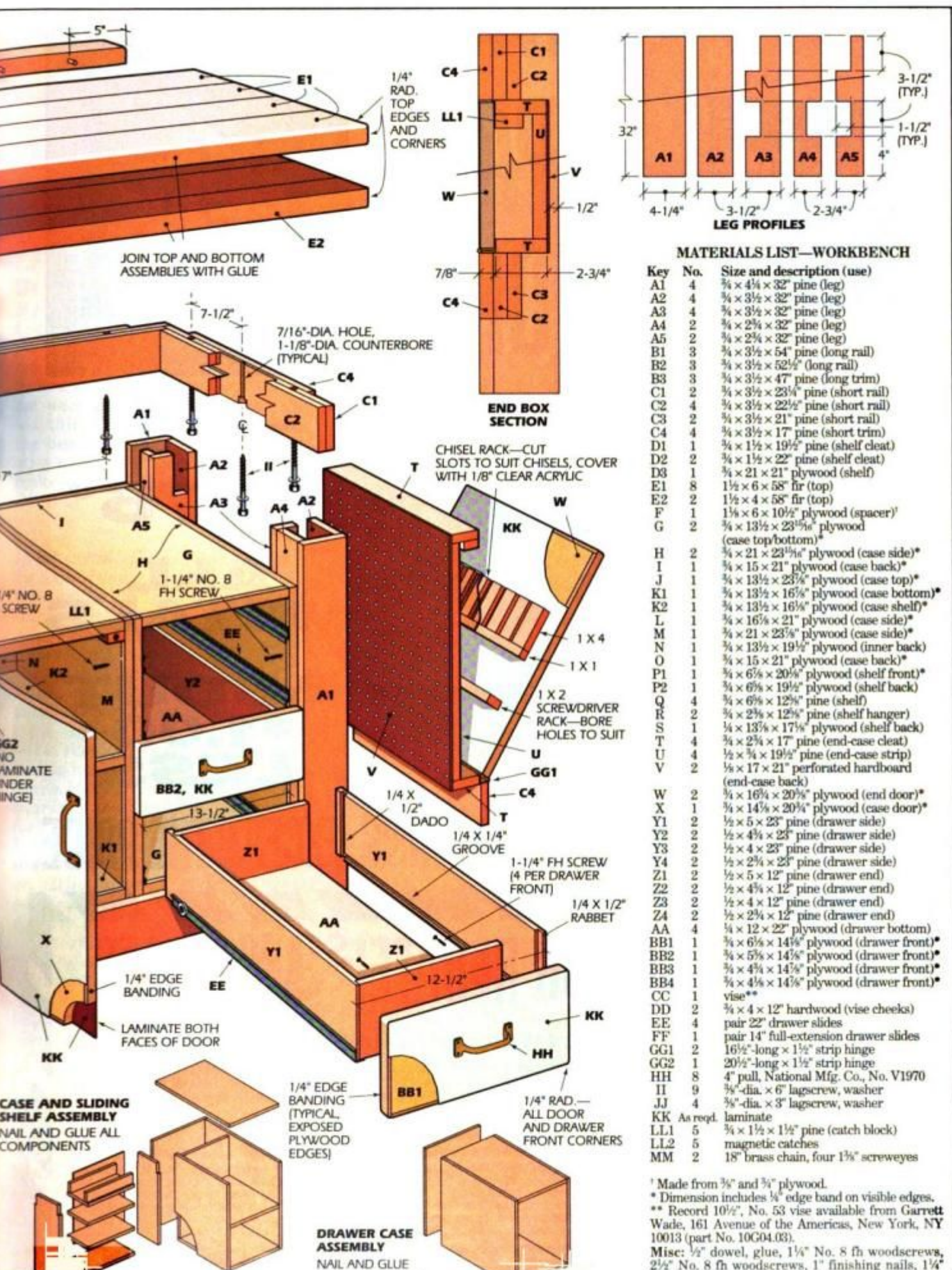
3/8"-DIA. PLUG (TYPICAL)

TOP AND BOTTOM REAR



RAIL CORNER PLAN

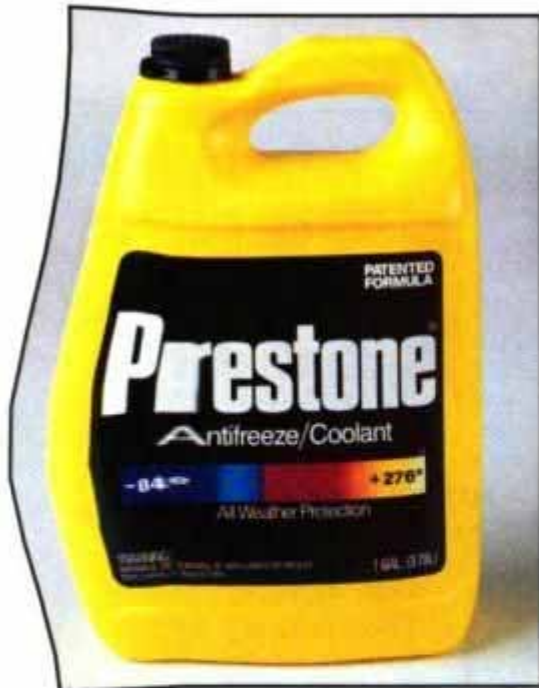
TOP FRONT
BOTTOM FRONT



MATERIALS LIST—WORKBENCH

Key No.	Size and description (use)
A1	4 3/4 x 4 1/4 x 32" pine (leg)
A2	4 3/4 x 3 1/2 x 32" pine (leg)
A3	4 3/4 x 3 1/2 x 32" pine (leg)
A4	2 3/4 x 2 3/4 x 32" pine (leg)
A5	2 3/4 x 2 3/4 x 32" pine (leg)
B1	3 3/4 x 3 1/2 x 54" pine (long rail)
B2	3 3/4 x 3 1/2 x 52 1/2" (long rail)
B3	3 3/4 x 3 1/2 x 47" pine (long trim)
C1	2 3/4 x 3 1/2 x 23 3/4" pine (short rail)
C2	4 3/4 x 3 1/2 x 22 1/2" pine (short rail)
C3	2 3/4 x 3 1/2 x 21" pine (short rail)
C4	4 3/4 x 3 1/2 x 17" pine (short trim)
D1	1 3/4 x 1 1/2 x 19 1/2" pine (shelf cleat)
D2	2 3/4 x 1 1/2 x 22" pine (shelf cleat)
D3	1 3/4 x 21 x 21" plywood (shelf)
E1	8 1 1/2 x 6 x 58" fir (top)
E2	2 1 1/2 x 4 x 58" fir (top)
F	1 1 3/4 x 6 x 10 1/2" plywood (spacer)
G	2 3/4 x 13 1/2 x 23 3/4" plywood (case top/bottom)*
H	2 3/4 x 21 x 23 3/4" plywood (case side)*
I	1 3/4 x 15 x 21" plywood (case back)*
J	1 3/4 x 13 1/2 x 23 3/4" plywood (case top)*
K1	1 3/4 x 13 1/2 x 16 1/2" plywood (case bottom)*
K2	1 3/4 x 13 1/2 x 16 1/2" plywood (case shelf)*
L	1 3/4 x 16 1/2 x 21" plywood (case side)*
M	1 3/4 x 21 x 23 3/4" plywood (case side)*
N	1 3/4 x 13 1/2 x 19 1/2" plywood (inner back)
O	1 3/4 x 15 x 21" plywood (case back)*
P1	1 3/4 x 6 1/2 x 20 3/4" plywood (shelf front)*
P2	1 3/4 x 6 1/2 x 19 1/2" plywood (shelf back)
Q	4 3/4 x 6 1/2 x 12 1/2" pine (shelf)
R	2 3/4 x 2 3/4 x 12 1/2" pine (shelf hanger)
S	1 3/4 x 13 1/2 x 17 1/2" plywood (shelf back)
T	4 3/4 x 2 3/4 x 17" pine (end-case cleat)
U	4 1/2 x 3/4 x 19 1/2" pine (end-case strip)
V	2 1/2 x 17 x 21" perforated hardboard (end-case back)
W	2 3/4 x 16 1/2 x 20 3/4" plywood (end door)*
X	1 3/4 x 14 1/2 x 20 3/4" plywood (case door)*
Y1	2 1/2 x 5 x 23" pine (drawer side)
Y2	2 1/2 x 4 1/4 x 23" pine (drawer side)
Y3	2 1/2 x 4 x 23" pine (drawer side)
Y4	2 1/2 x 2 3/4 x 23" pine (drawer side)
Z1	2 1/2 x 5 x 12" pine (drawer end)
Z2	2 1/2 x 4 1/4 x 12" pine (drawer end)
Z3	2 1/2 x 4 x 12" pine (drawer end)
Z4	2 1/2 x 2 3/4 x 12" pine (drawer end)
AA	4 1/4 x 12 x 22" plywood (drawer bottom)
BB1	1 3/4 x 6 1/2 x 14 1/2" plywood (drawer front)*
BB2	1 3/4 x 5 1/2 x 14 1/2" plywood (drawer front)*
BB3	1 3/4 x 4 1/4 x 14 1/2" plywood (drawer front)*
BB4	1 3/4 x 4 1/4 x 14 1/2" plywood (drawer front)*
CC	1 vise**
DD	2 3/4 x 4 x 12" hardwood (vise cheeks)
EE	4 pair 22" drawer slides
FF	1 pair 14" full-extension drawer slides
GG1	2 16 1/2"-long x 1 1/2" strip hinge
GG2	1 20 1/2"-long x 1 1/2" strip hinge
HH	8 4" pull, National Mfg. Co., No. V1970
II	9 3/8"-dia. x 6" lagscrew, washer
JJ	4 3/8"-dia. x 3" lagscrew, washer
KK	As req'd. laminate
LL1	5 3/4 x 1 1/2 x 1 1/2" pine (catch block)
LL2	5 magnetic catches
MM	2 18" brass chain, four 1 3/8" screweyes

* Made from 3/4" and 3/8" plywood.
 * Dimension includes 1/4" edge band on visible edges.
 ** Record 10 1/2", No. 53 vise available from Garrett Wade, 161 Avenue of the Americas, New York, NY 10013 (part No. 10G04.03).
 Misc: 1/2" dowel, glue, 1 1/4" No. 8 fh woodscrews, 2 1/2" No. 8 fh woodscrews, 1" finishing nails, 1 1/4"



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PKE 995

CAR CARE

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

Bearing Down

My mechanic replaced my front wheel bearings when he was doing a brake job and, as state law requires, gave me the old ones. I got curious and looked at them. They were used, but not necessarily bad. I trust this guy—I think. Should he have replaced the bearings, or just reused the old ones to save me some money? What makes a wheel bearing bad?

JOHN HAGOPIAN
TUCUMCARI, TX

If he installed new brake discs, he would have had to remove the old bearings in a hydraulic press, clean and repack them and press them into the new hubs, so the labor is a wash. The only cost is the new bearings—the wheel-bearing seals need to be replaced regardless when the hub is removed. So we're not talking much money here. If your discs, and bearings, were original and your car has a fair amount of mileage, I'd have used new bearings, too.

Having said that, to the right is an illustration of some bad wheel bearings, from the top:

1. This one is corroded, caused by moisture in the bearing, perhaps from fording streams or deep puddles. It's often seen on trailer bearings. Light corrosion, light enough to polish off with a cloth, is no problem. When you repack the grease, be sure to clean out the bearing cavity thoroughly to remove any water or dirt.

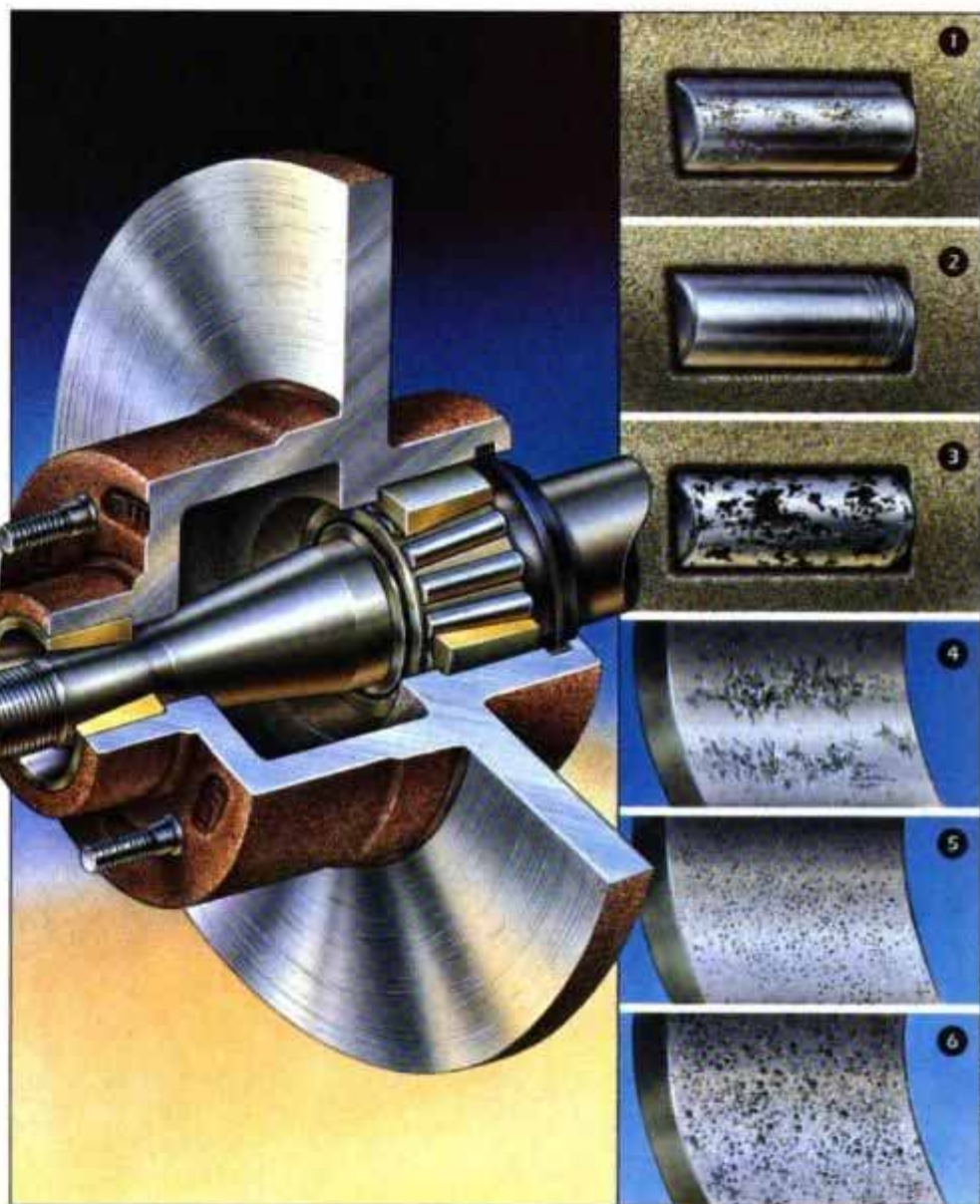
2. The end of this roller is scored from too much preload when it was installed. Replace it.

3. This bearing is so worn it's spalling—that is, losing chunks of metal. Replace it.

4. This outer race is corroded, but it's so badly corroded that it needs to be replaced.

5. This outer race is badly worn.

6. Here's what the bearing in No. 5



will look like within a few hundred miles. The pitting will rapidly turn into spalling.

Forward, Into The Past

You mentioned in your August column how difficult it is to reset an electronic odometer to read less mileage than it has accumulated. Okay, but what can I disconnect on my 1995 GMC to keep the mileage from accumulating? I can drive by reading the tachometer to keep from speeding.

R.E. DAVIS
CEDAR CITY, UT

I'm going to put the part where I tell you that this is illegal and, in fact, a felony in some states at the front of

my reply, R.E., because you seem to have stopped reading my August column before you got to that part.

Now, in answer to your question: You can't.

If you disconnect the vehicle-speed sensor, which tells the speedo and odo how fast the car is moving and how far it has gone, it also shuts off that data to the engine-management computer. This means your engine will never go into the closed-loop mode. You'll have poor performance, poor fuel economy, carboned-up spark plugs, a constantly shining CHECK ENGINE light and a raft of other problems.

And, yes, they did this deliberately so you can't disconnect the odo.

PM ILLUSTRATION BY DOCK MANNERS

Whose Turn Is It To File The Environmental Impact Statement?

Will you tell me if you know of anything that can remove motor oil from an asphalt driveway? **TONI BICOCCHI STRATFORD, CT**

Commercial oil dry is available at your corner grocery store under the guise of kitty litter. This is basically just granulated clay. Sprinkle it liberally on the oil spill or stain. Then, scuff it into the surface with your shoes (wear old shoes). The clay granules will pulverize. Let this remain on the stain for a few days—but don't let it get wet. Sweep up the residue and discard it in the trash.

This will work for most automotive fluids. Concrete driveways will remain stained, however. For really stubborn stains, try some trisodium phosphate, which you can find at paint stores.

Thick As A Brick

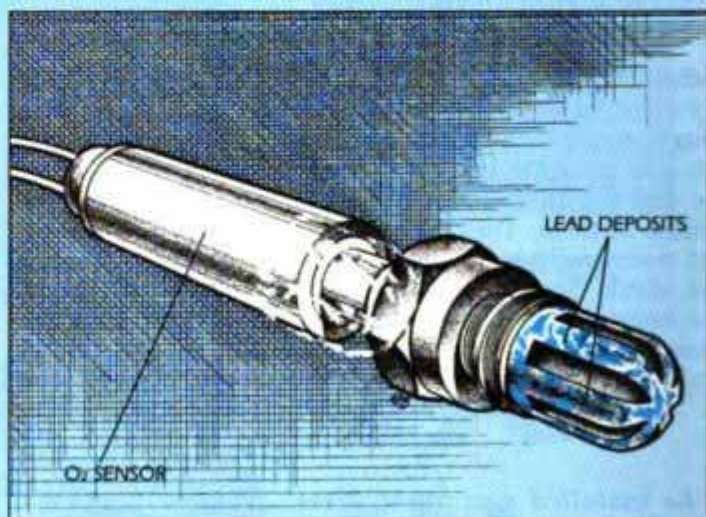
I have a Ford pickup with the 5-speed manual trans. At about 65,000 miles, it started to make a whining noise in Third, Fourth and Fifth gears. I've changed the recommended Mercon

Getting The Lead Out

● Amazingly, leaded gasoline is still available in some areas of the country. I can usually tell when it's being phased out in any one area by the number of letters I get from people asking me if they can use unleaded in their older car or truck. (You can use it for light-duty driving, and there are commercial additives to help.)

But you can't use leaded gas in a lead-free car. Now, no one I know would use the less expensive leaded gas deliberately, of course. But sometimes the two get mixed a little in transit, or a gallon or two of gas intended for the lawnmower gets poured into the car by accident. Problem is, the lead will contaminate the

O₂ sensor, as well as the catalytic converter, almost immediately. Unscrew the sensor and look for evidence of lead buildup. You can replace the sensor—and if the converter isn't too bad, it will clean itself. Don't forget to drain the leaded gas and put in fresh no-lead.



DRIVING WHILE IMPAIRED.

Nobody looks forward to driving in winter weather. From blinding snowfalls that make the highway disappear. To freezing rain that smears across your windshield. This winter, combat the snow and ice with specially designed winter wiper blades from TRICO.

TRICO WINTERBLADES are specially constructed with a protective rubber boot that blocks out snow and ice.

This helps to prevent wiper blade clogging and nasty ice buildup. So you're left with a clearer view of the road, all season long.

Be smart. Drive safe. And purchase new TRICO WINTERBLADES today. Winter driving never looked so good.



ATF every 20,000 miles. I suspect that there's a bearing on its way out. What would happen if I replaced the Mercon with regular 90-weight hypoid lube, like I've used previously in all my other trucks? I did try some brand-name ATF additive, which seemed to make it shift a little easier.

RANDALL MIZES
CHALMETTE, LA

I agree, a bearing is going south. The only real cure is to rebuild.

Do not under any circumstances use anything but the recommended Mercon ATF in your manual trans. It was engineered to use ATF, with clearances, surface hardnesses and shift efforts set up for the lighter viscosity lube. You'll have a hard-shifting, short-lived tranny if you use anything else. And that additive, of questionable merit in an automatic trans that uses ATF, has no business in your manual transmission.

TSBs From Cyberspace

For several years, we've used Alldata Corp.'s CD-ROM-based database for technical service bulletins and service information. It's exhaustive and easy to use. But expensive. Too expensive for the average guy to use just for fixing his own car or truck. Most of Alldata's clients are independent repair shops.

SERVICE TIPS

- GM says sticky cylinder locks need a multipurpose lubricant (PN 12345120), 5W-30 motor oil or spray silicone, in that order. WD-40-type penetrants will evaporate.
- Rough brakes on 1986-93 Ford Taurus and Mercury Sable cars require the use of an on-car brake lathe or new rotors, and softer pads (PNs F20Y-2001-A or F3DZ-2001-C).
- Chrysler has revised the body-control modules (PN 4759227) for 1993-94 LH cars with instrument panels, door locks and interior lights that go spastic.
- Delayed upshifts for the first quarter mile in cold weather plague some 1992-94 Dodge and Jeep trucks. The trans needs a new cast-iron governor-drive seal ring.
- Mitsubishi dealers will replace peeling roof-rack parts on any 1992-93 Expo or Montero that suffers from the inferior-paint problem.
- Hand-tightening the antenna cable at the antenna motor on '93 Jaguar XJ6 models will keep the radio from occasionally losing its presets.

But now, Alldata has expanded to the World Wide Web. Simply log onto its home page and peruse a listing of TSB and recall-campaign titles for any vehicle manufactured since 1966. However, you can't get the whole text of the TSB or recall notice—at least not for free. There are hypertext links to Alldata-Link, including a free demo you can download. Once you have the Alldata-Link software and open an account, you can access the full database.

But just browsing the titles can give you a lot of help. It sounds like a good thing to try before taking your vehicle in for repair, to see if the dealer or repair shop checks for TSBs on their own.

Alldata's Internet address is <http://www.alldata.tsb.com>. **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, e-mail or phone calls cannot be answered individually, problems of general interest will be discussed in this column.

Let's Focus On Why WIX® Air Filters Work Better.

When you take a close look at WIX Air Filters' superior media, it's no wonder other filters don't match up. The non-phenolic pleated cellulose traps particles so small, filtering efficiency is nearly 100%.

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NEW PRODUCTS

Improve Your Car

Latest products to make your vehicle safer, surer and easier to start this winter.

BY CLIFF GROMER, Contributing Editor

● The old ritual of winterizing your car just doesn't hold true anymore. Today's cars ride on all-season tires that can go in snow. Cooling systems are filled with antifreeze that will last for years. Seasonal tuneups are history, as ignition systems fire with 100,000-mile platinum-tipped spark plugs and without maintenance-needy distributors.

So what's to do when the chill of winter nips at your cheeks? There is a whole host of products for your car and winter driving situations that will help keep you going through the worst that the season can dish out. Here are some of them.



Personal Snowplow

Laugh at snow with a lightweight plow that is easily attached and removed from your 2wd or 4wd light truck, van or sport/utility. The Snowbear Model SB50 uses hidden mounting brackets that bolt to your vehicle frame and require no cutting or welding. A remotely operated electric winch moves the blade, eliminating the need for hydraulics. The SB50 costs about \$1000, and is available from Snowbear Products Inc., 32 Ward Rd., North Tonawanda, NY 14120; (800) 337-2327.

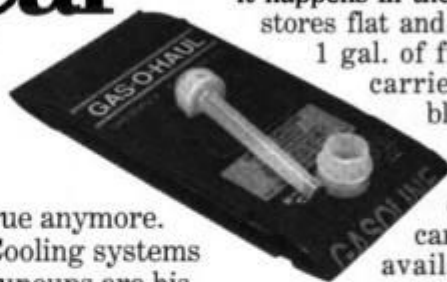


Driveway Ice-Melter

Ice is one of winter's nastier tricks. You slip and slide, and so does your car. Rock salt is the usual weapon against ice, but Prestone's new Driveway Heat may work better. While rock salt starts losing effectiveness at 20° F, Driveway Heat works down to -25° F. It also melts to a clear solution so you won't track a white residue into your car or home. A 9½-pound jug costs \$6.99, and is available at auto supply stores. Contact Prestone Products Corp. at (212) 593-6400.

Emergency Gas Carrier

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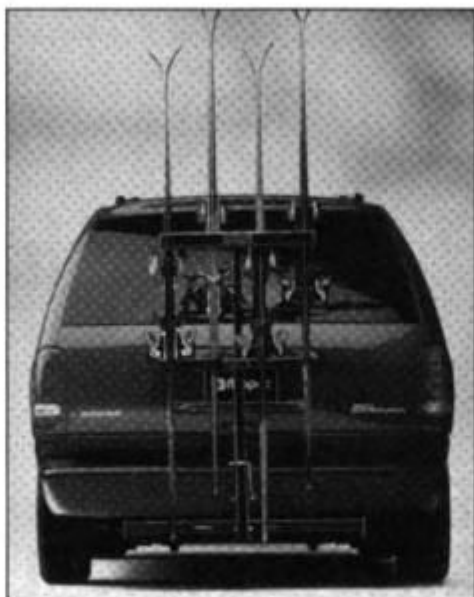
High-Performance Radiator

Winter isn't normally associated with a need for additional cooling, but heavy snowplowing or slogging through rough snow—especially off-road—can tax your cooling system. The Ready-Rad Heatbuster radiator is a bolt-in upgrade that gives your system up to 20% more cooling capacity. The brass and copper radiator uses an extra row of specially louvered fins. Prices range from \$284 to \$494, depending on the model. It's sold at auto parts stores and radiator shops. Contact Go/Dan G&O Industries, 100 Gando Dr., New Haven, CT 06513; (800) 755-2160.



Snow Radial

Studded snow tires work great on ice—where they're legal—but the drumming of studs on dry pavement can drive you crazy. Dunlop's new Graspic S200Z M&S tire features a unique studless ice compound that's said to deliver good ice and snow performance. The Graspic comes in popular 60-, 65- and 70-series sizes, and is available through independent tire dealers. The price for a 205/65R15 is about \$85. Contact Dunlop Tire Corp., P.O. Box 1109, Buffalo, NY 14240; (716) 639-5200.



Ski Rack

Winter snow needn't always be a constant source of dread—especially if you're a ski buff. Owners of the popular Chrysler minivans with receiver hitches will like the convenience of their hitch-mounted ski carrier. You can load up to four pairs of skis on the carrier, which features a tab for locking the skis to the carrier and the vehicle. The ski carrier has a price tag of \$190, and is available through all Chrysler/Plymouth and Dodge dealers.

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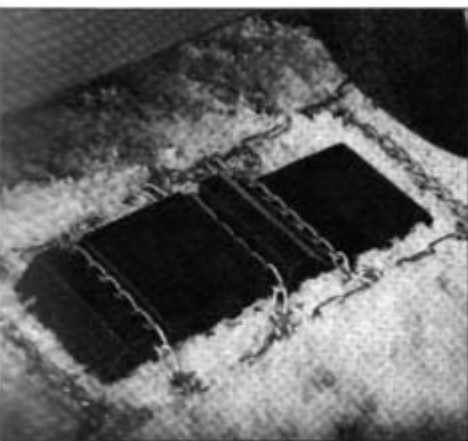
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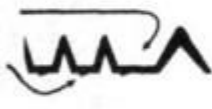
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THE ROAD BACK

An oval and a road race—life's getting better.

BY AL PEARCE



PHOTO BY DON HUNTER

● NASCAR visited two of America's most famous motorsports venues on consecutive weekends in August, and the Western Auto/POPULAR MECHANICS team had solid runs at both.

Darrell Waltrip, driving the Chevrolet Monte Carlo race car, qualified 20th and finished a lead-lap 17th behind winner Dale Earnhardt in the Brickyard 400 at the 2½-mile Indianapolis Motor Speedway.

A week later, in ideal conditions, the team started 27th and finished an impressive eighth in the 90-lap race Bud At The Glen. The season's 20th race was around the 2.54-mile Watkins Glen International road course in upstate New York, which Mark Martin won for the third consecutive time.

Brickyard 400

Last year, in the first Brickyard 400, Waltrip started 27th and finished sixth, and then rode that momentum to eight more top-10s in the final 12 races of 1994.

This year's finish wasn't as good, perhaps because the 160-lap race went so long before its only caution, at lap 133. Down the straightaways, Waltrip's Chevy ran well, but seemed sluggish off each of the four corners. An early caution would have offered a chance to make needed adjustments, but it never came.

"I don't know if we got water in the ignition or the fuel tank," he said afterward. "When you're not running



Before the start of the Brickyard 400, Waltrip rolls out of Indy's hallowed Gasoline Alley.

well and the race stays green for a long time, you're in trouble because you don't have time to work on the car. Under green, you have to pit, do



The Western Auto/PM Monte Carlo ran fast down Indy's two straightaways, but slowly in the corners.

what you can and get back out. "We made some adjustments as we went along and were better at the end. Maybe if we'd had a caution or two early, we could have adjusted some things and blown out the distributor with the air hose. That might have put us right there. But 'ifs' don't count in this business."

Waltrip was sixth at lap 100 and ninth at lap 130, but lost any shot at a top-10 when he pitted under green and dropped to 18th. Moments later, the day's only caution slowed the pace and allowed drivers who hadn't already pitted to get their final service without losing as much track position.

Bud At The Glen

The Western Auto/PM team got its sixth top-10 of 1995 in the season's final road race. Despite starting 27th, Waltrip used fuel efficiency and heady driving to quickly move toward the front.

He gained nine positions in the first 25 laps, and briefly sat as high as second after 30 laps. He settled into the top-10 for good at lap 65, reaching seventh place at lap 70 and sixth place by lap 80. He lost two spots when he slid off-track while trying to take fifth away from Terry Labonte, going into Turn 1 at lap 86.

"I'm hungry and wanted to be in the top-5," he said of his bold but unsuccessful maneuver. "I went for it into Turn 1 and saw that I wasn't going to make it. I had passed a lot of cars down there, but there's a real fine line between going in right and going in too far. I got a little too aggressive."

"Overall, though, I'm very pleased with our run. This was more fun than I've had in a long time because this was the best car I've ever had here." **PM**

gearing. And while that supercharged Four is in an odd place—mounted midships, lying on its side under the floor between the front seats—there's nothing unusual about the way it works. Its 161 hp and 201 ft.-lb. of torque cranked the Previa DX to the second-best acceleration runs of the group, coming up on 60 mph just a tenth of a second after the Lumina and clearing the quarter-mile two-tenths behind the Chevy. The Previa was about 2 mph slower through the traps than the Lumina, however.

Besides its somewhat unorthodox—particularly for a minivan—engine, the Previa offers its own spin on a minivan interior as well. The third row of seats splits and folds against the sides of the van—up and away. And the dashboard features some of the biggest, most compound curves this side of Watkins Glen.

However, style aside, the Toyota's interior matches—or exceeds—the Honda's for flawless fit, finish and feel. This van has quality-feeling and quality-looking materials all over. It also has a decent amount of space inside—152.3 cu. ft.

There are also dual airbags inside. However, to get antilock brakes sets you back more than a grand. And the a/c in our van came as part of a package that included power windows, locks and mirrors, which added almost another three grand. The ABS on the Previa is definitely money well spent—this van used up the least amount of road to stop from 60 mph. However, its long-travel, softly sprung suspension kept the Previa rocking on its springs each time we stopped it. Yet, despite the somewhat nautical ride, the Toyota's handling is actually pretty good—middle of the pack on the skidpad and through the slalom.

GMC Safari SLT

Like the Chevy Astro, the GMC Safari presents a no-nonsense face to the minivan world. This van, like the Aerostar, is built the old-fashioned way—body on frame. And like the Aerostar and Previa, the Safari is available as either a rear-wheel or all-wheel drive. For our test, we drove an awd version.

For '96, the Safari—along with its Astro twin—has a new interior, which comes with dual airbags. The shape of the engine cover has been changed and the center console is canted toward the driver. There's a storage compartment on the passenger side of the console.

The interior also benefits from GM's latest series of sound systems with speed-sensitive volume control. Other interior changes include more storage and headrests on the middle

and third row of seats. Coming to the minivan later in the year, will be GM's interpretation of built-in child safety seats.

But the Safari's really strong suit is its engine. The 4.3-liter V6 is the largest powerplant in the group, and it cranks out the most usable torque: 260 ft.-lb. With that kind of moxie and the separate frame, the Safari (and Astro) is the minivan of choice when you need to tow something. The Safari has a 5000-pound tow rating. And, it means it.

Inside there's an awful lot of cargo room—170 cu. ft., second only to the Grand Caravan. Antilock brakes and air conditioning are on the standard equipment list, so this minivan is ready to work.

However, remember, with its truck-derived lineage, the Safari has a ride that's harsher and more choppy than any of the vans in this group. It also fared in the bottom tier as far as handling and noise levels. And price-wise, our well-loaded SLT sat near the top.

Ford Aerostar XLT Extended

The Aerostar was Ford's fast and initial response to the minivan swell created by the Caravan in '84 and the Astro/Safari in '85. Ford put the Aerostar out on the market as an '86 model and used it to buy time while developing the Windstar. The plan was to retire the Aerostar once the Windstar was up and running.

Well, here we are, Aerostar and Windstar, side by side.

The Aerostar's virtues of either rear-wheel or all-wheel drive, body-on-frame construction and choice of regular or king-size have kept the van alive and relatively well. In fact, it's still the best-selling rear-drive minivan in the country.

However, since Ford keeps thinking that the minivan won't be around much longer, the company has done little to update it.

The differences between the '96 models and the '95—or '94 or '93, for that matter—models are miniscule. The Aerostar just goes out and does what it does without a fuss.

Its ride is trucklike, like the Safari's. Its handling is mediocre for this group, like the Safari's. It's noisy like the Safari, as well. Where the Aerostar stands alone—unfortunately—is in its dismal braking performance. It took nearly 20 more ft. for the Ford to get stopped from 60 mph than any other van we tested—you see, the Aerostar is the only van equipped with rear-wheel-only antilock brakes. It's also equipped with only a driver's-side airbag. **PM**

(Continued from page 75)

POPULAR MECHANICS test-car career in a rather ignominious manner. It was our office beater. Everybody drove this car during those three months, from auto editors to summer interns to the wives of vice presidents.

And while everyone was beating on the Neon, it remained calm and cool,

TEST SUMMARY: PLYMOUTH NEON HIGHLINE

Report number: 4
Total miles driven: 12,445
Miles driven since last report: 2250
Average fuel economy: 26.4 mpg
Worst observed fuel economy: 19.7 mpg
Best observed fuel economy: 36.5 mpg
Maintenance/repair costs: none

dependably fulfilling a multitude of transportation needs.

This kind of duty is severe. The Neon came through with flying colors, including one stretch last summer where the temperature hovered between 95° and 105° F every day for almost two weeks straight. Our test Neon spent most of that time sitting in Manhattan traffic—idling, windows up, air conditioner blasting.

We'd recommend a Neon to anyone. It's a bit rough around the edges, but it's tough, fun to drive and big on the inside. —J.O.

Nissan Maxima SE

Driving L.A.'s maze of freeways in this 190-hp 5-speed Maxima means your reactions have to be quick and awareness keen. Things happen fast.

Redline two gears and you're gone. Sports car gone. This has to be the best V6 engine in the universe. Power up and down the rev range. Smooth like frozen yogurt.

Crank in some mph, and the car stays right with you. The suspension never bails out, even when things get

TEST SUMMARY: NISSAN MAXIMA SE

Report number: 3
Total miles driven: 15,287
Miles driven since last report: 6990
Average fuel economy: 25.9 mpg
Worst observed fuel economy: 20.4 mpg
Best observed fuel economy: 28.4 mpg
Maintenance/repair costs: scheduled 12,500-mile service, \$21.29

serious. During hours of long-distance hauling or around-town driving, the Maxima never loses its sense of humor, remaining at the ready for hurried acceleration or a directional change.

Since its last report, our test car has solidified, leaving a growing list of teething problems behind it.

We find it insulting, however, that the buyer of a \$28,000 Infiniti I30, which is essentially the same car as the Maxima, gets a trunk net for his briefcase and a backseat ceiling hook for his suit jacket, and the buyer of a Maxima does not. Our car's sticker price was over \$27,000. We want our net and little plastic hooks. —S.O.

a big help for homesick retirees who want to keep up on the town they left behind, for anyone interested in a major news story taking place in another city (Access Atlanta plans extensive coverage of the 1996 Summer Olympics) and for people who want to find a job or home in another city across the country.

"We have by far the best high-tech employment classifieds in the country," says Barry Parr, product development manager of Mercury Center, available from the *San Jose Mercury News* on America Online and on the Web. "Suddenly, the positions in those ads are available to people who don't have access to the paper."

Despite all of the high-tech advantages that computerized newspapers confer, the youth of the medium makes it impossible for publishers to confidently predict which of their features will turn out to be the most popular with readers. On the World Wide Web incarnation of Mercury Center, drawn from a paper famous for its coverage of the computer industry, what do readers gravitate to? "The comics," says Parr. "It turns out to be a lot more popular than we would have guessed—probably the single most popular thing on the service," he says.

To a lesser degree than newspapers, television news organizations are also going online. If a local television station maintains a site on the World Wide Web, the news area is typically limited to pictures and profiles of the local newscasters. At the network level, CBS is taking tentative steps onto the Web. The only CBS News show to get more than cursory Web treatment last summer was the little-known overnight broadcast "Up To The Minute." UTTM's site included synopses of some of its stories, such as one covering religion on the Web that included hypertext links to Jewish, Catholic and Muslim sites.

ABC obviously puts a lot more effort into the ABC News section of America Online. Its site includes such elements as conference areas for getting together with newsmakers and an archive of transcripts of some of its stories, such as its American Agenda features.

The most interesting incarnations of TV news on the Web are tied to the cable services C-SPAN and CNN. As part of its coverage of the 1996 presidential campaign, C-SPAN has a Web page devoted to the campaign announcement speeches of all the major candidates, along with a speech from President Clinton about balancing the budget.

Political junkies can not only read

these speeches but listen to them, too, thanks to the RealAudio software available for free downloading. Unlike the usual procedure for listening to audio on the Web—spending minutes downloading a file to hear a few seconds of sound—the RealAudio speeches are audible as they download to a home computer in real time. The only disadvantage is that the speeches sound as if they're coming through an ailing telephone with a weak connection.

One of CNN's computerized outposts is the Internet CNN Newsroom. The product of a joint effort by Carnegie Mellon University, Dartmouth College and the Massachusetts Institute of Technology, the service dovetails with "CNN Newsroom," an established 15-minute daily educational broadcast that the cable net-

WHERE TO GO

Along with the news media available through the major online services (America Online, CompuServe and Prodigy), there are numerous newspapers, TV networks—both broadcast and cable—and TV stations available on the Internet's World Wide Web. To find the site you want, go to these directories:

- Yahoo—Media Section
<http://www.yahoo.com/business/corporations/media>
Includes separate listings for newspapers, television and radio.
- NewsLink Associates
<http://www.newslink.org>
Includes well-organized links to news sites on the Web operated by newspapers, TV broadcasters and magazines.
- Newspaper Association of America
<http://www.infi.net/naa>
Links to newspaper Web sites.
- TVnet
<http://tvnet.com/TVnet.html>
Links to networks, both cable and broadcast, and television stations.

work aims at junior-high and senior-high-school students. From the Internet CNN Newsroom, schools can download study guides for each program. If they have MPEG decoder boards on their computers, along with the time or bandwidth to download large video-clip files, they can download individual clips for use in the classroom. While teachers can already get these clips by recording the daily "CNN Newsroom" television broadcast, the goal of the World Wide Web version is to let teachers and students search through a library of several months' worth of video clips and easily retrieve the stories that they're looking for.

CNN also has an outpost on CompuServe. This past summer, members of the service could immerse themselves in the O.J. Simpson trial, read-

ing court transcripts related to juror dismissals and watching clips of Simpson joking during the taping of an exercise video.

Whether they are from newspapers or television stations, one of the goals of electronic news publishers is not only to create new ways of getting information to the public, but also to spark discussion between readers and the paper's editors, and among the readers themselves.

"What we're trying to do is craft a site that's a hybrid of presented information and communication amongst and between the readers and the producers," says The Gate's Coate.

One common way for newspapers to increase that communication is to set up bulletin boards and conferences related to national news and issues of local importance.

But newspapers are trying other approaches. The Gate, for example, announced earlier this year that it would award monetary grants to individuals or groups in the community who wanted to create original content for the Web site. Coate says the content can be anything from art to a game to a database that might be useful to the public.

Amid evidence that younger Americans are less likely than their parents to read the newspaper regularly, Raleigh's Nando.net devotes a part of its Web site to an area called NandoNext, which features stories written by local high-school students.

One of the most ambitious ideas for drawing readers closer to a paper is Houston Chronicle Interactive's Virtual Voyager feature, which has not only sent reporter Lydia Lum to China, but has covered several other stories closer to home—including an Elvis Presley conference at the University of Mississippi, complete with stories, photos and audio clips.

To a skeptic, though, Virtual Voyager sounds like an expensive, un-maintainable publicity stunt. After all, the phone bill alone for "Voyage To China" ran up to \$2000, says Gale Wiley, the *Houston Chronicle's* director of new media. But Wiley insists the Virtual Voyager offers a glimpse of the future, where on a regular basis, editors at a newspaper could filter back readers' questions to reporters while they are still out in the field covering the story. He predicts that such programs will be win-win for newspapers and readers. "It really puts the reporter in the loop with the audience," Wiley says.

Like everyone else who talks about papers going electronic, Wiley hopes that computers won't dehumanize the newspaper experience, but instead give it a whole new life.

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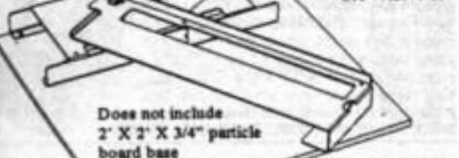
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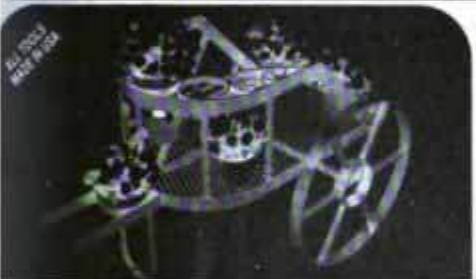
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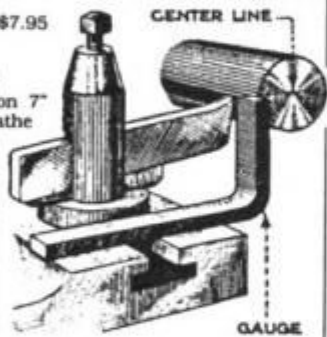
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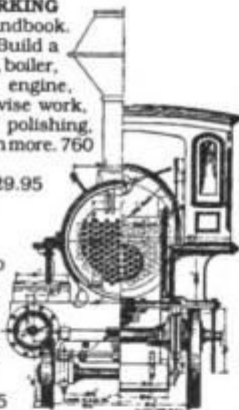
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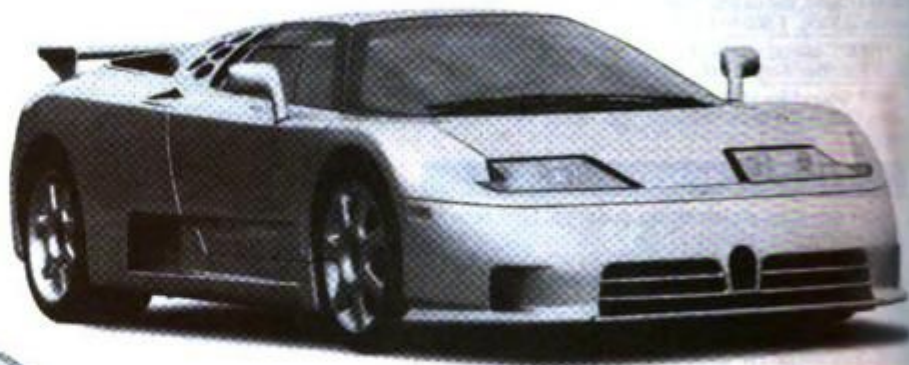
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