

Popular Mechanics

JANUARY 1995

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JANUARY 1995
VOLUME 172
NO. 1



DESIGN & ENGINEERING AWARDS 1995

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EDITOR'S NOTES

● Men from Mars? Aliens from other solar systems? Little green men with huge heads and almond-shaped eyes? I don't know about any of that. But I am convinced that rational, sane people have seen flying saucers. Yes, flying saucers are for real. I think you'll believe it, too, once you read Senior Correspondent Abe Dane's investigative report, which begins on page 50. Hey, no one believed that you could build a 65-ft. aircraft that was invisible to radar,



PHOTO BY GLENN CAMPBELL

Dane at Groom Lake.

either. Yet, Lockheed's F-117A was operational for 10 years before the Air Force revealed its existence. I don't rule anything out, certainly not something as commonplace as flying saucers. . . . **Border to border** in a Blazer. That was the concept. In other words, drive from the Canadian border to the Mexican border, *off road*, as a torture test for the new '95 Chevrolet Blazer. After all, we have given the Blazer one of our coveted Design & Engineering Awards for '95, so it had to prove its mettle, right? Made sense to me. Executing the concept for PM were Outdoors Editor Joe Skorupa and Associate Automotive Editor Mike Allen. How did the Blazer do? To find out, you'll have to read about it on page 58. . . . **Speaking of Design**

& Engineering Awards, this being our January issue, you'll find the complete crop of this year's award winners beginning on page 39. The awards are our way of recognizing excellence. Let me know if you think our choices are excellent. . . . **Have you heard about** direct broadcast satellite television? You put this tiny little dish antenna on your house and you get TV signals directly from satellites in orbit around the Earth. Up to 175 channels. Sounded fantastic, so we decided to try it. Check page 54 for our report. And don't complain to us if there's nothing on. . . . **Are you into furniture-making?** If you are, then you know that the hottest style right now is Arts & Crafts, also known as the Mission style. Leave it to our trendy Home Improvement department editors to be right on the edge of the most fashionable styles, as they take you step by step through the construction of a beautiful white-oak-and-leather sofa, beginning on page 88. A perfect project for the winter. Till next time.



Joe Oldham

Popular Mechanics

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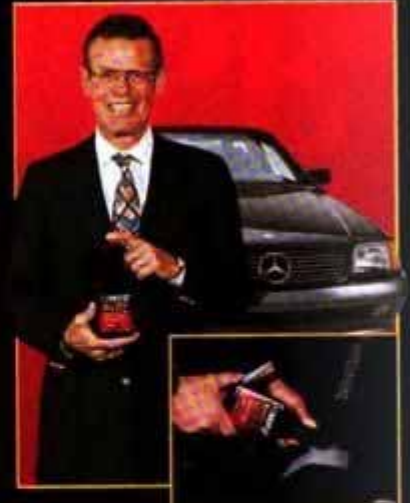
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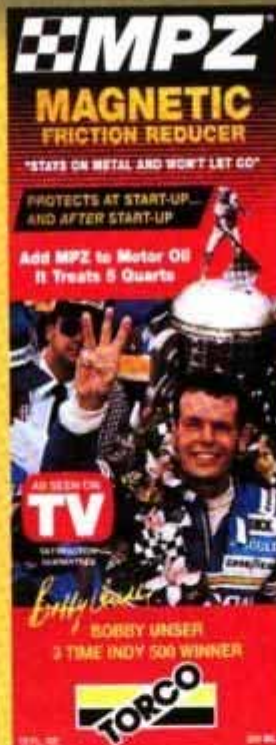
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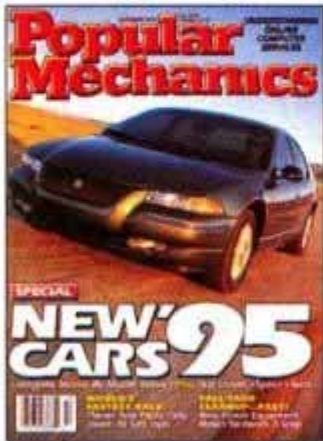
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LETTERS

Airbag Engineering



In "Engineering The '95s," you mention a fully mechanical airbag steering wheel for the '95 Jeep Cherokee. Breed Technologies has been making a mechanical airbag system for Jaguar and many Japanese cars. The company is based in Lakeland, Florida, and has been making aftermarket airbag steering wheels for retrofit to many cars. I had one installed on my 1993 Chevrolet Cavalier Z24 convertible about a year ago, and am now installing one in my Chevy pickup, as well. It's not cheap at about \$900, but it could save one's life or at least that much money in dental work caused by an accident. My insurance went down as well.

WOODY RICHEY
ST. PETERSBURG, FL

Going Online

I read with great interest your article about online computer services. They are, indeed, very informative and varied. I have found America Online and Prodigy to be very expensive services because they tend to be addictive. An alternative that I've discovered is local bulletin boards. These friendly folks run their boards either

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

from private homes or as a small business, and are either free or cost a few dollars a month. You can choose from many topics and many have large libraries of files. Many offer Internet gateways also. You can find these boards from a lot of different sources, but one usually leads to several others. I found mine by downloading a list provided by my modem manufacturer.

JIM MCKINLEY
WYLIE, TX

You did a good job of summarizing the various online services. However, you recommend "for most cyber-surfers, 2400 [bits per second on a modem] is plenty fast," and imply that 9600 bps and 14,400 bps (called 14.4) may not be worth the extra cost. I have found that generic internal 14.4 modems *with fax capability* cost about \$70, only about \$20 to \$30 more than the 2400-bps models. Brand-name versions cost about \$125. To anyone who has seen the difference in speed for graphic-intensive services like Prodigy, there is no question which is the better value. For Internet users, who read their Usenet and E-mail offline, 9600/14.4-bps capability is essential.

DOUG WILMSMEYER
EDWARDSVILLE, IL

Topping Off

While today's organic shingle products, constructed on a paper-based membrane, may be more pliable in temperatures less than 30°F, it is also true that these products have been shown to be more prone to premature failure from curling and clawing associated with moisture absorption over time. We believe

that the inorganic nature of fiberglass provides improved dimensional stability and better durability. Those, plus the fact that in most areas of the country they can be installed nearly year-round, no doubt account for the fact that fiberglass shingles comprise nearly 90% of all strip shingles in the United States. It is for precisely these reasons that GAF Materials Corp. has made *only* fiberglass-based roofing shingles for more than 10 years. We believe homeowners should carefully evaluate all aspects of roofing products before deciding what is best

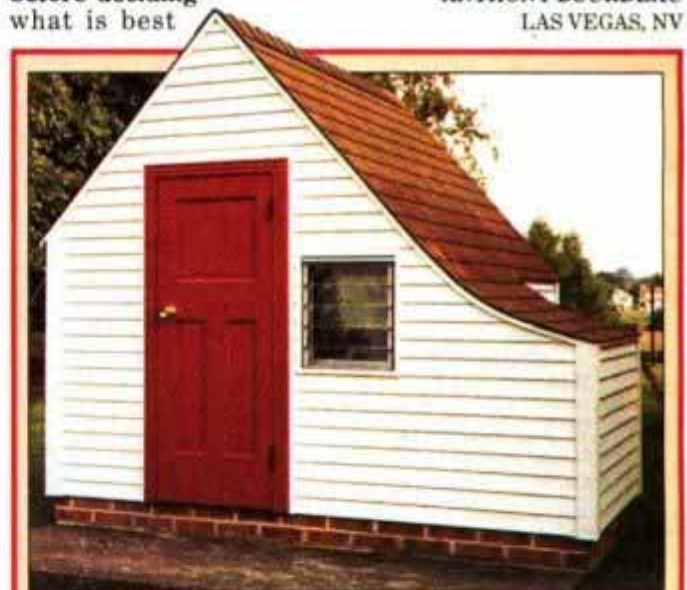
for them. Only in that way will application, appearance and durability tradeoffs be properly addressed.

ROBERT L. GARRETT
DIRECTOR OF MARKETING,
RESIDENTIAL ROOFING
GAF MATERIALS CORP.

Vegas Vickie

Your "Neon Cowboy" article said the cowgirl with Vegas Vic is nameless. I was astonished the Miller Co. didn't tell you her name was Vickie. I am the chief of security at the Glitter Gulch and have looked at her on my roof every day for two-and-a-half years.

ANTHONY BOURDEAU
LAS VEGAS, NV



Reader Project Of The Month

In the spring of 1968, my husband built the playhouse that was featured in your September 1957 issue. It was originally all constructed of wood and placed on a concrete slab. Last summer, to celebrate its 25th birthday, we gave it a facelift. My husband covered it in vinyl siding and gave it a new roof—it now matches the roof on our home. We raised the playhouse and had a brick-layer put down two rows of brick and an air vent on both sides to help keep it nice and dry. It was a big hit with our three girls in 1968, and it's a hit all over again with our grandchildren, who are now old enough to enjoy playing in it. It was and still is one of the nicest projects my husband has ever done.

JACOB & RENA AARONSON
HARRISBURG, PA

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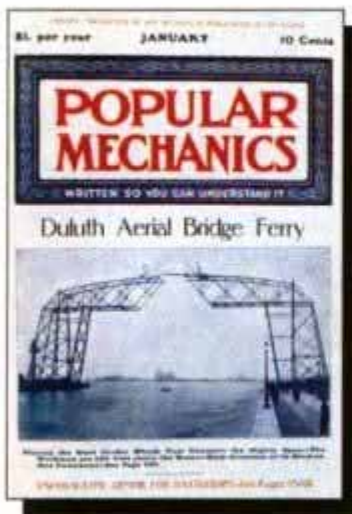
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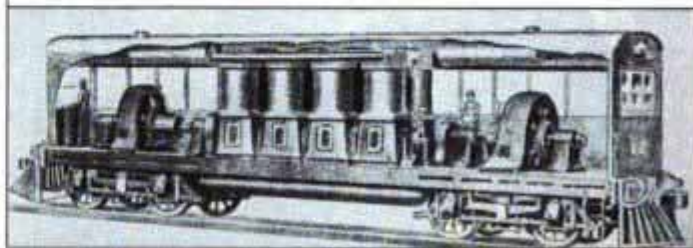
High Way

Aerial ferries already shuttled cars, cargo and people across shipping channels in Europe and Africa. Now America was finally getting a sky track. In Duluth, Minnesota, a center-pier swing bridge would have impeded navigation. So instead, a huge steel-truss structure supported rails 185 ft. off the ground. The ferries themselves hung on thick cables from the trucks that plied this track. Powered by electric motors, they buzzed back and forth at 4 mph.

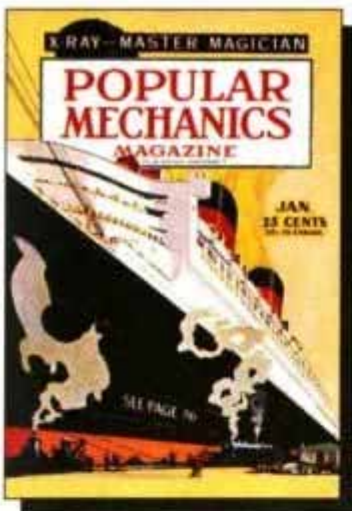
Dream Engine

Traction engineers were already plotting to cut short the reign of the steam locomotive. On the drawing boards for the Southern Pacific was a forerunner to today's diesel-electric. This 100-mph locomotive would

run on an 8-cylinder internal-combustion engine, its output channeled through an electric dynamo. Unencumbered by coal and water, the locomotive would carry enough gasoline to speed from New York to San Francisco nonstop.



60 YEARS AGO: JANUARY 1935



Ruling The Waves

The *Queen Mary* held court in the Clydebank shipyard, awaiting its first run. The mighty liner carried enough generating equipment to power a small city. But its true strength lay in the colossal steam boilers that drove the ship through the waves. They squeezed out the extra fraction of a knot that won the *Queen Mary* the trans-Atlantic speed crown.

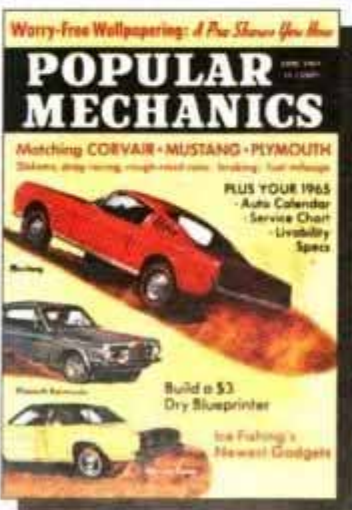


FDRadio

During a "fire-side broadcast," radio left nothing to chance. Five microphones on FDR's desk

tied directly into the networks' Washington affiliates, from which the sound went out for broadcast. Meanwhile, studio orchestras stood by in case FDR's speech came out short.

30 YEARS AGO: JANUARY 1965



Ponies At Play

How would the new Mustang stand up against its rivals? We asked road-racing veteran John Fitch to wring out three muscle cars. The Mustang's brute strength scored well on the straight-away. But the nimble Chevy Corvair Corsa, although it pulled up 89 hp shy of the Mustang, kept within a third of a second of Ford's ponycar on the handling course.

Meet The Aardvark

Billed as the world's most versatile aircraft, the F-111A was undergoing flight trials that did little to quell the controversy around its development.

Designed to leap from both Air Force runways and Navy decks, the swing-wing fighter-bomber promised Mach 2.5 speed and globetrotting range. But the flight tests, marred by engine-compressor stalls and a weight problem, shattered this dream. The One-Eleven proved too heavy for Navy use and wound up a long-range Air Force bomber. **FM**

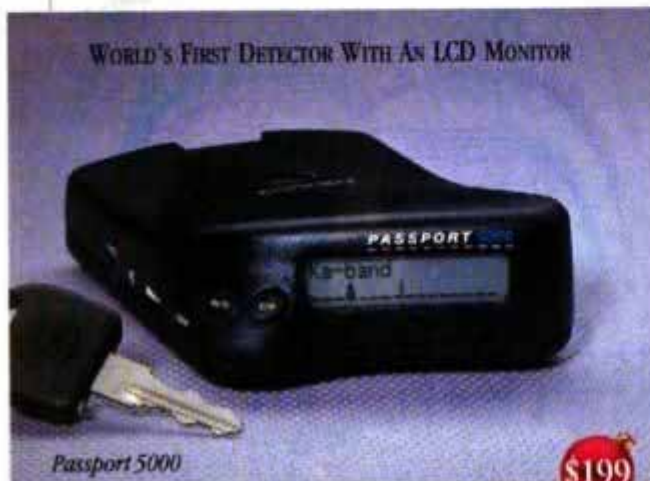


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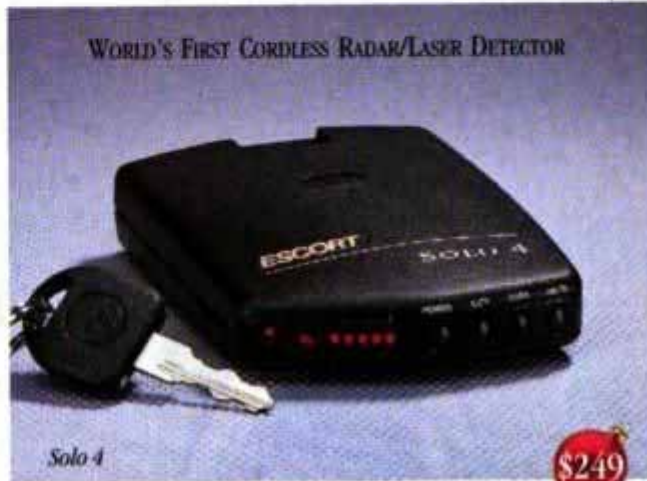
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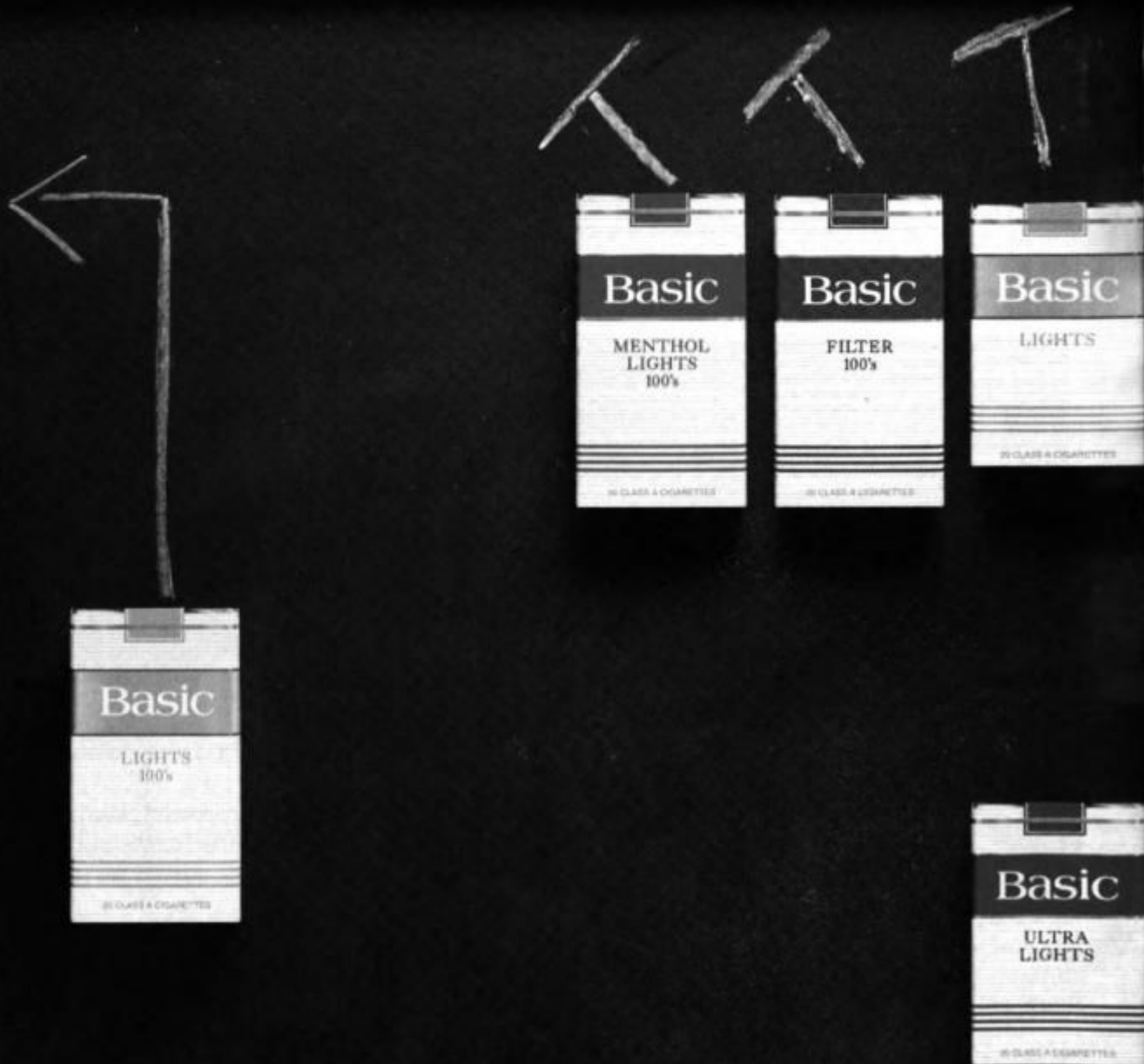
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By Dane Spotts



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It was as if a movie were playing inside my head. I could see myself in France having lunch at the Eiffel Tower. The music, the sounds, even the fragrance of summer in Paris. A beautiful woman spoke to me. "Bonjour, mon ami," she said. In an almost unconscious way I began following the dialogue. The mental imagery was so intense I not only understood what was going on, it was like I was there.

Learning at Light Speed

The Learning Machine is more than virtual reality. More than just a cool way to relax after a hard day at work. According to one college professor, "It may be the most powerful learning tool since the invention of the book."

Here's why. When you do a Learning Machine session your mind is cut off from outside distractions. Your attention becomes focused inward as the powerful sensory stimulation (light-sound matrix) bombards your imagination. Ideas and mental images float in and out of your consciousness. It feels like the best

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Let's say you want to learn a foreign language, improve your reading and comprehension, or increase your math skills. Or just give your kids a powerful edge in school, learning many times faster than their peers. It's simple.

You select a specially programmed Learning CD in the area you want to study. Plug it into any ordinary CD player. Then attach your Learning Machine digital headset into the headphone jack. Push play and a few moments later your mind is launched into a pre-programmed learning session. In a fun, almost effortless way, the Learning CD unfolds its program and literally forces you to learn. It's the most amazing thing you've ever experienced.

Speak French, Spanish, German & Italian

Learning foreign languages, or anything for that matter, at rocket speed can be very empowering. And I'm going to include a ton of valuable Learning CD software with your Learning Machine so you can get immediate results from this new technology.

You'll receive 4 basic language courses — French, Spanish, German, and Italian. Plus a Super Vocabulary course, a Super Memory course, and a Super Speed Reading course. And for your kids, a SuperPhonics™ reading program. Over \$200 worth of Learning CDs make this the deal of the century. But I also



Beyond virtual reality, the light-sound matrix stimulates your mind and opens your learning centers. Like magic it pours in new information, skills, mental programming, and launches your imagination.

want to show off its other incredible mind expanding powers.

10 Fantastic Mind Journeys

So I'll include the 3-D Mind Sync™ Library, with 10 mind launching programs on 3 CDs. Turn your Learning Machine into a meditation, self-hypnosis, and virtual fantasy computer. You'll get the following titles: *Creativity Booster*, *Quick Energy*, *Stress Zapper*, *Mental Tune-Up*, *Virtual Visualization*, *Imagination Stimulator*, *Learning Accelerator*, *Super Intuition*, *Lucid Dreaming*, and *Super Zen States*.

A \$150 value, this extensive collection is a super added bonus. But even more exciting is how it can be used for habit control, success conditioning, and eliminating self-sabotaging behavior.

Super Motivation Library

Let's say you want to transform a loser mind-set into a winning one. Or you'd like to quit smoking or lose weight. Pop in an InnerMind™ Programming Disc. The sensory stimulation matrix opens a window into your unconscious mind. Then by infusing your "inner mind" with positive programming, you can rescript negative, self-defeating attitudes. I'm including an awesome 18-title InnerMind Programming Library. From success conditioning to weight control this is another \$150 value.

30-Day Risk Free Trial

Plus in addition to the Language Learning Library, the SuperPhonics, Super Speed Reading, Super Memory, and Super Vocabulary programs, the 3-D Mind Sync Library, and the InnerMind Programming Library (a \$600 combined value), I'm including coupons worth a thousand dollars. These coupons are for hundreds of future Learning CD applications, including software that links your mind directly to a multi-media computer. It's something you absolutely must experience.

Try the Learning Machine for 30 days risk free. Take your mind on an incredible journey. If for any reason you're not totally blown away by the experience, send your kit back to me for a full refund.

To order, credit card holders call toll free. Or send your check or money order for \$299.95 plus \$12 shipping & handling to the address below. (Item #4501). Please allow 4-6 weeks for delivery.

\$600 Super CD Bonus Pak

Hundreds of dollars worth of valuable Learning Disc Libraries are bundled with your Learning Machine™ to make this an incredible deal. Here is just a sample of the mind-boggling benefits of your Learning Discs that will be bundled FREE as part of this special introductory offer.

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3-D Mind Sync™ Library (\$150 Value) 10 mind journeys: *Creativity Booster*, *Quick Energy*, *Stress Zapper*, *Mental Tune-Up*, *Virtual Visualization*, *Imagination Stimulator*, *Learning Accelerator*, *Super Intuition*, *Lucid Dreaming*, and *Super Zen States*. Launch your mind into fantastic mind journeys from deep meditation to extreme alertness.

InnerMind™ Programming Library (\$150 Value) 18 programs on 3 Learning Discs program success behaviors into your subconscious. Titles: *Building Self-Esteem*, *Eliminate Fear & Anxiety*, *Projecting a Winner's Image*, *Attracting Love Relationships*, *Health & Healing*, *Expanding Psychic Powers*, *Attracting Prosperity & Wealth*, *Time*



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Super Speed Learning™ Beginner's Pak (\$59 Value) 4 accelerated learning programs, Super Speed Reading, Super Memory, Super Vocabulary, and SuperPhonics (for kids K-6) teach you learning skills you'll use for life.

Plus \$1,000 Worth of Coupons for More Software

Included in your kit are coupons for additional Learning Disc programs. Plus info on future programs including ESL, Japanese, Chinese, and Russian. The Photographic Mind Series, Transcendental Mind Series, Fantastic Journeys that launch your consciousness into incredible new worlds, The Time Traveler Series, World History, Science & Space, World's Greatest Mind Series, Study Habits Discs, Self-Esteem For Kids, Children's Classic Literature Series, Corporate Training Programs and more. Future multi-media titles include the Civil War series, Everything I Ever Wanted To Know, plus existing CD-ROM software converted into Learning Machine format.



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TECH UPDATE

News Of Tomorrow's Technology Today



AN ILLUSTRATION BY PAULA CHAMBER

Eye In The Sky Combines Stealth And Stamina

WASHINGTON, DC—Military commanders have long craved a bird's-eye view of the battlefield to see the enemy, gauge its intentions and hit its weak spots. Later this decade, their wishes may come true if a new technology program, sponsored by the Advanced Projects Research Agency, launches into production.

Known as High-Altitude Endurance Unmanned Air Vehicle, the effort has two components. One vehicle, designated Tier II-plus, will soar above 65,000 ft. nonstop for up to 30 hours. This drone will prowl over a radius between 1000 and 2000 miles, carrying up to 1500 pounds of sensors. Meanwhile, the other vehicle, called Tier III-minus, won't enjoy the same payload and range but will be so stealthy that it will seem no larger than a pinprick to enemy radar. Compare that to the radar cross section of the F-117A stealth fighter, said to mimic a sparrow.

Both air vehicles will send data to

ground stations equipped to process avalanches of information and relay it to decision makers.

Theater commanders are excited about both vehicles for a variety of reasons. While spy satellites draw great demand during wartime, most are useless when clouds obscure the target area. Tactical reconnaissance aircraft are more flexible, but have endurance limits and put crews in harm's way. By contrast, the new drones' relatively low cost—less than \$10 million per unit—should ensure that no tears are shed if one were to crash or be shot down.

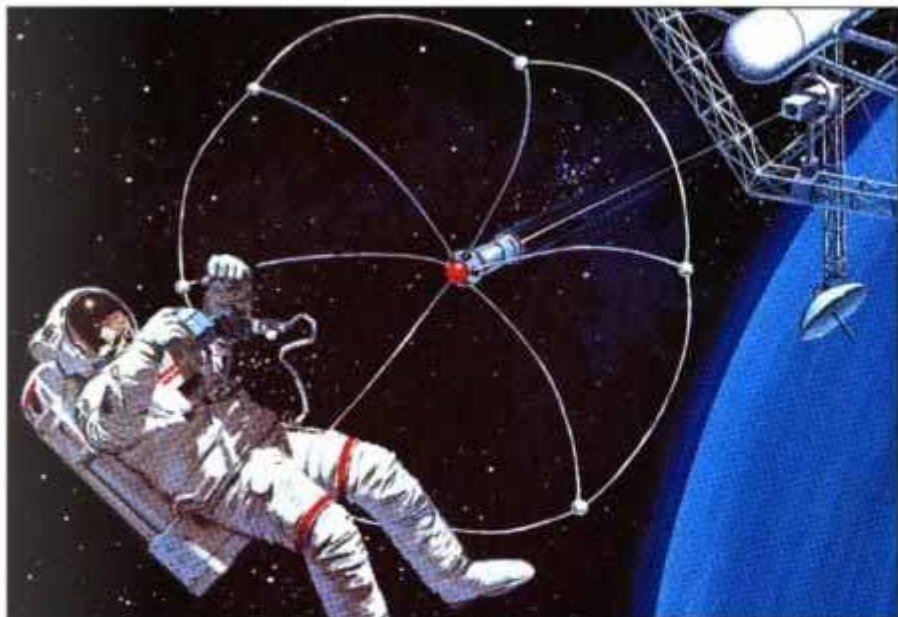
A 100-ft. flying wing, Boeing-Lockheed's ultra-stealthy Tier III-minus will lurk unnoticed in the stratosphere.

The program, funded to the tune of \$115 million this year, has attracted a variety of big-name defense companies. Boeing and Lockheed are jointly developing the Tier III-minus behind closed doors. The first phase of the Tier II-plus project is also under way with five rival designs from Loral, Raytheon, Teledyne Ryan, Northrop Grumman and Orbital Sciences, the latter two teamed with Burt Rutan's Scaled Composites. A Tier II-plus winner will emerge in May 1996.

Highlights This Month

- **Safety Net**—Astronaut rescue, Spiderman style.
- **Sky Lights**—Lasers flash from space to Earth.
- **Concorde-Ski**—NASA gets to fly Russia's SST.
- **Harrier's Sons**—Getting a jump on future jump jets.
- **Out Of The Nest**—What's the next military trainer?
- **Sorry, Charlie**—Robotic fish that mimics tuna.
- **Liquid Drive**—Electric engine shrinks and expands.

Editor/Writer: Gregory T. Pope
Reporters: John Boatman, Philip Chien, Mike Fillon,
Ted Francis, William Garvey, Scott Gourley



Tethered shuttle springs from launch tube, releasing weighted balls to deploy rescue web.

Pop-Gun Net To Rescue Astronauts

HOUSTON, TX—Shuttle astronauts will have to work untethered as they piece together the space station. That piques concern at Johnson Space Center, where planners worry about emergency measures to back up astronauts' new spacewalk jetpacks (see Tech Update, page 18, March '93).

One notion under development is a rescue net. To snare a drifting astronaut, the net would fan out from a tethered shuttle-like device shot from a solenoid-triggered gun.

Under this scenario, when the shuttle reaches the end of its tether, the sudden tension shatters a retaining ring around the device. Out spring six balls, coated with a Velcro-like material and linked by a web of filaments. The balls carry the web around the target and stick to each other on the other side, securing the astronaut. Other crew members then retract the tether and return the astronaut to the station.

Declassified, But Denied

HAWTHORNE, CA—The Tri-Service Standoff Attack Missile (TSSAM) has burst from its cocoon of classification with a flourish. In test firings last summer, the stealthy next-generation cruise missile hit bull's-eyes, in one case



Retouched photo of TSSAM reveals stealthy shape, but little of engine ports or sensors.

zeroing in on an air conditioner.

Unfortunately, TSSAM's future looks much less on target. Congress won't fund its production this year, mostly because its cost has ballooned to more than \$3 million per missile.

The Air Force and the Navy (the Army has dropped out of the program) may eventually win a handful of these missiles as silver bullets. With unprecedented nimbleness and a minute radar cross section, TSSAM should elude sophisticated air defenses. Originally designed to loose submunitions on targets, the weapon is now slated to carry a 1000-pound warhead.

On the South Side Of The Sun

PASADENA, CA—What's up with *Ulysses*, the joint NASA/European Space Agency mission to the Sun? Well, the spacecraft (see Tech Update, page 20, Feb. '91) just completed its pass below the southern polar region of the Sun and is now climbing in an orbit nearly perpendicular to that of the planets.

Already *Ulysses* has scientists scratching their heads. The probe is detecting unexpected shock waves and floods of high-speed particles, ejected from vast disruptions in the Sun's outer atmosphere, or corona.

After arcing over the solar north pole, *Ulysses* will swing across to Jupiter, whose gravity will hurl it back under the Sun.



Ulysses radios data back to Earth as it wheels below the Sun, shown here as an X-ray image.



Re-Using The DC-X

HUNTINGTON BEACH, CA—Grounded by an explosive burp of hydrogen this past July, the DC-X should fly again in 1996. McDonnell Douglas is repairing and upgrading the vehicle, a testbed for reusable-rocket technology (see Tech Update, page 16, Jan. '94).

Now NASA has taken the reins of the project, originally developed for the Ballistic Missile Defense Organization. The experimental vehicle, to be renamed the DC-XA, will gain a new liquid-hydrogen fuel tank and reaction-control system, among other components.

Damaged by hydrogen explosion, the DC-X will undergo surgery and begin new flight tests late in 1996.

NASA hopes to gain insight as it mulls options for a reusable launch vehicle to replace the space shuttle.



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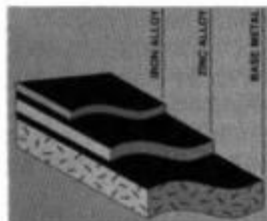
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NASA Flies Russian SST



Tu-144, nicknamed "Concorde-ski," will be modified for NASA research program exploring new SST technologies.

HAMPTON, VA—The world's first supersonic transport? Purists know it was the Soviet Union's Tupolev Tu-144, which went up three months before the Concorde, in December 1968. Now NASA—and its contractors on the High-Speed Research

Program—will get to harness one of these little-seen Russian racehorses as a testbed for the next-generation SST (see Tech Update, page 26, Dec. '94). Langley Research Center is funding the program, via a contract with Boeing.

Under the current arrangement, American personnel will travel to Russia to fly the aircraft, a 1982 model

with only 87 hours of flight time. Because Tupolev engineers have been using the jet as a winged laboratory, the plane is already festooned with research instruments.

More important, the Tu-144 will supply data on the construction, aerodynamics and environmental impact of a supersonic passenger jet. The plane cruises at Mach 2.35 and can reach altitudes above 60,000 ft.

Coaxial Kit Helicopter

JACKSONVILLE, FL—Two brothers—both stock-car racers with no aviation background—have built an 800-pound backyard rotorcraft that's now available as a kit.

The coaxial-pendulum helicopter, designated the Nolan 51-HJ, flies on two counter-rotating rotors of fixed pitch, with no collective-pitch and cyclic controls. Instead, the pilot wields stick, rudder and throttle levers, similar to the controls of a fixed-wing plane.



Coaxial kit helicopter flies on simple controls, displaying unprecedented agility for an experimental rotorcraft.

The fuselage hangs like a pendulum from the rotor head. Rudders on the tail, along with the tiltable rotor, provide maneuverability. The aircraft can take off backward rotating 360° and can swing much tighter turns than a conventional helicopter.

Two Rotax 503 engines supply power. The aircraft can maintain flight—although hover it can't—on a single engine. A ballistic parachute provides an extra margin of safety.

According to Perch Inc., which is marketing the helicopter, the kit takes 250 hours to build with basic hand tools.

Instant Navy Chopper



Bell turned Model 230 into a naval chopper sporting nose-mounted radar.

HURST, TX—Aided by Heli-Dyne Systems, Bell Helicopter Textron has modified one of its Model 230s into a special-mission demonstrator aimed at maritime patrol. The idea:

to package the familiar commercial chopper with advanced technologies—and lure navies and coast guards that can't afford a full-blown naval helicopter.

Most prominent of the modifications is the nose-mounted search-and-surveillance radar, which operates in conjunction with an airborne infrared imager. Once these systems spot a target—such as a downed pilot—a unique side door jackknives out of the way above the fuel sponson, giving a crew member easy access to the rescue winch. To automate searches, the navigation and flight-control systems are fully integrated.

Cockpit Display To Visualize Radar

ARLINGTON, VA—Combat aircraft could soon slither through holes in enemy radar coverage, guided by a cockpit instrument that presents hostile radar as a 3-dimensional display. The display, formulated by Anser Corp., evolved from another system used by U.S. government agencies to analyze ground-based anti-smuggling radar performance.

According to Anser, the system could eventually be able to incorporate changes in radar coverage while the aircraft is in flight, to provide continuous updates. Overlaid on terrain maps, the system displays radar as a green mesh. Pilots can use the display to pick a safe route, through a valley or between peaks, for example. The same technology can also provide diagrams to aid layout of line-of-sight communications systems.

Prototype display visualizes radar as green mesh over terrain map.



A Flash Of Green

HAMPTON, VA—Last September, had you been staring at the sky while the shuttle *Discovery* arced overhead, you might have glimpsed a brilliant green flash. Astronauts were peppering Earth with a light-detection-and-ranging (lidar) laser, the first to have shone in space.

Lidar works much like radar, except that it uses light instead of microwave frequencies. Aboard the shuttle, the Lidar In-space Technology Experiment (LITE) pulsed in ultraviolet, infrared and visible green wavelengths, bouncing the beams off clouds and



airborne particles. Flashing 11 times per second, LITE illuminated Earth with circles 300 yards wide, spaced about half a mile apart because of the shuttle's great speed.

A telescope in the cargo bay picked up lidar reflections. From the strength of these echoes, atmospheric scientists gleaned information on cloud formations and stratospheric pollution.

While NASA has flown lidars in aircraft since 1980, LITE's performance will help engineers judge whether a free-flying lidar satellite is warranted. Lidar might also figure into planetary probes.

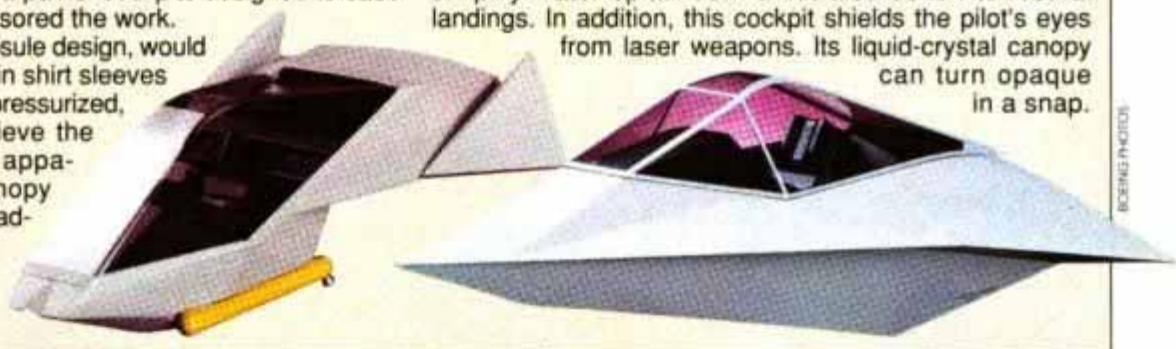
Pencil-thin lidar pulse plunges through atmosphere, to be reflected into LITE telescope.

Cockpits With Comfort

SEATTLE, WA—As they fly the fighters of the future, pilots will have to fend off fierce workloads and the forces of unprecedented aircraft performance. Knowing that, Boeing has conceived a pair of cockpits designed to ease stress. The Navy sponsored the work.

One, an ejection-capsule design, would allow the pilot to work in shirt sleeves most of the time. Fully pressurized, the cockpit would relieve the aviator of breathing apparatus. Across the canopy spreads panoramic head-

One cockpit ejects intact (right), while the other (far right) splits out seat with built-in raft.



up imagery. On the outside, fixed fins would stabilize and slow the capsule after ejection, while rockets would hike it to a height safe enough for a parafoil to deploy.

The other design features a more conventional ejection seat, enhanced by an inflatable liferaft that would not only simplify water splashdowns but also soften terrestrial landings. In addition, this cockpit shields the pilot's eyes from laser weapons. Its liquid-crystal canopy can turn opaque in a snap.

X-31 May Turn Bobtail

EDWARDS, CA—The marathon performance of the X-31 continues, as the U.S.-German jet (see Tech Update, page 16, Aug. '91) has now flown more times than any previous X-plane. Meanwhile, test pilots are flying the X-31 in a "quasi-tailless" condition. The plane's software can let control surfaces cancel out the aerodynamic effects of the vertical stabilizer. In this condition, the X-31's thrust-vectoring paddles, rather than its tail, steady the plane at supersonic speeds.

So much attention has been drawn to this project that X-31 managers are considering shaving the tail off one of the twin aircraft for future research. After all, a tailless aircraft would enjoy better stealth and less drag.

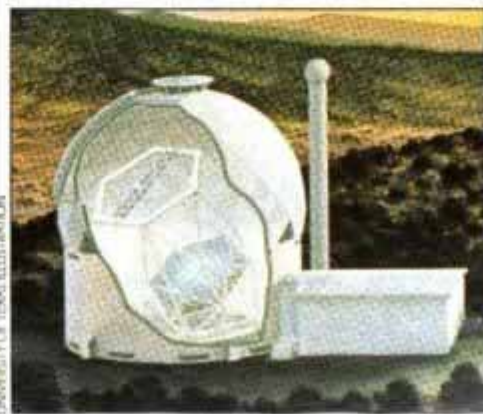


X-31 has also been simulating launches of highly maneuverable missiles.

Big Mirror, Small Cost

AUSTIN, TX—Now under construction in the hills of western Texas is a huge observatory, with a segmented mirror a yard wider than the Keck Telescope's record 396-in. reflector. But unlike Keck, the new telescope won't move to follow the sky's motion. And it won't need Keck's precision.

The Hobby-Eberly Telescope was previously called the Spectroscopic Survey Telescope (see Tech Update, page 17, Sept. '88). Because spectroscopy—determining a sky object's chemistry from its light—doesn't require pinpoint imaging, the big mirror will have a simple spherical shape. Several universities are collaborating on the low-cost observatory, which will open its eye in 1997.



Fixed mirror will stare at 70% of the sky, while instruments above mirror track objects.

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

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X-32 To Preview One-Size-Fits-All Fighter

WASHINGTON, DC—The F-22 is due to replace the Air Force's F-15. But when the 21st century rolls around, what will replace the Marines' AV-8B Harrier—and, for that matter, their F/A-18 and the Air Force's F-16?

The X-32 may pro-



Lockheed's X-32 proposal relies on lift fan and vectoring nozzle, while Northrop Grumman studies separate lift engine independently.

vide a single answer. Its key feature: a jump-jet propulsion module—suited for carrier operations—that extra fuel tanks could replace for an Air Force variant.

Racing to build the next X-plane are rivals Lockheed and McDonnell Douglas. Both will test models this summer. Each plane will sport a lift fan below its nose, while its main engine's

nozzle will vector downward during takeoff and landing. In Lockheed's concept, a shaft from the engine will drive the fan, whereas McDonnell Douglas will divert engine air to blow its fan.

Because the X-32 effort has merged with the Pentagon's Joint Advanced Strike Technology program, other proposals are likely to surface from contractors.

Dogfight For Navy/Air Force Trainer

WASHINGTON, DC—The Pentagon will soon announce a winner in what may be the last great military aircraft competition in this century. The Air Force and Navy have teamed to select a single off-the-shelf successor to the aging T-37

and T-34—the Joint Primary Aircraft Training System, or JPATS.

Lockheed is proposing its version of the turbojet-powered Aermacchi MB-339. The bad bird, dubbed T-Bird II, scorches along at 475 knots.

The only high-winged entry is Northrop Grumman's Pampa 2000, based on a Dornier jet.

Also offered by Northrop Grumman is the Super Tucano EMB-312HJ, designed by Embraer of Brazil.

The Cessna CitationJet is the only all-American contestant—and the only offering powered by twin turboprops. A derivative of Cessna's business jet, it comes from the same outfit that built the T-37.

Rockwell's Ranger 2000 derives from the Deutsche Aerospace-MBB Fantrainer and flies on a single turboprop.

Meanwhile, Beech is proposing a modified Pilatus PC-9, a Swiss-made turboprop.

Smallest—and touted as the most nimble—is the Agusta-designed S.211A, also proposed by Northrop Grumman.

Whichever company wins this contest will gain a healthy backlog of orders. But it's likely that budget woes will defer acquisition for several years.



Cessna CitationJet.



Rockwell Ranger 2000.



Beech PC-9 Mk II.



Northrop Grumman S.211A.



Lockheed's T-Bird II.

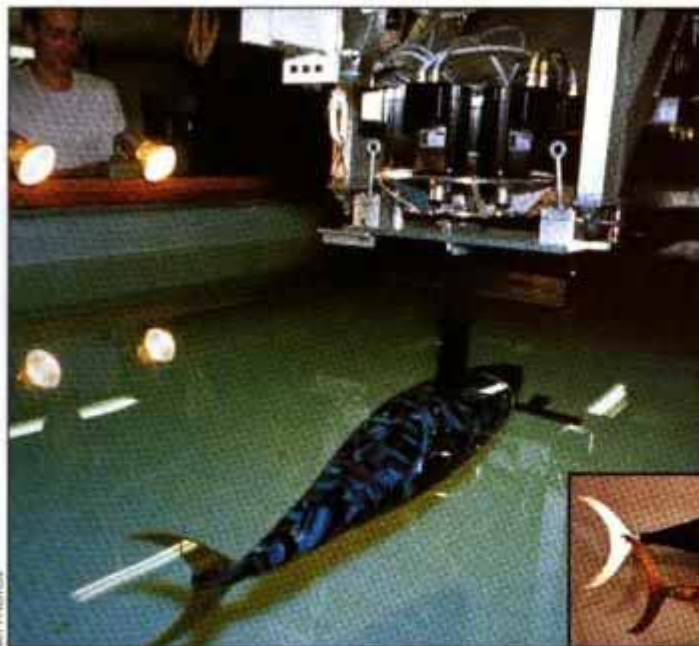


Northrop Grumman Pampa 2000.



NG's Super Tucano EMB-312HJ.

(LEFT, TOP TO BOTTOM: LOCKHEED PHOTO; NORTHROP GRUMMAN PHOTO; NORTHROP GRUMMAN PHOTO; (RIGHT, TOP TO BOTTOM) CESSNA PHOTO; ROCKWELL PHOTO; BEECH PHOTO; NORTHROP GRUMMAN PHOTO)



MIT PHOTOS

Charlie The Robo-Tuna

CAMBRIDGE, MA—Nothing man has ever built can cut through the water like a bluefin tuna. But don't tell that to Charlie. This tail-driven robotic tuna is now plying a test tank at the Massachusetts Institute of Technology.

Charlie's complex mechanical skeleton has more than 2000 parts. It features 40 ribs, a segmented spine and tendons driven by brushless DC motors, all tissue with foam and sheathed in a Lycra skin. Right now the fish swims in a straight line, hooked to a sliding overhead guide structure that houses its electronics. Researchers are experimenting with sensors and controllers to home in on the most effective swimming motions.

The MIT crew next plans a "robo-pike" that can make hairpin turns at the end of a tether. The ultimate goal of the work? Efficient, fully autonomous underwater vehicles that can cover vast swaths of territory without draining batteries.



Beneath a Lycra racing skin, robotic tuna flexes mechanical skeleton to swish tail in test tank.

Pogo Stick On Water

SEATTLE, WA—Paul MacCready made history in 1977 when his *Gossamer Condor* made the first controlled, sustained flight by a human-powered aircraft. Trust his son—one of *Condor's* original pilots—to get into the act. Parker MacCready, an oceanography professor at the University of Washington, has devised a bizarre human-powered watercraft that draws lift and propulsion from a flapping wing.

MacCready calls his machine—christened the *Pogo Foil*—an ichthyopter. The pilot bounces on a pogo-stick mechanism linked to a submerged wing. Wagging up and down like a dolphin's tail, the wing propels the contraction and supports the pilot's weight.

Pogo Foil can hit 11 mph driven by flapping of submerged wing. Smaller front foil allows turns.



MUSEUM OF FLIGHT PHOTO

Bombs Into Kilowatts

MINNEAPOLIS, MN—What to do with those growing international stockpiles of obsolete munitions? Sandia National Laboratories and Alliant Techsystems are jointly researching a nifty chemical solution—converting the explosives and rocket propellants into synthetic fuel gas for industrial turbines.

The process pulls the energetic compounds from the munitions, suspends them in a slurry and injects them into a high-temperature chamber. Inside, a plasma breaks down the chemicals into their constituent atoms. These gases flow to a second chamber, where they reform into syngas—a mixture of carbon monoxide and hydrogen that's also the output of coal-gasification plants.



ALLIANT TECHSYSTEMS PHOTO

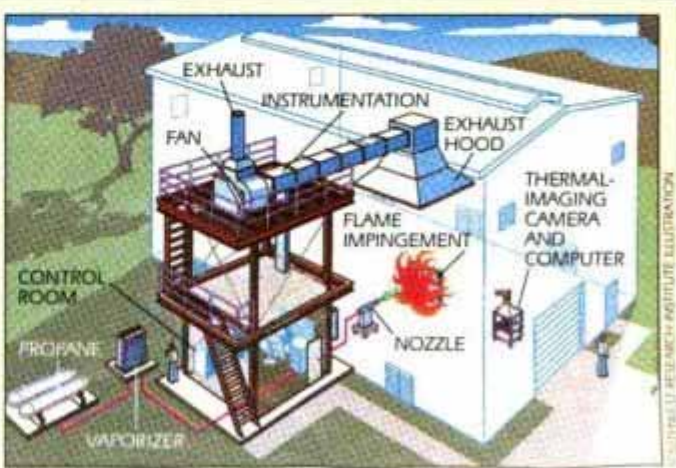
Ukraine could demilitarize its stockpile of munitions, creating synthetic fuel for turbines.

Fighting Fire With Fire

SAN ANTONIO, TX—Some of the world's most catastrophic fires break out on offshore oil and gas rigs, where high-pressure pipes and tanks can spew vicious jets of flame. To develop better fire-protection systems, the Southwest Research Institute is operating a unique flame-throwing laboratory. The research is tailored for an international jet-fire working group under British direction.

The facility resides in a 2400-sq.-ft. building outfitted with a precision nozzle fueled by propane. The nozzle simulates pipe failures by unleashing fire jets at pipes, bulkheads, emergency shutdown devices and other oil-rig components. Riddled with sensors, the facility performs thermal imaging during tests.

Computer-controlled test facility hurls high-speed flame jets at oil-rig structures.



SWRI PHOTO BY PHOTOTECH ILLUSTRATION

Diesel Supercars

BEDFORD, ENGLAND—Two diesel-powered vehicles have been rewriting the record book at Millbrook Proving Ground. Setters of new speed marks in their respective classes are the 4-wheel-drive IbeX—built by IbeX Vehicles of Edinburgh, Scotland—and the Shrike, built by Honiton, England-based Supacat.

Propelled by a 280-hp supercharged diesel, the IbeX recently tore around the track at 132 mph over 10 miles. Meanwhile, the smaller Shrike clocked 127 mph on a 120-hp engine. That not only breaks the diesel-category record but also the British record for all vehicles with 1500cc engines.



Shrike (foreground) and IbeX have set new speed records, powered by modified off-the-shelf diesel engines.

Solar-Power Roll

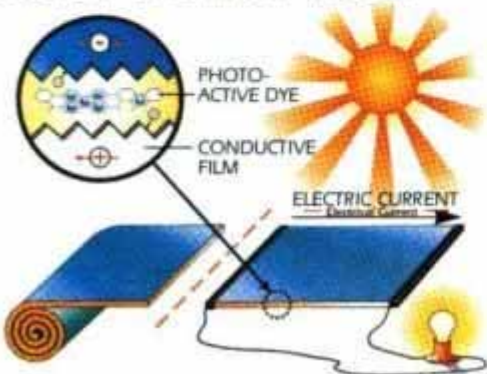


Photo-active dye molecules separate charges in response to sunshine, touching off electric current.

ATHOL, MA—A whole new way of tapping the Sun for electricity may see daylight, emerging from a joint effort between Advanced Research Development Inc. (ARDI) and Argonne National Laboratory.

ARDI has come up with a low-cost, stretchy, electrically conductive film. Meanwhile, Argonne

chemists have developed molecules that, when struck by sunlight, cause positive and negative charges to separate. Sandwiched between sheets of the film, these dyes would trigger an electric current.

The material, dubbed Lumeloid, should outproduce today's photo-voltaic cells, says Argonne.

The Incredible Shrinking Engine

OAK RIDGE, TN—An engine whose volume can swell for quick-response acceleration, then shrink for efficient high-speed cruise? It's no fantasy, but rather the focus of research at Oak Ridge National Laboratories.

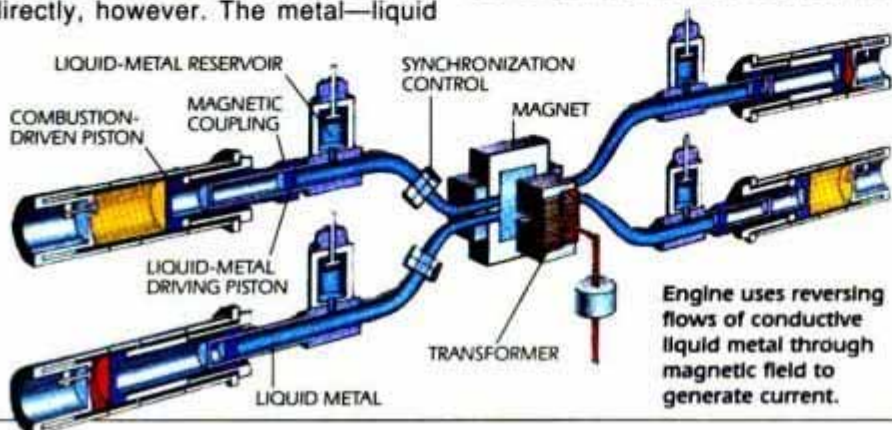
Under development is a generator that harnesses electrically conductive liquid metals. Pumped back and forth in opposite directions through a strong magnetic field, the double flows of liquid metal touch off an alternating current. In a vehicle, this output would feed AC motors that turn wheels, the current's frequency determining speed.

To propel the liquid metal, combustion-driven pistons ride back and forth in two pairs of opposing cylinders. The pistons don't contact the liquid metal directly, however. The metal—liquid

potassium or sodium—must be sealed inside a pair of ducts, because it burns spontaneously in air or water. So separate free-floating pistons—linked magnetically to the combustion-driven pistons—move back and forth inside the ducts to push the liquid metal.

How does this engine expand and contract? Each duct has its own reservoir that can add or withdraw liquid metal under computer control, thus varying the stroke of the pistons.

Installed in a car, this arrangement would allow a driver to floor the accelerator to do 0 to 60 mph in 7 seconds, then let up on the gas to shrink the engine. Other advantages cited: no rotating parts, scant friction, an 80-mpg fuel economy and a lifetime of 500,000 miles.



Engine uses reversing flows of conductive liquid metal through magnetic field to generate current.

Superball For Golfers

CHICAGO, IL—In its endless quest for the perfect golf



Mix of dimple sizes in geodesic pattern lets air flow smoothly.

ball, Wilson Sporting Goods turned to a former NASA engineer, who manipulated the pattern of dimples around the little sphere into a unique geometric arrangement. The result: the Wilson Ultra 500.

Typical golf balls have roughly 400 dimples arranged into an icosahedral pattern, with 20 repeating triangles. Wilson has squeezed 500 dimples onto the Ultra 500 by varying the size of the dimples. The largest indentations cut drag and boost lift, while the smallest stabilize the ball in flight. The result: longer, more accurate drives.



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Most important among the improvements is the 4.6-liter 32-valve 260-hp V8 engine under the new plastic hood. This is the same engine, detuned slightly to fit the front-wheel-

powertrain delivers near best-in-class smoothness with more than adequate power.

Continental has an automatic system that lets you select about a dozen of your driving choices with one push of a button. Features like seat position, ride and steering settings, mirror positions, temperature setting, radio station selections and volume and a few others are included.

Continental again offers air springs on all four wheels. The springs automatically adjust the road height of the body so that it maintains

ard. A unique sliding box in the trunk will hold files and other small items and still leave room for other storage. Despite the radical styling and powertrain changes, the 1995 Continental's size is within an inch or so of the 1994 model. However, curb weight is up 300-plus pounds. —Jim Dunne

Ford Explorer

With Explorers moving like free white-wine spritzers in a fern bar, Ford has a hard time making enough to meet demand. So there was no reason to change the already best-in-class sport/utility vehicle. But, realizing that being the best is a moving target, Ford refined the formula nonetheless.



The Range Rover 4.0 SE is better than the original.

The changes, though largely subtle, are for the best. The most visible is a new front-end treatment, rounded and bulbous, with a lower hoodline and a new liftgate to match. There's also a new interior, with a revised instrument panel. Mechanically, the big change was the replacement of Ford's venerable Twin-I-beam front suspension with a more conventional upper-lower control type, and that included a change from an inherently mushy recirculating-ball steering box to a rack-and-pinion steering system. Standard equipment also now includes 4-wheel disc ABS. The Explorer now has more suspension travel, a better ride, reduced tire wear and a much-improved on-center feel on pavement. Another refinement is to the 4wd itself—the Explorer is available with Control Trac, a computer-controlled awd system. —Mike Allen



Explorer's nose conceals all-new front suspension and computerized awd system.

drive transmission, that's used in Lincoln's Mark VIII. Coupled with Ford's electronic 4-speed automatic, the

the same height whatever the load inside the car may be.

Inside, Continental offers either 5- or 6-passenger space. Split front seats are standard, but shift levers are column mounted (6-passenger) or floor mounted. Dual airbags, 4-wheel disc ABS, leather upholstery, wood-grain trim and a unique 3-dimensional gauge pack are stand-



Saab 9000 CDE has additional refinement, inside and out.

Saab 9000 CDE

Place the accent on luxury when you talk about the new 9000 CDE luxury sport sedan. The upscale label fits this V6-powered, automatic-transmission-driven, wood-paneled 4-door sedan.

Yes, you still get Saab's taut body, agile handling and controlled ride.

But the 9000 CDE also gives you a quiet cabin, modern sedan styling and touches of elegance that you never found in Saabs of old.

Saab engineers believe rightly that sport equals performance. In the 9000 CDE they depend on the 210-hp output of a smooth 3.0-liter V6, a 54° V that's based on an Opel design. That output is disciplined by a 4-speed automatic transmission and traction control at the front wheels. The specifically designed tires and tuned suspension let the 9000 CDE ride more smoothly on rough pavement. Refined styling features a lower, wider grille/headlight cluster, slightly revised taillights and slimmer bumpers. Prices start and end at an all-inclusive \$38,995. —J.D.

Range Rover 4.0 SE

The all-new 1995 Range Rover 4.0 SE represents the first major change in that British marque in 24 years. And it's built for the most discerning of us: The Range Rover 4.0 SE carries a price tag of about \$55,000—the highest price tag, by far, of any of the sport/utility types. For that cost you naturally expect all the goodies that the Cherokee/Explorer/Blazer crowd offers, and much more. Range Rover delivers. Standard items include V8 engine, 4-speed automatic, all-wheel drive, Connolly leather interior, burlwood trim, full instrumentation, two airbags and power windows, to name only a few.

A short stint behind the wheel confirms that this is not a warmed-over model. The vehicle is noticeably quieter on the road, thanks to carefully selected road tires and improved chassis isolation. The 4.0-liter aluminum V8 engine delivers power smoothly through a state-of-the-art ZF automatic transmission.

Overall, interior space is greater than the 1994 Range Rover, with emphasis on legroom, headroom and cargo accommodations.

A unique transmission shift pattern is more convenient to operate. All transmission settings are controlled by one lever. The 1995 chassis has an all-new suspension as well as a sturdier ladder-type frame. Exterior body panels remain aluminum. All the electronic control goodies you find on other luxury vehicles are standard on the 4.0 SE, including message center, ABS, traction control, air suspension—with five body-height settings—and multiport fuel injection.

For the 1995 model run, the Range Rover 4.0 SE will be sold alongside the older model it will eventually replace. Both models will be 1995 versions, with the older model now called the Range Rover Classic. —J.D.

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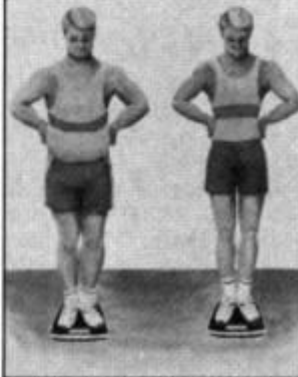
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AUTOMOBILES

Detroit Spy Report

BY JIM DUNNE, Detroit Editor



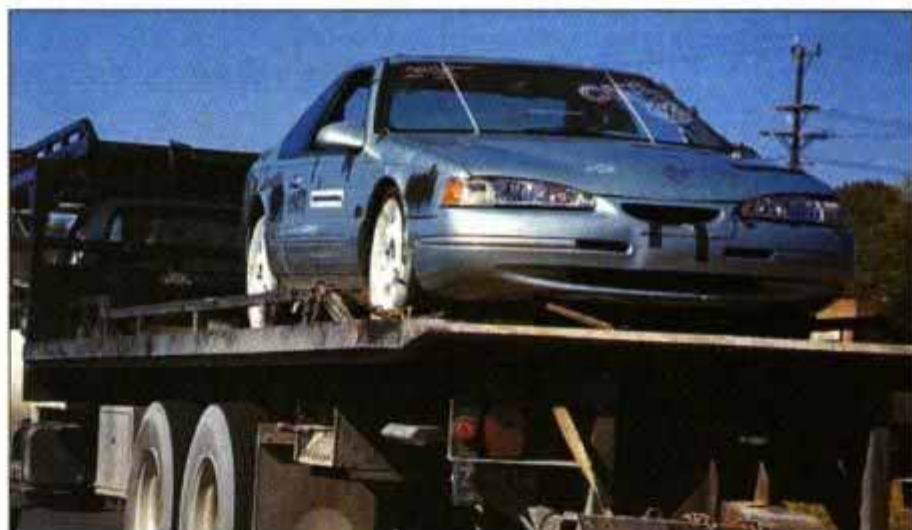
Soft-Top Sebring

● The normally tight security veil over Chrysler's future prototype models developed just enough of a crack for us to grab this view of the carmaker's sporty front-wheel-drive Sebring ragtop. The car will replace the LeBaron convertible in Chrysler's 1996 lineup. While details of the front and rear styling are not clear from the photo, you can look for this convertible version to have essentially the same grille and taillight treatment used on the recently introduced Chrysler Sebring coupe. The prototype seen here is undergoing shake testing of the new body structure. Note the weighted package atop the hood. That's not a disguise, but a counterweight that puts extra strain on the front end as part of a structure test.

The '96 Bonneville

Here's how the Pontiac Bonneville is going to get its face lifted for next year. Like the other full-size cars in GM's lineup, the car is going to get new grille inserts. Being a Pontiac, the car gets those recognizable, prominently displayed trademark round running lights in the fascia. The changes are not only to the front. Also look for revised styling on the rear, where the taillights will spread wider. Overall, the body will feature even more rounded surfaces, with fewer

character lines and a smoother overall appearance. Under the hood, the '96 Bonneville will feature the updated version of GM's 3.8-liter V6 engine with a supercharging option.



No, this T-Bird wasn't parked illegally. It's a '96 prototype at the proving grounds.

Thunderbird, 1996

A slight facelift is planned for the '96 T-Bird. This photo of an early prototype on a Ford flatbed shows most of the changes. Look closely and you see the Thunderbird trademark nestled in the center of the grille opening. Ford is still trying to decide what shape the Thunderbird should take in the years after '96. You can count on the new car being smaller and lighter. And making the next T-Bird a front-wheel-drive model is a moderate possibility, too, at this point. But for 1996, all Ford can offer is this facelift of the present car.

Mazda Cougar

While Ford's management is thinking hard about the next Thunderbird, you know that Mercury's think tank is concerned about

the Cougar. In fact, the next version of Mercury's sporty coupe, due for 1998, could have its origins in Hiroshima, not Dearborn. One of the critical design goals is to build a smaller, lighter coupe with better fuel economy than the car has delivered in the past. But at the same time, Mercury wants to offer some luxury to Cougar buyers. That's where Mazda comes in. Its Millenia sedan just begs for a coupe version. Mazda doesn't have one. So one possible scenario is to use the Millenia chassis for the next Cougar. That means a V6 engine, front-wheel drive and world-class quality for Cougars of the future.



Changes to the new 88 are conservative.

Oldsmobile 88 for '96

It doesn't appear to be much of a change, but this is the front end of a 1996 Olds Eighty Eight. While the development car shown here is not the final design, it is close. Note that the fit of the headlights to the grille is not quite correct. The small gap will be closed when a new headlight shape is fitted to the '96 production cars. **FM**



New nose and tall for the Bonneville.

BOATING

Brave New Water World

BY JOE SKORUPA, Boating/Outdoors Editor

● Except for people who live on an island, nobody really needs a boat. We may want a boat or even lust after one, but we don't need one. However, wanting one is usually enough motivation to buy one. But not always.

Wanting one wasn't enough for vast numbers of people between 1989 and the middle of 1993. Why? Probably the biggest reason was a squeeze on our wallets, which was caused by the economic recession that occurred during much of the period.

Another reason was boating's so-called cyclical nature. From '89 to '93, the industry was going through one of its regular down cycles. We don't need boats, right? Therefore, it figures that when economic times are tough, we postpone nonessential purchases. Other recreational industries surely go through similar boom/bust cycles. Don't they?

Not exactly.

Most industries, including those that serve leisure-oriented markets, refer to a down year as one that is less successful than the year before. A bad year is one that is flat (registering no growth). A very bad year is one in which growth is measured in negative numbers. This is relatively rare and is considered so catastrophic that it typically causes heads to roll.

Boating describes the above phenomena a bit differently. For example, the term "cycle" is used to measure time, because a single year isn't long enough to cover boating's regular downward plunges. And when boating refers to a down cycle, it doesn't mean a period of slow or zero growth. It refers to a multiyear period of catastrophically negative growth.

How catastrophic? Well, during boating's last down cycle, the industry shrank by more than 40%. The interesting thing is that carnage of this type isn't unusual for boating. As a matter of fact, it has happened in each decade since World War II, although the last down cycle set a new record. Is this normal?

I've been told by experts that it is, and I used to believe them. Lately, I've begun to wonder.

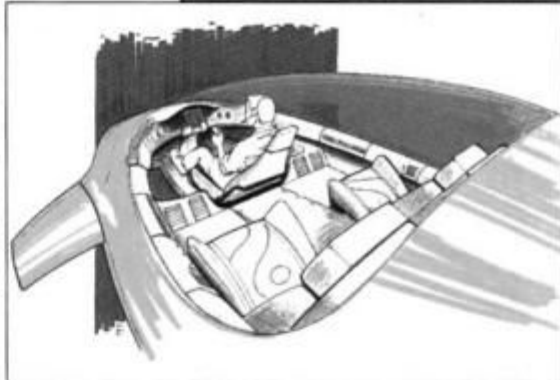
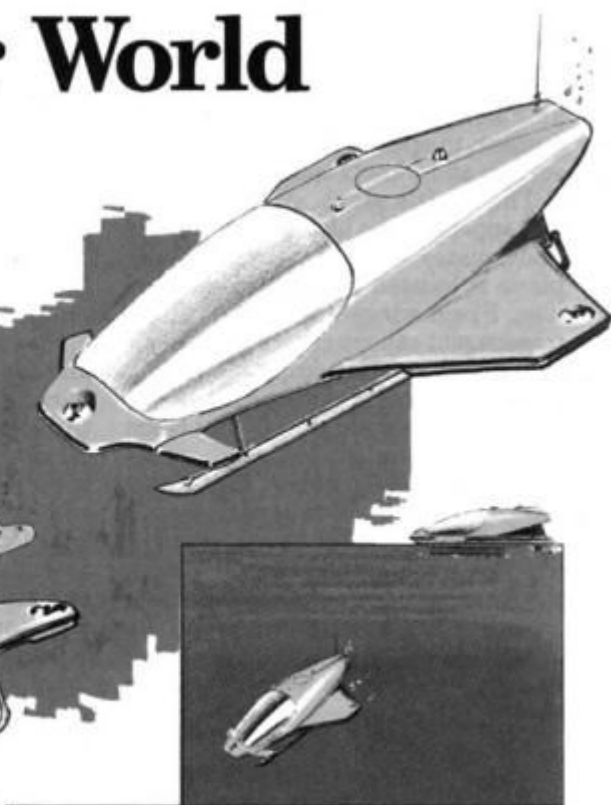


Walking down the aisles of the recent Chicago Boat Show, my mind turned to these thoughts. Here were all the boats, motors and accessories for the coming 1995 product year, and in many ways they were truly impressive. Boating's last down cycle ended in 1993, so the industry was flush with cash and optimism after a year of riding a strong upward cycle.

But despite all the flash and dazzle, I couldn't help but think about boating's cyclical nature. What goes up must come down. In a couple of years, the show's sparkling exhibitors will be broke. Are boaters well served by an industry that accepts catastrophic loss as the normal course of business?

I don't think so. Here's why: Boat companies are either rolling in profits or scraping the bottom of the barrel.

Budgets for product develop-



ment, customer service, research, long-term planning and other basic functions get slashed during down cycles. In many ways, this causes boating to operate like a part-time industry. Every so often it simply takes a few years off. Hmmm.

With these thoughts in mind, I decided to spend less time on the business-as-usual aspects of the Chicago Boat Show, for example the newly styled sport boats, runabouts, ski boats, cabin boats, fishing boats and cruisers. Instead, I decided to concentrate on boats that seemed to point toward the future, boats that showed a healthy respect for anticipating trends, boats that broke the copycat mold.

The most interesting of these new boats was the Hydro-Glide submersible by Paragon Design (shown at the top of the page). This minisub is an underwater pleasurecraft with limited depth and underwater duration

(Please turn to page 30)



The sporty solar-electric Dolphin-Star.

capability. While not intended to handle research or salvage duties, the Hydro-Glide is capable of reaching an operating depth of 150 ft. and a duration limit of 3 hours. It's powered by an electric motor that propels the minisub to speeds of 10 knots on the surface and 5 knots submerged.

The craft's sleek, narrow-nosed hull appears to be ideally suited to the underwater environment. A diving plane is located on each side of the bow. Fixed wings are located aft. A transparent canopy covers the cockpit and provides a wide scope of visibility to the driver and two passengers. Length of the craft is 18 ft. and beam is 9 ft.

Paragon Design thinks of the Hydro-Glide as the ultimate yachtsman's toy—after all, the company's primary business is designing yachts. To facilitate this role, the submersible is designed to be loaded onto a yacht like a conventional tender.

Personally, I think the Hydro-Glide

(which exists only on paper for the moment) has a much wider appeal. After all, who doesn't want to fly beneath the waves and explore the ocean bottom for sunken treasure? For more information, contact Paragon Design, 107 Kilmayne Dr., Suite D, Cary, NC 27511; (919) 319-0559.

For head-turning looks and environmental friendliness, the solar-electric Dolphin-Star is a standout. Well beyond the concept stage, the Dolphin-Star is ready to hit the water, and in fact, the unit on display had already performed sea trials. Compared to other solar-electric boats, the Dolphin-Star, built by SunWize Marine Technologies, is a cut above because it combines sport-boat looks with near-runabout speed—12 knots.

Looking at the side of the Dolphin-Star, the boat appears to be a typical, sleekly contoured catamaran. But from the bow there is no mistaking its solar-electric heritage. The long, wide foredeck is covered by sturdy photo-

voltaic panels that are strikingly integrated into the curving deck structure. These highly efficient solar cells are encapsulated in rugged polymers that not only make them strong enough to withstand blows from a hammer, but provide a skid-resistant surface for walking or sunbathing.

Using power generated by these panels, the big cat can cruise all day on bright sunlight alone. In addition, powerful batteries provide up to 8 hours of operational use. Propulsion for the Dolphin-Star comes from twin inboard 2-hp permanent-magnet DC motors. Length is 21 ft. 6 in. and beam is 8 ft. Weight is 1200 pounds. The craft has a wide bench for seating and can accommodate up to four.

As the boating industry moves in the direction of environmental friendliness, the future continues to brighten for solar-electric boats. For more information, contact SunWize Marine Technologies, 1151 Flatbush Rd., Kingston, NY 12401; (914) 336-7700.

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No picture of boating's future would be complete without checking out the latest from inventor extraordinaire Harry Schoell. Schoell brought two of his recent creations to Chicago, and not surprisingly, both were impressive. The boldest of the two is the Schoell Rolling Radial Engine, a fuel-injected 2-stroke motor that was shown in the form of a proof-of-concept unit.

Several things make the Rolling Radial Engine unique. These include radially oriented pistons, direct fuel injection into the cylinders and a crank-driven blower that scavenges the cylinders and also supercharges the engine. The radial orientation of the pistons not only contributes to a significant reduction in size and weight, but also enables opposing forces to counterbalance operational vibration, so the engine is exceptionally smooth.

While it would be hard to judge the effectiveness of an engine prior to a hands-on test, Schoell doesn't waste his time and money on wild-goose

chases. It will take a great deal of effort to convince engine builders to move away from current technology, but in the long run I wouldn't bet against the soundness of a Schoell design.

The latest Infinity Yacht also occupied important space in the Schoell Marine display booth. Called the 83 Stargazer, this futuristic concept craft has an encapsulated, see-through bridge dome that converts to a hard-top bridge at the touch of a button (the front and rear windows slide out of sight). While this luxury yacht is large, at 83 ft. long and 21 ft. wide, it is unusually fast for a 40-ton boat. With standard engines (four 1100-hp Detroit Diesel 12V92 DDECs) the Stargazer will cruise at more than 50 mph and will top out in the mid 60s. With optional power (four Deutz 1400-hp V12-616s), the Stargazer will reach the mid 70s.

Part of the reason for the big yacht's sport-boat speed is the bottom

configuration, which features Schoell's patented Duo-Delta Conic hull. For more information, contact Schoell Marine, 2701 Reese Rd., Davie, FL 33314; (305) 581-3313.

So, will a focus on forward-looking boats and powerplants, like the ones mentioned above, solve boating's problem with boom/bust cycles? Not alone. But making an effort to reach nontraditional boaters is a step in the right direction. Why? Because industry figures show that 80% of all boats are sold to previous boat owners. New boaters are a rare breed.

An even more telling statistic is that of all first-time boat buyers, roughly 50% never buy a boat again. This says a lot about an inability to achieve buyer satisfaction and indicates a problem with the industry being out of touch with new buyers. By attracting and satisfying new boaters, boating could damp the severity of the boom/bust cycles and become a fast-moving, healthy modern industry. **FM**



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Magellan's Last Voyage

BY GREGORY T. POPE, Science/Technology Editor



● Just after 3 am PDT on Oct. 12, 1994, *Magellan* called home for the last time. The spacecraft, launched five years ago to map Venus, was completing its 15,034th orbit when the planet's horizon cut off its radio signal to Earth. At the time, *Magellan* was obeying its final order, a suicide command that forced the spacecraft to ply a dwindling orbit down into the Venusian atmosphere. At 3:29, the probe should have re-established communication as it emerged from behind Venus. But ground controllers could only pick up the lonely crackle of interplanetary static. *Magellan* was dead.

Jim Neuman, *Magellan* program manager for Martin Marietta Astronautics, was at the company's mission-support area outside Denver at the time. "It was interesting," he recalls, "in that we had spent the entire night trying to kill the spacecraft. And it was so tenacious it would not die. It wouldn't lose attitude control, or memory, or engines. But then when it finally went in, the mood changed, and it was very emotional. I'll never forget it." Neuman had been with the project since 1983, when Martin Marietta began assembling the spacecraft—largely of spare parts from other planetary programs.

Proving much more than the sum of its components, *Magellan* deserved a poignant farewell. Its tour of duty—a 4-year exploration of Earth's nearest neighbor—succeeded beyond all hopes. *Magellan* and a resourceful crew of ground controllers overcame a string of technical glitches to collect more data than all previous planetary missions combined. So why did NASA decide to snuff out the life of this gallant probe?

Well, for one thing, *Magellan* had already fulfilled its original goal. Its X-band radar had pierced the caustic clouds of Venus to map 98% of the planet's surface. Mission managers then worked some overtime out of the spacecraft by using it to chart variations in Venus's gravity.

But by last summer the *Magellan* budget was running dry, and the spacecraft was on its last legs. So NASA's Jet Propulsion Laboratory (JPL) decided to terminate *Magellan* with a final

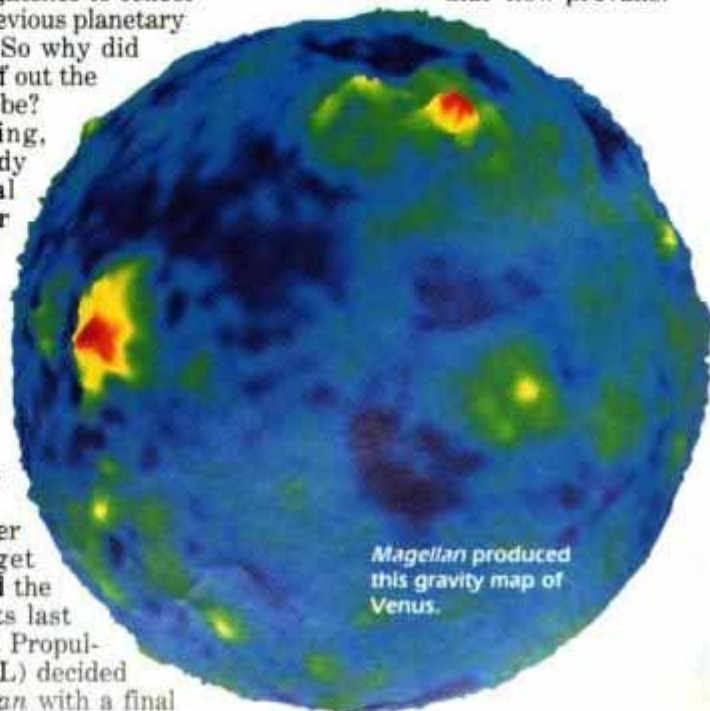
series of experiments. Called windmill maneuvers, these would send the spacecraft through the upper reaches of the Venusian atmosphere with its solar panels awry, one tilted forward 30° and the other tilted backward.

Atmospheric resistance against the skewed panels would result in a torque force, windmilling the spacecraft into a roll. But ground controllers programmed the spacecraft's computer to fight this force by firing attitude-control thrusters. By recording how many thruster firings were needed to resist the torque, the *Magellan* team could measure the aerodynamic forces that the probe was encountering.

Unfortunately, the off-kilter angles of the solar panels would also turn their faces away from the Sun, dooming *Magellan's* battery. The spacecraft would lose consciousness hours before it dove through the atmosphere and crashed.

But *Magellan's* death was as productive as its life. According to Doug Griffith, *Magellan's* project manager at JPL, the windmill maneuvers spun out a wealth of data that will help shape future spacecraft.

Magellan executed the maneuvers against an atmosphere so scanty that a condition known as free molecular flow prevails.



Magellan produced this gravity map of Venus.



Magellan revealed Venusian topography.

"That's when molecules might have to travel yards before hitting another molecule," explains Griffith. "One thing that's vexed satellite designers for years is what the drag effect is in this kind of flow. Do molecules hit and stick to a surface, or do they just bounce off like billiard balls? Knowing that is going to be very useful for designing satellites for low Earth orbit. It turns out that it's never been measured."

The first set of windmill maneuvers took place last September in the loftiest fringes of Venus's atmosphere, roughly 105 miles above the surface. Up there, the atmosphere consists of atomic oxygen, just like the high wisps of air through which low-Earth-orbit satellites move. The second and final experiment occurred at an altitude of 80 to 90 miles, where carbon dioxide predominates. All this lies far higher than the notorious sulfuric acid clouds, which drift 30 miles above the Venusian landscape.

Instrumental in the design of these experiments was Bob Tolson, a mechanical engineering professor at Hampton, Virginia's Joint Institute for Advanced Flight Studies, run by George Washington University and NASA's Langley Research Center. According to Tolson, both sets of maneuvers produced unforeseen results.

In the oxygen atmosphere, the spacecraft felt more torque than anticipated. Free oxygen atoms are highly reactive and will cleave to virtually anything. Because of this, researchers expected them to stick like putty to the solar panels, unloading their momentum in a way that would not produce torque. Instead, some of the oxygen apparently ricocheted off the panels and triggered opposing lift forces that caused the rolling moment.

By contrast, the more stable carbon-dioxide molecules were expected to bounce elastically off the solar panels. But again, the data surprised Tolson. "The best I can tell you is that we have

inconsistent results," he says, "but we got considerably less torque than we thought we would."

As they puzzle over these results, researchers are already looking ahead. Data from the oxygen windmill should help engineers predict the decay in the orbits of satellites above Earth. The carbon-dioxide results, meanwhile, will factor into the design of probes slated for Mars. In fact, Martin Marietta is absorbing the new data as the company designs *Mars Global Surveyor*. This spacecraft will rocket off in November 1996, to carry out part of the mission of the ill-fated *Mars Observer* (see Tech Update, page 18, May '94). *Mars Global Surveyor* will aerobrake through the carbon-dioxide-rich Martian atmosphere after arriving at the Red Planet.

Magellan has done yeoman service on behalf of NASA's future planetary probes. And as a probe in its own right, *Magellan* has set a standard that may be hard to match. **FM**

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AUTOMOBILES

Import Spy Report

BY MIKE ALLEN, Associate Automotive Editor
and JIM DUNNE, Detroit Editor



Toyota Pickup

● It's hard to tell from the photograph, but the diminutive size of this pickup pegs it as a replacement for the smaller of the two Toyota trucks. This means a more distinct family resemblance to the full-size T100. No, Toyota isn't returning to the slab-sided days of yesteryear—that's

styling change moves the license plate to a housing in the new bumper.

1996 Mazda 323

We don't have any information about it, but here's a 1996 Mazda 323 caught during testing somewhere in the Southwest, probably while Ford engineers were developing their 323-based Escort subcompact.

the Eurovan—an indication that the new engine has the muscle to carry a full load and do some towing, too.

Hyundai, 1996

All-new styling is planned for the 1996 Hyundai Elantra models. The coupe, with styling roughly based on the HCD-2 show car, replaces the Scoupe. It will be powered by a 2.0-liter version of the Hyundai-designed-and-built



'96 Mazda 323 captured testing in U.S.

Alpha 4-cylinder engine. The coupe's 2-plus-2 passenger layout and hard-top door-glass design set this model apart from its more conservative 4-door stablemate. Look for the coupe to debut as a 1997 model, almost a year after the all-new 4-door Elantra makes its official appearance.

BMW Roadster

Based on the 318 model, the Bavarian automaker's roadster is scheduled to be built at BMW's new assembly plant in South Carolina. Only one body style will be offered, the 2-seat convertible coupe. A 1.8-liter 4-cylinder engine and 5-speed transmission will drive the rear wheels. Price? BMW would very much like to keep it under \$30,000, if possible. **FM**



Suzuki will freshen the front-end appearance of the Sidekick 4x4 for the '96 model year.

about an acre of flat cardboard duct-taped to the bodywork for a disguise.

Suzuki Sidekick

Suzuki plans major changes to the front-end appearance of its Sidekick 4-wheel-drive model for 1996. A new hood, new front fascia and a new grille and bumper are in store for the future model. Reports of a new engine coincide with the changes in front-end styling. The slight powerdome in the hood will accommodate a larger engine. Today's 1.6-liter Four is being replaced with a 1.8- or 2.0-liter Four in the 1996 model. At the rear, a

Eurovan V6

Volkswagen will try to rev up its Eurovan image with new front-end styling and a more powerful V6 engine. The 1996 version of the VW van will get a car-like front end and use the 172-horsepower 2.8-liter V6 engine to be more competitive with U.S.-designed vans. Right now, low engine output places VW at a disadvantage. VW is testing the pulling power of



VW's anachronistic Eurovan gets facelift, much-needed V6 motor.

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Bill Smith

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- VCR Cleaning, Maintenance & Repair, Dept. 62254
- Computer Repair, Maintenance, Upgrade, Dept. 64154
- TV/Satellite Dish Service and Repair, Dept. 31048
- Professional Gunsmithing, Dept. 92059
- Professional Woodworking, Dept. 43377
- Professional Computer Programming, Dept. 35008
- Upholstery, Dept. 81043



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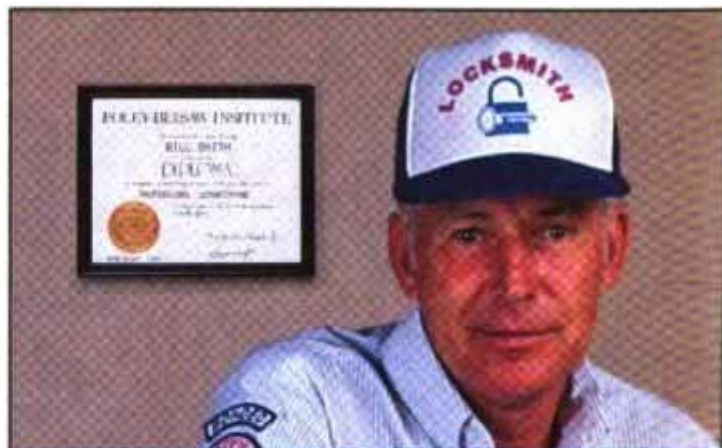
Send today for a free opportunity kit on one of the following profitable fields:

1 Locksmithing - As crime rates rise and millions of Americans seek more protection, locksmiths are now enjoying more business and higher profits than ever before. Your professional locksmith training includes a burglar and fire alarm course to complete your education as a highly paid security specialist.

2 Small Engine Service & Repair - Today, there are over 65 million small engines in America, with 1,000,000 more purchased each month. And most owners don't have the skills to perform even simple repair jobs on them. This course could be your golden career opportunity. With the skills you gain, you can earn as much as \$49.94 for a simple tune-up that takes about an hour of your time.

3 Professional Saw and Tool Sharpening - Imagine earning \$18-\$30 an hour — and 90 cents out of every dollar you earn is cash profit! All the work space you need is a corner of your garage and you're in charge. Foley-Belsaw provides everything you need to master the craft, including your own professional Sharp-All machine.

4 VCR Cleaning, Maintenance & Repair - Right now, more than 77 million VCRs are in use and a thousand more are purchased every month. VCR repair is clearly a great career choice for the 1990s! And you need no prior experience for success. David K. Knowton, New York, tells us, "I thought you



"Your best choice for top-of-the-line skills is Foley-Belsaw. The training is respected worldwide."
Bill Smith

had to be a 'wiz' in electronics to succeed in VCR repair. Now I know nothing is further from the truth."

5 Computer Repair, Maintenance, Upgrade - Most businesses are "on-line." And so are a growing number of homes — personal computers are practically household appliances! The need for skilled computer installation, maintenance, upgrades and repair is tremendous. Foley-Belsaw offers the training you need to cash in on this growth.

6 TV/Satellite Dish Service and Repair - You see them popping up in yards all over town. The market for satellite dishes will continue to grow to satisfy the demand for variety in entertainment. Get the skills you'll need to profit.

7 Professional Gunsmithing - Skilled gunsmiths - when you can find one - charge up to \$50 per hour for simple repairs. That's money you can put in your pocket with the training you'll get from Foley-Belsaw.

8 Professional Woodworking - You'll start your course with the simplest of projects, but soon will be crafting mortise and tenon joints, creating heirloom-quality pieces worth thousands of net-profit dollars. The course is also ideal for the do-it-yourselfer. As J. B. of Shawnee Mission, Kansas, writes, "I saved well over \$2,000 in kitchen remodeling and \$1,000 on a deck."

9 Upholstery - Furniture prices have increased yet quality has noticeably decreased. So many individuals and businesses now turn to skilled upholsterers to restyle furniture instead of discarding it. With the Foley-Belsaw course, you'll become an upholstery professional, using your knowledge for a full-time business, part-time career, or a satisfying, money-saving hobby.

10 Computer Programming - It's a fact: Computers are more widespread than ever before. And programmers with the right skills command top dollar for their work. Learn the languages most in demand — Q Basic, C, C+ and C++ — and watch your income soar.

You could be earning good money in one of these money-making fields. Send for one of these informative opportunity kits today ... absolutely FREE.



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ELECTRONICS

Epcot's Innovention

BY FRANK VIZARD, Electronics Editor



● Over the years, mention has been made of many trade shows where the latest and greatest new products are unveiled. The Consumer Electronics Show and COMDEX, which is devoted to computers, are two examples. Unfortunately, however, these shows are generally open only to those people in the business. More than once I've heard people exclaim: "Gee, I wish I could go to that!"

Well, if you want to go to an electronics trade show, there is one you can go to any time in Orlando, Florida. The show is called Innoventions and it is at Walt Disney's Epcot Center.

The idea is to give visitors a glimpse of the near future using new products and technologies that are just appearing in the marketplace, many of which already are familiar to PM readers. For example, Sony's new Magic Link



Sony's new personal communicator.

personal communicator is on display at the AT&T exhibit. This device is driven by operating software developed by General Magic and AT&T communications software, technologies reported by PM in our April 1994 issue. AT&T is also displaying a prototype wrist telephone, a device first seen in PM's August 1994 issue.

Innoventions is both a learning experience and a lot of fun. A big attraction on the fun side of the equation is the Sega exhibit. Here you can play 140 of the latest videogames developed for both the home and the arcade. The arcade games include a high-speed space simulation ride and "Virtua Formula," a game that lets drivers compete against each other on an Indy 500-style course displayed on giant TV screens in front of each car.

Another fun attraction is the Walt Disney Imagineering Laboratory, where a new theme park is under development.

The centerpiece of this project is a blend of virtual reality (VR) and animation technologies. Put on a VR headset and you can ride a magic carpet through an "Aladdin" environment.

Meanwhile, an experimental robot named "Alec Tronic" is your host at the Electronics booth, devoted to many

new audio and video technologies. Perhaps the most interactive attraction is the "Virtual Music" game, in which you play a computerized guitar and join in on a music video. No musical training required. Across the aisle, electronic golf clubs and baseball bats from Sports Science Inc. give videogames a new realistic dimension.

Another video-related booth is manned by Videonics, which makes video-editing devices. Here you can learn how to produce better home videos with a variety of special effects.

On the more educational side are a number of exhibits reminiscent of bygone world's fairs. General Motors, for example, will tell you all about its Impact electric car. Both IBM and Apple have computer centers, where you can experiment with the latest multimedia tools. General Electric and Honeywell exhibit the latest in home appliances and energy-saving technologies.

Of course, the information superhighway gets a lot of play. Oracle Corp. provides visitors with a good grounding on the subject with treatises on navigation, home shopping, movies-on-demand and other related topics. Motorola explores the wireless connections available from a variety of communications devices.

Putting it all together, though, is Masco Corp.'s tour through the Magic House of the near future. In a room-by-room tour, you can see how tomorrow's appliances and electronic innovations blend into the home. The exhibit goes so far as to include liquid-crystal windows that switch from clear to opaque for privacy, and a toilet that analyzes waste for a report on health status and then cleans itself after each use. I can't wait to move in.

PM

Park Avenue's back seats don't take a back seat to most other cars' front seats.

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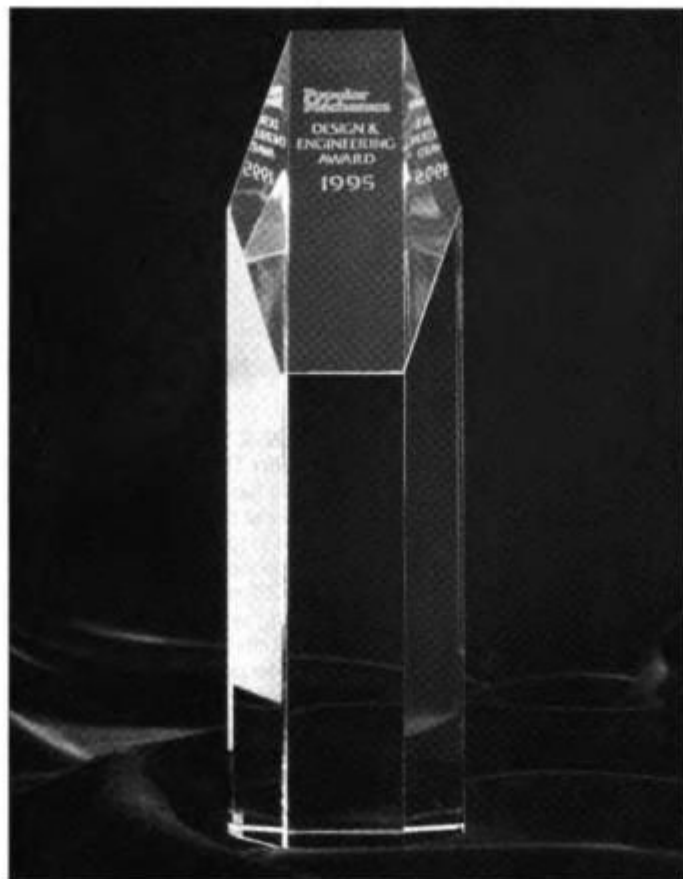


PHOTO BY BRIAN KOSOFF

1995 DESIGN & ENGINEERING AWARDS

- One of the great pleasures of being editor of POPULAR MECHANICS is to be able to announce our annual Design & Engineering Award winners in each January issue.

A Design & Engineering Award is the highest honor we can bestow. We present our awards to recognize innovation, invention and just plain great ideas. Anyone can nominate anything for a Design & Engineering Award. However, only our department-head editors—each an expert in his own particular field—select the final winners.

In some cases, the selections are made easily. Some winners are so obvious they almost seem to select themselves. In other cases, many hours, or even days, of discussion and deliberation take place until our final slate is complete.

This year, out of the many, many nominations, only 37 winners were finally selected. Here they are. The best of the best. The 1995 POPULAR MECHANICS Design & Engineering Award winners. —Joe Oldham

DESIGN & ENGINEERING AWARDS



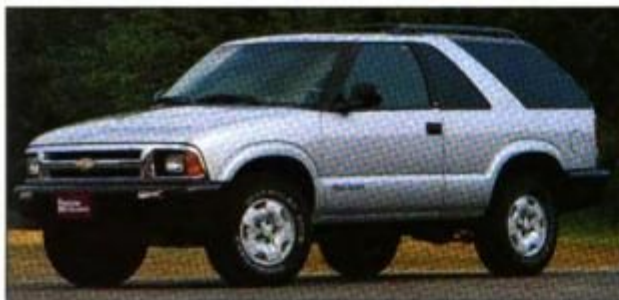
TOYOTA AVALON Toyota Motor Sales USA

The Avalon is a great new execution of a great old idea: a car with a great big, roomy interior that seats six full-size adults, comfortably. A trunk that holds all their luggage. What's the big deal? Do it in a car with exterior dimensions only slightly larger than those of a Toyota Camry.



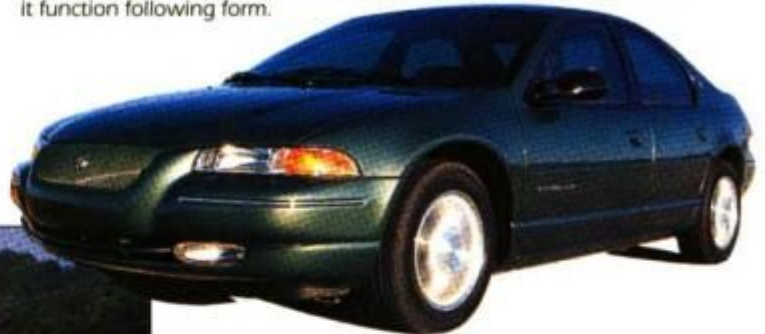
CHEVROLET BLAZER/GMC TRUCK JIMMY Chevrolet Motor Division/GMC Truck Division, General Motors Corp.

Aimed squarely at the heart of the booming compact sport/utility market, the all-new Chevy Blazer and its cousin, the GMC Truck Jimmy, will set the new benchmark for the category. Start with the quietest, most carlike ride of any sport/utility. Add the most powerful V6 you can get in an SUV, then top it off with a comfort, luxury and amenity level that makes you want to own one.



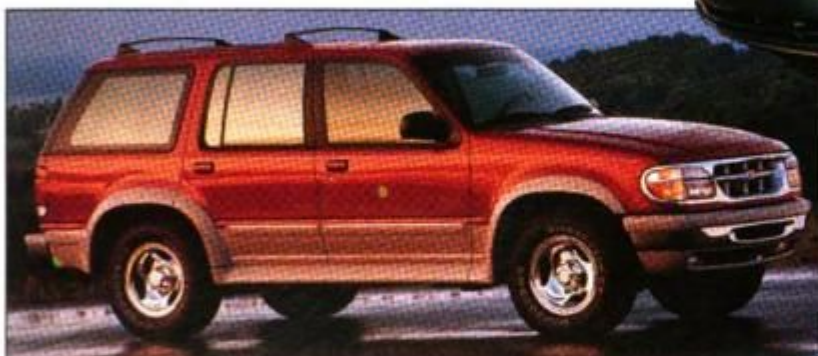
CHRYSLER CIRRUS/DODGE STRATUS Chrysler-Plymouth Division/Dodge Division, Chrysler Corp.

Among the best-looking new cars of 1995, Chrysler has taken its cab-forward styling to the next level, and designed these cars to go head to head with the best of the midsize class. Cirrus and Stratus deliver fun-to-drive performance and handling to back up their terrific looks. Call it function following form.



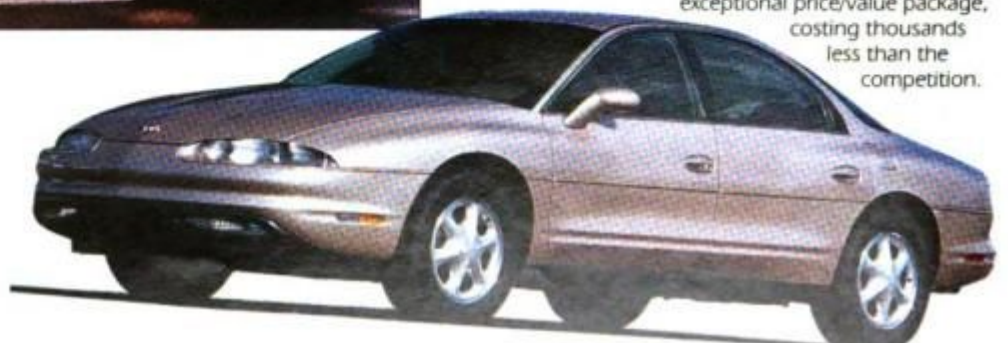
OLDSMOBILE AURORA Oldsmobile Division, General Motors Corp.

Sharing a stiff 25-Hertz platform with the Buick Riviera, Oldsmobile from there goes its own way with a 250-horsepower V8, world-class suspension system, and luxury oozing from every pore. And Aurora is an exceptional price/value package, costing thousands less than the competition.



FORD EXPLORER Ford Motor Co.

The undisputed sport/utility sales leader becomes the high-tech leader as well. Explorer features a new computerized 4-wheel-drive system that automatically senses when 4wd is needed and shifts from 2-wheel drive to 4-wheel drive, and vice versa when conditions warrant. Add the updated looks for an unbeatable combination.



GREEN-X TIRE Michelin Tire Corp.

Michelin has developed a new rubber compound that offers up to a 35% reduction in rolling resistance compared to conventional tires. That translates into an instant 3% to 5% increase in overall fuel economy, with no compromise in traction or tread life. So putting on a set of Green-X tires is like putting gas in your tank.



MITSUBISHI 3000GT SPYDER

Mitsubishi Motor Sales of America/ASC Inc.

An old idea with a new twist. That's the Mitsubishi 3000GT Spyder, with its one-button operation for the opening, folding and stowing of the car's all-steel hardtop. Now you can enjoy true open-air motoring as well as snug cold-weather operation. Of course, you still get one of the world's premier high-performance sports cars, and itself a Design & Engineering Award winner in 1991.



SIDE-IMPACT AIRBAGS

Volvo Cars of North America

Volvo takes airbag benefits one step further by introducing side-impact airbags as an addition to its standard airbag package. The new airbags deploy from the outboard edges of the front seatbacks to protect driver and passenger from side-impact loads. It's just a safer way to drive.



LEXUS LS 400

Lexus Division, Toyota Motor Sales USA

Lexus set new luxury-car standards when it introduced its luxury sedan five years ago. The new LS 400—with refinements that make it quieter, smoother running, more responsive in handling, and better equipped with more standard equipment—answers to an even higher standard.



BUICK RIVIERA

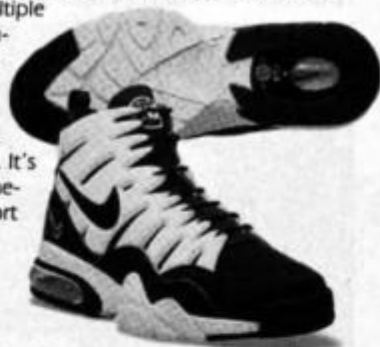
Buick Motor Division, General Motors Corp.

The '95 Riviera continues the marque's distinctive heritage by starting with one of the stiffest platforms in the industry for crisp handling, uncanny quiet and no rattles. Then it adds supercharged horsepower under the hood and yards of luxury in the cabin. The result? A very satisfying driving experience.

AIR MAX² ATHLETIC SHOES

Nike Inc.

A new plateau in air-cushion footwear, Nike's Air Max² technology uses a new manufacturing process that features multiple chambers to conform to different shapes and levels of air pressure for different parts of the foot. It's a new kind of fine-tuning for comfort and support.



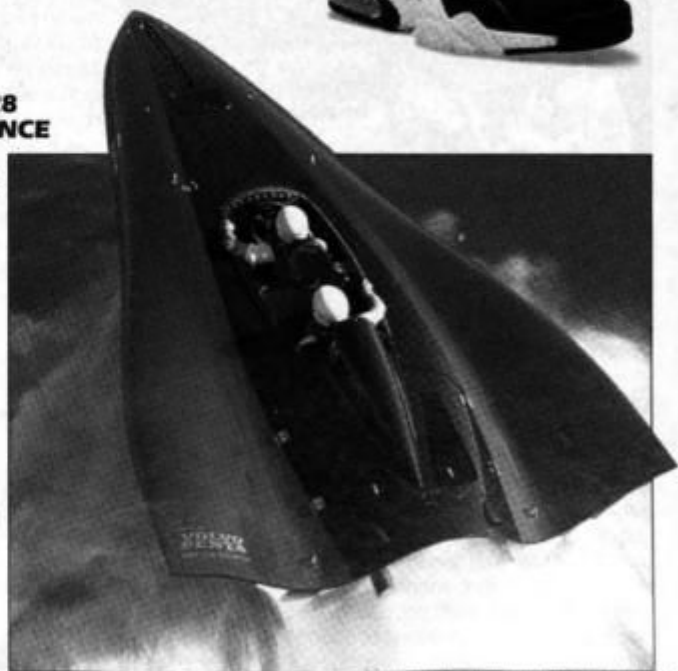
TRIFRAME TANDEM BICYCLE

Designing a mountain bike to fit inside a suitcase is no easy feat. The TriFrame Tandem is an 8-ft. 2-person model that uses a unique hingeless tube-within-a-tube system. The bike folds and unfolds in minutes without the need for tools, making it easy to go and easy to stow. And you'll have the fastest suitcase in town.

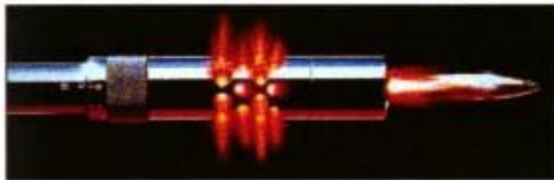
MANNERFELT B-28 HIGH-PERFORMANCE BOAT

Volvo Penta of the Americas Inc.

The Mannerfelt B-28 explores the outer reaches of aerodynamics and hydrodynamics with a futuristic hull design. It uses Speed Rails that run down the longitudinal axis of the hull, deflecting water beneath the hull to produce lift. A delta-wing design ensures stable handling and control at 80 mph. So you feel like you're flying over the water rather than riding on it.



DESIGN & ENGINEERING AWARDS



BALLISTIC OPTIMIZING SHOOTING SYSTEM (BOSS)

Browning Arms Co.

Browning has taken rifle accuracy to a new level. Developing an adjustable rifle-barrel vibration modulator and muzzle brake, the system adjusts timing of the barrel vibrations so that the bullet consistently leaves the rifle muzzle at the most advantageous point in the barrel's oscillation. With precision ammunition, BOSS-equipped rifles of many calibers are capable of 100-yard, one-hole shot groups.



NEKTON PILOT DIVE SHIP

Nekton Diving Cruises

The Nekton Pilot dive ship takes recreational diving to new heights, er, depths. This new vessel features a unique Small-Waterplane-Area Twin Hull—or SWATH—design. In choppy water, the water just below the surface is much more calm, so the vessel uses submerged pontoons to provide unmatched stability and comfort.



CANADAIR CL-415

Bombardier Aerospace Group

The CL-415 is the only aircraft specifically designed and built to fight large-scale fires. The plane is actually a flying boat that can scoop up 1600 gallons of water in 12 seconds, and fly at 190 knots to deliver the load over a raging fire, such as the disaster that struck California in 1993. It's a giant step in conquering one of nature's most destructive forces.



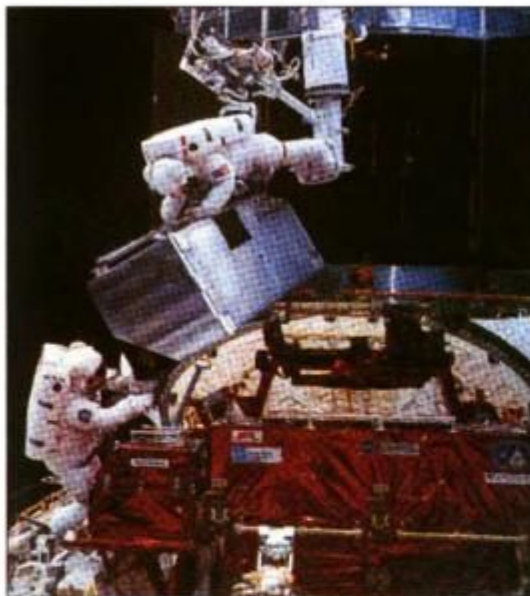
LASER-BASED 3D VOLUMETRIC DISPLAY

Naval Command, Control and Ocean Surveillance Center, Research Development Test and Evaluation Division

This new development produces the most realistic 3-dimensional effect yet. A computer-controlled laser lights up points on a spinning helix inside a globe. It generates 3D images for 360° group viewing, at any angle, and in real time. Applications include everything from medical care to air-traffic control to home entertainment.

STS-61 HUBBLE SPACE TELESCOPE SERVICING MISSION

National Aeronautics and Space Administration



Try to repair something the size of a school bus traveling 17,000 miles per hour in the vacuum, cold and zero gravity of outer space. That's what NASA's astronaut repair team did on an 11-day service call to fix the troubled Hubble Space Telescope. The mission involved a record number of space walks, precision timing and skill, and unique tools specifically designed for working in the unforgiving conditions of outer space.



STEMME S10 MOTORGLIDER

Stemme GmbH & Co. KG

A new concept in self-launching powered sailplanes, the S10's flight performance matches that of the best open-class gliders. Powered by a concealed 94-horsepower Limbach engine, the S10's prop folds and retracts into the nose when in glide mode. Ranging between 800 and 1250 miles in continuous engine-powered mode, the S10 will fly faster and farther than any other motorglider in the world.

SUBARU TELESCOPE MIRROR BLANK

Corning Inc.

The Japanese turned to American technology—and Corning Glassworks—when they needed a mirror blank—the world's largest—for their Subaru telescope. The project involved fusing together individual glass hexagons at 3100°F into a monolith that weighs 33 tons and measures 27 ft. in diameter, yet is only 9 in. thick. The new sky eye is destined to shed new light on the universe's greatest mysteries.





PUSHBUTTON-START STRING TRIMMER
Homelite, Division of Deere & Company

Homelite's new string trimmer starts by pulling a trigger and pushing a button. You won't even find a pull-cord. Starting power comes from a rechargeable nickel-cadmium battery that gives 40 starts on a single charge. It makes starting your trimmer as easy as starting your car.

SABRE PLUS IN-LINE GRIP JIGSAW
S-B Power Tool Co.

The Sabre Plus is significant, because it bridges the gap between heavy-duty reciprocating saws and conventional sabre saws. The tool's compact inline design enables it to reach into confined areas to make curved and straight cuts, notches and holes. A wide range of quick-change accessories makes this one of the most versatile power tools on the market.



WEED EATER ROBOTIC SOLAR LAWNMOWER
Poulan/Weed Eater Division, WCI Outdoor Products Inc.

A robot that cuts the lawn for you? Yep. The Weed Eater Robotic Solar Lawnmower is the world's first fully automated, emissions-free, solar-powered lawnmower. The robot wanders across your lawn, in an area defined by buried wires, trimming grass tips continuously—as long as the sun shines.

BATTERY-OPERATED RIDING MOWER
Ardlcam Inc.

The Turfstar 2000 Electra is an electric riding mower with surprising capability. Powered by six 6-volt deep-cycle batteries, the mower has a 44-in., tri-blade deck and a 5-speed transaxle. With a 2-hour run time, it can cut about 2 acres before it needs recharging. Mowing doesn't get any easier than this.



SLAKELIGHT
Black & Decker Corp.

This unique flashlight stands on its own for hands-free illumination. The flexible core allows adjustment of the beam in any direction, and the tubular coil body can be wrapped around or draped over any nearby object if no flat surface is handy. Two C-cells power this beacon in a sea of ordinary flashlights.



DUAL-COMPOUND MITER SAW
Makita USA

This is the first tool of its kind that cuts bevels to the right as well as the left. The tool's ambidextrous ability comes from a redesigned powerhead, where the motor housing is mounted on an angle to clear the work when the saw is set for right bevels. The saw cuts work time as it cuts bevels.



MODEL 7800 DRYWALL SANDER
Porter-Cable Corp.

Sanding finished drywall is dusty and unpleasant at best. Porter-Cable's new Drywall Sander is a faster and safer way to a professionally finished job. Using a 62-in.-long wand that weighs only 8 pounds, the tool features a swiveling sanding head that houses a unique foam-backed abrasive pad. When used with a shop vacuum, dust is minimized so you can breathe—as well as work—easier.

DESIGN & ENGINEERING AWARDS

DATA LINK WATCH Timex Corp.

Wristwatches are telling much more than time these days. Timex's Data Link uses optical scanning technology and built-in programming software to easily transfer information—appointments, phone numbers, addresses, to-do lists and more—from your computer to your wrist. It's almost like having a traveling secretary.



AERO SUBNOTEBOOK COMPUTER Compaq Computer Corp.

The 3½-pound Compaq Aero shrinks desktop computer performance into a small size without the drawbacks normally associated with notebook computers. Packing a 486SX microprocessor, a keyboard that is just 5% smaller than its larger competitors, and sharp monochrome or color display screens, the computer features PCMCIA slots for CD-ROM drives and more. It's an on-the-go computer that just loves the fast lane.



WIRELESS TV SYSTEM CellularVision Technologies and Telecommunications

Think of it as cable television, but without the cable. CellularVision uses high-frequency radio waves to transmit its signals. Beamed down from satellites, the signal is received by a local relay point that distributes it, distortion-free, to the viewer's small 5-in. antenna.

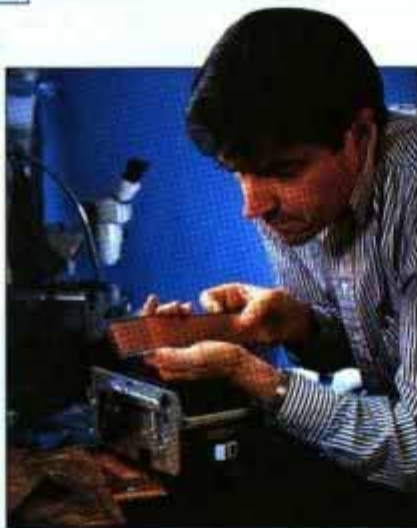


BRIEFCASE SATELLITE TELEPHONE SYSTEM Magnavox Electronic Systems Co.

Need to call your office from the middle of the Mojave Desert? No problem. Just open up your MX 3030 MagnaPhone M briefcase, switch it on, raise the lid and point it toward the appropriate satellite. The MagnaPhone, a totally self-contained portable satellite telephone system that weighs just 27 pounds, lets you place or receive calls from anywhere on Earth.

PLASTIC LITHIUM BATTERY STRIPS Bellcore

Bellcore's answer to reducing battery size and weight is its power-strip sandwich. Lithium ion technology is the power-storage medium, reducing the battery to just thin strips, which can be combined for higher power requirements. The energy density of these rechargeable strips far exceeds that of nickel-cadmium, lead-acid and nickel-metal-hydride batteries.



DIGITAL SATELLITE SYSTEM RCA/Thomson Consumer Electronics

The first direct broadcast satellite TV system in the United States utilizes a pair of orbiting satellites with the ability to transmit 175 channels. The system features sound and picture quality superior to both broadcast and cable television. Even more remarkable, the receiver dish is just 18 in. in diameter. **PM**



PRESARIO 500/SPECTRIA INFORMATION APPLIANCES

Compaq's Presario 500 and Packard Bell's Spectria information appliances combine a stack of electronic components into one tidy unit that features color TV with a cable-ready tuner, compact disc and CD-ROM for music and multimedia discs, hi-fi stereo amps and speakers, a phone, fax, modem and a smart answering device to run the switchboard while you're away.



'BIG' SEDANS

The ever-changing face of today's American family sedan.

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

● The family sedan is an icon of American life. So many of us remember growing up in the back of a Chevrolet Bel Air, or a Ford Galaxie, or a Dodge Coronet, or maybe a Rambler Classic. With their broad bench seats, these cars had ample room for the typical American family. The V8 under the hood had no trouble hauling the family across town or country.

Well, times and the typical American family sedan have changed. Take, for example, our group of four. While there is still a Chevy, a Dodge and a Ford, their given names have changed. And nowhere is there a Rambler. Yet they are still American icons, even though only two of the four are actually built in the

U.S.A. And one of those is a Japanese-branded model, which was unknown when Ramblers prowled our roads. And though the current family sedans are hardly as big as their forebears, they are appreciably larger than modern compacts. In fact, other than what are now commonly considered road monsters, these front-drive sedans are today's "big" family cars. Though none of them offers a V8, they all can be equipped to seat six—a requisite for this test.

We have compared the two newest sedans—the Chevrolet Lumina and Toyota Avalon—with the best-selling Ford Taurus and the trend-setting Dodge Intrepid. Here, alphabetically, is what we found.

'BIG' SEDANS



CHEVROLET LUMINA LS



The Lumina has a sleek, good-looking new body that's built on a stiff new chassis and all-independent suspension. The interior is modern, well thought out and ergonomically designed. There's a choice of engines—our car had the optional 24-valve dohc V6.



Chevrolet Lumina LS

Chevrolet has gotten very serious about once again offering a solid contender in this market segment. So the folks with the bow tie have packed the Lumina with a most impressive weapon: value. Our Lumina LS was as well equipped as the rest of our test group—optional V6 engine, 4-speed overdrive automatic, antilock brakes, air conditioning, cruise control, power driver's seat, windows, mirrors and door locks, remote keyless entry, AM/FM/cassette stereo—but was the only one with an as-tested price below \$20,000. That fact alone is enough to make this new Lumina a serious contender.

A prime design goal for the new Lumina was that it have a quiet, rattle-free passenger compartment. So, for one thing, the Lumina now has more sound-deadening material and fewer parts than the old. For another, the Lumina is built on a substantially stiffer platform than before.

The passenger compartment is much quieter than before. It is also a much more modern and hospitable place than it used to be. There are cubbyholes and pockets galore. There's the mandatory cup holder in the center console. There's a large, usable glove compartment beneath the passenger's airbag. The ventilation and radio controls are large, soft and rounded. The instrument panel is clean and legible. Among the warning lights is one for low oil level.

The stiff (21-Hz) chassis, which is at the root of the Lumina's quiet, is also the starting point for the car's suspension. And the Lumina is much crisper and rides infinitely more smoothly than its predecessor. The all-strut suspension does a creditable job of keeping the wheels on the road and the shocks of an unfriendly highway out of the passenger compartment—just fine for your family sedan.

However, when pressed into ever-intensifying extreme handling situa-

tions—like our 700-ft. slalom course at the test track—the Lumina's suspension begins to reveal some of its limitations. Despite its steady-state sticking aplomb—it tied for top honors on the skidpad—the Lumina was slowest through the slalom. It also ended up with the longest stopping distances of the group. Like all of the others in this test, the Lumina was equipped with 4-wheel ABS. Unlike any of the others, however, the Lumina has a front disc/rear drum braking system. And though the brakes worked unflinchingly with no appreciable fade or fuss, the Lumina covered more ground while stopping than any of the others.

Our Lumina LS was also equipped with the optional 24-valve dohc 3.4-liter V6. This brings with it 50 more horsepower and 30 more ft.-lb. of torque than the standard 3.1-liter V6. Other than the extra \$960, the larger motor also penalizes slightly at the gas pump (17/26 mpg versus 19/29



DODGE INTREPID ES



The Intrepid, with its sharp-looking body and forward-thinking design, boasts more room inside than any other car in this group. The optional 24-valve sohc V6 provides more than ample performance. The wide stance and solid suspension deliver group-leading ride and handling.

mpg). But it rewards you with more than admirable performance. The Lumina was the quickest of all the cars through the quarter mile.

Wrap the entire package in a more modern and more stylish aerodynamic body, with a large (15.7-cu.-ft.) trunk and family-size (17.1-gallon) fuel tank and you do have a contender.

Dodge Intrepid ES

Only on the market for two years, the Intrepid (along with its LH-body cousins from Eagle and Chrysler) has driven to the head of the class. With its combination of interior space and comfort, performance and have-to-take-another-glance good looks, the Intrepid has become the benchmark family sedan. Okay, it's a bit more pricey than the Taurus and the Lumina—it's still quite a bit less expensive than the Avalon. And as far as we're concerned, it's well worth the money.

The Intrepid is the largest of this

group, both inside and out. But a look at the numbers reveals that it's less than an inch longer overall than the Lumina. Yet it has scads o'room inside. That's thanks primarily to its long wheelbase, which is more than 4 in. greater than the Lumina's. The Intrepid is also the widest car in this group and sits on the widest track.

That stance does more than contribute to the cavernous passenger cabin, it helps give the Intrepid sure-footed, crisp handling and a well-damped, comfortable ride. Fastest by far, easiest to navigate through the slalom, and tied for top honors on the skidpad, the Intrepid is simply a joy to drive.

Its 4-wheel disc ABS and wide tires (the Intrepid is the only one in our group with 7-in.-wide wheels) stopped the car in less time and less distance than any of the others.

Our Intrepid ES test car was also equipped with the most powerful engine, Chrysler's optional sohc 24-

valve 3.5-liter V6. And performance over the road is just what you need when you need it. At the track, the Intrepid was in the thick of the chase running to the finish line.

What can we say? We think that you cannot do any better in this class than the Dodge Intrepid.

Ford Taurus SE

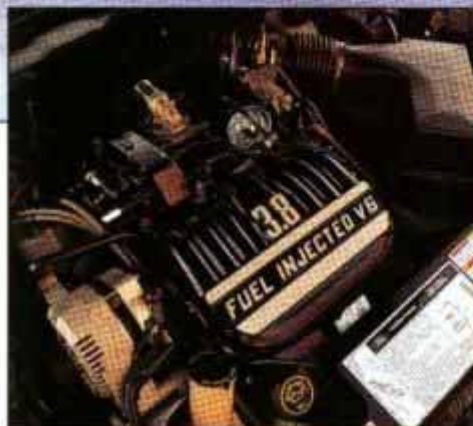
It's for all the right reasons that this is the best-selling car in the country. The combination of comfort, convenience, performance, quality and value make the Taurus (and its very close cousin, the Mercury Sable) a tough bogey indeed. But for all its well-deserved popularity, the once-ultra-modern design is beginning to show some gray at the temples. The truth is, the Taurus has lost at least a half a step to these young Turks.

For one thing, despite the fact that our test Taurus SE was equipped with the optional 3.8-liter V6, the largest engine—and the only push-

'BIG' SEDANS



FORD TAURUS SE



The best-selling Taurus still gets down the road in style and refinement. Our test car was equipped with the optional 3.8-liter V6. Despite its displacement, this engine lacks the moxie of others in our group. Interior is comfortable and well appointed, but lacks the spaciousness of the others.



rod engine—in the group, the Taurus was the slowest down the track. No surprise since the Taurus is giving up more than 50 hp to the competitors.

And speaking of the test track, the Ford was also the slowest around the skidpad, second slowest through the slalom and used up the second most amount of room to stop. However, throughout it all, the Taurus remained predictable and nondemanding to drive.

Another sign of how much times have changed since the Taurus was introduced back in 1986, the Taurus's

wheelbase is more than 1 in. shorter than any of the other cars in this group. And it has less hiproom—front and rear—than any. So though it's still quite comfortable and has an acceptably roomy interior, it's a trifle tighter than all of the others. The once-modern interior, as well as the once-ground-shattering exterior, have become somewhat dated.

Yet, the Taurus remains an excellent value—our loaded-to-the-gills SE had the second lowest sticker price—and a superb overall package. But it's no longer the envy of one and all.

Toyota Avalon XL

On the one hand, the newest kid on the block may be the biggest surprise. But on the other, given this company's history of methodically studying a market segment and carefully creating a product to appeal to that segment, the Avalon should be no surprise at all.

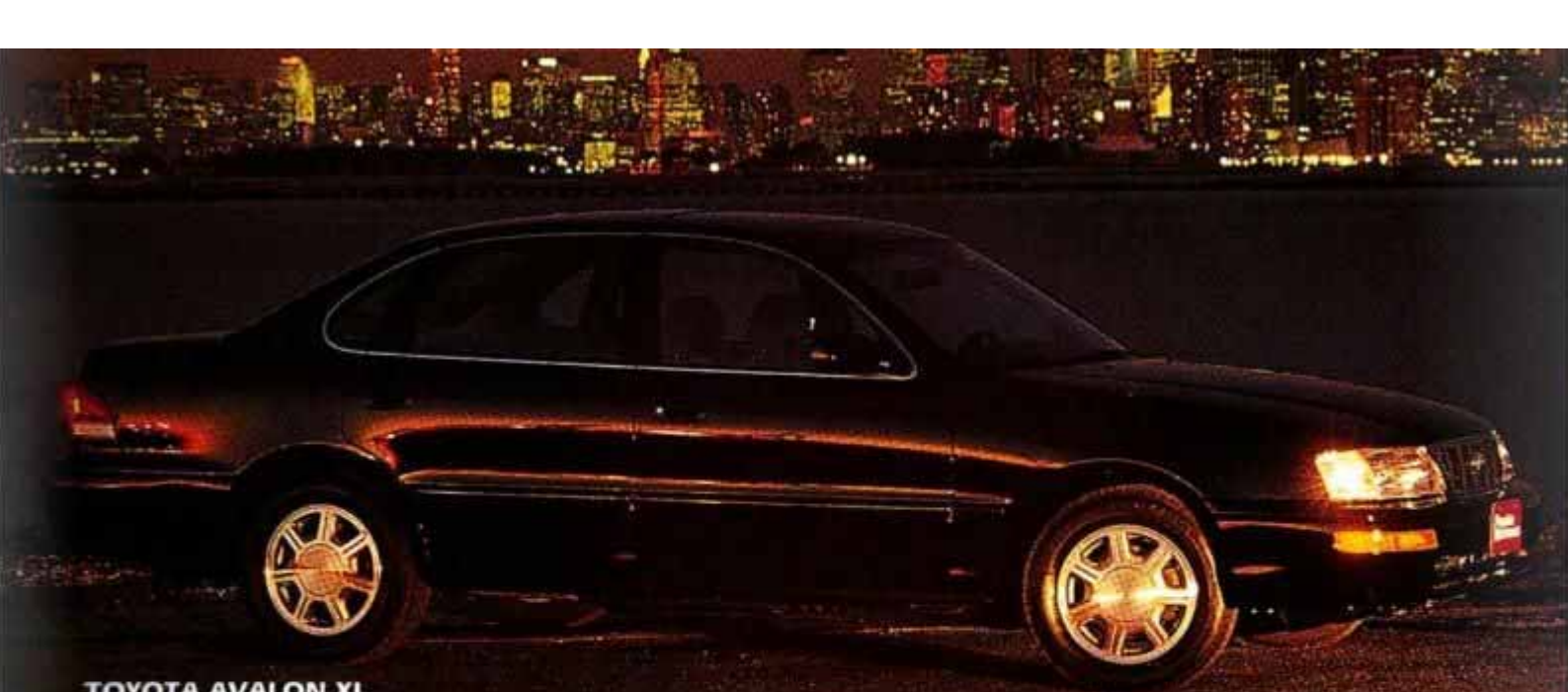
Despite Toyota's Japanese headquarters, this is one very international company. The Avalon was designed in California. It is built in Kentucky. And it cuts a wide swath through these more homespun sedans.

SPECIFICATIONS AND DIMENSIONS

MANUFACTURER/ MODEL	BASE PRICE/ PRICE AS TESTED	ENGINE/ DISPLACEMENT (ci/cc)	ENGINE HP, NET/ TORQUE (ft.-lb.)	ENGINE/ DRIVE LAYOUT	TRANS- MISSION TYPE	WHEELBASE/ LENGTH (in.)	TRACK FRONT/REAR (in.)	WIDTH/ HEIGHT (in.)	HEAD-, LEG-, HIPROOM, F/R (in.)	CURB WEIGHT (lb.)/ WEIGHT/HP RATIO (lb./hp)
Chevrolet Lumina LS	\$16,970/ \$19,900	V6 DOHC 207/3342	210 @ 5200 rpm/ 215 @ 4000 rpm	front/ front	4-speed automatic	107.5/ 200.9	59.1/ 58.8	72.5/ 55.2	F: 38.4/42.4/55.4 R: 37.4/36.6/55.3	3372/ 16.04
Dodge Intrepid ES	\$20,844/ \$25,415	V6 SOHC 215/3518	214 @ 5850 rpm/ 221 @ 3100 rpm	front/ front	4-speed automatic	113.0/ 201.7	62.0/ 62.0	74.4/ 56.3	F: 38.4/42.4/56.3 R: 37.5/38.8/60.9	3372/ 15.75
Ford Taurus SE	\$17,585/ \$22,590	V6 OHV 232/3800	140 @ 3800 rpm/ 215 @ 2200 rpm	front/ front	4-speed automatic	106.0/ 192.0	61.6/ 60.5	71.2/ 54.1	F: 38.3/41.7/55.2 R: 37.6/37.7/54.8	3118/ 22.24
Toyota Avalon XL	\$23,548/ \$27,516	V6 DOHC 182/2995	192 @ 5200 rpm/ 210 @ 4400 rpm	front/ front	4-speed automatic	107.1/ 190.2	61.0/ 60.0	70.3/ 56.1	F: 39.1/44.1/55.8 R: 37.8/38.3/57.4	3285/ 17.19

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.

Материал, защищенный авторскими правами



TOYOTA AVALON XL



The upstart Avalon has conservative styling and solid engineering. The potent 24-valve dohc V6 is the same as used in the Camry. Suspension is also shared with the Camry. Fold up that center armrest and the split-bench front seat can seat three across, a first for a Japanese sedan.

The Avalon is the smallest of all of these cars—on the outside. Yet it's as roomy as all but the Intrepid. It has the smallest engine in the group, yet it's the quickest from 0 to 60 mph and from 40 to 70 mph. And the Avalon was second quickest through our slalom course. That means that the Avalon has no trouble getting onto the highway, passing other, slower traffic and maneuvering through crowded urban streets. All while wrapping its occupants in solid, if uninspired, comfort.

Of course, along with Toyota's

well-deserved reputation for thoughtful engineering and design, the Avalon is an example of another trait the Japanese giant is known for: conservative design.

The Avalon is not going to spin many heads as you drive it around town. There is nothing trendy, startling or particularly exciting about the way it looks. Then again, there's nothing trendy, startling or particularly exciting about the way it performs, either. It just goes about its business of carrying six—yes, that's right, the Avalon is the first

Japanese sedan with a split-bench front seat and six seatbelts—in quietness, comfort and safety.

In fact, the Avalon's conservatism is just a mite off-putting. When you first see the car in this company, and even when you first slip behind the wheel, it's tempting to write off the Avalon as a somewhat poor imitation of what once was a truly American phenomenon. But after spending time behind that wheel, or in the spacious back seat, you realize that the Avalon is clearly very close to the top of this class. **PM**

TEST RESULTS

STEERING RATIO/TYPE	TURNING CIRCLE (ft.)	WHEELS/TIRES	BRAKE SYSTEM FRONT/REAR (in.)	FUEL ECONOMY (MPG EPA city/hwy.)	ACCELERATION 0-60 MPH (sec.)	PASSING ¹ ACCELERATION 40-70 MPH (sec.)	BRAKING 60-0 MPH (ft.)	700-FT. ² SLALOM MPH	200-FT. ³ SKIDPAD (lateral g)	PM ⁴ SERVICEABILITY INDEX
				PM test	1/4-MILE (sec. @ mph)					
16.1:1/Power rack & pinion	39.0	16 x 6-in. alloy 225/60R16	Disc/Drum ABS 10.5-in. vented/8.86-in.	17/26 18.0	8.58 16.21 @ 85.1	8.2	169	52.8	.88	6
17.5:1/Power rack & pinion	37.7	16 x 7-in. alloy 225/60R16	4-wheel disc ABS 11.1-in. vented/10.6-in.	18/26 19.8	8.54 16.35 @ 85.0	6.0	132	59.9	.88	7
Variable/Power rack & pinion	38.6	15 x 6-in. alloy 205/65R15	4-wheel disc ABS 10.8-in. vented/10.1-in. vented	19/28 18.4	9.15 16.96 @ 81.5	8.6	146	56.5	.78	6
15.9:1/Power rack & pinion	37.6	15 x 6-in. alloy 205/65R15	4-wheel disc ABS 10.7-in. vented/11.4-in. vented	21/29 19.9	8.35 16.29 @ 85.0	7.5	137	56.7	.84	7

3. G-force generated during steady-state travel around a 200-ft.-dia. circle. Number is an average of best cw and ccw. 4. Based on 12 basic-maintenance functions.

FLYING SAUCERS: THE REAL STORY

From the hopeless tangle of claims and counterclaims emerges the documented fact that secret military research *has* explored flying saucer flight.

BY ABE DANE, Senior Correspondent

● Exposed and utterly alone beneath the incandescent stars of the Nevada desert, I dropped my pack and squirmed the last few yards to the summit of White Sides Mountain. Carrying only a pair of binoculars, a tape recorder and a radio scanner, I groped over the rocks, knowing that carelessness now would waste all my care in getting here: the long, 4-wheel-drive detour to avoid road sensors that alert base security, the zigzag hike through the sagebrush, the pains taken to stay off ridgelines where I might be profiled against the sky.

Pulling myself up to peer over the last jagged parapet, I was sure for the first time in hours that I was in the right place. Across 12 miles of darkened scrub, just beneath the far horizon glimmered Dreamland, a splash of gemlike lights tossed into a hollow in the hills. Also known as Area 51, it's a terrestrial black hole into which it's estimated millions of tax dollars disappear each day while hardly a word of explanation escapes.

A complex of hangars, giant parabolic antennas and one of the longest runways on Earth, Area 51 spreads the length of Nevada's remote Groom Lake dry lake bed. For four decades—through the top-secret U-2 spyplane program of the '50s, the SR-71 spyplane of the '60s, the F-117A stealth fighter of the '80s—



Groom Lake has been where our government has come when it wants to be alone.

Now, five years after the fall of the Berlin Wall, the lights of Groom Lake still burn throughout the night with wartime urgency. And whatever secrets lie there are guarded with undiminished vigilance. Armed, unidentified men stalk the sagebrush in camouflage fatigues.

Unmarked Black Hawk helicopters sweep the hills. Electronic sensors hidden along the approaching roads report the presence of vehicular traffic. Keep in mind that you're subject to all of this on public land, before you make it to the border marked with signs reading "use of deadly force authorized."

UFO capital

It was not until this past summer, amid mounting publicity, that the Air Force gave up denying the undeniable. "We do have facilities within the complex near the dry lake bed of Groom Lake," says its latest official statement. The Air Force adds that the Nellis Range Complex—of which Groom Lake is a part—is "used for testing and training technologies, operations and systems critical to the effectiveness of U.S. military forces. Specific activities conducted at Nellis cannot be discussed any further than that."

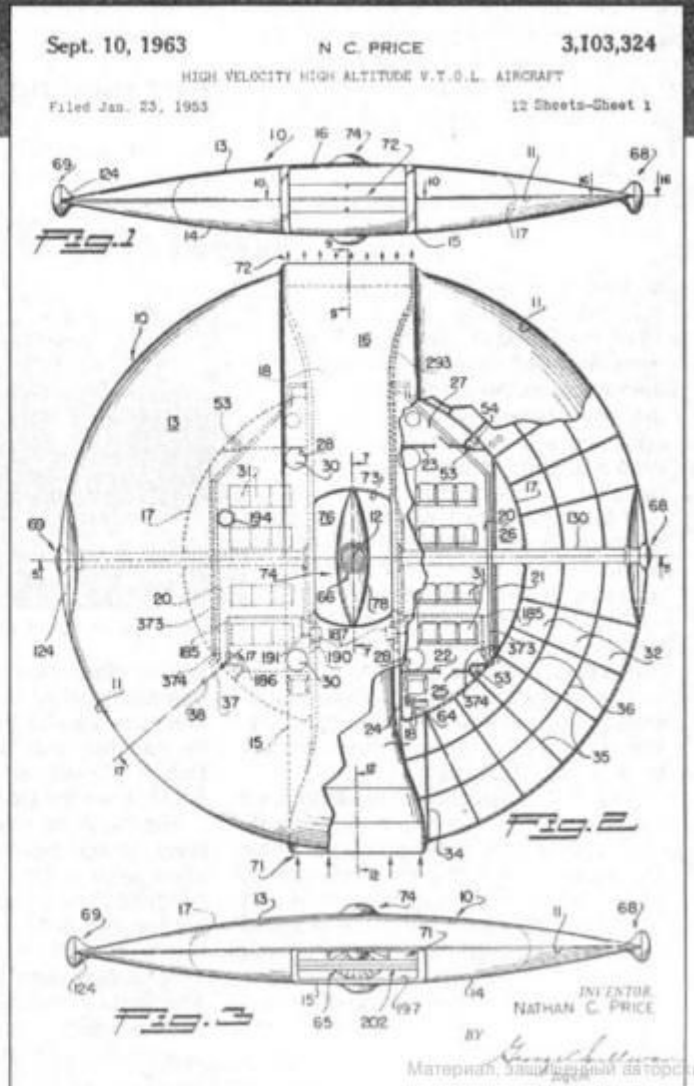


The VZ-9V Avrocar (left) and the Russian Thermoplane blimp (top) are two formerly secret incarnations of saucer aeronautics. Old Lockheed patent (right) almost certainly wasn't built. We spied on Area 51 (backdrop) in search of new developments.

But that, of course, is only the beginning of the discussion. With so much unexplained, speculation naturally ranges from the merely exotic to the otherworldly. Glenn Campbell, a former computer programmer who has studied and written about the base full-time since moving to the tiny nearby town of Rachel a year and a half ago, fondly refers to his adopted neighborhood as "the UFO capital," and "America's most popular secret airbase."

Articles and TV specials have theorized endlessly about Groom Lake. Aerospace technology enthusiasts point to the likelihood that Lockheed would be testing a hypersonic spyplane there, just as it earlier tested the SR-71. But what has really established Groom Lake as a place of pilgrimage for UFO watchers is the lure of the flying saucer.

It was this same fascination—one that has gripped America since the term first came into common parlance 47 years ago—that brought me to Groom Lake this past fall. It stands to reason that if our military has flying saucers, this is where they'd be.



FLYING SAUCERS ARE REAL



STEP ONE TECHNOLOGY PHOTO

But as it turned out, Groom Lake was only the beginning of the story. Sure, it is possible that there are flying saucers somewhere in the Nellis Range Complex. Given the level of secrecy almost anything is possible, and there are in fact a number of intriguing claims to this effect. But more fas-

inating is the verifiable fact that these would not be the first flying saucers our government has hidden from us.

First sighting

Think back to 1947, to a world sick of war and an America racing to build its nuclear deterrent against the looming

Soviet threat. In June of that year, while flying his private plane near Washington's Mount Rainier, Kenneth Arnold said he spotted "a chain of nine peculiar-looking aircraft" that "flew like a saucer would if you skipped it across the water." By timing their passage between two peaks, he later estimated their ground speed to be about 1700 mph.

Arnold, a deputy federal marshal and successful businessman, was a difficult witness to dismiss. His sighting was widely reported and thoroughly investigated, eventually by the Army Air Force (AAF), which feared he might have seen some new Soviet secret weapon.

Return To Roswell

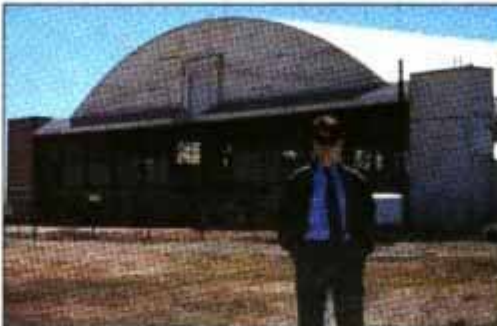
● Area 51 wasn't always "America's most popular secret airbase." Back in 1947, the title applied better to Roswell Army Air Field (RAAF). The base was then home to the 509th Bomb Group, the only operational unit in the world equipped with nuclear weapons. Like Area 51, RAAF is the focus of intense flying saucer speculation.

It began just two weeks after the Kenneth Arnold sighting. The 509th's public relations officer, Lt. Walter Haut, issued a press release saying that intelligence officer Maj. Jesse Marcel had recovered remains of a crashed "flying disc" at a nearby ranch.

The next day, after attracting world-wide press, the AAF retracted the story. Higher-ups said the disc had actually been a weather balloon.

Pro-UFO researchers have long cried coverup, but the Air Force stuck by its story until this year, when congressional pressure prompted them to reinvestigate. There was a coverup, the new report says, but it guarded a top-secret program to listen for Soviet nuclear blasts with balloon-borne sensors. No saucer, they insist. Many remain unconvinced.

So we went to Roswell to do a little re-investigating of our own. We spoke to



Closed 30 years, RAAF remains a saucer flashpoint.

Walter Haut, now head of a storefront operation called the International UFO Museum. Loretta Proctor, a neighbor of the rancher who found the debris, and Robert Shirkey, an operations officer at RAAF when the story broke.

Haut says he saw nothing firsthand; he was just following orders when he wrote the release. Proctor recalls a piece of brown, plastic-like debris that her father couldn't cut with a knife or burn with a match. And Shirkey says debris that he happened to see being carried through the base

operations building didn't look like it came from a balloon. This is all interesting, but hardly conclusive.

The key issue appears to be this: Of the two men universally acknowledged to be the first military officers on the scene, one (Maj. Marcel) insisted until his death he saw a saucer.

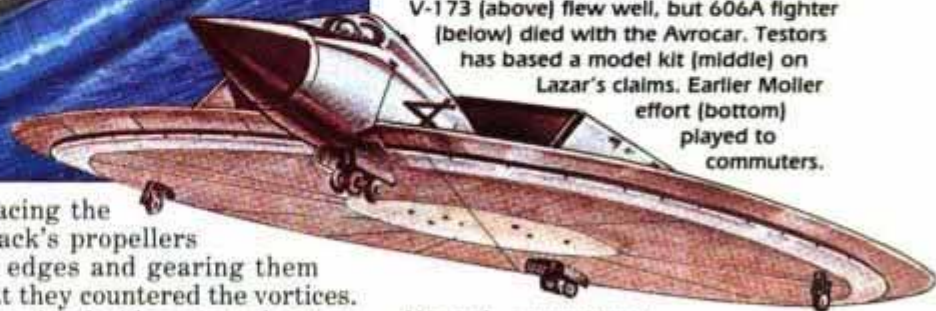
The other (Capt. Sheridan Cavitt) still says it was a balloon. Some, including the Air Force, side with Cavitt. Others believe Marcel.

What struck us most, however, is how much Air Force secrecy—both at Area 51 and at Roswell—has done to undercut its own denials in the eyes of many. "They lied about the first balloon," goes the word around Roswell. "Why believe them this time?" —A.D.





Opposite page: Moller M200X (left) and Sikorsky Cypher (right) tamed instability. Thermoplane (inset) is promoted for heavy lift. This page: Convair concept (left) surfaced briefly but its fate is unknown. V-173 (above) flew well, but 606A fighter (below) died with the Avrocar. Testors has based a model kit (middle) on Lazar's claims. Earlier Moller effort (bottom) played to commuters.



But first another possibility had to be ruled out: Was it one of ours? According to Curtis Peebles' *Watch The Skies!*, a history of the flying saucer phenomenon recently published by the Smithsonian, an early suspect was a formerly secret Navy fighter program. "Are you positive the Navy junked the XF5U-1 project?" asked one 1947 AAF memo.

America's first saucer

Built by Chance Vought of Stratford, Connecticut, the XF5U-1 "Flying Flapjack" was at the time the closest thing anyone knew of to a flying saucer. Although capable of nothing like the 1700 mph reported by Arnold, its bizarre circular plan-form nonetheless promised performance unlike anything that had come before.

The program traces back to the 1930s, when National Advisory Committee on Aeronautics engineer Charles Zimmerman flew a series of unmanned models that led him to the Flapjack shape. The extraordinary virtue of the design was that it defied what had seemed a fundamental aerodynamic tradeoff. The Flapjack managed both the high top speeds desirable for combat and the low stalling speeds needed to operate out of small airfields, or off the decks of ships. In fact, with enough engine power, it could hang by its props and take off vertically, without any airstrip at all.

The saucer shape's high-speed performance came from the fact that it was essentially a very-low-aspect-ratio wing—a wing with a low ratio of length to width—like that on a modern fighter jet. Although stubby wings can be shaped to produce relatively little drag at high speeds, they suffer badly at low speeds. The cause is partly that large amounts of air spill up from under the wingtips and swirl into tornado-like vortices that trail behind the aircraft. Zimmerman limited this induced drag

by placing the Flapjack's propellers at its edges and gearing them so that they countered the vortices.

This simple idea proved out remarkably well in more than 100 flights by a manned test craft called the V-173. In late 1942, the Navy okayed construction of two full-scale XF5U-1 fighter prototypes. Powered by a pair of 1600-horsepower Pratt & Whitney



Twin Wasp radials, the XF5U-1 was expected to fly at up to 425 miles per hour and yet alight daintily at as little as 40 mph. Based on his experience with the V-173, Zimmerman predicted that a turbine-powered Flapjack would eventually reach 550 mph, while takeoff and landing speeds would dwindle to zero.

We'll never know if he was right. The XF5U-1 prototypes were ready by 1947, but never flew. The Navy had by this time decided to throw its full weight behind more orthodox jet fighters, and ordered the XF5U-1 destroyed. No plane did what the Flapjack promised to do until the Hawker Siddeley

Kestrel—a precursor to today's Harrier vertical-takeoff attack fighter—began flying in the 1960s.

As 1947 drew to a close, the Arnold sighting and a number of others remained unresolved. The XF5U-1 wasn't behind them. Nor did they seem to be anything within the reach of Soviet technology. An exhaustive review of Nazi wartime research hadn't turned up any explanations either. The newly instituted U.S. Air Force took very seriously the possibility that something we didn't understand was roaming our airspace. It secretly launched Project Sign, the first of a series of UFO investigations that were to stretch on for more than 20 years.

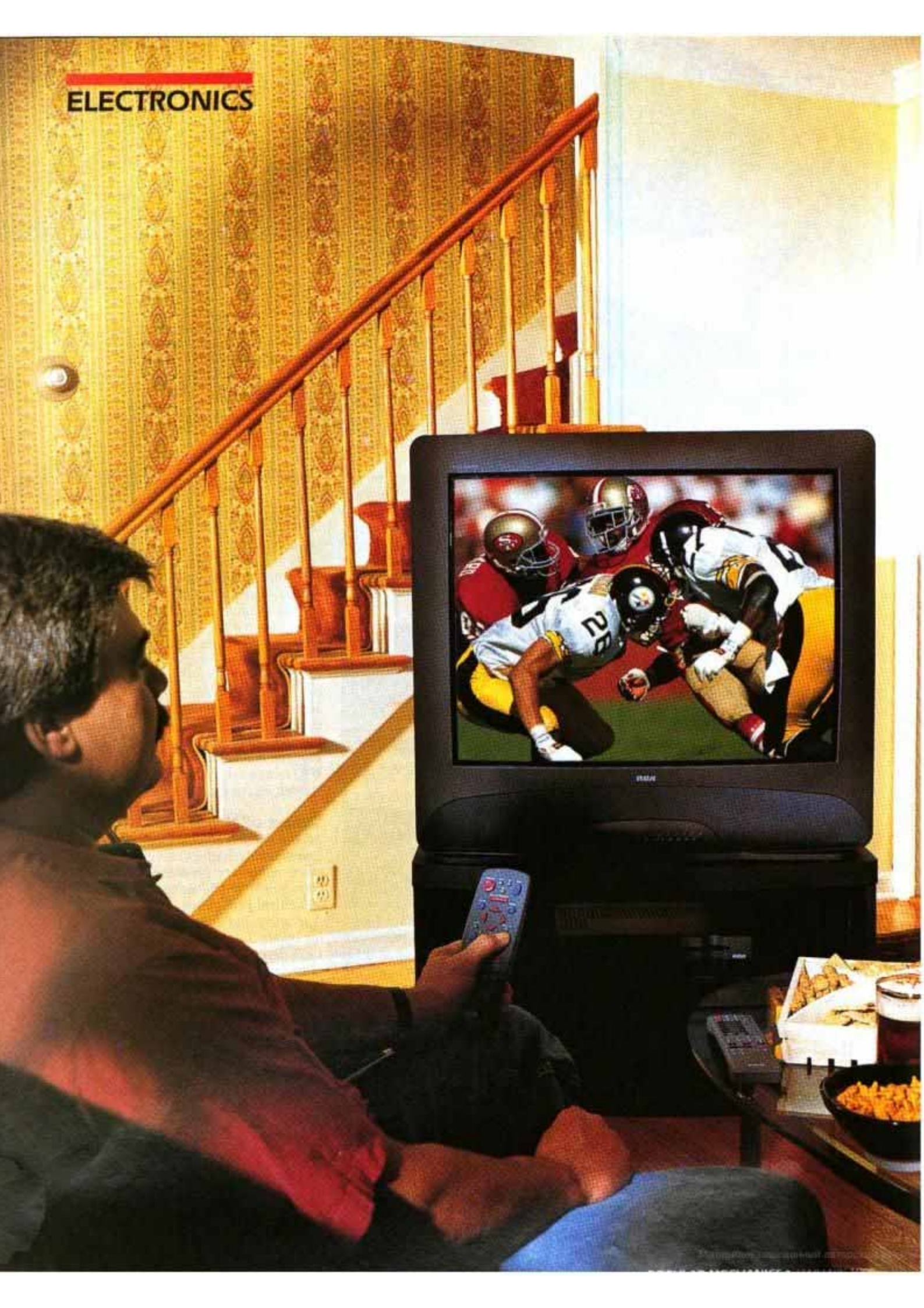
Shape of the future

As the Air Force pondered reports of unbelievably high-performance flying discs, engineers grew more and more intrigued by the aerodynamic and structural properties of such a shape. A lengthy and detailed patent applied for by the Lockheed Aircraft Corp. in 1953 describes an "aircraft of circular plan-form and of bi-convex vertical cross section"—basically, a giant lentil. As with the Flying Flapjack, the benefits foreseen included a combination of high forward speeds

(Please turn to page 121)



ELECTRONICS



SMALL DISH TV

Installing and testing RCA's new direct broadcast satellite TV system.

BY STEPHEN A. BOOTH, Contributing Editor; PM Photos by Spencer Jones

● It was like being the first guy on the street to have a color TV. The tiny satellite dish antenna rising into place drew a crowd of neighbors, long-lost relatives and new best friends all craving a free look at RCA's Digital Satellite System (DSS), the much-heralded uplink that allows you to get TV signals directly from an orbiting satellite.

Satellite TV, of course, isn't new, but heretofore it required an unreasonably sized, and often objectionable, 10-ft. dish for signal reception and the satellite-tracking skills of a NASA mission controller. The big difference here is that the DSS satellite dish is only 18 in. in diameter and less obtrusive than a standard broadcast TV mast antenna. And thanks to the use of just a pair of high-powered satellites, you don't have to cruise through all the satellites in space looking for programming. On top of it all, the picture is supposed to be excellent and installation easy. PM decided to see if that indeed is the case.

By now, the RCA Digital Satellite System should be for sale in most of the contiguous 48 states and parts of Canada. Some 175 channels of programming arrive at the pan-size, shallow dish antenna from two high-powered satellites positioned 22,300 miles above the equator, due south of Texas. Since all of the channels originate from the same satellites, the home antenna remains stationary once installed—it need not pivot to find stations.

You tune in channels with the DSS receiver, a sleek component about the size of a VCR. Within this black



The 18-in. DSS antenna is small and light, but needs a clear view south and secure mounting.

box is the circuitry that decodes the digital transmission. Digital technology also is what makes DSS different from other satellite TV systems (as well as broadcast and cable TV)—all of which are basically analog. Because the signal is compressed in the digital language of 0s and 1s, only two satellites are required to deliver so many high-quality program choices to an antenna so discrete.

Although RCA makes and sells the DSS receiver and antenna, TV programming comes from two services: DirecTV, a unit of GM Hughes Electronics (which built and launched the satellites), and United States

Satellite Broadcasting (USSB), a subsidiary of Hubbard Broadcasting. The former delivers about 150 of the 175 channels, the balance coming from the latter.

The offerings tend to complement one another rather than compete, so you might subscribe to both. Each service offers a variety of subscription packages, ranging from \$4 to \$35 a month and comprising just about everything you'd expect from cable—and then some (like five different HBO channels, for example). Additionally, DirecTV devotes more than 50 of its channels to pay-per-view programming, at \$3 a showing, with starting times about every half-hour.

This extensive entertainment menu is available to just about any home—provided there is access to an unobstructed view of the southern sky. Mere "southern exposure" isn't enough. This means you must take into account any blockage, including trees and

SMALL DISH TV



In the pre-installation assembly, four flat head bolts with self-locking nuts secure the dish to the support arm.



Coaxial cable is fed through support arm and connected prior to securing LNB (low-noise block) converter to arm.

foliage—even on adjacent property.

RCA's in-store demonstration program will give you a fairly good idea about the suitability of your location. Basically, "sighting" the satellite with the dish involves two variables. One is elevation, the up-and-down angle that varies by your latitude (it's about 35° for New York City and 46° for Los Angeles). The other is azimuth, the left-right orientation depending on your longitude.

To satisfy both conditions, picking the right site for the dish antenna is critical and may require some creative thinking. For example, obstructions that prevent a ground-level installation (say, on a patio deck or in-ground on a short mast) might be circumvented by mounting the dish at a higher location (a chimney or second-story wall).

The installer guide that comes with DSS is quite clear and thorough about different mounting locations (roofs are a last resort) and mounting surfaces (wood, masonry and others). Any do-it-yourselfer who's comfortable working at heights and on ladders and competent with plumb, level and basic tools should be able to handle the job.

Plumb line and bubble level are critical: The manual stresses that the antenna mount must be perfectly level in vertical and horizontal planes (or else, good luck finding the satellite!). Technically, the shingled exterior of our installation site wasn't the flat surface RCA recommends. This, however, could have been remedied to achieve a perpendicular mount. Because it was a temporary installation,

we went for the chimney instead.

For DIYers, RCA offers an installation kit (\$70) with cables, connectors and so on—even a compass for setting your azimuth. As for learning your azimuth and the angle of elevation for your home, that's provided by the DSS receiver even before you hook it up to the dish.

Once the receiver is connected to your TV, just call up the on-screen setup menu and punch in your ZIP code via the remote control. Presto—elevation and azimuth. You adjust the



New antenna for old: For chimney mount, Scherer (left) and Akers preferred stainless-steel to galvanized straps.

first with the elevation-indicator scale embossed right on the antenna's support arm. You adjust azimuth by rotating the dish until it lines up with the proper compass heading.

Feeling edgy about your Boy Scout training? Here again, the DSS receiver pitches in. By this time, you've connected the dish to the receiver. As you're rotating the antenna to find your azimuth, the setup screen displays the degrees you need to move to lock the signal. You probably won't be

able to see this if you're on a ladder, and even with a partner to relay commands you might find such fine-tuning difficult with a compass. So the DSS also provides a visual signal-strength meter and an audible guide—short beeps tell you you've located the satellite and then escalate to one long, continuous tone when you've locked in.

RCA also offers professional installation, through your local dealer. This costs \$150 more than the system's \$699 list price and covers a surface-mount installation with up to 100 ft. of cable, routed externally by the most direct route to a single entry point. Any interior snaking or other work has to be negotiated with the installer. Professional installation is advisable for more complicated jobs, such as those that might involve long cable runs or require trenching or erecting towers.

To make sure the job was done right, PM employed professional installers and learned a lot in the process. The installers, J.R. Scherer and Fred Akers of Ardsley, New York-based Scherer Industries, characterized the site as fairly typical and, for a pro, about an hour's work. Their company specializes in communications and security installation, and works under contract with RCA.

Both installers think the DSS installation manual is pretty good and that the job is within the capabilities of a handy homeowner—with several caveats. Namely, technique and tools: For example, would the DIYer necessarily know how to drill through stucco without creating damage? Would he have the right bit, and a drill with



Indicator scale on LNB support arm has tick marks in degrees to set the angle of elevation correctly.



LNB angle is secured after proper elevation is obtained by entering your ZIP code in DSS receiver.

sufficient torque? Scherer and Akers had qualms too about the integrity of connections, suggesting F-connectors with moisture-proof, neoprene seals—more expensive than the standard issue in RCA's kit. Regarding chimney mounts, they recommended stainless-steel straps instead of galvanized ones, which might lose their coating and corrode.

Our uplink connection must be good, because the DSS picture and sound are simply the best we've ever seen on a home TV—better even than the show in some local cinemas.

It took PM's couch-potato squad awhile to get used to the new setup—much of this just getting the eyes accustomed to the crisp, bright RCA 35-in. direct-view TV we used to evaluate the picture, becoming familiar with the remote control (a snap) and zapping around the extensive DSS on-screen menu (a joy) of some 150 channels.

We eyeballed the picture as critically as possible, specifically looking for so-called artifacts of the MPEG (Motion Picture Experts Group—a standard for digital video compression)



Digital signal compression lets RCA's system receive 175-plus channels of sharp video from just two satellites—all on an 18-in. dish.

digital signal. Such artifacts could take the form of pixelization—a mosaic-like pattern to the picture. We suspected DSS would handle movies well—these can be pre-encoded for transmission. What we wanted to see was how DSS and MPEG handled encoding on the fly—as in live sports with plenty of movement. All we can say is—whew!

Another thing to get used to is DSS digital sound. This is CD-quality audio and, consequently, there is no noise (hiss) or compression of the dynamic range. Speaking of sound, you'll find the 28 channels of music-only programming available from DirecTV quite pleasant. One gripe here: There's no on-screen information yet to tell you what title or artist you're listening to, for genres that are unfamiliar. It's coming later this year.

DSS is aimed at people without cable or with poor broadcast service. Of course, it can be configured so you can switch between DSS and cable or broadcast TV. DSS service does not deliver over-the-air broadcasts, local or network. However, DSS owners in areas not served by broadcast can purchase a monthly package of five networks (ABC, CBS, Fox, NBC and PBS) for \$3.50 or a single network for 99 cents. There are sports packages, too.

How do you pay for programming? Once a month, DirecTV or USSB telephones the receiver (their nickel, not yours) to extract the ordering information stored inside. It's painless, and if you want to keep the bill that way and the repo man away you can set spending limits or otherwise restrict what your family views. This is a good idea if only to keep you from watching until dawn the best TV you've ever seen.



ADVENTURE

BORDER TO BORDER

From Canada to Mexico the hard way. We bang out 1400 rugged off-road miles in the all-new '95 Chevy Blazer.



BY JOE SKORUPA, JPA, *Beating/Outdoors Editor*; PM Photos by Scott Dahlquist and Joe Skorupa

• "We're lost!" I say, pointing the Chevy Blazer down a rugged dirt road in central Wyoming. Despite loading up down and hitting the trail before the first mated, copilot Mike Allen and I are sitting nowhere fast. We are out from here to identify landmarks for the past hour. Crossing a brushy ridge, we surprise a herd of skittish pronghorn antelope. A couple of miles later we spot a coyote trotting over a ridge. Further on we come

across a herd of wild horses. Yes, the West is still wild in the boondocks, but that's what worries me. With more than 200 miles of dirt roads to navigate before nightfall, we can't afford to get lost in the great, wide open.

"No, we're not lost," clarifies Mike, PM's associate automotive editor. "We're just off course."

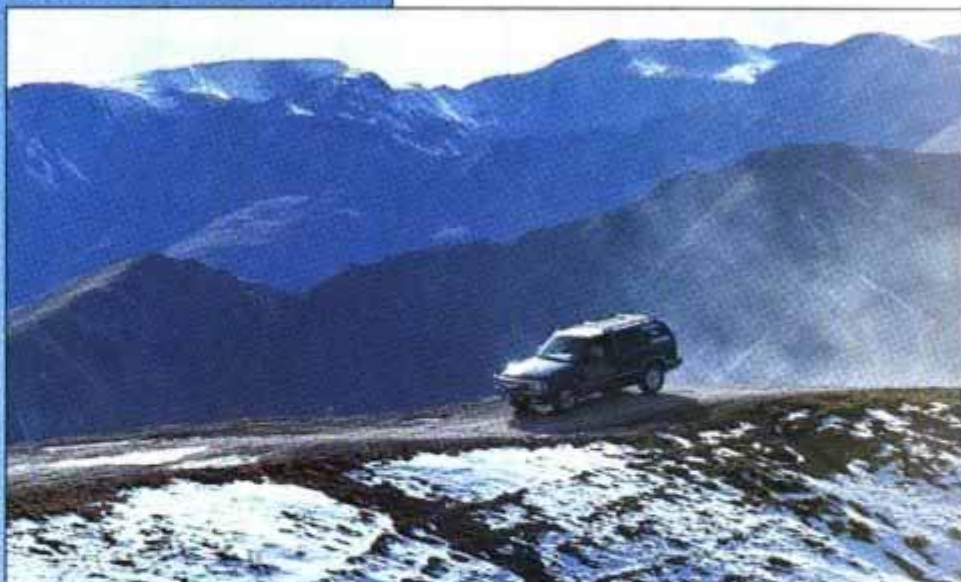
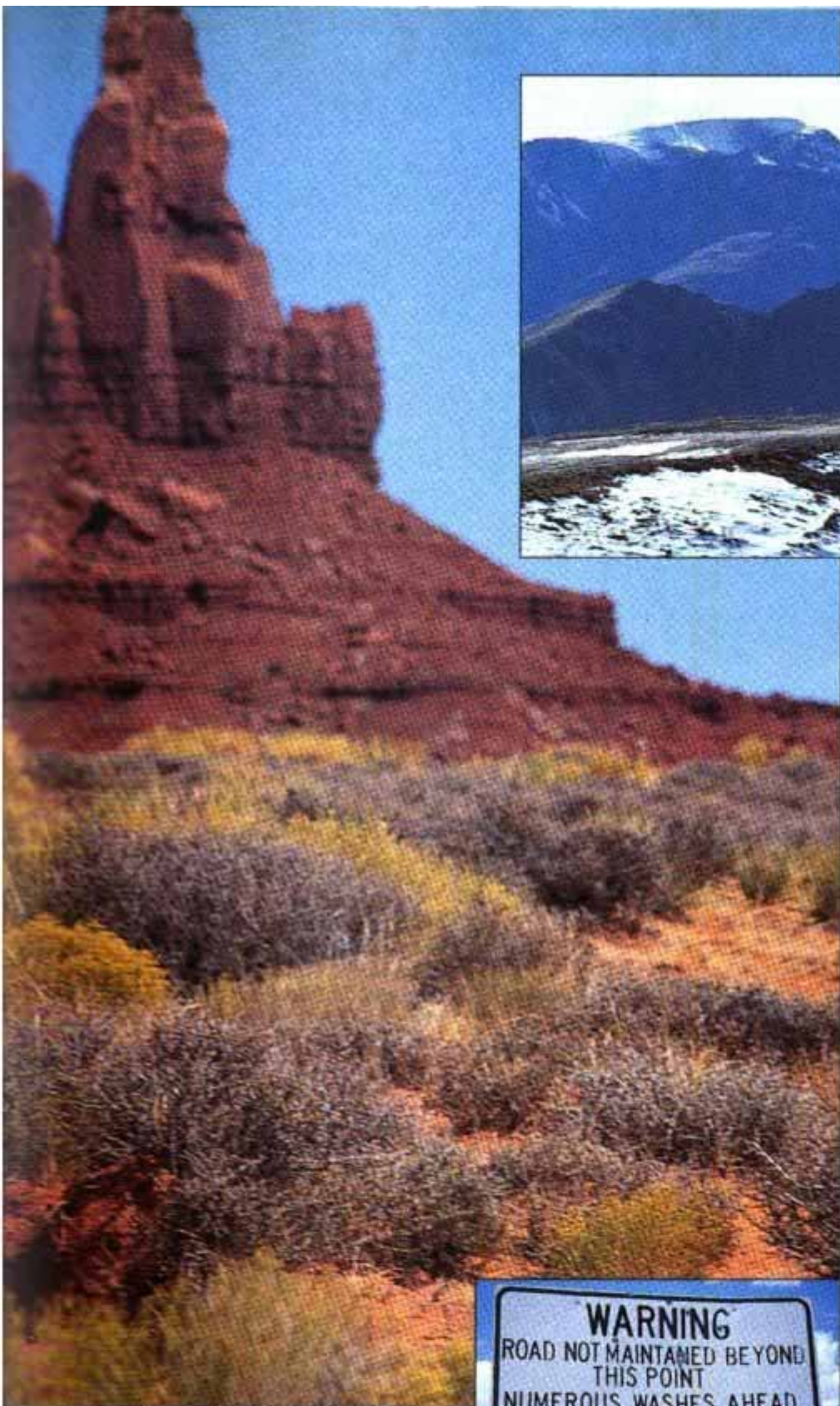
Huh? Mike motions to the Magellan and Trimble GPS units resting on the dash. He points out that these

computerized satellite receivers can fix our position to within 100 meters in three dimensions. So, how can we be lost?

Well, we're in a bewildering maze of bushwhacked roads that don't appear on maps. We're not where we intended to be (especially not on bushwhacked roads). And, finally, we don't know how to get back on course. In my book, that's called being lost.

Still, there are several things we do

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Where the road ends (right), the Chevy Blazer border-to-border adventure begins. Arizona's Monument Valley (above) and Colorado's American Peak (top right) were two of the more spectacular challenges along the way.

know that may help us get back on track. We're somewhere in the general vicinity of an 8500-ft.-high plateau called the Great Divide Basin. It's the third day of a southbound off-road adventure that began in West Butte, Montana. We're driving an all-new '95 Chevy Blazer in a classic PM torture test—from the Canadian border to



the Mexican border on dirt roads. And by evening, we need to be somewhere beyond Craig, Colorado, which is more than 200 unpaved miles away. The pace is grueling, but it's designed to keep us ahead of snow that arrives like clockwork in the Rockies after the passing of the autumnal equinox (Sept. 23), which is today.

Eventually, Mike and I discover that we are too far west. We need to head back north and go around the Oregon Buttes, a well-known landmark on the old Pony Express and Oregon Trails. We made this discovery by marking a road map with latitude and longitude crosshairs in seconds of degrees. Until mapmakers include these markings, high-tech GPS adventurers will be forced to rely on low-tech pencils and rulers.

Back on course, we make up for lost time and arrive in Steamboat Springs for the night. Total driving distance today is 320 miles, with 218 on dirt. We cross the Great Divide three or four times en route and go astray an equal number of times. But being off course is routine now, and even though we often didn't know where we were or in which direction to head, at least we weren't lost. Technically.

Like a rock

Carrying a reputation for igniting the boom in compact sport/utility vehicles and for being as tough as a rock, the all-new '95 Chevy Blazer has big shoes to fill. The former S-Blazer (the "S" prefix is dropped this year) has been modified in recent years, but hasn't had a complete overhaul since 1983. The aim of the current makeover is to add smooth on-road manners and people-pleasing comfort to what is already a rugged, go-anywhere 4x4.

To accomplish this feat, Chevrolet softened the Blazer's exterior lines by creating a low-slung, swept-back profile. The interior was made more user friendly by freshening up the instrument panel and adding deeply tinted glass windows, cup holders, a driver's-side airbag and a unique 12-volt outlet arrangement for powering as many as three cellular phones or other high-tech toys.

While these warm and fuzzy features are attractively packaged into

BORDER TO BORDER

Alberta
CHECKSTOP
Province



an appealing and comfortable interior, Mike and I were more concerned with features located somewhat closer to the ground. With 1400 miles of dirt roads to drive, our attention was drawn to such elements as the revamped suspension system (offered in five options, including the rock-solid ZM6 Off-Road package), the muscular 4.3-liter ohv V6 engine (the largest mill in this class), the shift-on-the-fly 4wd transmission, 7.5 in. of

ground clearance and 4-wheel ABS.

Clearly, Chevy did its homework before rolling out the '95 Blazer. Not only did our test vehicle deliver a smooth, carlike ride on pavement, but it took everything we could dish out during 50 hours of off-road pounding. Acceleration in traffic and overall power delivery were effortless, so much so that a humorless Arizona state trooper took special note of our southward progress on one of the few

paved roads we traveled. Fuel economy was typical for vehicles in this class. We averaged 17.5 mpg over the entire trip, with a high point of 20 mpg on superhighways and a low point of 14.5 mpg on rutted high-altitude trails.

Fans of the former S-Blazer will find the all-new '95 (\$21,953 base price for a 4-door 4wd, \$25,903 as tested) to be a major leap forward in terms of interior comfort, on-road manners

Stronger Than Dirt

● Unless you like walking 30 or 40 miles in the sun, you should start any off-road trek with a well-tuned vehicle. We did, and you should, too.

Two other important tips are to install a skidplate and bring a winch. Because our '95 Blazer was one of the first production vehicles available, we didn't have time to have a skidplate fabricated. We recommend that you make the time. Your oil pan and front suspension will appreciate the effort. We didn't have to use the winch, but we were glad to have it along. The heavy-duty Warn X9000 winch would have been able to pull us out of axle-deep mud, if necessary. Fortunately, it wasn't.

Our Blazer was equipped with P235/75 Goodyear Wrangler AT/S tires. These are great if your off-roading consists of parking in the unpaved overflow lot at the flea market. But for serious stump jumping, the sidewalls are too fragile. We blew a rear tire on day one that necessitated a 100-mile detour to find a Goodyear dealer in the boondocks. Get LT-rated (Light Truck) tires, whose stiffer sidewalls are more puncture resistant, albeit at the expense of noise and a stiffer ride.

We took a second spare for an extra measure of safety, as well as a spare tube and an air pump.

Navigating, we found, is not trivial. We had a steamer trunk full of maps by the end of the trip, and often found that three maps of the same territory didn't agree completely. Forget about gas station maps—you need topographical maps, Forest Service maps, Bureau of Land Management

maps, and any other good maps you can find. We found state atlases produced by the DeLorme Mapping company to be very useful.

You'll also need—at the least—a compass. The Blazer had a directional display (including an outside temperature readout) built into an overhead panel. Both proved to be very handy. We brought two GPS satellite navigation receivers—a Trimble Scout and a Magellan Nav 5000 DX. We used every one of these navigational tools extensively. If you're not strong on orienteering, consider taking a course to nail it down before heading out

on any long-distance off-road adventure.

The final tip is to follow the low-impact principles of the Tread Lightly organization. We recommend you do this whenever you go off-road. Chevy Trucks is a strong supporter of Tread Lightly, and so are we. —Mike Allen





and aero styling. And to be honest, I must admit that the PM test team's appreciation of the Blazer's creature comforts skyrocketed after spending more than 80 hours behind the wheel.

Features we became especially fond of were the sweet-sounding CD player, the noise-damped ride (no rattles or roaring from wind or drivetrain) and the space-saving underbody-mounted spare tire, which permitted us to load the expansive cargo area with about 400 pounds of tools, parts, luggage, food and miscellaneous gear.

The only nits to pick were with the balky 4wd transfer case, which was less than a smooth operator when shifting on the fly or shifting in Neutral, and the standard all-season tires, one of which suffered a high-speed sidewall blowout on the first day of the trip.

Peak experience

"Can you spell oxygen deprivation?" Mike says, not without justification at an altitude of 13,100 ft. We're at the summit of Engineer Pass, an amazing world of vertical peaks, high-altitude meadows, broad panoramas, long vistas and copious snow. The dreaded winter element we've been racing to beat is in generous supply here in this Colorado portion of the Rockies. Fortunately, it fell two days ago and the sun has evaporated it off the roads. If it hadn't, much of our route to this point would have been impass-

(Please turn to page 119)



Opposite page, clockwise from top: Departure from a rural prairie location in the Canadian province of Alberta, navigating through a recently flooded and seriously rutted Arizona wash, and wild horses galloping through Wyoming's Great Divide Basin. This page, clockwise from top: Descending Colorado's spectacular 13,100-ft. Engineer Pass, a sidewall blowout on day one in Montana, a remote Mexican border pylon near Naco, Arizona, the border-to-border route, and the famed Four Corners medallion.





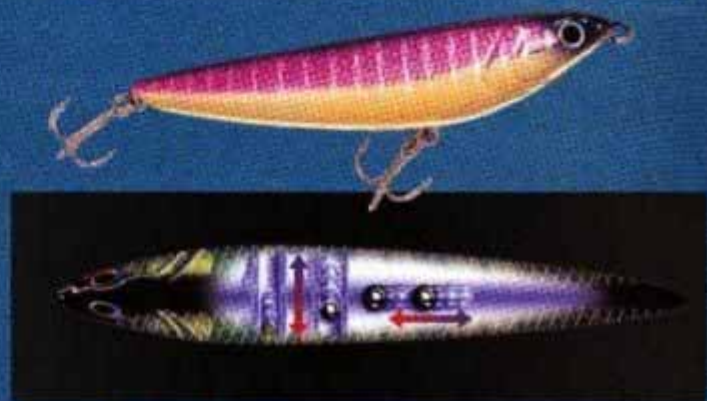
THE COMPLEAT HIGH-TECH ANGLER

Hot new gear lets you fish or cut bait.

BY JOE SKORUPA, Boating/Outdoors Editor

• Fish aren't getting more high tech, so why is the gear? Well, despite an essentially pastoral nature, fishing has always had a close relationship with technology. It began in the 1800s with the invention of the multiplying reel (which spins the reel faster than the rotation of the handle) and continues today in the use of space-age synthetics in rods and lines.

Perhaps the biggest news in current gear is downsizing. Everything from GPS units and depth-sounders to reels and lines are getting thinner and more compact. A second major trend is environmental friendliness, which appears in non-lead sinkers, lures that make an effort to tread lightly and dripless wheel-bearing protectors for trailers. Fish may not change, but tackle boxes will never be the same.



High-Tech Bait

Can there really be anything new about hard artificial baits? Well, for one thing, holograph technology is used to create realistic eyes. And for another, weight-transfer systems are integrated into complex bodies that create a natural motion as the bait is pulled through the water. Fenwick makes these sophisticated hard artificials (shown above and at top of page) and calls them Method Lures (\$9.97 each).



Night Eyes

Based on proven military technology, recent ITT Night Vision products have gone a long way toward leveling the after-dark playing field for fishermen. Admittedly, the price has been high, but the new Night Mariner 150 Monocular (\$1195) is the least expensive Night Vision product yet. It has a 40° field of view, is water resistant and even floats. The Night Mariner DX 101 version (\$1495) includes magnification lenses and a low-light illuminator (ideal for scouting locations and navigating after dark). It's powered by three AAA batteries and weighs just 16 ounces.

Look, Ma, No Wires

It was only a matter of time before remote-control operation would come to the world of fishing. The first to pull it off is MotorGuide (a name brand of Zebco) with its new wireless Lazer RF electric trolling motor (\$475 for 37-pound thrust and \$525 for 41-pound thrust). A radio-frequency computer pad controls the trolling motor and maneuvers the boat at the push of a button. The pad can be located anywhere on the boat and operated either by hand or by foot.





Just Add Water

What makes the Spony-Tur different from other soft artificial bait is that it's made of material that actually belongs in the water—sponge. The worms, frogs, craws and lizards (\$2.50 to 3.4 per pack) look realistic, absorb fish attractant, resist leaching, float, and in the water they feel, look and move naturally. Best of all, they contain no oils or plasticizers, and when lost off the hook, they become a medium of growth for the natural marine ecosystem.



Micro Fishing

Nothing beats compact tackle for road trips, but small gear usually loses something in miniaturization. In fact, most quality manufacturers stay away from mini tackle. This is not true for Shakespeare, which has made the commitment to develop a full line of micro fishing reels. The latest additions to the line

are the Microspin reels (\$21.99 for aluminum spool and \$14.99 for graphite), which weigh 4.9 ounces each and have a smooth gear ratio of 4.4:1.



Little Black Box

Research has shown that fish are sensitive to electrolysis, both attracted and repelled depending on the charge.

To take advantage of this, Scotty has developed the Black Box (\$160 to \$200) downrigger accessory, which counters fish-repelling negative charges typically associated with downrigger wires. The electrical charge from the Black Box is transferred to downrigger wires through metal contact sleeves, and the voltage can be adjusted to the chosen setting. Commercial salmon fishermen have been using similar technology with success for years.



Sonar With Horsepower

All right, you've seen inexpensive sonar units, but what can you get when you want kick-butt fuhring performance? The answer is the Lowrance X70A 3D (\$1500), which offers 3-dimensional graphics that can rotate real-time images in four different perspectives. It also has the Summer 4-beam 384-KHz 3D transducer, a curved faceplate to reduce glare, a split-screen display with multiple zoom ranges and all the normal bells and whistles you can think of.



World In Hand

Handheld GPS units aren't new, but what makes the Panasonic GX-G5700 (\$1095) stand out from the crowd is its ability to run Navionics chart cards. Similar to the operation of a large-screen GPS chart plotter, the palm-size device can zoom in and out of digitized charts, show current location in relation to landmarks and perform dozens of computerized navigation functions, such as plotting routes, storing waypoints and calculating speed over ground and distance to a waypoint. It runs on six AA batteries.



Kiss Of The Spider

Monofilament will always be important to fishermen, but superstrong braided line has commanded great interest in recent years. Now Salarland Co. moves to the next frontier with SpiderWire Spectra 2000 (\$29.95 for 100 yards), a braided monofilament that is thinner than equal-strength line. Made from material designed by Allied Signal for compact bulletproof vests, SpiderWire Spectra 2000 comes in 30-pound and 50-pound fishing line.

Get With The Program

The Digi-Trol IV (\$999.99) by Cannon (a division of Computrol) takes downriggers to a new level of sophistication by adding nearly as many programmable features as a notebook computer. The unit lets you program three descent and retrieve speeds, five different depths, up-and-down jig cycles and bottom contour following. In addition, the unit provides positive-ten control to make sure the downrigger wire electrically attracts fish.



THE COMPLETE HIGH-TECH ANGLER

Line Of Steel

Fenwick, the company that woke the fishing world to the benefits of braided line (called IronThread), has gone deeper into heavy metal with a braided gel leader cored with stainless steel. The full name of the product is a mouthful (IronThread Gel-Spun/Stainless Steel Braided Alloy Leader), but it's worth remembering because it has better flexibility than solid-wire leader, is more abrasion resistant than nylon and ties directly to lures and other lines using easy knots rather than crimping tools.



Get The Lead Out

Here's an idea whose time has come—non-lead sinkers: Gremlin Green, a line of sinkers made by Water Gremlin, uses an amalgam called rubbercor to take natural and artificial bait to the bottom. Since they contain no lead, poisoning of waterfowl and bottom feeders can't occur when the sinker is lost. The sinkers (89 cents per bag) are made from a unique tin and plastic compound that has half the density of lead. It's not a perfect solution to the problems caused by lead and it certainly costs more than typical sinkers, but it's a good step in the right direction.

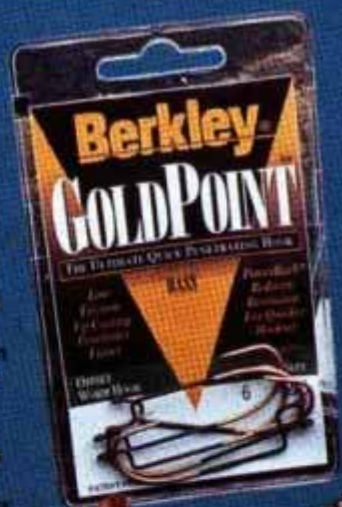


SOURCE LIST

- Berkley, Outdoor Technologies Group, 1 Berkley Dr., Spirit Lake, IA 51360; (800) 237-5539.
- Computrol, 499 E. Corporate Dr., Meridian, ID 83642; (800) 456-5432.
- Fenwick, 5242 Argosy Dr., Huntington Beach, CA 92649; (800) 642-7637.
- ITT Night Vision, 7635 Plantation Rd., Roanoke, VA 24019; (800) 448-8678.
- Liqua-Lube, P.O. Box 71, Lake Mills, WI 53551; (414) 648-5188.
- Lowrance Electronics, 12000 E. Skelly Dr., Tulsa, OK 74128; (918) 437-6881.
- Panasonic, 1 Panasonic Way, Secaucus, NJ 07094; (201) 348-7000.
- Safariland Ltd., 3120 E. Mission Blvd., Ontario, CA 91761; (800) 347-1200.
- Scotty USA, 5700-A Imhoff Dr., Concord, CA 94520; (800) 645-9119.
- Shakespeare, 3801 Westmore Dr., Columbia, SC 29223; (803) 754-7000.
- Sponj-Lur, 9551 Watson Industrial Park, St. Louis, MO 63126; (314) 968-2010.
- Water Gremlin, 1610 Whitaker Ave., White Bear Lake, MN 55110; (612) 429-7761.
- Zebco, P.O. Box 270, Tulsa, OK 74101; (918) 836-5581.

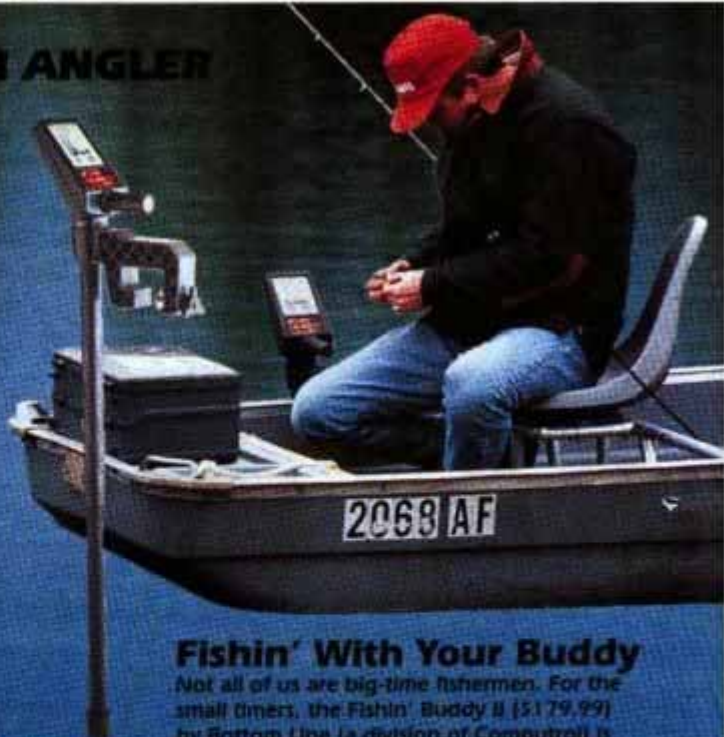
The Better Hook

Little improvements can sometimes produce big results. A good example is the GoldPoint Hook (\$3.95) by Berkley, which simply repositions the barb (called a Power Barb) on the outside of the hook point instead of the inside. What this does is maximize hook penetration energy for better setting. In addition to the repositioned barb, the hooks are also coated with friction-reducing Xylan and made of heavy-duty wire to maximize flex.



No Greasy Kid Stuff

Fishermen frequently trailer boats, and when they do they encounter the age-old problem of keeping the wheel bearings lubricated. Continuously replacing lost grease is the old answer, but Liqua-Lube (\$1.25) offers something new. The Liqua-Lube system encloses the entire hub in a non-greasy lubricant that can't freeze and is biodegradable. The see-through, leak-proof cap bolts onto the hub and uses a bellows to control outside atmospheric pressures and internal pressure, ensuring constant lubrication.



Fishin' With Your Buddy

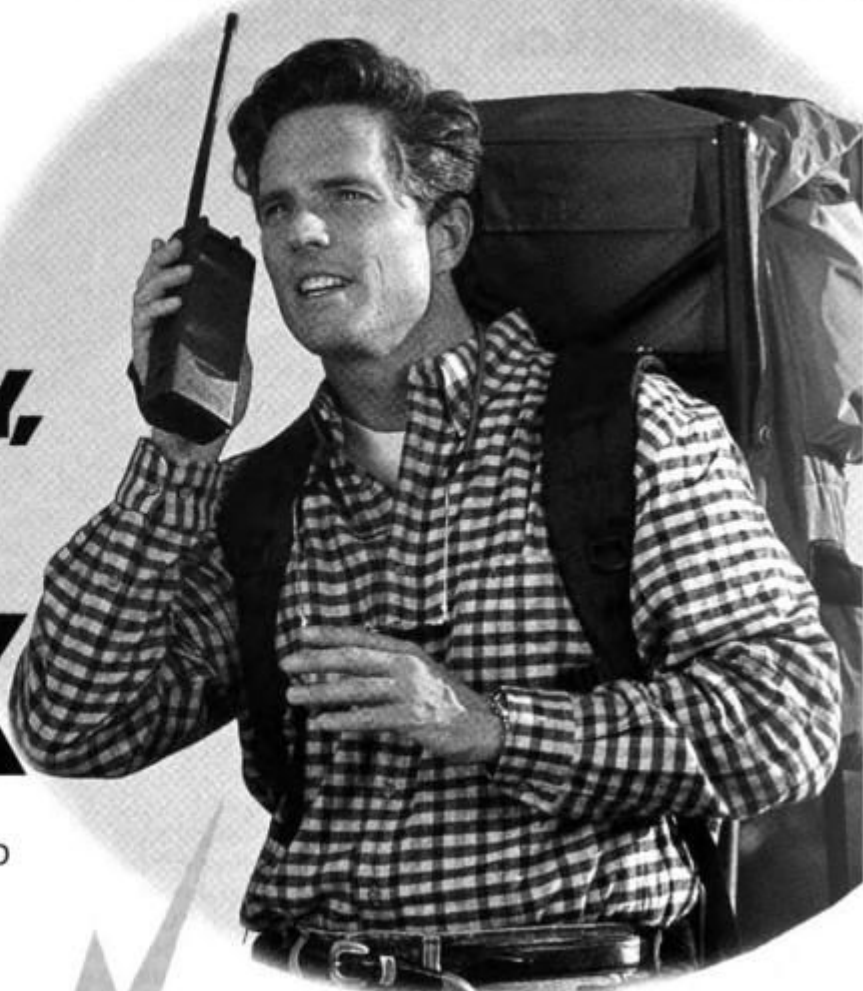
Not all of us are big-time fishermen. For the small timers, the Fishin' Buddy II (\$179.99) by Bottom Line (a division of Computrol) is the ideal portable, self-contained sonar. The compact unit uses a C-clamp system that enables it to be mounted to any small fishing craft or floating belly boat. Its transducers are built into the end of a telescoping shaft and offer downward and side viewing. The LCD measures 3.3 x 2.5 in. and displays multi-view screens. The unit also shows a water-temperature readout and runs for up to 45 hours on three C batteries.

HEY, GOOD BUDDY, CB IS BACK

A new generation discovers that talk is cheap and that a citizens band radio is a lifesaver in an emergency.

BY REBECCA DAY; PM Photos by Brian Kosoff

● It's late on a Sunday afternoon and I'm southbound on the New York Thruway, clicking through the 40 channels of my Radio Shack TRC-227 handheld CB radio hoping to eavesdrop on some mobile chitchat. Only the famous channel 19, the



power channel for truckers, delivers any action.

"Traffic clears up at 73 and then slows down again at 69," I hear as I crawl past mile marker 69.3. Right on target.

"What's all the traffic about?" I venture in my rookie CB accent.

"All the apple orchards are letting out," drawls someone in front or behind.

"That's where I was!" I squeal.

"Told ya."

I pick up a traffic warning from a stuck trucker that the tollbooths two exits down are backed up for 3 miles, so I make an early exit and take an alternate route. When I observe the Thruway traffic about 30 miles later, it's a slow train of bumper cars. Thanks to the CB, I've saved megatime and frustration. I tune back in to channel 19 to see what other goodies I might catch. This time it's philosophy.

"This is a mess," says somebody who's in a bumper car.

"This isn't a mess," says most probably a trucker. "A mess is when you're sitting here and you run out of coffee and cigarettes."

Cheap chat

Whether the impetus is for emergencies, professional use or simply a way to chat, there's a surge in mobile communications these days, and we're not just talking about the ubiquitous cellular phone. Along with '70s relics like platform shoes, half-pint hi-fi systems and John Travolta, the CB radio is staging a comeback.

Revived by the expanding market for cellular phones, the citizens band of the radio spectrum offers



CB IS BACK

drivers an affordable alternative to the pricey service charges imposed on cellular-phone users. While the trucker contingent never left the band, the audience has expanded to include everybody from chauffeur mothers to mobile teenagers, who for \$50 or more can secure an adult version of the walkie-talkie, with no activation fees and unlimited air time. While everybody and their brother mimicked the vernacular of the 18-wheelers a generation ago, the colorful banter remains the language of the truckers these days. You know you're in the '90s when you hear anxiety-ridden adolescents blandly scheduling a rendezvous on a Friday night. "Meet you at McDonald's at 10" doesn't have the same panache as "Catch you on the flip-flop" or "There's a bear in the air," but it gets the job done.

The radios themselves have gone contemporary, too, to reflect the stylized, downsized '90s. At $1\frac{1}{2} \times 4\frac{1}{8} \times 6\frac{1}{2}$ in., the Midland 77-104XL (\$100 list price) can fit in small spaces, whether it's being stored in the trunk, the glovebox or a small dash. The small size also makes it possible to take the CB from one vehicle to another, if necessary, using a cigarette lighter

adapter to draw power from the car battery. CB manufacturers have lopped quite a few pounds off the weight of radios, too, so that they don't

tax the strength of plastic dashboards. Where CB radios were once 10 to 12 pounds, 2 pounds or so is a more realistic weight for today's models.

Just as handheld cellular phones are the fastest-growing segment of that market, handheld CBs are opening the CB world to users outside of the car. Portability is a marketing bonanza for CB companies that want to expand the buyer market to include bikers, campers, boaters, hunters and other outdoor enthusiasts who need to stay in touch. Operated by batteries, the handhelds offer the security of independent power as well as use away from the car.

The FCC-mandated RF power output is the same 4 watts for both portable and fixed CBs, but the range of CB radios varies greatly. Handheld CBs have a more restricted range than their in-car siblings primarily because of antenna strength. A typical fixed-mount CB radio delivers a range of 2 to 7 miles, compared with about 1 to 3 miles for a handheld communicating with a mobile. Portable-to-portable range is as low as $\frac{1}{2}$ mile to 1 mile. Range is determined by a number of factors

that affect all AM radio-band transmissions and reception: quality and power output of the radios, antenna heights (usually the higher the antennas, the farther the range), terrain and atmospheric conditions. Handheld models generally have external antenna inputs, thereby increasing range when in use.

The FCC has allocated 40 channels for the citizens band, although you can gain access to additional channels if you have a single-sideband (SSB) model. SSB models double the number of operating channels available by utilizing channels on the upper and lower sidebands of the main carrier. Single-sideband models such as the Uniden Grant XL (\$280), can boost range to about 25 miles since there are fewer transmissions on those channels and thus less interference.

Because power consumption is an issue with a battery-powered portable CB, most portables come with adjustable transmitter power switches, which enable you to transmit using between 1 and 4 watts based on what you need. When using a CB handheld as a walkie-talkie within a building, for example, the 1-watt mode would generally be sufficient. Midland's 75-779 handheld (\$199) packs a battery-saver circuit that's said to reduce the drain on the battery by as much as 80% when the unit is in receive mode.

One of the most beneficial new features of today's high-end CB radios is the ability to monitor weather. A number of CB radios have access to National Oceanic and Atmospheric Administration (NOAA) weather warnings,



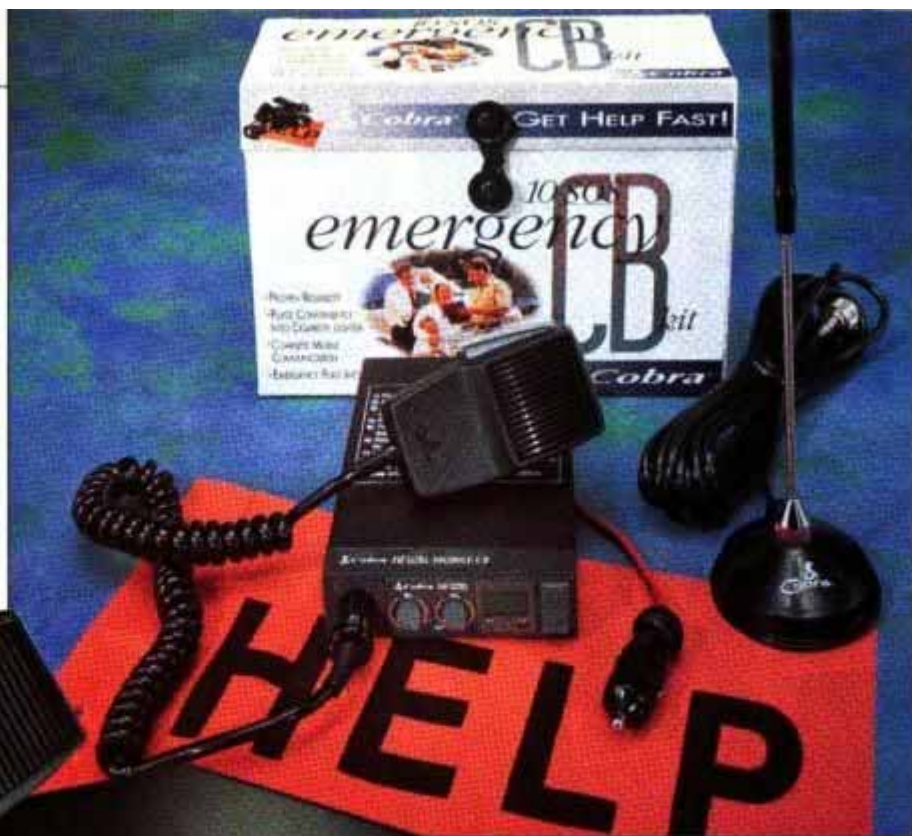
Radio Shack's TRC-493 cuts out background noise.



A downsized CB like Midland's 77-104XL is small enough to move between vehicles. Midland's handheld 75-779 features battery-saving circuitry for extended use.

which have been given widespread attention since a tornado struck a church in Alabama last spring killing 20 people. After the disaster, Vice President Al Gore backed an initiative to update and expand the country's weather-radio network to reach at least 95% of the population in the hopes that such disasters could be averted in the future by a broader dissemination of information. Part of the Gore message is to encourage that homes, cars and public gathering places be equipped with a tone-alert radio that can signal upcoming disasters. Base and mobile CBs are logical choices for weather-alert technology.

The new Cobra models 25LTD-WX (\$150) and 29LTD-WX (\$179), for example, are equipped to receive 24-hour emergency



Store a CB for an emergency (above) or stay with a modern model sporting a classic look from Cobra (left).



time, according to Midland), consumers are buying CBs as insurance policies against emergencies. In those situations, the CB radios may never leave the trunk, like other safety nets including jumper cables, flares and first-aid kits. Addressing that user, Cobra sells the 35EM emergency kit, which bundles a handheld CB with jumper cables, a "send help" flag and a carrying bag. The radio operates via AA batteries or the cigarette lighter. Price for the kit is \$79.

A variety of accessories are available to give you more flexibility with a CB radio. Optional antennas will boost the range of any CB. The stubby rubber antenna provided with handhelds, for example, is great for safety but short on performance. You can add a telescoping antenna for added range or connect a magnetic-mount or deck-mount antenna to the outside of the car for under \$50. Speaker microphones, available for about \$30, let you communicate without removing the radio from your belt, which can be useful if you plan to walk around with your radio and don't want to give up a free hand.

Whether it's for access to emergency information, a way to stay awake during long late-night drives or a simple mode of communication, CB radios can be a smart investment. If you didn't catch the CB wave the first time around, try it again on the flip-flop. If conversation and weather warnings aren't incentive enough, there's always that bear in the woods down the road.

weather-alert broadcasts over any of the frequencies used by the NOAA. When an emergency weather announcement is issued, the alert function activates automatically whether the radio is on or off. The special tone alert overrides any CB reception, prompting you to tune in to the area weather channel. The Uniden Pro 538W (\$110) provides access to the weather channels as well as an instant channel 9—the universal emergency channel in the CB world. Midland's mobile 77-118 (\$169) pulls in most of the weather channels in the 162-MHz FM band that constantly broadcast weather information.

Noise cutters

Other popular CB features are those that help clean up the static-filled signal. Squelch control, for example, reduces background noise when there's no incoming signal, enabling you to filter out long-range transmissions and other radio interference. Automatic noise limiters reduce background interference, and noise blankers cut

down on noise from the vehicle's engine. RF gain control lets you adjust the receiver's sensitivity to incoming signals, compensating for strong or weak signals. Clarifier control, which is found on the Uniden PC 122XL, fine-tunes incoming signals by shifting the reception frequency to pull in signals that are slightly off frequency. Radio Shack goes so far as to include digital signal processing (DSP) as an on/off noise-elimination feature on its TRC-493 model (\$150).

Certain CBs feature some form of level adjustment, which acts like a compressed audio circuit to bring all transmissions up to an equal level for better audibility. Midland calls the feature enhanced modulation, while Uniden refers to it as mic gain.

A few feature-packed CB radios are equipped with public-address capability (PA). The Midland 77-130 (\$169), for example, can switch between PA and CB operation. The unit includes a 5-watt amplifier, which can transmit over a 200-ft. range.

In most cases (about 74% of the

MONTE CARLO'S RACING HERITAGE

One of the winningest nameplates in Winston Cup history is back on the track.



Benny Parsons



Bobby Allison (No. 12) in the '72 Daytona 500. Darrell Waltrip (No. 11) piloted an Aero coupe in '86.

When Dale Earnhardt rolls out onto the track at Daytona this February, in his black 1995 Chevrolet Monte Carlo race car, a lot of history will be riding on his shoulders. Absent from the NASCAR Winston Cup circuit since mid-1989, the new Monte will be measured against the formidable record chalked up by Chevy's original Monte Carlo that plied the stock car ovals and road courses from 1971 to mid-1989. Of course, it wasn't the cars alone that rewrote racing history, but the men behind—and in—them. Names like Junior Johnson, Bobby Allison and Cale Yarborough, just to mention a few.

The Monte Carlo made its Winston Cup debut at the 1971 Daytona 500. A private entry driven by Pedro Rodriguez, the Monte experienced some teething pains as the 427-cu.-in. big block gulped a valve. Things would improve the following year at the 1972 Daytona, as a Monte Carlo driven by David Sisco scored a creditable seventh place finish.

The '72 Daytona also saw Bobby Allison piloting a gold and red No. 12 Monte Carlo, with the legendary

Junior Johnson serving as his crew chief. But a valve-train failure caused Allison to finish the race running only on four cylinders.

On shorter road courses where aerodynamics aren't as critical, the Monte Carlo was much more effective. At the 1972 Winston Western 500 in Riverside, California, Allison set the fastest qualifying time at 110.212 mph and finished second behind Richard Petty's STP Plymouth. Other victories for this famous Monte Carlo included wins at Charlotte and Rockingham. As 1972 drew to a close, Bobby Allison had won 10 Winston Cup races, and he also became the *Motor Trend* Super-track champion over such rivals as Richard Petty and A.J. Foyt. Allison's efforts also put Chevrolet in third place in the manufacturers' standings, making the Monte a force to be reckoned with.

Big-block engines were phased out in the '70s due to new rules by NASCAR, and the small-block Chevy V8 was readily adapted into Winston Cup competition. By 1977, it was the most popular engine on the banked ovals, giving Chevrolet 21 wins in the 30 Winston Cup Grand National series—a streak not rivaled since the 1950s. When NASCAR became alarmed that racing

This special advertising section was produced by General Communications, Bronx, NY, which is solely responsible for content.



Darrell Waltrip (No. 88) duels with Richard Petty (No. 43), as both men race Monte Carlos in 1979.

was becoming an all-Chevy affair, they required that the engines in the Monte Carlo be moved forward in the chassis some 2½ in. to eliminate some of the weight distribution advantage they held over competing cars like the Ford Torino and Dodge Charger. Teams racing Monte Carlos complied with the NASCAR requirements and kept on winning just the same.

The Monte Carlo was downsized in 1978, but teams kept racing the "old" body style under NASCAR's 4-year rule. King Richard Petty switched from Chrysler to Chevrolet and won his seventh Grand National championship in 1979, racing a 1973-77-style Monte Carlo.

The Monte Carlo entered the '80s rather mildly, but by mid-1983, a special version was released that brought back a lot of memories for performance enthusiasts—the more aerodynamic Monte Carlo SS. And at the 1984 Daytona 500, won by Cale Yarborough, Monte Carlo SS race cars accounted for an amazing eight of the top-10 finishers. The Monte victory roll continued for the 1985 and '86 race seasons, where the nameplate reigned as the winningest stock car on the circuit. But the competition was in hot pursuit and closing. The Monte Carlo needed a new edge,

and it came in the form of the 1986 Aero Coupe.

By the close of the 1987 season, the merit of the limited-production Aero Coupe body panel package had been proven time and time again, and Dale Earnhardt drove No. 3 to his second consecutive Winston Cup Championship. For his efforts, he pocketed more than \$2 million and won the hearts of all Chevy fans.

Although many teams still used the Monte Carlo Aero Coupe for the 1988 season, a number of the big teams were making the switch to cars based on the downsized GM-10 platform. The handwriting was on the wall. The Monte Carlo ran out of time midway through the 1989 season, and the new Chevrolet Lumina was introduced as a replacement for the Monte Carlo and Celebrity model lines.

In the six years it competed, the Monte Carlo SS had made its mark—winning 91 of 175 races, and earning the Winston Cup manufacturers' championship for Chevrolet for all six years.

Now, with the introduction of the all-new Monte Carlo for 1995, and racing stars such as Jeff Gordon, the stage is set for a brand-new chapter in Winston Cup racing.

PLYMOUTH NEON HIGHLINE



LONG-TERM

Say hello to some bright new lights.



CHEVROLET LUMINA LS

● As we begin the year, our fleet is bulging. We have five mighty important new vehicles to introduce this month. And to help make room for them, we're saying so long to three trusty workhorses that have served their 12 months well.

Plymouth Neon Highline

Few cars have burst into the national consciousness with the same verve as the perky little Neon subcompact twins from Chrysler Corp. But now that the initial fanfare has abated, and Chrysler is focusing its seemingly bottomless energy on the new Cirrus and Stratus midsize sedans, the Neon has settled into the unforgiving routine of vying for sales based on its own merits.

Naturally, given this car's importance to both Chrysler Corp. and to the domestic auto industry, we felt it was a mandatory addition to our long-

term test fleet. All the track testing aside (see "Neon Lights," page 32, July '94), there is ultimately only one way for us to accurately gauge how well a small, inexpensive American car could cope with the daily stresses of real life.

So we ordered a typically equipped

TEST SUMMARY

Report number: 1
 Base price: \$10,690
 As-tested price: \$13,831
 Extra-cost options: automatic, a/c, ABS, power door locks, center console, rear-window defroster, AM/FM/cassette stereo, tilt steering column, remote trunklid release, P185/65R14 tires
 Drivetrain: 2.0-liter sohc 16-valve 4-cylinder engine, 3-speed automatic, front-wheel drive
 Engine performance: 132 hp/129 ft.-lb.
 EPA fuel economy: 27 city/33 hwy.

Highline version of the Neon, and luck of the draw found us behind the wheel of a red Plymouth version. As we noted in our Comparison Test back in July, the only differences between the Plymouth and Dodge versions of the Neon are the badges on the hoods and the names above the dealerships' doors.

We're now deeply involved in running our Neon seriously through the daily grind, having finished accumulating those initial break-in miles. And already some interesting trends have emerged. For one thing, everyone who has driven the Neon appreciates its peppiness, overall comfort and versatility. For another, anyone who has faced the toll-booth laden commute into and out of New York City has voiced disappointment that power windows were not yet available when we ordered our Neon (they are now). We'll let you know how it settles into the routine. —Don Chaikin

Chevrolet Lumina LS

In case our brand-new and very shiny black Lumina LS looks familiar, it's because it's the very same car that we tested against three of its most direct competitors in this month's Comparison Test (see page 45). The fact that the Lumina appears twice in this issue speaks to the critical importance of this car to Chevrolet. And it is an important car, not just to Chevrolet but to the car-buying public and the domestic industry as a whole.

For less than 20 grand, here's a



HYUNDAI SONATA GLS

TEST CARS

very well-equipped sedan with dual airbags, ABS, power windows and whatever else you might want. The Lumina LS also has a stiff chassis, a roomy, ergonomic, modern interior and aerodynamic good looks. Just how did Chevrolet do all of that without blowing the lid off the window sticker? Well, we know of only one way to find out: spend a year behind the wheel of one and give the car the test of its life.

Ergo, we have added a Lumina LS to our fleet. And aside from the thrashing the car took at the track, we're just beginning to put the Lumina into the routine of serving us as daily transportation.

To see how the Lumina fared at the track, see the Comparison Test. To find out how it fares over the course of a long-term test, stay tuned. —D.C.

TEST SUMMARY

Report number: 1
 Base price: \$16,970
 As-tested price: \$19,900
 Extra-cost options: 3.4-liter engine, alloy wheels, P225/60R16 tires, remote keyless entry, cruise control, power mirrors, driver's seat and trunk opener, AM/FM/cassette stereo, rear-window defroster
 Drivetrain: 3.4-liter dohc 24-valve V6 engine, 4-speed overdrive automatic, front-wheel drive
 Engine performance: 210 hp/215 ft.-lb.
 EPA fuel economy: 17 city/26 hwy.

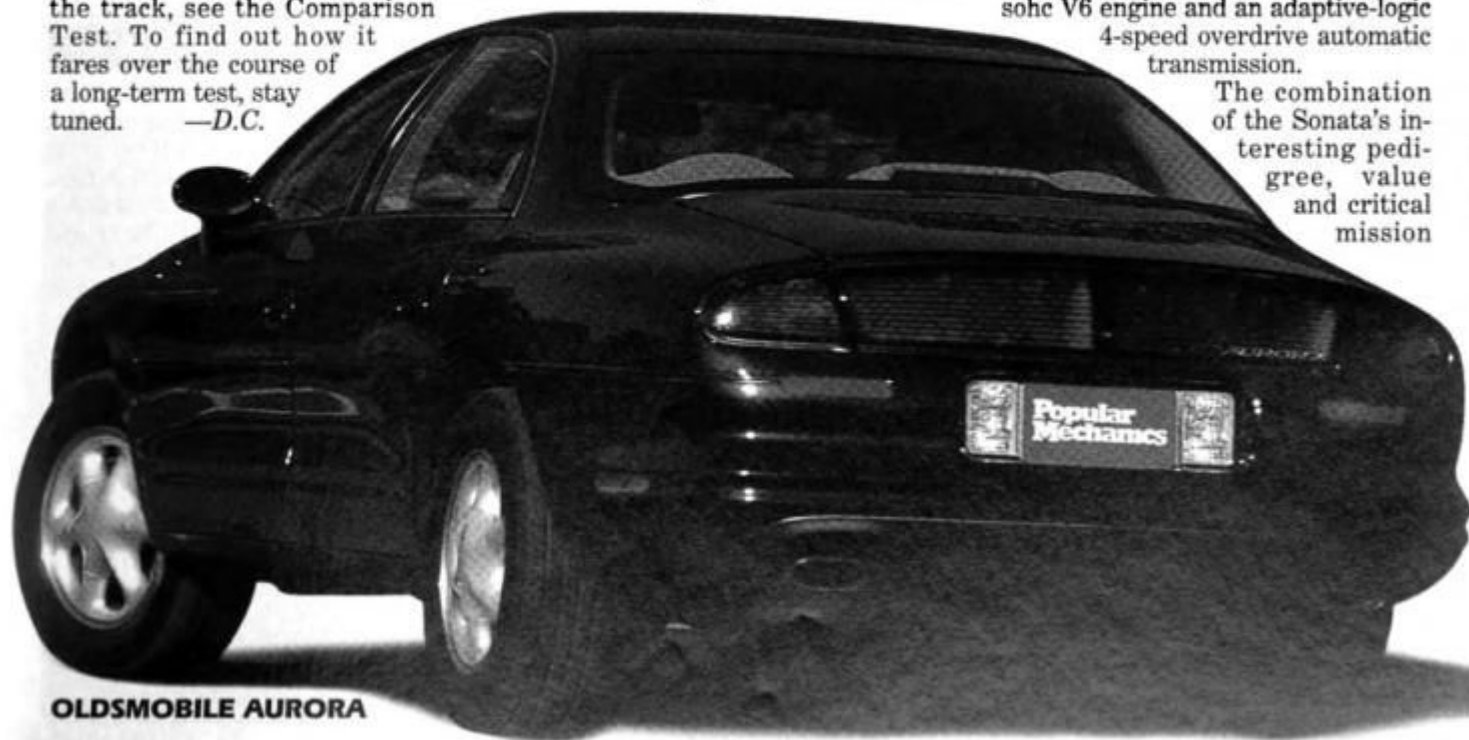
Hyundai Sonata GLS

For most people, this Korean carmaker's name is associated with inexpensive, utilitarian econobox transportation. So when Hyundai introduced the

decidedly non-spartan Sonata, we were intrigued, and impressed. True to the Hyundai formula, the Sonata is still inexpensive—compared to other midsize, well-appointed sedans. For well under \$20,000 our top-of-the-line GLS sedan boasts such standard features as power windows, mirrors and door locks, air conditioning, AM/FM/cassette stereo with six speakers and a power antenna, map pockets galore and plenty more.

But even more to the point, the Hyundai Sonata shares a great deal of its beneath-the-skin engineering with the highly regarded—and somewhat costlier—Mitsubishi Diamante. Among other things, our GLS long-term is equipped with a 3.0-liter sohc V6 engine and an adaptive-logic 4-speed overdrive automatic transmission.

The combination of the Sonata's interesting pedigree, value and critical mission



OLDSMOBILE AURORA

LONG-TERM TEST CARS



**DODGE RAM
1500 LARAMIE
SLT**

TEST SUMMARY

Report number: 1
Base price: \$17,199
As-tested price: \$17,425
Extra-cost options: California emissions equipment, carpeted floor mats
Drivetrain: 3.0-liter sohc V6 engine, 4-speed overdrive automatic, front-wheel drive
Engine performance: 142 hp/168 ft.-lb.
EPA fuel economy: 18 city/24 hwy.

of spreading the Hyundai gospel to an affluent, value-wise car-buying public made the Sonata a natural for further investigation. Right now we're still in the familiarization stage, accumulating some break-in miles. We'll let you know just what the Sonata is made of as the year unfolds. —D.C.

Oldsmobile Aurora

As far as General Motors—and Oldsmobile, in particular—is concerned, this is the car of the decade. The Aurora transcends any Oldsmobile that has gone before it: a benchmark in terms of structural rigidity, a technological showboat with a 32-valve dohc 250-hp V8 and an electronically controlled 4-speed overdrive automatic, elegant luxury for five and svelte,

TEST SUMMARY

Report number: 1
Base price: \$31,370
As-tested price: \$32,390
Extra-cost options: P235/60VR16 tires
Drivetrain: 4.0-liter dohc 32-valve V8 engine, 4-speed automatic, front-wheel drive
Engine performance: 250 hp/260 ft.-lb.
EPA fuel economy: 17 city/24 hwy.



HONDA ACCORD EX

TEST SUMMARY

Report number: 1
Base price: \$12,113
As-tested price: \$17,910
Extra-cost options: enhanced V6 engine, ABS, 4-speed automatic, a/c, power windows, mirrors and door locks, tilt steering wheel, cruise control, locking differential, aluminum wheels, P205/75R15 tires, foglamps, airdam, trailering equipment
Drivetrain: 4.3-liter V6, 4-speed overdrive automatic, rear-wheel drive
Engine performance: 191 hp/260 ft.-lb.
EPA fuel economy: 17 city/24 hwy.

muscular, aerodynamic lines that help guarantee the original Aurora's place in the future as a collectible classic.

In fact, given this car's style, grace and technology, there's no way we wouldn't have wanted one in our long-term test fleet. Factor in the Aurora's marketing importance and emotional impact for everyone who loves cars and is interested in what's going on in Detroit, and, well, the only discussion

the wait for the keys, and the Aurora itself, have been worth the time. But somehow we already expect the answer is yes. —D.C.

GMC Sonoma SLS

When Chevrolet and GMC introduced the latest iteration of the small pickup truck last year, these two GM divisions essentially set the standard. Both the Chevrolet S-Series and the virtually identical Sonoma raised the bar on ride, handling, performance, comfort and ergonomics. In so doing, while proving (to anyone who may have still had doubts) that small pickups equal driving fun, the redone S-Series and Sonoma were each presented a POPULAR MECHANICS Design & Engineering Award last year.

This year we're intent on making certain that we didn't act too hastily by presenting those awards. We've added one of these trucks, a Sonoma Club Cab, in SLS trim to be exact, to our long-term test fleet.

With the enhanced version of the



ISUZU AMIGO XS

was about what color we wanted. As you can see, we opted for the dark cherry red.

The Aurora is the newest member of our fleet and arrived just barely in time to make the photo shoot. Yet the waiting list for its keys already has everyone's name on it. Over the next 12 months we'll let you know whether

already strong 4.3-liter V6 under the hood, 4-wheel antilock brakes and the spaciousness of its stretched cab, our Sonoma has not had a moment's rest since it appeared in our garage. As this useful and playful little truck quickly runs through its break-in miles and finds itself running farther and faster afield, we'll keep you apprised of the details. —D.C.



MAZDA MILLENIA S

Isuzu Amigo XS

The Amigo may get you out of a ditch or two, but the challenge that's too great, even for its low-range 4wd, is crossing the generation gap. My 19-year-old son and I shared the driving chores in this, our wrap-up installment on the Amigo. And while he and his college cronies thought the Isuzu Amigo neat and cool, I, on the other hand, was acutely aware of the vehicle's shortcomings and its lack of amenities.

Toyota Celica GT

After a full summer of driving fun, we can honestly say we're going to miss our little red rocket. Within four months we clocked more than 10,000 miles on the odo, and enjoyed every minute doing it.

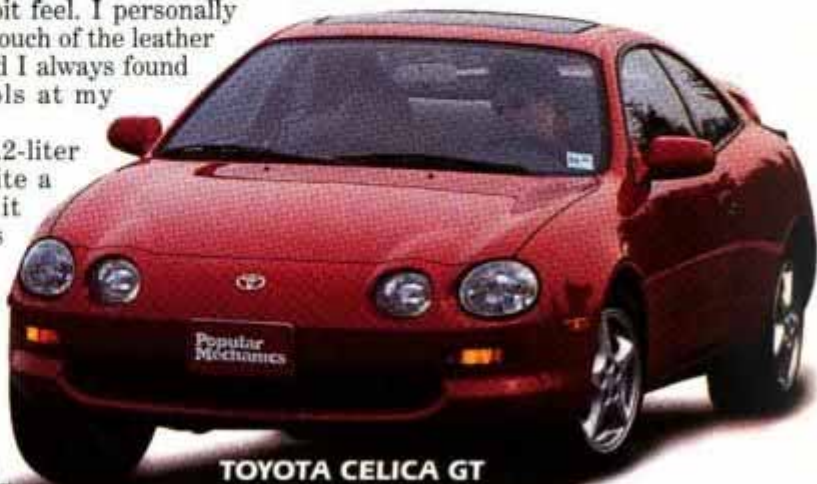
We didn't expect the Celica GT hatchback to be very comfortable as a daily commuter car, and, truth is, it wasn't. But, what it lacked in 4-passenger carpooling comfort, it made up for in 2-passenger handling excitement. This car easily maneuvers

the snug cockpit feel. I personally really like the touch of the leather upholstery. And I always found all the controls at my fingertips.

While the 2.2-liter Four gave quite a performance, it was the Celica's chassis that impressed us the most over the course of the last year. The car simply accepted all the daily pounding from construction barriers on the New Jersey Turnpike. The only casualty was the sidewall of one of the Michelin Pilot HX tires. (Which, by the way, took two days to get on special order and cost \$178.61.)

In all, however, the Celica more than survived our long-term test, and it won me over in the process. It's a gutsy 2+2 that handles with aplomb and looks real good doing it.

—Deborah Frank



TOYOTA CELICA GT

To the younger set, the Amigo represents more a lifestyle and an image statement than a mere machine. Joyful teenagers, out for a good time, can overlook the weak stereo and lack of air conditioning, because removing the half-top and climbing aboard is fun in itself. No matter where it's going, the Amigo always looks like it's going to the beach. The one complaint: The driver feels a bit isolated from the hi-jinks going on in the back because he's not part of all of that open-top fun.

Those on the paunchier side of 30 don't want to bother with the half-top,

(Please turn to page 120)

TEST SUMMARY

Report number: 4
 Total miles driven: 18,850
 Miles driven since last report: 10,109
 Average fuel economy: 27.1 mpg
 Worst observed fuel economy: 20.9 mpg
 Best observed fuel economy: 30.3 mpg
 Maintenance/repair costs: \$99.95 scheduled maintenance, \$99.95 4-wheel alignment, \$1150 replacement bumper, \$178.61 replacement tire.

its way through slow-moving traffic and around city-street obstacles. In addition, highway driving with the sunroof open is a delight. No wind-tunnel effect here.

While some of the larger staff members complained about the tight quarters inside, those of us who aren't 250-pound linebackers rather appreciated



GMC SONOMA SLS

PHOTOGRAPHY

HOT SHOTS!

Need a new image? These cameras will give you a whole new look.

BY GEORGE SCHAUB and
FRANK VIZARD, Electronics Editor



Clip Art

If you think a camera strap is a pain in the neck, then try the Quick Draw camera clip that hooks onto your belt. The camera is released by depressing the upper half of the holder. Available by mail from Quick Draw & Machining Inc., P.O. Box 2584, Ventura, CA 93002, for \$29.95 plus \$3.95 for shipping.



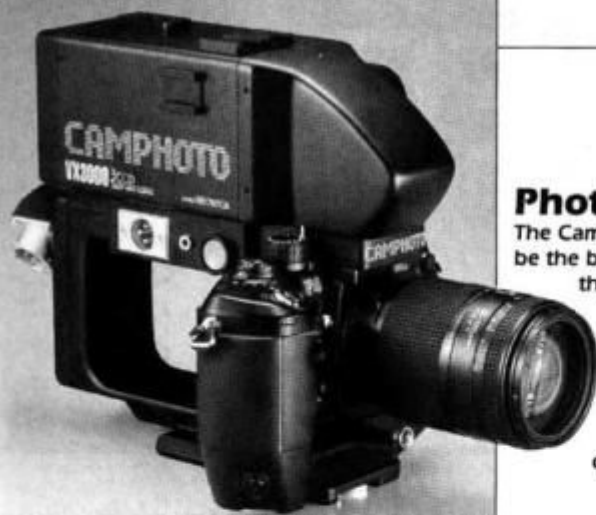
Film Camera...Not!

Sometime midyear, you'll see this Nikon E2 digital camera that uses PCMCIA computer cards as the storage medium for pictures. Up to 84 photos can be stored on one card. In the meantime, you can go shooting with the tiny 28Ti (\$1220), a camera that features a 3D matrix metering system usually associated with single-lens-reflex (SLR) cameras and a 541-step autofocus system housed in a titanium body.



Light Brigade

The Pentax IQZoom 928 (\$455) has an unusual feature for a point-and-shoot camera. It has an autoexposure override that allows you to compensate plus or minus 3 EV (stops) in 0.5 steps. This means you can darken or brighten the picture when shooting in high-contrast lighting situations. Another sharp shooter from Pentax is the silver-colored UC-1 (\$272), which is very pocketable and sports a rakish James Bond look.



Photos And Video

The Camphoto from Bronica may just be the beginning of a new path on the evolutionary tree. It combines a film camera and a video camera. You can't record the video, however. We saw this one at a European trade show. We don't know if you'll ever be able to buy one, but it does get you thinking.

Fast When Wet

Designed for outdoor use, the Olympus Infinity Superzoom 3500 (\$510) features special seals that make the camera waterproof. It's also the fastest camera in its class, capable of taking shots at a rate of four per second.



Thin Is In

Despite being only an inch thick, Ricoh's R1 (\$300) has a regular 30mm wide-angle lens that converts to a very wide 24mm focal length

in the panorama mode. The secret: The lens retracts into the body when the camera is off.

Picture Grabber

If you like to view pictures on a video screen and want an easy way to "grab" them, then the Fujix FV-7 photo-video imager (\$1000) is the answer. The 2-pound device has tiny legs, which you position over a print or object. You also can pull pictures directly from slides or negatives. There is also a 2X lens for enlarging details, as well as color balance and brightness controls. Focus and zoom controls let you fine-tune the image.



Rig For Silent Running

Canon's EOS-1 (\$2400) has more features than the local multiplex movie theater and is aimed at the professional market. It has a high-speed dead-quiet rewind system, so maybe you won't hear as many cameras whirring at sporting events. Meanwhile, Canon EOS camera gear can now be used underwater thanks to waterproof housings developed by Kenko Delphinus Co. Dive In!



Pictures Plus Palaver

A talking version of Polaroid's 636 instant camera should be available later this year. There are three pre-recorded messages and an 8-second window for recording your own. All this is thanks to a new technology that allows both sound recording and playback to occur using a single chip.



HOME IMPROVEMENT

Installing An

Adding a new entry makes coming home better than ever.

TEXT AND PHOTOS BY MERLE HENKENIUS

• Whether your home is new or old, you've probably learned to live with its minor shortcomings. However, if a more convenient entryway is high on your list,

the solution is simpler than you may think. For example, our home lacked a separate exterior door on the attached garage. To enter the garage, we either had to go through the house or open the large overhead door.

To solve the problem, we installed a new 9-light insulated steel door. The door we chose is made by Stanley (about \$165) and comes prehung in a wooden jamb, complete with molding and an aluminum threshold. In addition to the door, you'll need a few pieces of framing lumber, nails and basic power tools.

When ordering a door, you'll need to specify a left- or righthand swing. A good way to determine which version you need is to imagine yourself stand-

Entry Door

ing in the doorway with your back to the hinges. In that position, a left-hand door would swing to the left and a righthand door would swing to the right.

Bear in mind that our instructions are based on a garage-entry-door installation. Unless your situation is similar, you may have to modify the procedure. Installing a new entry door in a finished home requires locating studs, electrical wiring and plumbing runs and cutting through drywall or plaster. In our garage, all the framing is exposed. Additionally, cutting through load-bearing walls requires temporary supports appropriate to the structure. Be sure to check with your local building inspector to obtain the necessary permit for structural work.

Framing The Door

Structurally, a doorframe consists of two king studs—vertical framing members that extend the full height between the horizontal soleplate and the top plate of the wall. Nailed against the inner edges of the king studs are two jack studs, which reach only slightly higher than the door-jamb. A laminated header rests on top of these jack studs and bridges the door opening. Any supports located above the header are then framed conventionally.

To determine the rough opening width—the space between the jack studs—add $\frac{1}{2}$ in. to the jamb width of the door. The extra $\frac{1}{2}$ in. allows you to shim the door and accommodate any out-of-square framing. The height of the rough opening—the distance from the floor to the laminated header—equals the jamb height plus $\frac{1}{2}$ in. This dimension, less the thickness of the soleplate ($1\frac{1}{2}$ in.), equals the length of the jack stud.

Locate an existing stud that will serve as the king stud for one side of the door. Measure the rough opening width



1 Use an existing stud as the first king stud. Nail a jack stud to this stud and then toenail it to the soleplate.



2 After the second king and jack studs are in place, support the wall by nailing an 8-ft. 2 x 6 across the studs near the ceiling.

from this stud, add 3 in. to allow for the two jack studs, and mark the second king stud position on the soleplate. Then cut two jack studs and the second king stud.

Nail the first jack stud to the existing king stud (Photo 1), and toenail it to the soleplate. Then nail the second jack stud to the new king stud, and secure the assembly by toenailing it to the soleplate and the top plate.

Before cutting the studs between the new jack studs, add temporary framing to support the structure until the new door framing is complete. If your site is similar to ours (a one-story home), nail an 8-ft.-long 2 x 6 across the edge of each stud, centered over the door opening and near the ceiling (Photo 2). This supports the

roof above the wall long enough to frame in a permanent header. For added strength, use 16d common nails with duplex heads. A 2-story home may require post supports to temporarily handle the load.

To build the header, cut two 2 x 8s to fit between the king studs. Sandwich the 2 x 8s around a piece of 1/2-in. CDX plywood cut to the same size. Apply a liberal bead of construction adhesive between the plywood and the 2 x 8s, and nail the three parts together (Photo 3).

To install the header, measure 7 1/4 in. up from the tops of the jack studs and mark cutting lines across the center studs at this height. After cutting most of the way through with a circular saw, finish the cuts with a reciprocating saw (Photo 4).

Then use a reciprocating saw with a metal-cutting blade to slice through the nails holding the sheathing and siding to the studs.



5 Use a reciprocating saw with a metal-cutting blade to cut the nails that hold the sheathing and siding to the studs.

siding to the studs (Photo 5). With the studs removed, lift the laminated header in place and secure it with 16d nails driven through the king studs (Photo 6). Finally, toenail the studs above the opening to the header. Once the header is in place, you can remove



3 Sandwich the piece of plywood between the 2 x 8s and nail through from both sides. Use eight 16d nails on each side.



6 Lift the header into place and secure it to the king studs by nailing with 16d nails. Use four nails per header end.

the 2 x 6 temporary support beam.

Because the garage floor is concrete, we anchored the soleplate with an L-bracket on each side of the opening (Photo 7). If your floor is wood framed, nail the soleplate to the floor and into the framing below.



4 Cut studs at header location. Use a circular saw to start the cuts, then finish the job with a reciprocating saw or handsaw.



7 In a garage installation like ours, use an L-bracket to secure soleplate to floor at opening. Otherwise, nail to floor.

Cutting The Opening

When it comes to cutting siding and sheathing, you'll need to make two cuts. The first is a rough cut through both layers that follows the inside perimeter of the rough framing. The second cut is through the siding only and will follow the line of the door's

casing, which is usually made of standard molding, sometimes called brick molding.

Begin by drilling a 1/4-in. hole in each corner of the framed opening, from the inside (Photo 8). Then, move to the outside and use a straight-

edge to draw lines connecting each hole on the siding. Using a circular saw, set deep, cut along these lines until the siding and sheathing fall away (Photo 9).

With all but the bottom portion of siding and sheathing removed, use a reciprocating saw from the inside to finish the cut, slicing through the sole-



8 To locate opening on the outside of the house, bore 1/4-in. holes through the wall from the inside at the opening corners.



9 Using the holes as a guide, mark the opening and cut through the siding and sheathing with a circular saw.



10 Where the circular saw can't reach, use a reciprocating saw from the inside. Cut through the soleplate, as well.



11 Set the door in place with the molding against the siding. Then, trace the molding perimeter on the siding.

plate and siding at the same time (Photo 10).

Set the door in the opening, so that the molding rests against the siding. After checking to make sure that the door is square, mark the siding around



12 Use a circular saw to trim the siding. Set the saw for a 1/4-in.-deep cut, or just enough to go through the siding.

the molding (Photo 11). Set the circular saw depth to match the thickness of the siding, and cut the remaining strip of siding from the perimeter of the opening (Photo 12).

Mount a length of galvanized rain



13 To protect the header and door casing from rot, install a sheetmetal rain cap under the top section of the siding.

cap under the siding at the top of the opening. Cut this formed sheetmetal to match the opening width, and slide it under the top length of siding (Photo 13). Tack it through the siding with 4d galvanized nails.

Setting The Door

Press the doorjamb through the opening and center it between the siding cuts. Then nail the molding on each side, using four 12d galvanized casing nails (Photo 14). Don't drive in the nails all the way just yet, however, in case you need to adjust the door.



14 Temporarily secure the door by driving 12d galvanized casing nails through the molding. Leave 1/2 in. of nail showing.



15 After checking door alignment and operation, shim casing and drive 8d casing nails through casing, shims and jack studs.



16 Fill open holes in hinges with long screws. Drive these screws through the casing and into the jack stud.



17 Seal the door against the weather with a bead of high-quality flexible caulk applied around the casing perimeter.

rected the problem. Then renail the casing nails that you pulled out.

Finally, remove the temporary fasteners that came on the door and try opening and closing the door several times. It should operate smoothly, without binding at the top or bottom.

To permanently secure the door, first shim the spaces between the jamb and jack studs. Do not shim the header. Each side of the door should get three sets of shims, one near each hinge on the hinge side, and three corresponding shims on the lock side.

When shimming the jamb, use two pieces of cedar shingle. The goal is to provide support without altering the critical gap between the jamb and jack studs. This takes a little experimenting, but it's not difficult. Feed one shim into the gap thick-end first, and back it up with a second shim, thin-end first. When the gap is filled, nail through the jamb and shims into the jack studs with 8d casing nails (Photo 15).

Manufacturers typically leave one screw out of each lower hinge and two out of the top hinge. This allows you to drive longer screws through the jamb and into the jack stud behind it. To avoid splitting the jamb, bore pilot holes first (Photo 16).

At this point, all that remains are the finishing touches. Drive a few more nails through the casing and countersink them about 1/32 in. Then caulk the gap between casing and siding (Photo 17), paying particular attention to the rain cap at the top. Finally, caulk the inner and outer edges of the threshold, paint the door and jamb and install a lockset. **FM**



SHOP PROJECT

Craftsman Sofa

A turn-of-the-century design that still makes sense today.

BY NEAL BARRETT

● If you've ever worked on a design and found yourself wondering whether there was anything new left in the world, you'd be mistaken if you thought it was any easier before the turn of the last century. Dominated by Victorian styles, the designers of 100 years ago drew themes from the past—Gothic, Rococo and Renaissance, to name a few—and interpreted them with new industrialized production methods. With all of this activity and the wealth of decorative information on hand, it's easy to imagine that these leading-edge designers felt that anything worth doing was probably—in some form—already done.

As is usually the case, nothing was further from the truth. In the midst of the Victorian tradition, another design philosophy took shape. Called the Arts & Crafts movement, this school of thought emphasized a return to simple, unadorned forms—designs that achieved their character through an appreciation of the materials used and the hands-on skills that shaped them.

One of the most well-known proponents of the American Arts & Crafts movement in the early 1900s was Gustav Stickley. He designed and manufactured a line known as Craftsman furniture while his younger brothers, Leopold and J. George Stickley, developed their own line of furniture. The popularity of these styles encouraged other designers to follow suit. Today, the term Mission furniture refers loosely to the work of various builders influenced by the Stickley family. Our sofa project is based on one of Leopold and J. George Stickley's designs.

While you could use most any hardwood for this piece, quarter-sawn white oak is the wood generally associated with the style. One source is Talarico Hardwoods, RD 3, P.O. Box 3268, Mohnton, PA 19540.

After building our sofa, we had an upholsterer make the cushions. While leather would be the traditional choice, we chose a vinyl material that resembles leather in both appearance and feel. The core of each cushion is Dacron-wrapped foam. To support the cushions, our upholsterer installed a rubber mat to the interior cleats shown in the drawing. Alternatively, you could modify the cleats and install slats to support the seat cushions.

Start With The Legs

Construct the legs by gluing up four strips of stock, with mitered edges, around a $\frac{3}{4}$ -in.-square central core. First cut stock to rough size for the leg faces. Then set up the table saw to cut the 45° angles along both edges of each strip. To achieve good results, make sure your table saw is adjusted to exactly 45°, or the corner joints will not

Lead photo: John Griebisch
Step-by-step photos: Neal Barrett
Technical art: Eugene Thompson

come together properly. Clamp a featherboard hold-down to the table-saw rip fence (Photo 1). This will keep your fingers away from the blade and help yield a smoother surface on the mitered edges.

After ripping the mitered edges, readjust the saw and cut the four central core pieces for the legs.

Apply glue to all mitered edges and all sides of the central core strip. Loosely assemble the pieces, then apply clamps (Photo 2). After about 30 minutes, scrape off any excess glue and let the glue thoroughly set.

Crosscut the legs to finished length on the table saw and lay out the mortises. Cut the mortises with a plunge router and edge guide. A spiral-flute up-cutting bit eases the load on the router and results in a smoother cut with no burning. A 1/2-in.-dia. carbide bit of this type is available from Woodworker's Supply Inc., 1180 N. Glenn Rd., Casper, WY 82601.

Clamp a leg between bench dogs on the workbench and make the mortise cut in several stages, with each cut taking no more than 3/8 in. in depth.

To help support the router base when making the top rail mortise cuts, clamp a spare leg to the side of your workpiece, extending past its top end (Photo 3). Square the ends of each mortise with a sharp chisel (Photo 4).

The Frame Pieces

Choose the stock for the stiles that divide the panels, and rip and crosscut the stiles to finished dimension. Set these aside.

Select the stock for the sofa rails, and cut these pieces to finished dimension. Orient each piece as it will appear on the finished sofa, selecting for best grain figure, and mark the exposed face to indicate the top and bottom edges. Use a dado blade in the table saw to cut the broad tenon



1 Rip the mitered leg sides on a table saw. A featherboard clamped to the fence holds stock for a smoother, more accurate cut.



2 After applying glue to core and mitered sides, clamp assembly until the glue sets. Alternate clamps for even pressure.



3 Use a plunge router and edge guide to cut the leg mortises. Spare leg clamped to side of workpiece helps support router.



4 After the mortises have been routed, use a sharp chisel to square the mortise ends so the rail tenons will fit snugly.

faces on the rail ends (Photo 5). Clamp a stopblock to the saw table to aid in making the tenons the same length. Readjust the blade height to cut the top and bottom shoulders on each tenon. It's best to cut the tenons just slightly oversize and then pare to finished dimension with a sharp chisel. This practice eliminates the small ridge marks that most dado blades leave on the surface of a cut (Photo 6). Note that the tenons are 1/16 in. shorter than the mortise depth to

allow a place for the excess glue to go.

Use a dado blade to cut the tenons on the ends of the stiles. On these tenons, however, only make the cheek cuts, as the shoulders will be automatically formed when you cut the panel grooves.

Readjust the dado blade in the saw to cut the grooves in the top edges of the bottom back and side rails, bottom edges of the top back and side rails, and the edges of the stiles. Use a featherboard clamped to the saw



5 Use a dado blade to cut the tenon faces on the rail ends. A stopblock clamped to the table ensures consistent tenon length.



6 After cutting tenons slightly oversize, use a chisel to pare them for a snug fit. Paring also removes dado blade marks.



7 Reset the dado blade, and cut the grooves for the panels and the stiles. Use a featherboard to hold work against fence.

table to hold the pieces tight against the rip fence (Photo 7).

Next, mark the arched profile on each bottom rail. To achieve a smooth curve, spring a 1/4-in.-thick strip of pine or poplar between the clamps on each end of the rail and trace along the strip to mark the arch (Photo 8). Use a band saw or sabre saw to cut these arches (Photo 9), and use a spokeshave to remove the saw marks (Photo 10).

Use a 30° chamfer bit in the router to cut the chamfer on the top front edge of the front rail. Clamp the rail to the workbench before routing (Photo 11).

Select the stock for the back and side arms of the sofa. If you cannot cut all the arms from one board, try to match the pieces for color and grain pattern so that the arm has a unified appearance. After ripping the stock to width, use the miter gauge on the table saw to cut the 45° mitered ends on each piece, then cut the square ends on the two side arms.

Make a plywood or cardboard template of the arm bracket shape, using a thin strip to create a smooth curve. Then, trace the template onto the appropriate pieces of stock. Use a band saw or sabre saw to cut out the shape, and remove the saw marks with a spokeshave.



8 Bend a thin strip over the lower rail pieces to lay out a smooth curve. Clamp the strip at ends and trace curve with a pencil.



9 Use a band saw or sabre saw to cut the curve on the lower rails. Stay just to the waste side of the layout line.



10 Smooth the curves to the layout line with a spokeshave. Cut down the curve from each end to avoid tearing the wood.



11 Rout a chamfer along the top front edge of the front rail. Use a 30° chamfer bit with a ball-bearing pilot for the job.

Prefinishing The Panels

If possible, make each panel from a single board. Otherwise, glue narrower stock together to achieve the necessary width. Plane the panel stock to 3/8-in. thickness. If you do not own a thickness planer, you can usually find a lumberyard or professional woodworker who will plane your stock for a modest fee. Rip and crosscut the panels to finished dimension (Photo 12), and sand thoroughly, finishing with 220-grit sandpaper.

Prefinishing the panels ensures a neat job and eliminates the possibility of raw wood appearing if the panels shrink in a dry environment.

To color the wood we used a water-based aniline dye (Moser's English Brown Oak Aniline Dye No. W1230). Before applying the dye, wipe the wood with warm water to raise the grain. When dry, lightly sand the wood with 320-grit paper before applying the dye.

Dust off thoroughly and apply the

dye according to the manufacturer's directions, and let it dry before proceeding (Photo 13).

Next, seal the surface of the panels by applying one coat of the finish of your choice (Photo 14). We used Waterlox Transparent Finish. One coat of Waterlox will protect the stained surface and keep any further stain from penetrating the panels when the body of the sofa is finished. Allow the sealer to dry completely before beginning the final assembly.



12 After planing the panel stock to 3/8 in. thick, use a crosscut table mounted on the table saw to make square panel cuts.



13 Apply warm water to raise grain, let dry and sand. Then color the panels with aniline dye according to the instructions.

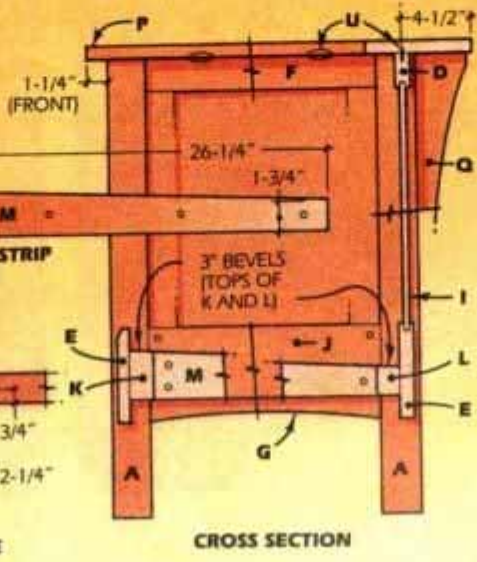
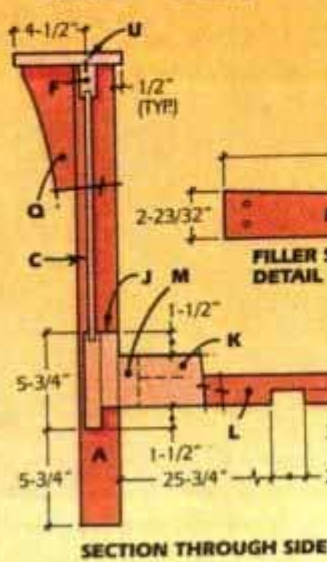
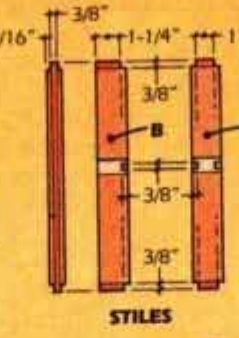
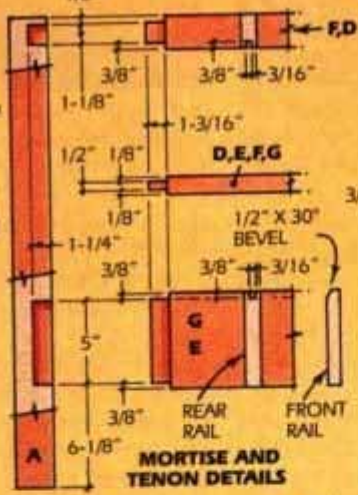
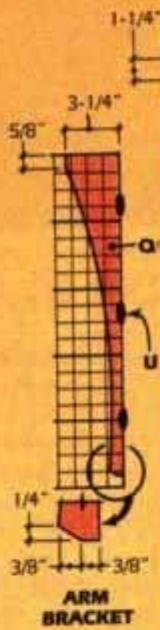
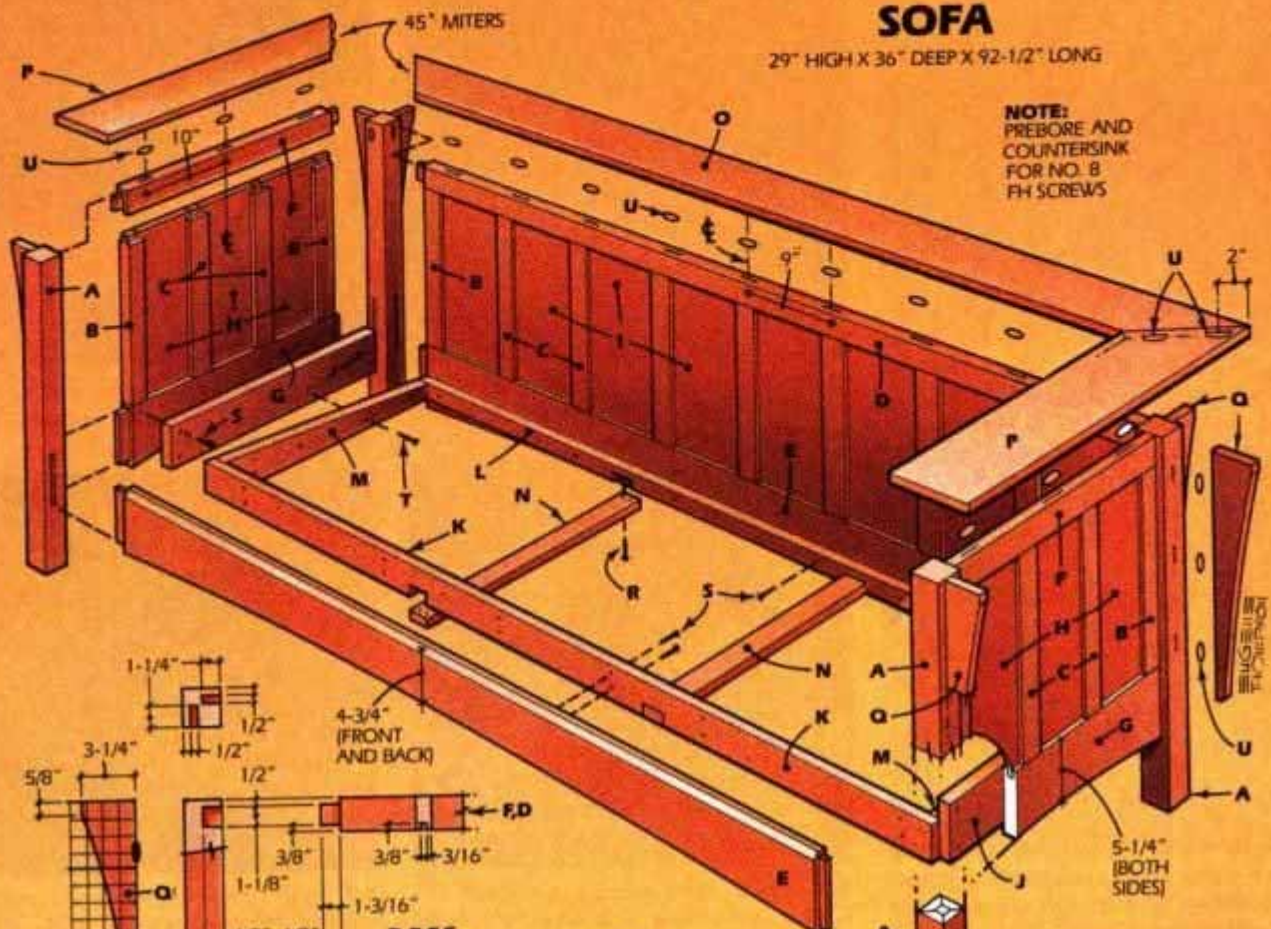


14 Apply one coat of the final finish after the dye has dried. This protects the panels when the assembled sofa is dyed.

SOFA

29" HIGH X 36" DEEP X 92-1/2" LONG

NOTE:
PREBORE AND
COUNTERSINK
FOR NO. 8
FH SCREWS



MATERIALS LIST—SOFA

Key	No.	Size and description (use)
A*	4	2 1/4 x 2 1/4 x 28 1/4" oak** (leg)
B	6	3/4 x 1 1/4 x 15 1/2" oak (end stile)
C	11	3/4 x 1 1/4 x 15 1/2" oak (middle stile)
D	1	3/4 x 2 x 82 5/8" oak (back top rail)
E	2	3/4 x 5 1/4 x 82 5/8" oak (wide rail)
F	2	3/4 x 2 x 28 5/8" oak (side top rail)
G	2	3/4 x 5 1/4 x 28 5/8" oak (side bottom rail)
H	6	3/4 x 7 1/4 x 15 1/2" oak (side panel)
I	8	3/4 x 8 1/4 x 15 1/2" oak (back panel)
J	2	1 1/4 x 4 1/4 x 28 5/8" maple (filler)
K	1	1 1/4 x 2 1/4 x 80 1/2" maple (front cleat)
L	1	1 1/4 x 1 1/4 x 80 1/2" maple (back cleat)
M	2	1 1/4 x 2 1/4 x 26 1/4" maple (side cleat)
N	2	3/4 x 2 1/4 x 28 5/8" maple (cross brace)
O	1	3/4 x 6 1/4 x 92 1/2" oak (back arm)
P	2	3/4 x 6 1/4 x 36" oak (side arm)
Q	7	3/4 x 3 1/4 x 19 1/4" oak (arm bracket)
R	8	1 1/2" No. 8 fh screw
S	20	1 1/2" No. 8 fh screw
T	10	2" No. 8 fh screw
U***		No. 20 joining plates

Misc: Waterox Transparent Finish; Moser's English Brown Oak Aniline Dye (No. W1230), available from Woodworker's Supply Inc., 1180 N. Glenn Rd., Casper, WY 82601.

* Overall dimension given. Build from four mitered 3/4-in.-thick boards with square core as shown.
** Quarter-sawn white oak.
*** As required.

Assembly And Finishing

First, assemble the side frame rails, stiles and panels. Mark the stile locations on the rails to ensure proper positioning. Apply glue to the rail grooves where the stile tenons will rest, and apply glue to the tenon ends. Don't glue the panels in the grooves.

Position the stiles in the bottom rail groove, slide the panels into place, then install the top rail. Clamp the assembly, and compare opposite diagonal measurements to guarantee that the frame is square. Scrape off any glue squeeze-out before it completely hardens. After the side frames are done, assemble the back frame and clamp (Photo 15).

When the glue dries, join the side frames to the legs. Apply glue to the mortise-and-tenon joints and to the edges of the stiles that abut the legs.

Next, join the two sides to the front and back rails. Be sure to complete the assembly on a flat surface to avoid imparting a twist to the frame.

Cut and install the filler strips on the inside of each side bottom rail. Use glue and screws to attach these strips. Cut poplar or maple stock to size for the cleats that support the sofa seat cushion. Note the beveled

top edge on the front and back cleats. Use the table saw and dado blades, or handsaw and chisel, to cut the notches in the bottom edges of the front and back cleats. Bore and countersink pilot holes in the cleats, and attach them to the frame with screws and glue. Cut the crossbraces and install them in the notches in the front and back cleats.

Mark the positions of the two joining plates in each arm miter joint, then cut the slots with the plate joiner (Photo 16). Apply glue and assemble the arm, clamping in two directions, to keep the miters aligned.

Lay the arm upside down on a padded surface. Position the sofa frame on the arm, also upside down, and align the two for proper overhang on all sides. Mark joining plate positions on the arm and top rail (Photo 17). Cut the slots on the bottom face of the arm, locating the plate joiner by clamping a straightedge guide to the arm to yield the proper setback. Use the plate joiner fence to center the slots in the rail top edge (Photo 18).

Apply glue to the rail edge, joining plate slots and plates, install the plates and assemble the arm to the sofa. Use bar clamps to pull the joints

tight, and let the glue dry (Photo 19).

Mark and cut the plate slots in the arm brackets, legs and center back stile. Use the plate joiner fence to position the cuts on the legs (Photo 20), but a straightedge guide must be clamped to the sofa back to position the slots in the center stile.

Use masking tape to hold the arm brackets in place until the glue sets. If the joints won't close, a light blow with a mallet will do the job.

Dye the sofa frame as described in the section on prefinishing the panels. When working with water-based dyes, it's important to keep a wet edge at the point of application to avoid lap marks. Therefore, start at a corner and work your way around the piece in one continuous application. If dye splashes onto the prefinished panels, simply wipe the panel dry and proceed.

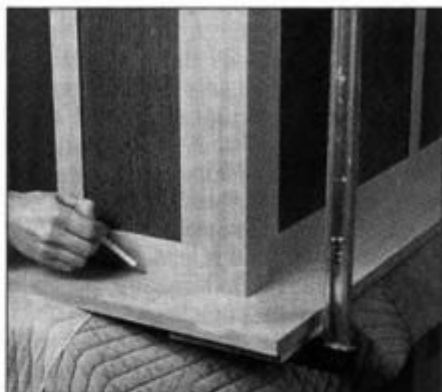
When the dye is dry, use a brush, rag or sponge to apply the Waterlox, then wipe off most of the finish leaving only a thin film. Let the finish dry overnight between coats. Three or four coats of finish, applied in this way, should be sufficient. To smooth the final finish, lightly buff the surface with 4/0 steel wool and polish with a soft cloth. **FM**



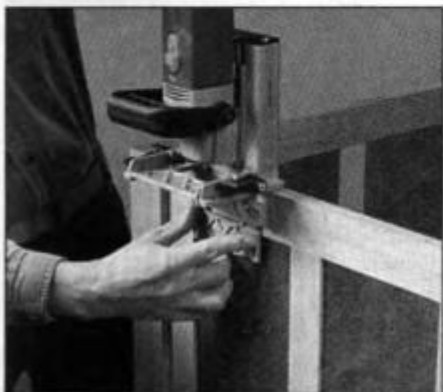
15 Apply glue to the stile tenons and to the rail grooves at the stile locations. Panels are held in grooves without glue.



16 After mitering the arm pieces, use a plate joiner to cut the slots for joining the components with plates (biscuits).



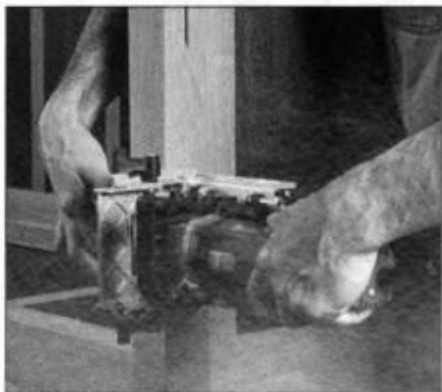
17 When the arm has been assembled, flip it over and lay the inverted sofa assembly on top. Then mark plate joints.



18 Position slots in rail using fence on joiner. Clamp a board to underside of arm, to position corresponding slots.



19 Apply glue to plate joints for connecting arm subassembly to frame. Then, clamp arm to frame and let the glue dry.



20 Use a plate joiner to join arm brackets to legs and arm assembly. Hold brackets in place with tape until the glue dries.

TOOL TEST

Micro-Fence Router Guide

TEXT AND PHOTOS BY
 ROSARIO CAPOTOSTO,
 Contributing Editor

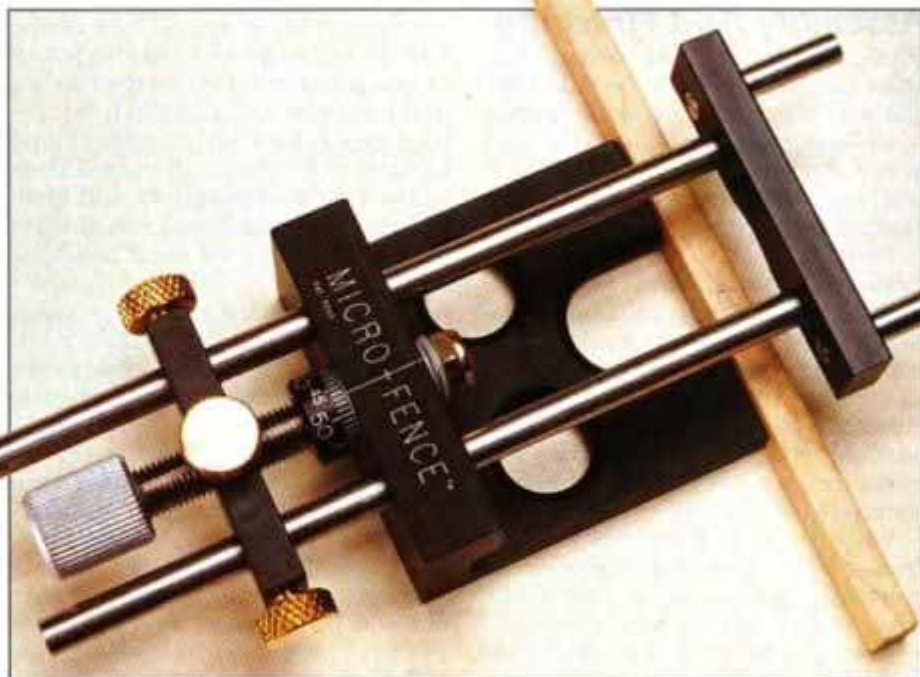
● If you've ever fumbled while making fine adjustments using a conventional router edge guide, you'll surely appreciate the capability and effectiveness of this recently introduced router accessory called Micro-Fence.

It looks and feels like the precision instrument it is. Its designer and developer is a well-qualified woodworker and mechanical engineer who recognized that standard router fences are often difficult to set up and adjust accurately. He set out to achieve an adjustable edge guide that was quicker and easier to use. His product nicely satisfies these requirements.

The unique feature of this edge guide is the micrometer-adjusted fence. It has readout accuracy to within 1/1000th of an inch (.001). The leadscrew that positions the fence can be adjusted to any position shown on the dial. This is graduated in .001 divisions from 0 to 50. A revolution will move the fence .050 in.

While general woodwork does not demand such close tolerances, other operations do. The Micro-Fence is extremely useful in making precise joints and cutting mortises for cabinet hinges and locks.

I tried it on a variety of edge-guided operations with excellent results. To use the device, first set it in approximate terms. Then, make a test



The Micro-Fence is an edge guide designed for quick and exacting adjustments to a router fence. By making edge operations easier, it extends a router's versatility.

cut and measurement, and move the dial to adjust the fence as needed.

I especially liked using Micro-Fence for setting up 2-pass dados. This is essential to match undersize plywood-thickness dimensions. A turn of the large knurled knob readily adjusts the leadscrew to the desired position (Photo 1).

The easily fine-tuned fence makes it a simple task to cut precisely spaced grooves, an operation known as veining (Photo 2). Without this feature, veining is much more time consuming.

Micro-Fence can be used with many router makes and models, and you must state your make and model of router when ordering it. The manufacturer also offers subbases that allow it to be used with laminate trimmers.

The basic package includes the interface mounting bar to fit your router and a 1/2-in.-wide hard maple sec-

ondary fence. This low-profile fence is advantageous because it allows you to clear 3/4-in.-thick material that is resting directly on the benchtop.

A Micro-Fence complete package expands the versatility of the accessory. It includes the basic fence with the addition of half-round inserts that are screwed to the fence for routing parallel to a curved edge (Photo 3). Also included in the complete package is a deep-profile secondary fence. Its extra width provides a greater contact surface. This is essential for pivoting a nonplunge router into the workpiece when cutting pocket mortises or blind dados. Finally, the complete package includes a pair of 12-in.-long guide shafts that provide additional reach.

The basic package is about \$98 and the complete package, \$125. Contact Micro-Fence, 11100 Cumpston St. No. 35, North Hollywood, CA 91601. **FM**



1 The fence excels at guiding groove cuts to fit plywood parts. These parts are often thinner than their nominal dimension.



2 The Micro-Fence guide is a boon for cutting accurately spaced grooves, and its low-profile fence helps on thin stock.



3 To do routing along curved edges, use the half-round plastic inserts. These are attached with screws to the main fence.

Homeowners Clinic

BY NORMAN BECKER, P.E.,
Contributing Editor

Storm Window Condensation

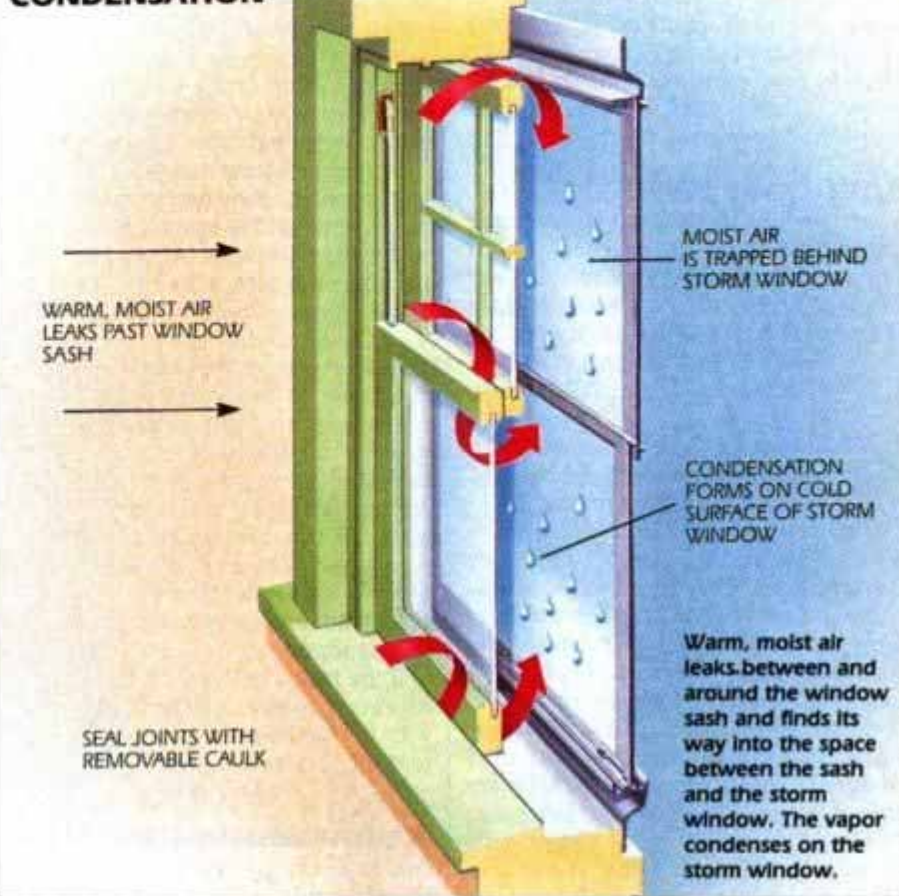
My house had wood double-hung windows and wood storm windows. Recently, we decided to do some remodeling. We kept the wood double-hung windows, but changed the wood storm windows. I don't ever remember seeing condensation on my wood storm windows, but I see condensation on the inside (near the bottom) of the majority of my new aluminum storm windows. What can I do to prevent this from happening?

M. KRISKY
PARIS, TN

The condensation problem is not caused by the aluminum storm windows, but is rather the result of loose joints around the primary windows. In all probability, the wood storm windows that you replaced also had loose joints. Consequently, the warm, moist air that leaked through the primary window joints also leaked through the storm window joints to the outside.

It will be very difficult to completely prevent condensation, but you can reduce it by using a removable caulk or weather seal around the inside of the windows and by installing weatherstripping. For instance, Polyseamseal makes an unobtrusive clear plastic weather seal

STORM WINDOW CONDENSATION



that sticks like tape to the inside window surface (for a complete explanation of this product, see "Peel And Stick" on page 102). A roll of the weather seal costs about \$5 at hardware stores and home centers. Contact the Darworth Co. at (800) 624-7767.

Any caulk or weather seal will render the window temporarily inoperable, and you may want to con-

sider whether this is more desirable than having foggy storm windows.

Also, keep the weep holes at the bottom of the storm window frame clean to allow any moisture that enters the area to escape.

Floor Covering, Before Or After?

Please settle a repeated difference of opinion. When someone's rooms need new carpets or tile, is it better to put down floor covering before or after you paint walls and ceiling? Some floor-covering people say put down new covering and then paint. I don't agree. Who wants dirt on new floors? What do you say?

S.J. KARP
PEMBROKE PINES, FL

There is no definitive answer. It is purely one of opinion, and the quality of care and workmanship on the part of the painter and installer. If the painter and carpet/tile installer are meticulous workers, then it doesn't matter whether the rooms are painted first or the floors covered first. If the workers are not careful in attending to details, then in my opinion, the rooms should be paint-

Free Torch Pamphlet

● The average homeowner's experience with torches is limited to soldering copper pipe. But a torch is a far more versatile thing than a gas-fired plumbing tool, and that's where this free Bernzomatic pamphlet comes in handy. It is a one-stop reference for soldering electrical and plumbing connections, brazing, welding, thawing frozen pipes, heating and bending metal and stripping paint. The pamphlet folds out to 24 panels, with each torch opera-

tion accompanied by at least one illustration and text that explains the basic procedure. Also included is an equipment list that tells you which Bernzomatic torch kit to use, the correct kind of eye protection to wear and what other accessories are needed, such as the type of brazing rod or welding rod required. The pamphlet concludes with a glossary that explains basic metalworking terms. The pamphlet is no substitute for a vocational course on metalworking, but for homeowners who are faced with small metalworking jobs, it's a good place to start.

The pamphlet is often available at hardware stores and home centers where Bernzomatic products are sold, or you can get one by writing the company. Write to: Bernzomatic, 1 Bernzomatic Dr., Medina, NY 14103. —Roy Berendsohn

How To Use
BERNZOMATIC
Torches

Soldering
Brazing
Welding
Cutting
Paint Stripping
General
Purposes

ed first and then the floors covered. My only concern is the scuffing of the baseboard when the carpet is being stretched. However, it is easier to touch up or paint a scuffed area than to remove paint spatter from a carpet. If any readers have another opinion, let me know.

Split Door Panel

I am writing to find out if you have anything in your bag of tricks for fixing split exterior door panels. In our block of homes, there are about eight out of 10 that are in this condition.

WILLIAM C. YOUNG
BALTIMORE, MD

If the homes on your street are relatively new, the doors may be covered by the manufacturer's warranty.

The type of door that you are referring to is a stile-and-rail design consisting of vertical and horizontal sections separated by panels. Cracked panels are typical problems for solid wood doors, as opposed to veneer-covered particle-board doors.

The culprits that cause the door panels to crack are sunlight and moisture, both of which can be reduced with a long roof overhang.

Wood shrinks as it dries and it swells as it absorbs moisture. Changes in moisture content cause dimensional changes, splitting, cracking and glue-line failures, especially if the wooden panel is wide, thin and restrained.

It's important to reduce the amount of moisture absorbed by the exterior door to minimize the potential for panel cracking. This can be done by sealing and finishing the door, with either an exterior enamel or spar varnish. Apply the finish not only on the front, back and side edges, but also on the top and bottom. The finish must be maintained and the door periodically refinished.

In order to further minimize moisture absorption, one door manufacturer mentioned that you

Skillet Maintenance

● Keeping your electric skillet in good working order is easy. The only thing that you have to watch for is grease getting on and around the terminal pins. Once this happens, the grease gets into the controls and gums them up. Not only will this make the skillet perform poorly, it also can create a fire hazard.

Better appliance makers, Farberware and WestBend among them, design their appliances so they can be maintained—the covers that protect the terminals are removable, so the terminals can be cleaned. The temperature control, however, is not repairable and should not be tampered with. If you notice a discrepancy between the temperature control setting and how the skillet cooks, contact a small-appliance repair shop or the manufacturer about replacing the control.

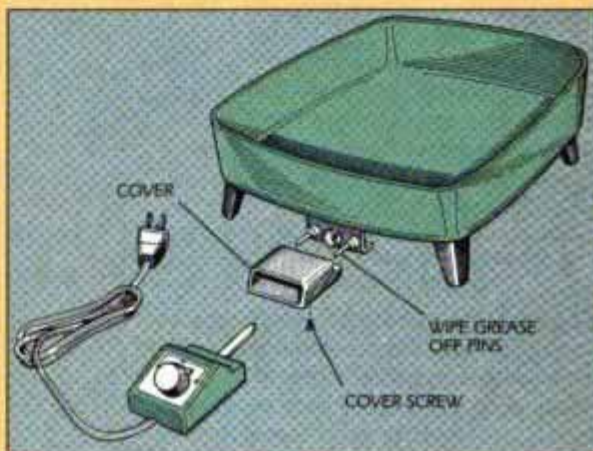
To keep your skillet in good working order, tip it over and remove the small screw or screws that hold the cover to the terminal pin assembly. Wipe the grease off the terminal pins and the temperature control pin using a clean cloth. If the grease has hardened, remove it by gently scrubbing with steel wool or wiping it with fine sandpaper.

If the inside of the skillet is very greasy, clean it with a grease-cutting detergent or cleaner.

—Sterling Frey



APPLIANCE CARE TIP



can seal the perimeter joints of the door panels with a small bead of silicone caulk.

There is not much you can do other than use a wood filler to cover the crack and then refinish the door.

Sump Pit Bottom

My basement has a sump pit with concrete sides and a sand bottom. In other words, the bottom is not lined with concrete or other material. When it rains, the water table rises, and my sump pump runs for four or five days straight. Would I have a problem if I closed the bottom of the sump pit?

RON GREENHALGH
TITUSVILLE, FL

Yes, you would have a problem. Your sump pit is working as it

should. That is, it's designed so that the bottom allows the entry of subsurface water. If the bottom of the sump pit is sealed, then as the water table rises, the water will press against the underside of the basement floor slab and seep through the cracks and open joints that often exist in basements.

On the other hand, if there are no cracks or open joints, depending on the level of the water table, the pressure the water exerts on the slab (known as hydrostatic buildup) could cause the concrete basement floor slab to crack and heave.

With your system, by pumping out the water that builds up in the sump pit, you are controlling the level of the water table so that it doesn't rise to a point where it will press on the underside of the floor slab, thereby eliminating the problem of water seepage through the cracks into the basement.

If the sump pit keeps the basement dry, our advice would be not to modify it.

FM

BUZZWORD

● If you are considering a new combustion appliance of some sort, such as a furnace, boiler or water heater, then you may run into the term "direct vent." This can sound confusing at first because the idea of venting anything, after all, is to vent it directly somewhere, usually outside. Well, some vents are more direct than

Direct Vent

others. In this case, some high-fuel-efficiency combustion appliances don't have to be vented up a chimney. The amount of exhaust gas that they produce is so small, and relatively cool (compared to older appliances), that they can be vented directly through an outside wall using plastic or metal pipe.

—R.B.

DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?

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

**HOME
IMPROVEMENT**

Refrigerator Maintenance

BY STEVE TOTH,
Contributing Editor
PM Illustrations by
George Retseck

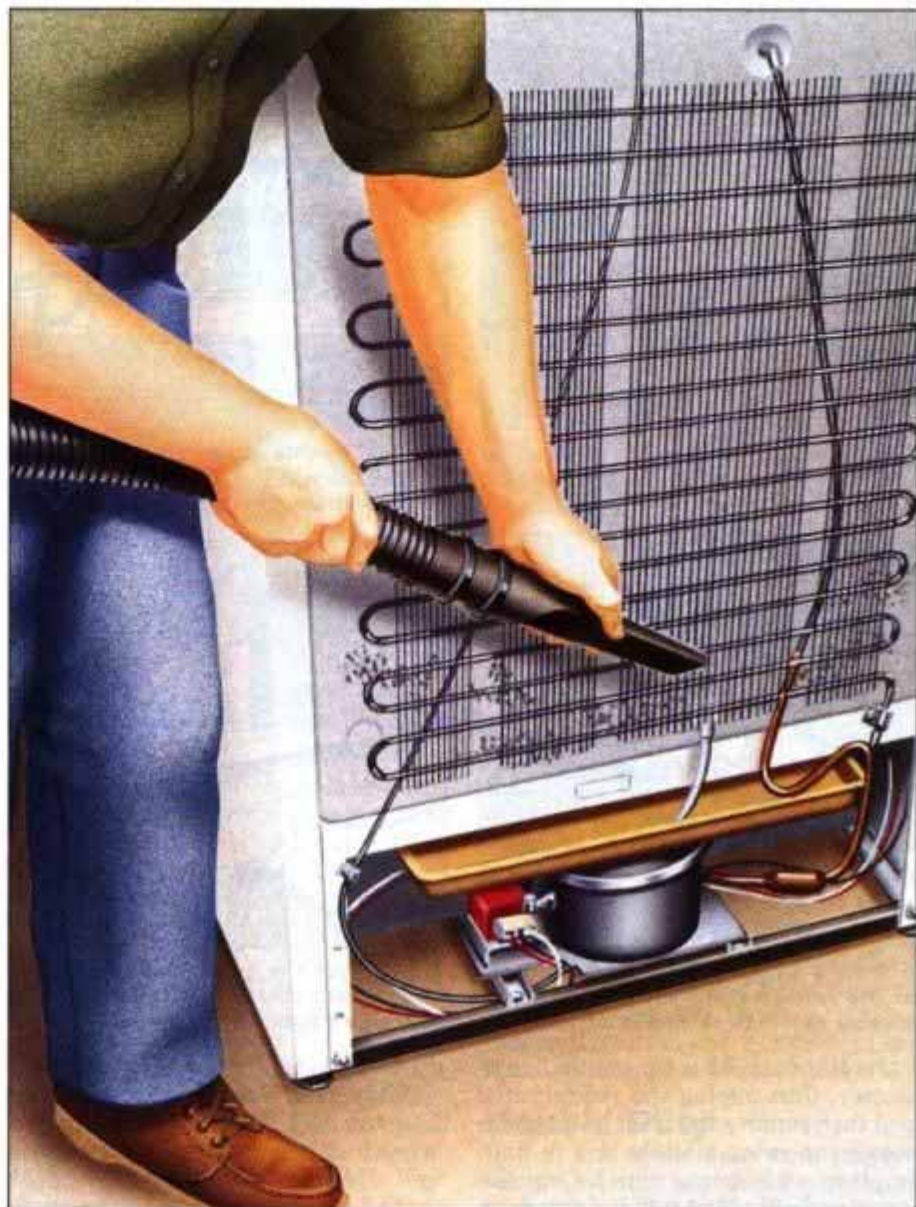
● The condenser is an important part of your refrigerator's sealed refrigerant system, and it is the only part that needs maintenance. Fortunately, all that's required is to clean the condenser's coils by vacuuming off the dust that accumulates on them. You should do this every three months or so.

Here's why it's important to keep the condenser coils clean: The condenser cools hot refrigerant vapors inside its tubes. If the condenser coils are dust covered, they cannot expel this heat efficiently. The dust acts as insulation and prevents the heat from escaping. In turn, the temperature inside the refrigerator compartment is higher than it would be if the condenser coils were clean.

This increase in temperature also causes the compressor to cycle refrigerant through the cooling system more frequently than it otherwise would. Not only does this increase the amount of energy the compressor uses, but the additional waste heat given off by the compressor further reduces the refrigerator's efficiency.

Efficient cooling, therefore, is the ability to pump heat out of the refrigerator using as little energy as possible and creating minimal waste heat.

Looked at another way, a little dust

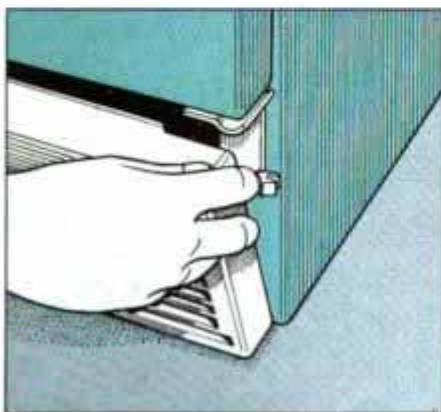


on your refrigerator can cost you a lot of money on your utility bill.

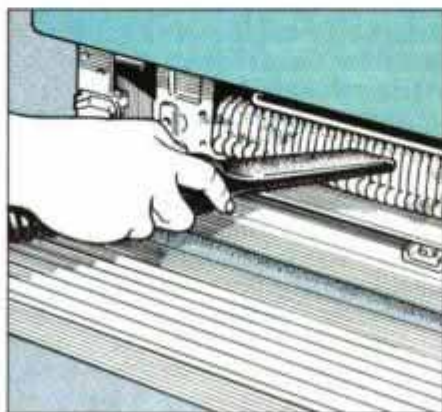
Condenser coil location

The first step in the maintenance process is to determine what kind of con-

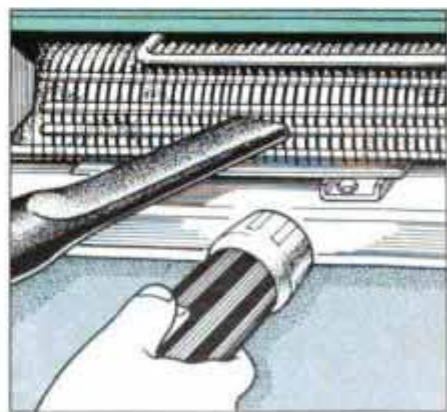
denser your refrigerator has. It either has a static condenser mounted on its back, or it has a fan-cooled condenser mounted underneath the compressor compartment. The fan blows air across the condenser to cool it.



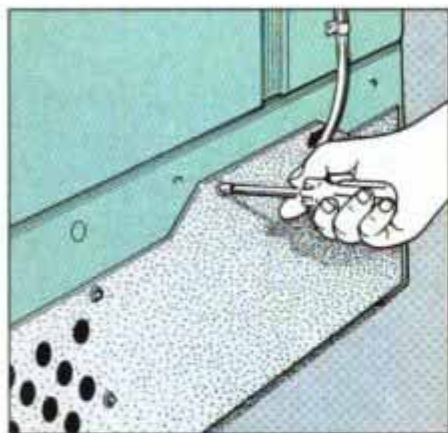
1 To remove a refrigerator's lower grille cover, grab the cover on both ends and pivot it down and forward.



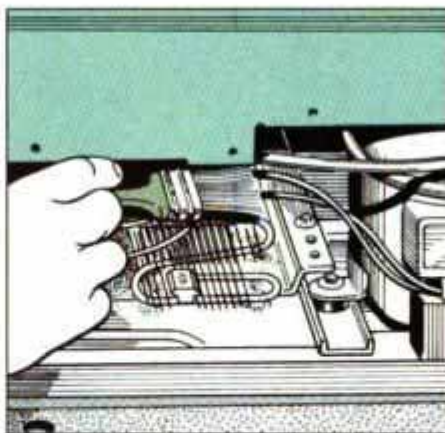
2 Vacuum off dust from the condenser coils and condenser coil fins. A crevice tool attachment on a vacuum works best.



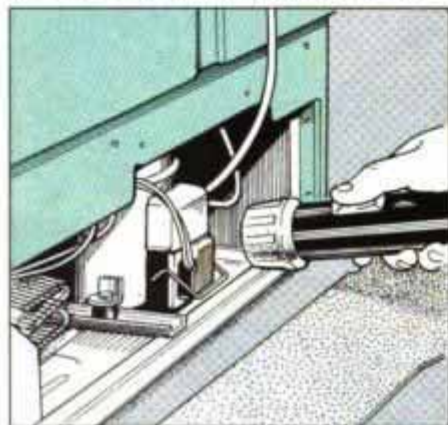
3 Shine a flashlight through the condenser coils and fins to find remaining dust. Continue vacuuming until the parts are clean.



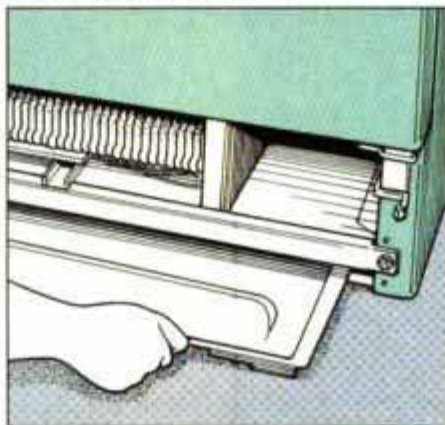
4 Using a nut driver, remove the hexhead sheetmetal screws that fasten the rear access panel to the refrigerator cabinet.



5 Use a paintbrush to dislodge dust in hard-to-reach areas. Follow this by vacuuming with the crevice tool.



6 Shine a flashlight through to the front of the refrigerator. All of the interior surfaces should be clean and dust free.



7 Slide out the condenser drain pan. Clean it with mild soapy water, dry it and then slide it back under the refrigerator.

In the case of a fan-cooled condenser, first unplug the refrigerator and then remove the front lower grille cover (on most models this is held in place with spring clips). Grip the cover on both sides, pull it down from the top, then lift it off (Fig. 1).

There is often a small tag on the cover's top edge that states how often the condenser should be cleaned or inspected (usually every three months).

Clean the condenser using the crevice tool attachment on your vacuum (Fig. 2). After vacuuming, check that the condenser is clean by shining a flashlight through its coils (Fig. 3). Incidentally, the flashlight should have fresh batteries in it so it throws a nice, sharp beam. Shining a dim flashlight under the refrigerator won't do you any good. If the flashlight is dim, and you don't have spare batteries, you can also use a drop light to check inside the appliance, though it is less convenient than a flashlight.

Next, go to the refrigerator's back and remove the rear access panel by backing out the hexhead sheetmetal screws that hold the panel to the refrigerator body (Fig. 4). Use a nut

driver to do this or a small socket on a cordless drill. Vacuum the coils clean from the back. If need be, use a paintbrush to dislodge dust that the crevice tool did not pull out or that was pushed toward the back of the appliance (Fig. 5). Check with a flashlight to make sure it's clean (Fig. 6).

The process is nearly the same in cleaning a static condenser. You vacuum it and brush it clean. However, you should check that there aren't any papers or pens stuck between the condenser coils and the refrigerator cabinet. Often these slide off the top of the refrigerator and fall behind it.

Next, pull out the condenser drain pan and wash it with mild soap and water. Dry it thoroughly and slide it back in place (Fig. 7).

Finally, plug the refrigerator back in, and clean the floor behind it before pushing it back into place. Leave enough space behind the refrigerator to allow air circulation (this is especially important with static condenser models). If you're not sure how much space to leave, look in the owner's manual, or contact a servicing appliance dealer or the manufacturer. **FM**

PRODUCT TEST

Condenser
Coil
Cleaning
Tools



● We think the best way to remove dust in and around a refrigerator is to do it quickly and without scattering tufts of gray stuff everywhere. Here are two professional-quality cleaning products that can help. Fortunately, you don't have to go to a janitorial supply house to buy them because they are sold at home centers.

The long-handled dust mops are called Super Dusters (about \$6.50). They consist of a washable split-head dust mop that slides over a plastic handle that looks like a tuning fork. Condition the cotton-poly mop with Pro Dust (about \$6), a water-based material that increases the yarn's dust-holding capability. Just mist the mop head and set the tool aside for 30 minutes, so the conditioner can dry.

We treated a Super Duster as described then used it under, in and behind a refrigerator with coils that had not been cleaned in six years. Our verdict: The Super Duster is super. It grabs dust by the handful. While it won't replace a shop vacuum with crevice tool, it complements it nicely. Its split-head design allows it to wipe off dust from pipes, and its narrow profile allows it to slide into tight spaces. Write HMP, P.O. Box 16653, Atlanta, GA 30321, or call (800) 848-1172.

—Roy Berendsohn



NEW PRODUCTS

Home Again

Building blocks for a better home.

BY ROY BERENDSOHN, Assistant Home Improvement Editor



Stay Warm

Owens-Corning has developed a new glass fiber called Miraflex that could make your next insulation job a lot easier. It's a twisted, spring-like glass fiber that makes for a more compact roll and one that is 40% lighter in weight than existing fiberglass insulation. Best of all, it delivers a near-equal R-value, and costs about the same as the company's existing PinkPlus insulation. A 25-ft.-long roll of Miraflex, with an R-23 rating, costs about \$11 to \$14. A roll of the new product has a diameter of 14 in. (compared to 27 in. for a standard fiberglass roll). Owens-Corning says it will reduce the roll diameter to about 9½ in. by the end of this year. To understand how Miraflex works, you should know that fiberglass insulation works like goose down: In it are thousands of tiny insulating air pockets. Miraflex accomplishes the weight saving because its shape reduces the amount of fiber needed to form these air pockets. Thus, it creates more air pockets per unit of volume. Once unrolled, the material lofts up to full thickness. Miraflex is sold at home centers and lumberyards. Write Owens-Corning, Fiberglas Tower, Toledo, OH 43659.

Anywhere, Any Time

The manufacturer of this gas fireplace says it can be installed anywhere there is an exterior wall. Its secret is that it vents directly outside through a short length of 8½-in.-dia. aluminum pipe that also supplies air for combustion. All that's necessary to install the appliance is to cut a hole in the wall and build a



small protective box around the pipe. There is no need to build a masonry chimney or install a steel flue. Furthermore, the appliance's insulated housing stays cool enough to allow it to sit right on the floor, not a masonry base. The fireplace comes in several sizes. The 6000 Supreme model shown costs about \$1200, and professional installation costs about another \$600. Contact Heat-N-Glo, 6665 W. Hwy. 13, Savage, MN 55378; (800) 669-4328.



Problem Solver

The new Reliant Plus series of faucets takes on three plumbing problems: lead, drips and too-high a water temperature. First, its waterways are lead free. Next, it has a ceramic disc valve that prevents drips, says its manufacturer, which backs up the claim with a drip-free-for-life guarantee. Finally, it has an adjustable hot-limit safety stop to reduce the chance of your being scalded. It's available in brass, chrome or white for about \$137. The Reliant series is sold at plumbing supply houses and home centers. Write American Standard Faucets, P.O. Box 6820, 1 Centennial Plaza, Piscataway, NJ 08855.

Double Duty

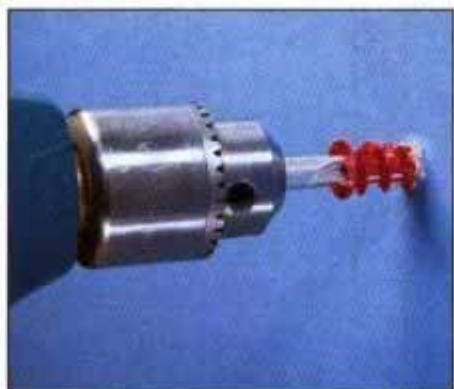
Before you tackle your next project, you might consider these containers—they have handy features such as lids that can be inverted to serve as work surfaces. The lids also have wells for tool and hardware storage, molded-in information regarding screw sizes, and rulers in inch and metric measurements. The containers come in 16-, 22- and 27-gallon sizes, and cost from \$20 to \$30 at hardware stores and home centers. Write Rubbermaid Inc., 1147 Akron Rd., Wooster, OH 44691.



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Radio Station

Usually it takes an electrician or a well-experienced homeowner to install a 3-way light switch, but this radio wave 3-way switch kit can be installed by any handy person, its manufacturer says. The device is wireless. First, replace an existing wall switch with the 3-way receiver. Next, place the transmitter switch on any wall within a 50-ft. radius. Radio waves sent between the receiver and the transmitter take the place of a standard 3-way switch circuit. You can add three more wireless switches to the circuit. The kit costs \$35 at hardware stores and home centers. Write Lamson Home Products, 27501 Science Park Dr., Cleveland, OH 44122.



Hanging On Air

Here are two handy anchors to use when fastening to hollow surfaces. The large red anchors are used to fasten to drywall, and they come packaged with a drill/driver bit. Use the bit to bore the hole in the drywall, then to drive the anchor and finally to drive a Phillips screw into the anchor. The green anchors are designed specifically for wood hollow-core doors. Bore a hole in the door, insert the fastener, then drive a screw into the fastener. As the screw threads into the anchor, its plastic wings spread out, locking the anchor to the door. A 25-pack of drywall anchors costs about \$7 and a 10-pack of hollow-core door fasteners, \$1. They're sold at hardware stores and home centers. Write Plasplugs, 780 Vassar Ave., Lakewood, NJ 08701.



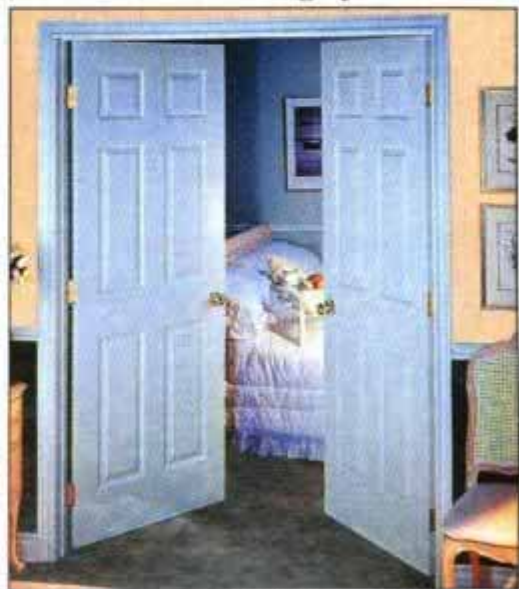
Open New Doors

If you're tired of hollow-core doors, but solid wood doors are out of your price range, then maybe these doors are the answer. Their core is a solid slab molded from wood fibers and resin, and they're available in a range of sizes and designs, all of which are preprimed (simulated oak and mahogany veneer doors that can be stained are also available). A 6-ft. 8-in.-high x 2-ft. 8-in.-wide door in the 6-panel design shown costs about \$75 at home centers and lumberyards. Write Premdoor, Marketing Manager, 4120 Yonge St., Suite 402, Willowdale, Ontario, M2P 2B8, Canada, or call (800) 666-3667.



Peel And Stick

You can install this sealant around a window when the cold drafts start leaking in, and remove it when the weather turns warm. Unroll a piece of the 3/8-in.-wide material, cut it to length and press it in place. Its manufacturer says it will not change color or become brittle. A 20-ft. roll costs about \$5 at hardware stores and home centers. Write Darworth Co., 3 Mill Pond Ln., P.O. Box 639, Simsbury, CT 06070, or call (800) 624-7767.



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Downright Alarming

This lock takes home security a step further—it has a built-in 130-decibel alarm that is triggered if someone tries to break in through the door. The alarm and its red warning light are powered by a 9-volt battery, which provides enough power for one year of operation. The point at which the alarm is triggered is adjustable by a dial in the battery compartment, so that the alarm won't be set off by accident. Also, the lock sounds a tone (not an alarm) any time the door is opened.



The Alert Lock costs about \$250 to \$300. A retrofit bolt with alarm is available without the knob and escutcheon. It costs \$150. Write Pease Industries, 7100 Dixie Hwy., Fairfield, OH 45014, or call (800) 883-6677.

Extension Service

You can extend the convenience of your Stanley (or other make) garage door opener with this device. It allows you to open the garage door with a flash of your car's high beams. The device wires into your car's headlight circuitry, and it comes with step-by-step instructions. Stanley says the 5-step installation is simple enough that any handy person can handle the job. Called the AutoTrans, the device works with

any garage door opener manufactured after April 1982. It costs about \$70. Another kit to make the device work with just Stanley openers costs about \$50. The kits are sold at hardware stores and home centers. Installation instructions are provided with both kits. For more information, write Stanley Door Systems, 1225 E. Maple Ave., Troy, MI 48084, or call (800) 521-5262.



Look Up

If you've got a remodeling job planned, include this ceiling system in your search. It's a wood grid system that hangs from the joists like a standard suspended ceiling grid, and it can use translucent or acoustical tiles. Each piece of the grid has a contoured face, and the tiles sit in a rabbet on the back of the interlocking grid pieces. The grid is available in oak, simulated wood-grain and simulated marble. An oak grid for a 12-ft. x 12-ft. room costs about \$220 at home centers. To locate a distributor, contact Neff Suspended Ceilings, 331 St. Joe Rd., Chicora, PA 16025, or call (800) 551-1046.

Tuxedo Junction

Congoleum's latest addition to its Intrigue line of do-it-yourself vinyl tile is Tuxedo, a 12-in.-square tile that has a traditional look but uses modern materials. For instance, its top surface, called the wear layer, is baked-on urethane. The peel-and-stick product is available in two color patterns, white and marble. It's sold 30 to a carton, but you can buy the tiles individually. They cost about \$2 apiece at flooring showrooms and home centers. Write Congoleum, 3705 Quakerbridge Rd., P.O. Box 3127, Mercerville, NJ 08619.





Keep It Simple

Sterling's Neo-Angle shower stall is designed with homeowner installation in mind. The kit includes the following: 3-piece shower wall, base and door, plus the hardware necessary to install the parts. You don't have to wrestle with a one-piece shower enclosure; instead, just slide the pieces out of the box, and carry them through the bathroom door one at a time. A 38-in. shower enclosure costs about \$700. If you decide to do some plumbing in the kitchen as well, you might consider the company's Waterstone kitchen sinks constructed out of a solid-color high-gloss plastic composite. The company says they will not chip or peel and are less likely to break a piece of fine china or crystal should you drop it in the sink. The sinks cost about \$335. Both products are sold at home centers. Write Sterling Plumbing Group Inc., 2900 Golf Rd., Rolling Meadows, IL 60008.

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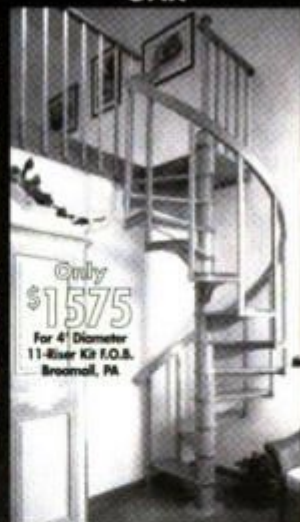
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PM HOTLINES

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Unfortunately, our Hotline Phone Service is temporarily discontinued.

HOME&SHOP JOURNAL

No Slouching

Hunter Fan Co. says you don't have to slouch when near this fan for fear of getting a closely cropped haircut—it's designed for ceilings as low as 7½ ft. The company accommodates lower ceilings by mounting the blades in the center of



the housing, not below the motor, giving the fan an additional 2 in. of height from floor level. Shown is the 52-in.-dia. model called Dimensions. It costs about \$200 at Hunter Fan dealers. Write to Hunter Fan Co., P.O. Box 3900, Peoria, IL 61612, or call (800) 252-2112.



Just Right

If you have electric baseboard heat and can never seem to get the temperature right where you want it, the Honeywell CT62 thermostat may solve your problem. The company says the device is accurate to plus or minus 1° F. The thermostat costs about \$25 at hardware stores and home centers. It's in limited distribution now, but will be available nationally in the fall. Contact Honeywell Inc., Honeywell Plaza, P.O. Box 524, Minneapolis, MN 55440.

Thoughts Of Spring

While winter winds moan outside your window, you might think about the landscaping and paving projects you have planned for spring. Quikrete has two concrete products that might interest you. One is a liquid color for concrete and the other is a mold that makes concrete look like brick. Here's how to combine the two: Mix one 10-ounce bottle of red, brown, buff or charcoal color with two



80- or 60-pound bags of concrete and pour it into the 2-ft. x 2-ft. form. Remove the form and pour another section. Sweep Quikrete Sand Mix into the joints between the bricks after the concrete has cured, and mist over the slab with a garden hose. A bottle of the color costs about \$4, and the form costs about \$30. Both are sold at home centers and lumberyards. Write Quikrete, 1790 Century Circle, Atlanta, GA 30345, or call (800) 282-5828. **FM**



CAR CARE

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

Getting The Brushoff

I sent my wife over to the tire store, with specific instructions and a phone quote from the store. She came back with four new tires and a bill substantially larger than the quote. After the shouting died down, I called back the tire store from the office the next day, and they assured me the bill was correct. Among the other charges, they wanted \$10 per wheel to paint the rims. This for a car with full-coverage wheel covers. Imagine my ire when I removed a wheel cover to see dirty black original paint. Now the manager of the tire store won't talk to me on the phone at all, and neither will my wife.

JOHN HARCOURT
BOISE, ID

Calm down, John. It's not uncommon for a steel rim to rust in the bead seat surface, out of sight. The rust can even start a leak as it works its way down into the crevice between the tire bead and the rim. The solution is simple: wirebrush the rust and all of the old paint off the rim—right down to bare metal. Follow that up with some antirust paint. Needless to say, if there's a lot of corrosion on the rim when the tire is broken down, it should be painted before mounting a new tire. That's undoubtedly what the tire dealer charged you for.

If you think you've been charged for something that wasn't done, look for fresh paint on the rim at the bead. Of course, there's no way to tell if the rim really was rusty—now.

If they were my rims, I'd use a zinc-based primer and some epoxy enamel on this area, but that would call for having the tire demounted, waiting 48 hours while the two layers of paint each got a full day to dry and then remounting the tire. It almost makes sense to get another rim, and take it and the spare down to the tire dealer to swap tires in pairs while you do this.



Bump And Then Grind

Several years ago my wife read that it was better to approach a bump—like a speed bump or a railroad crossing—at an angle, effectively allowing each wheel to cross the bump separately. What say you?

DAVID BERRY
FOREST, VA

Yes and no. At lower speeds, yes. This will lessen the jostling to the occupants. I don't think it will have much effect on the car's suspension either way.

But say we're cruising through the Dog & Suds parking lot at, oh,

60 or so and see a speed bump. I'd rather hit it straight on. Why? If you're going to bottom out the suspension, the damage to your wheel rims, suspension components and orthodonture will be the same whether you hit it straight on or at an angle—it's a function of the height of the bump and your terminal velocity. But if you hit it at an angle, you'll be trying to bend the structure of your car diagonally. That's the weakest dimension of your chassis, and enough pounding might loosen up important stuff, or at least cause a few squeaks and rattles.

The suggestion your wife read

CAR CARE

might be more appropriate for cars of a generation or more ago. They had separate frames and bodies, and consequently were substantially less rigid in torsion. Only a few cars are still made with this technology.

Barking Up The Wrong Tree

My new Jaguar has an extra set of throttle plates in the intake runners, apparently to reduce power below 3000 rpm. How can I reprogram the computer or disconnect them to regain this lost horsepower?

TED CHERNIN
HONOLULU, HI

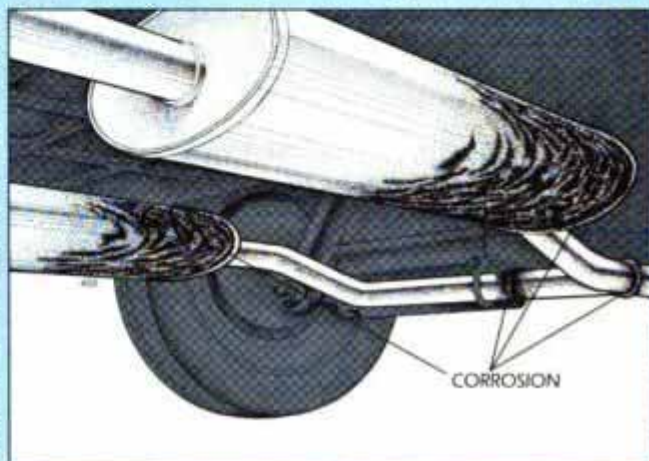
You've got it backward, Ted. Those auxiliary throttle butterflies don't artificially reduce power. They do block off one of two intake passages at lower rpms—when the engine has more air than it really can use. The intent is to raise the velocity of air moving through the intake, promoting swirl in the combustion chamber and—surprise—improving low-end power.

A number of multivalve engines from various auto manufacturers—including Lexus and Mercedes-

Rust Never Sleeps

● I was standing around one afternoon in a dealership garage that happens to be managed by a friend of mine. A customer, an elderly man, had brought his new luxury car in for its initial service, with only a few hundred miles on the odo. As the car went up on the lift, the customer immediately turned bright red. He started shouting that he'd been gypped. He had gotten his first look at his corrosion-resistant exhaust system and saw plenty of red rust speckles on the muffler and pipes. And he had bought this car over another specifically because of the fact that he'd never have to buy another exhaust system.

We did manage to calm him down. Many exhaust systems nowadays are made of steel that can withstand the terrific heat of catalytic-converter-equipped cars. But even though the corrosion-resistant steels are probably good for the life of the vehicle, they won't stay as shiny as a stainless soup-spoon. Surface discoloration, especially near the welded seams, is normal.



TECHNOLOGY UPDATE

The first alarm system designed to protect you and your car...

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

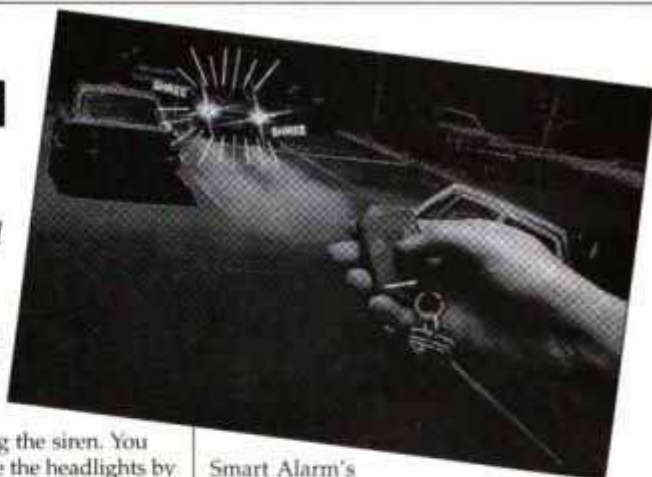
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- **Car finder.** Locate your car by flashing its lights and briefly sounding the siren.



CAR CARE

Benz—use this technique to fatten up the torque curve in the low-rpm range, not just Jaguar.

Cough Syrup

For some time now, my 1985 Buick Century has been stalling when it's cold. It starts normally, runs for 15 to 20 seconds, then stalls. It will do this six or seven times before the engine will stay running. It also has a flat spot under acceleration even when it's warm, and it occasionally coughs (backfires) through the throttle.

We've replaced a lot of fuel-injection parts, and everything seems fine. I think the computer is not going into open loop to provide for a cold start.

RICHARD KRAMER
MANDEVILLE, LA

I shortened your lengthy letter—but you certainly have been thorough in troubleshooting this most annoying problem.

FI computers always start in open loop. They don't go into closed loop (their normal mode) until after the engine warms up and a number of other parameters have been satisfied. So that's not your problem.

My guess is simply carboned-up

valves. Thick, crunchy deposits of coke on the back of the intake valves and in the ports will soak up a lot of fuel when the engine is cold—making the engine run lean. Eventually they saturate with fuel and then warm up above the boiling point of gasoline, so the lean stalling and backfiring go away.

Try several cans of Chevron fuel-injector cleaner, which seems to be the best. Stick with that for several tankfuls of gas to see if the problem improves. If not, you may have to pull the intake manifold in order to get a peek into the ports and scrape the carbon off manually, or at least to confirm my diagnosis.

I've seen a way to blast the carbon loose with a portable sandblasting unit filled with—get this—ground walnut shells. Effective, but messy, very messy.

You may ultimately wind up removing the cylinder heads to remove the carbon.

FM

DO YOU HAVE A CAR PROBLEM?

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

SERVICE TIPS

● GM has a new oil filter with an enhanced anti-drainback valve for most of its light trucks. The superior oil retention of this filter may help some vehicles with a short-duration knocking sound on cold startup.

● If your GM truck's PCV valve is freezing up in extremely cold (colder than -22°F) weather, it might cause oil leaks from the rear main seal or the dipstick tube. There's a special cold-weather valve to cure this. And it's covered under the warranty, according to the TSB.

● Oil seepage around the camshaft position sensor on your Dodge or Plymouth Neon can probably be cured by replacing the cam position sensor seal with a new seal, PN 4667745.

● Dodge Ram pickup trucks may have a cup holder that rattles when it's closed. To fix, simply install a small, self-adhesive foam block, PN 55115758, on the rear right quarter of the cup holder. To gain access, first remove two screws from the cup holder to remove it from the dashboard.

FROM FRONT...



SATURN
MAT SHOWN

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BLACK WITH
A RED PINSTRIPE

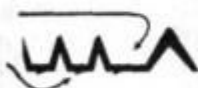
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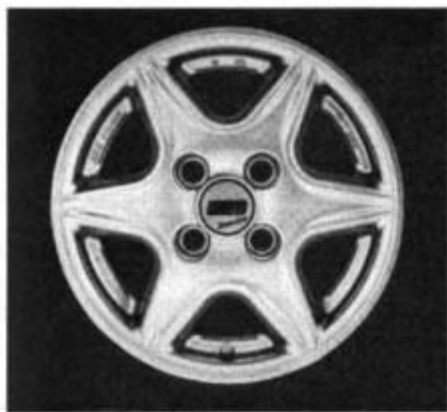
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Hose Clamp

A hose clamp is one of those low-tech devices that is expected to go about its job quietly and efficiently, because you have more important things to worry about. Occasionally, vibration will cause the locking screw to back out, causing the clamp to relax its grip, and making you the star of that roadside sideshow known as "coolant loss boilover." Another recipe for disaster is to see how much you can tighten the clamp. The Pintite SS solves these problems with a worm-gear clamping action that is pinned in place after tightening to prevent the screw from backing out and loosening. Since it stays tight, you're not tempted to overtighten it. The stainless-steel hose clamps cost \$3.49 for a 2-in. radiator neck size from The Hook Appropriate Technology Inc., c/o HWCW Corp., 250 Newport Ave., Rumford, RI 02916; (800) 460-4205.



Sensor Tester

So, you like the way your new car drives, but you get sweaty palms and an unsettled stomach at just the thought of popping the hood and wrenching on all that high-tech hardware in the engine bay? Not to worry. The truth is that the basic engine hasn't changed that much over the years. Pistons still go up and down, valves still open and close and spark plugs still spark. The big difference is that engine functions are monitored and controlled by a computer that gets its input information from various sensors. A bad sensor or a faulty ignition module can cause engine problems that may be difficult to solve—unless you can troubleshoot the sensors and the module. That in itself is not a problem, either. For about \$40, the Sensor Tester Plus, and the comprehensive instruction manual that comes with it, will walk you through seemingly complex problems by troubleshooting engine sensors and the ignition module. Contact: Actron Manufacturing Co., 999 Walford Ave., Cleveland, OH 44102; (216) 651-9200, or fax: (216) 651-2388.



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SATURDAY MECHANIC

REPLACING YOUR STEERING RACK

BY JOHN DECKER

● It's a crisp, clear and nicely cold winter morning. But your car starts right up. So you put the shifter into REVERSE and back out of the driveway—only to panic momentarily when the steering wheel freezes as you try to crank it to the left. So you end up running straight up the curb and into your neighbor's hand-carved

Zebrano-wood mailbox. It takes considerable muscle to turn the wheel in either direction, as your power steering has reverted to manual. A quick check reveals no slipping belt, plenty of fluid in the power-steering pump, and only a few pieces of 3rd-class mail embedded in your bumper.

You manage to pull away, and then,

after a few minutes of driving, the steering wheel limbers up and the power steering magically returns.

A temporary glitch? Not likely. The stiff-steering problem will probably return every cold morning, only to go away again once the power-steering fluid is warm.

The problem, aptly named "morn-



Replacing a steering rack that has lost its boost, or its oil, is a pretty straightforward remove-and-replace task. Aftermarket replacement racks for most cars cost less than \$200.

ILLUSTRATION BY RUSSELL J. VON SAUER

CAR CARE

ing sickness," is caused when hydraulic seals wear grooves in the soft aluminum pinion housing of the power rack-and-pinion steering unit.

When the steering fluid is cold and thick, hydraulic pressure goes up causing the fluid to leak around the seals, which results in a loss of power assist. When the fluid warms up, it gets thinner. Then the pressure goes down, the seals become more compliant and power assist returns.

"It's by far the most common rack-and-pinion problem we see," said Eric Banas of Federal Mogul, a large supplier of rebuilt power rack-and-pinion units. Morning sickness is a particular problem on GM A-body cars, such as the Buick Century, Chevy Celebrity, Oldsmobile Cutlass and Pontiac 6000. Indeed, Banas says that 30% of the rebuilt racks his company sells are bought to solve the morning-sickness problem on these cars.

To keep the problem from recurring, a steel sleeve is inserted into the pinion housing during rebuilding to eliminate the grooves and subsequent problem-causing wear.

How they work

All rack-and-pinion steering gears consist of a toothed rack that mates to a pinion gear. When the driver turns the steering wheel, the pinion gear rotates, which moves the rack to the left or right to steer the car.

Where power-assisted gears differ from their unassisted siblings is that the rack has a piston in its center that seals tightly against the rack housing. The pinion also has a hydraulic valve body that meters hydraulic pressure to the left or right of the rack piston.

When the driver turns the wheel, a small torsion bar in the pinion deflects, allowing fluid to flow through the valve body under pressure into the rack area. During right turns, hydraulic pressure is applied to the left side of the piston, which helps push it (and the rack) to the right. During left turns, the right side of the piston gets the fluid and the rack pushes to the left.

Like most other types of power-steering systems, hydraulic pressure is supplied by an engine-driven power-steering pump.

Why they go bad

Normally, power rack-and-pinion steering gears give years of trouble-free service. But, like the morning-sickness problem on A-body cars, different power racks can have different problems.

For instance, when an engine

loose, dirt and moisture can enter the rack, which causes corrosion and premature seal failure.

Some mechanics also forget to remove the spring clip before adjusting toe, causing the boot to twist when the tie rod is rotated. Before long, the contorted boot splits, allowing water and moisture to enter.

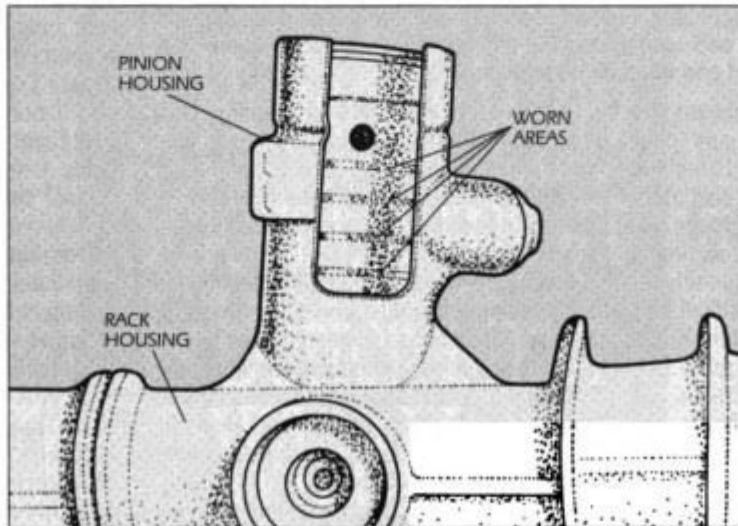
It's also possible for the rack's piston seal to wear. This allows hydraulic fluid to leak into the other side of the rack. Vague, wandering steering, when traveling straightahead, is the result.

If your car requires constant filling of the power-steering pump reservoir, but you don't see any fluid on the ground, check the rack bellows. If the rack's internal seals have failed, the fluid will fill up the bellows, causing them to balloon up. If you remove the spring clip, fluid will pour out.

Of course, steering problems can't always be traced to hydraulic problems in the rack. Before you condemn any rack-and-pinion steering gear, check the hoses and lines for leaks. You should also make sure the pump's drivebelt is tight and that it's not covered with oil or fluid.

Loose or worn rack mounts can also allow the rack housing to shift, which can cause wander and vague steering, as can loose or worn tie-rod ends, ball joints and other suspension components.

The inner tie-rod sockets under the bellows can also wear. You can check both the inner and outer tie-rod ends by doing a "dry park check." To do this, have an assistant turn the steering wheel back and forth while you lie

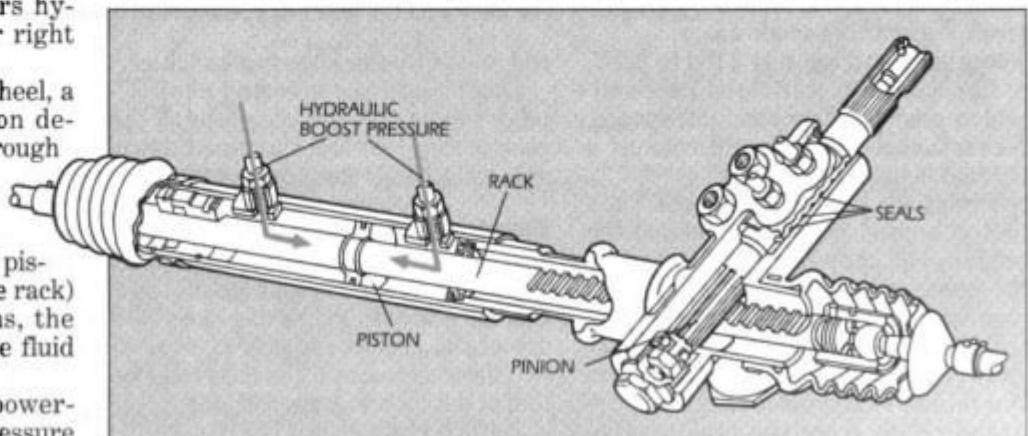


Morning sickness is caused by oil leaking past grooves worn in the aluminum pinion housing from contact with hydraulic seals.

mount breaks on a rear-wheel-drive Ford car, the engine oil pan rests on top of the soft aluminum rack housing. If the engine mount isn't fixed promptly, the oil pan wears a hole in the rack housing causing the loss of hydraulic pressure.

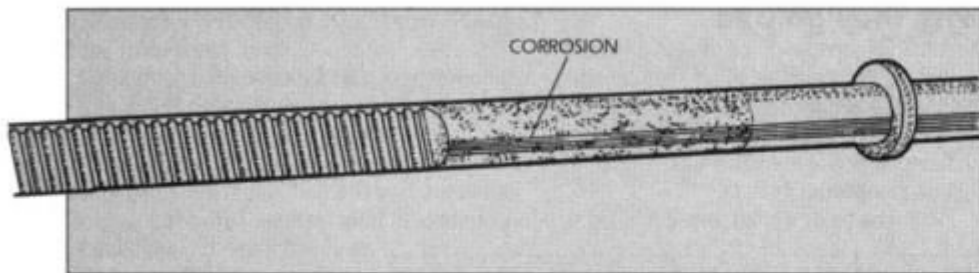
On Chrysler minivans with air conditioning, constant moisture dripping from the a/c evaporator can corrode the rack housing until hydraulic leakage occurs.

Alignment mechanics can also cause premature failure of the rack. The problem occurs when the mechanic forgets to reinstall the spring clip on the end of the rack boot after rotating the tie rods when adjusting toe. When the boot's spring clip is



Hydraulic pressure from the power-steering pump pushes on the rack's center piston to assist steering. Pressure is controlled by the valves surrounding the pinion shaft.

CAR CARE



Moisture and dirt entering past bad seals can cause the rack to corrode. Corrosion will contaminate power-steering fluid and degrade other seals.

under the car with the wheels on the ground. There shouldn't be any play at the outer tie rods or at the rack mounts. On racks that have soft rubber bellows, you can feel the inner tie-rod sockets by pinching the bellows. As your assistant turns the wheel back and forth, you shouldn't feel any play. Many racks have harder plastic bellows, which make it difficult to feel for inner-socket play. If that's the case, remove the bellows from the rack and visually inspect the sockets as the wheel is turned.

You should also check the universal joint on the steering shaft where it attaches to the pinion shaft. A rusty or binding joint can cause stiff steering.

Keep in mind that most GM front-wheel-drive cars have two of these U-joints. One is located inside the passenger compartment, and it should also be checked.

Rack replacement

Once you've confirmed that the rack-and-pinion gear is bad, the only cure is to replace it with a new or rebuilt unit. Like TVs, microwaves and other devices, there are no user-serviceable parts inside.

The good news is that rebuilt racks are available from companies such as Federal Mogul for only \$100 to \$200.

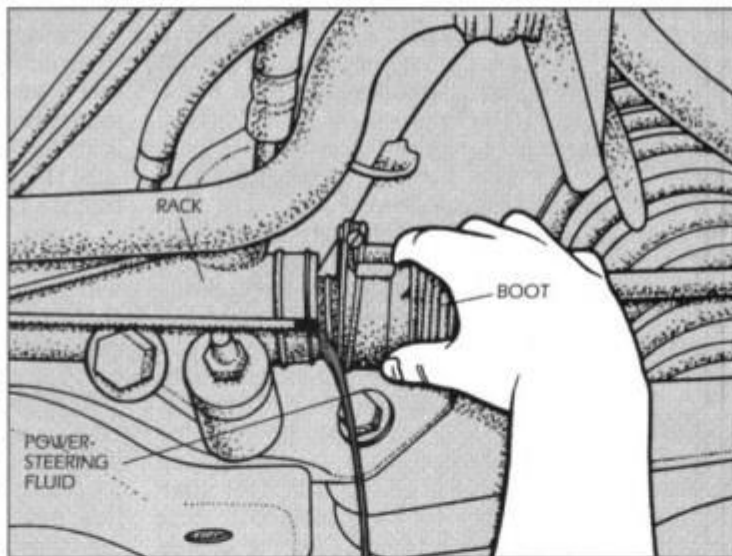
Replacing a power-assist rack-and-pinion gear is fairly straightforward. Nevertheless, you should consult a manual before proceeding.

Depending on whether the rack unit is located in front or behind the engine, you may have to disconnect the exhaust system from the engine manifold and lower the engine cradle. On all systems, you'll have to disconnect the steering column from the pinion shaft, disconnect the hydraulic lines from the pinion valve body, and disconnect the tie-rod ends from the steering knuckles.

Once everything is disconnected, you can unfasten the rack mounts and remove the rack.

To install the rebuilt rack, begin by installing new rack-mount bushings, (they come with the rack) if required. You'll also have to install the old tie rods (or new ones, if you are replacing them). To make sure the car's toe alignment is close, count the number of exposed threads on the tie rod of the old rack, then install the tie rods on the new rack with the same number of threads exposed.

When installing the replacement rack, tighten the rack mounts to the proper torque, then install the tie-



Leaking rack seals can cause the rack's tie-rod boots to fill with oil.

rod ends into the steering knuckles.

Don't place the steering shaft U-joint coupler on the pinion until the rack is installed and tightened down, otherwise the U-joint may bind.

Flushing the system

Bad racks leave all kinds of gunk, particles and dirt in the pump and lines. One sure way to guarantee early failure of the rebuilt rack (in as little as two days) is to avoid flushing the system of debris and contaminants.

Before connecting the return or pressure line to the rack, you must flush the system completely.

To do this, disconnect the positive wire to the coil to disable the engine. Then, place the return line in a drain pan and pour hydraulic fluid into the pump reservoir to flush the reservoir and the return line.

After reconnecting the return line to the rack, place the pressure line into the drain pan, then have an assistant crank the engine over while you repeatedly refill the pump with new fluid. To assure adequate flushing, you'll need to use at least 2 quarts of the fluid specified for your vehicle. Once the fluid flows clean and clear, install the pressure line to the rack. Don't worry if you can't discern the return line from the pressure line. Rebuilt racks come with instructions detailing which is which, as well as the flushing procedure.

Rebuilders are also adamant about how you install the return and pressure lines to the rack. Because the threads in the rack housing are extremely soft, they strip easily. Stripped and crossed threads are such a big problem for rebuilders that they all verify that the threads are in good shape before they leave the factory. For this reason, it's extremely rare for a rack rebuilder to accept one of its rebuilds for return if the threads are stripped or cross-threaded. You can avoid the problem altogether by carefully installing both lines by hand and tightening them to the proper specification using a crow's foot wrench on a torque wrench.

Bleeding air

Once the rack is installed, the lines are tight and the system is full of fresh, clean fluid, start the engine and check for leaks.

In all likelihood, the system will moan and groan for a while as air bleeds out of the system. Usually, the air bleeds out on its own after about a half-hour of driving. But sometimes, especially with Fords, the system needs help. If howling and moaning is a problem, jack up one side of the vehicle and then turn the wheel from left to right. Raising one side of the rack higher than the other often will bleed out excess air. Repeat the process on the other side.

With the air removed, you're ready to have the car's front toe-in checked at the alignment shop.

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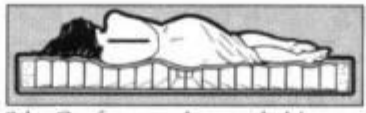
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BY GEORGE MANNES

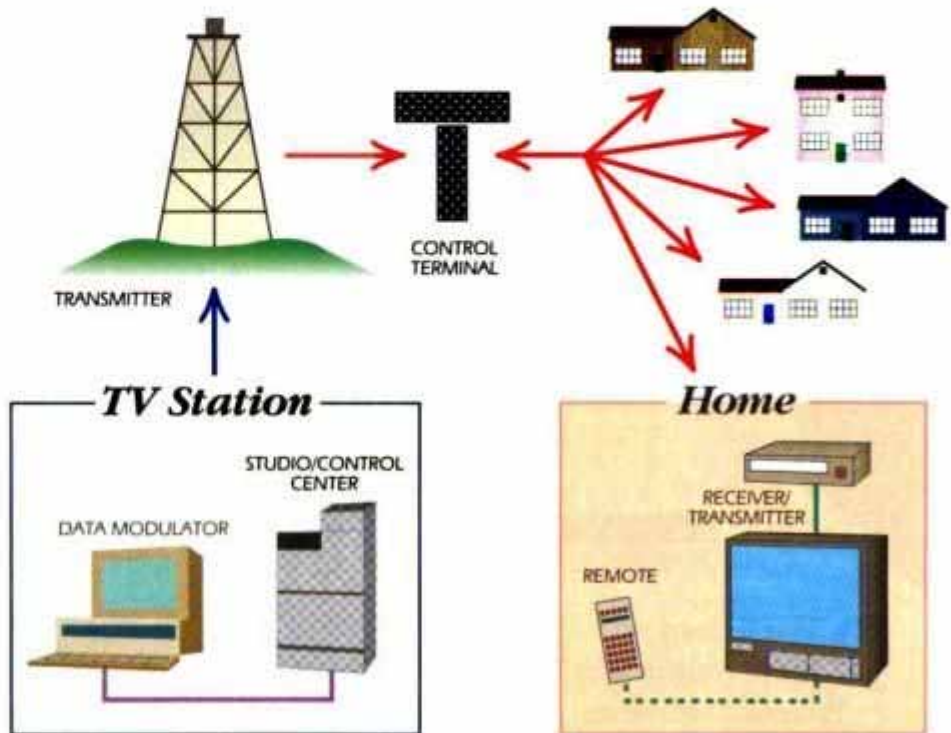
● Can you send video signals from room to room using the AC wiring in your home? How do you make TV interactive using an over-the-air signal?

The information highway is filled with players big and small, but even as billion-dollar conglomerates such as Time Warner and Bell Atlantic tunnel new information pipelines, lesser-known companies are trying to carve out their own niches in video and data delivery, hoping to become what Bill Gates and Microsoft are to computer-operating systems by answering the right question at the right time.

One example is a startup company called Elcom Technologies in Malvern, Pennsylvania. Elcom is developing a device for sending video throughout a house over the home's electrical wiring. With such a product, you could watch what's on cable or what's on satellite anywhere in your house—and you wouldn't have to run coaxial cable along your floor or drill new holes in your wall.

Several companies before Elcom have tried building such a power-line video transmitter. Several companies have failed.

The difficulty is that the power-line is an extremely hostile environment. Among other problems, a home's AC wiring is full of electronic noise. The



RTT's video data service would make broadcast TV interactive.

wired path is also uncontrollable and unpredictable: Its ability to transmit a signal can vary wildly over time.

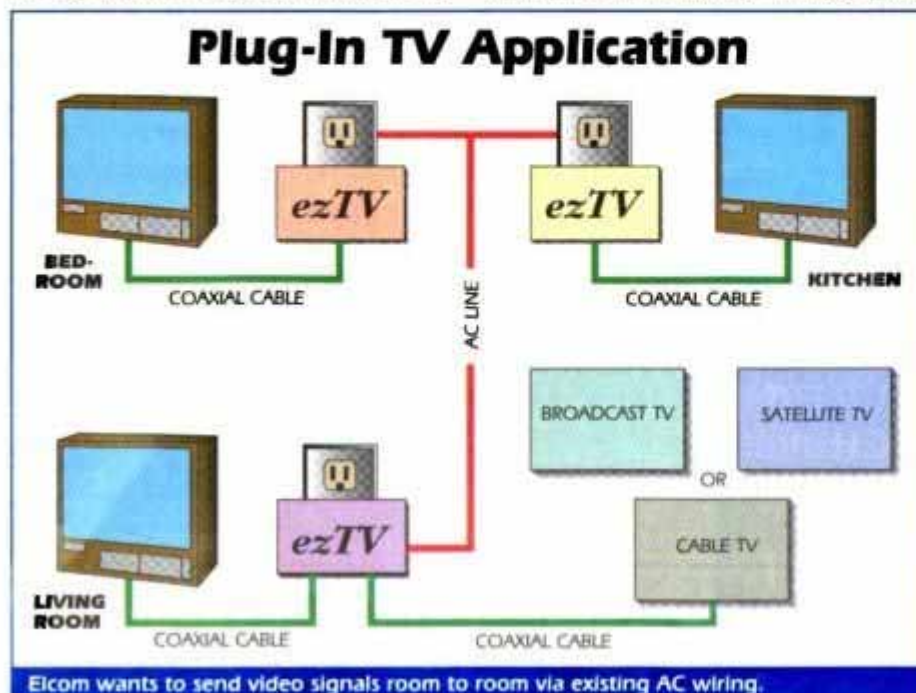
Elcom hopes to have at least three power-line communications products on the market next year. One, which Elcom has dubbed the ezTV, will transmit video signals. Another will substitute for telephone wiring. And a

third will turn an office's AC wiring into a local area network (LAN), linking several computers to one another and to shared devices such as a printer.

A demonstration of a working prototype of the ezTV began impressively. At one end of the office bullpen, the output from a satellite TV receiver was plugged into a 3-prong AC wall socket via something that looked like an oversized version of an adapter that comes with a videogame. A similar device, about 50 ft. away at the opposite end of the office bullpen, drew the signal from the wall and fed it to a TV set. The picture looked excellent.

Then it was time for an interference test. A visitor plugged a 1250-watt blow-dryer into the wall next to the receiving TV and turned it on. Immediately, the TV picture displayed some very apparent and unsatisfactory dropouts—that is, momentary white horizontal streaks on the picture similar to what you see when you watch a dirty tape on your VCR.

Charles Abraham, Elcom's chief technology officer, protested that no one would use a blow-dryer that close to a TV set. (Maybe they would use a hot-air popcorn popper, but that's quibbling.) He suggested the test would be more realistic if the blow-dryer were plugged into another outlet far-



Elcom wants to send video signals room to room via existing AC wiring.

ther from the TV set. That done, the intensity of the snowstorm diminished, but dropouts remained. Granted, the test was unscientific, but it illustrates one of the many difficulties associated with power-line transmission.

Despite the ezTV's spotty performance, Elcom President Robert Vito calls it an improvement over wireless video senders—devices, which have been on the market for several years, that can send video from one part of the house to another using short-range over-the-air broadcast. Vito thinks people will pay extra for ezTV, which he expects to go on sale this year at a list price of \$219 for a transmitter/receiver pair. That's substantially more than what wireless video senders are going for—such as a model from Recoton that was selling last fall for \$80.

Elcom also has high hopes for its ezLAN product for computer communications, which it hopes to debut this year at a price of \$599 per computer. Abraham estimates it will transmit data at an effective rate of 1 megabit of data per second—about 50 times faster than the 19.2 kilobit/second power-line modem products that have been produced since 1986 by a more established company, Adaptive Networks Inc. (ANI) of Cambridge, Massachusetts.

How can Elcom make such a leap in an area where so many have tried and failed? The company, which is applying for patents on its technology, won't say. Abraham, who has been working on power-line communications for more than a decade, will say that it doesn't use the spread-spectrum approach that ANI uses, which breaks data up into smaller packets that it sends at different frequencies. That's the same technique that a new generation of cordless telephones uses to extend the range of cordless phones.

While Elcom is focusing on wired TV, another set of entrepreneurs is trying to make money from wireless TV—specifically, a set of frequencies set aside by the FCC for interactive TV applications. But unanswered questions about necessary equipment make it difficult to predict what kinds of services will be offered and when they will appear in your neighborhood.

Called Interactive Video Data Services (IVDS) by the FCC, these new services would enable 2-way communication of TV-related data to the home. If an ad for a new Ford looked intriguing, IVDS might let you request a follow-up brochure from the company with a push or two of a button on your remote control. Essentially, IVDS would enable many of the same transactions that telephone and cable companies plan to offer in future

upgraded systems. It would just be an information pipeline to the home that uses over-the-air frequencies instead of hardwired networks.

To enable IVDS, the FCC divided the country into 306 markets, each to be served by two IVDS licensees. After a lottery, the FCC awarded 18 licenses for nine markets last March. To keep their prizes, the license-holders have to meet certain requirements, starting with building a system to serve 10% of their market by the end of March. At press time, though, only one company had FCC approval to sell IVDS equipment to license-holders. That company is EON, a Reston, Virginia, company that has been attempting to set up a national IVDS network. At press time, EON had only one letter of intent from a license-holder that it would buy EON equipment—actually, gear made by the Mateo Electronics Group, a contract manufacturer based in Vestal, New York.

Meanwhile, in early October, another company pushing equipment for IVDS—Radio Telecom & Technology (RTT) of Riverside, California—hadn't yet filed for necessary FCC approval. Upon receiving an order for its equipment—an order the company couldn't accept until after an expected 2-month FCC approval process—RTT could deliver its first systems in six to nine months, according to President Louis Martinez. But isn't that too late for the March 28 deadline? "It is a close call," he says. But none of the license-holders has been overly concerned.

However, concern about equipment delivery has apparently thrown a monkey wrench in the schedule for introducing IVDS in the remaining 297 markets in the United States—markets for which IVDS licenses weren't awarded by lottery, but auctioned off last summer to the highest bidder. At least 13 bidders—the two largest of which bid for a total of 35 licenses—have effectively defaulted, meaning that the licenses in question will have to be re-auctioned. Several of these bidders had argued, after they won their licenses, that they shouldn't have to meet the one-year build-out requirements because of expected difficulties in obtaining FCC-approved equipment in time.

An FCC official said last fall that he expected the non-defaulters to be granted licenses by the end of 1994, giving them a year to start building their systems. A date for re-auctioning defaulted licenses hasn't been set. It's just another example of what is often the case with technology of the future. It stays right there—in the future. **FM**

BORDER TO BORDER

(Continued from page 61)

able because of mud and the trip would have taken twice as long.

One morning in Montana, Mike and I learn what happens when finely packed Western dirt absorbs precipitation. Two inches of snow had fallen above the 6000-ft. mark, and the upper elevations were transformed into bogs of thick, brown muck with all the messy friction-reducing attributes of heavy oil.

But from this promontory at Engineer Pass onward the route is all downhill, and by the next day we pass through the Four Corners region of the desert Southwest and enter the relative safety of Arizona. It is a 2-day run from Four Corners to the Mexican border, which we encounter on a remote dirt road southeast of Tucson near the town of Naco. The final night is spent in historic Bisbee, a copper-mining town that proves to be up to the task of joining us in celebration at journey's end.

All of which brings me to an interesting point. If we could make the border-to-border trip by driving at least 60% on dirt roads (1441 miles out of 2356 miles overall), isn't it possible to do it by driving a route that's 100% dirt? Such a route would be far more twisty and challenging than the one we drove and it would take far longer to complete.

I believe a border-to-border off-road trail is possible, and what a trip it would make: running from the dry, rolling hills of northern Montana, through the high-altitude peaks of the Rocky Mountains along the magnificent Great Divide, through the monument-studded Indian country of the Four Corners region, and finally finishing up in the spectacular Sonoran Desert of southern Arizona.

An off-road route from Canada to Mexico (on existing roads that were built for mining, ranching and petroleum exploration) could eventually become to 4-wheelers what the Appalachian and Pacific Crest trails are to hikers. Then again, maybe not. Perhaps this is what happens when you spend too much time above 13,000 ft.

If I really were serious about blazing a trail like this, I could begin with some pretty good starting and ending points. I'd know where to find reasonably good maps, and I'd know how to pull off both high- and low-tech seat-of-the-pants GPS navigation. Also, I know the perfect vehicle to take—the rugged new Chevy Blazer, which can handle off-road pounding with aplomb and do it with a carlike level of creature comfort. Very impressive.

Now if I can just find a new co-pilot (Mike's noncommittal), I can be ready to roll when the snow melts. **FM**

TEST SUMMARY

Report number: 4
 Total miles driven: 12,017
 Miles driven since last report: 4373
 Average fuel economy: 19.3 mpg
 Worst observed fuel economy: 16.8 mpg
 Best observed fuel economy: 20.8 mpg
 Maintenance/repair costs: add 4 quarts motor oil, \$6.60

sweat more readily and experience deodorant failure without air conditioning, and are more annoyed by the notchy shifting and teeth-loosening ride. We did, though, develop rather nice muscles in our right leg from constantly standing on the accelerator, so as not to get run over by street-cleaning machines.

—Cliff & Jonathan Gromer

Mazda Millenia S

In less than six months we've rung almost 10,000 miles on our Millenia. From the twisty 2-lanes of the White Mountains in New Hampshire, to the broad, seriously fast-moving conveyor belt known as the New Jersey Turnpike, to the very mean streets of New York City, we have been hauling our Millenia S around, and, by and large, we've been doing it in a hurry.

In the process, we've discovered the joys and foibles of the Millenia's unique supercharged Miller Cycle drivetrain. When cruising, passing or climbing hills, the small V6 just sings as the torque builds along with the revs, from about 3500 rpm and upward. Too many times a glance at the speedometer produced an instant reflex reaction of lifting the right foot. However, from a standstill it takes the engine a mite longer to scoot to speed than it does once it's up and running. But our bigger complaint is with the Millenia's 4-speed automatic. The transmission almost seems to be totally disconnected from the rest of the car. Too often at speed, the gearbox seems to be loafing and finds itself in the wrong gear. And throttle-induced downshifts seem an awfully long time in coming when you want to pass in a hurry—luckily the engine makes up for it, once the gearbox drops a gear.

The car's chassis continues to delight everyone, with a supple, well-controlled ride and truly crisp, responsive handling.

As the Millenia is the stillborn Amati luxury car that Mazda never had, its lavish interior is a cozy and comfortable place to spend more and more time in. However, some of the controls—particularly the radio and the climate control—leave us wanting. To change the ventilation system's blower speed requires cycling up to faster and faster speeds to come around again to a lower speed. And

though the large rotary knobs for the sound system (which is a killer, by the way) work great for volume and tuning, other controls, like those for changing CDs or adjusting bass or balance, are strangely obtuse.

But our complaints are minor compared to the overall sweetness of the Millenia driving experience. Other than a clicking when the steering wheel was at full lock and a center sun visor that fell victim to a passenger who

TEST SUMMARY

Report number: 2
 Total miles driven: 9685
 Miles driven since last report: 5735
 Average fuel economy: 23.0 mpg
 Worst observed fuel economy: 16.2 mpg
 Best observed fuel economy: 26.6 mpg
 Maintenance/repair costs: add 1 quart motor oil, \$1.19
 7500-mile maintenance, \$108.60

tried to twist it counter to its plane of movement (both fixed under warranty), we've had no problems. —D.C.

Dodge Ram 1500 Laramie SLT

Our Ram has acquired 6800-some miles in a few short months, in testimony of how much we like to drive it. Naturally, the Ram has been popular with the staff for all kinds of truck stuff, like moving big, bulky things for the Home Improvement department, as well as furniture and appliances for folks on the move. But the big Dodge has also been a favorite commuter vehicle as well, honest. With the Ram's

TEST SUMMARY

Report number: 2
 Total miles driven: 6845
 Miles driven since last report: 4283
 Average fuel economy: 17.6 mpg
 Worst observed fuel economy: 11.1 mpg
 Best observed fuel economy: 19.7 mpg
 Maintenance/repair costs: repair front bumper, \$67.84

high seating position for good line-of-sight over traffic coupled with the truck's excellent acceleration and stopping power, the Dodge is quite perfect for beating up traffic commuting into New York City. And the relatively high ground clearance (remember, our Ram is a 2wd) makes it capable of digesting rim-bending, shock-bursting potholes for snacks.

Mind you, no one will mistake this truck's ride for that of a luxury car. It's long, tall and heavy, and the occupants' inner ears, as well as the rest of their anatomy, are a long way from the truck's center of gravity. The ride motions are well-damped—but definitely trucklike. Likewise, the steering is really pretty responsive and accurate, in a truck kind of way.

And while rolling with the molasses-like jell that typically defines the traf-

fic flow through the Lincoln Tunnel and makes mayhem of the Ram's 5.2-liter V8 fuel efficiency, the Dodge has not shown a propensity to drinking the Middle East's oil reserves dry, delivering well over 17 mpg on average.

Other than a front bumper, which lost when it met a solid-steel pillar in our parking garage, our only problem so far has been a small one with the driver's seat cushion, which is slowly popping a seam down near the hinge. The Ram is due for service, so we'll have the dealer attend to it soon.

—Mike Allen

Honda Accord EX

As our long-term Accord coupe fades into the sunset and heads back to Torrance, California, we can't help but be amazed at the difference two doors can make in the character of a car—or lack of same. In this case, lack of. You take two doors off a Honda Accord sedan and you transform what is generally conceded to be the finest family sedan you can buy into a sporty, fun-to-drive coupe that will make certain highly touted sports cars cry.

The Accord coupe has been one of the most popular cars in our test fleet the last 12 months, highly sought after for weekend jaunts and weekday errands. Why? It wasn't the most flamboyant car we had in our fleet. Far from it. It wasn't the fastest, or the roomiest, or even the most utilitarian. It was simply the most satisfying. Solid. Stable. Responsive. There, ready to do your bidding, be it hauling four people home from the office or blowing off a Mazda Miata on a New Jersey Turnpike on-ramp. Had we taken a poll during the last 12 months, the Honda Accord would have won as the car we'd most like to own.

That said, let's make sure no one mistakes a Honda Accord coupe as The Perfect Car. First, it's pricey these days, with a base list of over \$17,500. Second, it's pretty tight inside. The front seats are comfortable for two but you would not want to be in the back seat on a New York-to-Miami run.

That's about all the negatives we can say. A power door lock actuator aside, nothing broke or wore out during our test and we maintained it by the book.

Our long-term test can be summed up by our sister publication, *CarSmart*, in its test of a Honda Accord sedan. Its conclusion: Highly Recommended. —Joe Oldham

TEST SUMMARY

Report number: 4
 Total miles driven: 24,445
 Miles driven since last report: 11,945
 Average fuel economy: 28.4 mpg
 Worst observed fuel economy: 18.7 mpg
 Best observed fuel economy: 31.4 mpg
 Maintenance/repair costs: \$268.95 maint.

(better than Mach 4 in this case) and vertical takeoff and landing capability.

The patent enumerates several properties that suit a saucer to these goals. The shape, it claims, provides excellent structural rigidity, aerodynamic stability in vertical ascent and descent, and room inside for large amounts of payload and fuel. Furthermore, its smooth profile and unbroken leading and trailing edges were thought to lend it inherent aerodynamic efficiency.

There's no record of Lockheed's radical craft ever getting off the drawing board, but it seems somehow fitting that there should be an early link between Lockheed and a saucer. As creator of the U-2, SR-71 and F-117A, Lockheed's name intertwines with Groom Lake's from the beginning. And saucers, of course, are what people come here to see.

Weapon System 606A

Around the time Lockheed applied for its patent, Britain's Avro Aircraft, builder of some of World War II's most successful bombers, began work on a more practical saucer at its plant near Toronto, Canada. Under a Canadian government contract, Avro sketched out a vehicle that harnessed a newly discovered benefit of the circular wing. Jetted down from the wing's perimeter, a circular curtain of thrust created a "bubble" of high-pressure air that resulted in very efficient vertical lift, much like a hovercraft but without the flexible skirt.

Avro designed this effect into a GETOL (Ground-Effect Takeoff and Landing) craft that used it to get airborne, then gradually directed thrust aft until lift on the circular wing took over. Canada soon decided it couldn't afford to pursue the idea, but the U.S. Air Force saw it as a way out of a troubling Cold War vulnerability.

Fearing that Soviet strikes on European airfields could all too easily take our planes out of a fight, the Air Force picked up funding for Avro's GETOL work in 1954. Under a highly classified program designated Weapon System 606A, it developed a concept for a 30-ft.-dia. circular-winged plane with a top speed of 1000 mph.

Considering it would be years before a fighter *without* GETOL capabilities went that fast, this was a radical proposition. To lower the stakes, the Air Force joined the Army in funding construction of a slower, simpler test craft. The result was one of the strangest machines in the annals of military aviation.

The VZ-9V Avrocar bristled with untried ideas. Buried at the center of its 18-ft.-dia. circular wing was a 5-ft. fan, surrounded by three turbojets ly-

ing on their sides in a triangle. Jet exhaust spun the fan by blowing over turbine blades that ringed its edge, and the resulting thrust was ducted out to nozzles at the wing's periphery.

Lacking conventional tail surfaces, the Avrocar was expected from the outset to be unstable. The designers devised an ingenious but complex mechanism to automatically feed corrections back into the control system, using the central fan as a gyroscopic reference. In essence, it strove to mimic the performance of a modern computerized fly-by-wire system by purely mechanical means.

But instability still proved to be the Avrocar's undoing. In test flights, it hovered reasonably well close to the ground, but at 5 or 6 ft. it developed a violent "hubcapping" wobble and had to be tethered for its own protection. Wind-tunnel tests showed the control system couldn't hold it steady in forward flight either, and speeds greater than 35 mph were never attempted. In December of 1961, with \$10 million spent, the project was abandoned.

"It was a very ingenious idea, but it was just way too early," says Dan Murray, who managed the program for the Air Force. Murray now believes that helicopters and other specialized craft have taken over the roles for which the Avrocar was planned. "I'm sure you could build a flying saucer today," he says. "The question is, why?"

Saucers today

Yet the saucer lives on. Sikorsky Aircraft has been testing a 6-ft.-dia. disc-shaped unmanned aerial vehicle (UAV) called the Cypher since 1988 (see Tech Update, page 14, Oct. '90). In many respects, it is the robotic heir to the Avrocar, with maneuverability that lets it lurk around terrain features as it carries out reconnaissance. Then there's a series of saucers built by Moller International, whose founder, Paul Moller, drew lessons from the Avrocar. His latest, the one-man, 8-engined M200X, flew stably and demonstrated technologies for a proposed flying car (see "Skycar," page 34, Jan. '91). In the lighter-than-air arena, the Russians looked to a shape strikingly reminiscent of Lockheed's 1953 patent to make their huge Thermoplane cargo blimps stable at low speeds and efficient at high speeds.

But what about high-performance saucers, saucers like those the Air Force feared 47 years ago? Was Weapon System 606A and the failed Avrocar really the end of large-scale military saucer research?

Tantalizing leads suggest not. William Blake, an engineer at the Air Force's Wright Laboratory, told us of

a huge nuclear-powered craft designed by Convair in the early '60s under a Navy contract for a transoceanic transport. He found a brief article dated June 1960, which shows a general arrangement drawing, and describes the vehicle as 400 ft. in diameter and capable of carrying a million-pound payload. Known as a ground-effect machine, or GEM, the concept relied on a curtain jet like the Avrocar for lift near the ground, but had no provision for flight at higher altitudes.

More recent but also more dubious is the well-publicized story of Robert Lazar, who says he worked at a Nellis Range base even more secret than Area 51. He says the base, called S4, consists of nine underground hangars containing extraterrestrial saucers that the government is trying to reproduce. But when we ran his explanation of the spacecrafts' workings by a respected physicist, we were told it contained obvious errors. Nor does Lazar's claimed educational background check out.

A more mundane scenario might warrant consideration, however. Recent years have seen the maturation of the electronic flight controls needed to stabilize a saucer, while stealth has brought a whole new set of parameters to aircraft design. Although the techniques for foiling radar are complex and largely classified, a key principle is to minimize the surfaces that might intersect a radar beam at a right angle. What, one has to wonder, would do this better than a flying disc?

This question ran through my mind as I trained my telescope on Area 51. The night before, Glenn Campbell and I had been spotted by security as we watched from another hill, and we immediately heard "We just went into condition watchdog... we have visitors on the hill" over the control-tower frequency. Something was told not to land. Something they didn't want us to see even from 12 miles away.

So tonight atop White Sides, I'm determined to lay low. The tower opens at 4 am and with the words "no condition in effect" confirms I'm undetected. At 4:30 am, a Black Hawk flying with no lights makes a low pass, but I'm hidden in a rocky ravine. Dawn breaks. Activity at the base picks up. In the crisp morning air, cars, trucks, even people are visible moving among the hangars.

An F-117A takes to the runway, but no saucers. Still, there's a strange exhilaration at my solitary view into this secret world. There's something out there. And as long as they won't tell us what it is, our dreams of flying saucers will have this place to roost. **FM**

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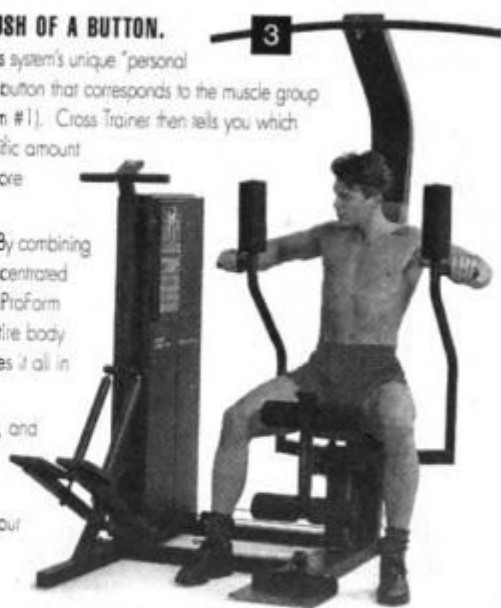
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(Continued from preceding page)

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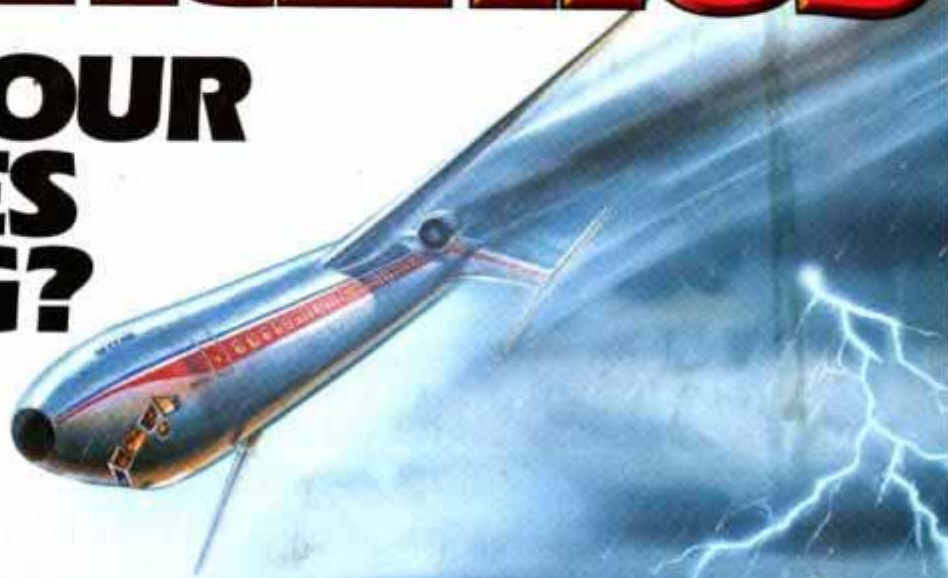
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