

Popular Mechanics

JULY 1994

U.S. \$2.50
Canada \$2.95

**CHRYSLER'S
NEW NEON:
BRIGHT LIGHT
OR DIM BULB?**
We Test It Against 8
Tough Compact Rivals

ZEPPELIN'S NEW AGE OF AIR TRAVEL

Rigid-Frame,
Lighter-Than-Air
Craft Flies With
Cruise Ship
Luxury, Comfort
—And Safety



MAN ON THE MOON: 25th ANNIVERSARY

- Buzz Aldrin Relives His Moonwalk
- Saturn V: Where Are You Now?

Plus Vice President
Al Gore Talks About
America's Space
Program Agenda

4x4s FOR YOUR FEET

New Rage In Boots
Combines Sneaker
Comfort With Rugged
Performance And Style

PLUG INTO THE INFORMATION SUPERHIGHWAY

Latest Souped-Up
Cable Boxes
Connect Your TV
To Everything





Our new available Convertible Console Seat flips from buckets to seat three.



Preferred Care helps down the road with free 24-hour roadside assistance for 3 years/36,000 miles.



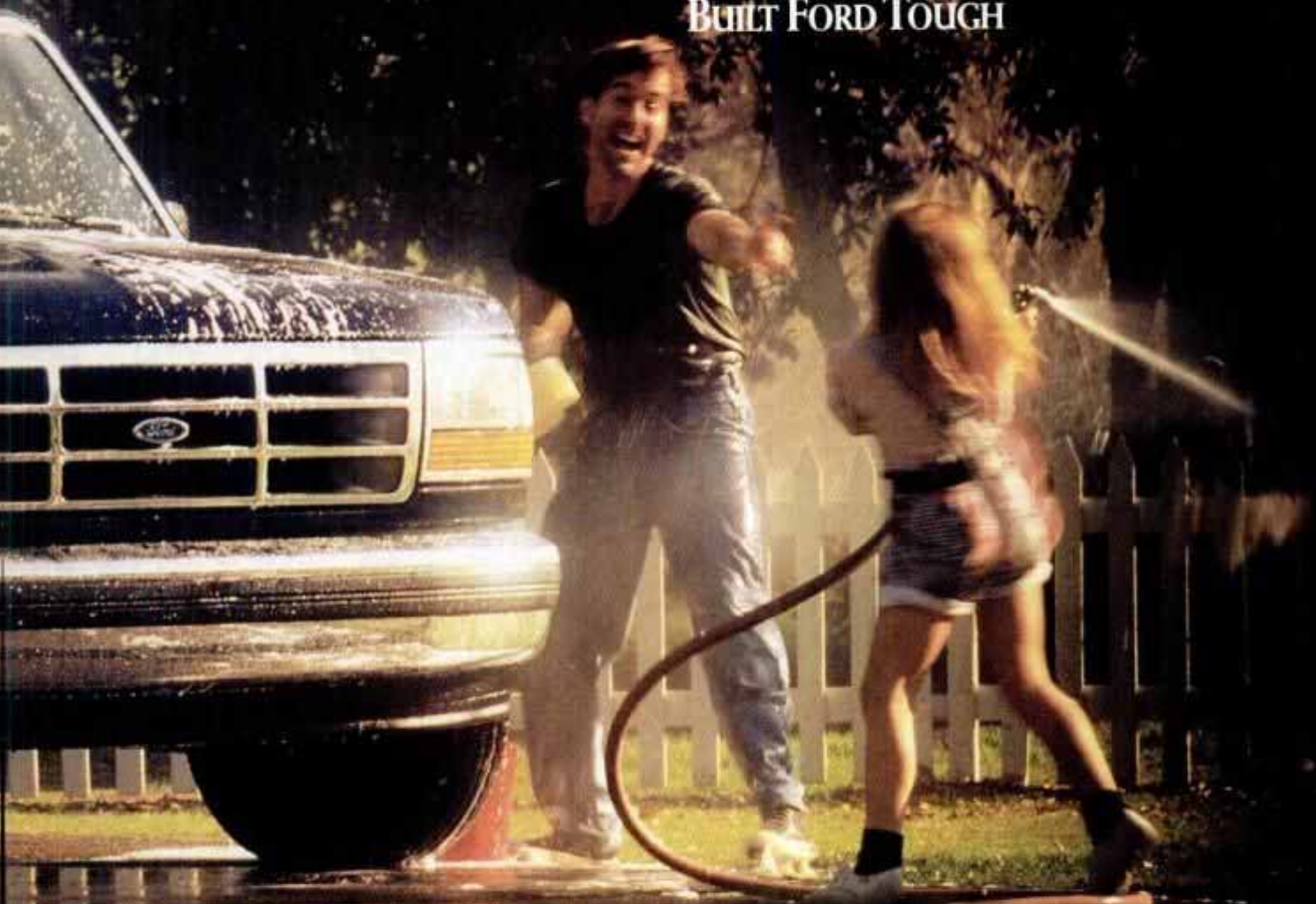
Our new CD option makes your travel even more first-class.

*Available on models under 8,500 lbs. GVWR. Always wear your safety belt. **Based on 1977-1993 model year manufacturer's reported retail deliveries by division.

FORD F-SERIES. THE BEST NEVER REST.



BUILT FORD TOUGH



An available anti-theft system with remote keyless entry is an exclusive.



Ford continues to be a safety leader with a new standard driver's airbag.*

F-150
XLT

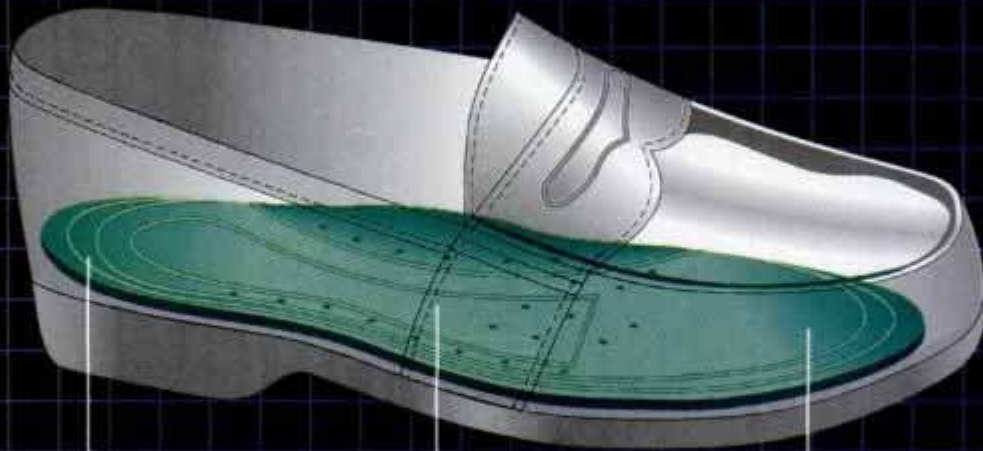
Once again, F-Series is the best seller, making it 17 years running.**

This One



TNLB-85B-CUUC

FROM NOW ON ALL YOUR SHOES WILL FEEL AS COMFORTABLE AT THE END OF THE DAY AS THEY DID IN THE BEGINNING.



HIGH-TECH FOAM ABSORBS SHOCK AND PROTECTS FEET

6-MONTH GUARANTEE

BREATHABLE TOPCLOTH

No small feat. After all, your shoes are under a lot more pressure than they were probably designed for. Which is precisely why Dr. Scholl's created an advanced line of insoles that are specifically designed to give your feet revolutionary support, cushioning and shock absorption. There's an insole made for every need and shoe style... Dress, Casual, Work, even Sport Replacement Insoles for your athletic shoes. And they can improve comfort by up to 100%. So now your feet will feel as good in the evening as they did in the morning.

DrScholl's

Maximum Comfort

DRESS/CASUAL

Insoles

Maximum comfort for dress & casual shoes.

Plushes heel cushions to ease... Contoured arch... Breathable... 6-month guarantee.

DRESS/CASUAL

1 PAIR SIZE 7-11
TRIAL TO FIT YOUR SIZE

Designed to fit dress shoes and loafers. Soft yet durable, they're made of advanced cushioning IMPLUS® foam that conforms to your foot. The form-fitting arch support provides additional comfort.



The average sumo wrestler weighs 420 pounds. The average man puts 9,000 times that much weight on his feet every day. That's why Dr. Scholl's created these revolutionary insoles.

Tough and durable, with a contoured arch, a molded heel and advanced shock-absorbing foam, they provide that extra cushioning and stability your hard-working feet need.

DrScholl's

Maximum Comfort

WORK

Insoles

Maximum comfort for work shoes & boots.

Contoured for... Plushes heel... 6-month guarantee.

WORK SHOES

1 PAIR SIZE 6-12
TRIAL TO FIT YOUR SIZE



©1994 Schering-Plough HealthCare Products, Inc. Product contains IMPLUS material. IMPLUS® is a registered trademark licensed from Implus Corp.



Make life in your shoes more comfortable.

Popular Mechanics®

JULY 1994
VOLUME 171
NO. 7



AUTOMOBILES

32 Comparison Test: 9 Small Sedans

Chrysler's new Neon says "Hi" to eight competitors in the compact-sedan category.

49 Owners Report: Chevrolet Camaro Still true to form—a stylish sport coupe that handles great and, in Z28 form, can be brutally fast.

81 Car Care

- **Car Clinic:** Car Care Q&A.
- **Maintenance Basics:** Replacing light bulbs.
- **Saturday Mechanic:** When your battery dies.

92 New Cars Ford Contour, Mercury Mystique, Chevrolet Lumina and Monte Carlo, Saab 900 and Mitsubishi 3000GT Spyder.

94 Detroit Spy Report The '96 Pontiac Sunfire, '96 Jeep Wrangler, '97 Chevy Corvette, '96 Ford F-Series pickup and future Suburban fighter.

104 Import Spy Report The 1996 Mercedes SLK convertible, '95 Porsche 911, '95 MGD, and more.

TELECOMMUNICATIONS

37 Cable Boxes Power Up To plug into the I-way, you'll need one of the new breed atop your TV.

BOATING/OUTDOORS

52 Comparison Test: 5 Ski Boats Lake-testing the best tournament models money can buy.

57 Sport Boots Hit Their Stride These 4x4s for your feet can handle rock climbing and rock concerts with equal aplomb.

102 Boating A boat that rides on rails.

HOME IMPROVEMENT

60 Home And Shop Journal

- **Yard Project:** Building a classic picket fence.
- **Shop Techniques:** Wood inlay.
- **New Products:** Latest barbecue gear.
- **Home Improvement:** Installing siding.

73 Homeowners Clinic Home maintenance Q&A.

SCIENCE/TECHNOLOGY

15 Tech Update

- SST without the boom.
- Charting the unseen Arctic.
- Cars that generate electricity, and more.

29 COVER STORY: Return Of The Zeppelin

Lighter-than-air craft return under the genre's most famous name.

40 Special Section: 25th Anniversary Of Man On The Moon

- Vice President Al Gore on America's future in space.
- Buzz Aldrin relives his moonwalk.
- Philip Chien remembers the Saturn V.

96 Science The faster, cheaper, better Moon mission.

ELECTRONICS

90 Video High-definition TV's new direction.

98 Electronics Thin strips of battery power.

DEPARTMENTS

5 Editor's Notes

10 Letters

12 Time Machine

120 Coming Next Month

Too Basic?



At their price...



You got taste!

*Based on manufacturers' list price
16 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.

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

EDITOR'S NOTES

Editor-In-Chief Joe Oldham

Managing Editor Deborah Frank
Graphics Director Bryan Canniff

Home Improvement

Editor Steven Willson
Associate Editor Thomas Klencik
Assistant Editor Roy Berendsohn
Contributing Editors Norman Becker
Rosario Capotosto
Steve Toth

Boating/Outdoors

Editor Joe Skorupa

Electronics/Photography

Editor Frank Vizard
Contributing Editor Stephen A. Booth

Automotive

Editor Don Chaikin
Detroit Editor Jim Dunne
Associate Editor Mike Allen
Contributing Editors Cliff Gromer
Michael Lamm
Rich Taylor

Science/Technology

Contributing Editor Gregory T. Pope

Art Department

Sr. Assoc. Art Director Alan Andresen
Associate Art Director Tom Kane
Assistant Art Director Kurt Novak

Electronic Production

EP Administrator Sarah Deem
EP Manager Robin LaSalle
Art Editor John Bostonian Jr.
Copy Editors Peter Burns
Nancy Coggins

Editorial Administration

Administrative Asst. Josephine Coronia
Asst. to the Editor Barbara A. Novak

Reader Service Department

Manager Norah I. Golad

Editorial Offices

224 W. 57th St., New York, NY 10019
(212) 649-2000

We cannot be responsible for loss of unsolicited queries, manuscripts, or photos. For return, they must be accompanied by adequate postage.

SUBSCRIPTION SERVICE: Popular Mechanics Magazine will, upon receipt from its reader of a completely new or renewal subscription order, undertake fulfillment of that order so as to provide the first-copy delivery either to the Postal Service or alternate carriers within six to twelve weeks. If for some reason this cannot be done, you will be promptly notified of the issue date that will begin your subscription, with a request for any further instructions you may have concerning your order. Please address all such orders to us at Popular Mechanics, P.O. Box 7170, Red Oak, IA 51591. •Should you have any problem with your subscription, please write Joan Harris, Customer Service Department, Popular Mechanics, P.O. Box 7170, Red Oak, IA 51591 or call toll-free 1-800-333-4948. Please enclose your mailing label when writing to us or renewing your subscription. •Subscription prices: United States and possessions, \$15.94 for one year; \$29.94 for two years. Canada and all other countries add \$16.00 for each year.

Use this address for subscription orders & inquiries. **POPULAR MECHANICS**, P.O. Box 7170, Red Oak, IA 51591.

MAILING LISTS: From time to time we make our subscriber list available to companies who sell goods and services by mail that we believe would interest our readers. If you would rather not receive such mailings, please send your current mailing label or exact copy to: **POPULAR MECHANICS**, Mail Preference Service, P.O. Box 7024, Red Oak, IA 51591-0024.

AS A SERVICE TO READERS, Popular Mechanics publishes newsworthy products, techniques and scientific and technological developments. Due to possible variances in the quality and condition of materials and workmanship, Popular Mechanics cannot assume responsibility for proper application of techniques or proper and safe functioning of manufactured products or reader-built projects resulting from information published in this magazine.

● I've often wondered what lighter-than-air travel might be like today were it not for that one fateful moment on May 6, 1937, in Lakehurst, New Jersey. Most of us have forgotten that many of flight's firsts—such as the first powered flight, the first powered and controlled flight and the first nonstop trans-



Anything for the shot.

Atlantic flight—were, in fact, accomplished by lighter-than-air craft. Airships, or blimps, as they are more popularly called, were running passengers and cargo when most airplanes and pilots were just running their mouths. A U.S. postage stamp was even issued in honor of the Graf Zeppelin. But the *Hindenburg*, built by Zeppelin, was to be the crown jewel—the most majestic, luxurious aircraft in the sky. And it was for most of its voyages. But as its 19th trans-Atlantic crossing came to an end, so did the airship era. To this day, people equate airships with the torchlike images of the *Hindenburg* at Lakehurst. Now, as the Zeppelin company presents a new airship design to the world, we may speculate that this is what it would have been like all these years had the engineers continuously improved and updated passenger airships from that day to this. Our cover story this month is all about Zeppelin and its new “hard structure” airship design, and we think it makes fascinating reading. . . . **Car testing can be a messy proposition.** Just ask our new Automotive Editor, Don Chaikin. Chaikin, a longtime contributing editor here, recently moved into the editor's chair and immediately went on the road—into the California desert, to be exact, to test and photograph Chrysler's new Neon and its compact competitors. After several days of track testing on pavement, it was into the sand country to find one of those scenic locations loved by photographers and art directors but loathed by editors. “I hate dirt,” says Chaikin. “It makes the cars dirty, and I can't stand a dirty car,” he says in true car-guy fashion. Graphics Director Bryan Canniff disagrees: “Anything for the shot.” . . . **You know that old cliché** about there being certain moments when something happens to change the world and you always remember where you were and what you were doing at that exact moment. Neil Armstrong's and Buzz Aldrin's landing on the Moon is that kind of moment. Now, believe it or not, it's 25 years later and we are honored to have Buzz Aldrin relive that historic moment for us in a special section commemorating the 25th anniversary of the Apollo 11 mission to the Moon, and one of America's finest hours. Among other articles in the section, you'll find a special message from Vice President Al Gore, who heads the National Space Council. In it, he lays out his views on America's future in space. And since his views are pretty much what we'll have for the next two (or perhaps six) years, let's listen up. Vice President Gore opens up a very special salute to Neil Armstrong, Buzz Aldrin and Michael Collins, the Apollo 11 astronauts, on page 40. Till next time.


Joe Oldham

\$3.00 BACK ON NEW VALVOLINE® DURABLEND™

When you buy 6 quarts of Valvoline® DuraBlend™ Motor Oil or \$50 rebate per quart (max \$3.00) on Valvoline DuraBlend Motor Oil.

Offer Expires September 30, 1994. To receive your Valvoline DuraBlend Check good for cash, complete this coupon and send it with your proof-of-purchase to:

DURABLEND \$3.00 CASH-BACK, P.O. BOX 7299
YOUNG AMERICA, MN 55573-7299

PROOF-OF-PURCHASE INCLUDES:

Your original dated sales receipt for Valvoline DuraBlend Motor Oil; AND One of the following:
(check one)

- UPC code from bottom of one 6-qt case of Valvoline DuraBlend Motor Oil
OR
 Tamperproof rings from up to six 1-qt bottles of Valvoline DuraBlend Motor Oil.

PLEASE INDICATE THE # OF VALVOLINE DURABLEND QTS. PURCHASED:

Rebate request must be made on this special order or a 3x5 card and may not be mechanically reproduced. Good April 1 through September 30, 1994. Can use offer once per quarter (check one):

- April 1 through June 30, 1994
 July 1 through September 30, 1994

Name _____
Address _____ Apt. # _____
City _____ State _____ Zip _____

Limit of two Valvoline DuraBlend checks each quarter per household, address or organization. Maximum rebate of \$6.00 allowed per quarter. Request in excess of the limit will not be acknowledged or returned. Offer good only in the U.S.A. Offer void where prohibited, taxed or otherwise restricted by law. May not be used in conjunction with any other Valvoline offer. Allow 8 weeks for delivery of your Valvoline DuraBlend Check. Rebate request must be mailed within 30 days of cash register receipt date. Rebate check must be cashed within 90 days of issue.



PEOPLE WHO KNOW
USE VALVOLINE®

THE VALVOLINE COMPANY, A DIVISION OF ASHLAND OIL, INC.

LEXINGTON, KY 40509 ©1994

PM HOTLINES

COMMUNICATE WITH US

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

LETTERS

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

FAX MACHINE

You can fax written mail to us if you have access to a fax machine. Our fax number is (212) 586-5562, and is available 24 hours a day.

ELECTRONIC MAIL

You can call the PM computer any day between 6 pm and 8 am (only Eastern time. The number is (212) 582-8369. Once you're on-line, you can leave messages for specific editors, or direct inquiries and comments to a specific department. The department bulletin board also allows you to share your thoughts with other readers who call in.

New users get an identification number and password that allow them to access the system. Simply set your communications software to 8 bits, no parity and 1 stop bit (8-N-1), and set the baud at 300, 1200 or 2400. Please remember that we are not a professionally staffed, fully operational bulletin board. We're simply trying to make it easier for you to communicate with us. So please bear with us if it takes awhile to answer your message.

READER SERVICE BUREAU

Our Reader Service Bureau is operational five days a week during regular business hours. The phone number is (212) 649-3127. Please call our Reader Service Bureau, *not our editors*, for information on back issues, reprints of articles, subscription inquiries and so on. It will save all of us time.

HOTLINE PHONE NUMBERS

Unfortunately, our Hotline Phone Service is temporarily discontinued.

Popular Mechanics

Publisher Robert B. Dillingham

Business Manager Agnes P. Maillaro

ADVERTISING

Director John A. Pagliaro

New York

224 West 57th St., New York, NY 10019

Paul M. Jowdy

(212) 649-3142

Robert G. Mattone

(212) 649-3141

Thomas D. Schreckinger

(212) 649-3143

Chicago

1 South Wacker Dr., Chicago, IL 60606

(312) 984-5190

Manager Richard T. Weithas

Spencer J. Huffman

Detroit

Hearst Magazines Sales, Inc.

2301 West Big Beaver Rd., Troy, MI 48084

(810) 649-2981

Manager D. Craig Rebold

Los Angeles

3000 Ocean Park Blvd., Suite 2002

Santa Monica, CA 90405

(310) 450-8881

Manager Michael T. Campbell

Atlanta

Collinson and Company, Inc.

4315 Cowan Rd., Tucker, GA 30084

(404) 939-8391

Manager Newton B. Collinson, III

Jonathan M. Kiger

Florida

Ron Saba

(813) 948-2088

Dallas

Ingersoll, Redding, Kellner & Zeko

14840 Landmark Blvd., Suite 230,

Dallas, TX 75240

(214) 980-8983

Manager Daniel F. Kellner

Dean Zeko

Mall Order

Manager Barbara Jones

(212) 649-3136

Classified

Manager Dorothy Nolan

(212) 649-3167

MARKETING

Director William E. Congdon

PROMOTION

Manager Erin M. Overend

(212) 649-3085

PRODUCTION

Manager Carole L. Hartman

Adv. Prod. Mgr. Patricia A. Woods

(212) 649-3164

Published by The Hearst Corporation

FRANK A. BENNACK JR.

President & Chief Executive Officer

RANDOLPH A. HEARST

Chairman

GILBERT C. MAURER

Executive Vice President

& Chief Operating Officer

Hearst Magazines Division

D. CLAEYS BAHRENBURG

President

K. ROBERT BRINK

MARK F. MILLER

Executive Vice Presidents

DANIEL E. ZUCCHI

Senior Vice President

ROBERT B. DILLINGHAM

Vice President for Popular Mechanics

RICHARD E. DEEMS

Publishing Consultant

POPULAR MECHANICS is published monthly by the Hearst Corporation, 609 Eighth Avenue, New York, NY 10019, U.S.A. Frank A. Bennack Jr., President; Randolph A. Hearst, Chairman; Gilbert C. Maurer, Executive Vice President; Victor F. Gazzi, Senior Vice President, Chief Financial and Legal Officer; Jodie W. King, Secretary; Edwin A. Lewis, Vice President and Treasurer. Hearst Magazines Division: D. Claeys Bahrenburg, President; K. Robert Brink, Executive Vice President; Mark F. Miller, Executive Vice President; Daniel E. Zucchi, Senior Vice President; George J. Green, Executive Vice President; Raymond J. Peterson, Executive Vice President; John A. Rahan Jr., Vice President & Assistant Controller; Robert B. Dillingham, Vice President for Popular Mechanics.

POPULAR MECHANICS • JULY 1994

Материалы, защищенные авторским правом

IT OUTPERFORMS CONVENTIONAL MOTOR OILS. IT COSTS LESS THAN FULL SYNTHETICS. IT'S NEW VALVOLINE® DURABLEND.™ AND IT'S ABOUT TIME.

INTRODUCING VALVOLINE DURABLEND

A REVOLUTIONARY NEW PARTIAL SYNTHETIC MOTOR OIL THAT
CAN HELP ADD YEARS TO A CAR FOR LESS MONEY THAN YOU THINK.

DURABLEND'S a remarkable new motor oil
that's a unique combination of technically
advanced synthetic oil and the highest
quality conventional motor oil. With regular
maintenance, Valvoline DURABLEND can
help your car stay on the road for 100, 200,
even 300,000 miles and more.



DURABLEND gives you better engine protection

at startup, better deposit control, better fuel economy
and a smoother running engine overall than
conventional motor oils.

But (and this is a big but) it costs
substantially less than full synthetic oils.
Sound like the best of both worlds? A better
oil at a lower price? Well you're right. So try
new Valvoline DURABLEND. It's a motor oil
whose time has come.

PEOPLE WHO KNOW USE VALVOLINE®

THE VALVOLINE COMPANY. A DIVISION OF ASHLAND OIL, INC.  © LEXINGTON, KY 40509 ©1993

The Not So

Because It Has So Much. *True. It looks like a minivan. But when you consider*

everything Chevy Astro comes with, including its bigger, truck-like feel and its solid,

truck-like performance, "minivan" is probably a misnomer. For starters,

a driver's-side facial air bag is standard. And for greater*

stopping control, even through sharp, slippery

curves, 4-wheel anti-lock brakes come not as an option,

but also as standard equipment. Add to this

optional All-Wheel Drive for greater traction,

and you have a vehicle with an extraordinary

range of safety features.

The engine? All Chevy

Astros come with a

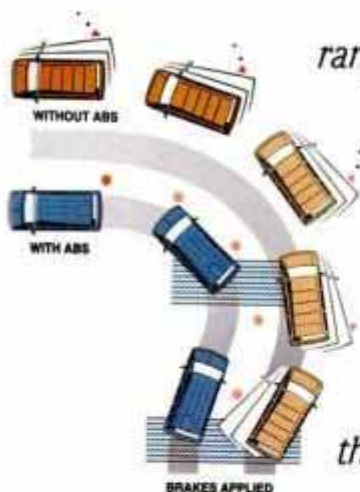
4.3 Liter Vortec V6,

the largest V6 you can buy.

A 200-HP enhanced version is also available.

Astro also boasts an industry exclusive—*

optional Dutch doors: rear swing-out half-



Mini Van.



doors below a one-piece lift-glass. They not only greatly increase driver visibility, they make your loading and unloading much easier.

So if you're looking for a van that's not so mini, the one you should

*look at is Astro. From Chevy. The most dependable, longest-lasting trucks on the road.***

**Chevy Astro
LIKE A ROCK**



For a free product brochure call 1-800-950-2438.
*Always wear safety belts, even with air bags. †Excludes other GM products. **Dependability based on longevity: 1983-1992 full-line truck company registrations. Excludes other GM divisions. The Chevrolet Emblem and Astro are registered trademarks and Chevy is a trademark of the GM Corp. ©1993 GM Corp. All Rights Reserved. Buckle up, America!

Bridge To Nowhere



I don't remember such a waste of your time and mine as your April cover story about the Alaska-Siberia bridge. With all the technology and the needs to rebuild a better and safer United States, you waste our imagination on a bridge that will be lucky to see three cars a day. Who's going to use this bridge? How much traffic will it handle every day? Where are the users of this bridge going? Who's going to pay for this bridge and maintain it? There are subjects such as the need for cheaper power units that should be introduced to the public through your magazine. Don't waste our time with some air-head's fantasy that has no value and is not technically progressive. JIM DILULLO LAS VEGAS, NV

This imaginative scheme would command more attention if the United States and Russia were to demonstrate a commitment to modern railways. Your petrol is too cheap, your cars are too thirsty and your consumption of this finite resource is prodigal. You need high-speed, trans-continental rail service.

ROGER LASCELLES
LONDON, ENGLAND

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

How in your right mind could you ever contemplate building a bridge across the Bering Strait? First, the so-called Cold War may be over, but Russia and the former Soviet republics are more dangerous and fragile than ever. Second, the Russian environment is a disaster. It is estimated that 15% of the former Soviet Union is uninhabitable, and the destruction is continuing. Third, Alaska is one of the last natural regions left in the world. This bridge would only bring on its eventual destruction. Let's use the \$55 billion it would take to build it and improve our environment, perfect alternate energies, and make our homes and cars more efficient. If we're going to spend any money on Russia, let's use it to teach them about democracy, freedom and how to clean up their environment.

ROBERT DALLY
TONGANOXIE, KS

Why did you present the U.S.-to-Russia bridge as a new, novel idea? It's not. Since the 1930s there have been writings about building a dam across the Bering Strait. The dam would protrude about 32 ft. above the ocean. At appropriate locations along the dam would be very large nuclear-powered pumps that would pump the water from the south side of the dam to the north side. This would cause the warmer water on the south side to flow north via the pumps, causing the north polar ice cap to melt. Climates would change so that as an example the climate at the Canadian-U.S. border would be like Florida is now. Wheat and other crops could grow perhaps 1000 miles north of where they now can grow, trans-

forming most of Siberia and Alaska into food-producing areas. The top of the dam could also serve as a roadway for trains and cars, and oil pipes could be imbedded. So why don't you discard the primeval idea of a simple bridge and feature an article on a Bering Strait dam, which would be so much more useful?

F. WESLEY MOFFETT JR.
ROCHESTER, NY

The mileage factor alone would nullify the use of such a bridge for pleasure traveling. Russia is sadly lacking in material things, such as hotels, gas stations, restaurants and decent roads. If built solely for pleasure, it would be a bridge to nowhere.

JOSEPH R. MANNING
BRAintree, MA

Read A Book

Your response to Jeff Douthwaite regarding GM's electric car is bunk. What's wrong is you. Batteries store energy, as in 16.8 kwh, not power as you stated.

GEORGE A. CHADWICK
CHESAPEAKE, VA

Your response leaves a lot to be desired. Please read a book.

KATHY SMITH
PELL CITY, AL

Your flip-type response may appeal to some, but it detracts from any attempt to sound professional.

BILL BRANDEL
FAIRFAX, VA

Your reply was abrupt and nonsensical.

BILL HENRY
IRVINE, CA

Your response was too terse and opened on a negative note. Don't discourage questions by insensitive responses.

EDWARD J. MROCZKA
PORTLAND, CT

Do us a favor, go back to school.

MARTIN D. McDERMOTT
FORT LUPTON, CO

Someone has burned all my books and school's out for the summer. However, I have enrolled in a course called Principles of Electricity at NRI Schools.
—Ed.

Reader Project Of The Month



I attempted to make the POPULAR MECHANICS knife and succeeded. I used an Atlanta Cutlery blade blank, which was a round tang with a stainless, laminated steel blade. The blade length is 4 in., and the tang length is just over 4 in. The only differences were that I used walnut and cherry for my 9-piece handle because they were more readily available than satine and tulipwood. I constructed the knife stand out of oak. I also added an identification plate that I formed out of 1/8-in. brass bar stock and then had professionally engraved. I attached the plate to the base with small brass brads.

JOSEPH D. LAHOOD
ANDOVER, MA

You have a 30-year mortgage.
Shouldn't you have a 30-year faucet?



It seems only fair. With its sturdy construction and durable washerless cartridge, Moen faucets have an unrivaled reputation for reliable performance. Not to mention a lifetime limited warranty against leaks and drips. No wonder so many new homes are built with Moen faucets.

 **MOEN**

BUY IT FOR LOOKS. BUY IT FOR LIFE.®

1-800-553-6636

©1994, Moen Incorporated. For complete details on Moen's lifetime limited warranty, call Moen or see a dealer near you.

Материал защищенный авторскими правами

TIME MACHINE

90 YEARS AGO: JULY 1904



Primo Limo

In the years before mass production, the automobile turned the corner from novelty to status symbol. Car-makers introduced luxurious excesses, as witnessed in a behemoth built for a Cleveland business baron. This vehicle could accommodate 10 and featured sleeping compartments, a kitchen and a dining room. Inside, a dynamo provided heating and lighting. One number may ring familiar to today's luxury-car buyers: the price tag of \$35,000.

Roll To The Pole

Chicagoans were amused by what looked like a gigantic football spiraling across Lake Michigan. Inside was eccentric stuntman Peter Nissen. His pneumatic roller

was merely a scale model for a huge windblown conveyance that he had blue-printed. His planned destination? The North Pole.



60 YEARS AGO: JULY 1934



Fresh Wings

Randolph Field, Texas, attracted flocks of would-be flyers during aviation's golden era. The Army Air Corps' primary flying school indoctrinated cadets with the dogma of dogfighting, 1930s-style. Long gone were the lone-eagle tactics of World War I. Instead, formation flying was the new rule. And the swift new squadrons of aircraft—the Army's first monoplanes—were more than a match for the hungry young pilots who yearned for them.

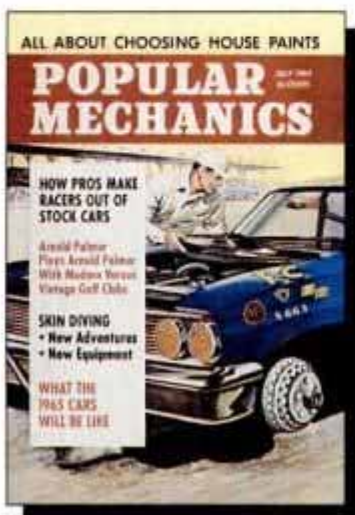
Diesel Days

Revved up to put the steam locomotive out of business, the diesel engine was challenging its gasoline-burning counterpart for street supremacy. To showcase his

powerplants, C.L. Cummins began entering diesels at Indianapolis. The racers chugged along at 86 mph and ran the entire 500 miles without a stop.



30 YEARS AGO: JULY 1964



Stock Brokers

What turns a standard 2-door Ford Galaxie into a fire-breathing NASCAR racer? Charlotte, North Carolina's Holman & Moody walked us through the procedure. The V8 engines received the most attention, being rebuilt to meticulous specifications. The giant air-cleaner shroud and oil cooler were among the few stock options that NASCAR would sanction. But safety features abounded, from roll cages and crash bars to brake air scoops.

Fault Lines

Caltech's Charles Richter offered his predictions for the Big One. Southern California was most prone, followed by the Bay Area, and then the San Andreas Fault, connecting the two. Earthquake engineering was a young science in the '60s, but fortu-

nately Los Angeles was a young city. New steel-frame skyscrapers would sway with a quake, rather than resist stiffly. But quake forecasting remained hardly more evolved than a quip: "The longer it has been since the last quake, the sooner it will be to the next." **PM**

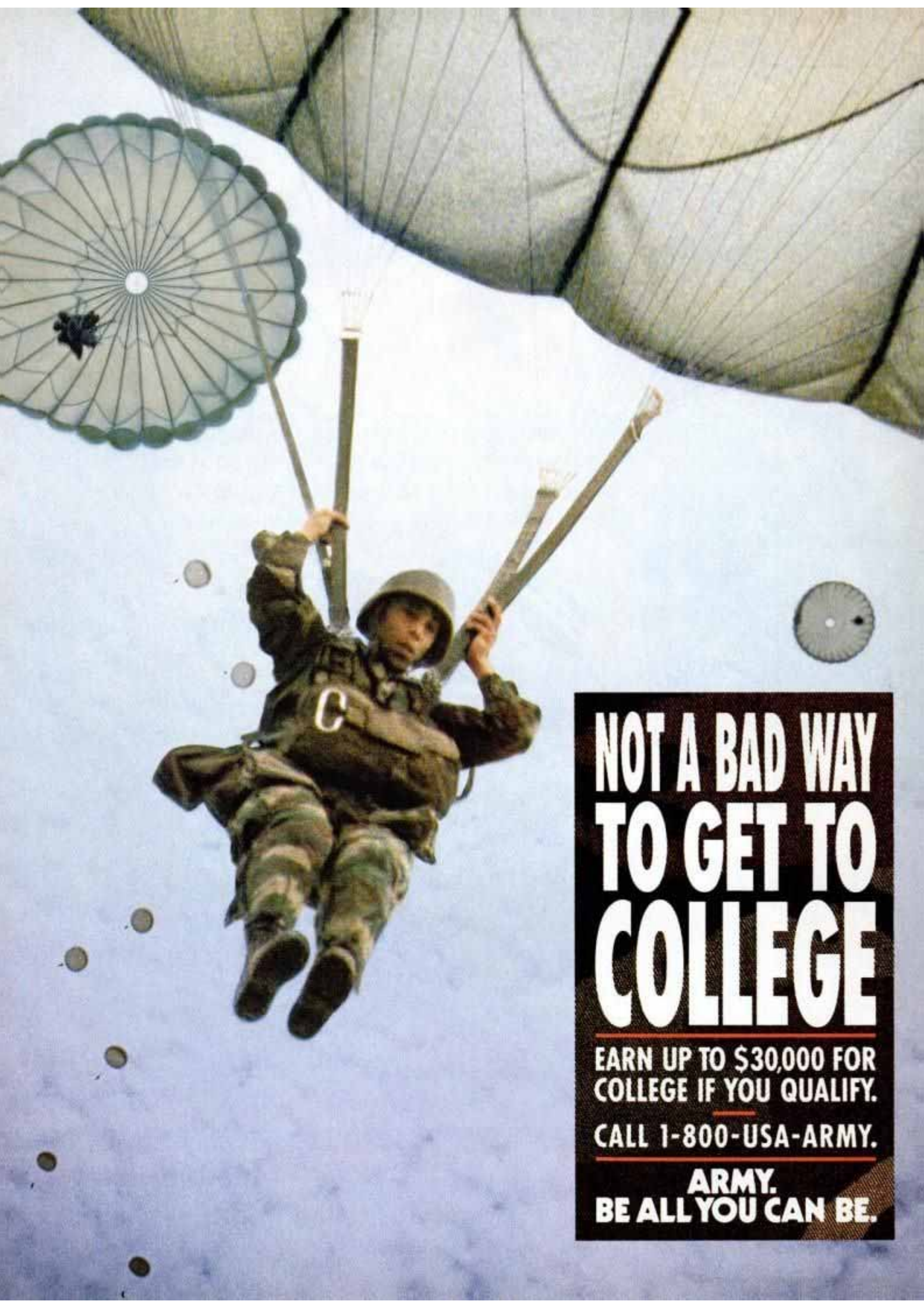


SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

INDY'S GONNA BE SMOKIN'!

Forget horsepower. CAMELPOWER is here. And on August 6, Smokin' Joe's Racing is gonna take on the Brickyard 400™ at Indy®. So get to the track, and bring your Camel Cash C-Notes to the Camel store. 'Cause the action's gonna be hot, and the deals will be smokin'.





**NOT A BAD WAY
TO GET TO
COLLEGE**

**EARN UP TO \$30,000 FOR
COLLEGE IF YOU QUALIFY.**

CALL 1-800-USA-ARMY.

**ARMY.
BE ALL YOU CAN BE.**

TECH UPDATE

News Of Tomorrow's Technology Today



Largemouth Jet Could Swallow Its Sonic Boom

WHITE PLAINS, NY—Knifing through the sky at twice the speed of sound, the Concorde SST leaves a wake like a string of firecrackers. The sonic-boom trail erupts as the jet's nose parts the air in front of it. Objections to this racket are what keep the plane from flying supersonic over the United States. But to silence those complaints, a plane would have to break the sound barrier without shattering the sky.

Leonard Greene, a prolific aerospace inventor, believes he has the solution. Instead of muscling the sky aside, why not stifle the sonic booms by shoving the air down the aircraft's throat? Greene's newly patented aircraft design does just that.

The concept isn't new. During his days at Grumman Aircraft, Greene demonstrated aircraft wings and ballistic models that funneled air internally to squelch shock waves. Now president of Safe Flight Instrument Corp., Greene has adapted the princi-

ple to a 250-passenger Mach-3 airliner.

The jet would simply punch a core through air in its path, with a rectangular fuselage of uniform cross-section. In supersonic flight at 60,000 ft., the air would rush into a wide-open aperture. A hinged ramp in the plane's nose would ram-compress the air, squeezing it through a duct running below the passenger compartment. Turbo-ramjets would add thrust. Then a similar ramp in the rear would permit the air to expand, exhausting through a hole of the same dimensions as the front opening.

The air would thus contract and dilate with scant disturbance, mini-

Greene's machine opens aperture to gobble air during supersonic cruise. It closes up for takeoff and landing.

mizing sonic boom. The wings, highly swept deltas, would also contribute little to shock noise.

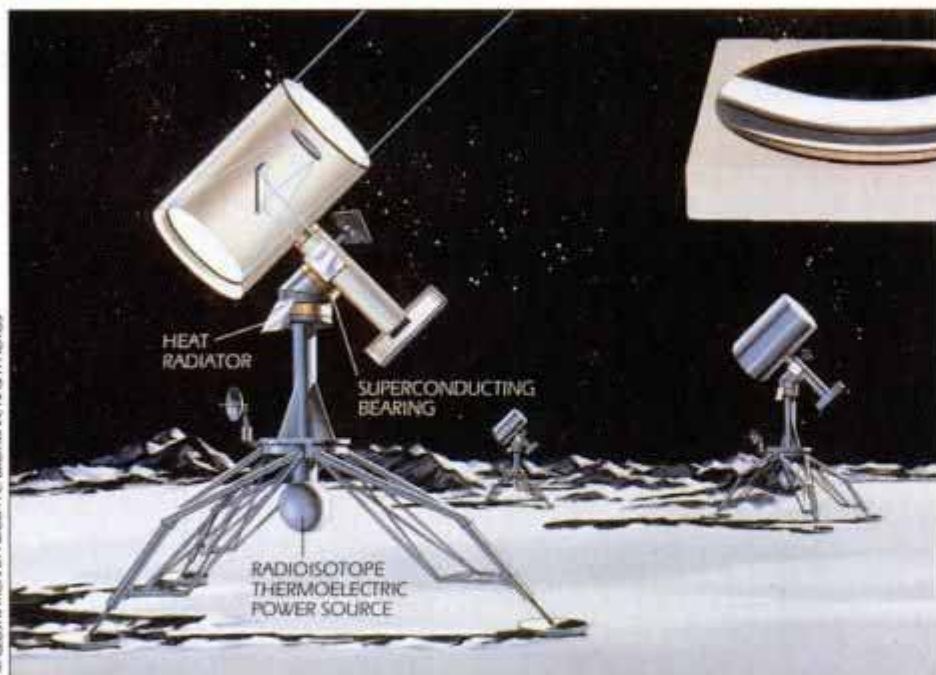
During travel at subsonic speed, the front ramp would articulate downward to shrink the opening and avoid unnecessary ram compression. This shift would also provide forward vision to the cockpit during takeoff and landing.

Greene has assigned patent rights to Boeing Aircraft, one of several aerospace giants developing high-speed civil transport for the next century.

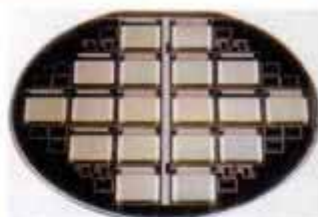
Highlights This Month

- **Space From Space**—Telescopes for the lunar surface.
- **Ice Jamming**—Sea rover charts the unseen Arctic.
- **Lawn Ranger**—Robot will graze while you laze.
- **Mason Automation**—Stonecutting goes high-tech.
- **Drive-By Power**—Turbines harvest roadside breezes.
- **Surgical Strike**—Fighter gear for the operating room.
- **Air Burden**—Giant blimps as cargo haulers.

Editor/Writer: Gregory T. Pope
Reporters: Philip Chien, Mike Fillon,
William Garvey, Scott Gourley, Barry Rosenberg,
Bridget Mintz Testa



FM ILLUSTRATION BY ADOLPH E. BICHTMAN; NASA PHOTOS



Telescopes would gaze the from Moon. Graphite-epoxy mirror and CIDs (above) make instruments light and ray-proof.

Three key components make their approach possible. First, high-temperature superconductors would levitate frictionless bearings on which the telescope would slue around. Since the Moon is already chilly, the superconductors would need only passive heat radiators to keep cool.

Second, the optics would be made of graphite-epoxy. The group has carved mirrors from spare graphite-epoxy shuttle tiles sheeted with the proper reflective coating.

Third, charge-injection detectors, or CIDs, would capture the images. These chip arrays are 100 times more radiation resistant than the charge-coupled detectors used in current space telescopes.

Star Search From The Moon

GREENBELT, MD—Astronomers have long eyed the Moon as a prime site for a telescope. Now technology is catching up with their yearnings. A

group of researchers out of NASA's Goddard Space Flight Center has put together a proposal for lightweight but productive lunar telescopes.

Do-It-Yourself Landing Strip

HANSCOM AFB, MA—The Air Force has developed a portable precision guidance-approach system that can turn any austere landing site into a Category I airstrip.

Typically, such systems are very large and take months to install. But the AN/TRN-45 Mobile Microwave Landing System, built by Textron,



DOD/AF/AFM

weighs only 850 pounds and sets up in less than an hour. Yet it allows military aircraft equipped with microwave-landing avionics to touch down when visibility is under half a mile and the ceiling drops to 200 ft. During

operational testing, the hardware worked while standing in 18 in. of water. An azimuth antenna gives a pilot left-and-right guidance during approach, while an elevation antenna provides a guideslope. A third beam flashes out from a distance-measuring antenna, supplying range from the airstrip.

The system was designed expressly for rapid deployment. Expected to be FAA-certified soon, it could find civilian applications.

Instant airport runs off generators or its own rechargeable batteries.

Power Assist For Pedalers

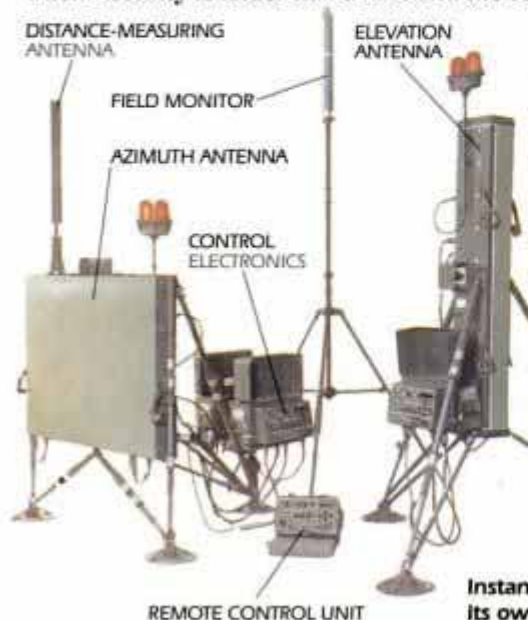
ALAMEDA, CA—When hills drain you of juice, the ZAP Power System can contribute its own. Made by McGreen Development, the system runs off a gel-cell lead-acid battery and can supply speeds of up to 20 miles per hour.

Each ZAP consists of one or two pancake-style motor rollers that engage the front wheel. To refresh the battery, the motors convert to generators when the rider coasts downhill or decelerates.

The power system adds between 5 and 8 pounds to a bike's weight, and the battery can tack on another 12 or 24 pounds.



ZAP Power System uses front-wheel rollers to lend electric power to pedaling efforts.





10⁹⁴
Every
Day



House Beautiful™ Flat Exterior House Paint
Protects against the elements so well, it's **guaranteed for 20 years**. Premium quality acrylic latex paint covers your house in just one coat. Mildew, blister, fade and chalk resistant. Mercury and lead free. **Sold exclusively at Wal-Mart.**



12⁹⁴
Every
Day

House Beautiful™ Gloss Exterior House Paint
Protects against the elements so well, it's **guaranteed for 20 years**. Premium quality latex covers in one coat and dries to a flat sheen. Mildew, blister, fade and chalk resistant. Mercury and lead free. **Sold exclusively at Wal-Mart.**



10⁹⁴
Every
Day



House Beautiful™ Exterior Primer Sealer
Protects against the elements so well, it's **guaranteed for 20 years**. Premium quality acrylic latex primer seals exterior surfaces, enhancing topcoat performance. Resists mildew, peeling and blistering. Blocks wood stains. Mercury and lead free. **Sold exclusively at Wal-Mart.**

MADE IN THE USA

“Even contractors get their supplies at Wal-Mart. They know they’ll find good quality paint here.”

Wal-Mart's exclusive House Beautiful paints are of superior quality. They're formulated with the finest resins and pigments to provide you with outstanding quality and value. And Wal-Mart can match paint in over 3,000 colors, so you'll get just the shade you want.

WAL★MART®

ALWAYS THE LOW PRICE.

Always.



Ron

Ron
Sales Associate
Hardware

**EZ Painter®
One Coater® Paint Brushes**

Bristlene filament bristles give one-coat coverage with application of one-coat paint, guaranteed!

MADE IN THE USA



One Coater® 1"
7004250600
244
Every Day



One Coater® 1 1/2"
7004250601
344
Every Day



One Coater® 1 1/2" sash
7004250605
394
Every Day



One Coater® 2"
7004250602
444
Every Day



One Coater® 3"
7004250603
594
Every Day



One Coater® 4"
7004250604
694
Every Day

EZ Painter® One Coater®

Seven piece paint kit includes: metal tray, deluxe 9" roller frame, One Coater® 9" semi-smooth roller cover, Trimline® Edger, 11" wood extension pole, plastic tray grid and roller cleaning aid. #7004250555

694
Every Day



294
Every Day

Premium Rust-Oleum Spray Enamel
Stops rust while providing superior coverage and protection. Dries in 2 to 4 hours. Comes in a variety of colors. 12 oz.

MADE IN THE USA



MADE IN THE USA

One Coater® 9" rough
7004250510
327
Every Day

One Coater® 9" semi-smooth
7004250502
247
Every Day

One Coater® 9" smooth
7004250500
247
Every Day

EZ Painter® One Coater® Rollers

Pronel fabric with flo-control carries more paint to surface. Guaranteed one-coat coverage with one-coat paints.



“Rollers, brushes, pads and edgers. We give you a lot of options when it’s time to paint.”

When it’s time to paint, Wal-Mart’s got you covered, inside and out. We carry a complete line of painting accessories to make the job easier. And they’re available every day at a low Wal-Mart price.

WAL★MART
ALWAYS THE LOW PRICE.
Always.



Ron
Ron
Sales Associate
Hardware



MIT SEA GRANT PHOTOS

Odyssey II, shown here during initial trials in New Hampshire, later mapped hidden underside of Arctic ice pack off Prudhoe Bay, Alaska.



1994: An Ice Odyssey

CAMBRIDGE, MA—Latest in a growing fleet of oceanographic robots (see *Tech Update*, page 22, June '93) is *Odyssey II*. Built by the Massachusetts Institute of Technology, the 360-pound submersible debuted beneath frozen Lake Winnepesaukee, New Hampshire, then headed north for a 9-day expedition in the Arctic.

Scouting the uncharted ice pack is just what *Odyssey II* was made for. The tetherless vehicle swims autonomously and, thanks to an acoustic navigation system, can maneuver freely through the fissures and fangs of the ice canopy.

Unlike its predecessor—the composite-hulled *Odyssey*—the second-generation robot keeps its electronic innards in an inexpensive vacuum-formed polyethylene shell. Another upgrade is an improved acoustic communications system. With it, *Odyssey II* can range over 170 miles.

During its Arctic expedition last March, *Odyssey II* mapped the ice's underside and gauged the conditions that lead to cracks. Ironically, an ice fissure ripped through the base camp, cutting the mission short. Next stop: hydrothermal ocean vents off the coast of Washington state.

Piecemeal Megamirror

KIRTLAND AFB, NM—Remember “fighting mirrors” from the heyday of the Strategic Defense Initiative? They were huge orbiting reflectors that would have ricocheted laser beams to intercept ballistic missiles.

Although laser missile defense has slipped from the drawing boards, the Air Force's Phillips Laboratory has forged ahead to demonstrate technology for these mirrors. Under contract, Itek Optical Systems has made two segments of a 13-piece mirror that would form a circle 36 ft. across—dwarfing even the record width of the Keck Telescope.



AIR FORCE PHOTO

A mere ½ in. thick, giant mirror segment rests on corrective actuators.

Exploratory Tree Surgery

GUILDFORD, ENGLAND—Like woodpeckers, skilled woodmen can hammer on timber and gauge its condition by ear. But a new method offers more precision—a decay-detection drill made by Sibert Instruments. The device pushes a blunt, hair-thin metal probe into wood and calculates decay from the variable resistance it encounters.



LONDON PICTURES SERVICE PHOTO

Decay-detection drill maps inner condition of wood by monitoring resistance as it penetrates.

The drill connects to a printer that provides a cross-sectional map of the wood. And the hole is slim enough to close up without leaving a gaping wound.

Beyond forestry, the tool is finding uses in preservation of historic buildings and ships.

Solar Lawnmower For Couch Potatoes

SHREVEPORT, LA—The sun made it grow, and now the sun cuts it down. An autonomous, solar-powered mower can wander across your lawn, trimming grass tips continuously—as long as the sun shines.

Marketed by Poulan/Weed Eater, the Belgian-designed robot operates within a perimeter defined by wires buried beneath the turf. An on-board sensor gauges the need for mowing by measuring the resistance that grass exerts against its rotating triangular blades. Other sensors detect obstacles, puddles and grass too wet to mow. The machine avoids all three. As a safety measure, the mower emits a piercing shriek if you remove it from its perimeter without deactivating its security system.



POULAN/WEED EATER PHOTO

Solar cells spin mower's blades directly, rather than feeding a battery. Unit grooms up to 13,500 sq. ft.

KAMAN INDUSTRIAL TECHNOLOGIES PHOTOS



Indiana Limestone's machinery has shaved hours off the production of finished stone.

work the rock. Huge 36-in. rip-and-joint buzz saws trim the blocks along two axes. Kerfing machines saw in the slots by which the limestone will be anchored to the building frame. If necessary, a third station carves ribbing or other surface-decoration motifs.

Previously, stoneworkers manhandled

a slab into place, strapped it down, machined it and carted it around on a forklift. A single piece of stone could take up to 6 hours to finish. But the new control line can finish the same slab in less than an hour.

The automated machinery was designed for Washington's gigantic Federal Triangle Building, which will require 800 truckloads of limestone.

Masonic Assembly-Line Robots

BEDFORD, IN—Stonecutting is one industry that automated manufacturing has not revolutionized. That is, until now. A robotic assembly line recently started up at the Indiana Limestone Co., whose rock graces structures from the Pentagon to the Empire State Building.

Huge slabs of limestone cut from the quarry now travel through a 140-ft. series of conveyors and cutting stations. Bedford Machine & Tool and Kaman Industrial Technologies teamed up to design the complex.

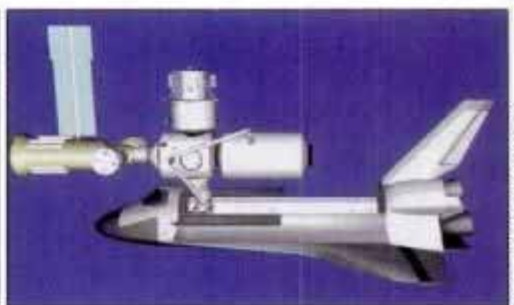
As the limestone moves from station to station, several machine tools

Dots Connect Space Station

HOUSTON, TX—Assembling the space station will pose an interesting problem. Standing in the crew compartment, astronauts will manipulate the shuttle's robot arm remotely. But station elements looming overhead will block their views, forcing them to operate half-blind.

The solution? Polka dots, courtesy of the Advanced Space Vision System.

Geometric patterns of 2- to 6-in.-wide dots will cover space-station elements. Cameras in the shuttle



NASA PHOTO AND ILLUSTRATION

Dot-based system was tested on '92 shuttle flight for future use during space-station assembly.

cargo bay and on the arm itself will look for these targets. Even with just a few dots, software can determine an element's size and location in space and

convey that data in visual and numerical form to the astronauts. The crew could then maneuver station elements around each other without seeing them.

Tail Wags The Dogfighter

EDWARDS, CA—In 1989, a United Airlines DC-10 crash-landed at Sioux City, Iowa. The jet had lost hydraulic power, and the pilot was forced to steer the widebody by varying engine

thrust. His propulsion-only heroics may have saved dozens of lives.

That's the inspiration behind an effort to develop a system that would let a pilot fly and land a jet using

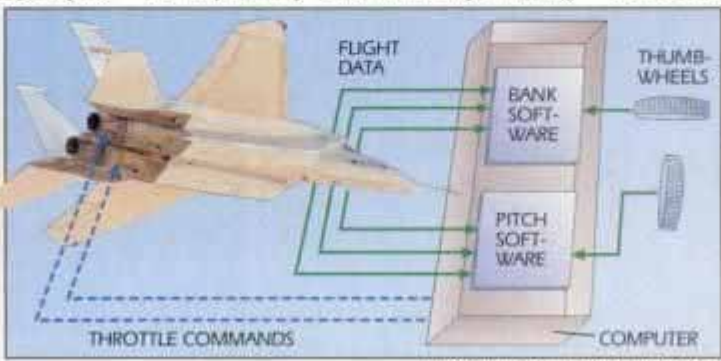
variable engine propulsion when control surfaces are disabled. Under this program, a NASA F-15—its normal flight controls deliberately locked—recently landed cleanly using engine power only. It was the first plane ever to make a successful propulsion-only touchdown.

Changes to the F-15's digital flight-control system include two thumbwheels to control pitch and banking. A computer translates thumbwheel motions into engine throttle commands.

NASA will install the system in a military transport plane as a step toward airline application.



Engines become steering mechanism in flight-control system that uses thumbwheels for input.



NASA PHOTOS, PM ILLUSTRATION BY TOM KANE

Because there are some things you can't put a price on, LeSabre's safety features are standard.

Driver and passenger air bags. Anti-lock brakes. A steel safety-cage body unit. And a range of other safety features, designed both to help you avoid collisions and to help protect you should one occur. You can't buy a LeSabre without them. To learn more, call 1-800-4A-BUICK.



BUICK

The New Symbol For Quality
In America.



 ©1994 GM Corp. All rights reserved.
LeSabre is a registered trademark of GM Corp.
Buckle up, America!

Freeway's Drive-By Wind Farm

ROYAL OAK, MI—Traffic barreling down Detroit's Southfield Freeway can whip up winds clocked at 15 to 20 mph. Why not put those breezes to work?

A string of wind turbines lodged in highway safety barriers could do just that, under a proposal by Vehilelectrical Power Systems.

The turbines would feature S-shaped blades mounted on flywheels. About 8 ft. high, they'd lie flanked in concrete to block off-angle currents that might slow them down. The blades would catch wind blasts from vehicles speeding by on each side, doubling the system's efficiency.

The electricity generated would flow either into a utility power grid or to an electric-vehicle recharging station.

Wayne State University engineers have concluded that expressway traffic blows enough predictable wind to warrant further study. Remaining questions: How expensive would it be to maintain the turbines? And how many of them per mile would be economically feasible?



Wind would rush through slots on each side of the crash barrier, spinning blades counterclockwise to generate electricity.

TM ILLUSTRATIONS BY ED VALIGURSKY

Big Green Electric-Drive Machine

SANTA CLARA, CA—Still think electric cars are wimpy? Go tell it to the Marines. They're testing a 30-ton amphibious assault vehicle fitted with an electric drive system.

Built by United Defense L.P., the Advanced Propulsion System demonstrator starts with a hull from the LVT-7 program. The power package consists of a 750-hp rotary engine coupled to a 750-kilowatt alternator. A power-electronics assembly distributes the current to high-speed induction motors.

Two of these motors turn the left and right drive sprockets. Two more power the waterjets for amphibious propulsion. And two electric fans cool off the powerplant. Despite all this machinery, weight and efficiency are on a par with traditional mechanical drive.

The system lends design flexibility for positioning the drivetrain. And the big alternator can juice up future electric subsystems such as weapons and armor.



Electric-drive amphibious assault vehicle will test technology in joint Marines-Army demo program.

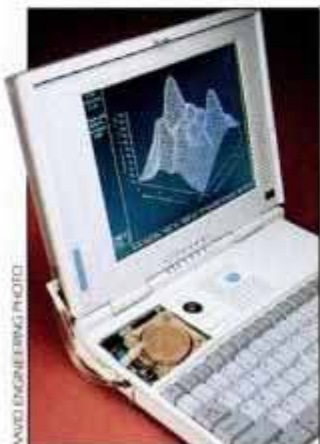
UNITED DEFENSE L.P. PHOTO

Chip Refrigerator

LACONIA, NH—Computer chips just keep getting denser and more powerful. Cramped inside a notebook computer, they can frazzle in their own heat. And cooling fans—the usual remedy—take up too much room for portables.

AAVID Engineering has designed an unusual solution—a passive cooling system with no moving parts. A lightweight copper-plastic condenser lies over the chip. The chip's heat boils a working fluid, sending the vapor through a tube to a condenser behind the display screen. There the gas cools to a liquid, which with gravity's aid drops back down to the evaporator.

Needing only 1/4 in. of clearance, Oasis cooling system uses inert Fluorinet fluid and leak-proof medical plastics.



AAVID ENGINEERING PHOTO

Nuclear Fusion In A Pinch

LONDON, ENGLAND—You usually find plasma physicists swarming around large fusion reactors. But not everyone who wants to study plasmas can

shell out a billion dollars for a tokamak reactor.

At Imperial College, physicists can replicate the core of a star with a much cheaper alternative. The machine is the Mega-Ampere Generator for Plasma Implosion Experiments, or MAGPIE.

MAGPIE's four pulse generators send 2 trillion watts into an optical fiber. Heated beyond 180 million °F and crushed by magnetic forces, the fiber becomes a thermonuclear plasma for a split second. The technique, called pinch fusion, actually predates the magnetic-confinement fusion that occurs in reactors.

MAGPIE generates fusion for research without the expense of a full-blown reactor.



LONDON PICTURES SERVICE PHOTO

New! Start Your Career Today!
No Royalties!
No Commissions, Ever!

Reg. Price \$499. Limited Time Offer!

Tired of working for someone else? Order any of Thoughtware's professional versions of our "Click & Grow Rich™" windows software products, and I'll guarantee that you'll be earning more money within 60 days than your present employment or

I'll refund your money! Don't quit your present employment, start part-time and when your business grows then go full-time. Operate from your home or office. Choose from any of the following. Read on.

1. COMPUTER CAR DEALER



Earn \$100's a deal helping your clients choose, buy and finance new and used vehicles.

Using the professional version of the Intelligent Car Buyer you'll help clients:

1. Choose the exact car, color & options,
2. Arrange leasing or financing,

3. Set up a bidding war between new car dealers, guaranteeing the absolute lowest price & best warranty on the car of your clients dreams.

Without ever leaving your computer!

Turn the tables on intimidating car salesman for your clients. Includes: Training & marketing materials, brochures, client contracts, & professional version of Intelligent New Car Buyer. **Just \$299 +\$9.50. Call today!**

2. COMPUTER STORE



Whether your client is looking for a complete system, software package, new monitor or a bigger, faster hard drive? **Intelligent Computer Buyer** will help you find it. **Intelligent Computer Buyer** allows you to set-up a bidding war between vendors, guaranteeing you the best price and service for your clients.

Earn hundreds of dollars without ever

leaving your computer. Select the exact computer(s).

Choose brand, speed and size of memory or resolution of every component, including CPU, monitor printer and software, etc... Specify type and length of support and warranty. **No inventory Needed!** Includes: Training & marketing materials, brochures, client contracts, & professional version of Intelligent Computer Buyer. **Just \$299 +\$9.50. Call today!**

Fax, mail or phone in bid sheet to your choice of over 250 computer hardware & software resellers to guarantee you the best price on any hardware or software purchase. Information on resellers include: Type of product or service, address, toll-free order # & FAX#.

3. PROFESSIONAL CREDIT MANAGER



Earn \$100's a day helping clients manage and repair credit.

Credit Repair: Use Instant Credit to automatically order free personal credit reports & contest negative credit information for your clients. Instant Credit follow-up forms will insure contested items have been permanently removed from credit files.

Credit Negotiations: Instant Credit provides forms that allow you to negotiate with your clients creditors:

1. A reduction in debt;
2. More favorable payment terms;

3. Full or percentage payment if negative items are removed from credit file.

Credit Management: Help clients find the best credit card values. Fill out one major credit application and Instant Credit automatically fills out over 300 bank, retail, & gas credit card applications per client. Including the leading gold and secured bank credit cards.

Each application includes: Fax#, 800#, & mailing address, allowing you to fax, mail or phone in applications.

Search the card database by: current rates, annual fees, geographic area or type of card, including gold, student, rebate, retail, gas or secured card.

Bonus: Information on how your clients can legally establish a new credit file. Includes: training & marketing materials, brochures, client contracts, & professional version of Instant Credit. **Just \$299 +\$9.50. Call today!**

Save Hundreds with Personal Versions!

Personal Versions: Order personal versions of any of the above advertised business products for only \$39.95 each or \$149.95 for all four products. A savings of \$19.85. Great Gifts. Order today!

Generic applications created by Instant Credit are not accepted by some credit card issuers. Upon request they will send you applications that are acceptable to them. Shipping time will range from 2 days to 6 weeks depending on availability. Thoughtware makes no guarantee that the purchaser to the amount of money that may be earned or if the purchaser will be successful. Intelligent New Car Buyer, Instant Credit, Thoughtful Moments, Click & Grow Rich, Intelligent Computer Buyer are all trademarks of Thoughtware, Inc. of Utah. All other product names are trademarks of their respective companies. For retail sales contact Ernie Hemple at -801-224-6825. Environmentally responsible packaging. System requirements: Microsoft Windows 3.1, 31/2" Disk, 2Meg RAM, 5MB Available HD Space.

You will never see an offer with greater potential no matter what the investment! This is your opportunity. Call and order today!

Earn More Money Than Your Present Job in 60 days or I'll refund your Money!

Kiss that boring job goodbye!
Start your own business.
Just \$299!

4 Different New Exciting Businesses for the 90's.



4. PROFESSIONAL RELATIONSHIP MANGER

Thoughtful Moments is about people. It's about knowing who they are and what they want out of life. It's about making others feel important. It's about knowing when to send roses or simply say "We appreciate the job you're doing", it's about success!

Thoughtful Moments is a relationship management program. It is designed to help businesses and individuals succeed by staying up-to-date in 9 areas of personal and business relationships and respond instantly to any special needs with a letter, card or gift.

When your clients subscribe to your relationship management service, they will save time, enjoy greater client and employee loyalty and hopefully improved personal relationships.

As a relationship manager you will use personal contact, classified ads and direct-mail to acquire clients who will contract with you to gather & maintain personal information on important personal and business relationships. You will also profit by selling flowers & gifts to your clients.

Ultimately, **Thoughtful Moments is about your success.** The more you help businesses or individuals succeed, the easier it will be for you to acquire additional business. As a professional relationship manager, you will earn money building relationship databases, maintaining relationship databases and reselling personal copies of Thoughtful Moments. Each copy of Thoughtful Moments also includes **JUST DO IT**, a lifetime goal management program. Includes: Training & marketing materials, brochures, client contracts, & 1 professional version of Thoughtful Moments. **Just \$299 +\$9.50. Call today!**

LightSpeed Micro™ Warehouse

Stack em' deep & sell em' cheap!

All products require a fax, computer and printer. So we've arranged with our sister company, LightSpeed Micro™, to offer:

1. **LightSpeed Micro™ Cyrix 486DLC-40 Equipped with 4MB RAM, 250 MB Hard Drive, 14" SVGA Non-Interface Color Monitor, Only \$995. Lowest Price on Earth!**

2. **LightSpeed Micro™ Pentium 60, PCI, 4MB RAM, 250 mb HD, 14" SVGA Non-Interface color monitor. Only \$1,995. Lowest Price on Earth!**

3. **LightSpeed Micro™ DX2-50 Notebook! Dual Scan Color, 4MB RAM, 200 mb HD, PCIMCIA Slot. Only \$2,595. Lowest Price on Earth!**

Call for prices on software, FAX modems & printers.

For Credit Card Orders- CALL DEPT. PM 0794

1-800-975-6300

60 day unconditional money back guarantee!

I guarantee the lowest price & the highest quality or I'll refund your money!

You have my word! Ernie Hemple, C.E.O. Thoughtware, Inc.

Save \$100 When you order any computer with professional program. Order today!

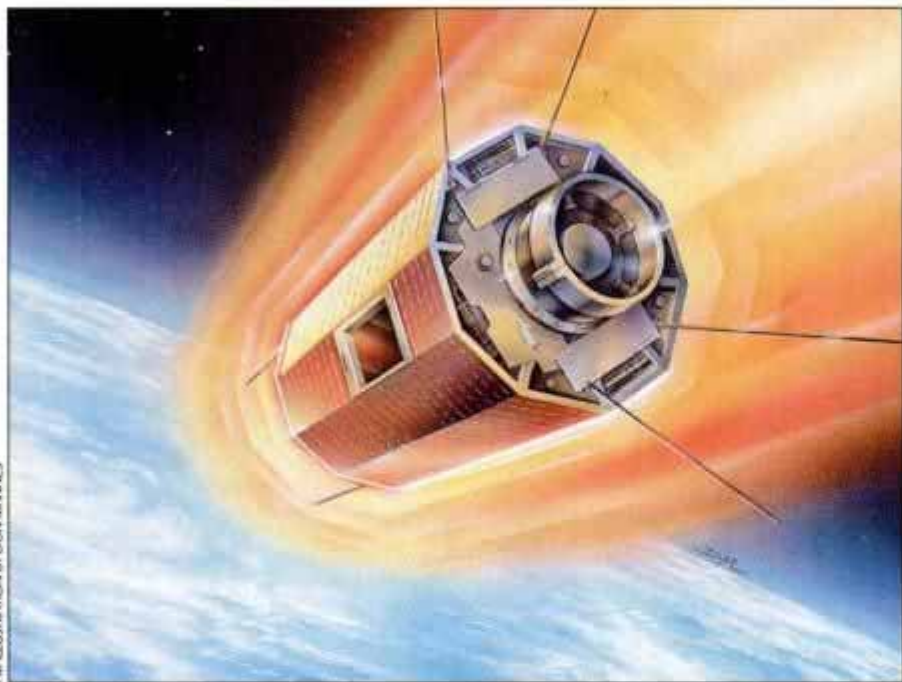


Thoughtware Inc.

1799 N. 80 E. Orem, UT 84057

Need stock orders or other address. Call number 801-224-6825.

1. COMPUTER NEW CAR DEALER
2. COMPUTER STORE
3. PROFESSIONAL CREDIT MANAGER
4. PROFESSIONAL RELATIONSHIP MANAGER



PM ILLUSTRATION BY DON MARINES

Bremsat reenters atmosphere, measuring interaction between itself and air molecules.

Satellite Goes For The Glow

BREMEN, GERMANY—Once Earth's gravity drags it back into the atmosphere, a satellite's work is over. Not so with Bremsat. The trashcan-size probe, ejected from the shuttle last February, will churn out results until air friction melts it into a man-made meteor.

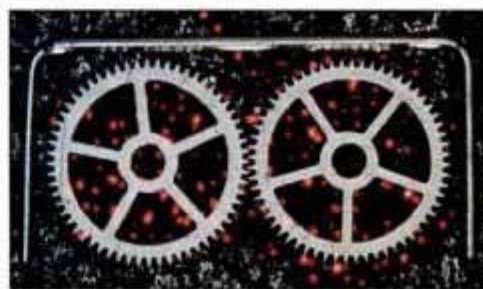
Built at the University of Bremen, the device will be the first satellite to garner data during all three stages of spaceflight—launch, orbit and reentry. Bremsat carried out automated heat-transfer experiments as the shuttle *Discovery* rocketed into space. Since its release into free orbit, the satellite has been probing the density of dust and oxygen. Once its orbit decays to 106 miles, Bremsat will monitor the hypersonic airflow around its shell. During its final hours, four rear stabilizers will lock Bremsat into an aerodynamic flight path—until it burns up.

World's Biggest Micromachines

UPTON, NY—Pinhead-size motors, gears and other micromechanical devices have tantalized researchers for years. While engineers have had success fabricating these minute machines, they haven't found the killer application that would justify high-volume manufacturing.

So why not just make 'em bigger? At Brookhaven National Lab, physi-

cists have used X-ray lithography to carve devices several inches wide. The key: high-energy synchrotron radiation that can penetrate thick sheets of X-ray-sensitive material. The material can then become a mold for metal or plastic parts. Even at large scale, the technique preserves the microscopic precision of X-ray lithography.



BROOKHAVEN PHOTO

Used on micromachines, X-ray lithography whittles gears framed here by paper clip.

Battery's Turbo Charger



PM PHOTOS BY MICHAEL A. SCHWARTZ

NORCROSS, GA—Seeking to jump-start the electric-car revolution, a new technique can recharge lead-acid batteries in less than 20 minutes.

Electric Power Technology Inc. (EPTI) showcased its system last February by running an electric Chevy S-10 pickup a record 831 miles in 24 hours.

EPTI's apparatus is a variation on Russian technology that introduces a short discharge pulse during the charging process. The pulse breaks up a layer of charged particles around the battery plates, reducing the battery's resistance. The battery can thus be recharged at higher currents without overheating.

In addition, the technique doesn't promote the large lead-oxide crystals that accumulate as batteries are repeatedly recharged.

The size of a coat closet, EPTI's battery charger revitalizes lead-acid batteries in less than 20 minutes.



Shock Photography



LEONARD WUERSTEL PHOTO

HAMPTON, VA—No, it's not a secret aircraft. It's merely a T-38 flying at Mach 1.1, photographed with a new technology that captures shock waves on film.

An adaptation of Schlieren photography, the technique was developed at NASA Langley Research Center. At the camera's focal plane lies a mask with a thin slit, which shuts off all but a sliver of the Sun's edge.

As the plane flies between the Sun and the camera, the film races beneath the mask at a synchronized speed. At supersonic speed the plane touches off shock waves, sharp gradients in air density. These gradients register on film because the sliver of sunlight refracts differently through the different air densities.

Look who's coming to your workshop.

Join John Ratzenberger, with help from his special guests and experts, each week exploring America's favorite hobbies, pastimes and much more.

Coming soon to a television near you!



Sponsored by:



WOODCRAFT

Quality Tools Since 1928

For Free Catalog Call:
1-800-542-9115



THE
POWER OF THE
PROS



DELTA
WOODWORKING MACHINERY



1-800-438-2486

Unique hobby or product? We'd like to hear about it (305) 892-2900 fax (305) 892-2004



Unmanned Skylon, 270 ft. long, would fly at a speed of Mach 5 before converting to rocket mode.

HOTOL itself has mandered on the drawing boards, the concept reduced to a straightforward rocket vehicle (see "Space Race 2000," page 24, March '92). But Bond is back with a fresh design. Called Skylon, it picks up where HOTOL left off.

Once again, hybrid powerplants propel this new spacecraft. Called synergistic air-breathing and rocket engines, or SABREs, these breathe air during the vehicle's horizontal takeoff. Once Skylon reaches 16 miles, they convert into rockets to boost the vehicle into orbit.

The fuel-efficient SABREs are more rocket than jet. But unlike liquid-air-cycle rockets, they use gaseous oxygen ducted in from the atmosphere during air-breathing flight. In rocket mode, they burn liquid-oxygen/liquid-hydrogen fuel.

A Skylon could loft a 10-ton payload for about \$6 million, says Bond.

Bond Is Back, With Skylon

STANFORD IN THE VALE, ENGLAND—Bond. Alan Bond. Ten years ago he unveiled plans for the HOTOL, a unique reusable launch vehicle pow-

ered by hybrid air-breathing/rocket engines. Until recently, those radical powerplants, dubbed SATAN, were among Britain's top state secrets.

Surgical Strike From The Air Force

WRIGHT-PATTERSON AFB, OH—Automatic target recognition is a boon to the strike-fighter pilot. A jet's suite of sensors can detect hidden targets, run readings through a computer and distinguish a tank from a farmhouse.

The Air Force believes this same technology can help surgeons zero in on hidden tumors. Working with local hospitals and universities, Wright Laboratory is developing computer-assisted minimally invasive surgery

(CAMIS) that transfers cockpit technology to the operating table.

Key to the CAMIS concept is a surgeon's wand containing infrared, ultrasound and other anatomical sensors. A supercomputer interprets and fuses the sensor information, instantly sculpting a 3-dimensional image.

Ultimately, the image would appear on a helmet-mounted display.

A pre-prototype setup tested in Cleveland has cut surgery time and complications by at least 30%.



CAMIS borrows target recognition and helmet-mounted display from the cockpit.

Blimps As Beasts Of Burden



Scale model demonstrates concept for articulating cargo blimp nearly twice the length of the Hindenburg.

NEPEAN, ONTARIO—The numbers are staggering. Length: 1500 ft. Diameter: 200 ft. Height: 270 ft. Payload: 500 tons.

Yes, payload. Pan Atlantic Aerospace is proposing this colossal airship to haul cargo.

The blimp's immensity would reduce its per-ton cost to 11 cents per mile—a fraction of the cost of normal air freight. And while at 66 knots it's no match for a Boeing, the blimp could outrace trans-Pacific freighters.

To withstand wind gusts, the airship would articulate. Behind a motor-driven tractor module would trail a series of 200-ft. helium-filled segments, hinged where they join one another. Each

of these trailers would carry a hold bearing scores of standard shipping containers.

Since the cargo airship is basically a string of balloons with motors in front, Pan Atlantic believes it could deliver one for under \$50 million. The company hopes to begin building a 1200-ft. prototype soon.



THE BEST FOR LESS



PASSPORT 4500 SuperWide RADAR+LASER

"...a remarkable achievement..."

AUTOMOBILE

*"...delivers well-rounded
performance..."*

CAR AND DRIVER

*"One of the most effective units
on the market..."*

WAYNE THOMPSON, THE OREGONIAN

*"...sets a new standard for
combining superior range with
user-friendly urban behavior."*

AUTOMOBILE

Passport 4500 SuperWide+Laser has been getting a lot of compliments lately. And deservedly so. It's the best combination radar/laser detector on the market today – a perfect synthesis of performance, features *and* value.

And if you order right now, Passport 4500 SuperWide+Laser is an even better value than ever because we're taking \$30 off the purchase price! You pay only \$199 (regularly priced at \$229).

Passport 4500 SuperWide+Laser offers superior protection from every type of radar and laser used today. And its patented anti-falsing circuitry minimizes Ka falsing without decreasing detection sensitivity.

Now you *can* afford to own the very best. Order your Passport 4500 SuperWide+Laser today and save \$30!

FANTASTIC SAVINGS!

*Order a Passport 4500 SuperWide+Laser
today and we'll take \$30 off!*

To order, call toll-free:

1-800-433-3487

In Canada, call toll-free 1-800-467-5452

Passport® 4500 SuperWide **\$199**
(regularly priced at \$229)

Shipping & handling is additional. Ohio res. add 6% sales tax.

ESCORT

► Department 406874
5200 Fields-Ertel Road
Cincinnati, Ohio 45249

ESCORT
The Innovative Edge.™

© 1994 GM

ESCORT products are designed and manufactured in the USA.

*When you want
something better,
Aspire.*



INTRODUCING THE NEW FORD ASPIRE

THE LOWEST PRICED CAR WITH
STANDARD DUAL AIR BAGS.

When we designed the new Ford Aspire, we set out to prove that paying less for a car doesn't have to mean settling for less. So we gave it more of the things you aspire to in a car. We gave it a 3-year/36,000-mile bumper to bumper warranty.** We designed it to go 43 miles on a gallon of gas.† Aspire offers anti-lock brakes. And we made Aspire the only car in its class with standard dual air bags.

STARTING AT
\$8,240.*

EVERY ASPIRE PROTECTS YOU
WITH THE FORD ROADSIDE
ASSISTANCE PROGRAM.††

Help is only a toll-free call away should you or your family need a flat tire changed, lockout assistance or a fuel delivery. The new Aspire, from Ford. A new kind of car for anyone searching for something better.

* 1994 Aspire 3-door. Manufacturer's suggested retail price excluding tax, title and destination.

** Ask your dealer for a copy of the limited warranty.


† EPA estimated highway mpg.

†† 3 years/36,000 miles. See dealer for details.

Always wear your safety belt.

HAVE YOU DRIVEN A FORD LATELY?





RETURN OF THE ZEPPELIN

ZeppeIn NT aims to bring back the luxury of air cruising.

The most famous name in lighter-than-air transport is back with an airship for the 21st century.

BY WILLIAM GARVEY; PM Illustration by John Berkey

● Engineers and romantics who yearn for an airship renaissance congregate every other year at the AIAA Lighter-Than-Air Systems Technology Conference. There they kick back, cogitate and kibitz about dirigible doings. Sadly, apart from the tenuous progress of the Westinghouse Sentinel 1000 military surveillance blimp (see [Tech Update, page 21](#), Oct. '91), there's been little of late to talk about.

That's what made last fall's meeting in Phoenix so unusual. After two days of presentations on historical facts and hopeless fantasies, a trim man with a crim-

son face, snow-white hair and rigid bearing strode to the podium. In a heavy German accent, he explained that his company had designed a new airship. Without fanfare, he filled in technical detail, and it suddenly became clear that the project was not a dream scheme. No, his outfit was cutting checks and cutting metal. This airship would fly.

When the speaker stepped back from the microphone, momentary silence ensued, followed by a quick burst of applause. Attribute the crowd's reserve to a twinge of envy. After all, the engineer was Klaus

RETURN OF THE ZEPPELIN

Hagenlocher of Luftschiffbau Zeppelin, the program manager for the LZ N07. That's right, Zeppelin is back.

Unknown to many, the company founded by Count Ferdinand von Zeppelin did not evaporate after the *Hindenburg* disaster of 1937. Today Zeppelin is a multibillion-dollar conglomerate with 20,000 employees engaged in construction and manufacturing. As Hagenlocher told his audience, the LZ N07 "is a phoenix for the Zeppelin organization. It is the resurrection of the airship concept."

Despite its long absence from the scene, the company has kept the balloon up, monitoring airship technology. A few years ago, Zeppelin concluded that economical, safe and durable airships would fly in today's market.

Specifically, the LZ N07—a ship just bigger than Goodyear's *Spirit of Akron*—would suit environmental monitoring, scientific experimentation, surveillance and police work. Meanwhile, a bigger version—the LZ N30—would hold 1 million cu. ft. of helium. Able to loft more than 50 paying passengers, this ship would pioneer an air-tourism business with voluminous potential.

But these two dirigibles—together tagged NT for "new technology"—aren't Goodyear retreads. Instead, they're designed to deflate airships' biggest faults: their awkwardness at the airport and the resulting high operational costs.

Airships have always resembled lumbering

dinosaurs during low-speed ground operations. Sheer mass, sprawling surface area and small props and powerplants leave them vulnerable to winds. Even with a squadron of heavyweights pulling cables, airships sometimes smash into things.

Zeppelin's solution? A 4-rotor, vectoring propulsion system. By quickly swiveling up to 120° from horizontal to vertical, the NT's two main props can counteract downward gusts or inertia. But what makes the NT unique are two more drives at the rear. One faces sideways, like a helicopter tail rotor. The other faces backward. Like the main props, it too can rotate from horizontal to vertical.

Happy landings

Thanks to this arrangement, the Zeppelin NT has pitch-yaw control that's unprecedented in an airship. By varying the props' vector and thrust, a pilot can fly a smooth, controlled approach without relying on a small army of ground workers to strong-arm his ship into submission.

Another NT novelty is its on-ground securing system. Typically, an airship dangles a single wheel, suspended on a flexible leg that extends from the gondola's center. The nose tethers to a ground mast, and the whole thing weathervanes. A ground crew

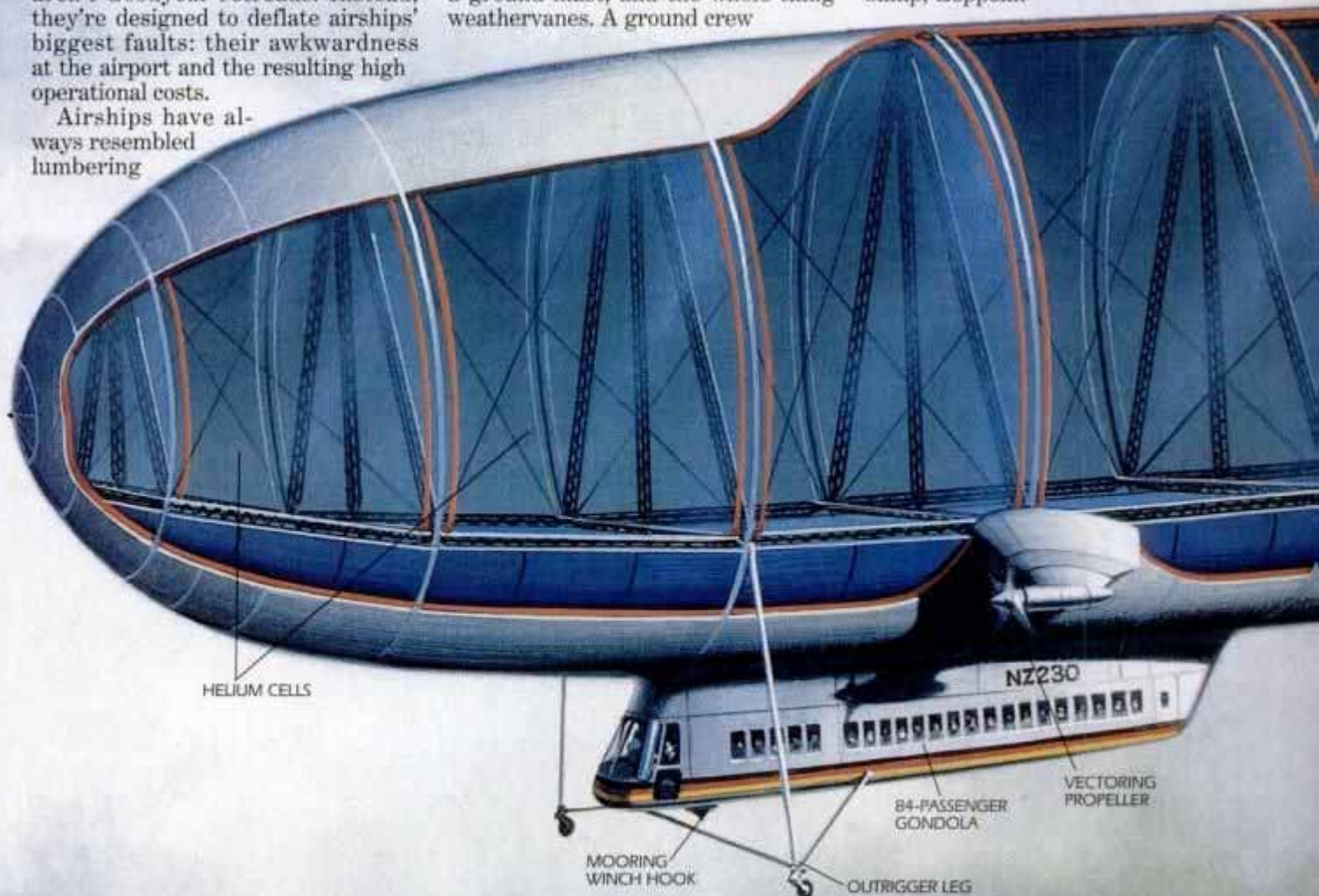
moves the ship by tugging on lines.

Zeppelin didn't like that approach. First, masts can be trouble. A mistake during coupling or decoupling can result in a speared envelope. Second, when a mast is required to secure a ship, a captain dare not venture far from one. Third, to work with a mast takes many hands, which require many paychecks, motel rooms and so on.

Hagenlocher and his engineers conceived a radically different system. The NT is equipped with two main wheels on long outrigger legs. When the ship comes in for a landing, a Kevlar cable tipped with a hook feeds out from the gondola's belly. A ground crewman slips the hook through an eyebolt on the ground. That done, the captain activates an on-board motorized winch, and the airship reels itself down.

Thus anchored, the ship can weathervane with the cable, rather than the nose, serving as the pivot point. Since this point still lies forward of the cabin and engine weight, there's no chance that a gust from the rear will nose the ship over. Meanwhile, a tail wheel prevents ground contact aft.

While a dozen or so personnel support a mast-dependent advertising blimp, Zeppelin



estimates its mastless NT needs no more than two or three people on ground chores. For the operator, that could save several hundred thousand dollars a year.

Hard core

Of course, the feature that separates the Zeppelin NT from all other modern airships lies hidden from view. A blimp maintains its sausage shape with gas pressure in an empty envelope. By contrast, the new Zeppelin has a forest of hard structures inside. For like all Zeppelins before it, the NT is a rigid.

Traditionally, rigid airships contained large ring-shaped girders connected by longerons, all built of aluminum. Huge gas bags lay between the rings, and thousands of tensioning wires strengthened this football-shaped framework.

The stiffness allowed designers to make old Zeppelins enormous. The *Hindenburg's* envelope loomed three times as long as a 747. And the resulting awesome lifting power meant they could load up with scores of passengers.

But size isn't everything. What appealed to engineers was the redundancy—and

thus safety—afforded by the multiple gas bags. Equally important, the internal framing offered a variety of hard points upon which to hang engines. The designers could tack powerplants and props on the tail and shift the side units off the gondola. That dramatically reduces cabin noise and improves efficiency.

There are two drawbacks, however. One is the cost of fashioning all those girders, beams and wires into a skeleton. The other is weight: The traditional structure is too heavy for a smaller airship.

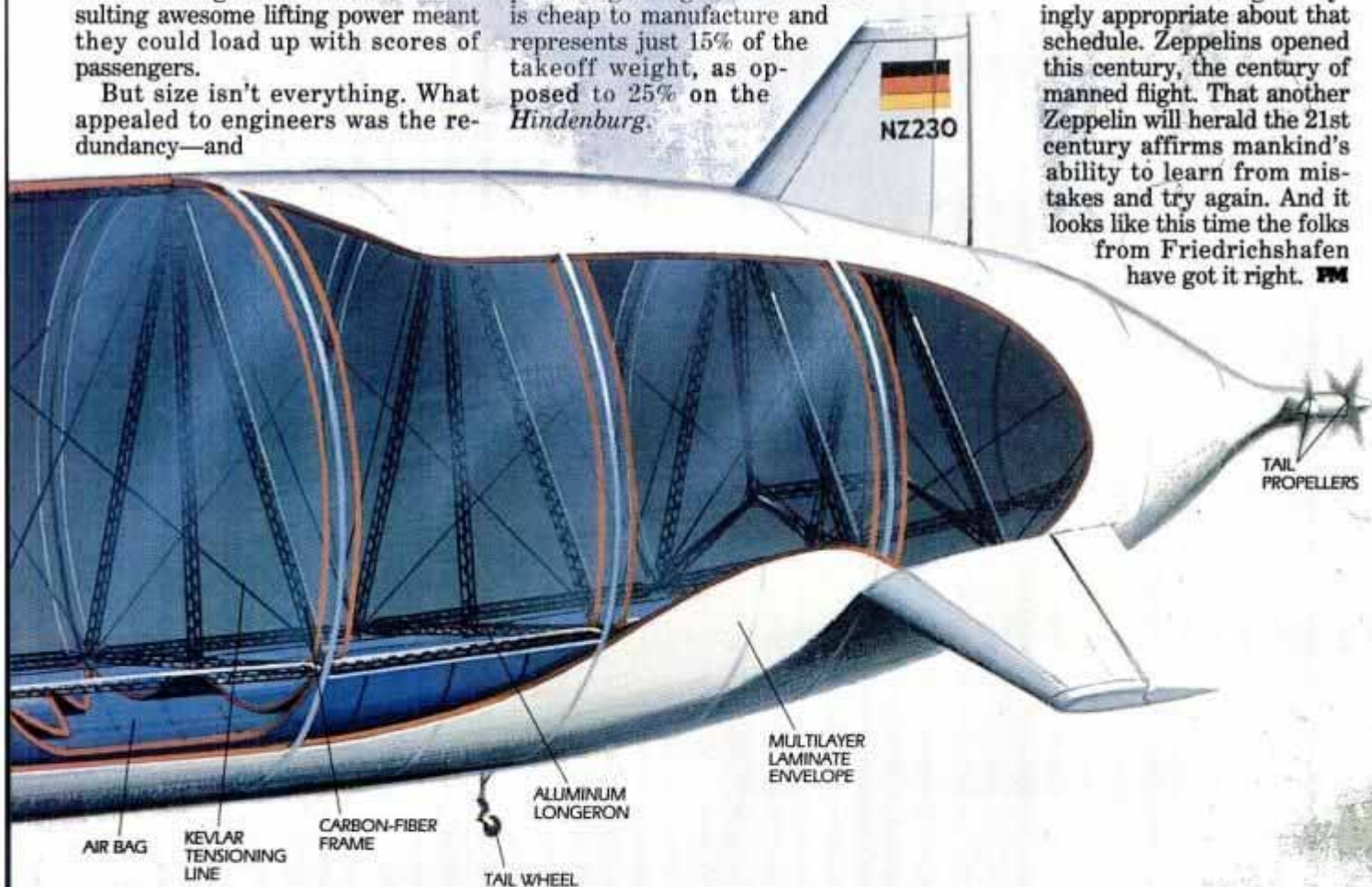
But Zeppelin engineered its way out of these problems. Hagenlocher's designers abandoned the ring skeleton in favor of huge carbon-fiber triangles connected by aluminum longerons. Tensioned with Kevlar wire, the structure is then wrapped in a multilayer Tedlar envelope. Both skeleton and envelope are load-bearing. Should either fail, the other can carry the ship's full weight. Simple and lightweight, the structure is cheap to manufacture and represents just 15% of the takeoff weight, as opposed to 25% on the *Hindenburg*.

Green light

How willing is Zeppelin to get all this innovation airborne? In January 1993, the company's executives gave the go-ahead to build the LZ N07 as a proof-of-concept demonstrator—a \$43-million decision. With a 225-ft. envelope, this mini-Zep will lift 15,320 pounds, 2 tons of which is payload. It will soldier along for 18 hours without refueling.

Before committing to the bigger LZ N30, Zeppelin will gauge the market's reaction to the N07 and assess the practicality of the new technology. If built, the LZ N30 will recall the majesty of the original Zeppelins. The envelope will be 360 ft. long, and the gondola will carry between 50 and 84 passengers. Altogether it will weigh 33 tons (without helium). Its 33,000-pound payload means it could carry enough fuel to fly for three days before heading for the pumps. If things go as anticipated, work on the LZ N30 would begin even as the N07 conducts its flight trials in 1997.

There's something satisfyingly appropriate about that schedule. Zeppelins opened this century, the century of manned flight. That another Zeppelin will herald the 21st century affirms mankind's ability to learn from mistakes and try again. And it looks like this time the folks from Friedrichshafen have got it right. **FM**



In the Zeppelin NT, the traditional ring-shaped girders are replaced with triangles. Between these frames are mounted buoyancy cells. Vectoring propellers, powered in this version by diesels, reduce the ship's vulnerability to wind gusts near the surface. Mooring winch hook and outrigger legs simplify ground operations.

COMPARISON TEST



GEO PRIZM LSI



MAZDA
PROTEGÉ LX



NISSAN SENTRA XE
LIMITED EDITION



TOYOTA
COROLLA LE

NEON LIGHTS

The brash little newcomer says "Hi!" to the competition.

● There's a new kid on the block. And there's no denying that it's a charmer. With a happy-go-lucky attitude and a darn-near irresistible look, this is one winsome little pup.

Trouble is, the new kid has moved onto one already very crowded block. But at this point in its resurgence, Chrysler Corp. is hardly going to be fazed by a little population density.

Without stopping at Go, the No. 3 domestic carmaker follows the success of its LH family of large sedans and the Dodge Ram pickup truck with its identical subcompact Neon twins.

Thanks to some seriously clever advertising and advance publicity, these small front-wheel-drive sedans have received a warmer welcome at your local Dodge and Plymouth dealerships than de Gaulle did when he marched through the Arc de Triomphe.

But unlike the liberated Paris of 50 years ago, the Neon is not about to step out to the instant adoration of frenzied locals. No, the cheeky little sedan must face some very competent adversaries. To see just how much

BY DON CHAIKIN, Automotive Editor
PM Photos by Bill Delaney

substance the Neon has to back up its advance notices, we took a Plymouth-issue variant and threw it in against eight of its most direct 4-door sedan rivals: Ford Escort, Geo Prizm, Honda Civic, Mazda Protegé, Mitsubishi Mirage, Nissan Sentra, Saturn SL and Toyota Corolla.

All of the players in our test group represent the heart of the market. Each was dressed nicely in mid- to high-level trim with air conditioning and an AM/FM stereo. Despite some minor variations in optional equipment (power windows, sunroof, etc.) the major differentiator among them was transmission. Four of our group were self-shifters, the rest depended on the driver to stir through the gearbox.

To fully evaluate the field, we did more than squeeze each car for its maximum performance at Los Angeles County Raceway's quarter-mile and the skidpad and handling course at Willow Springs. We spent the

better part of a week driving around the high desert of Southern California, rotating nine different drivers through each of the vehicles.

Plymouth Neon Highline

Chrysler's management charged the Neon design team with developing a small, economical and inexpensive car that gave customers all that they wanted and expected in terms of comfort and performance. Did we mention affordable? We'll mention it again.

The result is the well-publicized \$8795 Neon base price. For that money you get a roomy, snappy, comfortable 4-door sedan with a spunky 2.0-liter dohc 4-cylinder engine, a 5-speed manual, dual airbags, 4-wheel independent suspension and a warranty that you know will be honored by a solvent, honest-to-goodness American carmaker. However, you get precious little else. And as this is being written, there are about as many \$8795 base Neons as there are happy kids at dentists' offices. Truth is, most of the Neons are Highline models—like our



**FORD
ESCORT LX**



**MITSUBISHI
MIRAGE ES**



SATURN SL2



HONDA CIVIC EX



**PLYMOUTH
NEON
HIGHLINE**

tester—which start life with a \$10,690 base price. The Highline designation brings with it such additional items as an AM/FM stereo radio, low-back front bucket seats with adjustable head restraints, intermittent windshield wipers, added insulation and improved interior trim, among others. Perhaps not under nine grand, but still one of the bargains of the decade. Of course, once you add automatic transmission, air conditioning, anti-lock brakes and the assorted other goodies that adorned our test car, you end up with a price of \$13,987.

And therein lies the crux of the Neon. For about \$9000, this is one ab-

solutely fabulous automotive value. But once you're talking about parting with 14 grand, the clarity of the choice is suddenly somewhat less.

What is crystal clear, however, is that whether you shop at a Dodge dealer or a Plymouth store, you will find the same exact cars named Neon.

What's also clear is that each Neon is greater than the sum of its parts. If you inspect all the vital statistics, you'll see that—by and large—the Neon runs with the pack, with two very important exceptions. Its 2.0-liter Four has 7% more horsepower and nearly 12% more torque than any of the engines in our test group. How-

ever, the potency of the all-new sohc 4-cylinder is lost a bit through the 3-speed automatic. Truth is, while the Neon has a definite seat-of-the-pants sporty feel connected to your right foot, the Neon was more than 1.5 seconds slower to 60 mph than the Saturn, which boasts a 4-speed automatic. The Neon also saw the automatic-transmission-equipped Mitsubishi Mirage's taillights during the acceleration runs. Since there is no 4-speed automatic option for the Neon, if you want to gain full benefit of that peppy engine, select the 5-speed manual and bank the \$557.

While the lack of a fourth gear may have hurt the Neon's fuel economy as well, the car is more than respectable with its 3-speed. In more than 700 test miles, our smiling little Plymouth

NEON LIGHTS



FORD ESCORT LX



GEO PRIZM LSI



HONDA CIVIC EX

SPECIFICATIONS AND DIMENSIONS

MANUFACTURER/ MODEL	BASE PRICE/ PRICE AS TESTED	ENGINE/ DISPLACEMENT (liter/ci)	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./hp)
Ford Escort LX	\$10,550/ \$12,575	I4 OHV 1.9/116	88 @ 4400 rpm/ 108 @ 3800 rpm	front/ front	5-speed manual	98.4/ 170.9	56.5/ 56.5	66.7/ 52.7	F: 38.4/41.7/50.4 R: 37.4/34.6/48.0	2371/ 38.63
Geo Prizm LSi	\$11,230/ \$15,000	I4 DOHC 16V 1.8/110	115 @ 5600 rpm/ 115 @ 2800 rpm	front/ front	5-speed manual	97.1/ 172.6	57.5/ 56.5	66.3/ 52.8	F: 38.8/42.4/51.3 R: 36.1/33.9/57.5	2359/ 20.5
Honda Civic EX	\$15,740/ \$16,157	I4 SOHC 16V 1.6/97	125 @ 6600 rpm/ 106 @ 5200 rpm	front/ front	5-speed manual	103.2/ 173.0	58.1/ 57.7	66.9/ 51.7	F: 38.1/42.5/51.0 R: 36.3/32.8/51.3	2522/ 20.17
Mazda Protegé LX	\$13,185/ \$14,505	I4 DOHC 16V 1.8/112	125 @ 6500 rpm/ 114 @ 4500 rpm	front/ front	5-speed manual	98.4/ 171.5	56.3/ 56.5	65.9/ 54.1	F: 38.4/42.2/NA R: 37.1/34.6/NA	2487/ 19.89
Mitsubishi Mirage ES	\$12,579/ \$13,924	I4 SOHC 16V 1.8/112	113 @ 6000 rpm/ 116 @ 4500 rpm	front/ front	4-speed automatic	96.1/ 172.2	57.1/ 57.5	66.5/ 52.2	F: 39.2/42.9/55.0 R: 37.2/33.5/52.0	2295/ 20.31
Nissan Sentra XE Limited Edition	\$13,129/ \$13,704	I4 DOHC 16V 1.6/97	110 @ 6000 rpm/ 108 @ 4000 rpm	front/ front	5-speed manual	95.7/ 170.3	56.9/ 56.3	65.6/ 53.9	F: 38.5/41.9/51.2 R: 36.6/30.9/53.4	2438/ 22.16
Plymouth Neon Highline	\$10,690/ \$13,987	I4 SOHC 16V 2.0/122	132 @ 6000 rpm/ 129 @ 5000 rpm	front/ front	3-speed automatic	104.0/ 171.8	57.4/ 57.4	67.2/ 54.7	F: 39.6/42.5/50.8 R: 36.5/33.9/50.6	2248/ 17.03
Saturn SL2	\$12,595/ \$16,945	I4 DOHC 16V 1.9/116	124 @ 5600 rpm/ 118 @ 2400 rpm	front/ front	4-speed automatic	102.4/ 176.3	56.8/ 56.0	67.6/ 52.5	F: 38.5/42.5/51.7 R: 36.3/32.6/50.7	2334/ 18.62
Toyota Corolla LE	\$16,328/ \$18,508	I4 DOHC 16V 1.8/112	100 @ 5800 rpm/ 100 @ 4800 rpm	front/ front	4-speed automatic	97.0/ 172.0	57.5/ 57.1	66.3/ 53.5	F: 38.8/42.4/51.3 R: 37.1/33.0/54.3	2524/ 25.24

1. Times from a steady-state 40 to 70 mph. 2. Best speed achieved while weaving through 8 cones 100 ft. apart. Speeds provide index of transient response. 3. G-force generated during steady-state travel around a 200-ft.-dia. circle. Number is an average of best clockwise and counterclockwise. 4. Based on 12 basic maintenance functions.



PLYMOUTH NEON HIGHLINE



SATURN SL2



TOYOTA COROLLA LE

rolled through 28.1 miles for each gallon of no-lead. That's 3.5% better than the 4-speed-equipped Saturn managed. But it's also more than 1 mpg (and 5%) worse than the Mitsubishi Mirage delivered, and a shade below what the automatic-equipped Toyota Corolla managed. Once again, for full benefit, opt to shift gears for yourself and reap the benefits.

Besides its strong engine, the other place that the Neon jumps off the charts is its wheelbase. With 104 in. separating the front and rear axles, the Neon has the longest stance of any car in the group. Factor in its relatively short overall length—171.8 in.—and you come up with a well-bal-

anced package with a ride that's flat and well controlled in the European sport-sedan tradition. Add a well-tuned, fully independent 4-wheel strut suspension and you get an excellent combination of crisp handling and ride comfort. In fact, the Neon was nearly 2 mph faster through our slalom than its nearest competitor. On the handling course, the Neon was simply unflappable. Try as they might, our testers couldn't do anything but drive quickly and competently—the Neon simply would hang on up to its ultimate understeering limits in a very predictable fashion.

And on the skidpad, the Neon was part of a 3-way first-place tie.

In the translation from track to around town and country, the Neon's driving characteristics lose a smidge. Some of our drivers found the ride a trifle harsh and many found the drivetrain to be just a bit buzzy. Most wished for an additional gear or two.

Nobody complained about the room inside the Neon's cabin and everyone loved the attention to detail and superb appointments to be found inside. From the sun visors to the height-adjustable front shoulder belts to the cup holders, coin holders and large, easy-to-use radio controls, it is obvious that the Neon design team listened to the buying public. The generally comfortable, cozy and welcoming



HONDA CIVIC EX



GEO PRIZM LSI



MAZDA PROTEGE LX



MITSUBISHI MIRAGE ES



NISSAN SENTRA XE LE

TEST RESULTS

STEERING TYPE/RATIO (overall)	TURNING CIRCLE (ft.)	WHEELS/TIRES	BRAKE SYSTEM FRONT/REAR	FUEL ECONOMY (MPG EPA city/hwy.) PM test	ACCELERATION 0-60 MPH (sec.) 1/4-MILE (sec. @ mph)	PASSING ¹ ACCELERATION 40-70 MPH (sec.)	BRAKING 60-0 MPH (ft.)	700-FT. ² SLALOM MPH	200-FT. ³ SKIDPAD (lateral g)	PM ⁴ SERVICEABILITY INDEX
Power rack & pinion/17.0:1	31.5	14 x 5-in. steel/175/65R14	Disc/Drum 10.1-in. vented/9.0-in.	30/38 31.9	12.61 18.68 @ 73.7	9.3	164	52.1	.71	9.5
Power rack & pinion/22.7:1	31.5	14 x 5-in. alloy/185/65R14	Disc/Drum ABS 10-in. vented/7.9-in.	28/34 34.0	10.81 17.92 @ 78.0	8.2	158	56.5	.78	9.5
Power rack & pinion/19.3:1	32.8	14 x 5-in. steel/175/65RF14	4-wheel disc ABS 10.3-in. vented/9.4-in.	29/35 27.1	10.07 17.74 @ 78.6	8.2	152	55.0	.77	8.5
Power rack & pinion/Variable	32.2	14 x 5.5-in. steel/185/60R14	4-wheel disc 10.1-in. vented/9.9-in.	23/29 25.9	9.45 17.24 @ 80.6	8.0	154	58.6	.79	5.5
Power rack & pinion/18.1:1	35.5	14 x 5-in. steel/185/65R14	Disc/Drum 9.1-in./7.1-in.	26/33 29.7	11.19 18.32 @ 75.6	8.3	155	57.3	.74	6.5
Power rack & pinion/16.5:1	30.2	13 x 5-in. steel/175/70R13	Disc/Drum 9.4-in./7.1-in.	29/38 29.6	11.15 17.97 @ 76.7	8.0	177	56.4	.69	9
Power rack & pinion/18.0:1	35.4	13 x 5-in. steel/185/70R13	Disc/Drum ABS 9.5-in. vented/7.9-in.	27/33 28.1	11.81 18.70 @ 78.0	7.8	155	60.0	.79	7.5
Power rack & pinion/16.3:1	37.1	15 x 6-in. alloy/195/60R15	4-wheel disc ABS 9.9-in. vented/9.7-in. vented	23/32 27.1	10.21 17.77 @ 79.1	7.3	164	57.8	.78	10.5
Power rack & pinion/18.5:1	32.2	14 x 5.5-in. steel/185/65R14	Disc/Drum ABS 10-in. vented/7.9-in.	26/32 28.8	12.76 19.04 @ 73.2	9.0	158	57.5	.76	9.5



Neon's long wheelbase means real room front and back.

interior has an overall quality feel and look, but it does have its problems. Everyone lamented the lack of power window availability and the fact that the rear windows open only halfway.

All said and done, the Neon is going to make life in the already crowded market somewhat tougher for all competitors, and better for you.

Ford Escort LX

Ford has been selling lots of Escorts for a long time, and for good reasons. The current version of Ford's small car is a solid, affordable value. In fact, our Escort LX has the lowest

base price (\$10,550) of any car in our group and, equipped with such niceties as a/c, power windows and a CD player sound system, it also has the lowest sticker price: \$12,575!

However, a further look at the numbers shows that the Escort's performance is largely mediocre—aside from its superb fuel economy of better than 31 mpg during our test. The Escort's ride is tuned to the soft—something that many of our test drivers liked, since they found it reminiscent



of a "large" car. However, soft ride produced even softer handling, and the slowest slalom speed in the group. And despite the Escort's 5-speed manual, the 1.9-liter Four was the most anemic (88 hp) in the group and produced acceleration times better only than those of the automatic-transmission-equipped Toyota Corolla.

Geo Prizm LSI

Chevrolet's subdivision remains a bastion of smart shopping. The Prizm



NISSAN SENTRA XE LIMITED EDITION



MITSUBISHI MIRAGE ES



SATURN SL2



TOYOTA COROLLA LE

and the Toyota Corolla share more than engineering—they look remarkably alike and are built at the same joint-venture factory in Fremont, California. In fact, with minor differences in trim and available packages and a less minor difference in price aside, these are two darn similar cars. Our nicely equipped Prizm tipped the scales at \$15,000. Though the car lacked power windows, none of our testers found fault with the comfortable, well-laid-out interior. Like the Corolla (and the Neon and Honda Civic), the Prizm has dual airbags. And everyone appreciated its ride, handling and performance. At the track and over the road, the Prizm acquitted itself with aplomb, faring much in the heart of things. However, at the gas pumps, the Prizm ran away

plenty of thoughtful interior touches. However, the car lost points for inconvenient touches like a trunk that's hindered by a small opening—a result of the car's very short rear deck.

Mazda Protegé LX

The sleeper in our test group, our Protegé with its dohc 1.8-liter engine and 5-speed manual was the hot rod of this class. Scooting to 60 mph in less than 9.5 seconds, the unassuming Protegé was a full half-second quicker than its nearer competitor, the Civic. Through the pylons, only the Neon had a better slalom score, and on the skidpad, the Protegé was part of the first-place tie. Everyone found plenty of room inside the car, and nobody had any complaints about its comfort or its road manners. Our LX

Mitsubishi Mirage ES

As far as size, performance, comfort, ride, handling and amenities, the Mitsubishi sits at the epicenter of this group. And, in the process, the Mitsubishi casts itself as yet another excellent value. Our well-appointed ES tester rang the price bell at just under \$14,000—despite its 4-speed overdrive automatic, air conditioning, cruise control and power windows. The interior appointments are thoughtful—dual lighted visor vanity mirrors, good assortment of storage compartments and almost fully opening rear windows. And while all of our drivers praised the comfort and ride of the Mirage, nobody in the group was particularly enamored with its upholstery. However, like some of the other members of this test group, the Mirage does not have available antilock brakes.

Nissan Sentra XE LE

As Nissan tears through its model lineup, replacing first the Stanza with the Altima, and then the Maxima with a new version of the same name, the Sentra begins to look a little dated by comparison. Yet this is still one solid little car. Its road manners are unassailable, and its comfort levels brought no complaints from our test drivers. Perhaps more important to shoppers in this segment, the Sentra represents a well-developed value. Our XE Limited Edition—a model new to the line—carries a sticker price of just a shade over \$13,000. For that price, this car comes equipped with air conditioning, cruise control, power windows and an AM/FM cassette stereo. The only extra cost options are automatic (which we did not have) and a driver's-side airbag, which is well worth the \$575.

(Please turn to page 101)



MAZDA PROTEGE LX

from everyone, collecting 34 miles between each gallon.

Honda Civic EX

Long the benchmark for all car-makers introducing cars into this class, the Civic finds itself in the position of now having to prove itself against all newcomers. Honda has earned itself a well-deserved reputation for bringing effective, usable high-tech to the small-car market. The sohc 1.6-liter Four in this family subcompact boasts variable-valve timing, and each of the car's four wheels is suspended by a double-wishbone suspension—both features more commonly found at the other end of the automotive market. Not surprisingly, the Honda proved itself more than competent in all aspects of the track testing and its comfortable, well-equipped interior made it a favorite in town. Our Civic EX was extremely well equipped—including a power glass sunroof—and had

tester came with a list of standard equipment that stretched from power windows to variable-assist power steering. Even after the \$850 tariff for the air conditioning, the sticker still reads \$14,505.

However, the current Protegé is available with neither antilock brakes nor "real" front seatbelts. Despite its driver's airbag, the car has motorized shoulder belts. These caveats aside, the Protegé stands as quite a practical, small sporty sedan.



FORD ESCORT LX

THE CABLE BOX POWERS UP



To receive more channels and high-speed on-line services, you need a PC atop your TV.

• It may not look like it right now but on the information superhighway of the near future, the ubiquitous cable box may be the vehicle that puts you on the road. But your cable box won't be the econobox you're used to driving. Get ready for a souped-up cable box sporting a new engine with the power of a personal computer.

Soon, cable boxes—also known as set-top boxes,

BY GEORGE MANNES

converter boxes and converters/descramblers—will be the equivalent of luxury cars with all the options. They'll be the gateway for information services, commercial transactions and mega-channel cable systems filled with digitally compressed channels. You'll be able to use them to plan your viewing schedule for the week, make phone calls or even log on to the Internet. These boxes will have

THE CABLE BOX POWERS UP

greater intelligence and more features than the bulk of boxes already in peoples' homes.

Because virtually all cable boxes are owned not by cable subscribers but by the cable systems that deliver programming, the type of box you'll get in the next few years will ultimately be decided by your local cable company. And because there are more than 10,000 cable systems across the country—each, perhaps, with a different expectation of what the future will bring—companies that are major suppliers of set-top boxes are building boxes with varying degrees of capabilities.

For cable equipment manufacturer Scientific-Atlanta (S-A), the new top-of-the-line cable box is the 8600^x—which, in line with an industry-wide image reevaluation, the company doesn't call a "converter/descrambler" but a computer-sounding "home communications terminal." Building on an earlier S-A box featuring on-screen text menus, the new 8600^x will be compatible with forthcoming on-screen, interactive programming guides. Unlike current guides that slowly scroll through a list of a cable system's channel programming to let you see what's currently on the air, these new interactive guides will let you investigate at your own pace.

In addition to the memory and processing power necessary for these interactive guides, the 8600^x will even come with an infrared-signal emitter for 1-button recording. If you see an interesting program on the on-screen schedule, you will be able to just push a button, and at the proper time the emitter will function just like a remote control and order your VCR to start recording.

Cable operators will be able to download software through the cable system into the 8600^x. The converter will also have a slot for a card that can be used to change or add applications, provide security or expand the unit's memory. And it has a serial data port that can be hooked up to a printer. "The main idea is to be flexible," says S-A spokesman Bill Brobst. "There are applications out there that we haven't thought about yet. And when there are, we'll be able to download them," he says.

Flexibility is the idea behind Scientific-Atlanta's Project Skywalker. The plan is to build from scratch a low-cost box that can deliver conventional analog TV channels, digitized video and various interactive services. A collaborative effort of S-A, Motorola and Kaleida Labs (a joint venture of Apple



Scientific-Atlanta's 8600^x cable box features a slot for new application cards.

Project Skywalker: Digital Set-Top Terminal



and IBM), the Skywalker box (see chart above) will include a graphics processing chip, called Malibu, that will enable "a near-reality type of user interface...so that when you are going through a home-shopping experience, you can see the product as if you were in the store itself," promises Jeff Huppertz, director of interactive applications for S-A. If all goes as planned, the box will be available in 1995.

Also taking the flexible approach in box-building is rival cable equipment supplier General Instrument (GI).

The simplest boxes in GI's forthcoming line of cable converters will feature on-screen text menus enabling features like parental lockout, favorite-channel grazing and time-delay VCR recording, according to Dario Santana, GI's director of addressable systems. At the high end might be a box with a menu system based on icons for navigating through various activities—you could shop, access

your bank account, play videogames, watch a pay-per-view movie or examine an on-screen TV schedule.

In a cable system that offers sophisticated transactions, much of the intelligence will be in the device in the person's home, as opposed to residing in a central computer.

In fact, General Instrument is in the midst of devising a standardized module that could be included in set-top boxes for delivery of interactive services. "This would allow that set-top converter to run any level of graphical application that you could imagine," Santana says. Developed in cooperation with chip manufacturer Intel and software giant Microsoft, the module, dubbed the LinX, is based on Intel's 386 chip used in desktop computers and will have an operating system developed by Microsoft. Hoping to introduce the LinX module by the end of the year, GI is working to recruit companies to offer services using the 386 platform—everything from home banking and electronic yellow pages

to baseball stats and stock quotes.

Further down the road, some cable operators plan to increase their capacity by transmitting some of their channels in a digitized, compressed form over the cable network.

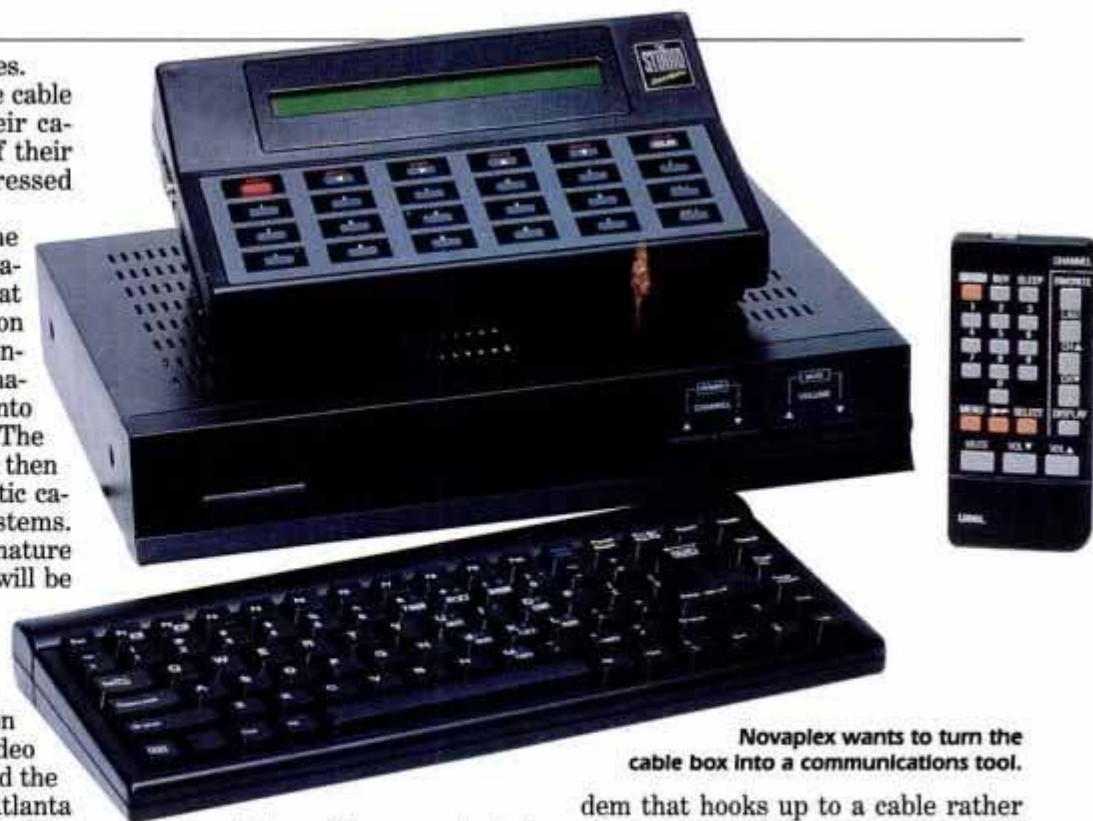
Tele-Communications Inc., the nation's largest cable TV company, is planning to do exactly that with the opening of a \$100-million digital television center in Denver. This facility will convert analog movies and other material onto a digital compact disc format. The compressed digital material will then be sent by satellite and fiberoptic cable to the company's cable systems. Given the compressed digital nature of the material, cable systems will be able to handle more channels.

The digital signal will require boxes that can decompress the signals and turn them into video viewable ones on your TV set. GI's first digital video box, the DCT1000, is due around the beginning of 1995. Scientific-Atlanta expects to deliver some digital-video 8600XD units by the end of the year. While digital boxes will start appearing in 1995, says Dean DeBiase, vice president of marketing for Zenith Electronics Corp., digital won't really come on-line until 1996.

More innovative in its business plan than it is in its technology is Novaplex, a Sun Valley, California, company that is marketing a new set-top box. Though cable TV suppliers such as Zenith, GI and S-A wouldn't be caught dead selling converter boxes to the general public, Novaplex hopes that cable subscribers will buy its boxes rather than rent the ones that cable operators give them. The company's \$199 NovaVision Personal Communications Terminal can connect to personal computers, telephones and fax machines as well as TVs. But a sticking point in the business plan, admits president Trey Prevost, is that the box won't descramble channels unless authorized by a system's local cable operator. Persuading piracy-paranoid operators to authorize a box they don't own is difficult.

Increased processing power in set-top boxes (along with the use of the word "terminal") blurs the distinction between televisions and computers. Another reason the line is disappearing is that cable operators are experimenting with offering access to computer services over the cable wire.

For example, cable operator Jones



Novaplex wants to turn the cable box into a communications tool.

Intercable, as a test, is providing access to the Internet—a loosely organized system of computer networks around the world—to two schools, a public library and two residences in Alexandria, Virginia.

The data rate for the Internet link in this test is 500 kilobits per second, according to Jim Ginsburg, senior information officer for affiliated company Jones Interactive Services. That capacity is sufficient to deliver 57 pages of text in a second, compared to the 1.6 pages of text deliverable with a

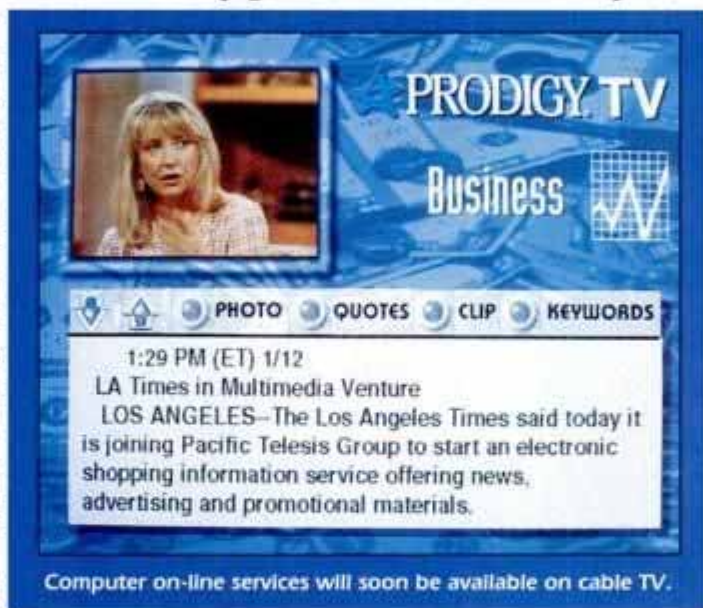
dem that hooks up to a cable rather than a phone line, along with a PC gateway card that goes inside a personal computer.

Other computer/cable tests include a gateway to Prodigy in Cox Cable Communication's San Diego system and access to CompuServe over a cable system operated by Continental Cablevision in Exeter, New Hampshire. One advantage of cable-delivered CompuServe is a data transmission rate in the range of 35 to 40 kilobits per second, according to CompuServe spokesman Richard Baker.

This is roughly four times that of a 9600-bits-per-second modem. Another advantage is a hookup that takes less than 8 seconds.

One of the interesting questions to be answered is how higher bits-per-second rates will affect how people use these computer services. A bigger pipeline might lead people to send audio files, moving video and sizable documents via E-mail instead of the usual brief text messages, Ginsburg believes. "You can imagine that the voice-mail systems of tomorrow will include your picture when you're leaving your message," he says.

In what appears to be the first step from experiment to business, Continental started offering 500-kilobits-per-second Internet access over its cable system in Cambridge, Massachusetts. But in what could be a sobering preview of tolls on the I-way, prices start at \$125 a month. **PM**



14.4-kilobit modem. A typical connection to the Internet for businesses and schools is 56 kilobits per second—about one-tenth of the rate in Alexandria.

The Jones experiment uses Zenith's HomeWorks system for connecting personal computers to cable systems. HomeWorks comprises a special mo-

AMERICA'S IN SPACE

On the 25th anniversary of man's conquest of the Moon, space offers new opportunities for our nation.

BY AL GORE, Vice President of the United States



• Like many of my generation, I dreamed as a child of exploring space—of pioneering new worlds and uncharted territories. Like many of my generation, I supported President John F. Kennedy's challenge to be the first country to put a man on the Moon. And, like many of my generation, I watched in wonder on July 20, 1969, as the United States made that vision a reality—stepping forth from the Apollo spacecraft and into America's future.

We have never been the same since. Our "giant leap for mankind" signaled the power of man, and the space program's potential to change human life as we know it.

President Kennedy was the impetus behind our far-reaching space program. He articulated its mission in 1961 with a clear goal: to land a person on the Moon by the end of the decade. That goal reflected the United States' competition with the Soviet Union. In those days, the landing was viewed as a triumph of American science, and it touched off

CHALLENGE



more than two decades of exploration that have given us a better understanding of our universe.

President Clinton and I are deeply committed to continuing that leadership through our strong support of the National Aeronautics and Space Administration. NASA contributes to America's goals by generating and sustaining interest in math and science education, providing new information to help us understand our environment and our role in the universe, and inspiring our young people to think beyond known horizons. Our space program creates economic opportunities and keeps America capable and competitive technologically.

And while we recognize the need for a strong civilian space program, we must also realize that its mission has changed from 25 years ago. Not only does the U.S. space program affect the economy, but in the 1990s the "race to the Moon" has been transformed into an international alliance that will contribute to global peace and prosperity. Today we explore the universe with the understanding that the space program provides opportunities to forge new relationships in the international community. It is a means to unite the nations of the world in the peaceful quest of science and space exploration.

To that end, NASA is working closely with Russia, Japan, Canada and many European nations to prepare for the challenges of the 21st century. This cooperation has helped to move the international community beyond the Cold War, shifting resources from military weapons to scientific research that benefits

humanity. It is a valuable lesson on how nations, working together, can define the challenges of the future—and find solutions.

For example, Russia, Canada, Japan and several European countries are partners with the United

States in building an international space station. And under the 1987 U.S.-U.S.S.R. civil space agreement and the 1992 U.S.-Russia space agreement, the two formerly competing programs are now working together cooperatively. The results will be earlier space station operations, expanded research activities and reduced costs for all countries involved.

Likewise, astronauts from Canada and the United States worked side by side in repairing the Hubble Space Telescope earlier this year. Their work was extraordinary, and a good example of the tremendous potential for a cooperative space program.

We must continue to ensure that the resources dedicated to the civilian space program are well managed and focused on goals that are important to the nation: a growing economy, education in math and science, a better understanding of the environment, inspiration for our young people and international cooperation that leads to peace and prosperity.

As explorers and innovators, we expand the frontiers of science and space. As pioneers and visionaries, we invest in our space program for the future of our country. President Kennedy said of the Apollo mission: "We choose to go to the Moon, not because it is easy, but because it is hard." His words still ring true 25 years after we met his challenge. **FM**

WHY I WALKED

And why, 25 years later, the Moon remains a part of man's destiny in space.



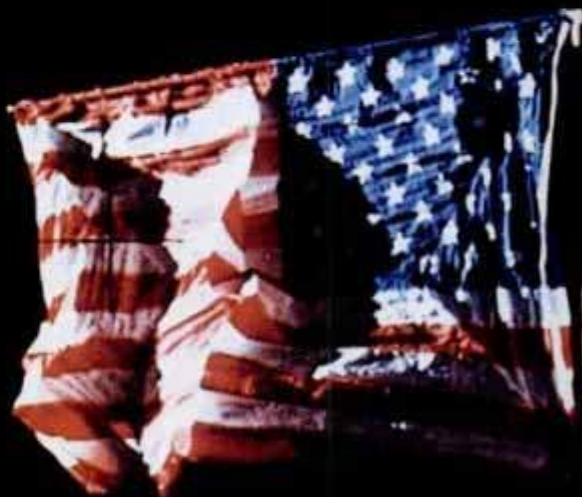
BY BUZZ ALDRIN

• I don't recall the precise words I uttered to Neil Armstrong when we slapped each others' shoulders on the Moon—"We made it," or "Good show," or something to that effect. But today, a quarter-century later, certain memories remain as crisp as the shadows that creased that airless, desolate landscape. The perfect little waves of Moon dust that rolled away from my boots as I walked. Later, back in the lunar module, its pungent smell—like gunpowder. The

pleasure of adapting one's movements to one-sixth of Earth's gravity. The horizon that fell away within a mile or two. The clean blackness of the sky. Above all, the quiet.

I hope Americans can experience that tranquility again. The national motivation that put us on the Moon remains unparalleled in the history of spaceflight. My own motivation, to see a continuous human presence in space, burns as brightly as it did in 1961, when I passed up test-pilot school to get my doctorate in astronautics at the Massachusetts Institute of Technology.

Ironically, that decision nearly cost me a trip to the Moon because back then, when I first applied to the astronaut program, NASA held doggedly to the test-pilot requirement. But I felt I could contribute some original ideas on manned orbital rendezvous, and I pressed on with my studies.



Buzz Aldrin piloted the Apollo 11 lunar module that touched down at Tranquility Base, July 20, 1969.

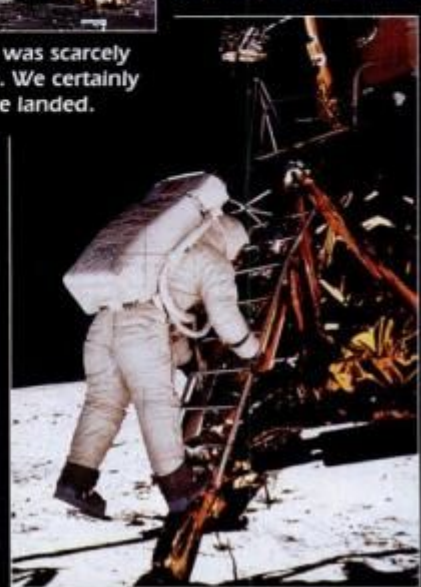
ON THE MOON



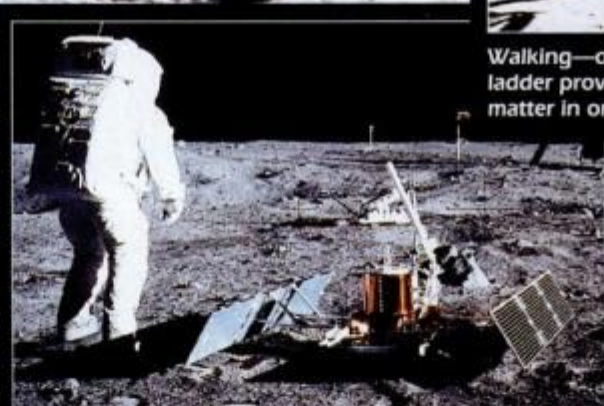
WHY I WALKED ON THE MOON



The surface beneath the lunar module was scarcely disturbed by the descent-stage engine. We certainly didn't create much of a crater when we landed.



Walking—or hopping—down the ladder proved a remarkably simple matter in one-sixth of Earth's gravity.



While Neil collected rock samples, I deployed the two pieces of scientific apparatus we left on the Moon, including this Passive Seismic Experiments Package.

My goal was already clear in my mind. I wanted to combine my background as a fighter pilot—an occupation of short-term reaction—with my desire to bring some imagination to the bigger, long-term picture. Sure enough, that desire is what ultimately brought me into the space program in October 1963. That—along with luck and timing and the labor of a hundred thousand colleagues—is what brought us to the Moon.

In a sense, the desire to contribute to the future is also what got me out of the space program. As the Apollo years slip into history, we tend to reminisce fondly about the good old

days when things were simple and goals were well defined. Well, even back then it wasn't simple (we'll find that out if we try to do it again), but our objective was unambiguous, driven by the Soviet Union's early prowess in space technology.

When you do something under a tight schedule, however, you don't necessarily invest in it for long-term sustainability. That was the case with Apollo. Then, after the Moon landings, we wanted a destination—a space station—and a means of getting there—a space shuttle. But nobody came to grips with an unfortunate reality, that the national motivation to

invest in space for the long haul had dried up.

Take the shuttle, for example. In 1970, just before I left NASA, the space agency advocated a 2-stage, fully reusable spacecraft—a booster and an orbiter. Representing the Astronaut Office, I helped evaluate some of the early shuttle proposals along those lines. To my dismay, the NASA center that designed the booster wanted to put a manned cockpit in it, to help ensure its safe return to Earth.

To me, it just didn't make sense, and I wish I had argued more aggressively against the idea. Putting people



in between. NASA feels it can't afford to advertise a compromise position on the space station, because then the political forces that oppose it would start chewing that away as well. But I don't have any vested interest, except my one objective—to get the best out of the resources we have.

That's why, instead of seeing nothing American in orbit for the next 10 years, I'd like to see a pared-down space station. I feel it's important to have a dedicated place for the shuttle to visit, to enhance the spacecraft's continued utilization. And I think there are ways we can cooperate with the Russians that offer far greater cost savings than the current plan. Why not let them concentrate on permanent presence in orbit, which they have right now in *Mir*? Sure, it's getting old, but instead of throwing it away and starting from scratch, we

the Moon is the slowest-moving object in the solar system. With its thermal stability and freedom from radio interference, the Moon beckons as a marvelous venue for space science.

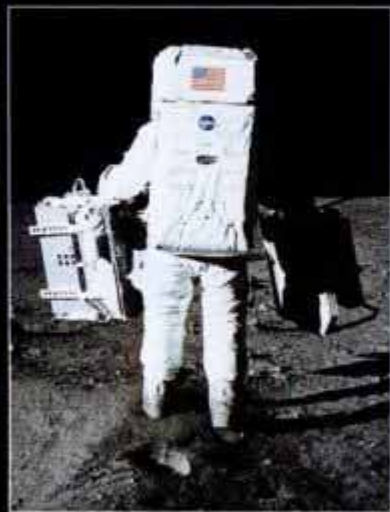
But I also think that a return to the Moon offers a way to leverage an evolutionary expansion of our capability in space—a way that's more likely to sustain itself than to drift in an ebb and flow. To that end, I foresee a scheme in which, first, a heavy-lift rocket with reusable strap-on boosters goes directly to the lunar surface, rather than performing a lunar-orbit rendezvous as we did in Apollo. Reusable flyback boosters, by the way, could also expand the shuttle's capabilities.

That done, you graduate to even more reusability. Moon-bound astronauts could transfer to a reusable lander at Lagrange point L1, the stable region just off the Moon's near side where lunar, solar and terrestrial gravity balance out. On the way home, they might switch back to an Earth-return vehicle parked at L1. You could even store propellant made from lunar materials at L1.

Once you have that capability, you have the foundation for sustained evolution. You have a system for assembling more ambitious projects—Mars convoys, for example. I still believe that orbital assembly is the most appropriate way to build an infrastructure for Mars exploration.

Thomas Paine, NASA's administrator during my days in the program, envisioned a permanent human presence on the Moon that burgeoned gradually, from four people to eight to 100 or more. But if you project 100 years into the future, it's quite possible that automation and virtual reality will make it unnecessary to sustain large numbers of people on the Moon. We might not even need a permanent presence on the lunar surface, as long as astronauts could get there on short notice to fix things.

After all, the Moon is not that far away. But to get from here to there requires a different kind of commitment than the one that put us on the Moon a quarter-century ago. Apollo was a glorious rush—one giant leap, as Neil put it. Today we need to take many small steps, each one leaving footprints that others can follow. One day, perhaps that path will lead to a fresh set of footprints at the magnificent desolation we called Tranquility Base. **FM**



Moonwalking, even in those bulky suits with hardware in hand, was a snap. The hardest part: stopping.



Our boots sank into a layer of grayish, cocoa-colored dust that proved surprisingly cohesive.

in the booster added such a price tag to the system that we had to abandon the fully reusable concept because of a budget squeeze. And that led to solid-rocket boosters, an expendable fuel tank and an orbiter that thrusts from launch—today's space shuttle. Yes, it's a great technical achievement, but it really wasn't built for operational simplicity, economy or reusability. By insisting on a manned booster, NASA priced itself out of the system it really should have developed in the early 1970s.

Today, I see the same problem in the struggle over the space station. It's either all or nothing—nowhere

could replace the aging main core module and perhaps attach a living facility such as the commercially financed Spacehab module.

Then, in the same orbit, the United States could build a laboratory that could attach to and detach from the permanent facility. The sustained human presence in space would remain there, but the stillness you want in a laboratory would be preserved without human disturbance.

Speaking of stillness, about 10 years ago I commented that the space program's most desirable space station already has six American flags on it. And Isaac Asimov once pointed out that

REMEMBERING APOLLO 11

An aerial photograph capturing the Saturn V rocket as it ascends from the launch tower. The rocket is the central focus, moving vertically upwards. It consists of a white upper section, a black middle section, and a white lower section. A large, billowing plume of white smoke and steam surrounds the rocket, particularly concentrated around the launch tower structure it is clearing. The launch tower is a complex of white metal structures with various platforms and ladders. The surrounding landscape is a mix of brown earth, concrete paths, and some greenery. In the background, a large body of water is visible under a clear blue sky. The overall scene is one of a major engineering feat in progress.

Clearing the launch tower at 9:32 am, July 16, 1969, the sixth Saturn V rode a 7.5-million-pound column of thrust. Including the Apollo 11 spacecraft, the rocket stood 364 ft. tall. Saturn V could hoist 125 tons into low Earth orbit, a capability unsurpassed in the annals of American rocketry.



SATURN REVISITED

Man's greatest space achievement has left a legacy of proven hardware. Could we parlay the triumph of Apollo into future glory?

BY PHILIP CHIEN; PM Illustration by John Batchelor

● Deep in the bowels of Launch Pad 39A runs a Teflon-lined slide, designed to carry astronauts from a Saturn V in danger of exploding. If you take the slide, you plunge into the egress-shaft termination room, today disused and littered with paint dust. Next door lies the actual blast room, a domed bomb shelter suspended on springs, fitted with 20 concrete chairs for astronauts and close-out crews. Here, a mouse has built a nest from discarded cigarette butts in the mechanical oxygen generator.

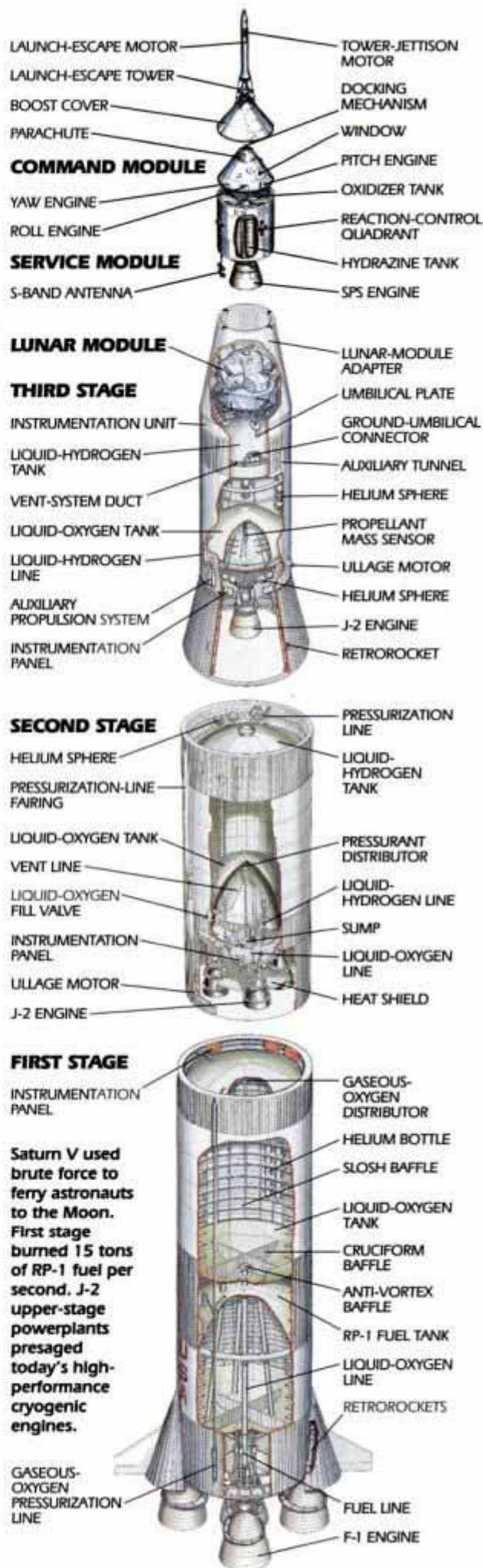
Yes, entropy has exacted its inevitable toll on the old Moon-launch complex. It's plain to the eye that two decades have slipped by since the last Saturn V blasted off, and to explore these abandoned chambers is to walk back through time. The dust and disrepair bring a question to mind: Could we ever revitalize Apollo's infrastructure, surely one of mankind's greatest engineering achievements?

The answer is complicated. Kennedy Space Center cannibalized much of the Apollo facilities for shuttle use. Work crews cut the launch umbilical tower in half, widened the Vehicle Assembly Building doors and upgraded the Launch Control Center. The crawler/transporters are still there, as are the astronaut crew quarters and other operations buildings.

But the crown jewels of Apollo were the Saturn V launch vehicles. Contrary to popular rumor, NASA has not lost the blueprints to its mightiest rocket. While much of the information resides in obsolete computer formats, it could be recovered if necessary.

What NASA has lost is its corporate knowledge. The rocket's designers and mechanics have retired, died or moved on without passing on their skills to a new generation. Although it may be possible to follow blueprints, it's impossible to relearn what was never written down.

Nevertheless, the Saturn V has a special appeal for aerospace engineers disillusioned with the finicky space shuttle. Thirteen flew—all successfully. The Saturn V was the archetype “big dumb booster” that many engineers feel is the way to go for future launch vehicles.



SATURN REVISITED

The termination of the Apollo program left two flight-qualified Saturn Vs, now museum pieces. Dozens of components lie scattered across the country, some canned in nitrogen-filled cells, others simply draped with tarpaulins or on open display. In 1989, the Strategic Defense Initiative Organization—seeking to put a huge X-ray cannon in orbit—asked Rocketdyne to outline a crash program that would assemble two Saturn Vs from existing parts. But otherwise, no one has suggested building carbon copies of the Apollo rockets.

Blast from the past

The real allure of the Saturn V comes from its engines—especially the five F-1s that lifted it off the ground. A single F-1 generated as much thrust as all three shuttle main engines. But unlike those state-of-the-art machines, tweaked for maximum performance, the F-1s were designed conservatively, with plenty of margin.

Instead of fiddling forever with the shuttle engines, why not return to simple, robust technology? That's the argument from Max Faget, who oversaw the design of the Apollo spacecraft. "Here we are 30 years later," he says, "and that darn thing still looks

like a wonderful piece of machinery, and we still wish we could use it."

Faget and others advocate using F-1s on flyback boosters for the shuttle (see *Tech Update*, page 15, Apr. '94), a proposal now gaining serious consideration. "The F-1 was a very, very reliable engine," Faget notes. "They all worked, and that's the best measure. It looks like an ideal candidate for reusable systems."

Rocketdyne, the F-1's manufacturer, put the engines through prolonged ground tests in the 1960s. And company officials today believe that a single F-1 could sustain five to 10 full-duration burns.

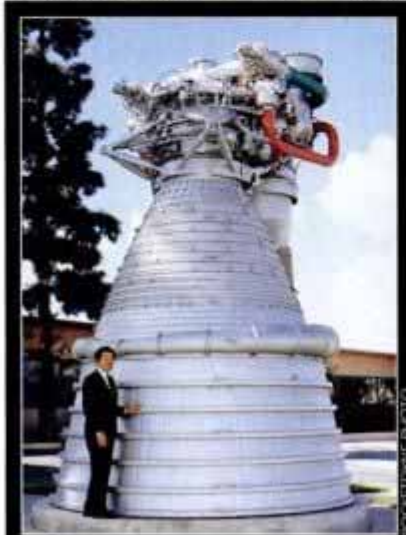
But Faget isn't the first to hanker for the F-1. In 1986, Hughes Aircraft proposed combining two F-1s and a Saturn upper-stage J-2 engine on an Air Force medium launch vehicle, named after *Challenger* astronaut Greg Jarvis. The Air Force turned down the idea because the Jarvis would have been simply too powerful to fall into the medium-lift category—in fact, it would have lofted twice the weight of the heavy-lift Titan IV. More recently, a 1991

commission, headed by retired Air Force Lt. Gen. Thomas Stafford, recommended F-1 boosters on a new heavy launch vehicle.

Intrigued by all this attention, Rocketdyne has already looked into the possibility of resuming F-1 production. According to program development manager Henry Minami, the assembly lines could be humming 30 to 36 months after a go-ahead decision. After all, following the *Challenger* accident, Rocketdyne restarted production of old Atlas and Delta rocket engines for satellite-launch vehicles. All they required were a few minor design changes and modernized plant equipment. "That's the same philosophy that people talk about for the F-1," says Minami. "You don't have the huge development cost associated with a new engine design."

Manufactured afresh, the F-1 could be tuned up to deliver 1.8 million pounds of thrust. That would eclipse Russia's RD-170 powerplant, right now the world's strongest rocket engine. Alternatively, engineers could derate the engine down to a million pounds, for a cheap expendable rocket.

Interest in the Saturn V is unlikely to fade. Of all the technology developed for Apollo, the faithful engines of that 3000-ton monster hold the most relevance for today's space endeavors. The last time F-1 engines put a payload in space was May 13, 1973, when Skylab was launched. But if engineers like Max Faget have their way, the F-1 will roar again. **FM**



First test-fired hours after Kennedy issued his Moon challenge, the F-1 was an overengineered masterpiece.

ROCKEY/DAVID PHOTO



Franklin Institute Science Museum
Philadelphia, PA
(215) 448-1200
Lunar module that would have flown on Apollo 19

Kansas Cosmosphere and Space Center
Hutchinson, KS
(316) 662-2305
Hatch from Apollo 13 command module, forward heat shield from Apollo 17, and other artifacts

One Small Step For Visitors

• Major Apollo hardware lies on display across the country, and a Saturn V museum (left) is under construction at Kennedy Space Center.

Michigan Space Center
Jackson, MI
(517) 787-4425
Apollo 9 *Gumdrop* (command module)

Museum of Science and Industry
Chicago, IL
(312) 684-1414
Apollo 8 command module

NASA Johnson Space Center
Houston, TX
(713) 244-3218
Apollo 17 *America* (command module), lunar module test article, Saturn V components

NASA John C. Stennis Space Center
Bay St. Louis, MS
(601) 688-2370
Apollo 4 command module (first Saturn V launch)

National Air and Space Museum
Washington, DC
(202) 357-2700
Apollo 11 *Columbia* (command module), Skylab 4 command module, LM-2 spare lunar module

Spaceport USA
NASA Kennedy Space Center, FL
(407) 452-2121
U.S. command module from Apollo-Soyuz mission, flight-qualified spare lunar module, Saturn V components

U.S. Air Force Museum
Wright-Patterson AFB, OH
(513) 255-3284
Apollo 15 *Endeavour* (command module)

U.S. Space and Rocket Center
Huntsville, AL
(205) 837-3400
Apollo 16 *Casper* (command module), lunar module test article, Saturn V dynamic test article

Virginia Air and Space Center
Hampton, VA
(804) 727-0800
Apollo 12 *Yankee Clipper* (command module)

CHEVROLET CAMARO

Playing loud and fast.

BY MICHAEL LAMM, Contributing Editor; PM Photos by Rich Cox

• For the '90s, the Camaro—including the new convertible—absolutely leads Chevrolet's fashion parade, and the owners we surveyed made sure we got that message. Styling, appearance, beauty, aura, mystique, whatever—owners are definitely hooked on looks. Nearly 85% of our surveyees listed styling as this ponycar's best-liked feature, and more than 75% confessed that the swoopy lines were the main factor that seduced them into signing on the dotted line.

Style, however, doesn't say it all. Underneath that plenitude of pulchritude, the fourth-generation Ca-

maro offers a plethora of changes. Despite nearly identical dimensions, almost nothing interchanges between this generation and the previous go-around.

Chevrolet currently offers only two Camaro series: the base Sport Coupe and the Z28. Both come standard with antilock brakes, dual airbags, a theft-deterrent system and air conditioning. Except for badges, the Sport Coupe looks exactly like the Z—outside and in. They also share structure and basic suspension. The differences are spring, shock and antiroll-bar rates, tires, wheels and powertrains.



CHEVROLET CAMARO



Most respondents like the dash layout. Snug cockpit-style interior is roomy for two. Camaro owners are happy with their engines.

The Z28 comes standard with Chevy's LT1 5.7-liter V8. This engine rates 275 horsepower at 5000 rpm, with 325 ft.-lb. of torque at 2400 rpm. That's 25 fewer horses than in the

Vette but still enough to give the Z28 a top speed that clears the basic national speed limit by a mere 90 mph. The Z's standard transmission is a Borg-Warner 6-speed manual, with

Hydra-matic's 4-speed MD8 automatic optional. The Camaro Sport Coupe lists Chevrolet's 3.4-liter V6 and Borg-Warner's T5 manual 5-speed as standard. The V6 produces 160 hp and

SUMMARY OF CHEVROLET CAMARO OWNERS REPORTS*

Total miles driven	1,351,753	Good	18.8	Sound system		Repair it yourself?	
Average miles driven	5563	Average	0.9	could be better	6.1	No	96.8%
Purchase price:		Poor	0.0	Noises and rattles	4.6	Yes	3.2
Average	\$19,207	Braking:		Shoulder harness		Dealer repairs satisfactory?	
Range	\$15,000-\$27,500	Excellent	78.4%	chafes neck	4.6	Yes	60.3%
Why did you choose the Camaro?		Good	18.3	Suggested changes:		No	39.7
Styling	76.6%	Average	2.8	More powerful engine	12.9%	Dealer service opinion:	
Performance	20.4	Poor	0.5	No changes	7.7	Excellent	36.3%
Price/value	17.9	Overall performance:		Less plasticky interior	7.1	Good	40.5
Power	14.9	Excellent	75.1%	More comfortable seats	6.5	Average	17.9
Previous ownership	14.9	Good	24.4	More comfortable		Poor	3.7
Handling	11.1	Average	0.5	shoulder harness	4.5	Dealer sales policy:	
Model choices:		Poor	0.0	better sound system	4.5	Excellent	42.6%
Camaro Z28	59.2%	Control layout:		Workmanship opinion:		Good	39.8
Camaro Sport Coupe (base)	40.8	Excellent	72.1%	Excellent	59.7%	Average	13.9
Options/Accessories:		Good	24.7	Good	34.9	Poor	3.7
Cruise control	98.8%	Average	2.7	Average	5.0	Number of vehicles owned:	
Power door locks	85.5	Poor	0.5	Poor	0.0	This vehicle only	23.3%
Premium sound system	78.7	Instrumentation:		Front seat comfort:		Two vehicles	31.8
Power driver's seat	56.2	Excellent	71.6%	Excellent	62.1%	Three vehicles	24.9
T-tops	3.2	Good	24.3	Good	31.5	Four or more	20.0
Avg. mpg, city/hwy:		Average	2.8	Average	5.2	Principal driver:	
3.4-liter V6	20.2/26.8	Poor	1.4	Poor	1.2	Male	55.8%
5.7-liter V8	17.3/23.0	Driver sightlines:		Rear seat comfort:		Female	42.1
5-speed manual	21.2/27.8	Excellent	40.8%	Excellent	14.4%	Equal	2.1
4-speed automatic	18.3/24.3	Good	42.7	Good	28.0	Age distribution of owners:	
6-speed manual	17.0/23.3	Average	14.2	Average	37.3	Under 29	24.5%
Engine choices:		Poor	2.3	Poor	20.2	30-49	56.3
5.7-liter V8	59.2%	Specific likes:		Overall comfort:		50-plus	19.2
3.4-liter V6	40.8	Styling	84.7%	Excellent	54.6%	Based on your experiences, would you buy a Chevrolet Camaro if you had it to do over again?	
Transmission choices:		Handling	41.0	Good	41.7	Yes	66.1%
4-speed automatic	74.3%	Power	37.1	Average	3.3	Maybe	25.0
6-speed manual	18.1	Performance	29.7	Poor	0.4	No	8.9
5-speed manual	7.6	Comfort	17.5	Any mechanical trouble?		If "maybe" or "no," would you buy a different Chevrolet product the next time?	
Engine power:		Riding qualities	12.7	No	62.4%	Yes	51.1%
Excellent	72.1%	Sound system	12.2	Yes	37.6	No	25.0
Good	23.7	Specific dislikes:		What type of trouble?		Maybe	51.1%
Average	3.2	No complaints	11.7%	Air conditioner	10.8%	No	25.0
Poor	0.9	Dashtop glare,		Electrical	10.8	Yes	22.9
Handling:		obstructed vision	8.1	Oil leaks	8.6		
Excellent	80.3%	Seats uncomfortable	7.1	High engine idle	6.5		
		Too much interior plastic	6.1	Starter problems	4.3		

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

200 ft.-lb. of torque. The same electronically controlled MDS Hydramatic is available in the base car as in the Z28. All of the V6 Camaro owners surveyed seemed pleased with the engine's blend of power and economy. No one felt shortchanged in either department.

One of this generation Camaro's most dramatic changes involves the body structure. The chassis now consists of a fully unitized steel cage with boxed rockers and door surrounds. On the surface, the hood and rear fenders are the only conventional, painted steel body parts. The rest of the car is skinned in plastic. The Camaro's roof, doors and rear hatch have steel inners under SMC-plastic outer panels—much like the late Fiero.

The Camaro's front fenders, nose and grille area also use steel inner reinforcements, but all their outer surfaces are again covered with a pliable plastic. The rear quarters and hood are galvanized on both sides.

The Camaro's cowl and windshield have been pushed forward in relation to the 1992's body, and the windshield now has a 68° rake, which is even more radical than the Corvette's. The good-looking, aerodynamic glass does have its drawbacks, however, as several respondents complained that the windshield fogs up easily and others mentioned annoying reflections in the glass under certain conditions. The cowl extends forward beneath the hood, into the engine compartment.

Workmanship was judged excellent by 59.7% of our owners and good by another 34.9%, with 62.4% reporting no mechanical problems. Among those who did need service, the two main complaints had to do with the air conditioner and the electrical system.

Ergonomics came in for mixed reviews. Front seating suited most respondents, but "the rear seats and the so-called trunk," as one Texan put it, "are ridiculous." The rear seatbacks fold individually, and there's a little opening on the driver's side of the trunk well that allows a golf bag to lie flat. Obviously, though, trunk space is not a serious consideration for most Camaro buyers.

Controls and instrumentation were deemed excellent by most, yet sightlines seemed less than ideal, especially for shorter drivers. These people had trouble judging the front of the car during parking maneuvers and were flying blind trying to see past the rear quarters for lane changes.

One of the Camaro's main attractions, and something not lost on most owners, was price. As an airline pilot from Colorado said, "Corvette performance for under \$20,000! What more could you want?"



The cutting edge of the Camaro's styling defines the car's personality and reels in the customers. Most everyone who owns one loves the way it looks.

EDITORS REPORT

What You See Is What You Get

● Through all of its iterations, the Chevrolet Camaro has always been totally honest. The only promises that this car has ever made have been to give brutally potent performance for a fraction of the cost of a more sophisticated and elegant car while looking good the whole time. This latest version is no different.

In fact, as the Camaro has kept up with automotive technology, this may be the best Camaro yet—it's probably the fastest of all the showroom versions. And equally important, it's probably the best handler as well. Few would argue that it's the best looking.

But the biggest step forward for the Camaro took place beneath the sexy sheet-metal. The stiffness of the current chassis is so good that the engineers were able to develop a suspension that pays most of its attention to keeping all four of the big tires planted squarely on the road. Further helping in the handling department is the departure of the last generation's MacPherson struts up front, replaced by a serious double-wishbone upper-and-lower control-arm setup with coil springs and separate shocks. Out back, the solid rear axle still can give you the willies as the rear tires start skipping sideways while you traverse some rough or broken pavement at energetic velocities.

And the Camaro continues to be about energetic velocities. In fact, it's all about energy. Merely slipping in behind the wheel of any Camaro instantly injects the driver with a heavy dose of youthful vitality. Take the driver's seat of a Z28 and, well, it's hard to not find yourself grinning the grin of enamored youth. Turn the key and wake up all eight cylinders of the LT1 V8, and you devour the engine's verve. Grab the 6-speed's console-mounted shift lever and the 325 ft.-lb. of torque courses through you in a nearly intoxicating rush. The intoxicating appeal of

the Camaro is simple and irrefutable—lots of performance for less than lots of dollars. You can go fast and have enough money to cover the insurance, the gas and the inevitable speeding tickets. In addition to the crisp rail-like handling of the Camaro, the other immediately felt benefit of the stiffer structure is the lack of twist-induced body squeaking. The current car is delightfully tight, solid and more than presentable to those who have denigrated the car's body noises in the past.

But despite the car's visceral charm, it is hardly without its penalty. You can only get so much for any finite amount of money. In the Camaro's case, you get tons of go-fast and stay-safe stuff. What you don't get is a whole lot of cushy comfort. The Camaro still feels less refined than many high-performance cars. In fact, if you spend any serious amount of time in a Z28, accumulating triple-digit miles, you are going to be one tired pup at the other end. And that's assuming you were either driving or riding shotgun. Anyone who's delegated to the rear seat of this car has ample reason to commit bodily harm to whoever put him back there. Fortunately, folding down the rear seats converts this into a very fast, actually very practical 2-person hauler with trunk.

With its looks, performance and 5.7-liter exhaust note, the Z28 tends to get attention. Most of it is friendly and admiring. Some of it, however, is a bit less desirable. The local constabulary seems to have a sixth sense about the location and velocity of every Camaro within its purview. And those who prey on the good fortune of others by stealing cars have a penchant for Chevy's ponycar. Fortunately, the Camaro comes with GM's effective Pass-Key antitheft system. As for the long arms of the *gendarmes*, you may want to have a serious conversation with your right foot.

—Don Chaikin

COMPARISON TEST

TOWNING



• Tournament waterskiing is a thrilling sport for spectators with its high-speed action, towering plumes of spray and elite athletes pushing their bodies to the limit on a demanding slalom course.

This point was driven home for the PM test team recently after a stint driving five top tournament water-ski boats for world-class slalom skier Susi Graham. Graham joined the test team for evaluation of the boats and wrung them out at towline lengths between 22 ft. and 35 ft. As an expert skier, Graham is as demanding of her equipment and driver as she is of herself, and her perspective helped the test crew formulate its analysis. Here's what we found.

American Skier TBX

The TBX is American Skier's newest inboard model and the test boat with the most unusual bottom. The bottom (called a compression tunnel wedge) features a double reverse chine with a pair of pockets and steps. In addition, it has a fixed trim tab (called a cavitation tracking plate) at the keel line, which is intended to reduce rooster tail by the prop. These features compress waterflow, knock down spray and deliver one of the best slalom rides in the fleet.

Wakes on the TBX were small, sharp edged and easy to slalom through, although most skiers typically prefer softer wakes. Trick skiers, however, will like the

THE LINE

Lake-testing five of the best tournament ski boats money can buy.

BY JIM YOUNGS; PM Photos by Doug Dukane



**CORRECT CRAFT
SKI NAUTIQUE**

firm edges that provide launch angles for aerial maneuvers. The wake table was basically flat.

The TBX is a beamy boat and as such has a roomy interior. One notable feature is an adjustable observer seat that can face forward, aft or a combination of both. There's also a flip-down bulkhead in the forward compartment and a rear bench seat that can be removed or elevated into a sun lounge.

Correct Craft Ski Nautique

A longtime veteran of the tournament scene, the Ski Nautique continues to maintain its leading edge. Gale-like conditions forced us to run the Nautique in a huge

chop one day, and we can report that in addition to being an outstanding slalom performer it has one of the best rough-water rides in the test.

The Nautique's hull features flat aft sections on both sides of the keel and relief pockets at the chines that extend to about the center third of the hull. The pockets are about an inch deep and reduce spray.

Our test boat was fitted with a low 1.23:1 gear ratio that enables the boat to use bigger props. As a result, the Nautique shined in the acceleration tests and placed second in top speed and on the performance course.

Wakes behind the Nautique are small, and not too hard. The same is true of the rooster tail. Overall, how-

TOWING THE LINE



AMERICAN SKIER TBX



MALIBU ECHELON

ever, it is extremely smooth and excellent for the slalom course. It is also outstanding for trick and aerial maneuvers thanks to an exceptionally clean table and wake.

The Nautique is a beamy boat and has a spacious cockpit. Storage under the foredeck is accessed by a hinged observer seat. A handy cooler is built into the passenger console. Helm wiring is easily serviced by removing an integrated instrument pod.

Malibu Echelon

The only Californian in the bunch, the Malibu Echelon is something of a different animal. It's leaner, lower in profile and a bit more high-tech.

The hull has a 10° deadrise at the transom, and a superb rough-water ride. Additionally, it has a pad at the keel to quicken time to plane.

The slalom wake on the Echelon is relatively small and smooth at all line lengths. Although the boat produces something of a rooster tail, it's flat on top and causes no problems when crossing. Some spray is evident, but only as a fine mist. The trick wake is considered average because of a double crest.

Malibu's slickest feature is its Computrol Advanced Technology Dash (ATD), a computerized digital panel that's controlled by buttons on the steering wheel. The ATD allows the driver to display such information as rpm, speed, fuel use, engine temperature, water temperature and air temperature. The system also performs a number of functions: stopwatch timer, speedometer calibrator, trip logger, graphic speed analyzer, depthsounder and engine analyzer.

MasterCraft Pro Tour 190

As the official towboat for the Budweiser Pro Tour, this MasterCraft model is aptly named. Its nifty racing profile is the result of a unique safety system—a Safe-T-Top (arch) and protective net—that prevents a snapped towline from whacking the driver or observer.

The Pro Tour's hull is a modified flat bottom with a rounded V shape. It has no strakes, but its three fins and rudder hold well in turns without sliding. The flat bottom delivers somewhat of a harsh ride in rough water, but the boat was specifically designed for tournament-type skiing where the water is calm, so this isn't really much of a problem.

The Pro Tour's wake crests and rooster tails are soft and small. In

TEST PARAMETERS

All boats were tweaked, tuned and propped by factory technicians. All models are showroom stock. Top-end speed, acceleration and performance course times (around a short, triangular, 3-buoy course) are averages of multiple runs. All boats were run with a crew of two. Bold numbers in chart indicate ranking in the fleet.



MAKE/MODEL	AMERICAN SKIER TBX	CORRECT CRAFT SKI NAUTIQUE
Length/Beam/Weight/Fuel Capacity	19' 9"/7' 7"/2450 lb./24 gal.	19' 6"/7' 7"/2340 lb./26 gal.
Engine/Displacement/Horsepower	MerCruiser 350 Magnum EFI/350 cu. in./265 hp	Pleasurecraft Pro Boss 5.6 HO/351 cu. in./300 hp
Top Speed/Acceleration	5. 44.1 mph @ 4800 rpm/3. 7.36 sec.	2. 46.9 mph @ 4900 rpm/1. 7.07 sec.
Performance Course Time/Prop Size	3. 20.76 sec./13" x 13"	2. 19.39 sec./14" x 16"
Slalom Wake Characteristics	2. (tied) Small, sharp wakes with little spray	1. (tied) Small wakes, low spray, flat rooster tail
Fit & Finish	3. (tied) A few rough edges	1. (tied) Excellent workmanship throughout
Hull Configuration	Compression pockets, double-reverse chine	Pronounced keel pad, relief pockets
Cockpit Area/Depth	21.5 sq. ft./22"	27.24 sq. ft./24"
Special Features	Flip-up swim platform, reversible observer seat	Teflon-coated tow pylon, removable swim platform
Price	\$21,921	\$23,000
Address	P.O. Box 1148, Giddings, TX 78942	6100 S. Orange Ave., Orlando, FL 32809



SKI RAY 185 SPITFIRE



MASTERCRAFT PRO TOUR 190



fact, the shorter the line gets, the better the wake. The drawback, however, is noticeable spray.

Significant among this boat's outfitting is a top-of-the-line Indmar engine, a marinized version of the 350-cu.-in. LT1 Corvette mill. It features multiport electronic fuel injection, a Northstar ignition and aluminum heads. It drives through a low 1.5:1 gear ratio that allows use of big props for excellent bite and acceleration. It was easily the best performing boat in the fleet, with firsts in top-end speed and handling-course time and a second in hole shot.

Ski Ray 185 Spitfire

As the smallest contender, the Ski Ray Spitfire competed as the fleet's only carbureted non-EFI engine. This choice resulted in making the

Ski Ray the fleet's most affordable package fitted with a long list of standard features.

The Ski Ray hull features a prop pocket to divert and reduce the rooster tail. To knock down spray, it has a recessed step amidships and a double chine. Like most flat-bottomed tournament ski boats, rough water is not the Spitfire's friend.

The Ski Ray's slalom wake is sharp and soft. The table has some bubbles, but they're minimal. Along with the American Skier, the spray is the best in the fleet, even at short lengths. The pointed crests are ideal for tricking. At slower speeds, the wake is good for kneeboarders and wakeboarders.

Since the Ski Ray was the narrowest boat in our evaluation, the interior seemed a bit tight. On the other hand, it has huge storage spaces and ski

racks under the gunwales to keep the cockpit uncluttered. The boat also comes with a removable stern platform, a trailer with a swing-away tongue for garage parking, a walk-through windshield and a nonskid foredeck.

Dedicated inboard waterski boats are a specialized breed designed to do one thing, and do it well. Within this rarefied circle, the MasterCraft Pro Tour and Correct Craft Ski Nautique are drivers' favorites. The Ski Ray Spitfire, American Skier TBX and Correct Craft Ski Nautique are skiers' favorites because of their outstanding wake and spray. For boat and skier performance together, the high-tech Malibu Echelon ranks up there with—you guessed it—the overall PM test favorite, the Ski Nautique. **PM**



MALIBU ECHELON	MASTERCRAFT PRO TOUR 190	SKI RAY 185 SPITFIRE
20' 0" / 7' 6" / 2550 lb. / 32 gal.	19' 6" / 7' 1" / 2400 lb. / 32 gal.	18' 7" / 6' 11" / 2350 lb. / 24 gal.
MerCruiser 350 Magnum EFI / 350 cu. in. / 265 hp	Indmar Tour Edition LT1 EFI / 350 cu. in. / 300 hp	MerCruiser 350 Magnum / 350 cu. in. / 265 hp
3. 45.8 mph @ 4600 rpm / 5. 8.68 sec.	1. 48.0 mph @ 5150 rpm / 2. 7.27 sec.	4. 45.5 mph @ 5000 rpm / 4. 8.10 sec.
4. 21.47 sec. / 13" x 13"	1. 19.05 sec. / 13" x 18"	5. 22.23 sec. / 13" x 12"
1. (tied) Small wakes, low spray, flat rooster tail	3. Small wakes, generally superb, but lots of spray	2. (tied) Sharp wakes, good spray control
1. (tied) Craftsman-like attention to detail	2. Sound, fundamental boat construction	3. (tied) Sound construction, minimalist approach
10° V bottom, wide center pad, two strakes	4° rounded V bottom	Prop pocket, recessed step, double chine
24.43 sq. ft. / 22"	20.23 sq. ft. / 22.5"	25.29 sq. ft. / 25"
Computrol Advanced Tech Dash	Safe-T-Top, Power-Slot gear reduction, DC outlet	Walk-through windshield, ski racks
\$23,595	\$29,144	\$20,400
1861 Grogan Ave., Merced, CA 95340	869 Binfield Rd., Maryville, TN 37801	2600 Sea Ray Blvd., Knoxville, TN 37914

500 miles from nowhere, it'll give you a cold drink or a warm burger...

NASA space flights inspired this portable fridge that outperforms conventional fridges, replaces the ice chest and alternates as a food warmer.

By Charles Anton

Recognize the ice cooler in this picture? Surprisingly enough, there isn't one. What you see instead is a Koolatron, an invention that replaces the traditional ice cooler, and its many limitations, with a technology even more sophisticated than your home fridge. And far better suited to travel.

What's more, the innocent looking box before you is not only a refrigerator, it's also a food warmer.

NASA inspired portable refrigerator.

Because of space travel's tough demands, scientists had to find something more dependable and less bulky than traditional refrigeration coils and compressors. Their research led them to discover a miraculous solid state component called the thermo-electric module.

Aside from a small fan, this electronic fridge has no moving parts to wear out or break down. It's not affected by tilting, jarring or vibration (situations that cause home fridges to fail). The governing module, no bigger than a matchbook, actually delivers the cooling power of a 10 pound block of ice.

From satellites to station wagons. Thermo-electric temperature control has now been proven with more than 25 years of use in some of the most rigorous space and laboratory applications. And Koolatron is the first manufacturer to make this technology available to families, fishermen, boaters, campers and hunters—in fact anyone on the move.

Home refrigeration has come a long way since the days of the ice box and the block of ice. But when we travel, we go back to the sloppy ice cooler with its soggy and sometimes

spoiled food. No more! Now for the price of a good cooler and one or two seasons of buying ice, (or about five family restaurant meals), all the advantages of home cooling are available for you electronically and conveniently.

Think about your last trip. You just got away nicely on your long-awaited vacation.

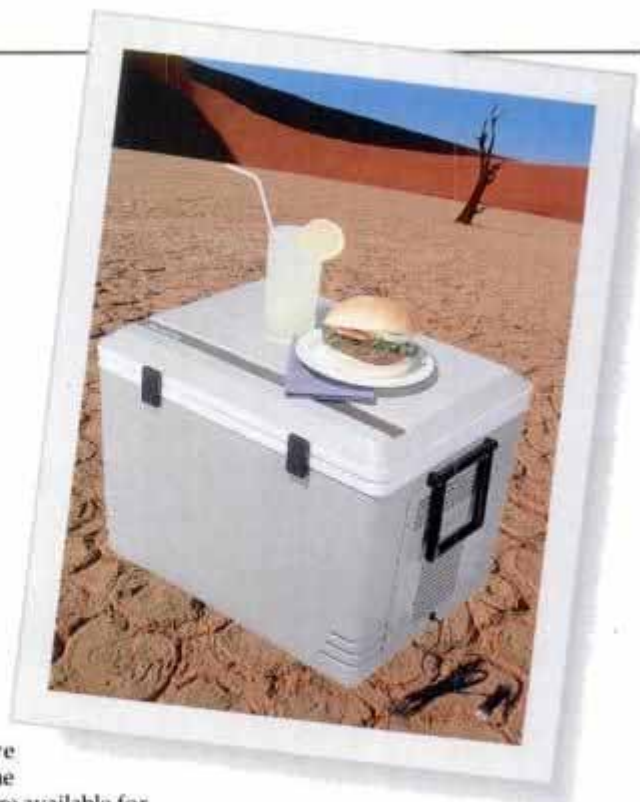
You're cruising comfortably in your car along a busy interstate with only a few rest stops or restaurants. You guessed it... the kids want to stop for a snack. But your Koolatron is stocked with fruit, sandwiches, cold drinks, fried chicken... fresh and cold. Everybody helps themselves and you have saved valuable vacation time and another expensive restaurant bill.

Hot or cold. With the switch of a plug, the Koolatron becomes a food warmer for a casserole, burger or baby's bottle. It can go up to 125 degrees.

And because there are no temperamental compressors or gasses, the Koolatron works perfectly under all circumstances, even

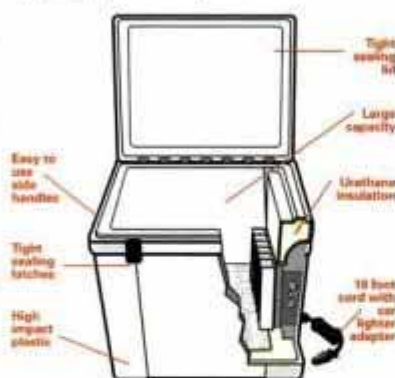
upside down. Empty, the large model weighs only 12 pounds and the smaller one weighs just seven. Full, the large model holds up to 40 12-oz. cans and the smaller one holds six.

Just load it up and plug it in. On motor trips, plug your Koolatron into your cigarette lighter; it will use less power than a tail light. If you decide to carry it to a picnic place or a fishing hole, the Koolatron will hold its cooling capacity for 24 hours. If you leave it plugged into your battery with the engine off, it consumes only three amps of power.



The refrigerator from outer space.

The secret of the Koolatron Cooler/Warmer is a miniature thermo-electric module that effectively replaces bulky piping coils, loud motors and compressors used in conventional refrigeration units. In the cool mode, the Koolatron reduces the outside temperature by 40 degrees F. At the switch of a plug, it becomes a food warmer, going up to 125 degrees.



Limited time offer.

Because Comtrad is bringing this offer to you directly, you save the cost of middlemen and retail mark-ups. For a limited time only, you can get this advanced, portable Koolatron refrigerator at the introductory price of \$99. Call today to take advantage of this special promotional pricing. Most orders are processed within 72 hours.

Try it risk free.

We guarantee your satisfaction with any product from Comtrad Industries. With the Koolatron you get our complete "No Questions Asked" 30 day money-back guarantee. Plus you get a full one year manufacturer's limited warranty. If you are not satisfied for any reason, just return the product for a complete refund.

Koolatron (P24A) holds 30 quarts.....\$99 \$12 S&H
Koolatron (P9) holds 7 quarts.....\$79 \$6 S&H
Optional AC Adapter (AC 10).....\$39 \$6 S&H

Please mention promotional code 022-PO1103.

For fastest service call toll-free 24 hours a day

800-992-2966



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

COMTRAD INDUSTRIES

2820 Waterford Lake Drive Suite 106
 Midlothian, Virginia 23113

OUTDOORS

BOOT CAMP

Street style and off-road ruggedness converge in new hybrid boots that are all-terrain vehicles for your feet.

BY ANDREW GAFFNEY, PM Photos by A. Greg Alter

• After running out of pavement, you shift on the fly and tackle mud, boulders and stomach-dropping declines. But instead of having a 4x4 vehicle beneath you, the only horsepower you command is your own adrenalin. Instead of taming wild terrain with 31-in. tires, you're handling it with rugged and comfortable outdoor boots that absorb all the punishment you can dish out and leave you ready to

take on more. Boots like these are called hybrids, a new type of shoe that incorporates a combination of features from hiking boots and athletic shoes. To the surprise of many, shoes like these have become as popular for their street style as for their ruggedness, and have recently be-

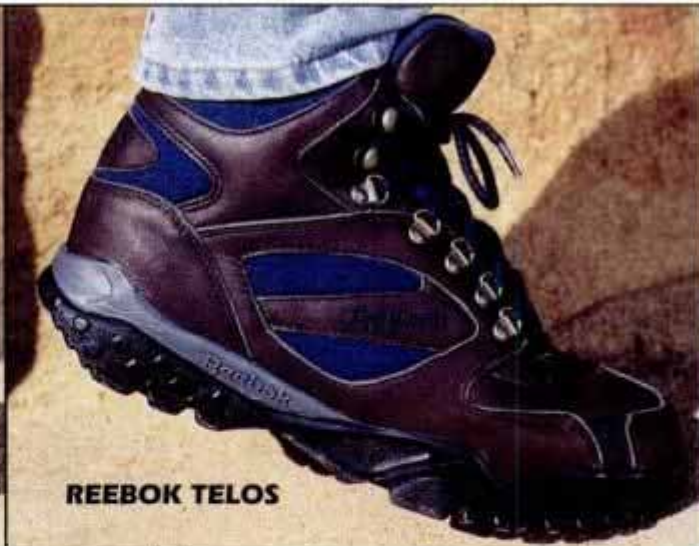


Hybrid boots, such as the Wolverine Wilderness (left) and Reebok Telos (right) are built with a combination of features that are ideal for rock climbing or rock concerts.

BOOT CAMP



**WOLVERINE
WILDERNESS**



REEBOK TELOS

come one of the hottest products in the country.

Most models are ankle-high and have padded collars with built-up heels similar to hiking boots. And while they are rugged enough to trek through the elements, these versatile shoes are also light, nimble and comfortable for everyday use in the concrete jungle.

Described by some as bulked-up sneakers or running shoes on steroids, hybrids take the qualities of a 4x4 truck and morph them into a shoe: Heavy lug outsoles provide traction and power, beefy rands (areas where the upper and sole are attached) add durability and airtight collars protect against flying debris.

The outsole on a hybrid shoe is one

of the most important components, and current designs reflect a bigger-is-better approach. The Adidas Cross-Trail shoe (\$90), for instance, has a knobby outsole that resembles the fat tires of a monster truck.

Most all-terrain shoes have aggressive, slip-resistant rubber lug outsoles that are fairly rigid and have enough teeth to keep feet from slipping on rocks or in mud. The forefoot lugs typically face the rear of the boot to aid in climbing, and the heel is slightly raised for braking. Some models feature a ripple-shaped pattern in the toe area of the outsole in order to fit into the toe clips of mountain bikes.

However, because most off-road enthusiasts are also environmentally active, the lug patterns are usually

meant to tread somewhat lightly on trails. To minimize damage to the path, the Reebok Telos (\$80) has a "self-cleaning beveled lug pattern," designed to eject dirt as the boot flexes.

Some outdoor shoe companies take the environmental agenda a step further by using recycled materials. In the Reebok Telos, for example, 70% of the shoe is made of recycled materials—used automobile tires for the rubber outsole and discarded plastic soda bottles for the upper fabric.

Nike takes a different approach with the Air Mada (\$80)—which the company has dubbed a "4-wheel-drive sneaker"—by using a process called Re grind. The company takes excess rubber scraps and adds them back into the manufacturing process to

Big Foot: The New Work-Boot Chic

● Traditional white sneakers and athletic shoes have become less fashionable streetwear the past few years, especially among teens and college-age youth. Surprisingly, the alternative of choice is not something bold, stylish and new. Instead, the hot new look from inner cities to suburban malls to college campuses is familiar, utilitarian and basically anti-fashion—the work boot.

As a result of this growing trend, former utility brands such as Dr. Martens and Timberland are enjoying a newfound status. Clearly, the new hybrid boots—recently developed by Nike, Reebok, Asics, Adidas and other sneaker company giants—are a direct response to the diminishing appeal of athletic shoes and the huge success of boots.

Leading the way in the work-boot arena is "Doc" Martens (\$116), a

British-based manufacturer, which traces its original popularity to the punk-rock movement of the late '70s. Throughout the '80s, Doc Martens grew to cult status among the hip-hop generation. Recently, they have exploded amid the flannel shirts and ripped jeans of grunge rockers.

Michael Greenberg, president of Skechers USA, which imports Doc Martens, points out that the appeal of the modern, lightweight work boot is not limited to blue-collar workers, but extends to aerobic exercisers and outdoor enthusiasts as well.

"Many people don't want to wear sneakers," he says, "and utility shoes

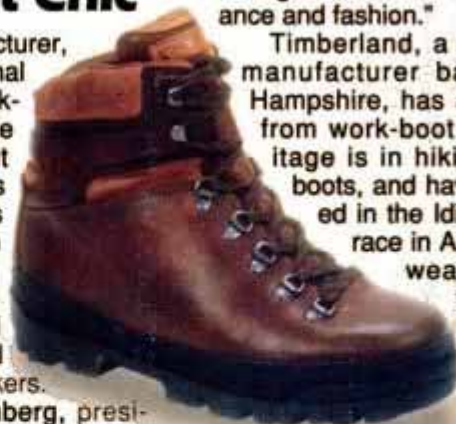
are a good combination of performance and fashion."

Timberland, a family-owned manufacturer based in New Hampshire, has also benefited from work-boot chic. Its heritage is in hiking and utility boots, and having been tested in the Iditarod sled-dog race in Alaska, the footwear is designed to withstand severe conditions. Yet the current appeal of Timberland's classic tan, water-

proof work boot is as much because of its appearance as for its ruggedness. To compete in the new hybrid category, Timberland recently introduced the Up-Country Hiker (\$165), which is a hybrid with a twist. Instead of being a street boot with rugged characteristics, the Up-Country Hiker is a hiking boot with street characteristics—functional, utilitarian and anti-fashion—the height of style. —A.G.



**DR. MARTENS
BY SKECHERS USA**



**TIMBERLAND
UP-COUNTRY HIKER**



**NIKE
AIR MADA**



**ADIDAS CROSS-
TRAIL HIKER**

create the recycled outsole.

Because trail runners typically do a lot of bumping and rolling when they're off the beaten path, shock absorption is also an important consideration.

Wolverine World Wide offers a technology called Durashocks in its Wilderness line (\$47-\$227) of outdoor shoes and boots. The compression pads provide additional impact protection and transfer body weight forward from the heel as you walk or run.

The Asics Gel-Havoc (\$75), labeled an "alternative training shoe," uses a unique cushioning system called Alpha-Gel, whose key feature is a liquid/gas-filled bag in the rear of the midsole. The shoe is built on a running last (a mold around which a shoe is shaped), and is light enough to wear for basketball or running.

Nike's Air Mada incorporates the company's Air cushioning technology, via a large Air Sole unit in the heel of the shoe, where much of the impact is absorbed during landings. Reebok's Telos features the company's Hexalite honeycomb cushioning technology in the heel.

Many of these cushioning compo-

Inside The Asics Gel-Havoc



nents come from athletic-shoe technology.

In addition to cushioning systems, most off-road shoes feature heel and toe counters to keep the foot stable inside the shoe. These components also help the wearer avoid injury and blisters,

and they help enhance comfort. Although a shoe's outsole absorbs most of the pounding on the paths, hybrids also take into account that Mother Nature frequently throws in a few surprises. On hybrids, the rand is typically raised and used as a bumper for protection around the toe, heel and forefoot.

The bodies or uppers of most models are designed to keep water, mud and rocks outside the shoe where they belong. Nike's Air Mada, for example, incorporates a gusset tongue, which is sewn to the upper at the base and sides, and a neoprene spandex sleeve in the upper for a snug fit.

Keeping the foot dry inside the shoe, even as you trample through puddles or streams, is also an important consideration. Most off-road shoes have leather or synthetic uppers that are water resistant. The Adidas Off-Road has a water-resistant mesh upper, while the upper on the Reebok Telos is a blend of leather and the water-repelling Naturetex polyester fabric.

Unlike serious hiking boots, few hybrids are truly waterproof or fitted with insulation, which are the chief components that differentiate between the two types. The difference between water-resistant and waterproof leather typically boils down to the addition of a high-tech material such as Gore-Tex, and the impact is felt in the wallet. Hybrid boots are not intended to be big-ticket items nor do they aspire to be the footwear of choice for hardcore athletes.

So, if you intend to spend a lot of time hiking, mountain biking, trail running or rock hopping in all four seasons and in all weather, then you might want to check out serious, high-dollar hiking boots. However, if you're looking for an alternative to sneakers but still want street comfort and off-road ruggedness, then the new hybrid boots have everything you want. Plus they look great, too.

PM



**ASICS
GEL-HAVOC**

HOME&SHOP
JOURNAL

HOME IMPROVEMENT

Picket Fences

This fence won't guarantee good neighbors, but it's a start.

TEXT AND PHOTOS BY MERLE HENKENIUS



1 After digging the holes with a posthole digger, coat the ends of the 4 × 4 posts with a sealer made for exterior use.



2 Place each post in a hole and hold it plumb while backfilling. Tamp the soil regularly with the shovel handle.



3 Begin laying out the rail notches by partially driving nails into the posts at the lower edges of each rail location.

There's nothing like a fence to help define boundaries, both physical and social. Even when a fence is not designed to keep anything (or anyone) in or out, it helps draw a line between what we can impact and what we can't. In addition to its utilitarian role, a fence is part of an overall architectural plan. Like a deck or porch, a good fence complements the visual character of your home and links its design to the surrounding landscape. And you can build it yourself with simple tools in a few good weekends.

Planning the fence

The kind of fence you install depends on what you want it to do. If it's to corral the family dog, then it must be dog-tight, starting at ground level and rising at least 4 ft. high. If its purpose is to keep the local kids from cutting across your lawn, then a split-rail fence will do. And if it's to reduce legal liability, as when fencing off a swimming pool, then a stockade fence with a locking gate may be in order.

If, however, you just want to conceal the lawnmower



4 Position the uncut rails on the partially driven nails, and scribe the notch locations on the posts with a pencil.



5 Set the blade depth on your circular saw to the thickness of the rails, and make a series of cuts in the notch waste area.



6 Use a sharp chisel to remove the waste from the notch area. Then, test fit the rails and adjust the notch if necessary.



7 After cutting the rails to exact length, set them in the post notches and secure them with 3-in.-long deck screws.



8 At the corners, you'll have two notches. Drive screws into the post and into the end of the adjoining rail.



9 To secure a post to the house, first counterbore a $\frac{1}{2} \times 1\frac{1}{2}$ -in.-deep hole. Then, drive a deck screw into the siding.



10 Align the slat tops with a string stretched from post to post. Space the slats with a $\frac{3}{4}$ -in.-thick strip, and nail.



11 After nailing a slat to the top rail, position the slat bottom with the spacer strip. Drive two nails at each location.



12 Lay out the gate slats and align the ends. Then, cut the crossmembers to length and secure them with screws.

and keep the neighborhood at bay during those weekend barbecues, then you're in the market for a privacy fence—a simple wooden screen that contains your outdoor life and presents an attractive façade to the rest of the community.

The most popular wooden fences are made of cedar, redwood or treated yellow pine. Redwood is the most rot resistant, but without treatment it weathers to a dull gray. Cedar is slightly more prone to rot, but can be more attractive over the long haul. When installed properly, cedar lasts many years. Pressure-treated lumber is normally quite rot resistant, but it too can fail. The problem is that fenceposts are often made of heartwood, which is the most resistant to the treatment process.

Post deterioration is also affected by the installation method. Installing a post in concrete, for example, makes an extra-sturdy fence. But the concrete traps moisture—a situation that eventually causes rot. On the other hand, direct burial provides good rigidity along with superior drainage around the post.

We opted for a cedar fence made up of 4×4 posts, 2×4 rails and 1×6 rough-sawn slats with dog-eared, or chamfered, top ends. While you can buy similar fencing in 8-ft.-long sec-

tions, doing this only makes sense if your yard is level. If your yard is sloped as ours is, it's best to build the fence from scratch.

Before digging any postholes, check to see what may be lurking underground. Contact your local building department and local utilities to find out what's buried on your property. Usually any interested party will be more than happy to come and locate its lines. It's then up to you to avoid digging through them. As for legality, it's your job to know where your property lines lie, and to set your fence a distance inside the lines that complies with local requirements.

Laying it out

After locating your boundaries, drive wooden stakes at the corners the appropriate distance inside the property lines. Then, stretch a string between the stakes to establish the fence line. Measure each straight run of fence and divide by the width of the slats plus the slat spacing to determine whether full-width slats will complete the run. While you can make minor adjustments to slat spacing over a long length, short fence sections require careful measuring.

Then, divide each run to produce post spacings of about 8 ft. You may have to vary the post spacing slightly

from one run to the next, or modify the size of the fence. Plan gatepost positions based on multiples of your slats and slat spacing, less one-half of the slat width. This allows one-half of a slat to overlap a gatepost.

Setting the posts

Use a posthole digger to dig the holes. To protect the grass, place the soil on a piece of plywood. Dig each hole to a depth recognized in your area as being adequate for the frost line. (In our area, this was 28 in.) Plan for the bottom 4 in. of the hole to be filled with sand for drainage. After digging all holes, paint each post with a sealer formulated for new wood (Photo 1). We used Seasonite made by The Flood Co., P.O. Box 399, Hudson, OH 44236.

After the sealer is dry, shovel 4 in. of sand into each hole and drop in the posts. With the string line in place, level and plumb each post while tamping loose soil against it (Photo 2). Use a shovel handle to tamp 2 to 3 in. of soil at a time. Mound the soil around the post for water runoff.

Attaching the rails

After the posts are in place, mark the rail locations and cut the rail notches. If your lawn is relatively level, you can position the rails by marking the positions on a corner post and then



13 After the horizontal gate crossmembers are in place, check that the gate is square and secure a diagonal brace.



14 Use a socket wrench to drive lagbolts that secure the gate hinges. Bore pilot holes for the lagbolts.



15 After installing the gate spring, adjust the tension by removing a pin, turning a hexhead nut and reinstalling the pin.



16 Gate hardware usually comes with the necessary screws or bolts. Install the gate handle and then check gate operation.



17 To withstand repeated closings, install a 1½-in.-wide × ¾-in.-thick gate stop on the post. Use galvanized nails or deck screws.



18 Apply sealer to fence with a roller, brush or garden sprayer. Then, apply a UV-screen sealer to prevent weathering.

transferring the positions to the other posts with a line level. If your lawn is sloped, mark the rail positions on each post by measuring up from the grade. For a roughly 4-ft.-high fence, measure up 12 in. for the lower edge of the bottom rail and about 36 in. for the lower edge of the upper rail. Drive nails partway at the marks on each post (Photo 3). Then, rest 2 × 4 rails on the nails and scribe the rail notches (Photo 4).

Set your circular saw to cut 1½ in. deep, and make several cuts through the waste area of each rail notch (Photo 5). Then, chisel out the remaining waste (Photo 6). With each post notched, cut the rails to length and fasten them with 3-in. deck screws (Photo 7). At a corner post, cut notches on both sides, screw the first rail in place and screw the second rail to both the post and the first rail (Photo 8).

To attach a post to the house, bore a ½-in.-dia. × 1½-in.-deep counterbore into the post. Then drive a 3-in. deck screw through the post and into the siding (Photo 9). Finally, cut the top of each post a uniform distance above the ground. If your grade is level, use a line level to match the post heights.

Installing the slats

We aligned the slat tops 1¼ in. above the posts. First, drive a nail into the

top of each post, leaving 1¼ in. showing. After stretching a string from nail to nail, use this line to sight the tops of the slats. To maintain uniform spacing, place a ¾-in. piece of cedar between slats when nailing them in place (Photo 10). After nailing each slat to its top rail, move the spacer down to the bottom rail (Photo 11) and nail it in place. Use two 6d galvanized nails at each rail location.

Building a gate

Our gateposts were spaced so that one-half of one slat overlapped a post and served as a stop. The crossmembers are made from slat stock.

Lay the slats out on a flat surface. Butt the slat ends against a wall, and space them to match the fence. Then, cut two crossmembers equal to the distance between the gateposts and lay them across the slats flush with the hinge-side slat. Fasten each slat to the crossmembers using one 1¼-in. deck screw at each juncture (Photo 12). Then, use a large square to check the assembly and add three more screws per joint. Cut a diagonal brace to fit between the crossmembers, and screw it in place (Photo 13).

We used ornamental steel hinges and hardware to mount the gate. The hinges required ¼-in. galvanized lagbolts. Bore pilot holes for the lagbolts,

and then drive them in with a socket wrench (Photo 14).

To keep the gate closed, we installed an adjustable gate spring mounted diagonally on the hinge side of the gate. After mounting, adjust the tension by pulling the pin from behind the large hexnut at the bottom of the assembly (Photo 15). Tighten the hexnut with an open-end wrench, and, with the spring under tension, replace the pin. Finally, install the gate handle (Photo 16). It's a good idea to nail a cedar strip to the inside of the gatepost to act as an additional stop. Place this so the gate's crossmembers bear the impact of the spring-loaded closing (Photo 17).

Sealing the fence

No matter which type of wood you've chosen, it's a good idea to seal it as soon as possible. In this case, rot is less an issue than warping and twisting. If you want a weathered look, give the fence an immediate coat of Seasonite, which seals against moisture but doesn't resist UV light. When you see the degree of weathering you like, treat the fence with a UV-screen penetrant such as CWF-UV, also manufactured by The Flood Co. To apply the finish, use a vacuum-pumped garden sprayer or a brush and roller (Photo 18).

SHOP TECHNIQUES

Inlay

How to add understated elegance to any woodworking project.

TEXT AND PHOTOS BY
ROSARIO CAPOTOSTO,
Contributing Editor

● What makes or breaks a woodworking project? Well, most woodworkers will tell you it's all in the details—the little things that catch the eye and give the piece value far beyond its utility. For some, it can be as simple as a delicately tapered leg with chamfered corners, while others rely on elaborate moldings or turned spindles to give life and character. However, if your involvement stops here, you're missing out on a world of visual possibilities all based on inlay work.

Like marquetry, inlay adds a decorative element to the wood surface by incorporating patterns made up of contrasting woods. However, while marquetry is concerned with laminating veneer on top of the surface, inlay involves embedding a pattern or design into recesses cut in the wood.

To demonstrate a few inlay variations, we've chosen a simple jewelry box. To start, we'll show you how to make a diamond mosaic banding. We'll then move to a simple triple-stripe inlay and finish with a marquetry insert.

Most of the tools are common to the typical home woodworking shop (see inset). For special tools and supplies, check out mail-order outlets such as Constantine's, 2050 Eastchester Rd., Bronx, NY 10461, and The Woodworker's Store, 21801 Industrial Blvd., Rogers, MN 55374.



To make our banding inlays, you need a router with guide bushing, masking tape, spring clamps, shopmade T-guide, veneer saw, knife and glue. To lay out and inlay a marquetry insert, use carbon and tracing paper, a hard pencil, rule, rubber cement, gummed veneer tape, a fret saw and a shopmade birds-mouth (cutting support).



1 With the saw blade tilted at 45°, cut the lamination into 1/4-in. slices. Clamp a stop-block to a miter gauge fence for uniformity.



2 Reassemble the slices so each maple section abuts a mahogany piece. Use tape and spring clamps to hold pieces in place.



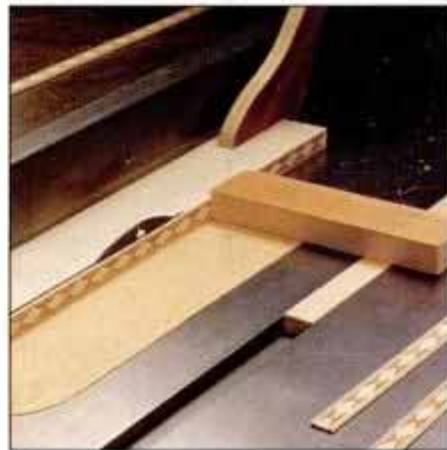
3 Tack strips to both edges of assembly and place between guide boards. Install a wide base on router and trim faces flat.



4 To add stripes to each side of the diamond pattern, cut maple and mahogany veneer to the size of the diamond blank.



5 Laminate a stack of maple, mahogany and maple veneer to each side of the diamond blank. Clamp until glue sets.



6 Rip 1/8-in.-thick strips on outside of blade. Use a T-jig in miter gauge slot to reposition fence and work after each pass.

Diamond Mosaic Banding

At first glance, a diamond motif might seem difficult to make. And it would be, if you had to fit each small piece in one at a time. The secret lies in assembling the elements in the form of a board, and then slicing off thin layers.

Begin by cutting two pieces of mahogany and one piece of maple to $\frac{1}{2} \times 3 \times 20$ in., then laminate the mahogany pieces to each side of the maple piece. This blank will produce more than enough banding material for our small jewelry box.

When the glue has dried, joint the edges of the blank and tilt the blade on your table saw to 45°. Crosscut the end of the blank to produce a 45° bevel. Then, cut the board into 1/4-in.-thick slices with the blade set at 45° (Photo 1). Use an angled stopblock clamped to an auxiliary fence on the miter gauge to ensure uniform cuts.

The next step is to reassemble the strips, only offset, so a mahogany layer is adjacent to a maple layer. To hold the pieces together while the glue

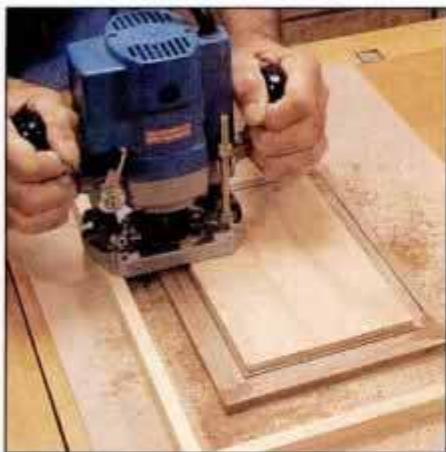
sets, use spring clamps and masking tape. Align a pair of sections, maple to mahogany, and apply a strip of masking tape along the mating line on one side so the two pieces hinge open. Then, apply fast-setting yellow glue to the mating surfaces and let the glue become tacky by allowing it to dry in the air for about a minute. Bring the faces together and apply tape to the opposite joint line. Add two spring clamps to fully close the joint (Photo 2). Leave the spring clamps in place for at least 5 minutes.

Next, construct a jig to rout off the peaks on both faces of the blank. First attach a $\frac{1}{4} \times \frac{1}{4}$ -in. strip to both edges of the blank with a few 1 1/4-in. finishing nails. Make sure the strips are parallel to each other and in line with the blank. Then, screw the assembly to a workboard and add a 3/4-in.-thick guide board on each side of the assembly. Secure an oversize base on your router to ride on the guide boards. Install a straight bit in the router, and adjust the depth to take off the peaks of the blank while the

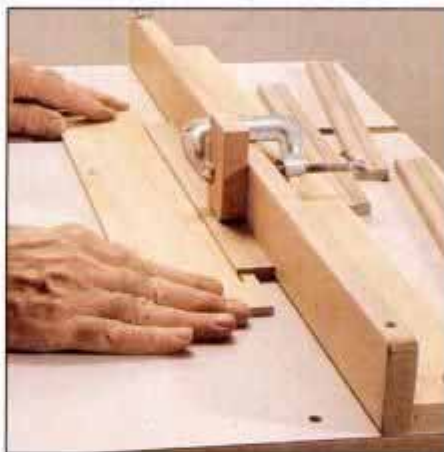
router rides on the guide boards. A strip tacked on one side and then moved to the other keeps the router in line while you are trimming the edges (Photo 3). When the first side is done, flip over the blank and trim the other side. When you're done, you'll have a flat board with the diamond pattern visible on the edge. Because the pattern runs through the whole piece of wood, you can cut off many thin strips for inlaying.

To add triple-border stripes on either side of the diamond pattern, cut two pieces of mahogany veneer and four pieces of maple veneer slightly larger than the blank (Photo 4). Use 1/8-in.-thick veneer. The veneer and blank can be laminated in one step, but you'll have to work fast if you're using white glue. For a more relaxed pace, use slow-setting hide glue, available in a bottle.

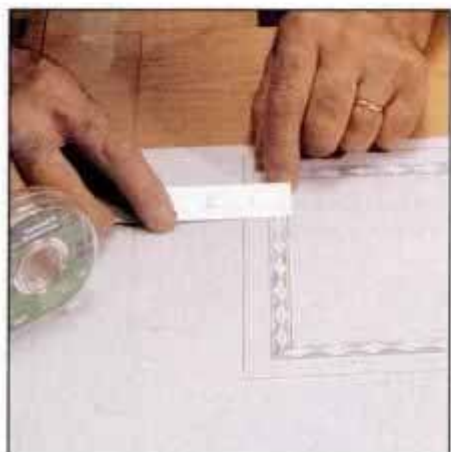
With cauls (flat boards that distribute clamping pressure), clamps, glue and wax paper on hand, stack the assembly in the correct order—each side of the blank is glued to a maple/



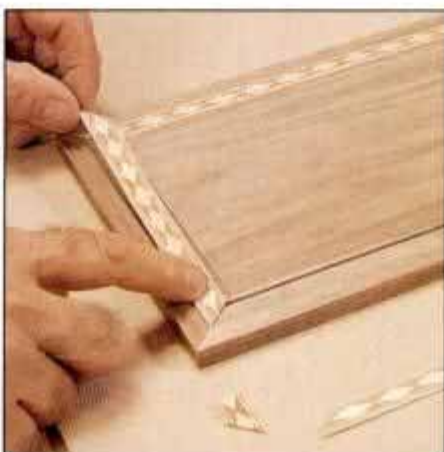
7 Rout diamond band recess with a straight bit. Use a template and guide bushing. Trim round corners with chisel.



8 When inlaying banding in pieces to be assembled later, such as for a picture frame, use a router table to cut the recesses.



9 To position miters, first make photocopies of the banding. Align and cut these to length and then use as a pattern.



10 Test fit each piece. Then apply glue and cover with wax paper and a caul before clamping. Sand flush when glue is dry.

mahogany/maple stack (Photo 5). Then apply glue to each piece, drive a few nails through the wood at a waste area to prevent shifting and clamp the bundle with wax paper between the work and the cauls.

To slice the completed blank into banding, first install a smooth-cutting blade in your table saw and fit the saw

with a close-fitting blade insert.

The $\frac{1}{16}$ -in.-thick bandings must be ripped on the outside of the blade—not between the blade and the fence. To ensure uniform cuts and speed up the fence adjustment after each pass, make a T-shaped jig (or T-guide) that fits in the miter gauge slot. Trim the leg of the jig that extends toward the

blade so it ends $\frac{1}{16}$ in. from the blade, and clamp the jig to the table saw a few inches in front of the blade.

With the work against the fence, adjust the fence until the work touches the jig and cut the first strip. After each cut, readjust the fence so the work touches the jig and make the next cut (Photo 6).

To rout a recess for the banding, install a straight bit that matches the banding width, or use a smaller bit and make the cut in two passes. Set the depth of cut to slightly less than the thickness of the banding.

For a rectangular installation, such as the one shown here, make a template of the recess and use a guide bushing on the router to follow the template (Photo 7). Be sure to size the template properly for the bit and bushing sizes you're using. Secure the template with double-sided tape or clamps. After routing the recess, square the corners with a sharp chisel.

If you're banding individual pieces that will be assembled later, such as in a mitered frame, rout the recesses on a router table (Photo 8).

To inlay a mitered rectangular banding, first make several photocopies of the banding. Then, cut and fit the copies (Photo 9). When you're satisfied with the placement of the miters, use the photocopies as a guide in cutting the pieces to length with a veneer saw.

Finally, test fit the bandings and trim, if necessary (Photo 10). Then apply glue sparingly, place the bandings in the recesses and clamp. Use a flat scrap of wood as a caul to provide even pressure and place wax paper between the work and the caul.

When the glue is dry, sand the banding flush with the worksurface. Begin with 120-grit or finer paper and finish with 220-grit paper.

Triple-Stripe Inlay

Like a pinstripe on a car, one of the most effective decorative elements in woodworking is a simple, single or multiple inlaid stripe.

Single-stripe inlays can be made by simply slicing solid wood. For our triple-stripe inlay, start with maple and mahogany veneer. Laminate three layers of 3×20 -in. veneer, with the mahogany sandwiched between two maple pieces, to obtain a roughly $\frac{1}{10}$ -in.-thick triple veneer.

To cut the assembly into strips on your table saw, tape the piece to a $\frac{3}{4} \times 3 \times 19$ -in. support board so that 1 in. overhangs the front end of the board. Apply the tape to the edge of the



11 Tape triple veneer under board with 1 in. extending past end. Reference T-guide against extension to cut $\frac{1}{16}$ -in. strips.



12 Cut triple-stripe recess with a fine-cutting thin-kerf blade. Then glue stripes in place, using butt joints at corners.

board that will ride against the fence.

Adjust the blade so it projects about $\frac{3}{16}$ in. above the table. Then, place the work against the fence and use the T-guide, described on page 67, to set the fence for a $\frac{1}{16}$ -in.-rip on the outside of the blade. Reference the T-guide against the 1-in. overhang of triple veneer that projects

from the support board.

After the first cut, shift the fence over so the veneer abuts the T-guide, and make the next cut (Photo 11).

To install the triple-stripe inlay, make the recesses with a fine-cutting thin-kerf blade, slightly shallower than the depth of the strips. Cut the inlay strips to length, using butt joints at

the corners and carefully test fit them in the recesses. Make sure that these recesses are free of all sawdust and other debris that could keep the inlay from seating properly. Then, apply a thin bead of glue to the recesses and clamp the strips in place (Photo 12).

When the glue is dry, sand the triple strips flush to the surface.

Inlaid Marquetry

To make an inlaid marquetry pattern similar to the central design on our jewelry box, begin by laying out the design on paper and then choose your veneer—we used limba and mahogany, $\frac{1}{28}$ in. thick.

You can cut the marquetry pieces with a knife (see "Marquetry," page 53, Aug. '92), or use the fret-saw method that we chose for this project. The advantage of the fret saw is that you can cut more intricate shapes. The sawing technique shown is called the double-cut because it produces two complete assemblies—one the inverse of the other in terms of light and dark.

Begin by cutting two pieces of contrasting veneer slightly larger than the complete design and stack them together with a piece of scrap veneer underneath.

Temporarily secure the veneer together with rubber cement. Trace your pattern on the stack by placing carbon paper between the drawing and the work and going over the lines with a sharp pencil.

To cut the individual veneer pieces, first install a fine blade in a fret saw—this saw is similar to a coping saw, but with an adjustable or very deep fixed throat, and capable of using blades ranging from .008 to .034 in. thick. Support the veneer stack on a $\frac{3}{4}$ -in.-thick board with a narrow V notch cut into one edge. This board is called a birds-mouth, and the V notch provides clearance for the blade while the work is supported for cutting.

Use a pushpin to pierce starting holes at the corners of the lines of the design. Then, insert the blade in a hole with the teeth pointing down, tension the blade and begin cutting out the shapes (Photo 13). Hold the fret saw so the blade is vertical and at 90° to the veneer stack. When all the lines have been cut, carefully pry apart the pieces with a knife and rub off the rubber cement with your fingers.

Assemble the segments of the design that are to be used, and apply gummed veneer tape over the surface (Photo 14). Then, flip over the assembly. Because the pieces were sawn with a vertical stroke, you'll notice a slight gap between them. Fill the gaps



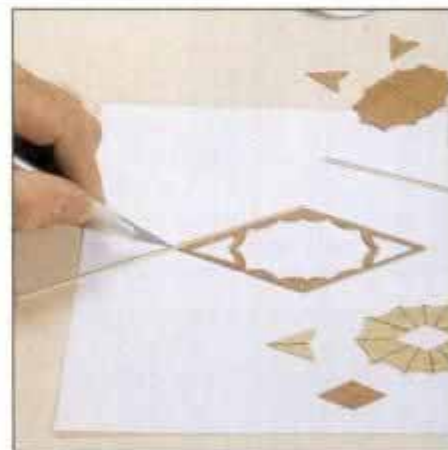
13 Support veneer on birds-mouth, and use fret saw to cut shapes. A pushpin makes holes that start each internal cut.



15 Use a template, guide bushing and straight bit to rout marquetry recess. Bushing and bit size determine template size.

with a paste made from fret-saw dust and white glue. Just spread some very fine dust on a piece of scrap wood and squeeze some glue into the dust. Mix the two thoroughly, using a small splinter of wood, until you achieve the consistency of commercial wood fillers. With practice, you can eliminate the gaps by sawing the pieces at a slight angle. The resultant beveled edges allow the pieces to nest together snugly. The degree of bevel is related to the thickness of the fret-saw blade.

To inlay the marquetry assembly, first make a template for the overall shape that suits your router bit size and your guide bushing, and then secure it to the work (Photo 15). It's a



14 After cutting, separate the two sets of shapes. Then, assemble a contrasting set and apply veneer tape to the top face.



16 Use a sharp knife to trim round corners left by router. Apply glue and clamp marquetry assembly. Sand flush when dry.

good idea to first test the template on a scrap board. After you've routed the actual recess, trim the rounded inside corners with a sharp knife (Photo 16).

To glue the marquetry assembly in the recess, first apply glue sparingly to the mating surfaces and position the assembly in the recess. Lay a sheet of wax paper over the surface and then add a pad of about six sheets of newspaper to equalize the uneven pressure caused by variations in veneer thicknesses. Place a flat caul over the pad and then clamp.

When the glue has set, remove the clamps and pad, dampen the gummed veneer tape and peel it off. Allow the inlay to dry thoroughly, then sand and apply the finish of your choice. **PM**

NEW PRODUCTS

Basic Barbecue

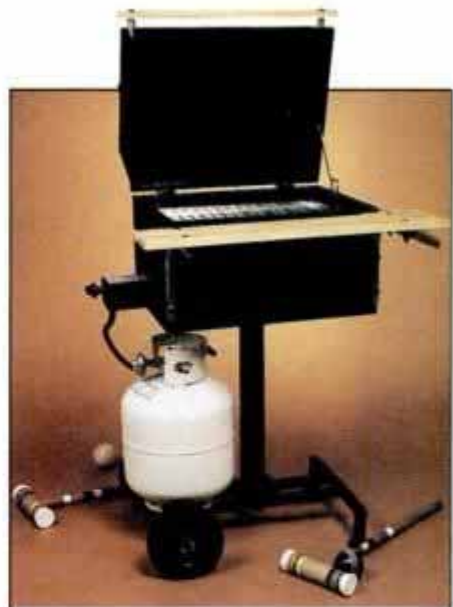
The newest backyard barbecue gear.

BY ROY BERENDSOHN, Assistant Home Improvement Editor

Blue Flame

Thermos VIP gas grills display a number of design improvements. Thermos says it has virtually eliminated flare-ups by directing grease away from the burner and into a disposal tray. Also, it has increased airflow to the burner and has shaped the component so it produces a series of hot and clean blue flames around its perimeter. The result, says the company, is a burner that uses a third less gas than conventional grills while heating the cooking grid evenly. According to Thermos, this grid has a temperature difference of 50-60°F between its center and corners, as opposed to a 100-150°F difference for other grills. Part of the grill's fuel efficiency was achieved by using thermally efficient aluminized steel for the firebox and for the grill cover. The aluminum also improves corrosion resistance.

The improved design has done away with venturi tubes, which can harbor spiders and other insects. Instead, the burner connects directly to the gas valve at the side of the appliance. The grills cost about \$140 for a 404-sq.-in. model to \$279 for a 975-sq.-in. model at hardware stores and department stores. Write the Thermos Co., Attn.: Dept. 31, 1555 IL Route 75 E., P.O. Box 600, Freeport, IL 61032.



No Burnt Offerings

This barbecue oven/grill is worth a look because it is designed to end the bane of barbecue chefs everywhere: food burned beyond recognition. It accomplishes this, says its manufacturer, with a sealed burner that circulates heat while keeping the flames covered. Furthermore, it's designed to cook the food evenly and at comparatively low temperatures and eliminates the need for rotisserie turning.

To prevent flare-ups, grease is routed away from the burner and into removable trays that can be cleaned in a dishwasher. The grill has a 16-in.-wide x 20-in.-long cooking surface, but it's supposed to use only a quarter of the propane a standard gas grill uses. It costs \$495, shipping included, from: H. Jurgens Grill Co., P.O. Box 45218, Tacoma, WA 98445.



Sit Back, Relax

Wood furniture doesn't rust, obviously, but its fasteners do, and that's why we thought these products were worth a mention—they use stainless-steel fasteners. The product quality doesn't stop there. All the pieces are built from No. 1-grade southern yellow pine, and, for protection against rot and wood-eating insects, the lumber is pressure-treated and receives a finish of water-repellent sealant. Included in the company's extensive line of outdoor furnishings are a 52-in. octagonal table and chair set, about \$460 (the octagonal table is about \$149), and a 42-in. octagonal table and bench set, about \$230. The furnishings are sold at home centers and building supply stores. Contact Palmetto Manufacturing, P.O. Box 1124, Orangeburg, SC 29116; (800) 476-6716.





New Horizons

If you're interested in broadening your barbecue horizons, so to speak, you might consider this retrofit kit for Weber kettle grills. It allows you to grill using the indirect method. Barbecue connoisseurs know there are the direct and indirect methods of barbecuing. In the first, you simply grill burgers, hot dogs and chops over a flame or red-hot coals. With the indirect method, the food is cooked over a drip pan, with the coals piled on both sides of the pan and against the kettle. This cooks the food with reflected heat, as in a convection oven. Weber maintains this is the correct way to cook large cuts of meat.

The kit includes two charcoal baskets, two aluminum drip pans, a recessed charcoal grate so you can pile the charcoal over Weber's Fire-starters cubes (the cubes replace charcoal lighter) and a hinged grill. The kit costs about \$30 at hardware stores and home centers. For more information, write Weber-Stephen Products Co., 200 E. Daniels Rd., Palatine, IL 60067; (800) 446-1071.



Clean And Shiny

Run this handy little tool over the bars on your grill to get them clean. Its manufacturer says the star-shaped head strips off even the toughest deposits of cooked-on grease and rust. The steel tool has a comfortably shaped rubber-coated handle and costs about \$3 at hardware stores or \$6 each postpaid from Clark R&D Ltd., 1918 N. Eastwood Dr., Arlington Heights, IL 60004.

Stormy Weather

It's happened to all of us: You have a cookout planned when bad weather spoils the fun. But bad weather doesn't mean you'll have spaghetti instead of grilled steak. Consider this electric appliance that will grill a steak in 1½ minutes, its manufacturer says. Also, it's supposed to be smokeless and odorless, and it has nonstick surfaces. It cooks seafood, poultry, vegetables, hot dogs and burgers, and, because it also uses steam, the food is cooked without being dried out, its manufacturer says. The UL-listed Grill Express costs from \$130 to \$150 at department stores and through televised infomercials. Write Creative Technologies Corp., 170 53rd St., Brooklyn, NY 11232.



Standing Room Only

Ever notice how there never seems to be enough seating at picnics and barbecues? Here's an unusual solution to the problem: a portable cushioned seat that makes sitting on the ground more comfortable and is easier on your back. The cushioned nylon and polyester seat folds up and is washable. Called the Handi-Back Chair, it costs \$28.50 postpaid from Algoma Net Co., 1525 Mueller St., Algoma, WI 54201.

Hot Stuff

If you love to barbecue, check out this free catalog. In it, you'll find smoker chips, recipe books, utensils and every degree of barbecue sauce from mild to volatile. A PM staffer who uses Tabasco like ketchup vouches that Dave's Gourmet Insanity Sauce nearly scorched a hole through the roof of his mouth.

It also has barbecue grills, smokers, parts and accessories. Write Char-Broil, P.O. Box 1300, Columbus, GA 31902.



Your Choice: Hot Or Cold

A thermoelectric cooler is a neat gadget, and Rubbermaid's version of it has several worthwhile features. First, it keeps food hot (140°F) or cold (40°F below the outside temperature). The appliance plugs into a 12-volt cigarette lighter or a voltage converter, which in turn plugs into a 110-volt outlet. It can stand on its bottom or on its end, like a small refrigerator. Its interior compartment is divided with a removable shelf. It weighs about 23 pounds and has retractable handles. It costs from \$100 to \$120 at camping supply stores and home centers. Write Rubbermaid, SPI, 1147 Akron Rd., Wooster, OH 44691.



BE "THE BOSS" OF YOUR OWN NEW BUSINESS!

Send now for your free opportunity kit; get "hands on" training in one of seven profitable fields!

Learn to Earn!

The Federal Government projects the service sector of the economy will show tremendous growth over the next several decades. You can get your share of the profits when you become a "pro" in one of 7 high income professions. Professions that could easily earn you \$18 to \$30 per hour. Foley-Belsaw's unique training programs can make those dreams come true. The key to your success lies in providing a service that is in great demand. Foley-Belsaw training programs focus on seven fields where the demand is growing and will continue to grow through the twenty-first century! And with Foley-Belsaw's unique approach, you gain skills quickly in your spare time at home; you can even earn cash while you learn. There's no "classroom pressure" . . . no fierce competition . . . you set your own pace, your own study style. Foley-Belsaw also provides "extras" other courses don't offer: a 100% money-back guarantee; along with all the professional tools and equipment you need.



1 Locksmithing. As millions of Americans demand greater protection, this becomes a high demand field. We provide the training to make you a professional locksmith who commands \$25 per hour.

2 Professional Saw & Tool Sharpening. Imagine a business where 90 cents out of every dollar you take in is cash profit! You'll earn \$18 to \$25 per hour running machines that do the work for you.

3 VCR Cleaning, Maintenance & Repair. The VCR has become a basic part of nearly every American household. You can make up to \$50 per hour in this fast growing field.

4 Upholstery. As furniture prices rise and quality noticeably decreases, it makes good sense to pursue a career in upholstery. You'll learn to make big profits in both commercial and consumer markets.

5 Small Engine Service & Repair. There are more than 65 million small engines in use today (a number growing at a rate of 1,000 each month). You can make \$45 in just 1/2 hour for a simple tune-up, and even more for many of the simple repairs you'll learn on everything from snow blowers to bass boats.

6 Professional Woodworking. Build over \$3,000 worth of valuable furniture while you learn! You'll start the Foley-Belsaw course with the simplest of projects then move on to creating heirloom-quality furniture! You'll save thousands on your own home repairs alone.

7 Computer Repair, Maintenance & Upgrade. There's no doubt about it, the computerization of America is taking place! Get a jump on a high paying occupation or business of your own in a field with an unlimited future.

CALL TOLL FREE

800-487-2100

FOR FREE INFORMATION PACKET!

COMPLETE AND RETURN THIS COUPON TO:

Foley-Belsaw Institute, 6301 Equitable Road, Kansas City, MO 64120

(Please check only one of the following.)

- Locksmithing, Dept. 12484
- Saw & Tool Sharpening, Dept. 21347
- VCR Repair, Dept. 62156
- Upholstery, Dept. 80964
- Small Engine Repair, Dept. 52396
- Woodworking, Dept. 43299
- Computer Repair, Dept. 64057



NAME _____

STREET _____

CITY/STATE/ZIP _____

YES!
SEND ME
THE FOLLOWING
FREE
OPPORTUNITY KIT

See The Light

Groping through the icy darkness can make your hair stand on end, and that's just to get a cold soda. It's not surprising that Coleman, well known for its outdoor lighting products, would come up with this good idea: a cooler with a battery-operated light in its lid. The light is removable so you can use it as a flashlight. Also, you can turn it off during the day, to conserve its two AA batteries. The cooler is available in three sizes: 48-, 54- and 68-quart capacity (about \$25, \$30 and \$40). They are sold at department stores and sporting goods stores. Contact Coleman Consumer Service, P.O. Box 2931, Wichita, KS 67201.



Flip It

This 1500-watt electric grill is designed with a built-in rack that pivots over on a pair of rails. Since the rack rides on rails, turning it is easier than it would be if you had to lift it and reposition it. Also, the rack height is adjustable. Its cooking surface measures about 11 x 11 in. Its other features include a removable drip pan and insulated handles that are supposed to stay

cool. It costs about \$100 at department stores. For more information, write DeLonghi America Inc., 625 Washington Ave., Carlstadt, NJ 07072.

Land Of The Midnight Sun

These solar-powered lanterns provide fuel-free outdoor lighting. To recharge a lantern, remove the solar cell/battery stored in its base and put it in the sun.



This allows the battery to charge separately from the lantern. One lantern (bottom inset) has twin tubes and can be used with one or both tubes lit (for 4 or 8 hours of light). The other model (top inset) has a single tube that functions as a flashlight or a blinking emergency light. The twin-tube model costs about \$60, and the lantern/flashlight model costs about \$70. Both are sold at home centers and sporting goods stores. Write Siemens, P.O. Box 6032, Camarillo, CA 93011.

Hasta La Vista

This ultraviolet bug light is designed to attract mosquitoes and flying insects. Once they're near, it sucks them in with an axial fan that produces up to 120 cu. ft. of air movement per minute. The bugs are then killed by a powerful electrostatic grid. The UL-listed Galaxie Mosquito Trap costs from \$60 to \$70 at home centers and hardware stores. Write Flowtron Outdoor Products, 2 Main St., Melrose, MA 02176.



Well Done

This little gadget is designed to take the guesswork out of barbecuing meat. It's an electric thermometer that correlates the food's temperature with the extent to which it has been cooked. Stick its stainless-steel probe into the food, then press its button, and one of several lights on the device glows telling you whether the meat is rare, medium rare, medium, well-done and so forth. It's supposed to work on everything, from red meat to poultry. It comes with a 5-year lithium battery and costs \$24.49 postpaid from Improvements, 4944 Commerce Pkwy., Dept. 5438, Cleveland, OH 44128; (800) 642-2112. **PM**



Homeowners Clinic

BY NORMAN BECKER, P.E.,
Contributing Editor

Ceiling Fan Wobbles

I recently installed three new 42-in. ceiling fans in my house. All three have light fixtures on them. Two of them run evenly and smoothly. The third one vibrates and shakes. Can anything be done to make the fan run smoothly?

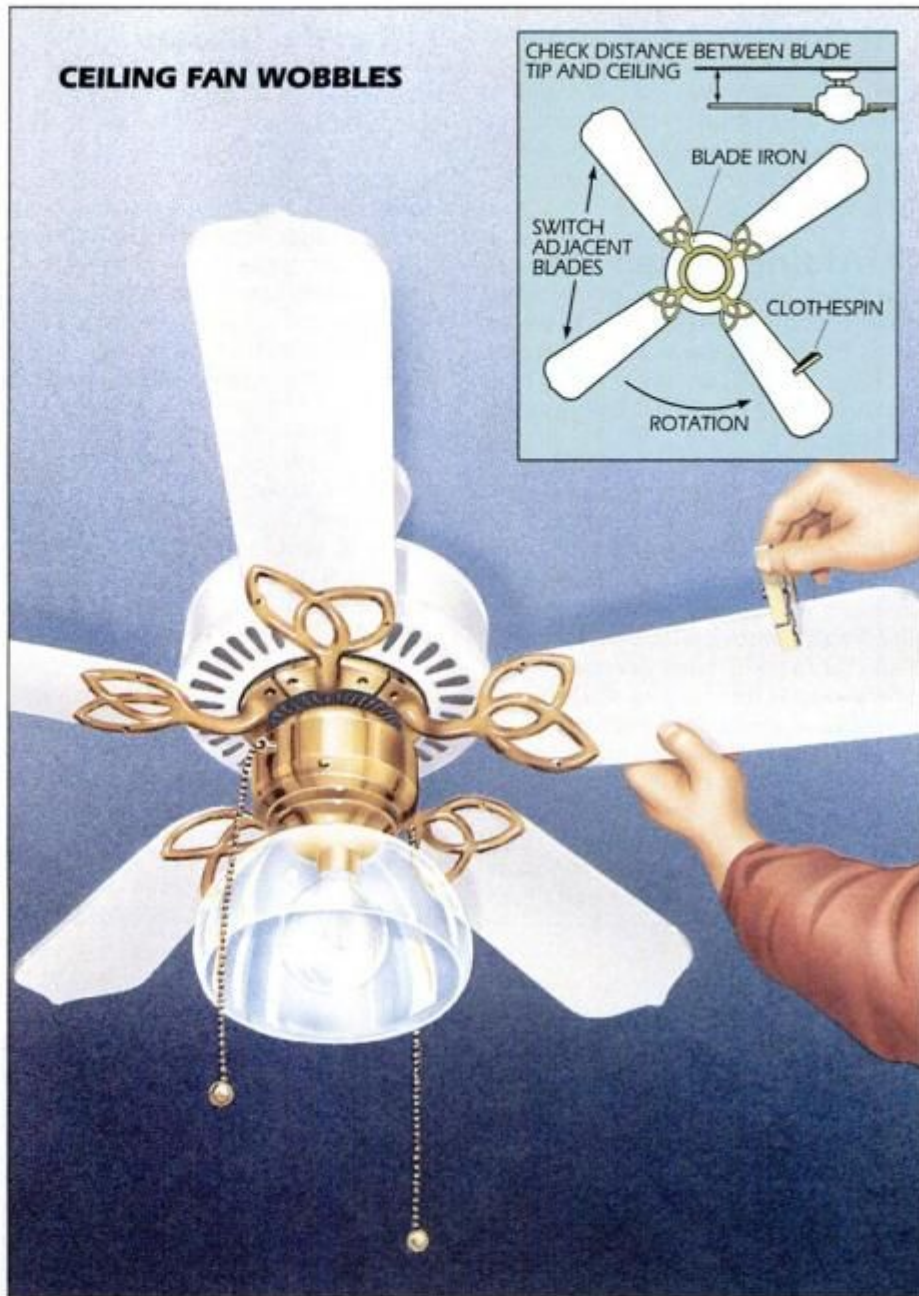
WILLIAM SWOPE
PHILIPSBURG, PA

There are several reasons why a ceiling fan wobbles when operating. The fan blades could be out of balance, out of track or warped. The wobble could also be caused by the air turbulence that results from the blades being closer than 6 in. from one side of a sloped cathedral ceiling or ceiling beam.

You can check to see if the fan blades are out of balance by clipping a spring-type clothespin halfway between the tip and the blade iron on the leading edge of one blade. Turn on the fan to LOW speed and see if the weight stops the wobble. Try each blade to determine if it needs more weight. If the clothespin stops the wobble, it should be replaced with thin adhesive-backed lead-weighted tape, which is available through the fan manufacturer's service center.

Check to see if one or more blades are out of track. Using a yardstick, measure the distance from the ceiling to the tip of each blade. The distance should be equal for each blade. If it isn't, contact the nearest manufacturer's service center about correction or warranty replacement.

If the blades are not out of track, try swapping blades to correct the problem. Switch the



A ceiling fan can wobble for a variety of reasons. Check that the blades are not warped or out of balance. Fasten a clothespin to a blade and see if it corrects the problem.

position of two adjacent blades while leaving the other two in their original positions. While the blades are off the fan, lay them on a flat surface to see if they are warped. If so, then replace the blades.

Free Info

Want to cook a 10-pound turkey on your barbecue but don't know how? Just call (800) 474-5568. Barbecue grill manufacturer Weber-Stephen Products has established this toll-free hotline to answer homeowners' questions about barbecuing. As an additional service, you can also order a free copy of *Backyard Barbecue Basics*, a pocket-size guide to grilling. The toll-free line is open weekdays, 11 am to 9 pm, and Saturdays, 9 am to 6 pm, through July 8. However, you can continue using the line to order the barbecue guide through Labor Day.

Water-Based Versus Oil-Based Paint

Can I apply a water-based paint directly over an oil-based paint? And conversely, can I apply oil-based paint over a water-based paint? I have had conflicting advice from paint stores.

M. LOYE
AUBURN, CA

You can paint over a water-based paint with oil-based paint, and vice versa. However, you should not paint over a very smooth or high-gloss surface with either product without first roughing the surface. If the initial surface coat is flat, clean and free of chalk-like powder, there is no need to use a primer.



On the other hand, if the initial surface has a gloss, and you sand it to rough it up, you should use a primer. The primer will ensure a good bond to the surface beneath and will help produce an even level of gloss on the finish coat.

Corroding Aluminum

The aluminum sills on my sliding glass doors are corroding. In some spots, the corrosion has eaten through the sills. The sills are set directly on a concrete slab. What can I do to stop the corrosion?

DONALD PENAPRESE
PORT HUENEME, CA

The aluminum sills should never have been placed in contact with concrete. An unprotected aluminum surface in contact with concrete and water creates a very corrosive environment. One way to isolate the aluminum from the concrete is to coat its bottom with a bituminous mastic, such as roofing cement.

The sill could also be placed on a strip of tar or asphalt felt. Any noncorrosive material can be used to isolate the aluminum sill from

Barbecue Tuneup

● Tuning up a barbecue is simple, first remove the cooking grid, lava rocks and burner. With a stiff wire brush, scrub the firebox clean. Cover the burner orifices while you're doing this to keep debris from getting into them. Next, unthread each orifice (a brass fitting attached to the gas valve) and check its opening. Clean it gently with a toothbrush if it is plugged.

Thoroughly clean the cooking and fire grates. To clean greasy lava rocks, turn them over and burn the grease off them with the grill on HIGH and the lid closed.

Flush and clean the burner. During the winter, spiders and insects build nesting webs in the burner venturi tubes. Using a stiff brush, lightly scrub the burner, and with a thin piece of wire, clean clogged burner holes. Use a bottle brush to clean the venturi tubes, then flush the burner with a garden hose.

Make a solution of water and liquid soap. Turn the gas on at the tank valve.

Brush the solution on the tank, valve, hose and regulator. If there is a gas leak, it will form bubbles. If a gas leak occurs at a connection, tighten the pieces and test the part again. If the parts still leak, replace them. Check the automatic ignitor. If it doesn't spark, replace it.

—Steve Toth



APPLIANCE CARE TIP

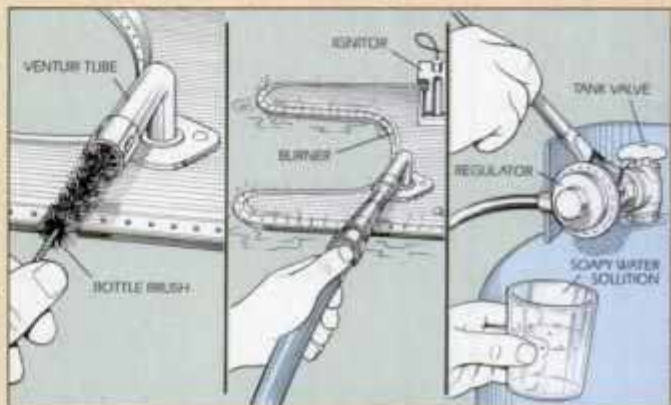


PHOTO ILLUSTRATION BY GEORGE BETHUNE



the concrete. Thin (3/4 in. or less) red-wood or cedar boards can be used because they are rot resistant, and their thickness will not create a tripping hazard. Pressure-treated wood is not recommended for this application because the salts used in the pressure treatment are corrosive to aluminum.

Water-Activated Sump Pump

I have heard of, but cannot find, a sump pump that is propelled by water pressure. The pump is connected to the house water supply and does not depend on electricity. I want to use this pump as a backup in case I am without electric power. I am trying to find out who manufactures it.

STANLEY BURCZYK
ORLAND PARK, IL

HiLo Industries has just introduced a water-powered backup sump pump that costs in the range of \$100 to \$130 at lumberyards and home centers. Another option is the company's 12-volt battery-powered backup sump pump called the Basement Sentry. It's also sold at home cen-

Toll-Free Help Lines

● Need help with your appliance? This list of toll-free numbers is provided by the Major Appliance Consumer Action Panel:

Admiral: (800) 688-9920	Frigidaire: (800) 451-7007	Kelvinator: (800) 323-7773
Airtemp: (800) 285-1080	Gaffers & Sattler: (800) 688-1120	Kitchenaid: (800) 422-1230
Amana: (800) 843-0304	General Electric: (800) 626-2000	Litton: (800) 843-0304
Caloric: (800) 843-0304	Gibson: (800) 458-1445	Magic Chef: (800) 688-1120
Carrier: (800) 227-7437	Glenwood Range: (800) 843-0304	Maytag: (800) 688-9900
Chambers: (800) 422-1230	Hardwick: (800) 688-1120	Modern Maid: (800) 843-0304
Climatrol: (800) 285-1080	Hotpoint: (800) 626-2000	Norge: (800) 688-1120
Coolerator: (800) 632-2243	In-Sink-Erator: (800) 558-5700 (outside WI)	O'Keefe & Merritt: (800) 537-5530
Crosley: Refrigerators, freezers: (800) 688-1120	Jenn-Air: (800) 688-1100	Philco-Warwick: (800) 688-1120
Air conditioners: (800) 285-1080		Rheem/Revco: (800) 688-1120
Emerson: (800) 285-1080		Roper: (800) 447-6737
Fedders: (800) 285-1080		Speed Queen: (800) 843-0304
		Sunray: (800) 843-0304
		Tappan: (800) 537-5530
		Whirlpool: (800) 253-1301
		White-Westinghouse: (800) 245-0600

ters. The Sentry is available in two models (\$200 and \$400). The price includes the pump itself, a 12-volt transformer/charger and a battery case. A 12-volt marine battery is not included. Such a battery costs about \$100. For more information, write HiLo Industries, P.O. Box 16056, Louisville, KY 40256.

A water-powered sump pump is helpful as a backup device in vacation homes where the house will be

vacant for extended periods. However, it's of no help if water to the house is supplied by an electrically driven well pump. Also, be sure to install a backflow preventer when using a water-powered pump. **PM**

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.



**WHEN YOU KNOW WHAT
HD STANDS FOR, YOU WON'T
STAND FOR ANYTHING LESS.**

THERE'S NEVER BEEN A MORE POWERFUL LINE OF SKIL TOOLS THAN NEW SKIL HD. THE HD IS FOR HEAVY DUTY. THAT'S HOW THEY'RE BUILT. THAT'S THE KIND OF JOBS THEY'RE BUILT FOR. AND THAT'S HOW THEY'RE BACKED. WITH A ONE YEAR WARRANTY, 90 DAY SATISFACTION GUARANTEE AND ONE YEAR SERVICE PROTECTION PLAN. SO, FOR TOOLS THAT STAND UP TO THE TOUGHEST JOBS, GET SKIL HD.

SKIL HD
HEAVY DUTY

TOUGH TOOLS FOR TOUGH JOBS.

**HOME
 IMPROVEMENT**

**How To
 Install
 Clapboard
 Siding**

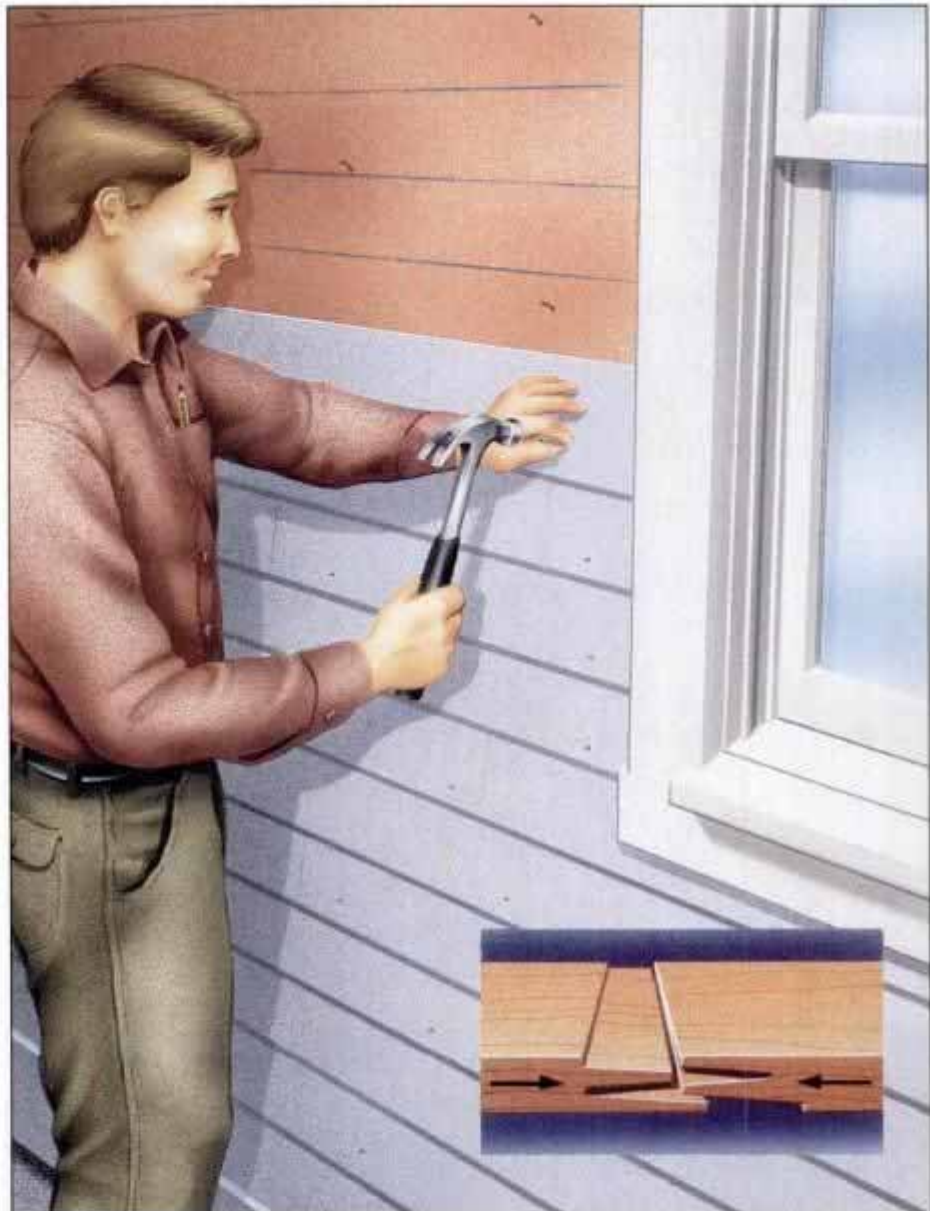
BY STEVEN WILLSON,
 Home Improvement Editor
 PM Illustrations by
 George Retseck

● When you are driving through a nice neighborhood and looking at the houses you like, it's a good bet that what attracts you to them has something to do with the siding. This exterior finish usually occupies more square footage than the roof and windows combined, and therefore can become the defining characteristic of any house. Not only does siding catch your eye first, but it also says the most about the way a house is maintained. If good fences make good neighbors, then certainly good siding makes a good impression.

One of the best things about siding is that usually it can be painted. This allows you to change the entire look and feel of your house for a relatively modest sum, especially if you do the work yourself. Replacing your siding, on the other hand, is not nearly such an easy or inexpensive job. Because of the large square footage that must be covered, the material is expensive. And if you're working on a 2-story house, the job can be very time consuming and dangerous.

But if you are building something on the small side, like an addition, a free-standing garage or even a utility building for lawn and garden gear, you may well want to tackle the siding job yourself. And if you choose a traditional clapboard look, like we did, here are the steps required for getting the job done.

Keep in mind that these techniques will work for any type of wood clapboard siding. The most common varieties are redwood, cedar and pine. For this job, we chose a relatively new redwood siding that comes in $\frac{1}{2} \times 6$ -in. fingerjointed boards up to 20 ft. long. This product is available in two grades—clear and all-heart wood—and can cost up to 25% less than top-of-the-line redwood siding (which usu-



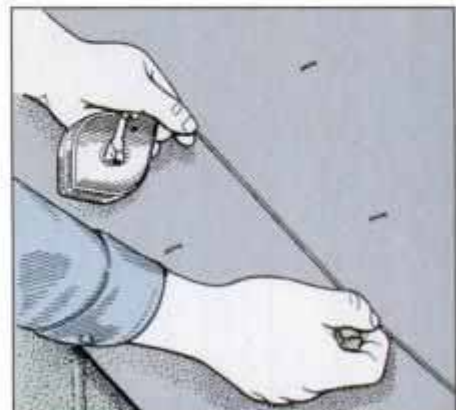
For the best paint performance, wood siding should be primed on the front and back before installation. The redwood product we used (inset) came primed, and featured fingerjointed construction. This provided the high performance of redwood at a lower cost.

ally runs between \$2.50 and \$3 per square foot). But it delivers the same structural stability, rot resistance and

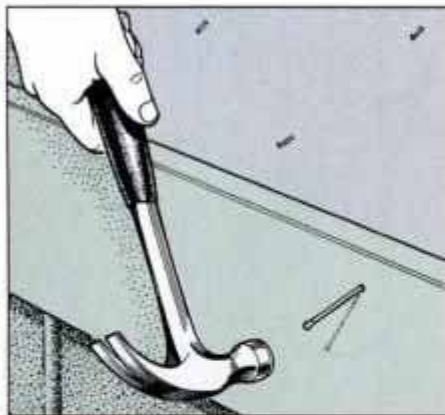
workability that have always made redwood the premium siding choice. While these boards can be covered



1 Begin siding job by installing builder's paper at the bottom of the wall over the sheathing. Staple paper every 8 to 12 in.



2 Determine the height of the baseboard trim at both ends of the wall and snap a chalkline between these points.



3 Cut the baseboard to length and attach it with galvanized nails. Set the nailheads and fill the holes with caulk.

with a clear finish, we preferred to paint them because we wanted a traditional look. This product is available uncoated or with an optional alkyd primer already in place. We chose the



4 Cut all the corner board stock to length, and nail the boards together. Space galvanized nails about 6 to 8 in. apart.

primed version—which costs about \$150 extra per thousand square feet—because of its convenience.

Getting started

Your first step is to determine how much siding and other materials—



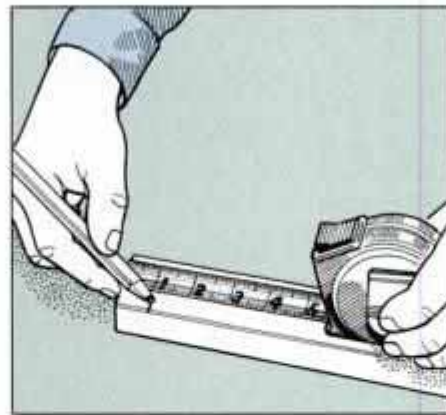
5 Lift corner boards onto house and attach securely. Make sure to drive nails into house corner studs, not just sheathing.

builder's paper, staples, hot-dipped galvanized siding nails, trim boards and paint—you need. The best thing to do is simply draw a sketch of your building, along with all the pertinent dimensions, and take it to your local lumberyard. They'll show you the various product options available and help you decide what exposure would look best. We chose a 4½-in. exposure, which means that 4½ in. of the surface of each board is exposed to the weather. They can also help determine the



6 Nail trim in place around all windows and doors. Keep the trim as tight as possible to the window or door casing.

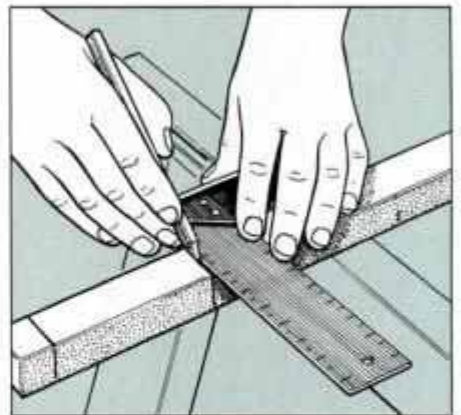
type of trim you should buy. We chose 5/4 stock in the following widths: 10 in. for the baseboards, 8 in. for the corner boards and rake boards, and 4 in. for the casing boards.



7 Begin marking the story pole at the 1-in. point. Then mark the rest of the pole every 4½ in. from this first mark.

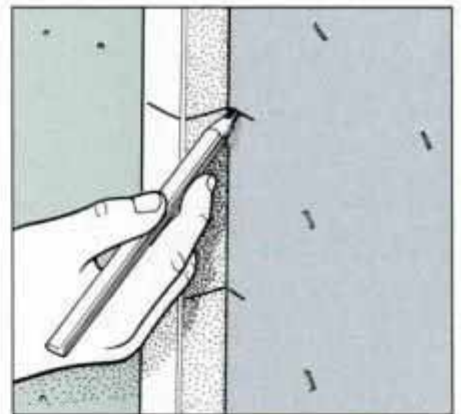
Nominal 5/4 thick boards actually measure about 1½ in. thick. By using this stock for our trim, the trimboards always projected more from the surface than the siding boards. This yielded a crisp finished look and provided a good edge against which we applied our caulk.

Begin by stapling your builder's paper along the bottom of one wall over the sheathing (Fig. 1). Keep the paper



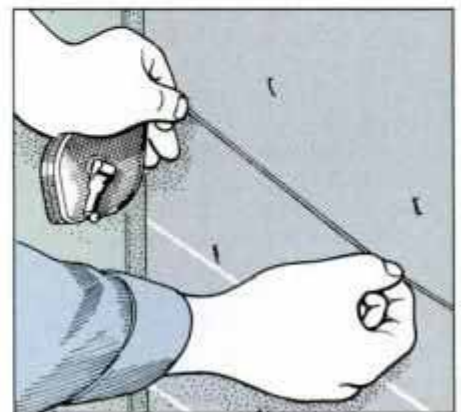
8 Once the story pole is laid out on one side, carefully transfer the marks to the other three sides using a square.

smooth as you roll it out and be sure to use plenty of staples. A sudden gust of wind can easily tear off the paper before you have a chance to install any siding. Then, establish where your baseboard will fall and snap a

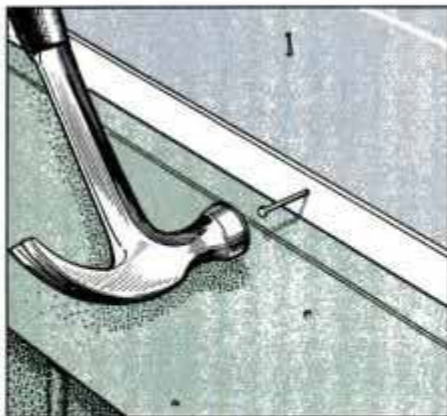


9 Place the story pole on top of the baseboard and against the corner board. Then transfer the marks onto the paper.

chalkline to match the top of the baseboard (Fig. 2). Hold the board just below the chalkline and nail it to the wall using galvanized finish nails (Fig. 3). Make sure to drive the nails into the wall studs, not just into the sheathing.



10 After marking both ends of the wall with the story board, snap a chalkline between the marks to locate the courses.



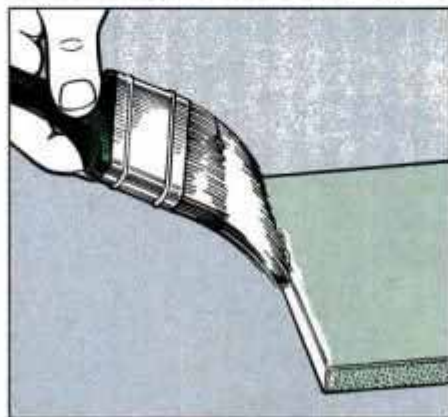
11 Cut 1 in. from the thin beveled edge of a piece of siding for a starter strip. Nail it on the wall just above the baseboard.

Once the baseboard is in place, get an accurate measurement for the length of your corner boards and then cut your stock to size and nail the boards together. Keep the joint flush and drive nails at least every 6 to 8 in. (Fig. 4). Also, make sure to spot prime any saw cuts. Then lift up the corner board, place it on the baseboard and nail it to the building (Fig. 5), again using galvanized nails. Install the rest of the baseboards and corner boards, then nail the casing boards around all

the windows and doors (Fig. 6). If your building is only one story, you should nail your frieze boards in place now. But if you need scaffolding to reach a 2-story height, then wait and install them from your scaffolding. For some pointers on scaffolding, see the box below.

Siding boards

Once all the trim is in place, lay out the trim boards with course marks for the siding boards. To do this, first



12 Cut the first piece of siding to fit, and remove any splinters. Then prime the cut with an oil or acrylic latex primer.



13 Nail the siding board in place—about 1 1/4 in. above the bottom of the board—to just clear the starter strip.

fabricate a story pole. This device is nothing more than a 2 x 2 that is marked to correspond to the proper course spacing of all the siding boards.

To establish the proper marks, first lay out the width of your course lap. In our case this was 1 in., so we made a mark accordingly (Fig. 7). Move the end of your tape measure to this line and then continue marking the story pole at the intervals that match your desired exposure. In our case this was 4 1/2 in., so we made a mark every 4 1/2

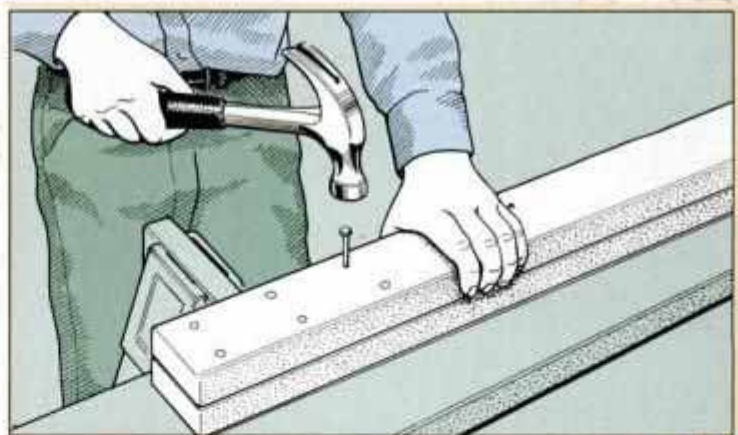
Scaffolding System

● If your siding job keeps you close to the ground, consider yourself lucky! A simple scaffold made of planks and sawhorses is all you need. It's cheap, quick to assemble and not very dangerous.

But if you are working two or three stories above the ground, you need a way to get up there that is not only safe and economical but that also provides enough room to do what needs to be done. One of the best scaffolding systems is the one shown here, commonly referred to as the pump jack system. All that's involved is making some double 2 x 4 posts and sliding some specialized hardware on each. (The poles should be spaced between 8 and 10 ft. apart.) A brace goes on the top of each pole, and the pump jack mechanism goes on the bottom. Between the pumps you install full-size 2 x 12 planks.

The top brace is attached to the house or roof and keeps the pole from falling. The bottom fixture supports the scaffolding boards. And, its clever, foot-operated pump mechanism is what moves you and the scaffolding up and down the pole.

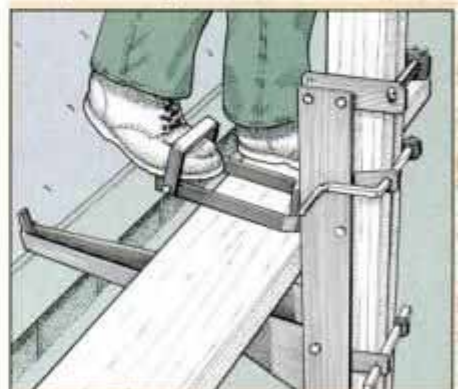
These systems are commonly available at rental outlets (in our area, a pair of jacks and braces rent for \$30 a week) and when installed and operated properly they're very safe. But if you are uncomfortable with heights, you really should consider hiring someone else to do the work. —S.W.



Construct the poles by nailing together two 2 x 4s from both sides. Use 12d common nails driven in pairs every 4 or 5 in.



Slide the pump mechanism and top braces over the pole. Then stand the pole in place and nail the top braces to the house.



Place planking on the pump mechanism. Then push the pump down and up with your foot to achieve the desired height.

HEAR A WHISPER UP TO 100 FEET AWAY!

AS SEEN ON
TV

Incredible WhisperXL™
Gives You Super Hearing
For Only
\$29.95?

This is the SAME famous WhisperXL™ sound amplification device that has been nationally publicized on TV and in leading publications – similar to those that have been sold in Europe for much, much more! But during this nationwide publicity campaign, TeleBrands is offering them for the unbelievable price of just \$29.95 only to those who respond to this ad before Midnight, August 5, 1994.

High Technology So Small, It Fits Right Behind Your Ear!

Don't be fooled by the small size or appearance of this device. The WhisperXL™ may look like a simple device designed to hide right behind your ear, but is actually a major breakthrough in sound interception and amplification technology. State-of-the-art electronic engineering actually allows you to hear a whisper up to 100 feet away. It works so incredibly well that you literally won't believe your ears!



"So Small, It Hides
Right Behind Your Ear!"

hear like a super hero. Incredibly, you'll be able to hear people talking in the next room loudly and clearly, or a pin drop from 50 feet away! Take a walk outdoors and you'll hear birds sing like you've never heard them sing before, and hear deer coming before they hear you! It's an outdoorsman's dream come true.

Never Miss A Word!

WhisperXL™ has dozens of practical uses! Take it to the movies, theater, or lecture hall and you'll never miss a word. It's great for watching TV with a spouse – just keep the volume on low and turn on WhisperXL™. She can read while you watch the ball game! Now you can enjoy the crisp, clear sound of a TV or radio playing at low levels, without annoying everyone else in the room. Experience the fascinating world of super hearing - order today!

The WhisperXL™ weighs less than an ounce, has 6 sound levels to accommodate your own sound enhancement desires, an on/off switch right at your fingertips and, best of all, it adjusts and rotates for ultimate comfort so you can wear the WhisperXL™ behind your

left or right ear! WhisperXL™ comes complete with battery and a one year money back guarantee.

WARNING: It is prohibited by law to spy or listen to the private conversations of others without the permission of at least one party.

Complete 5 Piece Set!



A New World Through Super Ears!

Just imagine what it would be like to hear sounds that you could never hear before. Studies show that there are thousands of different sounds that are not normally audible to the average person. Slip on this technologically advanced device and you'll instantly

**MAIL BEFORE AUGUST 5TH
FOR THIS AMAZING OFFER!**

YES! Please rush me the following sets of Whisper XL.

- One Whisper XL for only \$29.95 plus \$5 S&H.
 SAVE! Two for only \$54.95 plus \$6 S&H.
 SAVE MORE! Three for \$69.95 plus \$7 S&H.

Enclosed \$ _____, VA res. add sales tax.

Payment Method: (Check One)

- Check Money Order Visa M/C
 Amex Discover Carte Blanch

Card # _____

Expire Date _____ / _____

Name _____

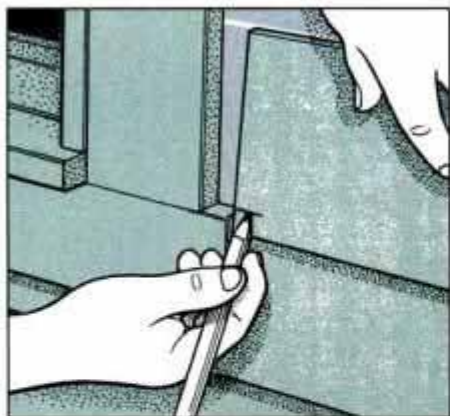
Address _____

Apt. _____ City _____

State _____ Zip _____

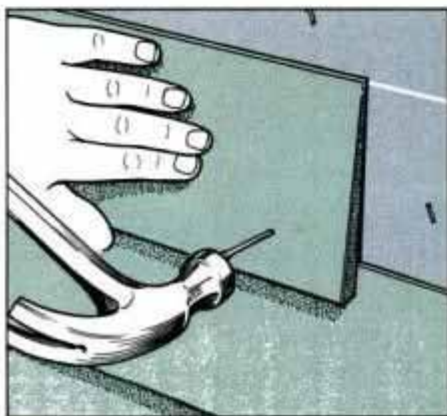
**TeleBrands, Dept. XL5507
One American Way, Roanoke, VA 24016**

©TeleBrands 1994, (2861). Allow up to 60 days for shipment.



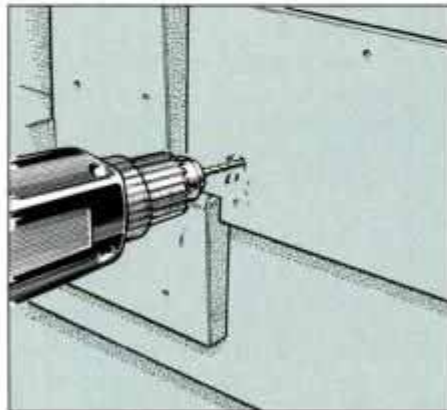
14 While not always practical, scribing is usually the best way to locate cutouts. Just hold the board in place and mark.

in. above our first 1-in. mark. Once the story pole is marked on one side, transfer these marks to all four sides (Fig. 8). Now the pole can be used in any position.



15 Nail directly into wall studs behind sheathing. To avoid splitting, keep nails at least 2 in. from the end of the board.

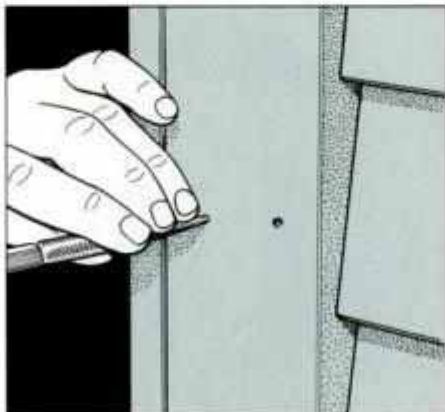
Next, transfer all the layout lines from the story pole to the builder's paper (Fig. 9). Make these marks at all the corner boards and casing boards. Then snap chalklines between all these marks to establish proper guidelines (Fig. 10). Be sure to stretch



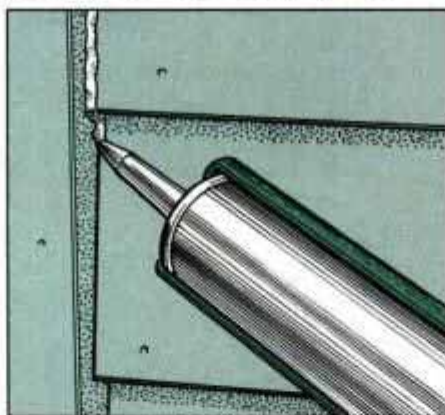
16 If the board end falls where there's no stud, bore a pilot hole in the siding and drive a nail only into the sheathing.

the string tight before you snap it.

Before you nail your first siding board in place, you must install a starter strip (Fig. 11). This is nothing more than a 1-in. piece ripped from the thin edge of a siding board. By nailing this piece at the bottom of the wall, the first full siding board will be held away from the wall at the same angle as all the other boards. Once this board is in place, cut your first siding board to length (if necessary) and coat any cuts with primer (Fig.



17 Once all the trim and siding is installed, make sure to set any projecting nailheads with a nailset and hammer.

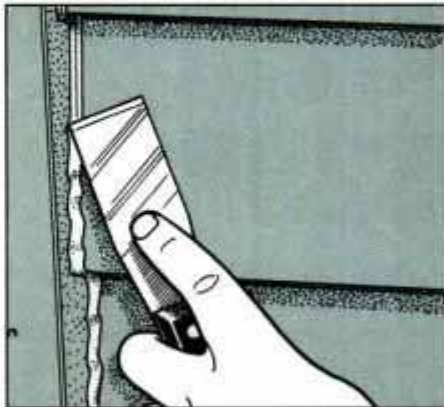


18 Thoroughly caulk all the joints between the siding and the trim boards. Be sure to use a high-quality exterior caulk.

12). Then nail the board on the wall. Keep the nail above the starter strip and make sure to nail into the wall studs (Fig. 13). If the end of a board misses a stud, you can nail the end into the sheathing only, as long as the sheathing is plywood. If you have non-structural sheathing, you must cut the siding to fall on a stud.

When you come to obstructions like windows and doors, you need to fit the siding boards to the trim. A quick way to do this is by scribing the end of the board (Fig. 14) and then making the cut. If scribing isn't practical, simply measure the cutout and mark the board accordingly.

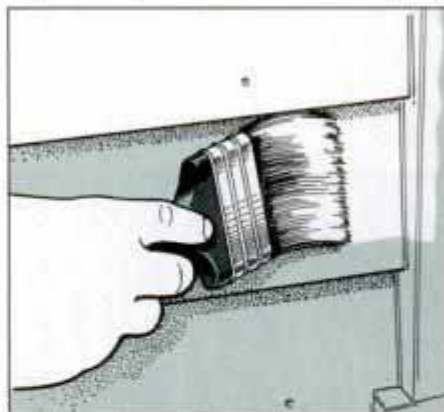
One of the biggest frustrations of working with any wood siding is the splitting that can occur when you drive a nail too near the end of a board. To avoid this, never nail closer than 2 in. to the end of a board (Fig. 15). If you have



19 Using a stiff putty knife, force the caulk into the joints and smooth out the surface to create a seamless finish.

to nail closer, simply prebore nail clearance holes (Fig. 16). Also, avoid driving the nailhead into the siding. This last blow usually does the splitting.

Once all the siding is in place, make sure to set all projecting nailheads on the trim boards (Fig. 17) and fill the holes with caulk. Then apply caulk to all the joints between the siding and the trim (Fig. 18). This step is very time consuming but yields a big reward by drastically improving the weather tightness of any building. Make sure all openings are filled, and wipe off any excess caulk with a putty



20 Starting at the top of each wall, paint the entire surface with acrylic latex paint. When dry, apply a second coat.

knife to achieve a smooth, professional surface (Fig. 19).

Once everything is caulked, paint the siding with two coats of paint (Fig. 20). Some people prefer alkyd paint for the exterior, but we feel that premium latex paint works just as well and is much easier to clean up. We used 100% acrylic latex on this job. **PM**

CAR CARE

CAR CLINIC

BY MIKE ALLEN,
Associate Automotive Editor

An Arresting Development

I just replaced the master cylinder on my Oldsmobile. The brake pedal is still so low and soft that it touches the carpet during even gentle stops.

It wasn't easy to get even this far, as I had to replace both rear wheel cylinders after the bleeder bolts broke off. I've spent literally hours trying to bleed the system, both by hand with a helper and with one of those vacuum gun gadgets that sucks out the air from the bottom.

JOHN IDESIGNE
BARSTOW, CA

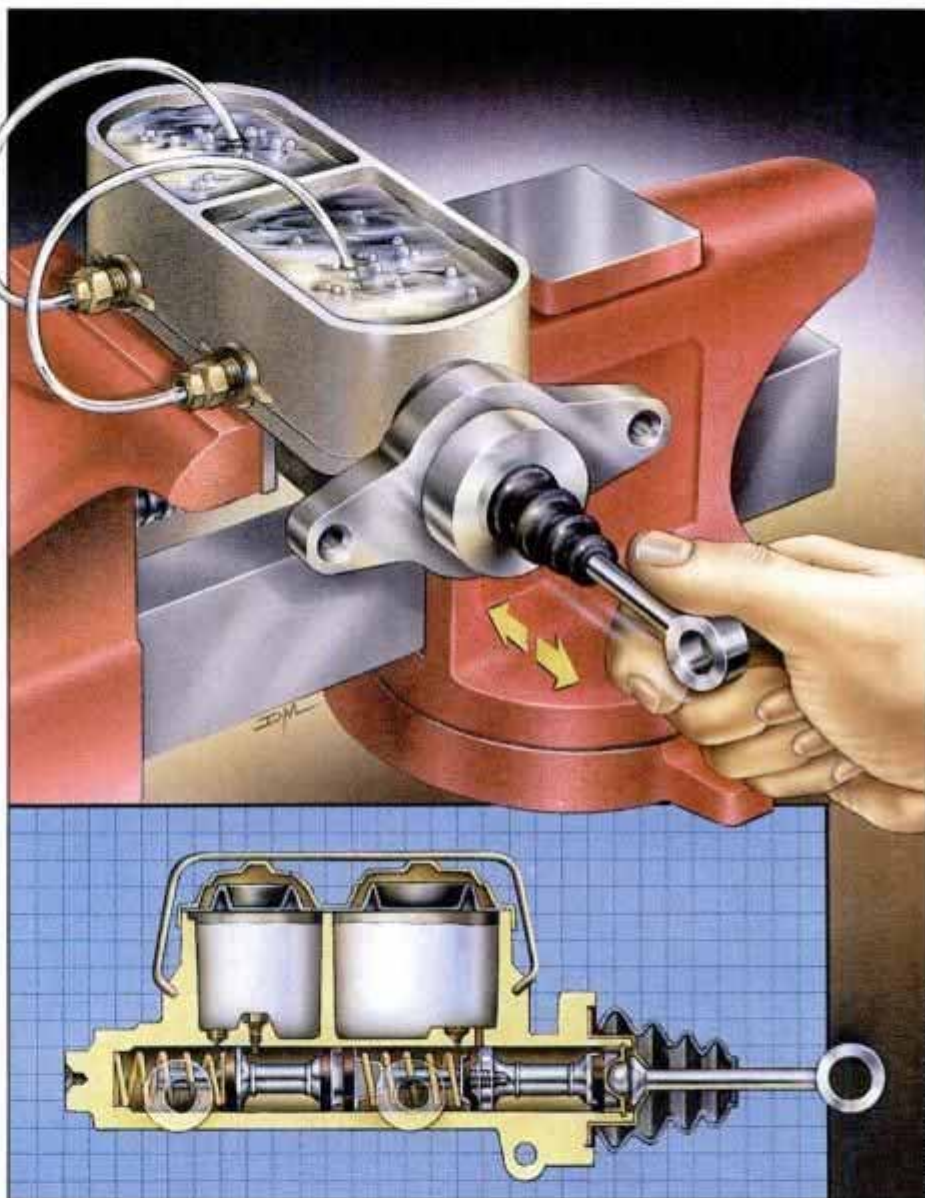
Modern master cylinders, with double circuits and an assortment of internal valves, are difficult to bleed properly. You've confounded the problem by replacing the wheel cylinders and draining even more fluid out of the system.

Start by disconnecting the brake lines from the master cylinder and bleeding the cylinder all by itself. A counterman at an auto parts store will know what you need to do this, but basically it's a pair of hoses and fittings that attach to the output ports of the master cylinder and recycle the brake fluid into the reservoir.

Attach the bleeding kit, and top up the reservoir with fresh DOT 3 or 4 fluid. (Always use a fresh can—brake fluid draws moisture from the air and goes bad.) Pump the brake pedal—slowly—until no more air is expelled. Normally, this operation is performed on the bench before installing the master cylinder, at least in part to keep from spraying brake fluid all over the vicinity. Brake fluid is an excellent paint remover, by the way.

One at a time, reconnect the brake lines. Top up the reservoir and bleed. Go slowly to avoid aerating the fluid you're pumping into the calipers and cylinders.

Let me suggest that an annual or at least a biennial flushing and



bleeding of the brake system will make your master cylinder last longer and keep your bleeder bolts from freezing up, not to mention the benefits of having brake fluid in your system that's not contaminated with atmospheric dirt and moisture.

Now They Listen

Several years ago, I wrote in this column about the potential dangers of the flammable gases used in canister tire inflaters. The danger is that a tire inflated with one of these may explode when being serviced by a tire technician, which has actually happened. Some manufacturers

have continued to produce the explosive devices, while others have substituted safer gases as propellants. Recently, some major brands have announced that they're finally reformulating their products, after years of producing the dangerous kind.

Look in your trunk. If the tire inflater can you're carrying says that it contains flammable gases, it's safe for you to use—but be sure to tell the tire technician.

Sometimes there's a sticker packaged with the inflater to tell the technician that flammables have been used—but if your trunk is anything like mine, there's a good chance the

CAR CARE

sticker has been damaged or lost since you threw the can in there. Not to mention the unlikelihood of getting the sticker to stick on a rusty, road-dirt-impregnated rim.

The technician should bleed the air from your tire grenade out-of-doors, then ground the tire and his air line, and refill and empty it again to vent any explosive gases. From there he can proceed with a normal repair.

Better yet, dispose of the canister (ask your local fire department

where) and purchase a new non-flammable canister.

Lost In The Ozone Again

I thought that all new cars used new, ozone-safe non-CFC refrigerant gas in the air conditioners. I was looking at a new car in the showroom last week, and it said on the window sticker that it did—but there was also a sentence on the sticker that said the car did use CFCs. I don't want to buy

a car that uses the older refrigerant because my mechanic told me it's going off the market and it will cost hundreds of dollars to change over if it ever needs servicing.

PETER CODY
ANN ARBOR, MI

Most new cars use R-134a in the air-conditioning system, which is non-CFC based. A few holdover vehicles still use the older R-12, which is getting expensive and eventually will be impossible to find.

The warning you saw in the window is required by federal law and refers to the CFC-based chemicals used in some of the car's other components. CFCs are used in the manufacture of some of the rubber padding in the seats, for example.

Rust Never Sleeps

I have a problem with my pickup truck. The coolant gets red and rusty within a month or two. I've flushed, chemically cleaned and replaced the coolant twice now, and still within a few weeks I'll take off the radiator cap and the coolant is no longer that nice green color but rust-colored. What brand of coolant should I use to prevent this from happening?

ROBERT ELLERSEC
SARASOTA, FL

Let Us Reveal Why WIX® Oil Filters Work Better.

The heart of WIX Oil Filters' superior performance is its filtering media. Not just a better type—but more of it. Up to twice as much, in fact, than leading competitors.

Add the rugged construction shown below, and

you'll see why you can't buy better protection for your engine.

But quality this high isn't available just anywhere.

So call us toll-free for the WIX Filters dealer nearest you.



1-800-NEED-WIX

WIX® FILTERS



SERVICE TIPS

- If your manual tranny Nissan Sentra or NX built before Sept. 16, 1991, has trouble going into Reverse, Nissan has a revised reverse idler gearset that will minimize the problem.

- Toyota has released a new speedometer assembly for Previa minivans to eliminate the clicking or ticking noises coming from the speedometer.

- If your GM car equipped with a Hydra-matic 4T60-E transaxle built before June 1993 has a whine that's audible in First, Second or Third gear, one of the bearings may have been improperly installed, leaving indents on the bearing race from the needles. The fix is to disassemble the transaxle and replace the bearing.

- Some early production Chrysler LH sedans—Intrepids, Visions and Concordes—may have automatic-transmission shifters that interfere with the center console bezel. Symptoms include a scraping noise when changing gears, and stiff shifting. There's a revised bezel to fix this.

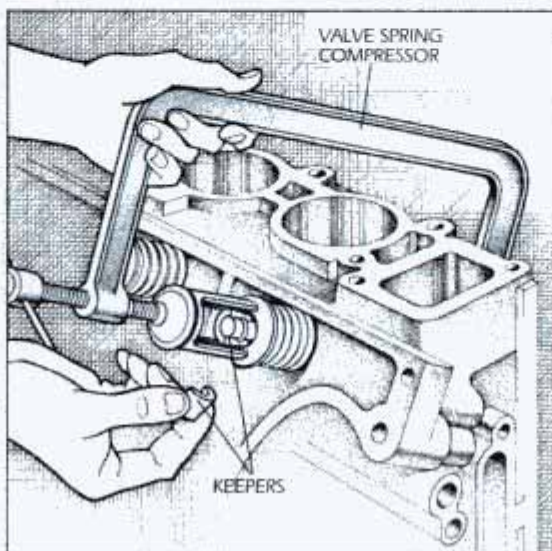
CAR CARE

A Sticky Situation

● I'm trying to reassemble a cylinder head one evening, logging some rack time so I will be fresh in the morning to go into the office and write next month's column.

But first I have to finish this head, because it's getting shipped off tomorrow to be installed on my race car. Problem is that the little tiny valve keepers won't stay where I put them when I release the tension on the valve spring. In fact, a couple of the little things have gone flying over into the farthest, darkest corner of the shop, probably to be discovered by archeologists from another galaxy several millennia from now.

So, I just dab a tiny bit of engine assembly grease (wheel-bearing grease will work just as well) onto the valve stem to temporarily hold the keepers in place. This scheme works for holding all kinds of stuff together—including gaskets you don't want to use gasket sealer on, washers that like to fall off before you can get the bolt through and O-rings that won't stay put.



If you've truly cleaned all the residual rust from your cooling system (and judging from the unprinted portion of your lengthy letter, you have), then there's only one explanation—you've got a combustion leak into the cooling system. The acids from the combustion gases are using up the anticorrosion additives in your coolant in a few weeks instead of the two years they're supposed to last. The acids then start corroding the iron in your engine.

You've got a bad head gasket—if you're lucky. If you're unlucky, you've got a cracked head or block. If the leak was worse, you'd have an overheating problem.

Confirm the leak by holding an exhaust analyzer probe over the open radiator cap when the engine is running. It should detect the combustion gases in the cooling system even at very low concentrations. Remember not to open the radiator cap when the engine's hot. **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.

You've Never Had This Much Fun On A Bike Before! The New NordicTrack ForeRunner™ Cycle Is Like Nothing You've Ever Seen.

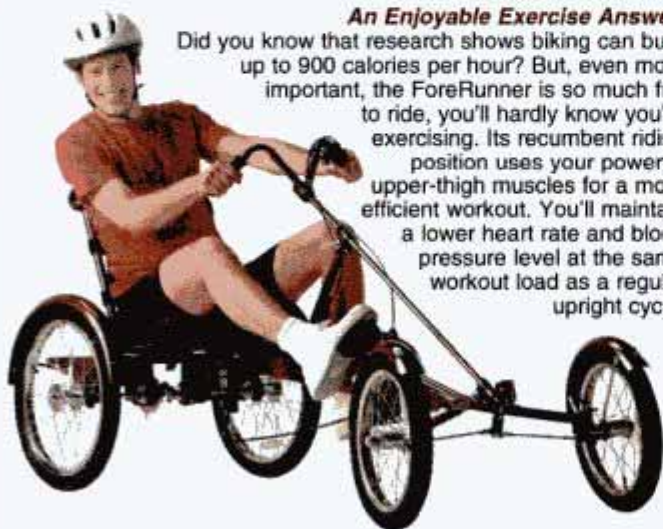
NordicTrack Has Put The Fun Back Into Biking!

Its sleek lines catch your eye and quicken your pulse even before you get on. And its low-profile, high-tech appearance suggests that fitness has never been so much fun. Forget that old, uncomfortable 10-speed in your garage. Once you've ridden the

ForeRunner, you'll be cycling in a whole new way. It's comfortable, fast and responsive, so whether you're accelerating down a straightaway or powering into a turn, its sure-footed four-wheel frame is ready to perform.

An Enjoyable Exercise Answer!

Did you know that research shows biking can burn up to 900 calories per hour? But, even more important, the ForeRunner is so much fun to ride, you'll hardly know you're exercising. Its recumbent riding position uses your powerful upper-thigh muscles for a more efficient workout. You'll maintain a lower heart rate and blood pressure level at the same workout load as a regular upright cycle.



And Best Of All, It's The Quality You Expect From NordicTrack!

Comfort Is A Top Priority!

The ForeRunner has a padded sling seat to provide enough comfort and support for a full day of riding. Plus its recumbent riding position places less stress on your neck, back and wrists than regular upright bikes.

Superior Performance Features!

- **Patented 9-Speed Reflex-Action Radial Transmission:** Choose any of 9 gears at the touch of a button for the flexibility to go practically anywhere — you can even downshift standing still!
- **Powerful Band Brake System:** Our advanced design provides more braking power than regular front and rear caliper hand brakes — even when wet.
- **Optional Rear Commuter Pack:** Holds everything you'll need for your full day at work, or use it to pack a lunch for a full day on the road.

NordicTrack's 3-Point Satisfaction Guarantee:

1. 30-Day Test Ride
2. Two-Year Limited Guarantee
3. Toll-Free Customer Service HOTLINE

We build bikes for the way you live!

NordicTrack 1-800-441-7509 Ext. 62FG4

Please send me a FREE brochure Also a FREE VHS videotape

Name _____ Phone (____) _____

Street _____

City _____ State _____ Zip _____

Call or send to: NordicTrack, Dept. 62FG4, 104 Peavey Road, Chaska, MN 55318-2555
©1994 NordicTrack, Inc., A C&I Company • All rights reserved.

MAINTENANCE BASICS

REPLACING LIGHT BULBS

BY DON CHAIKIN,
Automotive Editor

● In addition to the headlights, your car or truck has lights at each of its corners. These illuminate the extremities of your car and also signal your intentions—acting as directional signals, hazard warning flashers and brake lights. You should check—at least once a week—that each of these lights works properly. If any of the bulbs has burned out, you should replace it immediately.

Depending on the light's function, it may have one of several types of bulbs. To determine the bulb's type, check your owner's manual. It's a good idea to take the old bulb with you when you shop.

● To gain access to the bulb, you may either have to remove the lens from the outside of the light unit or you may have to remove an access cover on the back side of the light—possibly from inside the trunk or behind a bumper or body panel.

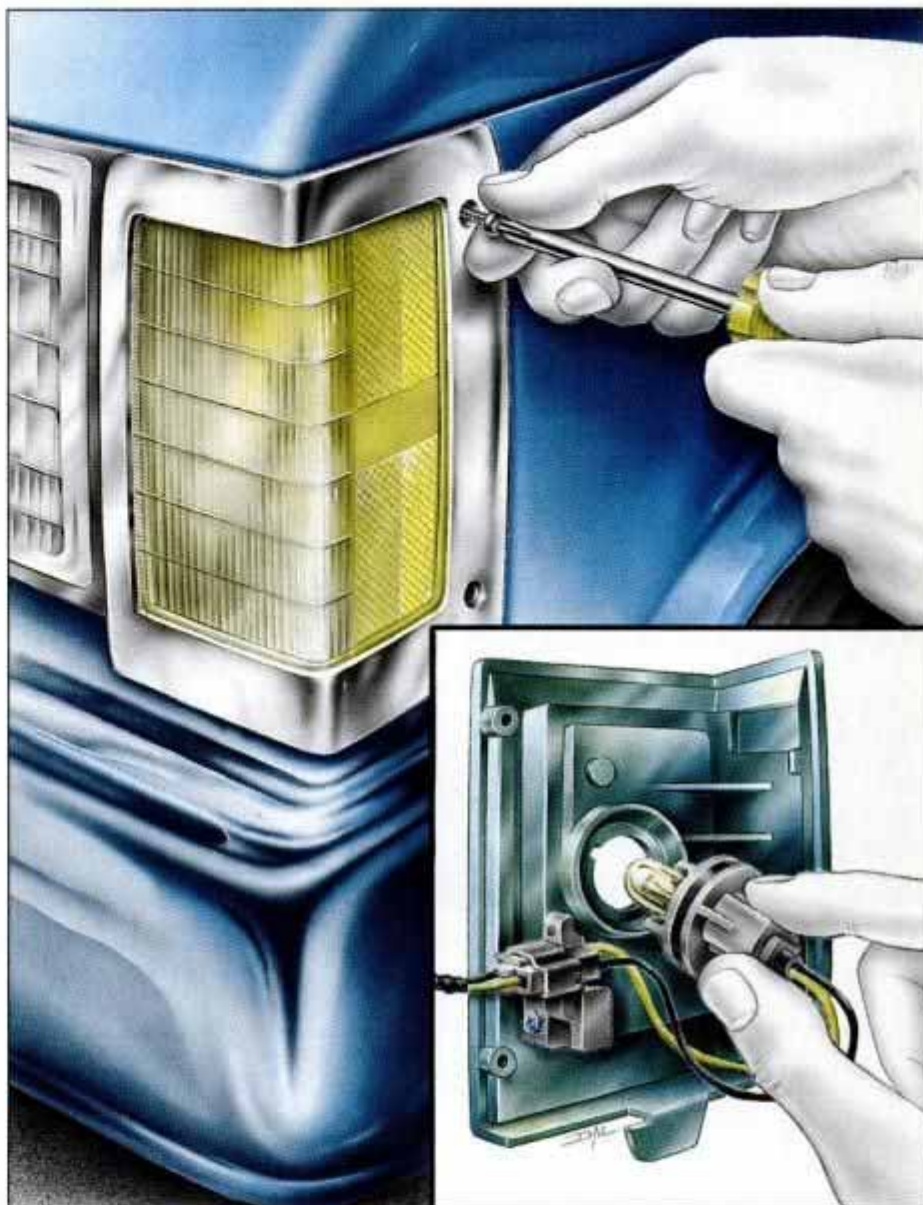
If the light's lens has fasteners holding it—either through the plastic itself or the trim around it—you probably have to remove the lens to get to the bulb.

● Before removing the lens, especially in cases where there are no obvious external fasteners, check the back of the light. If there is an easily removed—no tools needed—cover or if the bulb's socket is clearly visible, chances are the bulb is accessed from the back.

Remove or open any cover on the back of the light and twist the bulb socket counterclockwise. The bulb socket should twist easily and pop out of the back of the light unit.

If the back of the light is sealed or inaccessible and there are screws holding the lens, remove the lens. This may require a Phillips screwdriver, a Torx driver or a Pozidriv screwdriver—check your owner's manual. If the fasteners are very tight, douse them with some penetrating oil before trying to loosen them.

● Remove all the fasteners holding the lens or trim ring, and gently pry



the lens away from the housing.

● Do not tear, damage or lose the gasket between the lens and the light.

● Regardless of how you gained access to the bulb—from the back of the unit or through the front—removing the bulb from its socket is done the same way.

Some smaller bulbs simply pull straight out of the socket.

Larger bulbs—for brake lights, tail-lights and directional signals—twist and pop out. Gently push in on the bulb as you twist it counterclockwise.

● Reverse the procedure to install the new bulb.

Some bulbs do double duty—tail-light as well as brake light—and therefore have double filaments. Even if only one filament is out, the bulb must be replaced.

● Bulbs with two filaments look similar to those with a single filament. Ensure that the correct type of bulb is used because the bulbs have slightly

different mounts—the small tabs on their bases are different. A single-filament bulb will not easily twist into position in a double-filament socket, and vice versa. If your replacement bulb slips into the socket but does not lock into place, make sure that it is the correct type of bulb.

● After the bulb is installed, use a clean cloth or paper towel that has been moistened with glass cleaner to wipe away the oily residue left by your fingers. This helps ensure a longer life for the bulb by preventing hot spots on the glass.

● Reinstall the lens to the front of the light—taking care to properly place the gasket. Do not overtighten the screws to prevent cracking the lens.

With rear-mounting bulbs, align the tabs on the light socket with the notches on the back of the light, insert the socket in the unit and lock it in place by twisting it clockwise. Replace any protective cover.

FM ILLUSTRATIONS BY DON MANNING

SATURDAY MECHANIC

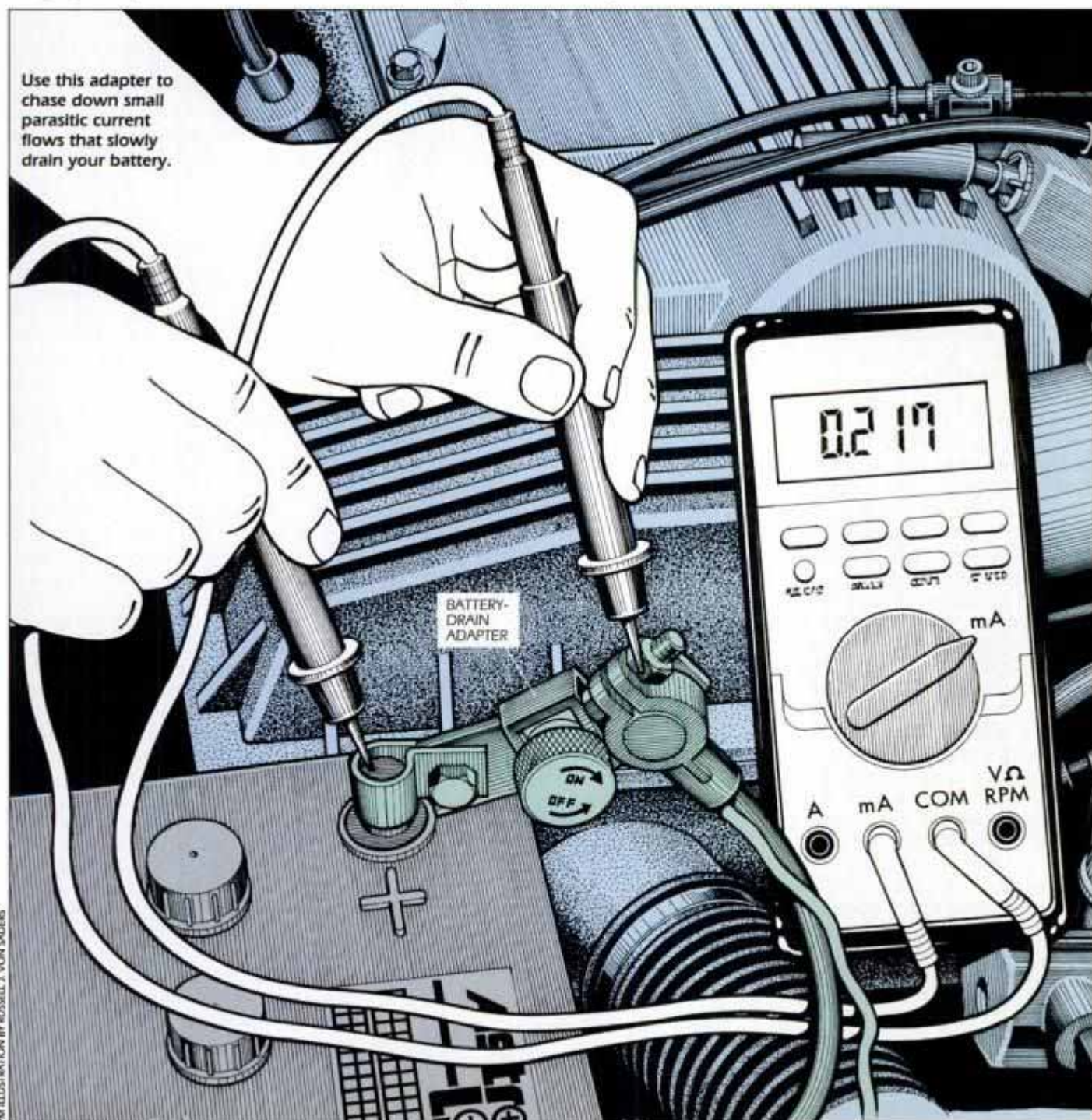
WHAT TO DO WHEN YOUR BATTERY GOES DEAD

BY PAUL WEISSLER

● You turn the ignition key to crank and either you hear a weak “uugh” or nothing at all. Dead battery again, and after a few boost starts, finding out what’s wrong has now become a high-priority item.

Well, it could be a bad battery—but if it takes a charge, there’s a good chance that the problem is something else. First, take a closer look at what’s happening within the charging system and compare it with how you drive.

If you drive only a very short distance each day (perhaps a couple of miles or even less), that isn’t enough to recharge the battery. A related factor would be a lot of high-current-draw electrical accessories that are



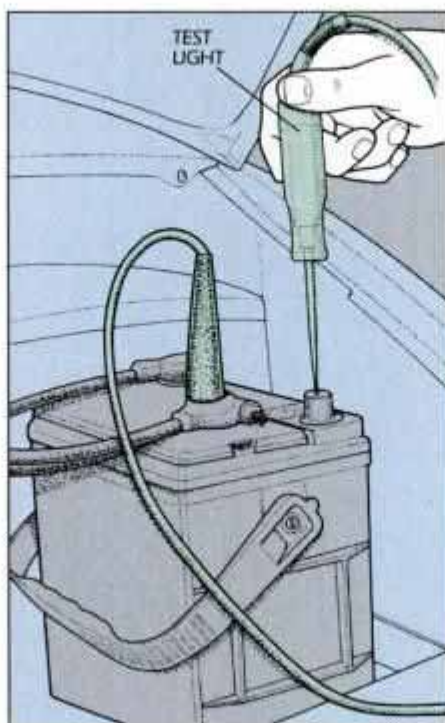
in use constantly (cellular phone, heater or a/c, high-performance sound system, lights and rear-window defroster grid). Cold weather also is an issue, as the ability of a battery to deliver electrical energy is lower—compared with what is available at 80°F, only 40% of the battery's potential can be realized at 0°F. If the problem was worse during the cold weather of winter, that's not surprising.

Next, do you let the car go unused for days at a time? The engine computer and other electronic systems in your car probably have "keep-alive" memory, which means a continuous current draw even when the key is out of the ignition. That continuous draw is typically under 60 milliamps (thousandths of an amp), which may sound insignificant but it adds up. Even a healthy battery may lose enough over a few weeks in an airport parking lot to make starting difficult. If the battery is just okay but really not very strong, that loss may be too much.

Hard to be too small

Did you replace the original battery or add electronic accessory load? The new battery may have too small a capacity for the demand. The old rule of thumb was to buy a battery with a Cold Cranking Amps (CCA) rating of 1 amp for each cubic inch of engine displacement. Well, you can hardly buy a battery with that little capacity if you have a typical car with an engine displacement of 3.0 liters (that's only 183 cu. in.) or even less. Today's electronics—including such add-ons as alarm systems, cellular phones and sound systems—are in cars with sophisticated fuel-injection systems that need a higher cranking speed for accurate measurements. Perhaps you should look for one of the higher-rated batteries you can fit into the battery tray. Today, a 500 CCA battery is almost a minimum.

Is a proper-size battery running down quickly despite moderate driving distances and frequent use? The charging system could be underperforming. Check output with a voltmeter (or a multimeter set on VOLTS) connected to the car battery. With the engine off, note the voltage reading. Then run the engine at fast idle with all lights and accessories off, and allow the voltage reading to rise to a peak (it can take 3 to 4 minutes). If it rises at least 1.5 volts (it typically may go up as much as 3 volts), that's a normal no-load charging rate. Turn on the heater and set the blower to HIGH, turn on the defroster grid and put the



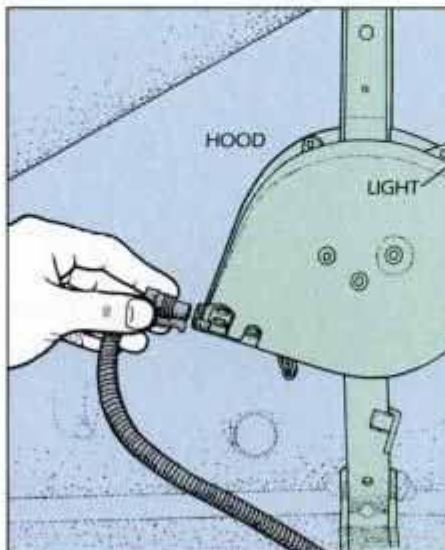
A test light can check for drains—but it can't tell you how much current.

headlamps on high beam. There still should be a voltage increase, but it should be something small, perhaps only about a half-volt.

What's the charge?

If the charging output is within reason, then the problem is a current drain of some type. One approach is to disconnect the battery ground cable and connect a 12-volt test light to the cable terminal and the battery terminal—with all accessories off and all automatic lights switched off. If the test lamp has more than the faintest glow, that's a significant drain.

Note: Unplugging the battery may



Try unplugging the hood or trunk light to see if it's the source of a current drain.

cause a lot of the car's electronics to lose the keep-alive memory. Yes, the clock goes out, the preset radio stations must be reset, the radio with a security lock code has to be re-activated (You do remember the code, don't you?), you may have to re-program the keyless entry, and the powertrain computers forget what they've learned. This last item can mean reduced driveability for as much as a couple of hundred miles. It's nothing to panic about—just be patient, and eventually the computer will relearn everything.

A more accurate approach than the test light is to measure the drain in amps (actually in milliamps), using a suitable meter and a battery-drain adapter. This is a low-cost tool that attaches in series to the battery's negative terminal. The adapter allows you to start the engine to activate the timer circuits in the electronic modules, then shut off the engine, attach an ammeter and turn a knob on the tool—which in effect "open circuits" it (as with a switch). With the adapter open, all the current flows through the meter, which should be a "high-impedance" design (rated at 10 megohms or greater, to prevent damage to the electronics). Thexton Manufacturing Co. makes a battery-drain adapter that can be ordered from most auto parts stores that carry its line of specialty tools.

First, make sure all accessories are off, doors closed, etc. Slowly open the hood just enough to peer underneath and make sure the underhood lamp is off. If it isn't, it could be the reason the battery is going dead. You still can't be absolutely sure, so if necessary as a later test, unplug the lamp.

After you install the drain adapter, run the engine and then turn it off, pull the ignition key and wait for all the electronics to "time out"—that is for them to go into a "just barely awake" mode when they draw the minimum amount of current. That can take up to 70 minutes on some cars, particularly with electronically controlled suspension systems. Then connect the ammeter, and if it has a dial with scales you select, begin at a high scale, and open the drain adapter by turning the knob. Gradually if possible, reset the meter down—one scale at a time—to the lowest possible scale, so you can get a precise reading. If the reading is over 50 milliamps, there's a current-draw problem. Above 200 milliamps, it's likely

to be a small bulb, such as the one in the trunk or glovebox, which you should also remove for test purposes. After that, remove one fuse at a time until you find the one that causes the reading to drop to normal. That fuse is covering the problem circuit, and now you have to head for a wiring schematic for detailed analysis of the problem circuit.

If you've had an add-on burglar alarm installed, don't be surprised if that turns out to be the problem. Some antitheft systems reportedly have large keep-alive memory current draws, which are more than the car's electrical system can handle in many cases.

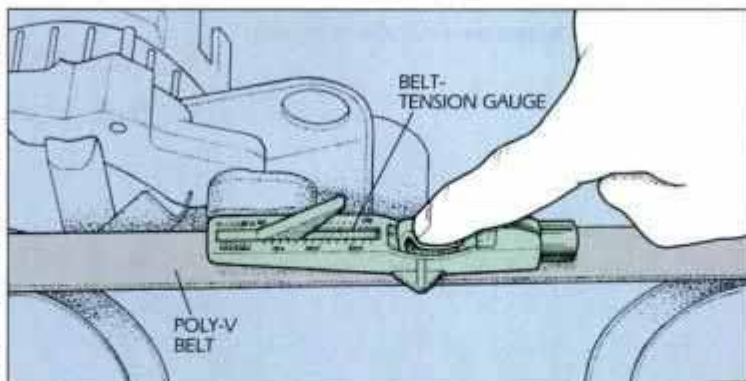
There's no charge

If there is no charge, there's either a snapped belt (which should be obvious) or an electrical problem with the charging system.

However, if the readings are just low, check for a slipping alternator belt. The single serpentine belt is the most widely used type today. But no matter what kind of belt you have, checking tension can be a problem, even if the carmaker provides a gauge reading (in pounds of strand tension). The problem: where to position the gauge so there's a meaningful span (about a foot or so) between the centerline of the pulleys. You'll probably need a compact gauge and may even have to work from underneath. Your best buy is a Gates Krikit gauge, which is under \$20.

Fortunately, many of the cars with serpentine belts have automatic tensioners with an indicator bar on the spring housing. As long as the indicator isn't against the minimum tension position, it's okay. Some indicators are at the mid-front of transverse engines, which means it's not exactly in plain view. In addition, twist the belt over at various points just to make sure there aren't long chunks of ribbed area missing.

There is no adjustment for a serpentine belt with an automatic tensioner. If it's stretched beyond the ability of the spring housing to compensate, the only cure is to replace the belt. Most Japanese cars and many Chrysler products have belts with jackscrew adjusters. In addition, when there is a 1/2-in.-sq. hole for a wrench, Chrysler also provides a torque wrench specification for the



If your belt is slipping, the alternator's output will be lowered. Therefore, use an inexpensive belt-tension gauge when tightening the belt.

tension adjustment.

And finally, there is always the "thumb press" check, in which you press on the belt at the midpoint between pulleys and check the distance that it deflects. Chrysler once provided a spring scale specification for this type of check, but we've never seen a readily available scale with which to do it, so it's strictly press-and-guess.

Belt tight? There could be a voltage drop through poor (loose) or corroded connections. On a top-post battery, you might see a buildup of white corrosion on the posts. On a side terminal, however, you not only can't see much, but there's so little electrical contact surface that it doesn't take much to cut the current flow. Even if you disconnect the terminals and eyeball the contact surfaces carefully, they may not look that bad. No matter what you see, however, wire brush contact surfaces on either type of battery until they are super-clean.

Tight enough for you?

The tightness of a battery cable clamp can be a tough call. Just because the nut is tight on a battery's top post doesn't mean the clamp is making good contact all around the post. If the clamp jaws are together, for example, tightening the nut just mashes the clamp, distorting it and actually making the connection electrically weaker. Either replace the clamp or trim the edges of the jaws so there's clearance when the nut is tight. (Our recommendation is to replace the cable altogether to get a new clamp.)

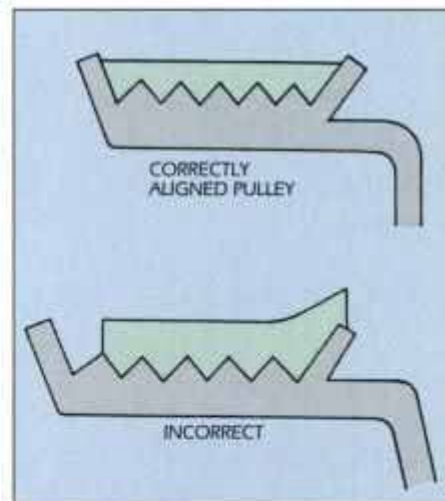
On a side-terminal battery, not only make sure the bolt is tight but also that the bolt threads are a close fit into the battery. If the bolt can wobble as you thread it in, no matter how much you tighten it, body vibration eventually will loosen it.

Don't forget to check the cable connections at the other end—and in the case of the ground cable, there may

be several branches. The one cable most critical for charging is the one to the engine. Does everything seem clean and tight? As a final test, check the ground cable voltage drop, which provides not only a check of the connections, but of the internal condition of the ground cable. Connect a voltmeter positive lead to the battery post or side-terminal bolt, and the negative lead to the

starter housing. Have a helper crank the engine, and if the reading is 0.5 volts or higher, it's more than the charging system should have to overcome. Although a defective cable or bad cable connection is likely, a poor mate between the starter and the bellhousing may even be responsible.

Today's electronics are responsible for many of our electrical problems, but they also can make major contributions to the solutions. Some new alternator circuits not only work within



Check pulley alignment with a straight-edge if your poly-V belt keeps slipping.

closer ranges, but on some cars turn on the dashboard warning light if there's either overcharge or undercharge, not just a total failure of the charging circuit. Some of the new General Motors cars (including the Olds Achieva, Pontiac Grand Am and Buick Skylark) have some battery rundown protection. Within 20 minutes, an electronic module turns off some interior lights that you may have forgotten. If the car is left unused for 24 days, it even unplugs some of the less important keep-alive memory (clock, keyless entry and radio station presets). It isn't the total answer (sorry), but it could be a start. **PM**



Performance.
Protection.
Quality.®

AND



Solutions to Engine Problems.®

PRESENT

THE NATIONAL AUTO QUIZ

1. This popular sports car of the 1960s is the:



A) Cobra. B) MGA. C) Shelby GT-350. D) Jaguar XK120.

2. What carmaker(s) currently offer V12 powered models?

A) Jaguar. B) Mercedes-Benz. C) BMW. D) All of the above.

3. The fastest NASCAR speedway in the country is:

A) Daytona. B) Talladega. C) Indianapolis. D) Michigan International.

4. How many miles can the Cadillac Northstar V8 engine go before its first scheduled sparkplug replacement?

A) 30,000. B) 60,000. C) 100,000. D) Plugs never require replacement.

5. Ignition timing advanced too far can cause:

A) Poor performance. B) Pinging on acceleration. C) Reduced fuel economy. D) Long cranking before starting.

6. The first production retractable hardtop model since the 1957 Ford Skyliner is currently offered on the:

A) Honda del Sol. B) Corvette. C) Mitsubishi 3000GT. D) Dodge Viper.

7. What production model Corvette boasted the highest rated horsepower engine?

A) 350 cu. in. ZR-1. B) 427 cu. in. L88. C) 454 cu. in. LS6. D) 427 cu.in. L72.

8. What General Motors division offered the "Super Duty" engine in the 1970s?

A) GMC truck. B) Buick. C) Pontiac. D) Oldsmobile.

9. In what form of motorsports is the term "Christmas tree" commonly associated?

A) Drag racing. B) Stock car racing. C) Indy car racing. D) Off-road racing.

10. Engines are classified by the following:

A) Number of cylinders and ignition type. B) Number of cylinders, operation cycles, ignition type, valve arrangement and camshaft number and location. C) Whether diesel or gasoline and size and number of cylinders. D) Material used for engine block, number of cylinders, ignition and cooling system design.

WIN A FREE VIDEO

Send us your auto-related questions. If we use one of them in a future quiz, we'll send you a free car care video. In case of duplicate questions, the one with the earliest postmark will win.

Send your entries to:
National Auto Quiz
POPULAR MECHANICS
224 W. 57th St.
New York, NY 10019

ANSWERS
1. A 2. D 3. B 4. C 5. B 6. C 7. D (early '66 model rated 450 horsepower) 8. C 9. A (refers to Chronodek starting lights) 10. D.

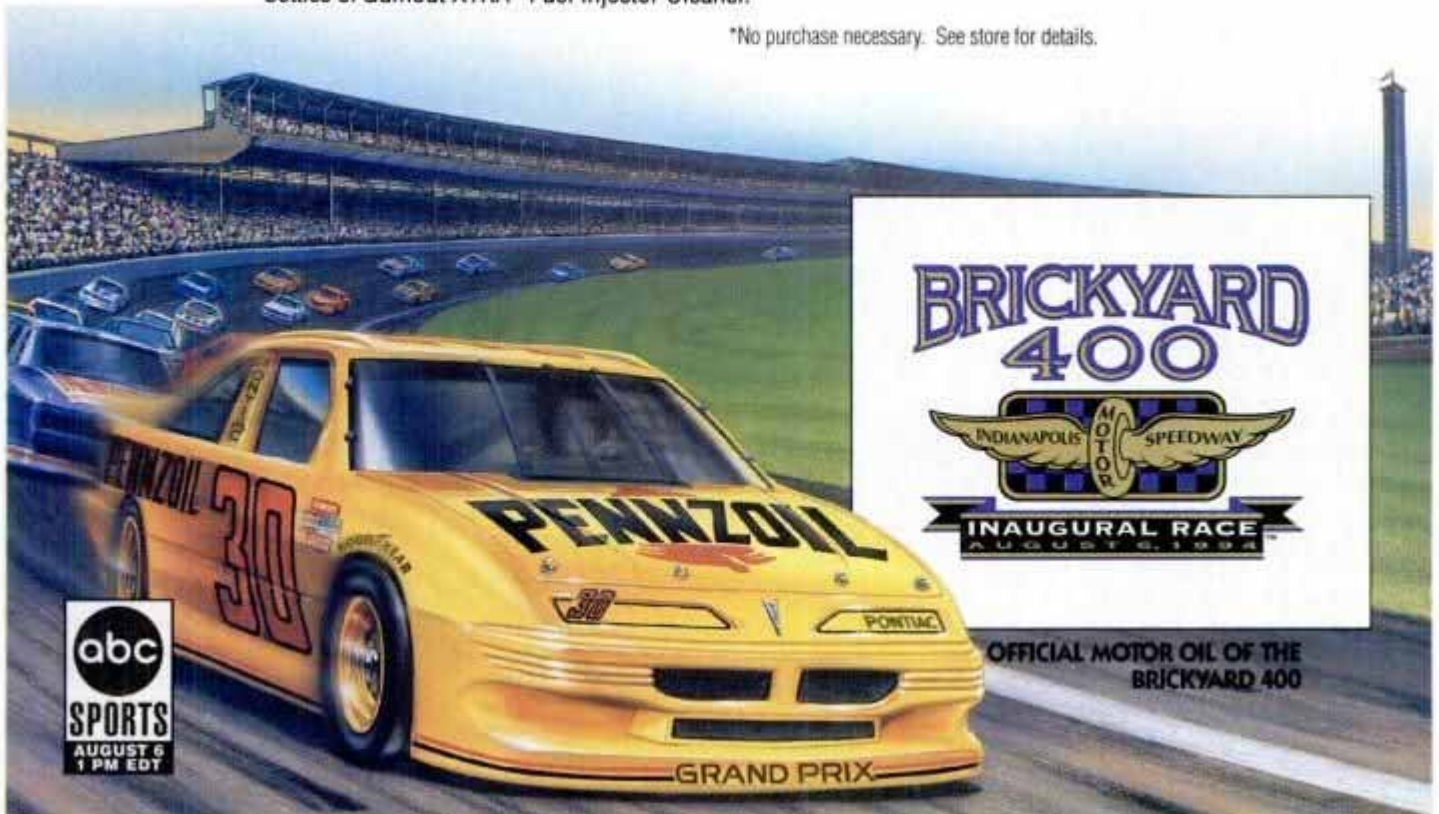


LET PENNZOIL® PUT YOUR BACKSIDE TRACKSIDE FOR THE BRICKYARD 400.™

BUY A CASE* SEE THE RACE!

Pennzoil's newest scratch and win game is turbocharged fun from the word go and could put you trackside, in person, for NASCAR's first-ever running of the Brickyard 400 at The Indianapolis Motor Speedway, August 6, 1994. Rev up your engines and get in the game! Scratch the gold boxes to reveal three checkered flags and you're an instant winner! Almost as exciting as the race itself. You'll find game cards inside specially-marked cases, or where you get your oil changed professionally with Pennzoil Motor Oil. Over 4,000 prizes featuring **10 deluxe trips for two to the Brickyard 400 in '94 or '95**. Other prizes include: 1,000 Brickyard 400 T-Shirts, 2,000 Collector's Pins, and 1,000 bottles of Gumout XTRA® Fuel Injector Cleaner.

*No purchase necessary. See store for details.



High-Definition TV's New Direction

BY MURRAY SLOVICK



● The long-awaited development of digital high-definition television (HDTV) cleared its final technical hurdle with the recent decision to use a signal transmission system developed by Zenith. Nevertheless, HDTV is still a few years away and even when it comes, HDTV sets will be expensive—\$5000 by some estimates.

In the near term, though, the HDTV standard being developed by an industry-wide Grand Alliance (GA) of TV manufacturers may have a more immediate effect on the standard NTSC (National Television Systems Committee) TV you're watching today.

While the GA consortium was created to develop a U.S. standard for HDTV, there is nothing to prevent broadcasters from using the same technology to spruce up old reliable NTSC. Since the GA HDTV system is digital, the thinking goes, information can be compressed, transmitted, reshaped and used pretty much as one sees fit. The transmission pipeline—whether it is over-the-air, cable or satellite delivery—does not care whether the data stream being sent is comprised of pictures, sound or computer programs. All are simply a series of 0s and 1s, and all can be read, seen or heard on a TV receiver with proper decoding equipment or downloaded onto a home computer.

Consequently, HDTV tech-

nology soon may be used to allow viewers to select different camera angles while watching baseball, or browse through a shopping catalog by turning "pages" to find and buy merchandise. Even if only some of the tantalizing possibilities being talked about in meeting rooms at television stations occur, a digital NTSC signal could change the way we watch television.

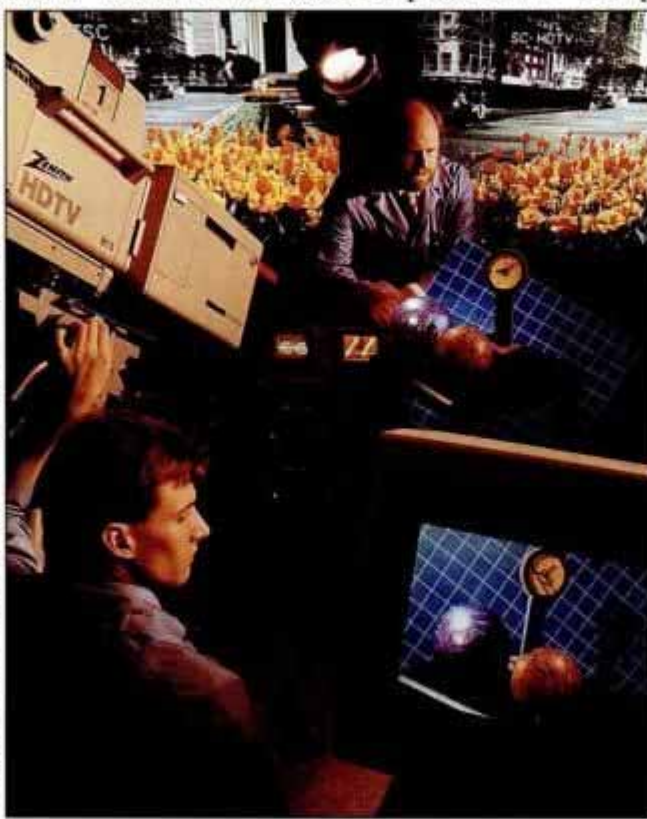
A few examples: TV broadcasters could choose to send picture-in-

guiding development of Grand Alliance HDTV, believes public television stations will use digital NTSC capabilities for interactive video and educational purposes while "more profit-driven companies may choose to deliver data that people would be willing to purchase. This data could include stock market quotes, sports scores, airline schedules and shopping opportunities. TV stations may become the source of movie rentals or CD-quality albums to be downloaded directly into the home on rewritable compact discs."

Not only does the developing HDTV standard offer great flexibility for new NTSC programs and services, the mix of services can be allocated on the go. That means a rapid-burst mode of addressing TV receivers is possible. This would allow you to pick and choose from among multiple streams of video, audio and data programming sent to complement or enhance the basic program content.

Broadcasters are feeling compelled to become full-service multimedia suppliers to play in the same league as computer companies, cable TV operators and telephone system suppliers that are teaming up to develop competing digital services as part of the National Information Infrastructure (the so-called information superhighway).

What is more, these broadcasters realize HDTV trans-



Zenith engineers (top and above) developing HDTV.

picture insets, with auxiliary video material displayed in a window on the screen. Or they could download software related to a television broadcast, providing, for example, biographical or other background information on a show's director or cast.

James C. McKinney, chairman of the U.S. Advanced TV System Committee, the governing body

missions won't be ready for several years. NBC, owner of the rights to broadcast the 1996 Summer Olympics, noted recently that there will not be enough broadcast-quality 1920 x 1080-line HDTV equipment available in 1996 to conduct a large-scale test of the platform in Atlanta. Based on the assumption that the FCC adopts the new Grand Alliance standard early next year, Zenith chief executive officer Jerry Perlman says the first consumer HDTV sets won't be available before 1996, and, more likely, 1997. Perlman is on record as estimating the cost of a consumer GA HDTV to be between \$3500 and \$5000, and many in the industry believe that even the higher figure is understated.

More potential

The added NTSC potential of the GA format is a result of the approach taken to deliver its digital bitstreams of video and audio data. The format packages and synchronizes the compressed video, audio and auxiliary data for transmission in separate digital packets.

A typical GA packet uses a "header" that tells the TV set what kind of data is carried by the packet and how it should be read by the decoding circuitry. A digital TV decoder will disregard any packet with a header it doesn't recognize or can't process. This eliminates backward compatibility problems when new services and applications are developed. There is no predetermined mix of video, audio or auxiliary data required for each packet so the packet mix can vary, allowing for system operator program flexibility. Each packet also contains backup data in case a packet is lost or misordered. If security is an issue, the packet can contain encryption control information, too.

The GA format also can work with computers and multimedia systems. The reason is that the packet codes are compatible with MPEG2 (Motion Picture Experts Group) transport protocols used for compression. These codes are easily translated to the Asynchronous Transfer Mode (ATM) data network format used by phone companies. The GA packets then can be delivered over telephone lines to computers using ATM links, and, by extension, over a future information superhighway.

Smart TVs

All this offers some delicious possibilities, although at this point they are merely wishful thinking. For instance, the GA standard could lead to the creation of an intelligent TV receiver that could peruse video streams on its own, searching for material you might

find interesting. Such a TV might also be able to play back compressed video and audio stored on a computer disk. There may even be room for a digital wireless telephone service in the manner of the planned Personal Communications Network that will compete against cellular telephony.

The constant that runs through all of these potential new applications is the need for an electronic interface. In an ideal world, each television receiver would already contain a standard interface for all digital broadcast applications, but this approach might add to the cost of a TV set since the

FCC does not mandate the existence of any TV receiver interface other than RF input. Happily, in a digital system a virtual port can be provided via a "black box" containing the microprocessor needed to download and run the appropriate software for many of these add-on applications.

Still, spectrum frequency use and access to the information superhighway are sensitive issues. Broadcasters will have to overcome telephone companies, computer network suppliers and cable industry firms voicing objection to their plans for alternate digital home services. **FM**



Steel Framed Homes for Lasting Value

- ◆ 9" (R-30) Insulation for BIG Energy Savings
- ◆ Unmatched Protection from High Wind, Fire, Termites, Heavy Snows and Earthquakes
- ◆ Environmentally-Friendly - over 66% Recycled
- ◆ 100 Standard Models or Custom Designs
- ◆ Straight Walls, Framing that won't Warp, Rot or Creep, Floors that won't Creak or Groan
- ◆ Open, Clearspan Interiors and much more



DISTRIBUTORS WANTED

- ◆ Join the 18-Year Industry Leader
- ◆ Homes in 50 States, 26 Countries
- ◆ Simple, Bolt-Together Construction
- ◆ Low, Refundable Investment
- ◆ No Experience Necessary with Hands-on Construction Training



Call Today to Order
a **FREE Info Packet**
or a **\$9.95 VIDEO:**



1-800-TRI-STEEL

1-800-874-7833 (B17) 497-7070 Fax: (617) 497-7497

'94 One-Day Seminars

Denton, TX	July 20
Los Angeles, CA	Aug. 3
Denton, TX	Aug. 17

\$50 per person. Attendance limited.
Call for reservations, details
and schedules for other Seminars.

New Cars



speed automatic, anti-theft system and power door locks—the new models offer a tremendous value. You see, complementing all this standard equipment is a base price of under \$16,000. And Chevy fully intends that you should be able to stroll into your friendly Chevy dealer and find the well-equipped base Lumina in the color of your

● It's been a long time in coming, but Ford has finally replaced its aging Tempo and Topaz models with cars designed for the present—and even the future. The Ford Contour and Mercury Mystique are nearly identical 4-door sedans slotted between the Taurus/Sable and the Escort/Tracer in the lineup.

The new cars ride on a 106.5-in. wheelbase that's longer than the Taurus's. That stance puts the wheels out near the ends of the tidy 183.9-in. body—about 10-in. shorter than Taurus.

ping for a midsize family sedan have been skipping right past the Chevy dealer as they traipse from Ford to Dodge to Honda to Toyota stores. The 1995 Lumina and Monte Carlo should stop that—pronto. The new Lumina sedan and the Monte Carlo coupe have instantly brought Chevy's midsize offerings into the



Contour (top left) and Mystique (above) come as 4-doors only.



choice. The better-equipped Lumina LS and Monte Carlo LS bring power windows and ABS to the standard equipment list (ABS is optional on the base models) and further open the broad list of options to include GM's 3.4-liter dohc V6 while still carrying a base price of under \$17,500. All said and done, fully laden Luminas and Monte Carlos will ring up a few thousand dollars less than all of the intended competitors—domestic and import.

Built on the same 107.5-in. wheelbase of the former model, the new Lumina is about 2 in. longer and re-

Contour/Mystique share two new engines and a new 4-speed automatic along with a 5-speed manual. Base engine is a 125-horsepower 2.0-liter Four, and a 2.5-liter all-aluminum 60° V6 that pumps out 165 hp is optional.

Dual airbags are standard and ABS and traction control are available, yet the new cars are priced well below their import-brand competition—starting at about \$13,000 and going up to \$17,000. —Jim Dunne

Chevrolet Lumina And Monte Carlo

The people at Chevrolet have been acutely aware that many folks shop-

The Monte Carlo (above left) has returned along with the new Lumina sedan (above).

thick of things. Armed with all the requisites—standard dual airbags, air conditioning, 3.1-liter V6 engine, 4-

places the old transverse-leaf spring rear suspension with struts and coil springs. More importantly, gone is





A single button operates the 3000GT Spyder's folding top.

sedan or coupe suddenly may well realize that a stop at the Chevy dealership is now as mandatory as a visit to any of the competitors.

—Don Chaikin

the archaic instrument panel, replaced by a clean, modern and efficient unit with easy-to-read round analog gauges and easier-to-use rotary controls for the heater/air-conditioning system. Also gone is the vast bulk of the noise that came along with the previous car. Careful attention to noise, vibration and harshness has paid off extremely well.

In fact, with the quiet, stylish new interior and retuned suspension, the base Lumina is a downright pleasure to drive. Up the ante to the LS or the Monte Carlo Z34 and the pleasure evolves into ear-to-ear grinning fun. The base 3.1-liter V6 has 160 horsepower—20 more than before—and the optional 3.4-liter dohc is still near the top of the class at 215 hp. The base engine develops 185 ft.-lb. of torque, while the 3.4-liter dohc is good for 215 ft.-lb.

Besides the new insides, the Lumina and Monte Carlo sport all-new outsides. The new cars look contemporary, not radical, and while some may find the new appearance a trifle conservative in the face of such a trendsetter as the Dodge Intrepid, few should find these cars offensive. Nope, with the '95 Lumina and Monte Carlo, anyone shopping for a midsize

Saab 900 Turbo Coupe

Some things are simply sacrosanct. And as far as Saab is concerned, those sometimes ethereal touches are what define this unique car. So the new Saab 900 Turbo 3-door Coupe, the second model in the 900 line, offers tradition along with all-new styling and some important technical advances.



New 900 strongly resembles the old one.

Yes, you still get the ignition lock on the floor between the front seats. Only now the lock sits on its own small pedestal, where it is easier to reach and less likely to gather dirt.

Under the hood is Saab's 185-hp 2.0-liter turbo 4-cylinder engine. The Saab Coupe delivers its elevated performance through a stronger chassis and predictable steering system.

Styling of the exterior is just as important to Saab designers as any tech-

nical improvement. The windshield angle on the 900 is almost as upright as on older models. The hood has a familiar rounded profile. And the C-pillar carries over the unusual triangle of sheetmetal that is familiar to Saab buyers. Saab owners should find the \$27,000-plus price familiar, too.

—J.D.

Mitsubishi 3000GT Spyder

What can you do to make a 300-plus-horsepower all-wheel-drive sport coupe with 4-wheel steering even more fun to drive? Why, take the roof off, of course! But what can you do to make your droptop totally unique in the marketplace—even when its "base" model lacks the twin turbochargers, awd and 4ws of its brutish big brother? Simple, instead of replacing its steel roof with a canvas one, design a way for the hardtop to neatly fold away and disappear into a special storage compartment behind the seats. Oh, and have the whole kit and caboodle operate totally automatically at the touch of a button. That's just what Mitsubishi opted to do with its 3000GT, both in the VR-4 and SL versions.

The technological wonder that is the car's retractable hardtop was designed by ASC Inc., of Southgate, Michigan. The Spydors receive additional chassis structure and reinforcing on the assembly line in Japan. The hardtop's operation opens the side windows (if needed), raises the trunklid and retracts the rear quarter windows up into the roof's C-pillars as necessary.

—D.C.

Detroit Spy Report

BY JIM DUNNE, Detroit Editor



Corvette, Circa 1997

Despite the fact that GM insiders are being tight-lipped about future Chevrolet sports cars, we can report that the future for the Chevy Corvette shows less weight, a tear-drop-shape hatchback body and a more powerful aluminum version of the LT1 5.7-liter V8 engine. Those in the know—and in control—at Chevrolet do admit that 'Vette buyers want the same performance of today's car but in a tidier package. The hatch styling is for

Pontiac's Sunfire

• Here's a revised look at the 1996 Pontiac Sunfire. The new front-wheel-drive car is a cousin to Chevrolet's new Cavalier. Though the Sunfire and Cavalier share much of their sheetmetal, they have different noses and tails. This photo shows the Sunfire's split air intakes—a Pontiac tradition—and a softer look to the exterior sheetmetal. Both the new Sunfire and Cavalier will be built in sedan, coupe and convertible versions only.

1996 Jeep Wrangler

A look at the next Jeep Wrangler shows only a few of the extensive changes Chrysler plans for its core Jeep line. If you take a close look, you'll notice the absence of leaf springs in the rear. The 1996 Wrangler gets coil springs on all four wheels—the most significant change in its suspension since the 1940s. Also, note the Jeep's somewhat lower, sloping hoodline. What this prototype does not show is a completely new body and passenger cabin. Thanks to real sedan-quality doors and a new windshield, the new Wrangler will look more like the Geo Tracker. It will approach that competitor in the area of comfort as well.

Change Of Plans

Things are constantly changing at General Motors these days. And now there are two more changes planned

in the No. 1 automaker's small-car lineup. For one thing, Buick will drop its Skylark line in 1997. For another, Chevrolet will pick up a new model that's based on the Skylark's chassis (N-body) at the same time. Those moves leave the N-body front-wheel-drive platform to the Oldsmobile Achieva, Pontiac Grand Am and the new Chevy. However, as a sop to Buick, the popular Century will stay in its lineup through the late 1990s.



Nothing but coil springs hold up the new Wrangler.

nostalgia's sake—similar in profile to the Corvettes of the 1970s. The all-aluminum LT1 V8 will develop 330

Ford's Future F-Series



This unretouched photo shows the unmasked front of Ford's restyled full-size pickup truck, scheduled to be introduced as a '96 model.



Unpainted body surfaces—front doors and fenders—of this prototype Seville are made of a plastic material, as Caddy seeks ways to shave weight from future models.

horsepower, without the added cost of the more complicated LT5 engine. Corvette market researchers ran into a problem when surveying owners of competitive sports cars. "They all say they want a car like they're driving now," reports a Chevrolet insider.

Plastic In Cadillac's Future?

A prototype of a future Seville was recently spotted going through its paces at a General Motors proving ground. And what may be the most interesting aspect of this maybe-to-be Cadillac is that it shows nonmetal material as body panels. Under usual testing procedures, new materials are not painted to match the car's paint. They are simply attached to the body. In this case, it appears that Cadillac is testing the durability of a plastic fender and door skin. The vertical rod that's visible on the right front wheel is a motion sensor.

Losing More Weight

At least three materials for constructing lighter-weight cars are being proposed to the automakers. As you might well suspect, aluminum is high on the list for body panels and engine blocks of the future. High-strength steel, like aluminum, is premium priced but can cut weight dramatically in the car's black metal (underbody structure). And now plastic is being proposed as a viable structural-part material. But the changeover from today's plain carbon steel will be gradual—there is not enough aluminum available to meet the demand of a high-production, all-aluminum car line.



No one's denying it anymore. Ford is gunning for the Suburban, and this is the ammo based on the F-Series pickup. Sloping hood is thanks to revised front suspension.

Body surface piece items such as hoods, deck lids and fenders will continue to be the areas of change.

British Blazer

As the compact sport/utility wars continue to heat up, watch for GM to slide its 4.3-liter V8 into the Chevy S-Blazer and GMC Jimmy models in the coming months. The General's move to pump up the compact sport/utilities' power is in reply to the success of Jeep's V8-powered Grand Cherokee. Chrysler sold more than 200,000 Grand Cherokees last year, and a large number were V8-equipped. Many buyers like the extra muscle of the V8, especially for trailer-towing duties.

Ford's Suburban Fighter

Ford confirmed reports that it is getting a Suburban-type vehicle ready for the 1996 model-year introduction. The new vehicle will be built on Ford's full-size pickup chassis—the same approach that GM uses for the Suburban. Ford's vehicle will be slightly smaller in cabin size than the Suburban, but it will offer the same 3-row seating that accommodates eight passengers. Like the F-Series pickup, the vehicle will have a conventional front suspension—coil springs and A-arms—in place of the old Twin-I-beam setup. That's one reason for the slope in the hoodline—the new suspension allows the engine to be placed several inches lower. Big V8s and a diesel make up the engine lineup. **PM**

A TV TURNTABLE AND VCR CABINET IN ONE!



We've got the perfect unit for housing your home viewing entertainment system. The TV/VCR Holder combines a convenient 360° swivel base to make TV viewing comfortable from any corner of the room along with a casing to keep your VCR out of the way and protected from dust, scratches and damage. Since the unit fits over the top of your VCR you can save space by stacking your television on the built-in turntable above. And you no longer need an unsightly stand or cart taking up space - any already available sturdy surface will do (i.e. countertop, desktop, dresser or chest of drawers). Made of durable high-impact ABS plastic, the TV/VCR Holder from ISI North America, Inc. houses VCRs measuring as large as 4" h. x 17½" w. x 15" d. and will hold up to a 26" screen size TV. Plus, its anti-scratch rubber base prevents damage to your furniture. Unlike other more expensive models, the TV/VCR Holder is **just \$49.95** plus \$6.00 for shipping, handling and insurance (total, \$55.95 each).

HOW TO ORDER: Send a check or money order (no cash, please) payable to **H.M. SPECIALTIES** for \$55.95 (\$49.95 plus \$6.00 for shipping, handling and insurance) for each TV/VCR Holder you want. On a separate piece of paper, please PRINT the name and address, including ZIP code, that you want the TV/VCR Holder(s) sent to. **Please be sure to include the department code shown below on your envelope and on your order paper.** Send your payment and your order information to:

**H.M. SPECIALTIES, Dept. PMVH 074;
P.O. Box 1764;
Sandusky, OH 44871-1764**

(Sorry, we cannot handle Canadian, foreign or C.O.D. orders.) Payments to H.M. SPECIALTIES are received on behalf of the manufacturer, which is solely responsible for the product. Please allow 30 days for delivery from our receipt of your order. We ship via United Parcel Service wherever possible. Orders outside continental United States will take six weeks for delivery via Insured Parcel Post.

Beyond The Moon

BY GREGORY T. POPE, Contributing Editor

● NASA looks fondly on the Moon, because its face reflects silvery memories that nothing can tarnish. The Moon bestowed mystique on NASA, and mystique endures, no matter how fortunes wax and wane.

Now, 25 years after Apollo 11, the Moon is again bringing the shine of success. Little *Clementine* (see Tech Update, page 16, Sept. '93), a spacecraft bristling with advanced technology, has finished mapping the Moon. It's currently bound for a historic Aug. 31 rendezvous with the asteroid Geographicos. As we went to press, the mission was proceeding flawlessly. And the modesty of this triumph may presage future space exploration—just as Apollo's grandeur left its mark, for better or worse, on NASA's subsequent adventures.

Indeed, the pomp of Apollo may have set up the circumstances for *Clementine*. NASA has learned the hard way that bigger isn't always better. Ironically, it's taken the Pentagon—not known for thinking small—to show NASA how to scrimp.

Clementine isn't the product of NASA's space centers and contractors. Instead, the Ballistic Missile Defense Organization (BMDO), the Naval Research Laboratory and Lawrence Livermore National Laboratory sent *Clementine* on its voyage. NASA put together a science team.

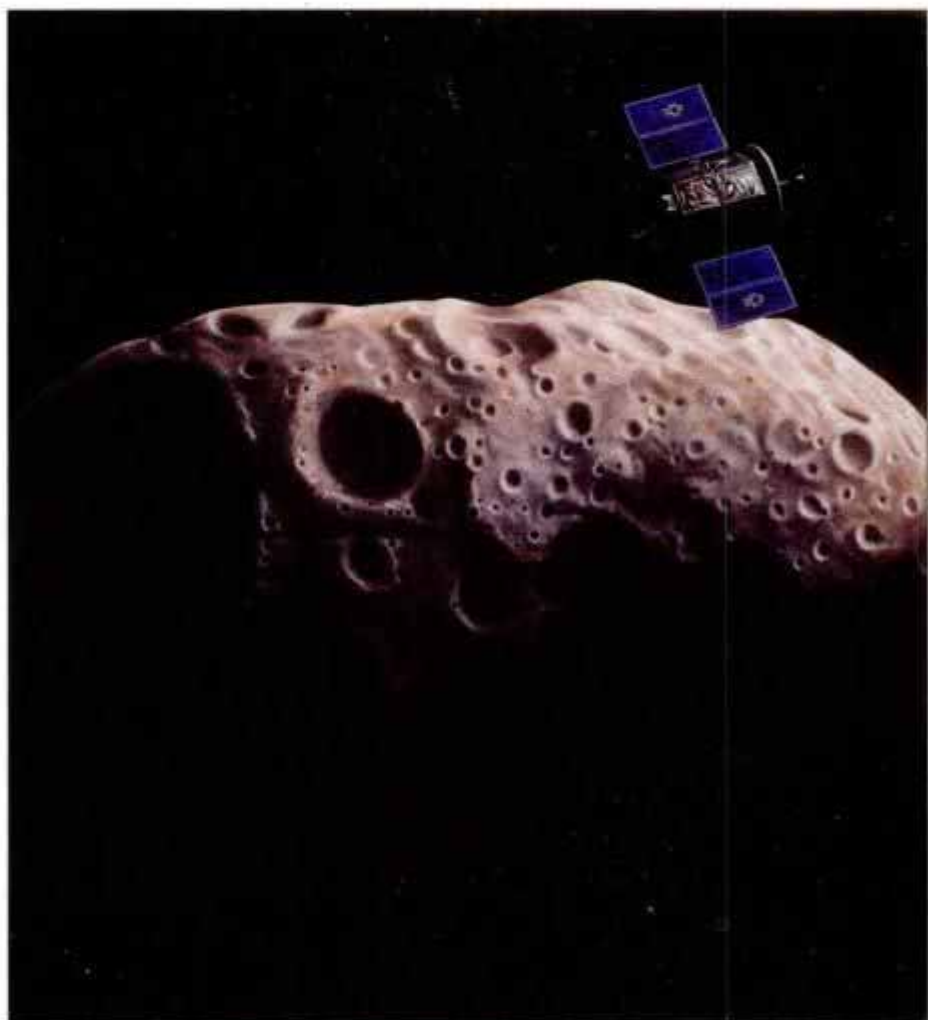
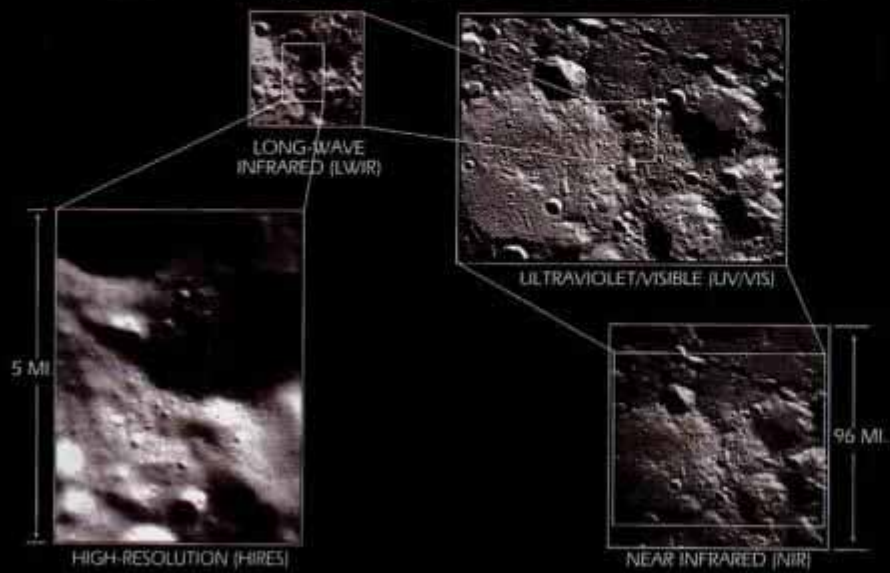


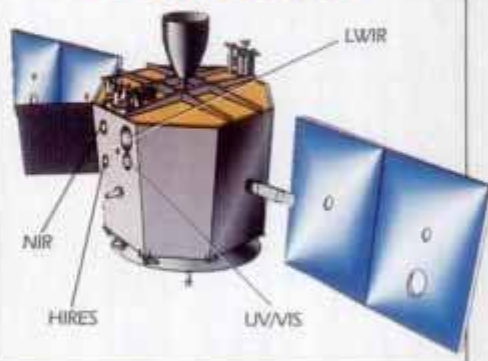
ILLUSTRATION BY PAT BIRNBAUM/NSA/C

Four Ways To Shoot The Moon



NAVAL RESEARCH LABORATORY PHOTOS AND ILLUSTRATION

Clementine



Now en route to Geographicos (top), *Clementine* (above) has charted the Moon with a quartet of sensors (left), developed by Livermore Laboratory. In total, they weigh no more than a cat. The ultraviolet/visible camera did the global mapping, with additional sensing from the two infrared devices. The laser-based HIRES camera snapped targets of opportunity.

For a measly \$75 million, the *Clementine* partners drummed up a spacecraft, a backup and a Titan IIG launch vehicle—all in 22 months.

"Quite honestly, these guys went back to a concept that NASA used to believe in," says Paul Spudis, deputy science-team leader. "They didn't sit around for months debating the optimum way of doing things. They assessed the technical risks and just accepted them."

But along with a get-it-done attitude, the military brought hardware to the *Clementine* project. During the 1980s, the Pentagon funneled billions of dollars into classified hardware—including miniature sensors and electronics designed for space-based "Star Wars" missile-defense systems. The breakup of the Soviet Union, however, forced the Star Warriors back to Earth.

The downfall of the Strategic Defense Initiative—now reconstituted as BMDO—meant that the hardware could now emerge from the "black" world. And when NASA scientists learned that the fruits of Star Wars were theirs for the asking, they asked.

Clementine's mission priorities reflect the unique joint nature of the effort. The spacecraft's prime objective is to flight-qualify military hardware. The science returned is mere gravy, albeit a generous serving for data-starved planetary scientists.

Last March and April, *Clementine* whirled around the Moon, completing the first-ever global map of our nearest neighbor. A set of digital cameras carried out the cartography in 11 different wavelengths. BMDO got to see how its sensors behaved in the vacuum and radiation bath of deep space. Scientists got the multispectral map.

That alone should open a rich mine of knowledge. The rocks brought home by the Apollo moonwalkers will allow lunar geologists to make sense of *Clementine's* data. The result should be a mineralogical chart of the Moon's crust. In addition, a laser altimeter aboard *Clementine* has provided a complete topological map—something no one has bothered to make for the Moon.

Meanwhile, as geologists sift through this data, it's on to the asteroid. Geographics is one of those space rocks that sweeps periodically across Earth's orbit (see *Science*, page 106, March '94). This leg of the mission has both BMDO and the science team on the edge of their seats.

Clementine is going to steer itself toward the asteroid the way an interceptor rocket might zero in on a ballistic missile in flight. "In midcourse, a spacecraft is a fairly cold body against a space background," notes BMDO's

Lt. Col. Pedro "Pete" Rustan, *Clementine's* program manager. "That's the same situation you find with a near-Earth asteroid. We'll have to detect it, acquire it, track it and pretend to intercept it." The approach will provide plenty of ammunition for missile-defense planners, who aren't allowed to practice such maneuvers on man-made space objects.

Rustan adds that Geographics and *Clementine* will zip past each other as fast as a kinetic-energy interceptor might home in on a headlong ballistic missile. At that velocity, *Clementine* will have only seconds to click off

pictures of the asteroid. Still, every frame will supply a world of information. Skirting Geographics at a distance of less than 60 miles, *Clementine* should return unprecedented closeup photos and mineralogical insight.

Beyond the raw data, however, *Clementine* is bound to become the darling of planetary scientists because of its powerful, up-to-date hardware. "There's no reason why NASA cannot use this technology on all its flights," remarks Spudis. "All that stuff is going to make some really neat missions possible." **FM**

Q: How Can A Mattress Be Both Soft And Firm At The Same Time?

A: When it's the Select Comfort® air sleep system.

That's because our unique patented Select Comfort air sleep system supports your entire body on a cushion of air that gives you the firmness you want at the push of a button.



Select Comfort's patented air design conforms to your body shape for relaxing sleep and perfect spinal support.



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

Studies prove our exclusive air design supports your spine more evenly than metal coil mattresses or waterbeds. And because Select Comfort has no springs to wear out and sag, we can offer you one of the longest warranties in the bedding industry—20 years.

Why Not Feel For Yourself?

With our 90 Night No-Risk Trial Period,

you can sleep on it for three months before you decide. For more information, call toll-free or return the coupon below.

Variable Firmness: A Comfort Breakthrough.

Dual air chambers inside the mattress can each be made firmer or softer, so you each get the exact support you need.



The Only Mattress with Push Button Firmness Control.



The Ultimate In Comfort and Support.

Call **1-800-831-1211**

Please send me a FREE Video, Brochure and Price List.

Name _____

Address _____

City _____ State _____

Zip _____ Phone _____

Mail to: Select Comfort Corporation
6105 Trenton Lane North, Minneapolis, MN 55422
Dept 2792

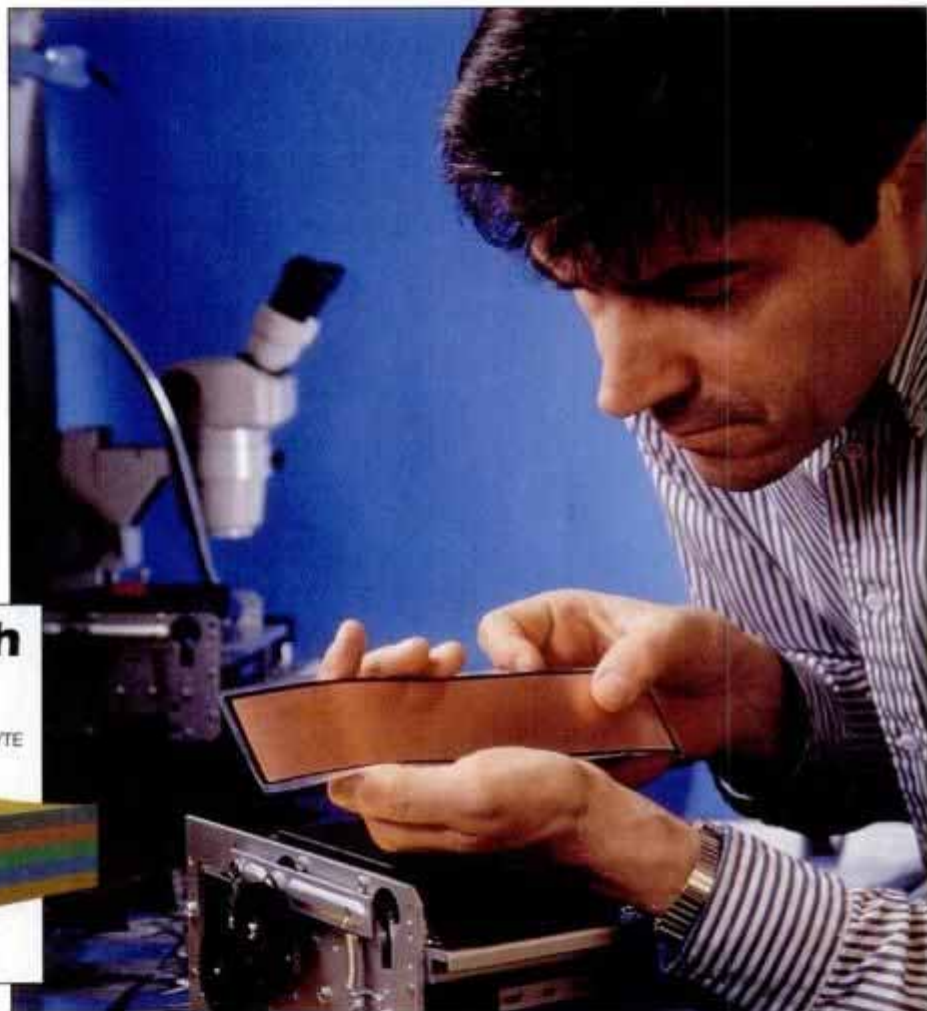
Strips Of Power

BY FRANK VIZARD, Electronics Editor

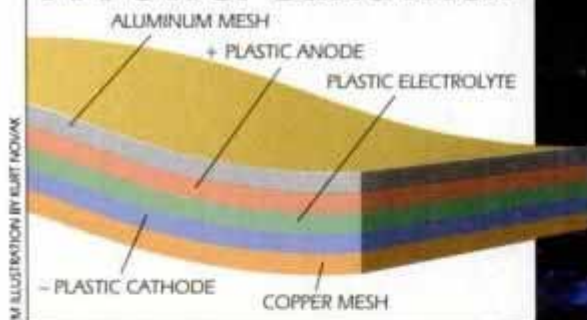
● While many electronic technologies continue to be miniaturized and become portable enough to take on the road, a big pothole is the lack of a long-lasting battery. Carrying around extra battery packs like so many ammo clips defeats the purpose. But if you don't, all you're left with is a large paperweight once the juice runs out.

A solution to the obstacles posed by battery limitations is being plotted by Bellcore, the research arm of the nation's regional telephone companies. Bellcore has developed a thin, flexible, plastic, high-power battery that is also rechargeable.

The new Bellcore battery uses lithium ion technology as its power storage medium. Since the Bellcore battery is nothing more than thin strips, a number of them can be combined



A Power Sandwich



for the desired power requirements.

For example, in a cellular phone, these battery strips could produce the same amount of power as those currently used but the battery weight would be cut in half. Alternatively, the weight could remain the same but the amount of power available, and thus the operating longevity, would double.

Operating at 3.8 volts, the energy density of the Bellcore lithium ion battery far exceeds that of the nickel-cadmium and lead-acid batteries used today. It's also about 40% more powerful than recently developed nickel-metal-hydride batteries now being used in laptop computers. What's more, the lithium ion battery is environmentally friendly since it doesn't contain toxic materials such as cadmium and lead.

The Bellcore battery is known

as the "rocking chair" battery because of the back-and-forth flow of lithium ions during the cell's charging and recharging cycles. Its development grew out of the need of telephone companies for a powerful rechargeable battery that would be a backup

for electronic components used in central switching offices. Bellcore had initially developed a liquid lithium ion battery but it was prone to leakage and therefore potentially damaging to equipment unless stored in metal containers. Liquid lithium ion batteries proved to be unwieldy for portable purposes.

Bellcore quickly realized its new plastic lithium ion battery could be configured to any shape, making it suitable for small electronic devices ranging from pagers to handheld videogames to laptop computers. Each plastic strip actually consists of five layers sealed in a metalized plastic bag that keeps out moisture and contaminants. If the bag is punctured or cut, however, it won't necessarily damage the battery.

(Please turn to page 101)



Sega's CDX system plays both cartridge and CD-ROM games.



The Triax joystick offers gamers better control of on-screen objects.

The top and bottom layers of the plastic power strip are metal mesh, copper on one side and aluminum on the other. The next layers, respectively, are a negatively charged cathode containing carbon and a positively charged anode of lithium manganese oxide. The middle layer is plastic that, while appearing solid, is half liquid but bound into the plastic so that it doesn't appear wet.

When the battery is charged, lithium ions move from the anode through the middle plastic layer and collect on the cathode. The reaction is reversed when the battery is operating and electricity flows across the terminals in the opposite direction.

While intriguing, Bellcore's lithium ion battery is probably at least a year away from appearing in actual products. Bellcore plans to license the technology to equipment manufacturers. The manufacturing process is so simple, says Bellcore, that companies not previously in the battery business may wind up producing it. But given product development cycles, it will take at least that long for this technology to appear. When it does appear, though, it may help make portable telephones and other devices truly pocketable.

Better Game Play

If you feel like you're having to choose between cartridge games and CD-ROM games, then the new Sega Genesis CDX system represents the art of compromise. This system integrates cartridge and CD-ROM play into one package.

Listing for \$400, the Genesis CDX unit is small enough to be very portable, measuring 7.8 x 5.5 x 1.8 in. Cartridge games plug into the top of the machine. The CD player is a top-loading machine that also plays standard audio cassettes.

Meanwhile, on the home front, a new joystick controller from Triax Technologies of Albany, New York,

promises to improve game playing dramatically. This new joystick allows you greater control of the speed of on-screen objects—allowing a football team's running back to run slow, medium, fast or backpedal to elude tacklers, for example. This same football player can now move in any direction rather than the four to eight directions common to most games.

The Triax joystick also allows a player to move on-screen objects more realistically along the z-axis. This means that in racing and flying games, for example, cars or planes can be maneuvered forward or backward in a more 3-dimensional way.

Listing for \$50, the Triax joystick works best with specially encoded games that will be available this fall from many game developers. The Triax joystick works as a standard controller for nonencoded games. It also works with both the Sega Genesis and Super Nintendo platforms.

VCR Clock Cure

It seems as though ever since the invention of the videocassette recorder, scores of people have been tormented by their inability to program the VCR clock. The flashing "12:00" on the front of the machine has become a symbol of their frustration with technology and the source of jokes for comedians.

It has taken awhile, granted, but perhaps technology will have the last laugh in this instance. A new breed of VCRs, the first two of which will hail from Sony, promise an end to the flashing "12:00" nightmare.

The solution is elegantly simple. The VCR clock will automatically be set by a signal broadcast by the nation's public television stations. The time and date are automatically updated each time the VCR is turned on. Sony's SLV-770HF and SLV-920HF models will be the first VCRs with this feature.

The solution to this minor but vexing problem is the result of a new technical standard for the transmission of program-related data. Called the Extended Data Service (EDS), this standard allows the time to be broadcast on a portion of the same signal used to deliver closed-caption text to your TV. The Federal Communications Commission required closed captioning as a TV feature in May 1993, thereby opening the door for other types of textual transmission as well.

The irony is that the VCR clock that so many people couldn't set properly is now likely to become the most accurate clock in most homes. **FM**

NEON LIGHTS

(Continued from page 36)

Saturn SL2

If there is one car in this group sitting in the Neon's crosshairs, this is it.

There's no denying the seriousness of the Saturn experience. First, there's the car itself—our SL2 tester came standard with a strong 124-hp dohc 1.9-liter Four and 4-speed automatic, variable-assist power steering, driver's airbag and *beaucoup* other goodies for a solid \$12,595. Another \$2750 brings power windows and door locks, air conditioning, as well as anti-lock brakes and—unique in this class—traction control. Our \$16,945 car was loaded to the hilt with a high-zoot sound system and leather interior.

At the track, the Saturn's drivetrain and chassis showed its mettle. Despite its 4-speed automatic, the Saturn was the third quickest car—beating everything but the manual-gearbox-equipped Mazda and Honda. It was fastest during the 40-70 mph passing test. Saturn was in the first-place tie on the skidpad and third quickest through the slalom.

Despite these dynamic strengths, many of our drivers had problems with the passenger cabin. Chief among these was the universal complaint about the lack of rear headroom.

However, as strong a total automotive package as the hardware called Saturn is, perhaps stronger is the software—Saturn's ground-breaking customer service from the factory through the dealership. This franchise has shown the buying public that the new-car purchasing experience can actually be a pleasant one.

Toyota Corolla LE

The Corolla is rolling proof that this company's success is no fluke. The Corolla is a solidly engineered, thoughtfully designed and well-put-together car. The car is comfortable, reliable and extremely competent transportation in a pleasing wrapper.

At the track, the Corolla made no fuss and spun no heads, it just did what it had to in a respectable if not mind-numbing fashion. Over the road, all the drivers found the car pleasant to spend time in.

When ordered in LE trim, like our test car, it carries a list of standard equipment that has more entries than some small-town telephone books have. The \$16,328 price brings a 4-speed overdrive electronically controlled automatic transmission, air conditioning, cruise control, power windows and door locks, electrically operated outside mirrors and dual airbags. Our \$18,000-plus test car also came with antilock brakes, a power glass sunroof and more. **FM**

BOATING

Speed Rails And Bat Wings

BY JOE SKORUPA, Boating/Outdoors Editor

● "You have to push close to the edge to find where the limits are. If you haven't pushed to the edge, then you don't know how far you can push." So says Ocke (pronounced ah-kee) Mannerfelt, who, unlike most fast-boat fanatics, isn't a prototypical adrenalin junkie. Instead he's a soft-spoken, engaging industrial designer and engineer from Stockholm, Sweden. Ocke can afford to be low-key about his life-on-the-edge philosophy, because he walks the talk.

You see, Ocke's limits aren't raw power and speed, they're the outer reaches of aerodynamic and hydrodynamic possibility. His latest project, the Mannerfelt B-28, is an impressive needle-nose, delta-wing water rocket that blew away the performance-boat competition at the recent Miami boat show.

"You have to let engineers play to explore the outer limits," Ocke adds in an earnest effort to further illuminate his design philosophy. I'm tempted to point out that this is a classic oxymoron. After all, can engineers play? Can politicians be honest? Can Michael Jordan hit a baseball? But this line of thought is suddenly irrelevant, because in a few swift movements Ocke has buckled me into a full-torso safety vest, jammed a crash helmet on my head and led me into the fighter-jet cockpit of his midnight-blue screamer. Within moments, the driver fires up the engine and Ocke shoves the boat away from the dock with a wave and a crooked smile.

Without question, the B-28 has the



most slippery contours in boating, with its fuselage-like stem and gull-wing stern. It not only appears fast, it looks like it could break the sound barrier.

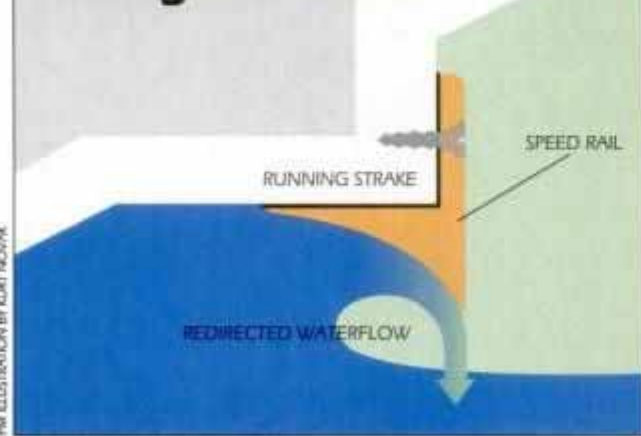
Still, I'm not overly worried about raw speed. After all, how fast can a single-engine 28-ft. 3500-pound V-bottom go? True, the powerplant is a massaged and modified 7.4-liter Volvo Penta EFI engine (not yet in the Swedish builder's U.S. product line), and it's mated to a sporty DPX twin-prop outdrive. But what will the top end be, the low to mid-70s? Even the most elite single-engine V-bottom racing boat would have trouble breaking the 80-mph mark.

So, my big concern isn't speed. It's handling. How will this bat-wing bullet respond at full throttle? Designers diverge from tried-and-true hull bottoms at their peril. Or at my peril, as the case may be.

But my worries turn out to be groundless. The boat pins full-throttle wheel-lock turns like it's on rails and handles big-boat wakes like it has shock absorbers. In fact, once the boat tops 55 mph, the ride actually improves. The lifting body and wings become functional at this point and stabilize the boat in its optimum angle of attack. After launching off the tops of waves, the B-28 maintains a plumb-level attitude and reenters the water in perfect control. Plus, the reentry is so soft that it feels like a flying fish gliding between waves instead of a thumping slab of fiberglass.

Another big surprise arrives when I glance at the speedo over the driver's shoulder. The needle is pegged in the mid-80s—an impressive

Riding On Rails



Speed Rail deflects water beneath the hull to produce lift.

PHOTO ILLUSTRATION BY KURT HONIG



Steps cut laterally across the hull. Speed Rails run along the hull's longitudinal axis.

feat that puts the B-28 well within reach of existing class speed records.

Back at the marina, Ocke once more attempts to elucidate his design philosophy. "A dolphin has a muscle engine of about 4 hp and can go 50 mph," he explains. "But if we built a dolphin, we would have to give it a 70-hp engine to go the same speed. So you see, there's a lot we can learn from nature about controlling friction." An elegant analogy for an engineer.

On the B-28, friction is controlled by the wings, which actually provide more stability than lift in the manner of a true airfoil, and a unique bottom configuration. Three transverse steps (clean sectional breaks across the running surface) control waterflow as it passes beneath the hull. In Ocke's words, the steps "suck in air" and add "lubrication" to the waterflow. The first transverse step, located amidships, sets up the waterflow to the second step, which is located farther aft. Once the boat gets on plane, the second step takes over and feeds the third step, located just forward of the transom, which is the load-bearing portion of the hull.

While sport and racing boats frequently experiment with hull steps, Ocke's inspiration wasn't nautical. It was aeronautical—pontoon seaplanes. Despite generating sufficient power to achieve takeoff, early pontoon seaplanes found they couldn't break free of the water. Natural suction was the culprit. To solve the problem, aviation engineers came up with an exact placement of transverse steps to break the pontoons free. After considerable tank testing, Ocke found that shape and placement of the steps are crucial. If poorly conceived, they actually slow a boat down.

But as cutting-edge as these friction-control components are—lifting body, airfoil wings, stepped hull—Ocke points out that each has already appeared before, although their combination is a singular achievement.

However, one component is truly unique to the B-28, and it may have far-reaching implications for the future of hull design. This component is called a Speed Rail, a long piece of extruded aluminum that runs down the longitudinal axis of the hull. Like

strakes, Speed Rails break the connection of the water to the hull and stabilize the boat's running attitude. But unlike strakes, Speed Rails are so sharply angled that they deflect water straight down beneath the boat. Strakes and even reverse chines merely deflect water outward. The difference is that Speed Rails provide true hull lift that doesn't come at the expense of engine power. In a way, it's a little like turbocharging. The extra power is there for the taking, all you have to do is tap into it.

Running down the hull in long rows, the Speed Rails turn the typically smooth bottom of a performance boat into something that resembles the ridged belly of a whale.

With all of these aerodynamic and hydrodynamic components in place, the B-28 virtually locks itself into an ideal running attitude. The familiar bow-up, bow-down tango through the rpm band is eliminated, and trim has no effect on the boat's running angle. Trim tabs, too, are equally ineffective. Cornering, as noted, feels like the boat's on rails because, well, it is. And finally, all spray is channeled beneath the boat and ejected aft, instead of outward, where you outrun it before the wind can blow it back in your face.

Volvo Penta brought Ocke and his incredible B-28 to the Miami boat show to showcase its commitment to cutting-edge technology and to demonstrate its industry-leading DPX drive. Ocke is thrilled to be associated with Volvo Penta and hopes to build racing and cruising boats for the American market that use the elements pioneered on the B-28.

While at the show, Volvo Penta announced that it will become the exclusive distributor of Speed Rails to the North American market, both for new hull designs and for bolt-on speed components intended for current sport and racing hulls. Speed Rails can easily be attached to existing bottom strakes and produce significant improvements in top speed, overall performance and fuel economy (which was actually Ocke's original design motivation).

I have seen the future of high-performance boats, and it looks something like the Mannerfelt B-28. **PM**

YOU HAVE NEVER SEEN A CATALOG LIKE THIS!



The 1994 Edge Company Catalog

Over 60 blazing full-color pages of the most incredible knives, action gear, electronics, self-defense, and optics your eyes have ever feasted upon.

Now get in on:

- One-Handed Knives
- Night Vision Scopes
- Automatic Air Pistols
- Hunting Knives
- Tear Gas Revolvers
- Locksmithing
- Car Alarms
- Watches, Lighters
- Sword Canes
- Bugging Equipment
- Stun Guns
- Pistol Crossbows
- Samurai Swords
- Tap Detectors
- Stilettoes
- Voice Disguisers
- Black Powder Guns
- Spy Equipment

And a thousand more, all with an iron-clad, rock-solid, money back guarantee.

Get Yours Today!

Send \$3.00 for a full 2 year subscription, to:



THE EDGE COMPANY
P.O. Box 826, Dept. PM07
Brattleboro, VT 05302

Or call toll-free

1-800-732-9976

Please allow a couple of weeks for your first catalog to arrive. Thanks!

Import Spy Report

BY MIKE ALLEN, Associate Automotive Editor

Topless Benz

● Springtime 1996, start looking at your Mercedes-Benz dealer for the SLK roadster, captured here while being tested by some engineers. Based on the C-Class sedans, the new roadster is definitely a 2-seater, and sports a pair of small rollover bars behind the occupants. For the DM 55,000 price (about \$34,000), we doubt the rollover bars are hydraulically actuated to extend



MG Returns

It may be monikered the MGD when it becomes available late in 1995, but for now it's code-named the PR 3.

Turbo Panzer

Porsche is currently selling 911 Carreras based on the 993 chassis, which uses a modern, double-wishbone rear suspension. But it's still selling Turbo models based on the older chassis with the semitrailing-arm "widowmaker" rear end. It's even making a special run of Turbos with slant noses, skirts and an extra oil cooler. But we do have a shot of the 1995 Turbo based on the newer chassis and body. External differences are subtle, but they include a larger pop-up rear wing and wider fenders and tires.



Underneath all that black tape is a new convertible Bentley.

automatically in an accident (à la SL). The SLK will have a 2-piece folding hardtop that powers away into the trunk—rear window and all. It's all done with a single button, including opening and closing the trunklid.

Whatever it's called, it will be based on the upcoming Rover 200 replacement platform. Using struts for front and

Pardon Me, Do You Have Any Grey Poupon?

Here's a somewhat disguised and very ugly prototype of a convertible version of the Bentley Continental R, captured while testing somewhere in England. Purportedly, the 6.7-liter turbo V8 has been tweaked to make up for the extra weight of the soft-top version. Further purported is the bankrolling of the project by the Sultan of Brunei, who really does own more than 100 luxury cars, including a number of Rollers and Bentleys.

rear suspension, the PR 3 will use upgraded versions of the K-series engines rated at 100 hp, and a supercharged 1.8-liter engine rated at 160 hp. The engine will be mounted behind the passenger compartment, and will drive the rear wheels through a 5-speed Honda transaxle. Look for this car to compete with basic, no-frills sports cars like the Miata and MR2, as well as upcoming Alfa and Fiat Spyders.



Porsche will upgrade the Turbo to the 993 chassis in '95.

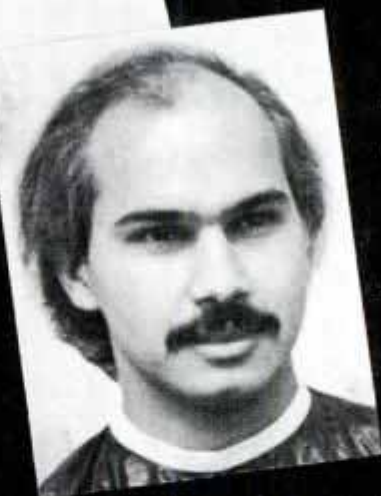
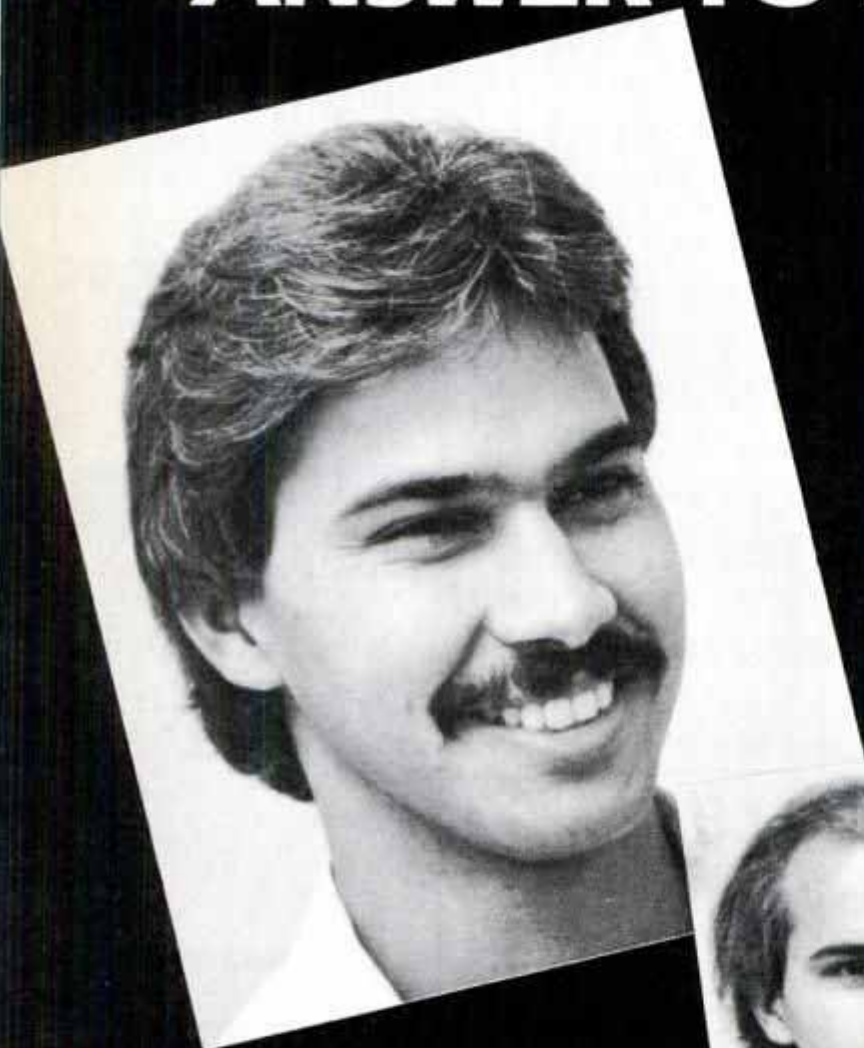


Ford and VW's European minivan might come to the United States.

But Will It Look Good Painted With Flowers And Peace Signs?

Ford of Europe has been testing this minivan, a joint venture with Volkswagen, which at this point is not intended for import into the United States. But we can't help but speculate that it might be a future replacement for the Nissan-based Villager minivan, which is in its third model year and due for at least a refreshing in the next couple of years. **FM**

"I FOUND A PERMANENT ANSWER TO BALDNESS"



A Simple 3 Hour Medical procedure where filaments of hair are applied to the scalp to *Thicken* or *Completely* restore hair back!

These filaments will duplicate natural hair.

A LIFE TIME WARRANTY IS NOW PROVIDED

Hairlines can be created and you can comb hair back.

This process is not a surgical transplant or hair implants and there is NO scheduled maintenance appointments as with hairweaves, fusion etc.

Reversible if ever desired.

This Procedure is Not a Conventional Hair Piece!

Procedure is now tax deductible and fee's range from \$1200 to \$5500

For free evaluation & brochure **CALL TOLL FREE**

U.S. 1-800-262-8844

Canada 1-800-523-8844

NJ and out of country

1-609-829-4300

or write:

ICL

The Presidential Center

Jefferson Building Suite #1B

101 Route 130

Cinnaminson, New Jersey 08077

TIP SANDBLASTERS REMOVE RUST FAST

Leading manufacturer 23 yrs. Pressure blasters are easy to operate & super fast, \$299 up. Enclosed cabinets recycle abrasive continually, \$249 up. Up to 8ft wide available. No faster way to clean parts. FREE TIP Catalog. Call today, 1-800-321-9260. Fax 216-533-2876. TIP Sandblast Equipment, Dept. PM, 7075 Rt. 446, P.O. Box 649, Canfield, OH 44406

THE TRUE "TUNE UP IN A BOTTLE"

PROFESSIONAL STRENGTH • NOT AVAILABLE IN STORES

Add this proven formula to your gas tank to clean injectors, intake valves and combustion chamber of harmful carbon, gum, and varnish "as you drive". Gasoline alone won't do it! One application will improve performance and mileage. Safe on catalytic converters. ORDER TODAY. Send check or money order for \$6.90 + \$3.00 S&H to:

A & G Auto Supplies • P.O. Box 1320
 Agoura Hills, CA 91376-1320

CA residents add sales tax Allow 2 - 3 weeks for delivery

WIN! WIN! WIN!

1994 Ford XLT SuperCab or \$15,000 Cash

to be raffled on July 16, 1994
 \$10 for 15 Tickets

Send Check or Money Order by July 1, 1994 to:
 Alexander Volunteer Fire Dept.
 GRAND PRIZE • P.O. Box 152
 Alexander, NY 14005

Yes! You can own your own home.



It's easier than you think!

Just being your own general contractor and doing some of the simpler work yourself may be enough participation to provide the equity (down payment) you need for a mortgage on your very own home! Call today!

No down payment on Miles materials or money lent for subcontracted work

1-800-343-2884
 Ext. 1



CABLE TV DESCRAMBLERS

JERROLD, SCIENTIFIC ATLANTA, ZENITH, TOCOM, PIONEER, HAMLIN

WE GUARANTEE YOUR COMPLETE SATISFACTION WITH A 30-DAY NO-RISK TRIAL PERIOD.

- ★ ONE YEAR WARRANTY ON ALL PRODUCTS IN WRITING!
- ★ BUY 2 SAVE 10% ON SECOND UNIT.
- ★ EASY TO INSTALL INSTRUCTIONS WITH EVERY ORDER.
- ★ FRIENDLY, COURTEOUS SERVICE.

TKA ELECTRONICS

7914 W. Dodge Rd. #334
 Omaha, NE 68114



FOR A FREE CATALOG OR QUESTIONS CALL:

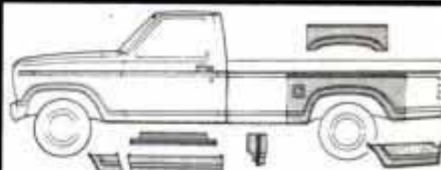
1-800-729-1776

CABLE TV DESCRAMBLERS CONVERTERS ACCESSORIES

SAVE \$\$\$ DON'T RENT

30 DAY MONEY BACK GUARANTEE
 PANASONIC, OAK, JERROLD,
 ZENITH, SCIENTIFIC ATLANTA
 PLUS MORE!!!! LOWEST PRICES!!!
 AA Electronics

CALL 1-(800) 258-9512



STEEL RUST REPAIR PARTS

Restore your car, van or truck to showroom condition with TABCO parts. Over 100,000 domestic and foreign parts, available for immediate delivery.

Send \$5 for illustrated, 150-page catalog with instructions to install TABCO parts. Refundable with order. Shipped 1st Class. Dealer inquiries invited.

TABCO (216) 248-5151
 FAX (216) 248-8979

30500 Selon Industrial Pkwy. Dept. PM Cleveland, OH 44138

NEW PRODUCT HELP! NEW PRODUCT

PROBLEMS with OIL SPOTS in your driveway or shop? The ALL NATURAL solution. Ten times more effective than any other product. Use it over and over. 1/4 cu. ft. bag absorbs up to 5 qts. of oil. Made from by-product of sawed "KELP"

Try "KELP" HELP!

Send check or money order for \$5.50 plus \$2.50 for shipping and handling: Kelp Help, P.O. Box 784, Tecate, CA 91960. Allow 10 days shipping. To order large quantities wholesale, phone (619) 443-7582

SINGERS! REMOVE VOCALS! Unlimited Backgrounds!

From Standard Records & CD's with the Thompsons Vocal Eliminator™. Call for Free Catalog & Demo Record.

Phone: (404) 482-4189 Ext 61
 Singer's Supply, Dept PM-1
 7986 Hightower Trail
 Lithonia, GA 30058

24 Hour Demo Info Request Line (404) 482-2405 Ext 61

Singer's Supply - We Have Anything & Everything For Singers

Don't have unprotected
DIVORCE!
 Get extensive help. Save \$\$\$
 Local lawyers & referrals, newsletter
MEN'S DEFENSE ASSOCIATION
 17854 Lyons Forest Lake, MN 55025
 >> 2 bucks brings info <<



CONVERTERS DESCRAMBLERS TEST MODULES RADAR DETECTORS SCANNERS

CALL FACTORY DIRECT FOR
FREE CATALOG

1-800-422-2640

TECH SERVICE AVAILABLE

ALL LOCAL, STATE & FEDERAL LAWS APPLY TO
PURCHASE OF ANY DESCRAMBLER DEVICE

SURVEILLANCE

& COUNTERSURVEILLANCE Electronic Devices

Vehicle Tracking • Bug/Phone Tap Detectors • Caller ID
• Covert Video Phone Scramblers • Voice Changers
Shotgun Mics • Transmitters • Locksmithing • AND MORE!

7-Hour Telephone Recorder
Tapes incoming/outgoing phone calls automatically. **\$125.00**

FOR CATALOG SEND \$5.00 TO...

P.O. Box 337, Buffalo, NY 14226 (716) 695-6660

CABLE DIRECT

100% MONEY BACK GUARANTEE! • 30 DAY FREE TRIAL!

Now you can tune-in to your
favorite cable TV programming
and **SAVE 100's—EVEN \$1000's**
on premium

CABLE TV EQUIPMENT
Converters • Descramblers • Filters

FREE Cable TV Catalog



MODERN ELECTRONICS
1-800-906-6664

2125 S. 156th CIRCLE • OMAHA, NE 68130

CHEAP HEAT

INEXPENSIVE • ENERGY EFFICIENT
MAINTENANCE FREE

Don't waste money on another space heater. Let your gas or
electric water heater give you continuous 90 degree heat AND
hot water. Do it yourself in an afternoon with easily
obtained parts. Don't delay! Order today!

Complete Illustrated Plans • \$12.95 postpaid
ROPERSEN ENTERPRISES
P.O. BOX 1112, DESOTO, TEXAS 75123-1112

USING YOUR
WATER
HEATER

WOOD HEAT

WOOD FURNACES
HEAT YOUR ENTIRE HOME

Call 1-218-326-6786 or Write

Charmaster®

2307A HWY 2 W.
GRAND RAPIDS, MN 55744

NEW! Model Hot Air Balloon Kits!

Watch Canada's First Hot Air
Balloon Soar Hundreds
of feet into the air!

Kit Includes:
• Materials for a four
foot balloon w/ wicker
basket
• Burner Assembly
• Illustrated full color
manual
• And More!

Kit Price
\$19.95

Send Check / Money Order
\$29.95 + \$3.00 S&H

Balloon Smith Inc.
2020 West Pensacola
Unit 46, Suite 546
Tallahassee FL 32304

SATELLITE TV

AT WHOLESALE PRICES
TOP BRANDS • OVER 200 CHANNELS
• FREE CATALOG • INSTALLATION GUIDE
U.S. AND INTERNATIONAL EXPERTS • INTERNATIONAL CALLS
1-800-814-LESS (718) 746-7810
ANTENNA KING INC. • OUR 41ST YEAR
6502 6TH AVE. BROOKLYN, NY 11220



BE SEEN. BE SAFE!

A SIMPLE RULE TO LIVE BY: DRIVE WITH YOUR LIGHTS ON DURING THE DAYTIME

International studies show that
daytime driving with lights on
can reduce vehicle collisions
by up to 32% or more!

LITE-MINDER PRODUCT #480

Automatically turns low-beam headlights on and off
with ignition. Works on virtually all vehicles.
Eliminates dead batteries from lights left on! Make
your vehicle easy to see with the most innovative,
least expensive, easiest-to-install automatic
lights-on product on the market today!

ONLY \$15.95 PER UNIT

Plus \$4 shipping & handling, MC / VISA.
Made in U.S.A. Quantity Discounts Available

LITE-MINDER

206 COMMERCIAL ST. SAN JOSE, CA 95112

CALL 1-800-900-LITE
FAX: 408-287-3557

Build a SHOP OF YOUR OWN
for prices you could only
dream about

LIMITED OFFER



EASY DO-IT-YOURSELF CONSTRUCTION
PACKAGES INCLUDE STEEL, FRAMES,
SHEETING AND HARDWARE

30x36
Value \$7,751
NOW \$3,975

36x48
Value \$12,145
NOW \$6,220

40x60
Value \$17,250
NOW \$8,846

46x72
Value \$25,143
NOW \$12,894

Other Sizes Available

MIRACLETRUSS®

1-800-843-8275

FAX 612-544-1835

Made in America

PM



You Can Drill Your Own Water Well!

During more than 30 years in business, one of the most common
statements we've heard from our customers has been, "You
know, I never even thought about drilling my own water well
before I saw your ad. Then I thought there was probably no way
I could do it myself. But, I decided to check it out anyway. Now,
I'm really glad I did!"

The benefits of drilling your own water well are so
numerous that we simply don't have room here to list
them all. But, by requesting our FREE information
packet, you'll soon see why thousands of
homeowners are glad they checked it out.

Call Toll-Free
1-800-333-7762

(Ask for Operator 7517)

Also, ask about our "How To..." videotape!
Or Clip Coupon and Mail Today!



7517 Anderson Road
Opelika, AL 36802

YES! Mail to me the FREE INFORMATION PACKAGE
and the illustrated guide **HOW TO DRILL YOUR OWN
WATER WELL.**

FREE! How to Drill Your Own Water Well



is a fully-illustrated guide that shows
you how to get all the pure, fresh,
chemical-free water you'll ever need.
Also, for only \$10 (plus \$3 S&H), you
can see the complete drilling of a well
from start to finish! This 20-minute, full-
color tape shows every step of drilling
a water well. The \$10 is refundable with
the purchase of a drill.

First Name _____

Address _____

City/State/Zip _____

Phone (must have) _____

© 1994 DeepRock

TOOL-TRONICS

AMERICA'S AT-HOME TOOL STORE
1-800-846-TOOL

Each order comes with our FREE 48-page tool and equipment catalog. Shop with confidence—you'll pay wholesale prices for national brand names and each purchase is fully covered by manufacturer's warranty and our 30-day satisfaction guarantee. Prices do not include UPS charges.

SUNFO Inductive High Speed Timing Light

Works on all 12-Volt systems. Accurate up to 6,000 RPM. Solid state circuitry for years of dependable use and inductive clamp for easy hookups. #2078

Reg. \$63.00
\$45.60

AUDIOTECH PROBE Diagnostic Listening Probe

Put on the headphones, adjust the volume and quickly locate problems in combustion engines, windshield seal leaks, motors, pumps, compressors, farm machinery and appliances. #AT100

Reg. \$49.95
\$39.96

SOG Para Tool

Each of the 20 components is quality crafted of stainless steel and backed by a lifetime guarantee. Features include needlenose pliers, wire cutter, saw, file, blades, awl, screwdrivers and precision measuring scale. Fits into a compact 4" belt pouch. #S31

Reg. \$32.00
\$39.20

Lisle Hot Sleeve

Protects hand or forearm from hot engines and exhaust. Made from Dupont heat-resistant Kevlar. Washable. #18700

Reg. \$10.95
\$7.95

Lisle Spring-Lock Coupler Disconnect Tool Set

The only way to disconnect couplers that are commonly found on brake, air conditioning, fuel, transmission and radiator lines on newer Ford, GM and Chrysler vehicles. Set includes six sizes: 5/16", 3/8", 1/2", 5/8", 3/4", and 7/8". #37000

Reg. \$9.95
\$6.60

ROBO-GRIP Self-Adjusting Pliers

Spring-action mechanism selects the right opening, then locks on tight. One squeeze with one hand is all it takes to remove rounded or stubborn bolts in tight or awkward spots. Lifetime warranty.

8" Straight jaw (1" jaw opening) #RG6... \$19.95
9" Curved jaw (1-3/4" jaw opening) #RG9... \$20.95

Makita 9.6 Volt Cordless Driver Drill

Variable speed with reversing for easy driving of screws. Electric brake for fast stopping and 12-position torque clutch. Comes complete with 3/8" chuck, charger battery and plastic storage case. One-year warranty is backed by over 300 service centers nationwide. #6093DW Reg. \$215.00

Special Buy
\$149.95

OMEGA 22-Piece Neon Screwdriver Set

Bright neon impact plastic handles are tough to lose and even tougher to abuse. Chrome vanadium blades come in a wide assortment of slotted, Philips and Torx styles. #SD22N

Reg. \$30.50
\$19.20

Telephone toll-free or mail your orders to:
TOOL-TRONICS, P.O. Box 415, Fair Lawn, NJ 07410
Call our toll-free number for shipping charges.
We accept Visa, Mastercard or Discover cards, money orders or personal/company checks.

SALE!

CABLE TV DESCRAMBLERS WE'LL BEAT ANY PRICE! CALL TOLL-FREE 1-800-284-8432

• JERROLD • TOCOM • ZENITH •
• OAK • PIONEER • HAMLIN •
• SCIENTIFIC ATLANTA •

**24 HOUR SHIPMENTS!
QUANTITY DISCOUNTS!
30 DAY MONEY BACK GUARANTEE!
FREE CATALOG & INFORMATION**

MasterCard American Express Visa C.O.D.
HAVE MAKE AND MODEL NUMBER OF EQUIPMENT USED IN YOUR AREA
1-800-284-8432
FOR ORDERS ONLY
For technical & customer service: 305-749-3122
ALL SHIPPING & HANDLING FEES AT CUSTOMER'S EXPENSE
Shipping requiring draft of service will be denied assistance.

CABLE WAREHOUSE
18117 WEST OAKLAND PARK BLVD., SUITE 315, SUNRISE, FL 33351
NO FLORIDA SALES

46 Ways to Help You Qualify for the Job You Want

Free Facts about Career Diplomas and Degrees

Now, at home in your spare time, without any previous experience, you can train for a money-making career...even get a Specialized Associate Degree. Call or send for free information on the career field that interests you most and how to train for it.

CALL TOLL FREE **1-800-595-5505 Ext. 3772**
CALL ANYTIME—24 hours a day, 7 days a week.
OR MAIL COUPON TODAY!

ICS International Correspondence Schools

Dept. AP8564S, 925 Oak Street, Scranton, PA 18515

Send free facts on how I can study at home for the career I have chosen. No obligation. No salesman will visit. **Check One Box Only!**

- ASSOCIATE IN SPECIALIZED BUSINESS DEGREE PROGRAMS**
- Business Management
 - Accounting
 - Bus. Mgmt.—Finance Option
 - Bus. Mgmt.—Marketing Option
 - Applied Computer Science
- ASSOCIATE IN SPECIALIZED TECHNOLOGY DEGREE PROGRAMS**
- Civil Engineering Technology
 - Mechanical Engineering Technology
 - Electrical Engineering Technology
 - Electronics Technology

- CAREER DIPLOMA PROGRAMS**
- High School
 - Auto Mechanics
 - Surveying & Mapping
 - Drafting
 - Air Conditioning & Refrigeration
 - Wildlife/Forestry Conservation
 - Police Sciences
 - Diesel Mechanics
 - Electrician
 - Small Business Management
 - Gun Repair
 - Electronics
 - Bookkeeping
 - Child Day Care
 - Medical Office Assistant
 - Legal Assistant
 - Art
 - Motorcycle Repair
 - Hotel/Restaurant Management
 - Catering/Gourmet Cooking
 - Computer Programming
 - Personal Computer Specialist
 - Personal Computer Specialist with Multimedia
 - PC Repair
 - Desktop Publishing & Design
 - Fitness & Nutrition
 - TV/VCR Repair
 - Photography
 - Animal Care Specialist
 - Journalism/Short Story Writing
 - Interior Decorating
 - Florist
 - Secretary
 - Teacher Aide
 - Home Inspector
 - Medical Transcriptionist
 - Professional Locksmithing

Name _____ Age _____
Address _____ Apt. # _____
City/State _____ Zip _____
Phone () _____

FLUSH UP TOILET
To Above Floor Drain
Install it Yourself - Anywhere
No Digging Up Floors
Write McPherson, Inc., Dept. 16
Box 15133, Tampa, Florida 33684

New Mod. E 1.6

CABLE BOXES
WE CARRY ALL BRANDS
Giant Inventory • Direct from Factory
Must Liquidate Overstocked Warehouse
BELOW WHOLESALE PRICES
1-800-237-4951

...for \$3,495. Now it's possible to buy the best for less! Call us on the engineering expertise of the world's finest light tower manufacturers. Whether you require a 10' tower or 100' tower, we have the professional, complete, heavy-duty, or heavy-duty, and \$111 (information) for our comprehensive info pack. Discover how effective it can be for you. Visa or Mastercard. Foreign orders add \$4.50.

FLY...O

Nectec Hovercraft Inc.
1048 Tappanock Street, Tallahassee, Florida USA 97807-6394
Fax: 915-834-3217 Phone: 915-834-1120

CABLE T.V. EQUIPMENT
10 Years Experience
Zenith, Jerrold, Scientific Atlanta
Pioneer, Toocom
Test Aids Available
30 day money back guarantee
Visa / MC / COD
Call for a price
NEWTRONICS
800-256-2880

WATER BALLOON LAUNCHER
ONE or THREE-PERSON
Three Sizes:
90 yard - \$10.00
120 yard - \$12.00
150 yard - \$14.00

USA-MasterCard-Check-Money Order - No COD
Shipping and Handling \$3.00 / Launcher
Every order shipped next day! Money Back Guarantee
C. X. BLASTER CO., INC.
13218 Jessica Dr., Spring Hill, FL 34809 **1-800-441-1047**

• DEALER LIQUIDATION • NEW CORDLESS DRILL KITS •
JOHN-SMITH • 30 DAY WARR. • WHILE SUPPLIES LAST
• ALL MODELS INCLUDE BATTERY, CHARGER, CASE (NO GAS)

• 1063385 (6" x 1/2")	\$43.95
• 12294130 (2100mAh 3.6V BATTERY)	\$14.95
• 104281 (1/2" x 3/8")	\$31.95
• 12664400 (5-PC KIT - DRILL, JOGGER, SANDER)	\$91.95
• 104160 (1/2" x 3/8")	\$56.95
• 12372100 (7.2 VOLT BATTERY FOR 12664400, 104160)	\$14.95

SEND CHECK OR MONEY ORDER PLUS \$7.00 SHIP. TAX • 10 WESTBURY RD. BOX 876
A.W.L. MFG. INC. • 4406 SIOUXVILLE AVE. #109 • MAPLE, IL 62552 (312) 943-5790

FREE P.H.D!
ACCREDITED DEGREES
MINISTERIAL LICENSE
PROFESSIONAL DIPLOMAS
Psychic • Hypnosis • Counseling • & More!
Rush Name & Address To:
P.U.L.C. • BOX 276265-PM • SACRAMENTO, CA 95827

**COMPUTER ERASE
BAD CREDIT FREE**
INSTANTLY!
Add tens of years of AAA credit in your credit file
"OVERNIGHT" 100% Legal **FREE DETAILS:**
FBI, DMV (DUI) Gold (TM)
Files too... 325 N. Maple Dr., #15574
Beverly Hills, CA 90209

BE A HOME INSPECTOR!
Train at home. Start a profitable business. Free literature: 800-223-4542.

Name _____ Age _____
Address _____
City _____ State _____ Zip _____

School of Home Inspection, Dept. PPH129
6065 Roswell Road, Atlanta, Georgia 30328

**CABLE TV
DESCRAMBLERS**
1-800-233-9388
FREE CATALOG
GUARANTEED BEST PRICES • IMMEDIATE SHIPPING
APPLE ELECTRONICS
3289 Sheridan St. • Suite 257
Hollywood, FL 33021

Concrete Dome Kit 1(800)608-0001
Monolithic Constructors, Inc. Free Brochure
PO Box 479-M • Italy, TX 76651 or Video \$19.95
Build your own super strong
concrete Monolithic
Dome™. As an office,
home, shed, cabin,
rental unit, anything!
Cost / Energy Efficient.

CABLE TV
BEST PRICES
Jerrold®
Zenith
Tocom
Oak
Hamline
Pioneer
Scientific
Atlanta
1-800-826-7623
3584 Kennebec, Eagan, MN 55122
30 DAY TRIAL 1 YR. WARRANTY
VISA MC AMEX DISC COD

WE DARE YOU...
To find a more intense experience
than a sport sub dive. This is not a
"wet sub". No breathing or dive gear
is worn. Take your friends for rides.
2 & 3 person models. In production
since 1987. Now build your own from
a kit for half the price! Info pkg \$9.95,
20 min. action video \$24.95, or both
for \$29.95. Outside N.A. add \$15.00.
U.S. dollar money order or Visa only.
International VentureCraft Corp.
1225 E. Sunset Dr. Suite 500
Bellingham, WA 98226-3529
Order line or Fax: (604) 436-5657

PLAZAC SALES INC.
Cable TV Converters Plus Panasonic, Scientific
Atlanta, Jerrold, Pioneer and more. Professional
Service, Good Prices. One Year Warranty - Ship
C.O.D. Any one implying theft of service will be
declined sales. Sorry, no New Jersey sales. Dealers
Wanted.
PLAZAC SALES INC.
1-800-A-WIRE-4-U (1-800-294-7348)

Celebrate July 4th & All Events
CARBIDE CANNON
BIG BANG! \$119.95
Mammoth Cannons shoot
with terrific BANG! Have
a bang-up time at special
events. Uses powdered
carbide ammo. Hundreds
of shots for few cents. All metal construction with large,
rugged cast-iron wheels. Machined brass mechanism for easy
loading and firing. Authentic turn-of-century design. Hand-
some decor when not in use. Made in USA to last a lifetime.
Available in 3 sizes: 9" cannon, \$49.95 postpaid; 17" cannon,
\$89.95 postpaid; 25" cannon (shown here) with rapid firing and
automatic loading, \$119.95 postpaid. The larger the cannon
the louder the bang! Carbide ammo, about 100 shots, \$6.00;
3 packs for \$15.00. Send check, money order or call. Visa,
MasterCard accepted by mail or phone (610) 866-0777. Give
card number & expiration. Money-back guarantee.
The Coenstoga Co., Inc., Dept PM, PO Box 405, Bethlehem, PA 18016
 SEND FOR FREE CATALOG

SPRING CLEARANCE!
STEEL
BLOGS
SAVE UP TO 45%
Buy Factory Direct. Build it yourself!
20 x 32 • 25 x 48
35 x 56 • 50 x 124
800-888-4606 STEELMASTER

Now you can
do something
about
the weather

Our ULTIMETER® II Weather
Station helps you plan your
day, safeguard your family and
property by alerting you to local
conditions that often vary from distant forecasts.

Tells you to: Warn loved ones when wind chill
threatens frostbite, secure outside belongings
against sudden gusts, protect plants against
weather extremes. Over 20 weather functions:

- Wind Speed and Direction (40 ft. cable)
- Temperature (25 ft. cable)
- Chill Factor
- Alarms • Highs/ lows/times/dates • Metric/ English
- Optional self-emptying rain gauge
- 30-day money back guarantee
- One-year warranty

HOME WEATHER STATION Only \$179.00
Add a Second Keyboard/Display Unit... Only \$69.00
NEW! Add our PC DATA LOGGER Only \$69.00
Del. in US, add \$8.25 shipping & insurance. NJ res. add 6% tax.
For information or to order with VISA/MC:
TOLL-FREE 1-800-USA-PEET (872-7338)
FAX orders: 908-517-0669
Or send check, m.o. or credit card no. and exp. date to:

PEET BROS. COMPANY 601-407M Woodland Rd.,
W. Allenhurst NJ 07711
Free Brochure Our 18th Year ©1993 Peet Bros. Co.

NOVAPLEX
CATV Converters
• Panasonic \$69!
• Scientific Atlanta

Remote Controls
Universal Remotes
for TV, VCR & Cable
Lowest Prices!
All brands & models!
call for your free
color catalog &
latest price list!!

8818 Bradley Ave., Sun Valley, CA, 91352
800-644-6682

GET RID OF YOUR GUTTERS!
THEY CLOG, LEAK, FREEZE, RUST AND ROT.

Replace them with the
RAINHANDLER

STOP CLOGGING.
RainhandleR needs no cleaning, because it can't clog. Its patented louvers break up roof water into a spray of tiny drops and disperse them away from your house.

STOP CLEANING.
You'll never climb a shaky ladder again to clean a gutter. RainhandleR comes clean with a quick blast from your garden hose—from ground level.

STOP WATER DAMAGE.
RainhandleR in winter, protects your investment by helping to prevent clogs and ice dams on the roof that otherwise lead to water rot and leaks.

Hundreds of thousands of RainhandleR have been installed on homes nationwide. They can be installed on yours in about 3 hours with a screwdriver. RainhandleR is virtually invisible, rustproof, and comes in white, brown or aluminum finishes.

For more information, send the coupon to RainhandleR or call
1-800-942-3004
Some distributor territories are available.

RAINHANDLER
Dept. PM074 from SAVETIME CORP.
1285 Boston Ave., Bridgeport, CT 06610
Please send me your free information kit.
Name _____
Address _____
City _____
State _____ Zip _____
Phone () _____

Look to the Future with Your Own Cable Converter & Descrambler!



1-800-228-7404



FREE CATALOG!

ALL
MAJOR
BRANDS

**NU-TEK
ELECTRONICS**
3250 Hatch Rd. Suite 1 C
Cedar Park, TX 78613



BUILD A BIKECAR
1 SEATER - 2 SEATER - PICKUP
BIKECAR - The Amazing Mini Car You
Build With Bike Parts. Fast, Fun, Easy
To Build! Complete 1 Seater
Plans \$12.95. For 2 Seater
or Pickup Plans Add \$5.00
each or Order All 3 For Only
\$19.95. To Order Send Check or MO.
Credit Card Orders Call 1-904-854-8324.
Satisfaction Guaranteed or Money Back

Street Legal
Parts

BIKECAR
CORP.
DEPT. F
P.O. Box 72
OCALA, FL 34478

World's Finest HOMEBUILT HELICOPTER
Super-easy, low-cost construction!

- Carries one person • Store it anywhere
- Powered by Go-Kart engines • License free.

Complete G-1 Construction Plans:
Only \$24.95
(Add \$3 post. Foreign add \$5)
Your order includes a helicopter transmitter
and a receiver helicopter control
Catalog only: \$10

VORTECH, Inc.
PO Box 511 • Fallston, MD 21047

24 HOUR ORDERING!
1-410-583-6366

MAKE \$90/HOUR FREE INFO

SAVE BROKEN,
SCRATCHED OR CRACKED
WINDSHIELDS & PLATE GLASS

Our Hi-Tech Optikleer system
repairs most glass breaks in
seconds without removal at
3500% profit. Easy to learn.
Low Investment.

CALL NOW - TOLL FREE 800-695-6224
NVS/OPTIKLEER DEPT. PM
P.O. BOX 8095, LYNN, MA 01904-2838 (617) 595-6224

TELEPHONE LISTENING DEVICE

Record telephone conversations in your office or
home. Connects between any cassette or tape
recorder and your telephone line. Starts auto-
matically when phone is answered. Records both
sides of conversation. Stops recorder when
phone is hung up.

\$19.95 EACH by the box

**Super Powerful
FM TRANSMITTER**
Many times more powerful than other transmitters.
Transmits up to 1/4 mile to any FM radio. (Easy to
Assemble Kit - up to 9V battery not inc.)
For catalog of Transmitters, Voice Scrapers and
other specialty items, enclose \$2.00 to USI Corp.

Call 407-725-1000 or send \$19.95 + \$1.00
P.O. Box 1000, Ft. Worth, TX 76101
No. 1207, Melbourne, FL 32902 C.O.D.'s OK.

CABLE T.V. EQUIPMENT
Why Pay High Rental Fees?

Replacements for all models. 60 day uncondi-
tional money back guarantee. Low Prices.
Ship within 24 hours. \$5AE for free catalog.
Visa, MC, C.O.D. Let our experience work for
you.

1-800-243-3967
SKYLINE SYSTEMS INC.
114 S. Euclid Ave.
Park Ridge, IL 60068

MAKE \$1,000 A DAY!
STAY HOME AND MAKE MONEY WITH
'INSTANT MAILORDER KIT'
Simple & Easy! Free Report: Opportunity.
Dept. PM794, Box 1649, Wailuku, HI 96793

Tan At Home! Don't You Love To Be Tan!
SunQuest
WOLFF
TANNING BEDS
Buy Direct and Save Up To 30%
Call for a FREE Color Catalog
and Wholesale Pricing!
Home Delivery • **1-800-462-9197**

VISA CABLE T.V. (MasterCard)
DESCRAMBLERS
--LOWEST PRICES-- CNC Concepts Inc.
P.O. Box 34503
-Money Back Guarantee- MPLS, MN 55449
BIG SALE MON-FRI 9-5 CST
Please have MODEL used in your area when calling
DEALERS WANTED EARN EXTRA \$\$\$ 1-800-535-1843

**4 WHEEL BIKE
DRIVES LIKE A CAR!**

- Easy to Pedal • Fun
- Comfortable • Stable
- Golf Bag-Cargo Carrier
- 1, 2 & 4 Seater • Street Legal

Free Literature 24 hr. 1 (615) 822-2737 Ext. 8681

RHOADES CAR DEPT. 8681 • 125 RHOADES LANE
HENDERSONVILLE, TN 37075

**At Last a New Amazingly Simple
GAS TURBINE
JET ENGINE**

Build from easy to follow plans.
Length 18", Dia. 8 1/2", Wt. 18 lbs.
Fuel: Gasoline or Kero.
"Screaming Demon" develops 20 H.P. Ideal project for
serious-minded hobbyists, students, scientific and industrial
arts classes. Make an 8" metal cutting lathe with milling
attachment. For use on small racing boats, model cars,
etc. Full size assembly drawings with critical dimensions,
bill of materials and photos. Price \$14.00 No. C.O.D.

SAVOY SCIENTIFIC P.O. Box 1398
SANTA MONICA, CALIF. 90406

CycleTote THE ELITE TRAILER
Top Rated by Bicycling's Buyer's Guide, 4/93

- Children, Touring or Utility
- Brakes & Jogging Options

FREE BROCHURE 800/747-2407
517 N. Link Lane
Fort Collins, CO 80524

Send for free brochure! **THE DICER** Build It Yourself Backhoe

Plans to build and use in your own backyard
Self propelled • No machining • Car towable
Under \$1,000 to build • Design in use over 8 years

CAD plans
CORPORATION

P.O. Box 606 • Daleville, VA 24083 • (703)992-4758

INSTANT WORKSHOP

COVER IT
INSTANT GARAGES
ALL WEATHER SHELTERS
Assembles and Anchors Quickly & Easily
30 Day Money Back Guarantee

2 YEAR WARRANTY

FREE DOORS!

BUY FACTORY DIRECT AND SAVE!
OPEN TO THE PUBLIC

12 x 20 x 8 \$469

STARTING AT \$199 Protection for Cars, Trucks, Boats, RV's,
Motorcycles, Paint Booths, Decks, Pools,
Workshops, Gov't. and Industrial Contracts,
Sandblasting, Camp or Temporary Shelter,
Walkways, Hot Tubs, and More! **HEAVY DUTY** Steel Frame,
Durable Support Cover with Zipper Door. Sizes available from 8'
to 60' Wide, 30' High, Any Length. Withstands High Winds, Sun,
Sap & Heavy Snow. No Property
tax or permit required. Survived
Hurricane Andrew! Canadian
Weather Tested! Covers last up to
20 Years We Ship to Your Door.
Dealers and Exporters Welcome.
For Information Call Toll Free

CALL NOW 1 800 932-9344 Ext. 202
(203) 781-8000 }
FAX# (203) 781-8005

CABLE TV BLOWOUT

"The Originals"

JERROLD® TvT \$29.95

JERROLD® TnT \$50.00

SCIENTIFIC ATLANTA® M80 \$50.00
NEW IMPROVED!!!

PIONEER® PIO-3 \$50.00

MicroCom Inc.
800-665-2002

NEW!!! OMNIVISION \$195.00

Revolutionary new universal one-piece con-
verter and descrambler. Fully activates all
Jerrold, Scientific Atlanta, and Pioneer
systems except baseband.

- Picture in Picture
- Computer interface
- Dual tuners
- Volume/Mute
- Parental control
- On-screen display
- Stereo
- Last channel recall
- Favorite channel memory
- Ch 3/4 switch

Quantity Orders Only • All Other Models Available
• Call for Pricing of Smaller Quantities
Jerrold, Scientific Atlanta, Pioneer are registered trademarks
and all references are for identification purposes only.

CABLE TV CHANNELS
EQUIPMENT **GUARANTEED**

→ The nationwide source for cable TV equipment.

"BUY WHERE THE DEALERS BUY."

FREE TV Cable Descramblers and Converters Catalog. Open Every Day!

MEGA ELECTRONICS
VISA • MC C.O.D. **1-800-676-6342** SAVE 1000's

21 South Main Street, Winter Garden, FL 34787

CORVAIR
Over 10,000 new, used & performance parts in our 500 pg. illustrated catalog: **Rushed - \$4.00** (in U.S.A.)
CLARK'S CORVAIR PARTS, INC.
Rt 2, Box PS, Shelburne, Ma. 01370
(413)625-9776

Satellite-TV **FREE**
100% Satisfaction Guarantee 56 Page Catalog Buyer's Guide

Systems from \$479

- All Major Brands
- Complete Systems
- Accessories.
- Huge Savings
- Easy Installation
- Complete Instruct.

Let Us Help You Select Your New Satellite TV Entertainment System

Over 40,000 Satisfied Customers

1-800-334-6455
Int'l 218-730-8251 Fax 218-730-8879
SKYVISION INC.®
1020 FRONTIER DRIVE
FERGUS FALLS, MN 56537

YOU CAN INSTALL OR UPDATE YOURSELF!

GO ANYWHERE!

max 6 wheel drive **ATV**
Amphibious 2 and 4 passenger models

(21-years-old and over, Please)

No Money Down. As low as \$115 mo.
Call Toll-Free **1-800-255-2511**
(From anywhere in the U.S. or Canada)

Recreatives Industries, Inc.
60 Depot Street, Buffalo, NY 14206

SHOP - TASK
MILL • LATHE • DRILL

The Original Home Machine Shop
Designed in USA by Shoptask

3 versions to Choose
Best quality, best price
3 Axis Power Feed Available
12 Month Warranty
100% Parts Supply
All Tooling Available

17" Swing
11 x 18 Mill Table

1-800-343-5775 **FREE BROCHURE**

DEMAND THE BEST
SHOPTASK P.O. BOX 591, MONTESANO, WA 98563
SINCE 1981

JP VIDEO

**WHY RENT?
SAVE! SAVE!**

**CABLE TV
DESCRAMBLERS**

JERROLD • OAK • HAMLIN • ZENITH
PIONEER • SCIENTIFIC ATLANTA

READY-TO-SHIP!

**1 YEAR WARRANTY!
ABSOLUTELY LOWEST
WHOLESALE /RETAIL PRICES!**
MASTER CARD • VISA • AMEX • C.O.D.

**FREE COLOR CATALOG!
1 (800) 950-9145**

1470 OLD COUNTRY ROAD, SUITE 315-PM
PLAINVIEW, NY 11803 NO NY SALES



1994 CONVERSION VAN

To be raffled off August 21, 1994 by the Attica Fire Dept. at the culmination of our Annual Car Show.

This 3 three toned Maroon and Silver Van is equipped with TV, V.C.P., Cruise Control, Air Conditioning, Power Locks/Windows, AM/FM Cassette Stereo and Walnut trim.

Van was purchased from Colton Auto, Inc., North Tonawanda, N.Y.

Delivery of van can be arranged should you win.

Winner has option of Van or \$18,000.00 cash.

The winner of last year's 1993 Conversion Van was John Cavanaugh, Attica, N.Y.

Send \$10.00 check or money order for each book of 15 tickets - U.S. Funds only! Make your check payable to the Attica Fire Dept. and include your name, address and telephone number, and your tickets will be returned to you before the drawing.

Send to: **Attica Fire Dept.**
c/o Bill Harloff
25 Jefferson St.
Attica, N.Y. 14011

**Don't Lose Your Head
Over High Cable TV Bills!**



Owning your cable equipment saves you the high cost of monthly rental charges and gives you complete control of your TV.

We have the *Best* in

**CONVERTERS
and
DESCRAMBLERS**

Everquest • Panasonic • Jerrold • Zenith • Pioneer
Scientific Atlanta • Oak • Eagle • Hamlin • Tocom

1 800 624-1150

NCCA
Member of
National Consumer
Cable Association

MD Electronics

875 S. 72nd St. • Omaha, NE 68114



Make and Sell Your Own Ornamental Concrete Items!

Book about Aluminum Molds including over 425 designs, prices and production trade secrets from the world's largest mold manufacturer.



Book only \$10

CONCRETE MACHINERY CO., INC.
P.O. Box A99, Hickory, NC 28603

SAVE THOUSANDS IN LEGAL FEES!



David Pressman's
PATENT IT YOURSELF SOFTWARE

Developed by Nolo Press & EDS

\$229.95

Everything you need to prepare and file your own legal U.S. patent application without a lawyer.

- Full stand-alone program.
- All forms you need with step-by-step instructions.
- Fully searchable version of David Pressman's bestselling book, *Patent It Yourself*.
- Context-sensitive, online legal and program help.



To order or for more information:

800-846-9455

NOLO PRESS, 950 PARKER ST.,
BERKELEY, CA 94710



CABLE T.V. CONVERTERS

WHY PAY A HIGH MONTHLY RENTAL FEE?

All Jerrold, Oak, Hamlin, Zenith, Scientific Atlanta, Pioneer and all specialized cable equipment available for shipment within 24 hours. For fast service MC/VISA or C.O.D. telephone orders accepted. 30 Day Guarantee (Quantity Discounts) 8 A.M. to 5 P.M. C.S.T. Monday through Friday.

Send self-addressed stamped envelope (60¢ postage) for FREE CATALOG.

MIDWEST ELECTRONICS INC.

P.O. Box 5000
Suite 311 (PM)
Carpentersville,
Illinois 60110

INFORMATION/ORDERS (800) 472-1110

Note: Decoders and Descramblers must not be used without authorization by your local cable operator. No Illinois Orders Accepted

CABLE TV DESCRAMBLERS Converters & Accessories

SAVE MONEY! OWN YOUR EQUIPMENT



You now have a choice to own your cable equipment to access all premium and basic channels. We offer the lowest prices on all major brand names including Zenith, Jerrold, Scientific Atlanta, Tocom, and Pioneer. **FREE 30**

day trial period and 1 year warranty. So, if you are tired of the rising cost of Cable TV...

CALL FOR YOUR FREE CATALOG TODAY.

Add-on Cable Company

800/334-8475

GO KARTS

FUN KARTS • MINIBIKES
ALL TERRAIN KARTS
ENGINES • KITS • PARTS

88 PAGE CATALOG \$399
Order the catalog by phone on VISA or MasterCard for \$3.99 in address below. Catalog sent by 1st Class Mail.



LARGEST SELECTION
DISCOUNT PRICES

KW KART WORLD DEPT M PHONE
1488 MENTOR AVE. PAINESVILLE, OHIO 44077 (216) 357-5669

MULTI-VISION ELECTRONICS

Converters & Descramblers



*Jerrold *SA
*Tocom *Oak
*Zenith *More

1-800-835-2330

BIKES BY MAIL-CHEAP!

IN-LINE SKATES, TANDEM, KIDS' BIKES, WHEELCHAIRS, ALL PARTS & ACCESSORIES



FREE CATALOG
(619) 286-5600

CHAPARRAL CYCLING & SKATING
6350 EL CAJON BOULEVARD SAN DIEGO, CALIFORNIA 92115

Affordable, Personal **HELICOPTER** Revolution
Easy Built in One Week - 60 High
Covers Complete - Go Anywhere!

1/2 hour Action Video \$30
Info Pack & Video Combo \$40
PAL European Format Video \$43
Info Pack & PAL Video Combo \$85
Foreign Video and \$10 to USA

Call: (816) 637-2800

Info Package Catalog \$15
1/2 hour Action Video \$30
Info Pack & Video Combo \$40
PAL European Format Video \$43
Info Pack & PAL Video Combo \$85
Foreign Video and \$10 to USA

Credit Card Orders Only: 1-800-43-ROTOR

SUBSCRIBE
TO THE MAGAZINE THAT MORE THAN 10,000 READERS TURN TO FOR ARTICLES, ADS & NEWS ABOUT MILITARY JEeps, TRUCKS, TANKS & MORE!

Full listing of upcoming rallies.

MILITARY VEHICLES
MAGAZINE

USA: 1 Year (6 Issues) \$15 • 2 Years (12 Issues) \$25
Canada: 1 Year \$24 • 2 Years \$44. All Others: 1 Year \$26 • 2 Years \$46

P.O. Box 1748-48 • Union, NJ 07083

THE MARKETPLACE FOR MILITARY VEHICLES

Earn A Degree in Electronic Engineering



Fully accredited with over 150,000 world-wide graduates. Founded in 1934. Send for Free Home-Study Course Catalog. Cleveland Institute of Electronics, Dept. AZR03, 1776 East 17th St., Cleveland, OH 44114-3679

OWN A MACHINE SHOP

Do your own machining and shop work with a Smithy 3-in-1 Lathe • Mill • Drill



FIX IT YOURSELF!

Easy to use!
Save Money!
Save Time!
As low as \$1095

Smithy

For FREE Fact Kit

Call:

1-800-345-6342

(Ask for operator PM)

or write:

Smithy Dept. PM
Lathe • Mill • Drill
3023 E. 2nd Street
The Dalles, OR 97058

New TRIMMER ON WHEELS!

The DR® TRIMMER/MOWER TRIMS far easier than hand-held trimmers because the wheels carry the weight. Plus, MOWS whole lawns, waist-high grass and weeds, even rough, rocky areas that would destroy any ordinary steel-bladed mower! A delight for anyone to use! Please call or write for FREE DETAILS, including prices of Manual and Electric Starting Models and "Off-Season" Savings now in effect!



COUNTRY HOME PRODUCTS®
Dept. 37407, Ferry Road, Box 89, Charlotte, VT 05445

CABLE TV DESCRAMBLERS

Best Prices in the U.S.A.! We Will Beat Any Price!



Jerrold, Scientific Atlanta, Pioneer
Panasonic, TVT, FTB-3, SA3

Jerrold Impulse & Starcom series
Sci. Atlantas incl. 8536/+, 8580, Drop-field
FAST SHIPMENTS FREE CATALOG
30 DAY MONEY BACK GUARANTEE

1-800-772-6244 M-F: 9-6 EST
U.S. Cable TV, Inc. Dept.: KPM074
4100 N. Powerline Rd. Bldg. F-4 Pompano Beach FL 33073

BUY USED VIDEO TAPES ONLY 50¢ GUARANTEED TOP QUALITY & CONDITION



FREE!!

World's Largest Discount Catalog with 3 FREE VIDEOS Special Bonus Offer for all New Customers. \$3 shipping For 25 EXTRA VIDEOS check here, add \$10 shipping. FREE MARKETING Dept. PM74 Box 5511, Hollywood, CA 90072

WORTH WRITING FOR

847 CUB CADET SERIES 2000 TRACTORS

Full-color guide to America's only complete line of shaft drive lawn tractors. Seven models, 12.5 to 18 HP available with either six speed AutoGear™ or Auto-Hydro™ transmissions. This brochure not only details the unique Cub Cadet construction, operations and attachments, it also provides complete technical specifications. Free Brochure

848 NEW! AUTOMATIC BATTERY MANAGEMENT SYSTEM

Automatic and "hands off" operation describes Wells Marine Technology's line of automatic battery systems. These units will replace manual battery selector switches whenever more than one battery is needed. Patented sensing system puts battery in parallel whenever engine is running and automatically isolates each battery when engine is shut down. Perfect for boats, RV's, Commercial Vehicles. 40 to 400 plus AMPS. Emergency start feature included. Free Brochure

849 LITEMATE - THE ORIGINAL VEHICLE-TRAILER WIRING SYSTEM

The Litemate Advantage makes installation of vehicle-to-trailer wiring weather-tight, plug in simple and professional with no cutting of wires! All connectors are Made-in-the U.S.A. Free Brochure

850 INSTANT CONCRETE

Nomix™ PostSet Instant Post Hole Concrete takes the time and mess out of working with all-day setting concrete. This quick-setting concrete needs no mixing and no tools. Brochure explains all. Free Brochure

851 ZIPPO LIGHTER COLLECTORS GUIDE

Zippo windproof lighters enjoy a widespread and enviable reputation as valuable collectibles. The Zippo Lighter Collectors Guide is a 28-page historical reference guide to Zippo collectible lighters since 1932. It contains illustrations and descriptions of popular lighters and lighter series and explains the date code found on the bottom of every Zippo lighter. Free Booklet

852 WOOD BEAUTIFUL™

From Minwax all new for 1994—Exciting, 36-page magazine is filled with step-by-step home improvement projects, decorating ideas, and expert tips and techniques designed to help you bring the beauty of wood into your own home. Free Brochure

853 HOMEBUILT HELICOPTER CATALOG

Take off from your backyard to open-sky adventure! Exciting, unique catalog from Vortech is filled with

photos, specs, prices, and fascinating information on homebuilt helicopter and gyrocopter kits, parts, construction plans, videos, etc. The rotorcraft shown are easy to build and affordable! Complete Catalog \$10.00

854 OUTDOOR POWER

Homelite® offers product information on over 100 outdoor power products, from walk mowers to blowers, string trimmers, edgers, tillers, chain saws, pumps, generators, pressure washers and space heaters. Free Brochure

855 ELIMINATE BATHROOM MILDEW

From William Zinsser & Co., Inc., learn how your bathroom can remain mildew free for up to 5 years. Perma-White is a unique, high performance, water-based paint designed to withstand humid conditions and prevent blistering and peeling. Provides a decorative, washable and scrubbable finish in satin or semi-gloss. Free Booklet

856 GLOCK INC.

Hailed by police and sport shooters alike, find out why the remarkable Glock pistols are setting new standards for handgun simplicity, reliability, cost effectiveness and safety. Send for Glock semi-automatic, safe-action pistols and accessories catalog and also receive "The Basic Rules of Firearm Safety" booklet. Free Booklet

857 HOME GARAGE CAR STOPPING SYSTEM

The WALL EYE Block is the ultimate stopping system. WALL EYE protects you from crashing, bumping or smashing into your equipment or walls. Simply drive onto the apron and stop at the block. WALL EYE is made from 100% recycle materials. Free Brochure

858 KNIFE SHARPENER

Chef's Choice® Diamond Hone® Knife Sharpener Model 110. Professional multistage electric knife sharpener uses 100% diamond abrasive sharpening system to create incredibly sharp, long lasting triple-angle edge. Gentle resharpening helps preserve the fine cutlery. Sharpens entire blade edge. U.S. listed. 2 year warranty. Free Brochure

859 DIAGNOSE AUTO ENGINE PROBLEMS AT HOME

Get back hands-on knowledge of your car's electronic engine with high quality, affordable tools from Sunpro. The Code Scanner safely plugs into the car's computer to identify trouble codes. Sensor Tester Plus troubleshoots faulty sensors and tests ignition modules. Both have eng./Span. user manuals. Free Brochure

860 KEEP YOUR HOME ENERGY EFFICIENT

If you're thinking about remodeling or adding a room

in your home, a free brochure called "Need More Space" offers tips on insulating and helping to keep your new living space energy efficient. From Certain-teed Corporation. Free Brochure

861 STARTING YOUR ENGINE

Slick 50 Engine Formula, from Slick 50 Product Corporation, protects car and light truck engines against wear at start-up. A single application treats metal surfaces of moving engine parts directly with super-slippery PTFE. Independent lab tests have shown that Slick 50 reduces engine wear by up to 50 percent for 50,000 miles. Free Brochure

862 THE COMPLETE GUIDE TO ROOF WINDOWS AND SKYLIGHTS

Full-color guide features complete line of VELUX Roof Windows, Skylights, Flashing Systems, Sunscreening Accessories and Controls. Includes design ideas for creating light-filled, spacious interiors for both new home and remodeling projects. Also showcases new products including the new "CABRIO" Balcony Roof Window and Electric Pleated Shade. Free Brochure

863 INFORMATION FOR THE DIVORCED

DIVORCE: Attorney and local group referrals, literature on finances, law citations, top writers, common sense on all gender issues. Membership information and sample newsletter from national organization. \$3.00

864 SCIENCE RESOURCE CATALOG

Edmund Scientific's 128 page catalog contains over 5,000 products for the budding scientist, student and educator - featuring microscopes, telescopes, weather instruments, fiber optics, solar equipment, magnifiers, high-tech science toys, plus many items designed for science fair projects. Free Catalog

865 DO-IT-YOURSELF KITS

Choose from a large selection of grandfather, wall and mantel clocks, as well as elegantly styled accent furniture pieces. Kits are made of solid 3/4" hardwood, primarily cherry, oak, and black walnut. Buy direct from the factory and save. Send for color catalog. Emperor Clock Company. \$1.00

866 FREE STUFF FROM UNCLE SAM

Get your copy of this valuable book. Every year our government hands out billions of dollars worth of free stuff, loans, subsidies, scholarships, grants, etc. This 64 page book tells you exactly where to write or call to get your share. It also tells you where to buy government surplus items (such as cars, boats, cameras, etc.) for "peanuts." \$3.00

Popular Mechanics 7/94
Box 1718, Sandusky, Ohio 44871-1718

Please see that I receive the items checked below

- | | | | | |
|------------------------------|--------------------------------------|------------------------------|------------------------------|-------------------------------------|
| <input type="checkbox"/> 847 | <input type="checkbox"/> 851 | <input type="checkbox"/> 855 | <input type="checkbox"/> 859 | <input type="checkbox"/> 863 \$3.00 |
| <input type="checkbox"/> 848 | <input type="checkbox"/> 852 | <input type="checkbox"/> 856 | <input type="checkbox"/> 860 | <input type="checkbox"/> 864 |
| <input type="checkbox"/> 849 | <input type="checkbox"/> 853 \$10.00 | <input type="checkbox"/> 857 | <input type="checkbox"/> 861 | <input type="checkbox"/> 865 \$1.00 |
| <input type="checkbox"/> 850 | <input type="checkbox"/> 854 | <input type="checkbox"/> 858 | <input type="checkbox"/> 862 | <input type="checkbox"/> 866 \$3.00 |

Total money for priced items \$ _____

Service Charge \$ _____ 1.50

Total money enclosed \$ _____

Total items requested _____

Name (Please Print) _____

Address _____

Town _____ State _____ Zip Code _____

(Please send check or money order made out to POPULAR MECHANICS. No stamps, please)

Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

CLASSIFIED ADVERTISEMENTS

Dorothy Nolan, Classified Manager

Rates: \$11.65 per word. 10 word minimum.

Bold Face Type—\$1.00 extra per word. (First word automatically set in Bold Face Type). **Gray Background**—Additional \$54.00 per advertisement. **Centered Headlines** (5 words or less)—\$60.00 per line. Our **SEPTEMBER** issue closes on **JULY 5TH**. (On sale date is **AUGUST 15TH**). All advertising is payable in advance by check, money order or credit card. Advertisers wishing to charge their MasterCard, American Express or Visa accounts, please be sure to include number and expiration date. Send order and remittance payable to: Popular Mechanics, Classified Advertising, 224 West 57th Street, New York, NY 10019. Be sure to indicate classification under which advertisement is to appear.

Advertisers using a P.O. Box number must furnish complete name and street address for our records. To avoid delay in the publication of your advertisement, please send samples and descriptive materials with your request if your advertisement does not state clearly what is being offered. For additional advertising information call 1-212-649-3167 or FAX: 1-212-977-5415/1-212-586-5562.

**WE HAVE OVER 150 CLASSIFICATIONS.
YOU CAN CALL/FAX/WRITE US FOR OUR ORDERFORM OR MEDIA KIT.**

PUBLISHER'S MART BOOKS & PUBLICATIONS

HOW TO Make MONEY SELLING your CAR! MANUAL
\$10.00. Najim Publications, RR1, Box 101-PM1, Jay, New York 12941

OUTLAWS sourcebook of forbidden devices / knowledge.
Write: #365-X7, Penfield, NY 14526-0365

BUILD SAFE, EFFECTIVE LOW COST INSECT TRAPS
complete instructions, booklet \$6.00. Dacom, 16715-12 Yonge St. #313 Newmarket, Ont. L3X 1X4

INFINITE Computer Memory Possible. (No Joke) \$15.00
For Details. Tau Ceti Publishing, 167 Milk St., Box #413, Boston, MA 02109-4315

"ANARCHIST COOKBOOK" Available again! \$25, delivered. Barricade Books, Box 1401-X, Secaucus, NJ 07096

"SHARPENERS REPORT" Monthly Newsletter. Valuable
Tips—Sources—Buy/Sell Used Equipment. Free Brochure. Skog Company, Dept. PM7, P.O. Box 22187, Minneapolis, MN 55422

SUPER-NINT/GENESIS . . . "Oriental Secrets" - Yes, game recording machines exist! Incredibly, anyone worldwide can acquire them. Many gamers in Asia spend under \$1.00 for any game! Highly informative reading. \$15.00. Del World Publications, 2390 Crenshaw Blvd., Dept. 707-7PM, Torrance, CA 90501. Just released in paperback! 130 pages of unprecedented money-saving information.

FRIGHTENING, Describes Our Computer Investigation Service & Underground Manuals. Free Catalog. INFO1., 680 Grapevine Hwy., Hurst, TX 76054

FREE BOOKLETS: Life, Death, Soul, Resurrection, Pollution Crisis, Hell, Judgment Day, Restitution. Bible Standard(PM), P.O. Box 67, Chester Springs, PA 19425.

VCR Maintenance & Repair Tips From A Professional VCR Technician! 1 Hour Videotape \$19.95. Insight Tapes, 205 East Cherry Street, McLeansboro, IL 62859.

"LAYMEN'S GUIDE TO BUYING A PERSONAL COMPUTER". Written in English, not Technobabble. \$8.95. TKAC, 1936 N. Harding Avenue, Altadena, CA 91001

COMPLETE Telephone Installation/Repair Manual. \$14.95. Brian Siadak, P.O. Box 3238, Fairfield, CA 94533

NEW LOTTERY STRATEGY REVEALED! Systematically improve odds. Technical report, \$10.00. Software available. Point Source Technologies, Box 91, Portage, MI 49081-0091.

NOW, You Can Chrome Plate, Melt Metal, Design Molds. Info, \$5.00. 22034 Saskatoon, Sask, S7H 5P1 Canada

SELF DISINTEGRATING CHECKS. Book reveals all! \$6.95 FYI: Paperhanger, P.O. Box 15232, Colorado Springs, CO 80935

BUILD SAFE, EFFECTIVE, LOW COST INSECT TRAPS
complete instructions, booklet \$6.00. DACOM, 16715-12 Yonge St. #313, NewMarket, Ont. L3X 1X4

SPORTS LOVERS - Revolutionary Neutral Network Techniques For Sports Betting—Horses, Football, Basketball, Etc. Call (212) 439-5103.

THIS IS A SCREENED AD!

LET Your Advertisement Achieve The Same Effect! For An Additional \$54.00 Per Advertisement You Can Order Our Screening Process. Same Price Applies To All Advertisements No Matter What Size, Small Or Large. For More Information Call **POPULAR MECHANICS CLASSIFIED**—1-212-649-3167. FAX: (212) 977-5415/(212) 586-5562

CATALOGS

EASY LEARNING VIDEOS! Golt, auto repair, computers, crafts, business, sports, fitness, much more! Write: **FREE CATALOG**, 595 Piedmont, Suite 736, Atlanta, GA 30308.

ATTENTION WOODWORKERS! Cherry Tree Toys has extended their parts and products lines while maintaining all skill levels. 68 page full color catalog \$1.00. Cherry Tree Toys, Box 369-310, Belmont, OH 43718.

AUTOMOBILES

MAKE BIGGER BUCKS, selling or trading your auto. Simple, Professional. \$10. Auto, P.O. Box 780056, Wichita, KS 67278

\$225 DAILY "CHROME PLATING" Auto Parts, Motorcycles, inexpensive, easy. (Free) information. Chrome Finish, Box 2285, Waldorf, Maryland 20604

GOVERNMENT SEIZED Vehicles from \$100. Fords, Mercedes, Corvettes, Chevys. Surplus. Buyers Guide. (1) 805-962-8000 Ext. 5-20024.

VAPOR CARBURETOR TRIPLES MPG. Free information. H&A, R2E35P Bowling Green, MO 63334-9350

INTERESTED

IN CLASSIFIED ADVERTISING?

READ POPULAR MECHANICS Latest Edition of "TIPS ON HOW TO MAKE MONEY THROUGH CLASSIFIED ADVERTISING". This Informative 24-Page Booklet Will Show You The Do's And Don'ts of Classified Advertising And How You Can Make It Work For You. So Order Today. Only \$1.00 Plus You'll Receive A \$2.00 Coupon Refundable With Your First Order. Send To: **POPULAR MECHANICS CLASSIFIED**, Dept. SG, 250 W. 55th Street, New York, NY 10019

DRUG RAID SEIZURES: Buy Dirt Cheap! Cars, Trucks, Boats, Computers, Seizures, Box 51468-AT, Ontario, CA 91761

CIGARETTE LIGHTER/KILL SWITCH! Car, Truck, RV, Boat, Motorcycle. Send \$6.00 SASE For Information. J. Costello, 355 South Franklin St., Holbrook, Mass. 02343

VEHICLES Under \$200! Cars Auctioned by IRS, DEA, FBI Nationwide. Trucks, Boats, Motorhomes, Computers, And More! Call Toll Free! 1 (800) 436-6867 Ext. A-1922

FREE Electroplating Catalog. Books, Kits, Chemicals. University Pubns, Box 1071, Provo, UT 84603

WANTED Jeep Wagoneer, Cherokee, Ford Bronco II, With Diesel Engine. Excellent Condition. 209-299-2216.

FANTASTIC GAS MILEAGE! It's Easy! - Free Details - Provost #EM4, 245 Jericho, New Hyde Park, NY 11040

CAR ALARM UNDER \$20.00 Plans \$3.95. Idea-Place, 26861 Trabuco Road, #E75 Mission Viejo, CA 92691

TIRED of peeling bumper stickers? Express yourself without diminishing your car's appearance. **STICKER STRUTTERS BUMPER STICKER HOLDER** Durable, transparent, 12" long, clips to straight edge up to 3/8" thick. Can be easily moved or sticker changed. \$9.95. CoonVentions, P.O. Box 2126, Alachua, Florida 32615-2126

CORVETTES At Carlisle August 26-28. Carlisle, PA Fairgrounds All-Corvette Fleamarket, Car Corral And Two Showfields. Downtown Parade, Special Display Corvettes. New: Bob Gold Auction PH: 215-869-2006 For Auction Details. Win A 1961 Corvette Sunday At 4:00 PM. Space Available PH: 717-243-7855.

ULTRA-SHIELD CAR POLISH with Teflon and Polymers. Quart \$18.95. Fichter, Enterprise, 310 Brice, Hudson, IA 50643

CAR ALARM. Under \$20.00 - E-Z How to Build Manual. **GUARANTEED**, \$9.95. A.R. Alarm Systems, 1785-F Queen Street East, Box 104, Brampton, Ontario, Canada L6T 4S3

SHORTWAVE radio in your car! Complete guide \$7. JS Associates, Inc., Dept. C, Box 50264, St. Louis, MO 63105.

CORVETTES At Carlisle Announces The Addition Of Bob Gold Auction August 26 & 27 Carlisle, PA Fairgrounds For Full Details Call: 215-869-2006.

ELECTRIC VEHICLES

ELECTRIC VEHICLE PLANS AND PARTS CATALOG: Use electric power for your bicycle, go-cart or car. Send \$6.95. Universal Products Company, P.O. Box 2704-175M, Huntington Beach, CA 92647

FREE INFORMATION! 1-800-KAYLOR-K. COMPONENTS, PUBLICATIONS, INSTRUCTIONS, VIDEOS. KAYLORKIT. POB1550PM, BOULDER CREEK, CALIFORNIA 95006-1550

AUTO SUPPLIES & EQUIPMENT

REBUILD YOUR ENGINE This Video with Master Mechanic Greg Colletti Guides You Step By Step. \$29.95. & \$3.50 S/H To: Rush Young, 251 South Olds Blvd., Ste 241, Fairless Hills, PA 19030.

ALTERNATOR Generator Rebuilding Book. Details: HV Technologies, 7505 Barkentine, Las Vegas, NV 89128

12 VOLT PORTABLE AIR SUPPLY. Great For Light Duty Air Tools Away From Home. Detailed Plans \$2.00. Honest Effort, P.O. Box 3368, Ann Arbor, Mich. 48106

DUMP KITS AND COMPONENTS. Convert Your Pickup/Flatbed Into A Dump Truck. No Welding Required. Reds Equipment, P.O. Box 555, Henrietta, Texas 76365, (817) 538-5601

GO-KARTS, MOTORCYCLES, & MOTORSCOOTERS

GO-KARTS All you'll need to know. 200 pages, \$10. KMI, Box 101, Wheaton, IL 60189

GO KARTS, Minibikes & ATV's. Assembled, Kits, Parts, Engines. Discount Prices. Large Selection. 88 Page Catalog \$3.00. 216-357-5569. Kart World, Dept. C., 1488 Mentor Ave., Painesville, Ohio 44077

CONVERTING BUSES TO MOTOR HOMES

FREE INFORMATION - Bill Lowman, 306M Riverbay, Tampa, FL 33619. 813-621-5296.

FOR INVENTORS

(Continued from preceding page)

PATENT AND DEVELOP Your Invention. Registered Patent Agent and Licensed Professional Engineer. Send for **FREE PATENT INFORMATION** Every Inventor Should Have. Richard L. Miller, 12 Parkside Drive, Suite-M, Dix Hills, NY 11746-4879. (516) 499-4343

INVENTORS! Can you patent and profit from your idea? Call **AMERICAN INVENTORS CORP.** for free information. Serving inventors since 1975. 1-800-338-5656.

INVENTORS. How To Invent; Protect; Sell! Free Report. Randolph, Box 92972, Lakeland, FL 33804

INVENTIONS, ideas, new products. We submit to industry. Call 1-800-288-IDEA.

REGISTERED PATENT ATTORNEY. D.A. Kettlestrings. Free Information. 1-800-966-7577.

INVENTORS-NEVER SEND IDEAS TO STRANGERS! AVOID RIPOFFS - SAVE THOUSANDS! REVOLUTIONARY PROTECTION MARKETING METHOD! NONPROFIT ORGANIZATION. FREE INFORMATION 24 HOURS: 1-800-846-3228.

BORSARI & ASSOCIATES provides **PROFESIONAL** patent searches & applications. Registered patent attorney guarantees **CONFIDENTIALITY** and **SUPERIOR SERVICE.** Located next to Patent Office. Call 800-225-2462 for free information packet.

INVENT SOMETHING? ESI Inc. links unconnected individuals with decision-makers. Free brochure supplied. 1-800-547-7885.

PATENTS INCORPORATED: SEARCHES, PATENTS, DEVELOPS AND LICENSES INVENTIONS FOR A PERCENTAGE. 800/261-7497.

ACCUSEARCH Specializes in Thorough, Prompt, inexpensive Patent Searches. 1-800-999-5498.

INVENTORS: Utilize The Logical Process™ to PROTECTION And Potential PROFITS. FREE ADVICE, Your First Step is Important. We Have a Database Of 7+ Million Companies To CREATE OPPORTUNITIES FOR OUR CLIENTS. APSI, Washington, DC 800-458-0352

PATENT SEARCHES \$195
UTILITY PATENT \$1750

INFOTECH Design and Patent Professionals. Call for information (800) 301-6036.

DO YOUR OWN Patent Search. Free Info. Karmin, 21 Parsons, Hempstead, NY 11550-4712

PATENT IT YOURSELF see our ad page 112

FREE help for inventors! No charge for protection forms and information kit. Affiliated Inventors Foundation. 1-800-525-5885.

INVENTORS: If you have an invention for sale or license, write for free booklet explaining how we can help you. Kessler Sales Corp., C-5-FI-4, Fremont, Ohio 43420.

REGISTERED PATENT AGENT David Thompson. **FREE** patent/cost information: 1-800-410-3943.

FREE INVENTION PACKAGE Davison & Associates offers Customized Development, Patenting, and Licensing. Proven Results: 1-800-677-6382.

INVENTORS Don't be Fooled - Call Our Inventors Club 1-800-466-1793.

CHRISTIAN based inventors Co. Patent Drawings, Patent applications as well as Sales. Throgmorton Crest 1-501-892 7781 fax/phone

INVENTIONS WANTED

HONGKONG factory needs several new products for their overseas buyers. Send product ideas for royalty evaluation. Can produce exclusively. Hongkong Plastic Metal Products Company, Box 69627, Kwun Tong, Hongkong.

INVENTIONS DEVELOPED & MARKETED. Licensed Professional Patent Engineer. U.S. Patent Office Former Examiner. Manufacturers Representative. Patmart, Suite 702PM, Woolworth Bldg., New York, NY 10279.

FREE Information Packet! Professional Patenting and Marketing Services. New product ideas with prototype or Schematics Preferred. But Not Required. Concept Network: (800) 835-2246 Extension 197.

QUEENSBURY Gifts Seeks Unique Products Ready For Distribution 412-922-8997.

REAL ESTATE

COUNTRY REAL ESTATE CATALOG—United National's **NEW** catalog features over 200 pages of the best country real estate bargains across America! Wilderness lands & retreats, farms, ranches, historic homes, waterfront properties & more. Send \$4.95 to: **UNITED NATIONAL REAL ESTATE**, 4700-PM Bellevue, Kansas City, MO 64112. Or call 1-800-999-1020, Visa/MC accepted.

GOVERNMENT HOMES from \$1 (U repair). Delinquent tax property. Repossessions. Your area (1) 805-962-8000 Ext. GH-20024 for current repo list.

CALIFORNIA Land. \$50 Down. \$50 Monthly. PM, Box 35291, Los Angeles, 90035

BUY IT WHOLESALE

BELTS, Buckles, Hat Tacs, Jewelry, More. Complete line fast sellers. Big Profits. Complete dealer set up. Color catalog \$1.00. Anchor, Box 3958-PMR, North Providence, RI 02911

FACTORY Wholesale Sources. Low Prices. 10,000 Products. Write: **MOSA**, P.O. Box 42787, Cincinnati, OH 45242

CLOSEOUTS, Wholesale. Buy cheap. **FREE** Report! CNP, 1344 Madonna #286-PM7, San Luis Obispo, CA 93405-6504

PRINTING PRESSES, RUBBER STAMP OUTFITS

RUBBER Stamp Makers. Letterpress Printers Supply Catalog. \$2.00 Deductible. Acme/Star, 2221 North Lister, Chicago 60614

TYPE for printing and stamps. Catalog \$2.00 deductible. Quaker City Type, R.D. 3, Box 134, Honeybrook, PA 19344

FOIL Imprinting/Letterpress/Rubber Stamp Catalogs. Specify \$2.00 Refundable. Barco, Box 1011P, Bensonville, 60106

CLOCKS, WATCHES, OLD GOLD, JEWELRY

IMMEDIATE CASH For Old Gold! Free Mailing Kit. Details 1-800-351-5222.

REPLICA Swiss Watches 18KT Goldplated! Lowest Prices! 2Y Warranty! (404) 682-0609.

TREASURE FINDERS

BURIED TREASURE - Sensitive equipment allows locating from distance. Brochure free. Simmons, Box 10057-MA, Wilmington, NC 28405

BUSINESS OPPORTUNITIES

IMPORT-EXPORT opportunity, profitable world-wide, mail order business from home, without capital. We ship plan for no risk examination. Experience unnecessary. Free Report. Mellinger, Dept. C2709, Woodland Hills, California 91367

PORTABLE 24K GOLD PLATING SYSTEM Make \$70,000+ Your First Year. Low Cost. Auto - Marine - Home. **FREE** Information. Mr. Francis 1-800-536-9936

READY To Change Your Earning Power? Discover "Profit Centers" A Low Start-Up High Profit Home Based Business. For Details Write To: The Holland Group, P.O. Box 220743, Newhall, Calif. 91322-0743

\$500.00 FROM ONE SACK CEMENT! Picture Proof \$1.00! **BRINCO**, Box 401092-K, Hesperia, CA 92340

HOW ordinary people (like you) make money and have fun publishing. Little-known, lucrative publishing opportunities revealed. Free details. Wild Ideas, PM794, Box 458, Greenwood, SC 29646

THIS IS A SCREENED AD!

LET Your Advertisement Achieve The Same Effect! For An Additional \$54.00 Per Advertisement You Can Order Our Screening Process. Same Price Applies To All Advertisements No Matter What Size, Small Or Large. For More Information Call **POPULAR MECHANICS CLASSIFIED**—1-212-649-3167. FAX: (212) 977-5415/(212) 586-5362

\$225 DAILY "CHROME PLATING" Auto Parts. Motorcycles, inexpensive, easy. (Free) Information: Chrome Plating, Box 2285, Waldorf, Maryland 20604

LET The Government Finance your small business. Grants/loans to \$500,000.00. Free recorded message: 707-449-8600. (K23)

NEON, COURSE WITH FREE VIDEO! NEONICS, BOX 5039, FALMOUTH, VIRGINIA, 22403-0639

\$100,000.00 POTENTIAL BRONZING BABY SHOES AT HOME FREE BROCHURE 1-813-655-0346

AMAZING HOME BUSINESS Easy To Start. Supplement Your Income. No Experience Necessary Make Profitable mail order Reports Free Details. Box 3192, Gresham, OR 97030

PLASTERCRAFT . . . Profitable Home Business 3000 Molds Available. Details. Lynnette, 6251C Mentpark, Mentor, Ohio 44060

\$40,000 ON 1/3 ACRE! New Hydroponics - inexpensive, pleasant, practical! Free information. Robin's, Box 681804, Franklin, TN 37068-1804

\$300.00 PER DAY for **MAILING LETTERS!** Details \$1.00 (dollar bill). Money-makers/B, Box 32368, Palm Beach Gardens, FL 33420

WHOLESALE BARGAINS. Freebies. Giveaways by mail. Write: Wholesale, Box 51488-A, Ontario, CA 91761.

MAKE YOUR DREAM COME TRUE, EARN \$75,000 YEARLY REPAIRING CRACKS IN WINDSHIELDS AND PLATE GLASS, NOT REPLACING THEM. CALL 1-800-826-8523 (US-CANADA): THE GLASS MECHANIX, 4555 N.W. 103RD AVENUE, FT. LAUDERDALE, FL 33351

MAKE homemade "How-to/opportunity" booklets. Mine have earned \$436,097. Money never stops. Free information. Booklets, 507J Oak Drive, Friendswood, TX 77546

HYDRAULIC JACK REPAIR MANUAL, CATALOG \$10.00. HYDRAULIC PARTS SUPPLY, BOX 4157, BROWNSVILLE, TEXAS 78520-4157

LEARN Sewing Machine Repairing. Men. Women. Lucrative Profits. Gresslin Correspondence School, Box 905, Alexandria, Ohio 43001.

NEW! GROW EXPENSIVE PLANTS. SELL FOR 2,000% PROFIT. Free information. Growbiz, Box 306-M7, Seminary, MS 39479

MAILORDER Books. 1,000% Profit. Selectco, Box 1140, Clearwater, FL 34617

\$1,000'S POSSIBLE, FREE. Stamped envelope: Progress, Box 93248-PM, Los Angeles, CA 90093.

NEW! 2000% PROFITS - in Moldmaking/Casting. Free information. Castcrafter, Box 16586(M7), Memphis, TN 38186-0586

RECYCLE METALS. NO, NOT BEER CANS! Easy \$458 weekly! Free information. Recycler, Box 681804, Franklin, TN 37068-1804.

\$2,000 DAILY From Your Telephone Answering Machine! I've made over \$1,000,000 using mine! (303) 674-2219. Recorded Details.

RECYCLE! (AMAZING PROFITS MADE) Reconditioning Automobile Batteries! (Free) Information! Battery Outlet, Box 3300PM, Hickory, NC 28603-3300.

\$1804 MONTHLY Buy/sell used cars (spare-time) **FREE** Details. Autonet, 507 Oak Drive, Friendswood, TX 77546

VINYL'S where the money is! Professionally repair, recolor furniture. Quick, easy. Two \$20 jobs a day earns you \$1,000 a month. Homes, cars, offices, restaurants. Start earning in a few days. Details free. VIP, 2007 Montrose, Chicago 60618.

DISTRIBUTE Unique Electronic Product. Manufacturer, Box 28307, Kenneth City, FL 33709

\$1,000 WEEKLY AIR TOOL REPAIRING. Free Details, Box 534, Wichita Falls, TX 76307

BIG PROFITS! REPAIRING WINDSHIELDS and plate glass. \$70,000 yearly. Call 1-800-441-4527 for **FREE** details. Glass Technology, Inc., Dept 7P, 434 Turner Dr., Durango, CO 81301

PIANO Tuning quickly learned with home study courses. Diploma granted. American Tuning School, 17050 Telfer Drive, Morgan Hill, Calif. 95037.

START A-Million Dollar mail order business. We drop-ship 2965 best selling products. Lowest below wholesale prices. Immediate delivery. Spectacular home business opportunity. Free Book. SMC, 9401 De Soto Avenue, Dept. 20-67, Chatsworth, CA 91311-4991. (800) 345-4SMC

BIG MONEY REPAIRING AUTO WINDSHIELDS. Supplies and information. Grubbs Glass Patch, P.O. Box 243, Monticello, AR 71655. 1-800-243-2213

GET RICH! Secret law smashes debts—brings Cash, Credit!! Details \$1.00 (dollar bill). Wealthkit/B, Box 32398, PBG, FL 33420

#1 MONEY Maker Spare Time! No selling! No inventory! Publicly documented seven week \$19,919 income! Free audio cassette and Report reveal everything. Real Money, 333-PM9 SW 5th Street, Grants Pass, OR 97526

(Continued on next page)

FINANCIAL

GET FREE CASH! Private grants. Foundation giveaways. Loans. Millions available. Sources, Box 5529-A, Diamond Bar, CA 91765

NEW Valid Credit File Guar. Free Info: Call 213-368-8114.

BAD Credit? Money Problems? Get It Fixed Now! Details. Smartcon-PM7, 6036 West Lawrence, Chicago, Illinois 60630

SECOND CREDIT CHANCE! Legally create **NEW** credit files. Secrets revealed. \$10. G.O.A.L., P.O. Box 325, Dedham, MA 02027

DEBT CONSOLIDATION

REDUCE interest. Cut payments 30-50%. Stop Collections. Avoid Bankruptcy. Licensed/Bonded. (Non-profit) MCCS 1-800/590-7474.

GET A Brand New Credit File. Not Repair. Recorded Message 1-507-288-0719 Ext. 4.

HEARING AIDS

HEARING AIDS - GUARANTEED LOWEST PRICES! No huge commissions. Home trial, terms. All makes. We're the oldest, biggest, best. Custom instrument specialists. Free information, 1-800-323-1212. Lloyds-PMC.

FREE Hearing Aid Catalog. All Models. Huge savings! No salesman will call. Rhodes, Dept. 31G, Brookport, IL 62910. 1-800-468-3100.

CONTACT LENSES

WHOLESALE Contact Lenses. All Brands. Example: Disposables-\$17.00. Bausch & Lomb Softlens-\$11.00. 1-800-521-3511.

TOBACCO

CIGARS, Tobacco, Pipes, Chew. Free Catalog. Erie Tobacco Co., 1828 Euclid, Cleveland, Ohio 44115

SAVE THOUSANDS. Grow Your Own **TOBACCO** Year Around. Instructions And Pelleted Seeds. \$19.95 U.S. Postpaid. Parkside Growers, P.O. Box 18799P, Spokane, WA 99208

SCIENCE & CHEMISTRY

"EXPERIMENTER" LABORATORY CHEMICALS GLASSWARE, Catalogue \$2.00. Established 1953. **HAGENOW LABORATORIES,** 1302 Washington, **MANITOWOC, WISCONSIN 54220**

SPECIAL SERVICES

INFORMATION. On anything. Ferguson Research Specialists, 60-15 Woodside, Woodside, New York 11377.

ANY QUESTION ANSWERED - \$30. Brown, 11726 S.W. 92 Terrace, Miami, Florida 33186

HEALTH, NUTRITION, VITAMINS

PREVENT Cure Colds Naturally \$10. "E.Z." Publishing, Box 2132, Imperial Beach, CA 91932

DRINKING WATER PURIFIERS

WANT Healthy Drinking Water With All Impurities Removed; Call For Free Facts. 1-313-281-6660.

RECIPES, COOKING, ETC.

DELICIOUS Sourdough Bread Recipes \$5.00. Ronan, Box 961, Jasper, GA 30143

30 DELICIOUS Easy Dishes From Grandmother's time for \$10.00. GGR, POB 925, Tucker, GA 30085-0925

SALSA, Six Recipes with **HOT PEPPER** Guide. \$5.00/LSASE; R. Davis, 2828 University Ave. #103268, San Diego, CA 92104

CAJUN Crawfish Etouffee' Recipe. SASE \$2.00. MEO, POB 32551, Lafayette, Louisiana 70593-2551

GREAT Southern Recipes! \$5.00/SASE. H.M.E., Box 633452, Nacogdoches, TX 75963

ORIGINAL Chocolate Drop and Scrumptious Pan Cookie Recipes From A Chocolate Lover's Kitchen To You! Send \$3.00 To: Melworks Inc., MC-A, P.O. Box 667, Pearl City, HI 96782

FANTASTIC GAME RECIPES! Plus easy Homemade Carmel. \$4/SASE- Nowell's, Box 880351, San Diego CA 92168.

SUMMER Cake Recipes. \$3.00/SASE. B. Carlson, 03216C60, Edgerton, OH 43517.

LOWFAT Delicious 5 Chicken Recipes. \$4/SASE: Healthy Russian Kitchen, P.O. Box 7256, Hampton, VA 23666-0256

HAWAIIAN PANIOLO CHILE. Spicy Island Favorite \$3.00. Box 5253, Kaneohe, Hawaii 96744

GRANDMA HARVEY'S Famous Osgood Pie, Blackberry Cobbler & Baked Candied Apples. Send \$3.00. Glenda Kaye Harvey, PO Box 145, Guffey, Colorado 80820.

WINEMAKING, BEERMAKING, ETC.

FREE CATALOG Brew quality beer yourself. Call Wind-River Brewing 1-800-266-HOPS.

BEGINNERS SPECIAL. Free Catalog and **GREAT PRICES.** Call **U-BREW** 1-800-845-4441, North Myrtle Beach, SC 29582.

WINEMAKERS - Beermakers: Free Illustrated Catalog Of Supplies. Semplex, Box 11476P, Minneapolis, Minnesota 55411

FREE BEERMAKING BOOK-Catalog. Finest Equipment, Ingredients. Fast Service! 1-800-852-9545.

WINEMAKERS - BEERMAKERS Free illustrated Catalog - Fast Service, Large Selection - VISA/Mastercard - (816) 254-0242 - Kraus, Box 7850-L, Independence, Missouri 64054

THE TROLLEY-AMERICA'S BEER CLUB America's Best Microbeers Delivered To Your Home. 1-800-638-2337.

FREE Catalog. Sebastian Brewers, 7710 91 Avenue, Vero Beach, Florida 32967. 1-800-780-SUDS.

FREE. Homebrewer's catalog. Brewery, 1300 Quincey, Minneapolis, MN 55413. 800-347-4042.

BURGLAR ALARMS & HOME PROTECTION

DETER BURGLARS with authentic **ELECTRONIC SECURITY WINDOW DECALS** for home/auto, 4/\$4.95 postpaid. Protek, Box 30277, Phoenix, AZ 85046.

ALARM/LOCK: PROTECT YOUR FAMILY. Secure doors and windows. Sample kit: Alarm, hardware, battery pack, warranty, instructions, full color info. and price list, \$23.95. S.R.U., Box 3713, Santa Rosa, CA 95402

Popular Mechanics

224 West 57th Street, New York, N.Y. 10019
Classified Advertising Dept. (212) 649-3167

DEADLINE FOR ADS: Copy and payment must be received by the 5th day of the 2nd preceding month for the issue in which the ad is to appear. See Head of Classified Section.

HOW TO COUNT WORDS: Name and address must be included in counting the number of words in your ad. Each initial or number used counts as 1 word: J.J. Smith, 224 West 57th Street, New York, New York 10019: 9 WORDS. Zip codes are not counted. Phone #: 2 WORDS. Symbols used as keys are charged for. City or state count as 1 word each: New Brunswick, New Jersey: 2 WORDS. Abbreviations such as C.O.D., F.O.B., R.P.M., U.S.A., P.O., 5x7, 16mm are counted as 1 word. (P.O. Box 392 counted as 3 words) Webster's International Unabridged Dictionary will be used as our authority for spelling, compound words, hyphenations, abbreviations, etc. Send remittance payable and order to Popular Mechanics, Classified Department, 224 West 57th Street, New York, New York 10019. Please indicate Heading under which ad is to appear.

Remittance of \$ _____ is enclosed to cover _____ insertion(s) in the _____ issue(s). Classification _____

NO CHARGE FOR CAPS	2	3	4	5	6	7
8	9	10-\$116.50	11-\$128.15	12-\$139.80	13-\$151.45	14-\$163.10
15-\$174.75	16-\$186.40	17-\$198.05	18-\$209.70	19-\$221.35	20-\$233.00	21-\$244.65
22-\$256.30	23-\$267.95	24-\$279.60	25-\$291.25	26-\$302.90	27-\$314.55	28-\$326.20
29-\$337.85	30-\$349.50	31-\$361.15	32-\$372.80	33-\$384.45	34-\$396.10	35-\$407.75
36-\$419.40	37-\$431.05	38-\$442.70	39-\$454.35	40-\$466.00	41-\$477.65	42-\$489.30
43-\$500.95	44-\$512.60	45-\$524.25	46-\$535.90	47-\$547.55	48-\$559.20	49-\$570.85

YOUR NAME _____ (PLEASE PRINT) PHONE: _____

FIRM (NAME IN AD) _____

YOUR ADDRESS _____

CITY _____ STATE _____ ZIP _____

DATE: _____ YOUR SIGNATURE _____

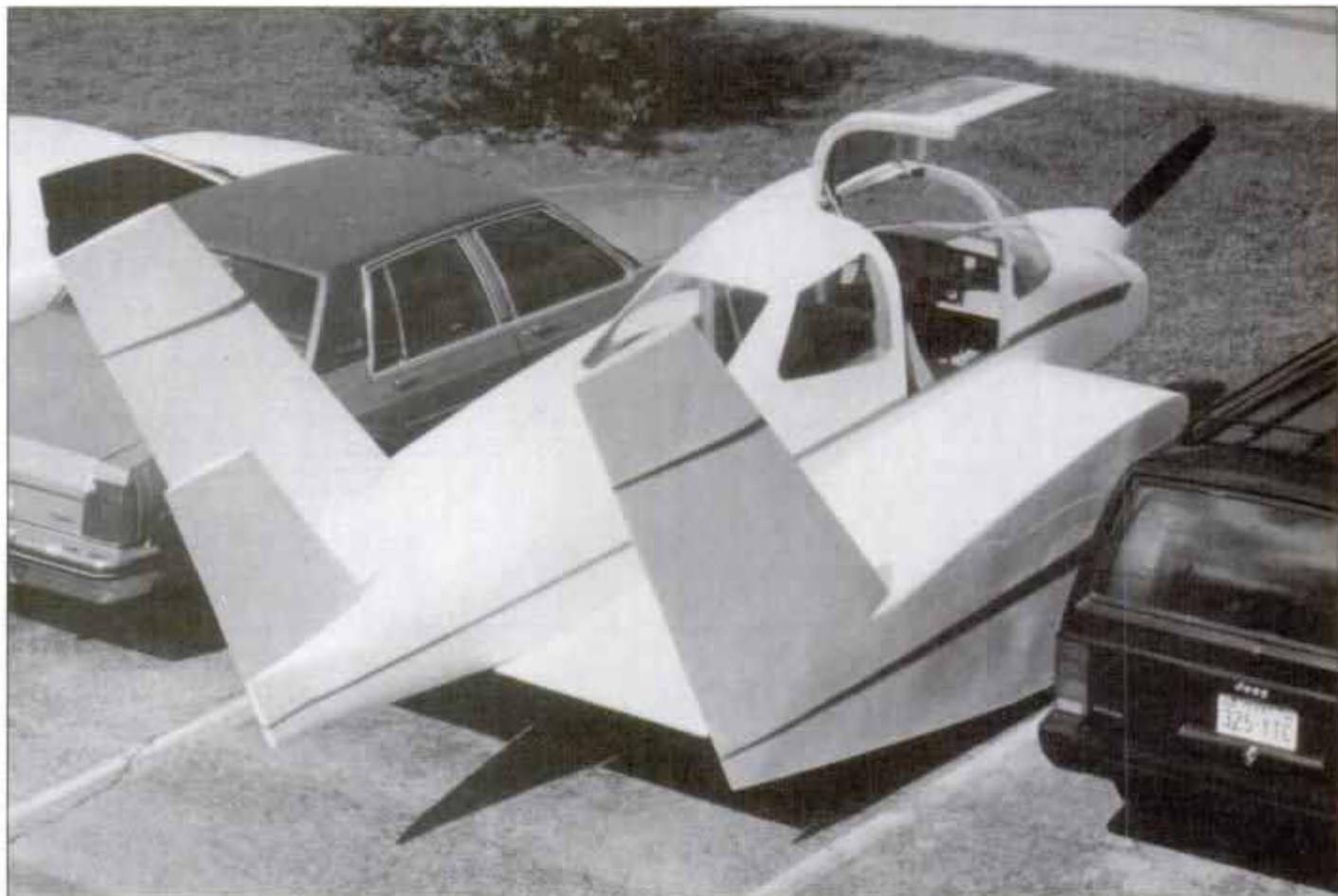
(PLEASE PRINT OR TYPE COPY • FOR ADDITIONAL WORDS ATTACH SEPARATE SHEET)

Order Form J94

FAX: (212) 977-5415
(212) 586-5562

\$11.65 per word—10 Word Minimum
BOLD FACE CAPS—\$1.00 Per word
(First Word: No charge for Bold Face)
\$60.00—B/F CENTERED HEADLINE
(5 Words or Less)
\$54.00—Screening

COMING NEXT MONTH



Drive/Fly The Air Car

Shift into D for Drive, or F for Fly. Our cover story features a street-legal hybrid with an 8-ft. wingspan. Rocket over the potholes at 310 mph—with no fear of speeding tickets.

Rumble Through The Jungle

Range Rover rolls out its '94½ Discovery model the hard way—right in the heart of a Central American jungle. Come along for 4x4 trekking at its finest, and explore ancient Mayan ruins, to boot.

New Muscle PCs

What's beyond the current 486-generation personal computers? You'll find out as we look inside the newest Intel Pentium and the Apple Power PC-based machines that offer speed and power you have to see to believe.

Engineered Wood

Save money with this alternative to large dimensional lumber. These strong, new laminates are used to span greater distances for larger open spaces.

American Classics: The Zippo Lighter

It survived four wars to become a collectible—it's the Zippo lighter. Virtually unchanged since 1932, this palm-size piece of hardware is a classic. Find out what makes it so hot.

150 TV Channels

The clearest signals for 150 channels are beamed from space directly to you. Step inside the nation's first direct broadcast TV facility.

Editor's Note—Due to changes in production schedules, an article may not appear when originally planned. We apologize for any inconvenience this may cause.

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

15 mg "tar," 1.1 mg nicotine av. per cigarette



© Philip Morris Inc. 1994

Материал защищен авторским правом

So what makes a Toyota T100 truly grand? Well, that depends on whom you ask. *Automobile Magazine* said, "There's one good reason to pick the T100. Toyota

SAVE UP TO \$1000 ON TOYOTA T100 EXTRA VALUE PACKAGES.*



is simply on another planet when it comes to quality.†

handle a substantial payload without sacrificing agility and performance. And there are those who are impressed with T100's safety features like side-door impact beams and a driver-

here. Cruise control with leather-wrapped steering wheel. CFC-free air conditioning. Power windows, locks, mirrors and antenna. A chrome rear bumper.

Body-side molding. And carpeted floor mats.



For T100 owners, the reasons are as individual as they are. Some say

side air bag.† Both standard for 1994.

So before you step up to a whole

that no other truck comes close to T100's



new class of truck, consider all the



spacious, car-like cabin. Others rave

To which, we would like to add some- thing synonymous with "grand." Savings of up to \$1000 on all the options you see

options. Because the Toyota T100 SR5 Extra Value Package is designed to make you feel,

about its unique size, large enough to

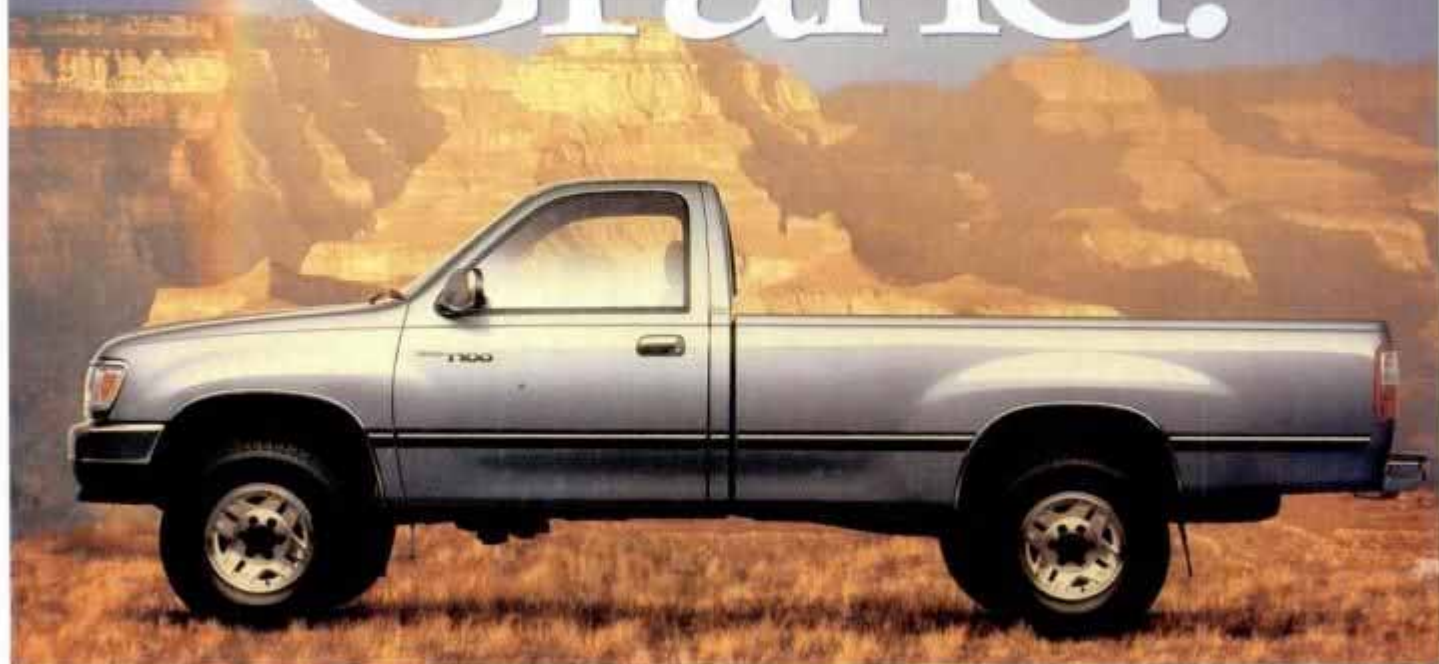
TOYOTA T100

well, positively grand.

"I love what you do for me."



Grand.



Call 1-800-GO-TOYOTA if you'd like a Toyota T100 brochure and the location of your nearest dealer. *Savings based on MSRP of individual options. Actual dealer price may vary. †*Automobile Magazine*, March 1994. ‡Always use your seatbelt. Driver-side air bag is a Supplemental Restraint System (SRS). Shown with optional alloy wheels at additional cost. Buckle Up! Do it for those who love you. © 1994 Toyota Motor Sales, U.S.A., Inc.