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Vol. 133, No. 5

Advancing the Automotive Service Professional Since 1899



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The 100,000 Jobs Mission is a coalition of firms investing in job-seeking veterans

TECHNOLOGY

A TALE OF COUNTERFEITS AND CONTAMINANTS

Is that 30-pound jug of R134A you bought online *really* R134A? Pete Meier investigates



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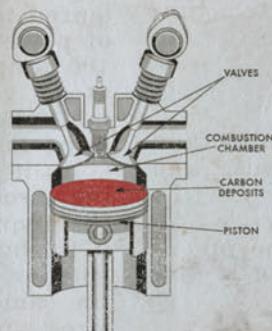


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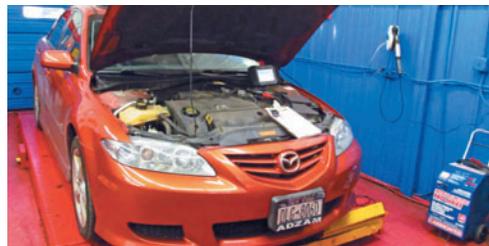
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A moment of clarity

OUR INDUSTRY'S MILITARY CONNECTION IS STRONG, AND THE STORIES HAVE POURED IN.

BY MIKE WILLINS | GROUP CONTENT DIRECTOR

EVERY so often I get one of those “Aah Haa!” moments when something I didn’t grasp or understand suddenly becomes crystal clear. I consider those to be my “How can I be so stupid?” moments. Last fall, I actually slapped my forehead after realizing that it was time for Advanstar Automotive Group to recognize the men and women who serve in the U.S. military, and all those veterans who came before them. It was startlingly obvious: The automotive industry has long been filled with vets and active duty personnel who have made sacrifices to give all of us a better life.

As a result of this moment of clarity, our entire Advanstar Automotive Group has worked diligently on our special “Salute The Troops” issues for every property we produce in May. When we began compiling ideas, stories poured in immediately from across the automotive sector. Our publications, *Motor Age*, *Automotive Body Repair Network (ABRN)* and *Aftermarket Business World*, share with you shop owners, distributors, technicians, suppliers and others who in one way or another are tightly connected to the military.

But we didn’t want to stop there. We wanted to maintain our mission as the leading source of quality

technical and business management information, but with a twist. So what you’ll find inside are some entertaining features on military technology and business operations that we hope you’ll enjoy.

Here in *Motor Age* you’ll find a couple historical features by contributor Norm Norville. On page 36, Norm tells the story of the Army Jeep and how it evolved from military mainstay into a consumer product. On page 69, he explains the tactical significance of the DUKW, or “Duck” amphibious vehicle. Technical Editor Pete Meier explains how Going Green means a lot more to the U.S. Army than simply saving fuel and reducing emissions (pg. 46). Pete also talks about how the military is dealing with counterfeit refrigerants, and the danger those products can pose for active duty personnel (pg. 58). And in our management coverage, Brain Canning and George Zeeks explain the benefits and challenges of hiring veterans.

As always, we aren’t simply making this a print project. We have a special webinar May 22 at 8 p.m. EDT on A/C Servicing Best Practices, conducted by Pete in cooperation with MacDill Air Force Base in Tampa, Fla. We journeyed to the home of Central Command at MacDill and hung out with the airmen (and women) charged with keeping the base mobile. Due to

base security, we had to record this webinar, but we will be “live” and standing by to answer your questions. If you’re interested in attending, go to www.motorage.com/MacDill and register for this special event.

We also have produced numerous video interviews with active and former military now working in the automotive sector. You can find many of those stories online at MotorAge.com.

Our sister publication *ABRN* conducted a video interview with Sterling Auto Body’s Bob Benjamin, an Army Ranger who recently returned from his second deployment to Afghanistan. *ABRN* Managing Editor Krista McNamara caught up with Bob shortly after his tour ended, and his daughter’s tour as an Apache attack helicopter pilot was just beginning. See the video at ABRN.com/benjamin.

We know we’ve only scratched the surface this month, so I’m encouraging you to continue sharing stories and goodwill initiatives with our team. Our industry does a fabulous job helping the men and women of our military re-enter civilian life and those stories deserve to be told.

Honoring those who have already served by telling their stories is the least we can do, given their sacrifices for the rest of us. **WZ**



MIKE WILLINS

has been involved in the automotive industry since 1997. He was formerly publisher and editor-in-chief of *Automotive Body Repair News* before assuming the role of Web director and now content director for the Advanstar Automotive Group. In 2005, under Mike’s direction, *ABRN* won the Advanstar Communications “Magazine of the Year” Award.

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Col. Robert Benjamin, Sterling Collision VP of Operations, talks with *Motor Age's* sister magazine *ABRN* about his military experience, how it has affected his role in the collision industry, the importance of supporting our troops and advice for others looking to follow in his footsteps.

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LEFT: Retired Snap-on Chief Engineer Ed Adams was a pilot in World War II. He was captured by the Germans and sent to a POW camp after his plane was shot down. RIGHT: Adams today, with his wife, Peggy.

MILITARY SALUTE

Duty in life and war

They are not famous, nor are they looking for fame. But when a group of 25 World War II, Korean War and Vietnam veterans who work at or have retired from Snap-on Inc. landed in Baltimore en route to the nation's capital to visit war memorials, they were recognized and greeted with a standing ovation. This flight and another were made possible last year by Snap-on's donation of \$50,000 to the Honor Flight Network, a nonprofit organization that honors American veterans for their sacrifices.

Since the inaugural Honor Flight, Snap-on has donated another \$50,000. Snap-on has hosted three flights to date, one with 25 veterans and two others with 26 veterans apiece. All flights also included a like number of companions — spouses, children and lifelong friends — traveling with the veterans.

There are two more confirmed flights scheduled for June and October; each flight reserved for 26 associates and their companions.

This commitment to the company's veterans should come as no surprise when you consider that William Rayburn, former chairman and CEO, and Nick Pinchuk, current chairman and CEO, are veterans. True to the cause, both attended the inaugural visit to the capital last year.

Every veteran has his own story to tell. But no matter the individual details, the running theme for all is that they were willing to give their all for their country. And some came pretty close to doing just that.

Take Ed Adams, for example. Adams, a 32-year Snap-on associate who retired as the chief engineer in research and engineering, defied all odds in WWII — at least for a while. But as a B-26 pilot who had been on 28 missions in the European theater, the odds finally caught up with him when his plane was shot down. Of the six crew members, only he and his radioman survived. After being thrown from the plane and pulling his ripcord, he landed remarkably right next to the plane, again defying all odds.

To this day, Adams still wonders why he was spared. But being spared had its price, as he and his radioman were captured by the Germans. First there was interrogation, followed by the train trip to one of the most dreaded places on earth at the time — Nuremberg,

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Germany, home of Stalag III-A. After three weeks in that POW camp, the Germans took all of the POWs on a four-week march to Stalag VII-A, the largest German POW camp, which was located in Moosburg, Bavaria.

But on April 29, 1945, they were liberated by none other than Gen. George S. Patton: "There was cheering when they came in for us. Then we listened to him give a speech. We were told all the time before to stick together and keep quiet. So,

after they came in and gave his speech, it was quiet, there was no gunfire."

Adams was awarded the Air Medal with five clusters (each representing five missions), the Purple Heart the POW medal.

And then there's the story of Snap-on retiree Werner Steinseifer. A Corporal in the U.S. 10th Mountain Division in Italy, Steinseifer trained in the Cheyenne Mountains in preparation for the harsh conditions he and his division would face in the Alps. It was training that paid off, as

they would sleep on a mountain in two-man tents in -25°F temperatures.

Then came a fateful three weeks. On Jan. 28, 1945, the 10th Mountain Division faced German positions along the 5-mile Monte Belvedere ridge. Other divisions had attempted to assault Mount Belvedere three times, only holding it temporarily. To get to Mount Belvedere, the division had to take a ridge line known as the Riva Ridge, which the Germans did not fortify well because they considered scaling a 1,500-foot vertical ascent an impossibility. That assumption turned out to be a grave mistake for the Germans, as the Americans overran them on the night of Feb. 18.

As a result of the Mount Belvedere siege, the Americans were able to capture German prisoners. And because Steinseifer could speak German, he had to sit down and question these men, who just hours before were trying to kill him and his buddies.

Although reluctant to discuss medals, we did learn that Steinseifer was awarded several, including the Bronze Star. He's just matter-of-fact about the experience: "I appreciated home and country more — we all did. But, when you came home, you just went back to work."

He added that the most usable skill learned in the military was "to follow orders and do your best." Steinseifer certainly did that, and continued to do so at Snap-on for 44 years. When he retired in 1986, he was the most senior associate out of 6,200.

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Jim Bosch and his wife, Cathy.



Morris Folk and his wife, Cathy.



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Werner Steinseifer, circa WWII.



Steinseifer today.

'More than just you'

One thing that happens to every young soldier during war: You grow up fast. Jim Bosch remembers the day that it happened to him. "I was just 19 years old, running a convoy one day, and I heard an explosion. One of the convoy tanks blew up; two were killed and the driver was injured. At this point, I decided this wasn't a game."

Bosch started out as a door gunner on a helicopter, and then was promoted to crew chief, which made him responsible for making sure everything on the helicopter was working. At the tender age of 20, he had assumed a leadership role — but that's what everybody did. "The pilot," he points out, "was just 21."

Being in the military in Vietnam, which Bosch describes as the "Wild West," left a huge impression on him. In fact, he credits it with helping him in work and life. "I consider people to be the most valuable asset in the world," he says. "Teamwork is very big — you have to be more than just you."

It's somewhat remarkable that Bosch feels this way, though, given the reception that he got when he returned home from the military: "It took about five years to get it out of my head. When I came back, I took a cab home from the airport, and there was nothing to welcome me back. It was disheartening. I worked at a trailer company, and three days after I got back, I was back at work."

Bosch has worked at Snap-on for almost 16 years, and is currently working in the Milwaukee plant as a machinist.

Another Vietnam vet, who was in for a rude awakening when it came to adjusting to home life, was Morris Folk.

"The woman who became my wife and I were dating when I got back," he recalls. "We went to a movie and while walking into the theater, a car backfired — and I hit the ground."

Still, Folk would recommend the military to young people. "I would tell them what my mentor told me, 'The Army will be what you make of it,'" he says.

To clear his head, Folk enjoys motorcycle trips, fishing and working on old cars. But life is unpredictable, whether it's in the military or as a civilian. Folk likes to tell this story to illustrate the point: "We go on a lot of motorcycle trips. About six years ago, we went with two other couples to Albuquerque, and drove up to Santa Fe and on to Silverton, Colorado. The trees were changing, and we had fairly good weather. The very next day, it snowed 24 inches!"

Folk has been with Snap-on for 36 years as a franchisee in Warsaw, Ind. He credits the military with helping him in life and business. Specifically, he says the military has helped him follow a program and to follow up on the things you need to do. And his general philosophy on life is simple, but poignant: "Follow the Golden Rule."

Folk greatly appreciated the D.C. trip honoring him and the rest of the Snap-on military vets. "The Snap-on Honor Flight trip was a great trip," he says. "We flew out of Ft. Wayne and because of a late arrival, we had to run from one end of the airport to another. But it couldn't have been a better time. It was when the monuments were shut down to the general public, but they let the veterans through."

Indeed, let the veterans through.

— Larry Silvey



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ASE GUIDES

QUESTION OF THE MONTH



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SURVEY: May is the first *Motor Age* issue devoted to the men and women serving in our nation's military. Included in this very special issue is a feature on the vehicle technologies being explored by the military, including hybrid and fuel cell designs. Because this is not purely a technical question, you may have to do a little research to get the answer right: Recently, a mainstream automaker was announced as a partner in a program researching the application of fuel cells in military ground vehicles. Which OEM is it?

- A. Audi
- B. Honda
- C. General Motors
- D. Hyundai

Answer the question at MotorAge.com/may14survey and enter our monthly contest from Federated Auto Parts.



Timken takes pride in initiative to recruit veterans

special to Searchautoparts.com

Last year, Timken joined the 100,000 Jobs Mission, a coalition of more than 130 companies across the United States with a shared objective to hire 100,000 armed forces veterans by the end of 2020. Recently, the final tallies for 2013 were reported, with members collectively hiring more than 117,000 veterans.

With the initial goal reached so quickly, the mission has expanded its target, and now hopes partner companies will hire an additional 100,000 veterans by 2020. For Timken, along with the benefits of 2013's new hires, membership is



continuing to show promise as a recruiting tool in 2014 and beyond.

"While we don't currently have specific hiring numbers for this year, we are certainly seeing increased activity on our Careers website that we can attribute, at least in part, to the 100,000 Jobs

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BEST OF THE BLOGS

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BEST OF THE BLOGS are articles written by bloggers on Motor Age's community pages

Best practices to increase your bottom line

By Kathi Kankis

ALLDATA® is in business to support the automotive repair and collision industries with proven systems and services that make a positive difference. Over the years, we have learned a thing or two about what it takes to help a shop succeed. We are sharing a few of these "best practices" in the interest of keeping your business strong and healthy.

1. Limit discounting.

Shops often offer discounts to family and friends, and you may occasionally feel obligated to discount your services. Before you create that next discount line, consider that people today are looking for fast, friendly, professional service, not just discounts. Check these huge mark-ups

for products and services that consumers pay every day:

- Bottled water – 4,000%
- Movie theater popcorn – 1,275%
- Brand name drugs – 200% to 3,000%
- Coffee – 300%

Drivers are willing to pay a fair price for work that is done right, and you deserve to make a fair profit. Offer value... not discounts!

2. Enroll with a few fleet companies.

This can be a great way to eliminate downtime and open the door to additional opportunities. Fleet work is usually discounted a bit, but generally increases your car count.

3. Ask for testimonials and referrals from your loyal customers.

When you build relationships, you may

benefit from referrals, and referrals are vital to business success. Each of your customers can potentially generate additional business from their friends, family, neighbors and co-workers. Referred customers can help maximize your profit on each ticket, because trust has already been established. And if you attract fleet business, you may also draw business from individual fleet drivers and their referrals.

Create a positive customer experience.

Educate and inform your customers. Explain additional recommended services and give them advance notice of upcoming maintenance items. Print and hand them the factory maintenance schedule for reference.

To read Kankis' blog post in full, visit MotorAge.com/KathiKankis

May 22
@ 8 p.m. Eastern

A/C Servicing Best Practices

We'll speak with air personnel at MacDill Air Force Base and recap the latest news affecting the air-conditioning service field.



EDITORIAL OPINION

MIKE WILLIAMS

A moment of clarity

THE TRAINER VIDEO

PETE MEIER

Up in smoke

Mission," says Shaun Branon, director of talent acquisition. "It's a promising sign for us as a company any time we can broaden the depth of our candidate pool, and it's a great point of pride to be considered a company that veterans can turn to when they're looking to continue their careers."

In addition to this initiative, Timken supports the Military Spouse Employment Partnership.

"This partnership creates employment connections that provide companies with direct access to military spouses seeking career opportunities," Branon says.

Timken and other employers signed a partnership agreement during a ceremony at the Pentagon. Visit MotorAge.com/Timken to watch the YouTube taping; the signing is just past 1 hour and 7 minutes into the ceremony. **ZZ**

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The OTC Encore Scan Tool

Looking for a scan tool with some diagnostic muscle? There are several on the market, and one of the latest offerings is the OTC Encore. Pete Meier delves further in this In The Workshop Update.

MotorAge.com/otc

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Noteworthy

comments from [MotorAge's](http://MotorAge.com) online communities

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@CorbanAuto TWEETS:
Picked up my mail. Sweet! My @Motor_Age Mag arrived! #locksoficedoor #donotdisturb #workonthebizNOTinit

@GoodwrenchGarth TWEETS (in response to <http://bit.ly/1fXHv3V>):
@Motor_Age Good Article, I suspect most

people wouldn't even know if they had Electric Power Steering.

stephen333 (in response to <http://bit.ly/1ic75ss>):

Good article, and you are correct — that's how we sell at our shop. If the customers are there, we show what is needed,

and if they're not there, we take [photos] and text them to the customers so they can see for themselves. We, of course, ask permission from customers if they do not mind if we do so. Nine times out of 10 they agree with us. Showing is the easiest way to sell.



STREAMING PROGRAMS

How to use LinkedIn for B2B and B2C marketing

For many shop owners and their employees, LinkedIn can be a big challenge. Engage Social Media goes over some of the benefits of using the network to grow your business. /linkedin

Choosing the right scan tool: Tips from Bosch/OTC

Recently posted to the OTCToolGuy YouTube channel, these videos may help answer the age-old question, "What is the right scan tool for me?" /scantips

Hybrid repair

Jim Bates, Advance Auto Parts technical training specialist, sheds some valuable insight and debunks several myths. /hybridrepair



2014 INDUSTRY CALENDAR

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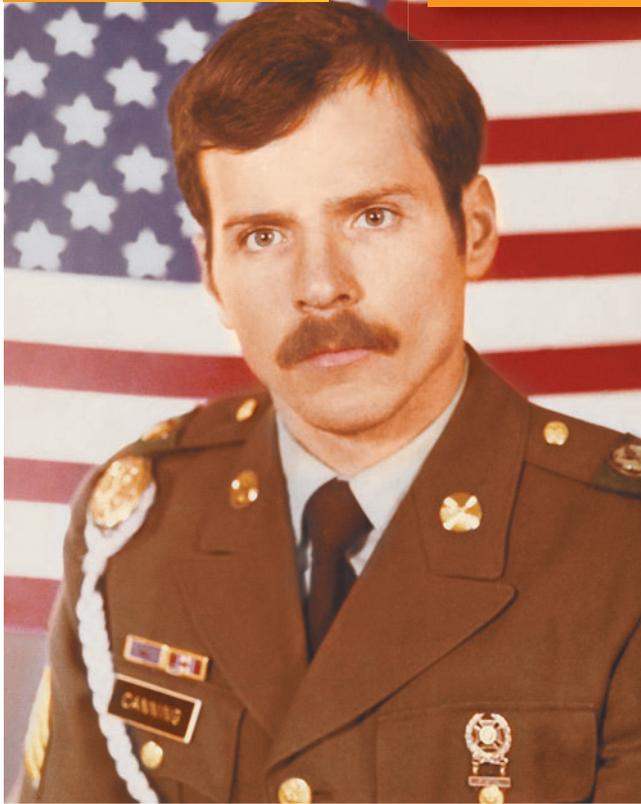
TAKE CONTROL
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from what makes
a pit crew tick.
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DIFFERENT WAY**Train employees
to make each
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profitable.
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MANAGEMENT



The author circa 1979, "way back when I had hair and was a tank commander with the 1st Armored Division in Germany."

KEEPING THE FAITH FOR OUR VETERANS

BY **BRIAN CANNING** | CONTRIBUTING EDITOR

HAVING been in the automotive repair, tire and parts worlds for more than 30 years, and having worked with shop owners and service managers as a business consultant and leadership coach for a large chunk of that time, I am well aware of the overwhelming challenges of finding and hiring the right people. With a national shortage of qualified technicians — along with a similar shortage of capable, competent service advisors and service managers in our shops — finding the right people is not just the difference between being good or great. It can often be the difference between success and failure, between prospering and bankruptcy.

On the other side of that is a group of individuals who, by character, motivation and training, are a cut above. They are the type of men and women you could build your business and future around. They have shown their mettle and drive in environments far more challenging than anything in your work-a-day world, staying true to the mission. Quitting is not part of their make up.

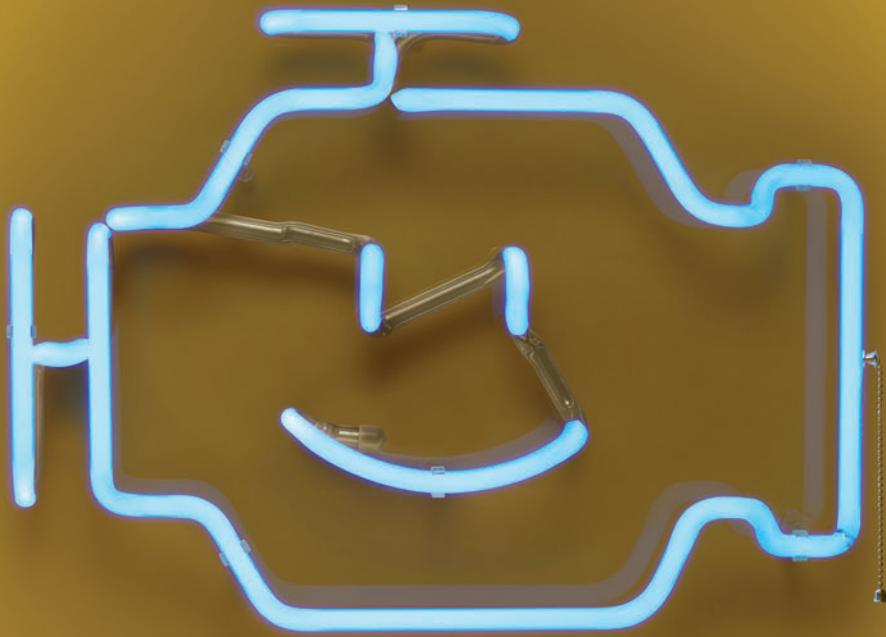
But although these men and women have been highly trained, many of their skills are no longer relevant, and their chosen career paths are no longer a possibility.

The automotive aftermarket, that sector of the industry that exists outside the dealership after a vehicle (car or truck, light duty to heavy duty) leaves the showroom, is a significant component of the U.S. economy, employing millions of people across the country. It accounts for all products and services purchased after the vehicle sale. That includes replacement parts, tires, accessories, performance parts, cleaners and waxes, collision and maintenance services — and even the tools and equipment used by technicians in the thousands of facilities across the country.

The Auto Care Association (formerly the Automotive Aftermarket Industry Association, or AAIA) knows that with a rapidly changing global economy, customer make-up, technology, legislation, environmental issues and competition, there is an urgent need for education and training programs.



Photo: Brian Canning



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ACA responds to this challenge by providing the industry with resources and opportunities to enhance continuous learning. ACA understands the value of education, training and professional development. An important goal of the association is to create an industry-wide, broad-based initiative to

“recruit and retain the best and brightest to grow the industry.” Its purpose is to advance the ability of aftermarket companies and organizations to recruit young people, recent college graduates and returning veterans, among others.

At press time, ACA was planning to launch a career opportunities website that describes the industry and emerging career trends by sector. Visitors to the website will learn ways to advance in an aftermarket career. The site will be hosted and maintained by ACA education staff. For ACA members or would-be members, there are tool kits and fact sheets that will be available later this year to help you understand the depth of these efforts — and the potential benefits to you and your business.

Taking advantage of these resources promotes business excellence by enabling current and future employees to enrich their lives and contribute toward business success and extraordinary career opportunities for those who would choose the automotive aftermarket. Veterans are an important part of this effort.

It is significant that ACA's effort to “recruit and retain the best and the brightest” includes veterans. Our returning veterans, many of whom are severely wounded or injured, are an extraordinary resource that is far too often overlooked. In recent months, ACA and the Wyakin Warriors have reached out to each other, exploring possibilities for partnership.

Case in point

In the late spring of 1979, I went to the U.S. Department of Veterans Affairs office in Washington to register for my benefits. Although I was there by appointment, I was directed to a long line. I knew it would most likely be a



Read the Six Tenets of the Wyakin Warrior Foundation online at MotorAge.com/six-tenets

couple of hours before I would be talking to anybody, so I resigned myself to a long wait.

While waiting in line, the gentleman in front of me struck up a conversation. For the next two hours or so, we talked about our various experiences.

Just like me, he was there to register for his benefits. He was an 11B, a grunt, one of those straight-legged infantry guys. He had spent two-and-a-half tours in Vietnam. He was older — maybe 28, as I recall — and was an E7 when he was discharged.

The other thing I remember about him was that he had a great sense of humor. I am naturally cranky and rarely talk to strangers. But he and I talked and talked, and those two hours went by like nothing.

Did I forget to mention that this “old” warrior signing up for his VA benefits was a triple amputee? Did I forget to mention that, as I fidgeted and impatiently waited my turn, he sat in a wheelchair, in a dark, narrow corridor waiting for somebody who didn't know or care about all that he had been through?

From that day, I began to see the challenge of being a severely wounded or injured veteran.

A hand up, not a handout

Although most of us genuinely care about our veterans, very few of us take the time to know or understand the challenges all veterans face, especially those who come home severely wounded or injured. The Boise, Idaho-based Wyakin Warrior Foundation (www.wyakin.org) is an organization I would like you to know about — not just because of its complete dedication and commitment to severely wounded and injured veterans, but because of what it could potentially do for you and your automotive staffing needs.

We are not talking charity; we are talking highly educated, highly motivated, capable individuals who could transform your business and move it in directions that you had only dreamed of. The Wyakin Warriors' stated mis-

sion, “Enabling severely wounded and injured veterans to achieve personal and professional success as business and community leaders,” doesn't talk much about charity. It talks about success. Their success is your success.

If I go to the Wyakin Warrior website, I see that, according to Native American legend, a wyakin is a spiritual guide that advises and protects a person throughout life. As a rite of passage, a young Native American was taken to an isolated mountain location where the child remained alone until the wyakin (often an animal, such as an eagle, bear or wolf) appeared in a vision or dream.

The Wyakin Warrior Foundation is a nonprofit organization providing mentoring (up to five mentors per warrior), professional development, a full scholarship, networking to facilitate job placement and proactive follow up with individual warriors to monitor physical, emotional and professional status. They further demonstrate the opportunity and the ability of individual warriors to become servant leaders and role models. The program is built around what the individual warrior wants personally and professionally, facilitating that journey. The Wyakin Warriors not only talk that talk, but they ardently and passionately walk that walk.

Right this very minute, your shop probably has a key management or leadership position open or needing to be filled by somebody capable of taking you and your business to the next level. The Wyakin Warriors and ACA would seem to have answers that most of us don't, and are exploring things that they can accomplish together. I vote that we join and support their efforts. *TM*



BRIAN CANNING
CONTRIBUTOR

Brian Canning is a 30-year veteran of the automotive repair industry. He has been a leadership coach, Goodyear service manager, retail sales manager for a distributor, run a large fleet operation and headed a large multi-state sales territory for an independent manufacturer of automotive parts.

Email Brian at brimarc@hotmail.com

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WHEN THE RIGHT CHOICE — HIRING A VETERAN — IS WRONG

BOY, THAT HEADLINE DOESN'T EVEN LOOK RIGHT, DOES IT? BEFORE WE GO ANY FURTHER, LET'S GET IT STRAIGHT. EVERYONE KNOWS THAT IT'S GOOD AND IMPORTANT TO HIRE VETERANS, BUT WE NEED TO GET PAST THE POLITICALLY CORRECT SPEAK AND LOOK AT WHETHER IT'S GOOD FOR YOU. LET'S LISTEN TO A VETERAN WHO IS ALSO THE TEAM LEADER OF OUR COACHES AT ATI, GEORGE ZEEKS:

BY CHRIS "CHUBBY" FREDERICK | CONTRIBUTOR

I HAVE dealt with shop owners for more than 30 years now, and the one thing almost every one of them had in common was how they hired people. If you lose an "A" technician, or even a "B" technician for that matter, with what skill level do you want to replace them? That's right, an "A" tech. If you lost a seasoned manager or service advisor, who do you want to replace them? Someone with years of experience, so you can just plug and play.

The biggest problem with that is the really great person who has all those years of experience may not be available right now, when you need them. If you can change the way you think, for just a moment, you begin to see why veterans can be one of the smartest hires you've ever made. That is, if you have the right things in place.

When I first started in automotive, I didn't know anything about cars. I didn't know how to change oil. I had no idea what was involved in diagnosing problems. I didn't even take very good care of my own car. It just never seemed that important to me. I had graduated from college with a degree in marketing and promptly joined the



Army. I had a great time, but the skills I learned in the Army had no value in the business world — or so I thought.

I stumbled into the automotive world by selling this guy a sprinkler system for his lawn. We walked his lawn, where I had placed my little flags showing the position of the proposed system, and sat down for the next two hours to discuss the particulars of the deal. At that point, he said, "I have to

think about it."

Knowing that I was the third person to talk to him, I wasn't ready to leave my commission to chance. I took my jacket off, asked his wife for a cup of coffee and she and I began to talk. He again mentioned wanting to think about it. I told him to go right ahead, since I was having such a great conversation with his wife.

An hour and one big check later, the deal was done. He then asked what I knew about cars, and if I would be willing to come and run one of his auto shops. He owned five at the time.

I thought he was insane and told him I knew nothing about cars or auto shops. I wasn't sure I even wanted to learn. That's when he started selling me. It was the beginning of my next 30 years.

Are you ready to teach them?

I tell you that story to prepare you for the rest of this one. You see, he knew

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business and saw something in me that I didn't. He hired for basic sales skill and attitude. He knew that he and the crew could teach me the industry knowledge that I would need, but if you don't have the attitude to win, it just doesn't matter.

Once veterans leave their branch of service, they can be a bit lost at first. They may not be sure of what they want to do, but they know how to learn. The military is very good at constantly teaching and refining skill sets, so they are ready and willing to learn new skills.

The real question is, are you ready to teach them? Do you, or can you, have systems in place to teach them what they need to know? By the way, you should have this in place anyway for all of your staff.

The challenge becomes one of commitment. Veterans will commit to you, because they want to get started on their new careers, but you have to really commit to them and their education in your field. They also know what halfhearted attempts look like.

There is a learning curve, but it's not as steep as you might think. Whether it's the sales side or the technical side, the attitude and life experience a veteran brings to the table will have a positive impact on the rest of your team.



Are you ready to lead them?

The next challenge is for you to lead them. Veterans know what hard work is. They know the importance of getting a mission accomplished. They can also sniff out a poor leader in a heartbeat. They have had good ones and bad ones, and they know the difference. A poor leader to them means frustration, disappointment and things just ending up being harder than they should be.

It's not a matter of your leadership style. You don't have to be Patton to get them to follow you, but you do have to care. What does that look like? Simon Sinek has a great book out called *Leaders Eat Last*, which would be a great place to start. If your philosophy is that everything is all about you, then you're in trouble no matter who you hire. A veteran has seen that leader before and will head for the hills.

If you care about your people, their success, their growth and their happiness, then they will try to perform miracles for you. The basic facts are

that they know what sacrifice is; they have done it and are willing to do it again. This means you have to live up to that standard. The reward for you is huge, satisfying and profitable. It just takes a little hard work on your part, but everyone, including yourself, will be better for it.

Now, back to that headline. It all boils down to pride. Almost every veteran I have met is proud of their branch, their service and themselves. They want that from you. I have worked in shops, but not for long, where I would make sure to take off my work shirt before I left the shop. You see, I had no pride in that shop and didn't want people to know that I had anything to do with it. I know that part of that comes back to me as the manager of the shop, but I can only do what the shop owner allows.

If you can give a veteran an environment that they can be proud of, a leader they can be proud of and work they can be proud of, then hire away and reap the rewards. If you at least try, they will help you become better. If you don't care or care only about yourself, then don't even try to hire a veteran. They'll know who you are, even if you don't. *ZZ*



CHRIS "CHUBBY" FREDERICK
CONTRIBUTOR

Chris "Chubby" Frederick is the CEO and founder of the Automotive Training Institute. ATI's 108 associates train and coach more than 1,150 shop owners every week across North America to drive profits and dreams home to their families. ATI associates love helping shop owners who are having the same struggle as many of them have had, and who are looking for the same answers — and in some cases looking for a lifeline. This month's article was written by George Zeeks, a veteran and the team leader to one of ATI's coaching teams.

E-mail Chubby at cfrederick@autotraining.net

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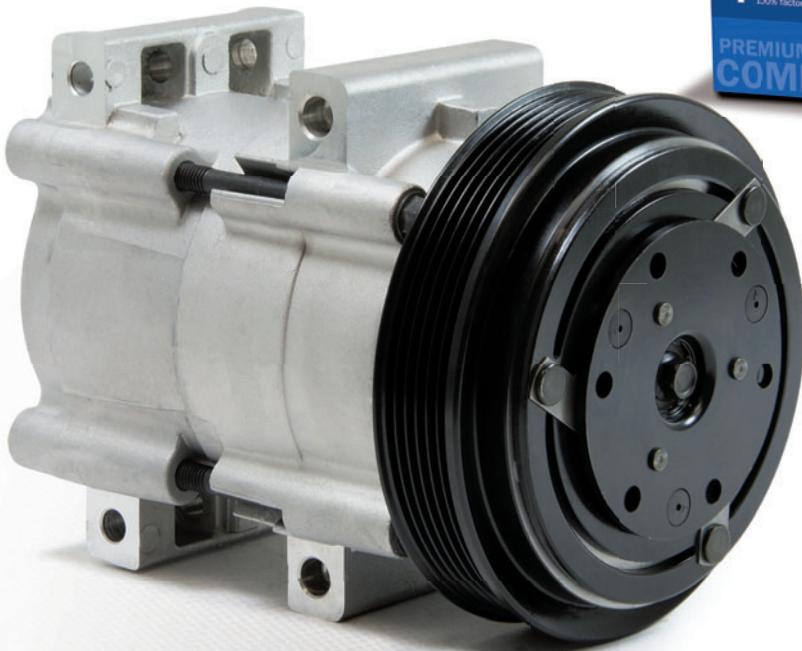
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OUR INDUSTRY NEEDS VETERANS

BY **ROBERT GREENWOOD** | CONTRIBUTING EDITOR



THE AUTO care industry is very complex, with many facets and career opportunities for veterans. A multitude of job paths exist today that are well known; however, others are less mainstream and rarely considered. To name a few:

- vehicle service shop technician
- counter service shop advisor
- internal shop bookkeeper
- shop manager
- wholesale jobber sales repre-

sentative and/or all the various positions within the independent jobber business

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- manufacturing positions, including sales reps, engineers and various management positions
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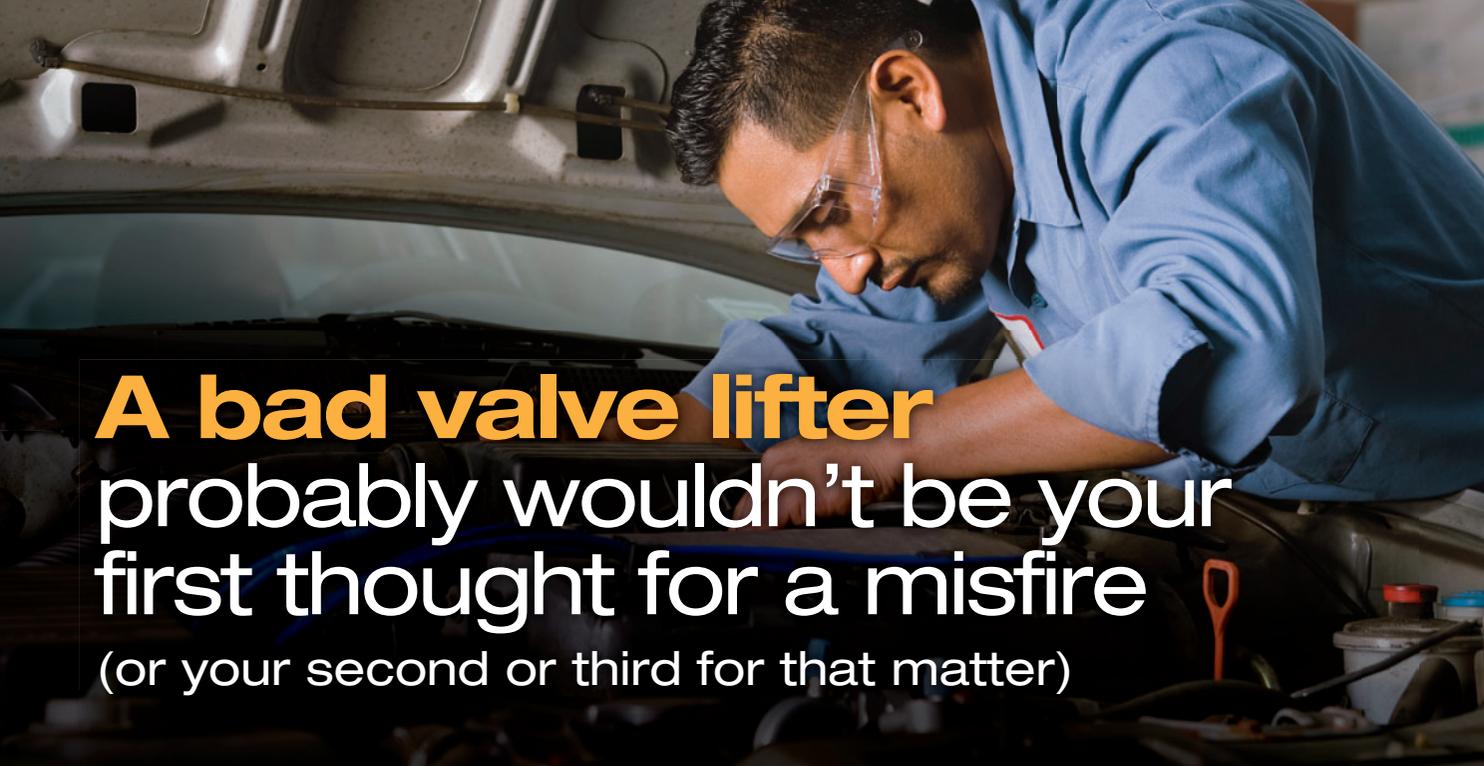
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As you can see, the imagination of what is available is really unlimited, and has been the best-kept secret retained by the industry. It is time to let the news out. We need to inform veterans what our industry can do for them and communicate that they could be excellent candidates to apply to companies seeking many of their skills and talents.

Veterans make excellent employees and partners for numerous reasons, including:

- the ability to research a task topic and determine a strategy to obtain results
- self-discipline, to focus and accomplish the task at hand
- an understanding of the need for teamwork
- acceptance and understanding of the individual accountability to the position held
- the ability to communicate in a timely and concise fashion

These characteristics create a positive culture within a company, and with most veterans, the characteristics listed above are a natural part of their DNA.

The issue for veterans may be, "Where do I find opportunities for my skillset and interests?" There are many websites out there listing opportunities, such as:

- Veterans Pipeline: usveteranspipeline.com/industries/25-after-market
- Hiring Our Heroes: www.hiringourheroes.org
- Hiring Veterans: www.hireveterans.com

Of course, the normal route of searching on various job bank sites or targeting specific industry companies would also be a natural procedure.

Another issue would be entrepreneurship, where a veteran or group of veterans would like to start or take over a small business. That can be very exciting; however, a deep breath must be taken and a proper checklist drawn up to ensure the opportunity is approached properly.

Opening a business is not just about your passion; it must be systematically approached to make sure it is the right thing for each individual. To give a basic example, the checklist above includes just a sampling of the items

FINANCING CHECKLIST

	Yes	No
1. Have you determined the gross profit return required for each revenue department in the business?	<input type="checkbox"/>	<input type="checkbox"/>
2. Have you determined the correct balance sheet ratios for the business? (accounts receivable, inventory, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
3. Have you determined your potential return on investment in this business? Is it an acceptable figure?	<input type="checkbox"/>	<input type="checkbox"/>
4. Have you determined the amount of capital you need to grow and expand the business?	<input type="checkbox"/>	<input type="checkbox"/>
5. Have you determined how much capital you can raise on your own?	<input type="checkbox"/>	<input type="checkbox"/>
6. Do you have enough ready cash to pay your bills during the slow months of the business?	<input type="checkbox"/>	<input type="checkbox"/>
7. Have you prepared an annual budget and cash flow forecast?	<input type="checkbox"/>	<input type="checkbox"/>
8. Have you allowed for an adequate living wage for yourself?	<input type="checkbox"/>	<input type="checkbox"/>
9. Have you determined your future borrowing requirements?	<input type="checkbox"/>	<input type="checkbox"/>
10. Have you investigated the following financing options, and determined which ones apply to your business?		
a. Banks and near-banks	<input type="checkbox"/>	<input type="checkbox"/>
b. Insurance policies	<input type="checkbox"/>	<input type="checkbox"/>
c. Friends and family	<input type="checkbox"/>	<input type="checkbox"/>
11. Have you accessed available government assistance programs at the federal and state levels?	<input type="checkbox"/>	<input type="checkbox"/>
12. Have you established a working relationship with a banker, including line-of-credit arrangements?	<input type="checkbox"/>	<input type="checkbox"/>
13. Have you established and reviewed your credit rating?	<input type="checkbox"/>	<input type="checkbox"/>

that need review.

These items are just the tip of the iceberg, but they point out the seriousness and detail required to open any kind of business. Always seek out professional advice to engage in a complete discussion about the business you may be interested in entering into or purchasing.

The auto care industry is immense and has many incredible opportunities. The trick for veterans is to take the time to investigate what interests you. Thank you for your service, and thank you for having the character that you do. 



BOB GREENWOOD
CONTRIBUTOR

Bob Greenwood, AAM, is president and CEO of Automotive Aftermarket E-Learning Centre Ltd. (AAEC), a company focused on providing business management resources and development for the independent sector of the automotive aftermarket industry utilizing the Internet environment. Bob has more than 36 years of business management experience within the independent aftermarket industry, consulting independent retail shops on all facets of their business operations. Bob is one of 150 worldwide AAM approved instructors.

 E-mail Bob at greenwood@aaec.ca



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SHOP PROFILE

A snapshot of one of the industry's leading shops

P.A.T. / ANN ARBOR, MICH.



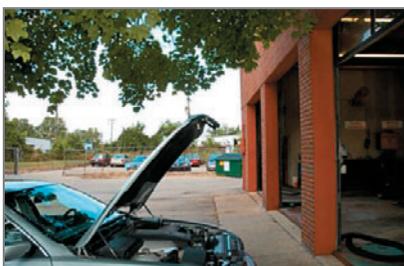
Superior Service

BY ROBERT BRAVENDER | CONTRIBUTING EDITOR

To say Jim Wakefield was proud of his military service in the Navy during the Vietnam War would be an understatement. "He really loved his military experience, the camaraderie," says Rob Wakefield, Jim's younger brother and his parts manager at Professional Automotive Technicians in Ann Arbor, MI. "It was a dramatic point in his life; he got to experience life on an aircraft carrier and travel around the world."

Wakefield was in charge of coordinating maintenance aboard the *U.S.S. Coral Sea* until around 1969, when he developed Hodgkin's lymphoma. Transferred into the Navy Reserve to receive treatment, after rounds of radiation therapy Jim and his wife, Midge, decided to treat themselves with a 1970 Porsche 911. This in turn led to Porsche club membership, employment at the local VW/Audi/Porsche dealership, and ultimately, his own shop.

"My brother and others decided that the people coming to the dealership weren't really being taken care of personally," Rob explains. "There was a disconnect between the customer and the technicians servicing the vehicle, (the latter) not really caring about what they were doing." To better cater to the clientele, in 1978 Jim and his business partners left the dealership and opened Professional Automotive Technicians, Inc., or P.A.T.



West side of P.A.T.



Front entrance.

AT A GLANCE

Professional Automotive Technicians Inc. (P.A.T.)

Shop name

Ann Arbor, Mich.

Sole location

Dec. 18, 1978

First day in business

3,600 square feet

Shop size

6

Number of bays (with in-ground lifts)

39

Average vehicles per week

\$471.43

Average repair order: current customer

\$512.52

Average repair order: old customer with new car

\$581.13

Average repair order: new customer

\$632.88

Average repair order: new Internet customer

\$1,020,583

Annual gross revenue

Bosch Service Center since

1986

Shop affiliation

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Photos: P.A.T.



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“The idea behind it was professional, personal care for your car, and it’s been that way ever since,” Rob says. “The technicians are responsible for talking to the customer personally. Not that our service manager doesn’t discuss issues if the technician is unavailable, but it creates a

connection you don’t have when it’s just a guy working on a car.”

As the shop prospered, Jim’s vision grew beyond exclusive European marques. “Asian cars started coming on very strong, the minivan came onto the scene,” recalls Rob. “We had a lot of customers that had one, and we

kept having to say no, we don’t work on them. Finally my brother said, ‘Look, these people believe in us, they have confidence in our abilities; we’re turning away good business.’”

Jim’s partners didn’t share this vision and by the late 1980s had sold out their portions, leaving him in sole control of P.A.T. Always forward-looking, he was also in the vanguard of computer use. “We started developing Apple software back in ’83 specifically for the automotive industry,” says Rob, who had studied computer science in college. “I later mentioned to him about the Internet, and we developed a website early on. Jim put quite a bit of content up there and we made our cyber entity known early on, optimizing our position on the web through Google AdWords and AdSense. My brother started off doing that in-house himself. We also started transitioning into direct marketing, probably quicker than other places, targeted specifically to our demographic.”

Wakefield also worked on optimizing the shop’s software. “He noticed that as technology evolved within the automotive industry, the flat rate was becoming a more difficult way of billing for repair,” Rob explains. “Take advances in the diagnosis of a drivability issue; some of our brightest technicians were losing out in billing to someone doing brake/suspension work. So to level the playing field, Jim developed a program called the Lab Dog Time Retriever to create matrix pricing for diagnosis, which is now incorporated into our shop software. I think that was something that really set us apart from a lot of other shops. We were able to attract very intelligent technicians and pay them well.

“We’ve evolved with the technology,” Rob continues. “Back when I had to look up information through microfiche, I dreamed of the day that I would have an exploded view of parts that I could just click on the screen and it would get me information. In that regard, the technology is wonderful. But it’s a double-edged sword: It opens up opportunities, but on the other side, it marginalized a lot of people. But you have to embrace it, or you’re going to fall behind.”



Lobby looking east.



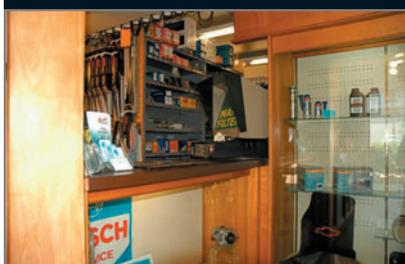
Lobby looking toward alcove.



Lobby looking toward south.



Customer restroom.



Alcove looking north.



Alcove looking south.



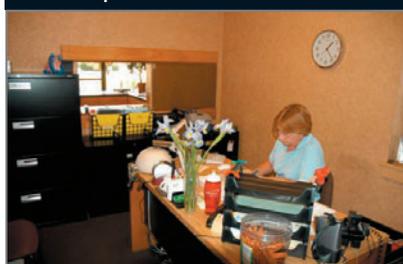
Parts department from alcove.



Parts department.



Parts department — another view.



Linda Rowland in the office.

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Yet keeping up is tricky; customers now expect more immediate turnaround. "We try the best we can in that regard," says Rob, "and we provide taxi service for them, getting them wherever they need to go. We've also got a lot of people out there who don't know what they're doing, so

consequently we have a lot of customers who come to us that have spent money on their car elsewhere, and they're frustrated and hesitant. So our job is to teach them about their car and what we're going to do differently."

Some people are putting off repairs to save money; to soften the financial blow to customers, the shop started classifying repairs by importance. Meanwhile, dealerships are offering new cars with better service packages to keep consumers coming back. "If they get these people to recycle through (the dealers), we may never see them again," Rob comments. "We're also starting to contend with computer systems like Ford has, which integrates text messaging, navigation and entertainment."

But they have a high-tech ally. Starting in 1986, P.A.T. began a long

and prosperous relationship with Bosch when they became one of Bosch's first certified Service Centers in the U.S. They were declared the best independent auto repair shop in the United States by the Robert Bosch Corp. after competing in a multi-level evaluation, and in 1997 won the

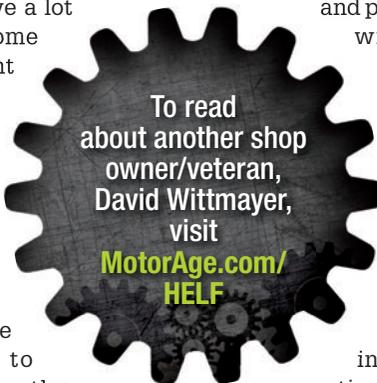
Bosch Jetronic Cup, formally presented to Jim at a ceremony held in Wernau, Germany.

"I'm hopeful with Bosch as a partner that we can continue," says Rob. "They've pushed a lot of technology into our field, and that's what it's really going to take for our industry to survive."

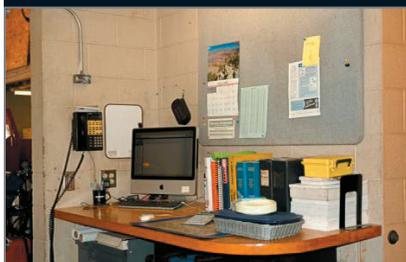
Sadly, Jim Wakefield is no longer at P.A.T.'s helm; in September 2013, he succumbed to the cancer he had fought so long against. Rob, Midge and the rest of the staff carry on his legacy — and memories.

"When we'd go out to eat dinner together," Rob recalls, "if he saw someone in uniform, he'd offered to pick up the bill. That always sent a message to me that he put those individuals on a different level because they served our country." *ZZ*

**Editor's Note: The P.A.T. staff photo is from 2009, so as to include Jim. Back row, from left, are Mike Jeffries, Tim Seeger, Jeff Krol, Mike Bittenbender, and Will, Rob and Jim Wakefield. Front row, from left, are Linda Rowland and Midge Wakefield. At far left in the photo, of course, is Howard the Jetronic Duck, visiting from Germany.*



Office looking toward shop.



Shop counter.



Alignment rack east side of shop.



Wash area.



Key department upstairs.



Locker room upstairs.



Bosch Jetronic Cup.



P.A.T. staff.*



Robert Bravender graduated from the University of Memphis with a bachelor's degree in film and video production. He has edited magazines and produced shows for numerous channels, including "Motorhead Garage" with longtime how-to guys Sam Memmolo and Dave Bowman.

Email Robert at rbravender@comcast.net



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THE STORY OF THE JEEP: THEN TO NOW

First production version of the Bantam Jeep. One of 70 initially produced for the Army. Fenders were squared off.

TODAY'S AVERAGE CITIZEN SELDOM CONSIDERS THE JEEP AN OFFSPRING OF A HERO, ALTHOUGH THERE ARE STILL THOSE TRIED-AND-TRUE FOLLOWERS WHO CONNECT THE PRESENT TO THE JEEP'S STAR-SPANGLED PAST. TRANSFORMATION INTO THE VEHICLE WE ALL KNOW AND LOVE TODAY WAS NOT WITHOUT DIFFICULTY, AND THE LATEST VERSION OF THE VEHICLE IS POSH COMPARED WITH ITS WORLD WAR II GRANDFATHER.

BY **NORMAN NORVILLE** | CONTRIBUTING EDITOR

The decision that led to motorized troop transportation — and thus, the Jeep — was not without early precedent. As the German army marched on Paris in 1914, French troops were dispatched to the front in commandeered Renault taxis. These taxis were considered to be the first use of motorized vehicles for troop transport.

Jim Gilmore is a military vehicle historian, restoration expert and member of the Redball Military Transport Club. He owns 18 restored military

vehicles ranging from armored cars to Jeeps, and has served as director and Judging Chairman of the Military Vehicle Preservation Association. According to Gilmore, the Renault taxis “were not used for day-to-day operations, but they did provide the French with effective transportation in a time of need.”

The U.S. relied heavily on horses and motorcycles during World War I. However, the cost of food and handling of horses took a toll on strategic advantages. Motorcycles proved no better,

with limited carrying capacity and the need for each driver to be thoroughly trained. Trucks were, and still would be used, but they were cumbersome

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and frequently got stuck in rough terrain. “In the late ’30s, Germany used more horses than any other army,” notes Gilmore.

The U.S. made several attempts to build a machine that would effectively replace the horse. As late as 1937, the military experimented with a vehicle called the Howie Machine Gun Carrier, nicknamed “Belly Flopper” because of the way GIs would lay on their stomachs to drive the vehicle. Reaching speeds up to 30 mph, the two-passenger, machine gun-equipped car was fast, but lacked an adequate suspension system. The ride was so rough that its occupants had to lie on mattresses.

Although debated by some as propaganda, the highly publicized mechanized advancement into Poland, Belgium and France would provide every incentive for the U.S. to speed up the process of developing more suitable mechanized transportation.

Beginning with Bantam

Most people associate the beginning of Jeep history with two companies, Willys-Overland Motor Co. and Ford Motor Co. But it was actually the American Bantam Car Co. that first produced a working Jeep prototype.

Bantam started out in 1929 as the American Austin Car Co., producing small cars based on the British Austin 7. The company struggled to make it out of the Depression and filed for bankruptcy in 1934. In 1937, a reorganized American Bantam Car Co. cut its British ties and resumed civilian automotive production.

As early as 1938, Bantam engaged in negotiations with the military to produce a lightweight reconnaissance vehicle. This paved the way for the small company to develop the first military-use prototype Jeep.

Skeptical that Bantam could produce enough vehicles, the military requested bids from 135 automotive manufacturers to develop a 4-wheel-drive (4WD) vehicle to their specifications, which included a wheelbase not to exceed 80 inches, height not to exceed



Watch a video showcasing DanAm Co.'s 1956 Ford Thunderbird Medal of Honor model at MotorAge.com/MedaIT-Bird

40 inches, a rectangular body with folding windshield and a mount for a .30-caliber gun.

The initial military request called for prototype production within 49 days, with subsequent production of 70 vehicles in 75 days. Most American manufacturers were reluctant to participate in a military bidding process because of the stringent deadlines, so there were very few takers.

Bantam hired engineer Karl Probst to design the prototype, which was delivered on Sept. 23, 1940 — on time and within specifications. The prototype would satisfy the military’s need for a small 4WD vehicle able to carry at least three people, while also being able to pull a trailer of at least 500 pounds.

The first vehicle was named “Bantam Number One” and was equipped with a Continental Motor Co. 112-cubic-inch, 4-cylinder, 45-hp flathead engine with 86 foot-pounds of torque. The vehicle also had a 3-speed Warner T-84 transmission with a Spicer Dana 2-speed transfer case.

Enter Willys and Ford

Little did Bantam officials know that two other companies would use their original design as a template for mass production. While the military was pleased with the initial Bantam prototype, there were concerns over price, and lingering doubts that such a small company could produce enough vehicles.

“Bantam was not in the same class as these other manufacturers,” Gilmore points out. “The company was almost out of business before they began negotiations with the military.”

Willys-Overland Motor Co. and mass-production giant Ford Motor Company were the only other bidders to respond, but they could not produce their prototypes within the required 49 days. To the chagrin of Bantam officials, engineers from Willys and Ford were permitted to study the completed Bantam prototype while their own prototypes were being built. After the two companies submitted their prototypes, the inexpensive price of the Willys

Quad caught the military’s eye. At \$739 per unit, it presented great value over the Bantam (\$1,166) and Ford’s Pygmy (\$1,200) prototypes.

Then, the military asked all three companies to produce 1,500 vehicles each for additional testing. While there was to be only one winner in the bidding process, the military’s strategy was to combine the best qualities of all three. In the end, the Willys vehicle (now designated MA) won the contract.

“Many believe Bantam was hoodwinked by the government, but it was just a matter of cost vs. budget. The Willys vehicle was much cheaper. That’s why they got the nod,” says Gilmore, adding that Bantam was aware that any and all blueprints became government property once the prototype was approved and “the military could do what they wanted with the blueprints.”

Willys began production of the welded slat grille vehicle (now designated MB) in November 1941. It soon became apparent that even Willys could not keep up with production demands; in 1942, Ford was subcontracted by the government to produce a similar vehicle and named it GPW.

Initially, both vehicles used the 60-hp, 105-foot-pound torque flat-head Willys-supplied L134 “Go Devil” engine. However, limited engine supply opened the door for Ford to start



No one knew at the time that this Jeep would become an American Icon.



The Howie Machine Gun Carrier was known as “The Belly Flopper.”

building the engine to Willy's specifications. To distinguish its origin, each engine was given a serial number that began with MB or GPW. Ford's vehicle was also initially distinguished by its stamped metal grille, which was said to be easier to produce and lighter in weight. To be uniform with parts interchangeability, Willys started using the stamped metal grille in April 1942.

The first production contract was for 16,000 vehicles. By the end of the war, Willys would produce more than 350,000 vehicles and Ford almost 280,000 more. Bantam, the company who built the first prototype and delivered it on time, would only produce around 2,600 vehicles, mostly to be used by American Allies.

A Jeep by any other name

Although there are no definitive answers as to how the Jeep got its name, different stories spawned from the times, with each story disputed in some way. Up until the start of the war, the vehicles were only known by the model designations issued by their respective manufacturers. Before they received their MB and GPW designations, Willys called its prototype the Quad, and Ford referred to its model as the Pygmy. Bantam named its prototype Bantam Number One, and subsequent production vehicles the Bantam Reconnaissance Car (BRC).



Bantam Number One was the model from which all Jeeps were derived. Note the rounded fenders.



Willys MB test vehicle with stamped metal grille designed by Ford.



Ford model GP crossing a stream.

Some say that the Jeep name was taken from the popular Popeye comic character "Eugene the Jeep," given his ability to go anywhere. Others say the name was derived from the acronym "GP," standing for general purpose. Gilmore contests the latter, saying that the military never designated the vehicle for general purpose. "GP was Ford's terminology," he said. "In their service manuals, the G stood for Government and the P designated an 80-inch wheelbase, which was the specification for the Jeep." He added that the "W" stands for a Willys-designed engine built by Ford.

The most likely origin of the name comes from military vernacular that dubbed anything new and untested a "Jeep." In early 1941, during a Washington press conference, Willys test driver Red Hausmann was asked by reporter Katherine Hillyer about the name and he replied, "It's a Jeep." The article was printed in the Washington Daily News on Feb. 20, 1941, and included a caption naming the car "Jeep." As he was performing tests at Fort Holabird, Hausmann said he heard soldiers refer to other new equipment as Jeeps.

Wartime uses

The Jeep earned its stripes very quickly after entering the war. Its 4WD, low stance, high ground clearance and set-forward front wheels enabled it to maneuver in the roughest terrain with relative ease. The equivalent German vehicle, the Volkswagen-based Kübelwagen, only had 2-wheel-drive, but had unit-body construction. The vehicle was fast and agile, but lacked some of the Jeep's 4WD prowess. Each

vehicle possessed certain technological advantages over the other, but the Germans were so impressed with the Jeep that a standing order was given to capture all Jeeps for use in the German army.

Jeeps could be quickly modified to do a multitude of jobs. With a properly customized exhaust, the Jeep could be driven through water almost totally submerged. It could also be wrapped in a tarp and floated across larger bodies of water. An amphibious Jeep designated "GPA" was built by Ford and modeled after the larger DUKW, or "Duck" amphibious vehicle.

Some Jeeps carried VIPs, while others were rigged to tow 37mm anti tank guns. Jeeps were even fitted with rail wheels for towing cargo along railroad tracks. The Jeep could be an ambulatory carrier when needed, drastically shortening transportation time to field hospitals. They were used to lay smoke screens, deliver mail, plow snow and clear brush. They were even equipped with water tanks and power takeoff (PTO)-driven pumps to double as mini fire engines.

All of these configurations served the Allies well, and the Jeep was said to be one of the most important vehicles in the war. According to Gen. Dwight D. Eisenhower, "the Jeep, the Dakota, and the Landing Craft were the three tools that won the war."

War's over, what's next?

As early as 1944, confidence in winning the war was getting strong, so Willys executives started planning for a postwar Jeep. The Jeep's popularity with GIs prompted the company to file a trademark application for the Jeep

name so they could exclusively sell the vehicles back home.

The U.S. however, faced a major problem. There had been more than 600,000 Jeeps produced and shipped all over the world. Bringing them back to use at home would be a major undertaking, and have a negative impact on Willys' future profits. The influx of such a large amount of vehicles could also hurt other manufacturers, and possibly the U.S. economy. Willys was against returning the vehicles to the U.S. and turned its attention to producing and selling new Jeeps for returning soldiers to use on farms. Instead of returning to the U.S. as heroes, Jeeps were unceremoniously scrapped, sold, given to the Allies or dumped into the ocean at war's end.

Enter CJ

In 1945, Willys produced the civilian Jeep CJ-1, which was nothing more than a modified version of the Willys MB. Later that year, the CJ-2, or “Agri-Jeep,” was created. The CJ-2 prototype would become the 1945 civilian full-production version CJ-2A, which was the first Jeep produced for farming, ranching and industrial applications.

The CJ-2A was produced from 1945 to 1949, taking advantage of as many war surplus parts as possible. According to Gilmore, “Willys couldn't stray too far away from the military Jeep because of the surplus parts that were available.”

It featured a bolstered driver's seat cushion, tailgate, larger headlights and a side-mounted spare tire. The Warner T-84 transmission was replaced by the stronger T-90, but the power plant remained the venerable Go Devil engine. Extras such as a canvas top, passenger seats, vacuum-powered windshield wipers and a PTO were available. CJ-2A colors included Pasture Green, Harvest Tan, Michigan Yellow and Picket Grey, among others.

Realizing the need to bridge the gap between utilitarian and farm vehicles, Jeep also produced a wagon (called the Jeepster) starting in 1946, and a pickup truck in 1947. The Jeepster was originally equipped with rear-wheel-drive (RWD), but eventually was outfitted with 4WD. This vehicle was said to be the first all-steel utility vehicle.

The popularity of the CJ-2A led to

the 1949 introduction of the CJ-3A. Still powered by the Go Devil engine and T-90 transmission, it featured a beefed-up suspension, one-piece windshield and waterproof ignition system.

The beginning of the Korean War in 1950 saw Jeep thrown into battle once again. The M38, which began production in 1949, was used alongside WWII Jeeps that managed to survive the war. The M38 was an updated version of the CJ-3A that had conventional

wipers, larger headlights and a stronger suspension and drive axle. In the war, they were mostly used to scout forward positions and to direct bombing raids. The military's conventional wisdom was while the Jeeps would be useful in the lowlands of South Korea; they would be impossible to maneuver in mountainous North Korea.

The next version of the military Jeep was the M38A1 and started production in 1951. This vehicle had a longer wheel-



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base and was heavier than the M38. It also had a larger gas tank and a new engine with increased horsepower.

Kaiser takes notice

In 1953, industrialist Henry Kaiser of Kaiser Motors was enamored with the Jeep brand and purchased Willys-Overland to operate as a subsidiary. The company's name was changed to Willys Motor Co., and production of the Jeep CJ-3B began, once again featuring updates to its engine and drivetrain. The CJ-3B was also licensed and exported overseas.

Willys intended to follow the CJ-3 designation with a CJ-4, but only one CJ-4 concept was ever built. It is said that the CJ-4 yielded to Korean War M38 and M38A1 production. The M170 Jeep started production in 1953, but was mostly used as a field ambulance. This vehicle was said to be close to the CJ-6 in design.

The CJ series continued after the war with the introduction of the CJ-5 in early 1955. Later the same year, the 20-inch-longer CJ-6 was produced and marketed as a work vehicle. The old CJ-3 coexisted in production through the 1960s, and the CJ-5 enjoyed a production run of almost 30 years. The CJ-6 was exported overseas until 1974.

The desire to utilize the more established Kaiser name led to the 1963 formation of the Kaiser-Jeep Corp. During the 1960s, an optional British-made Perkins 4-cylinder diesel was offered and a General Motors 155-hp V6 was introduced. Other upgrades such as power steering and side marker lights complied with consumer demand and government safety mandates.

Ford Motor Co. was given a contract to produce the M151 Military Utility Tactical Truck (MUTT) from 1960 to 1969. The vehicle had a redesigned body, which gave it better ground clearance. It also featured an independent front suspension.

There were rumors, however, that this vehicle suffered from excessive rollovers. "That's not entirely true," says Gilmore. "The driving feel of previous military Jeeps had a way of alerting a driver that vehicle limitations were about to be exceeded, but the independent suspension and increased ground clearance on the MUTT gave drivers a false sense of security, which prompted some driv-

ers to take unreasonable chances."

AMC jumps in

By the late '60s, the CJ-5 was starting to show its age. Kaiser's own Wagoneers, along with high-end vehicles from other manufacturers, were gaining in popularity. An influx of new production dollars was needed to expand the product line, so American Motors Corp. stepped in to purchase Kaiser-Jeep in 1970. The new company would be named AMC-Jeep, and would focus its marketing efforts on the youth. Afterward, the company would establish a subsidiary named AM General Corp., which would ironically contribute to the military Jeep's demise.

Taking note of consumer demand for size, comfort and power, AMC increased the size of the CJ-5 wheelbase, fenders and hood to accommodate larger engines and more sophisticated drivetrains. The frame was bolstered, and a limited-slip differential was added. Ergonomics were improved and options such as a tachometer, AM-FM radio and power disc brakes were offered.

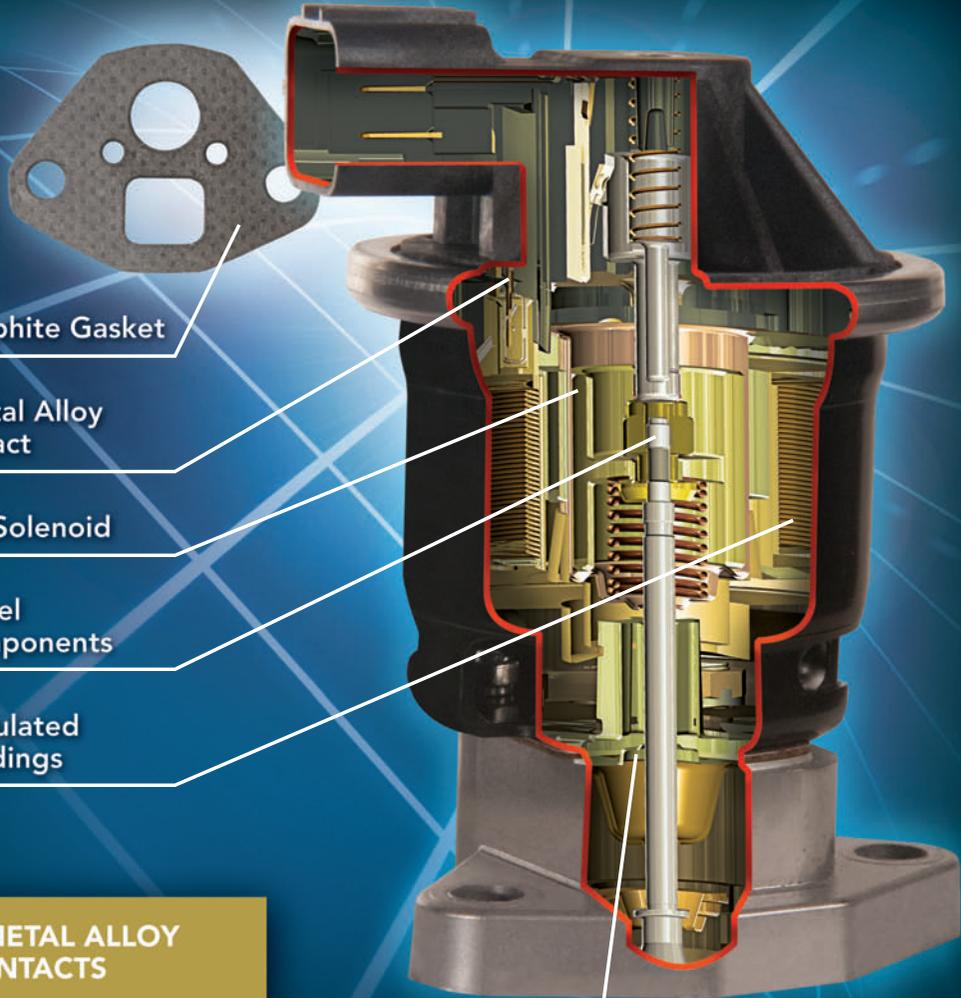
Sensing the need for an even larger vehicle with more creature comforts, the CJ-7 was produced from 1976 to 1986. The wheelbase was stretched and the chassis was improved to provide better handling and stability. Automatic all-wheel-drive (AWD), along with an optional automatic transmission, was offered. The CJ-7 also included a molded hardtop and steel doors. It could be outfitted with air conditioning, leather seats and a chrome bumper package, among other amenities. Engine offerings included a 2.4-liter diesel, 2.5-liter inline 4-cylinder, 3.8 and 4.2-liter inline 6-cylinder engines, and a 5.0 liter V8. Axles and transfer cases were dependent on the size of the engine and the year the vehicle was built.

The end of the 1970s saw a decline in the U.S. automotive industry. Costly emission and safety regulations were enacted at a time when automakers were fighting with European and Japanese competition that produced smaller, less expensive and more fuel-efficient vehicles. Conflicts in the Middle East caused oil prices to skyrocket, making imports even more attractive to consumers.

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controlling interest in AMC-Jeep. These times were particularly hard on the Jeep brand. The public viewed the company as a market share also-ran compared to the Big Three as Jeep sales steadily declined.

Still, AMC-Jeep moved forward with the CJ-8 Scrambler in 1981 and produced the vehicle until 1985. The car featured a unique design, with a small pickup bed and both soft and hard removable tops. Available engines were a 2.5-liter 4-cylinder and a 258 cubic inch straight six. Transmission choices included BorgWarner and Tremec manuals, along with Chrysler automatics.

Unfortunately for the military Jeep, AMC subsidiary AM General contracted to produce the High Mobility Multipurpose Wheeled Vehicle (HMMWV, or Humvee) in 1983. This was the death knell for the military

Jeep, and 1985 witnessed the end of its production.

"It was a sad day when they stopped making the military Jeep," says Gilmore.

Chrysler buys AMC-Jeep

The introduction of the 1984 Jeep Cherokee seemed to temporarily revive sales, making the company slightly more attractive for potential buyers. Looking to expand its market share, Chrysler Corp. took interest and purchased the struggling AMC-Jeep in 1987.

That year, the new Wrangler YJ replaced the beloved CJ. Produced until 1995, the YJ was not an instant hit. Even though it was recognizable as a Jeep, it featured rectangular headlamps and purists who mourned the demise of the CJ considered the YJ "soft" and more "sporty" than the rugged Jeep of yore.

The YJ offered a wider wheelbase than the CJ, along with improved comfort and handling. Fuel injection was introduced. A larger windshield allowed for greater visibility. It was offered as a two-door convertible or hardtop and included a choice of a 4-cylinder, straight six, or V6 engines. The vehicle could be equipped with one of four different transmissions depending on the trim level.

The next version of the Wrangler was called the TJ and was produced from 1997 to 2006. Reacting to consumer feedback from the YJ, this version was equipped with round headlamps. However, coil springs replaced leaf springs, enhancing comfort and handling. The vehicle could be

equipped with one of two 4-cylinder, or a 6-cylinder engine depending on the year and trim level.

The year 2007 brought on the current production Wrangler JK, featuring something that was never before seen in the military-derived Jeep. The option of a long-wheelbase 4-door model was introduced in two of the packages. Trim levels included right-hand-drive, off-road and "luxury" versions. Computer electronics were introduced, and new features such as antilock brakes, traction control, hill descent and stability control were added. The KJ is equipped with a 3.6-liter V6, and can be equipped with either a 4-speed automatic or 6-speed manual transmission.

In the end, it's still a Jeep

The Jeep has become one of the most versatile vehicles ever produced. Since the development of Bantam Number One in 1939, it has survived three wars, eight different ownership variations and no less than 10 model changes. Ford is the only World War II Jeep producer still standing, and Chrysler continues to carry the Jeep torch into the future. Although more consumer-friendly, today's rugged design and go-anywhere prowess still harkens back to the car's beginnings. Without a doubt, the intent is to stay close to its roots.

Some say that today's Jeep is a mere shell of its predecessor. Arguments are made that the original vehicle was "tough" and could withstand the rigors of war. Even debate over the origin of its name still rages. One thing's for sure, the Jeep is one of the select few automobiles in the world that was built for battle, but successfully evolved into a consumer favorite. *TZ*



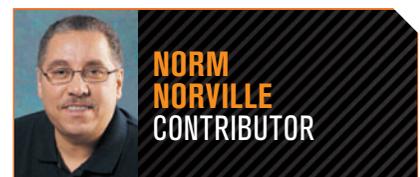
Willys MB Jeep rigged to run on rail-road tracks.



Many Jeeps became useful for farming



Ford GPA amphibious Jeep.



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Norm Norville is an ASE-certified editor, educator and automotive/diesel technical specialist. He has worked for various dealerships as a technician/manager, an editor at Chilton Book Co., and maintenance and technology editor for *Commercial Carrier Journal (CCJ)*. His experience also includes instruction and administration at two technical schools focusing on automotive and diesel technology.

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TECHNOLOGY

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The ULV is not intended for deployment, but for research that will have an impact on future designs of light tactical military ground vehicles.

WHAT 'GOING GREEN' MEANS TO THE ARMY

MILITARY HYBRID VEHICLE
DESIGNS DO A LOT MORE
THAN JUST SAVE FUEL.

BY PETER F. MEIER | TECHNICAL EDITOR

One of the most dangerous missions our service men and women face is in the delivery of fuel to remote outposts. These lumbering caravans make easy targets for insurgents, and we've all seen the carnage caused by improvised explosive devices (IEDs). The development of hybrid and fuel cell technology not only provides military ground vehicles with increased range and capability, they reduce the

need for these dangerous missions.

According to one military source, "a mere 1 percent improvement in energy efficiency would mean 6,444 fewer soldiers would have to participate in fuel convoy missions." With the help of some new friends at the U.S. Army's Tank Automotive Research, Development and Engineering Center (TARDEC), I was able to learn about some of the projects currently being worked on.

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But first, exactly who and what is TARDEC? Headquartered at the

Photos: TARDEC

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U.S. Army Detroit Arsenal in Warren, Mich., TARDEC is the nation's laboratory for advanced military automotive technology. It serves as the Ground Systems Integrator for all Department of Defense (DOD) manned and unmanned ground vehicle systems. With roots dating back to World War II, TARDEC is a full life-cycle, systems engineering support provider-of-first-choice for all DOD ground combat and combat support weapons, equipment and vehicle systems, and is made up of both military and civilian experts. TARDEC's staff of technical, engineering and scientific professionals lead cutting-edge research and development projects in Ground Systems Survivability, Power and Mobility, Ground Vehicle Robotics, Force Projection, and Vehicle Electronics and Architecture. All of these projects focus on improving the effectiveness of our nation's ground forces while keeping our soldiers safe.

FED Alpha and Bravo

Research into hybrid drivelines was only part of the equation with which TARDEC designers were charged. Improved efficiency is not only measured by miles per gallon, but what the vehicle can do in the field to support our ground troops, and how safe it can keep them in the case of an enemy attack or accident.

One of the early prototypes was the Fuel Efficient Demonstrator (FED) Alpha. "Light" by military standards (11,650-pound truck with a 2,900-pound payload), the Alpha featured a Cummins 4.5 liter 4-cylinder common rail diesel engine said to produce 200 horsepower and 560 foot-pounds of torque (they don't have to worry too much about emissions). It's coupled to a 30-kilowatt 24-volt starter/generator for power production. That can put a big load on the engine at low rpm, so a small overdriven supercharger is mated to the turbo-equipped diesel. The supercharger is only used at low rpm and disengages as the engine reaches turbo operating range. The electric power is needed because of all of the accessories and tactical equipment fitted to the platform. Power delivery to the drive wheels is accomplished through an Aisin six-speed automatic similar to the unit used in



The FED Alpha achieved a 70 percent improvement in fuel efficiency.



The FED Bravo added a hybrid system to the FED Alpha, plus the ability to export electrical power for field use.



The CERV uses electric drive and can go silent (electric only) for up to 12 miles.

the Ram Chassis Cab.

Built around a blast shielded aluminum monocoque frame, it measures roughly 17 feet in length, 7½ feet wide and 7 feet tall. It carries four fully equipped soldiers riding in blast-attenuating seats. Ride quality is provided through air springs, with titanium coils fitted inside to minimize ride height loss if a bag is damaged. Spring control is handled by Koni FSD shocks, and the terrain challenges are met with composite wheels fitted with Goodyear Unisteel 335/65R22 tires.

TARDEC testing put fuel economy for the FED Alpha at 7.1 mpg during urban mission use, 4.8 mpg on cross-country missions, and 12.6 when performing convoy and tactical idling (using half a gallon of fuel per hour). And while most of us would cringe at those num-

Watch a video of how Ford is studying robots in space to gain insight into autonomous driving

MotorAge.com/FordRobots

bers from our personal vehicles, even if we did own a Monster 4x4, the FED Alpha actually achieved a 70 percent improvement in overall fuel economy.

The following year, TARDEC displayed the FED Bravo at the SAE World Congress. The Bravo incorporated hybrid drive

technology that the Alpha didn't have, and was also designed with the ability to export electrical power — enough to handle the electrical needs of a small command post or base if need be. The Bravo is powered by a Ford 4.4 liter, twin turbocharged V8 diesel rated at 268 horsepower coupled to a six-speed automatic connecting to the rear drive. The front drive is powered solely by an electric motor/generator that is used to recharge the lithium ion battery dur-

ing braking (regenerative braking). It is also equipped with automatic start-stop like most hybrids to conserve fuel and is capable of going electric only for short distances. Further efficiency improvements were gained from using ceramic brake rotors (rather than steel), and by combining the braking and steering hydraulics into one system. The Bravo's fuel economy is estimated at 8.2 mpg in urban environments (that's military for city driving) and 14.2 mpg on paved highway.

CERV

The Clandestine Extended Range Vehicle (CERV) is a joint project of TARDEC and Quantum Fuel Systems Technologies. It was designed for quick-paced surveillance and target acquisition missions. This diesel/hybrid platform can maintain speeds of 80 miles per hour and climb 60 percent grades. It's the ultimate dune buggy.

Power is supplied to the wheels through a 100-kilowatt drive motor and is entirely electrically driven. The

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Ford 1.4 liter Duratorq engine drives a 50-kilowatt electric motor/generator used to keep the 380-volt lithium-ion battery pack charged and to feed the electric drive. The CERV can operate in electric-only mode for 5 to 12 miles with the engine off, earning the "clandestine" in its name.

Its overall size allows it to fit in the back of the V-22 Osprey tilt-rotor aircraft. There's room for three seated soldiers, with a fourth standing to man the .50-caliber M-2 machine gun; it has a towing capacity of 5,000 pounds. It's relatively light, too, weighing in at 3,500 pounds. Range is approximately 300 miles with its internal fuel storage, but that can be doubled with the addition of external tanks.

ULV

How about a Humvee-sized vehicle with the survivability of a larger trans-

port, mated with the fuel efficiency of a hybrid drivetrain? That's what the Ultra Light Vehicle (ULV) prototype was designed to do. From concept to build in only 16 months using commercially available materials, the ULV is one of TARDEC's newest projects and was designed to meet these Department of Defense goals: 4,500-pound payload capacity, under 14,000 pounds curb weight, and occupant protection at least equivalent to the Mine-Resistant Ambush-Protected (MRAP) vehicle.

Three prototypes were built, with two assigned for mobility, mine blast and ballistic survivability testing while the third was moved to TARDEC's Ground Systems Power and Energy Laboratory for mobility and fuel efficiency testing. The ULV is not intended as a future replacement for the Humvee or for the Joint Light

Vehicle Tactical program, but instead will be a research platform that will shape the design of ground vehicles in the foreseeable future.

"It's all about sharing the data," says Mike Karaki, ULV program manager, in a TARDEC press release. "If we have an ability to share the data internally within TARDEC, and externally within the program managers and program executives offices, and beyond that with other government agencies, we will attempt to do that. It's helping shape and inform future programs."

The ULV uses a hybrid powertrain that drives the front and rear axles with electric motors mounted in the center of axle and directly coupled to a conventional differential (only one is needed for propulsion, adding redundancy to the powertrain in the event of damage). The elimination of the driveline allows engineers to

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Ultra Light Vehicle (ULV) Research Prototype




U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC)



EPA DOT Fuel Economy Estimates JP8 Vehicle

Fuel Economy

14.7 PTM
[6.86 MPG]

Munson Gravel Terrain 17.0 PTM [8.10 MPG]	Harford Paved Terrain 12.9 PTM [6.14 MPG]
Churchville B Trails Terrain 13.1 PTM [6.26 MPG]	Tactical Idle at 10kW Export 1.27 GPH

Combined Fuel Economy Rating

30 GAL fuel tank **cost \$111.90**

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tardec.army.mil/ulv

PERFORMANCE @ GVW (MODEL PREDICTIONS)

Top Speed: 74 mph
Speed on 5% Grade (Initial/Cont): 45/38 mph
Acceleration 0 - 30 / 0 - 50 mph: 5.1/16.2 s
Vertical Step: 18 inches
NATO Lane Change: > 45 mph
Lateral Acceleration: 0.54 g's
Gradeability Longitudinal/Side Slope: 60%/40%
NMM Cross Country Speed/% No Go: 25 mph/18.2%

SILENT OPERATION @ GVW (MODEL PREDICTIONS)

Battery SOC: 80%-20%
Silent Watch: 4.38 hours
Electric Range: 12 miles

SUB-SYSTEM DESCRIPTIONS

Subaru Boxer Horizontally-Opposed Turbo Diesel Engine Maximum Power: 175 hp
Rated Engine Torque: 260 lb-ft
JP8, 30 gallon tank

UQM-200 Power Phase Generator and Inverter Peak Power: 200 kW
Continuous Power: 120 kW
380VDC bus, 6kW 380VDC to 28VDC converters
3kW 380VDC to 12VDC converter

Navitas Li-Iron Phosphate Battery (Li-Fe-PO₄) Capacity Energy Power: 14.2 kWh
Peak Output Power: 180 kW
Continuous Output Power: 65 kW

American Traction Systems (ATS) Drive Inverters Remy-410iVH HT drive motors, High Voltage Hairpin Conductor, Permanent Magnet Rotor

EATON E-Locker Differentials Ratio: 3.08:1
LOC Planetary Gearing Hubs Ratio: 2.6:1
Gearing ratio overall, motors to tires: 8:1

LiquidSpring Compressible Liquid Adaptive Suspension System: 18 inches of travel, with integrated elastomeric jump bumper

Hutchinson Wheels: Aluminum, 20" diameter X11" wide, 40mm positive offset, 335mm bolt circle, 8 hole pattern.

Mickey Thompson Tires: Baja ATZ Radial, 40X14.5R20LT - 4805 lbs load capacity at 65psi

Service Brakes: Outboard mounted, hydraulic, master cylinder push rod, 380mm carbon-ceramic rotors, six piston calipers

Parking Brake: Caliper type - rear wheel outboard, spring activated, hydraulic release

Jankel: Blast Limiting Attenuation Seats

MODEL PREDICTIONS and ESTIMATES

Length: 199 inches	Curb Vehicle Weight: 13,916 pounds
Width: 95.7 inches	Payload: 4,284 pounds
Ride Height: 81 inches	Gross Vehicle Weight: 18,200 pounds
Transport Height: 72 inches	Axle Weight (Front/Rear): 43%/57%
Wheelbase: 134 inches	Crew Seating: 4 + 1 Gunner
Ground Clearance: 5 to 23 inches	Range (35mph, flat): 337 miles
Interior Volume: 171 ft ³	

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improve blast shielding in the underbody of the vehicle. A Subaru Boxer (horizontally opposed 4-cylinder) turbocharged diesel provides the power to the 200-kilowatt motor/generator, feeding a 380-volt lithium-iron phosphate battery pack rated at 14.2 kWh and capable of providing all-electric drive for approximately 10 miles if needed. A liquid adaptive suspension system with 18 inches of travel keeps the 40x14.5R20LT Mickey Thompson Baja ATZ radials on the terrain. Inside are the latest command, control, communications, intelligence, and surveillance and reconnaissance equipment.

“We tried to push the envelope in terms of state-of-the-art and out-of-the-box materials throughout the entire development process,” Karaki says.

Remote-mounted and controlled electronics improves space and reduces HVAC loads. Occupant safety is enhanced through the improved blast protection allowed by the electric-only drive and by designing in seven different points of entry/exit. “Clamshell” doors open away from the B-pillar to offer protection to soldiers as they exit the cabin. Further protection from attack is provided by a floating floor design that acts as a crush zone between the occupants and the steel hull, as well as by newly developed ceramic armors that also aid in overall weight reduction.

Hydrogen fuel cells

Nearly two years ago, in Honolulu, the Army unveiled a fleet of 16 hydrogen fuel cell vehicles that were tested in an effort to find ways to reduce the dependence on petroleum fuel sources. This past December, TARDEC hosted a ribbon-cutting ceremony to kick off its newest hydrogen fuel cell testing program in partnership with General Motors at the U.S. Army Ground System Power and Energy Laboratory (GSPEL, in military lingo). The event highlighted the already numerous Cooperative and Research Development Agreements (CRADAs) aimed at furthering the overall mission of improved fuel efficiency and reduced energy dependency.

“Through CRADAs, such as the one with GM, the Army has the opportunity to leverage its research and development efforts with industry,”



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explains TARDEC Director Dr. Paul Rogers in the press notice. “A goal of TARDEC is to demonstrate battlefield fuel reduction to reduce the logistical burden on our warfighters... and will assist in maturing and accelerating technologies critical to the Army’s future ground vehicle platforms.”

Unmanned vehicles

If you’ve been keeping up with our reports on autonomous driving, it

should come as no surprise that the same concept is being applied to military applications. What better way to handle the most dangerous of logistical operations (keeping the troops supplied) than by removing the troops from the vehicles entirely?

That’s the thinking behind the Autonomous Mobility Appliqué System (AMAS). Developed jointly by TARDEC and Lockheed Martin, the concept of driverless convoys

was demonstrated at Fort Hood, Texas, earlier this year. The system is designed not only for long-distance, open-road missions, but is also compatible with the challenges of an urban environment.

In testing, driverless vehicles were able to navigate a variety of hazards and obstacles — including pedestrians, road intersections and traffic circles, oncoming traffic and passing vehicles. The vehicles themselves aren’t what are special; it’s what is added that makes the system work. Each vehicle is equipped with a high performance Light Detection And Ranging (LIDAR) sensor system and second Global Positioning System (GPS) receiver. The system equipment, according to Lockheed Martin, could be used on virtually any military ground platform.

Initially awarded an \$11 million contract in 2012, Lockheed Martin developed the multi-platform kit integrating low-cost sensors with both Army and Marine tactical vehicles to enable autonomous operation in convoys. The result is not only improved safety for our military men and women; it also helps move the military toward an end goal of totally autonomous warfare.

Similar AMAS algorithms are also used in the Squad Mission Support System (SMSS), a distinctive six-wheeled platform that has been successfully used by troops in Afghanistan. Robotics, integrated and actual, are helping to relieve the burden of supervisory and mundane tasks from soldiers in the field under combat conditions, allowing them to focus on keeping themselves and their fellow soldiers safe. **ZZ**



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Pete Meier is an ASE certified Master Technician and sponsoring member of iATN. He has over 35 years practical experience as a technician and educator, covering a wide variety of makes and models. His primary goal is to bring working techs the information they need.

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A TALE OF COUNTERFEITS AND CONTAMINANTS

IS THAT 30-POUND JUG OF R134A YOU BOUGHT ONLINE *REALLY* R134A?

BY PETER F. MEIER | TECHNICAL EDITOR

Back in March 2011, *Auto A/C Reporter (AAR)*, a respected publication serving the automotive air conditioning industry in Europe, reported the discovery of severely contaminated R134a in several locations across the European Union. The magazine report-

ed that these containers contained large quantities of R40 and R22, and there had been instances of severe system damage as a result of the use of these contaminated sources. About the same time, it was found that hundreds, if not thousands, of international refrigerated shipping contain-

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ers had been serviced with the same formulation of counterfeit refrigerant.

Inside those containers, a bomb was brewing.

R40 is more properly known as methyl chloride. Any material can be used as a refrigerant if you can manipulate its pressures accordingly, and any material considered for use as such is assigned an “R” designation. The problem with using this particular gas in any modern refrigeration unit — be it a shipping, automotive or aerospace application — is that it doesn’t play well with the aluminum found in most of these systems. When it interacts with aluminum, it

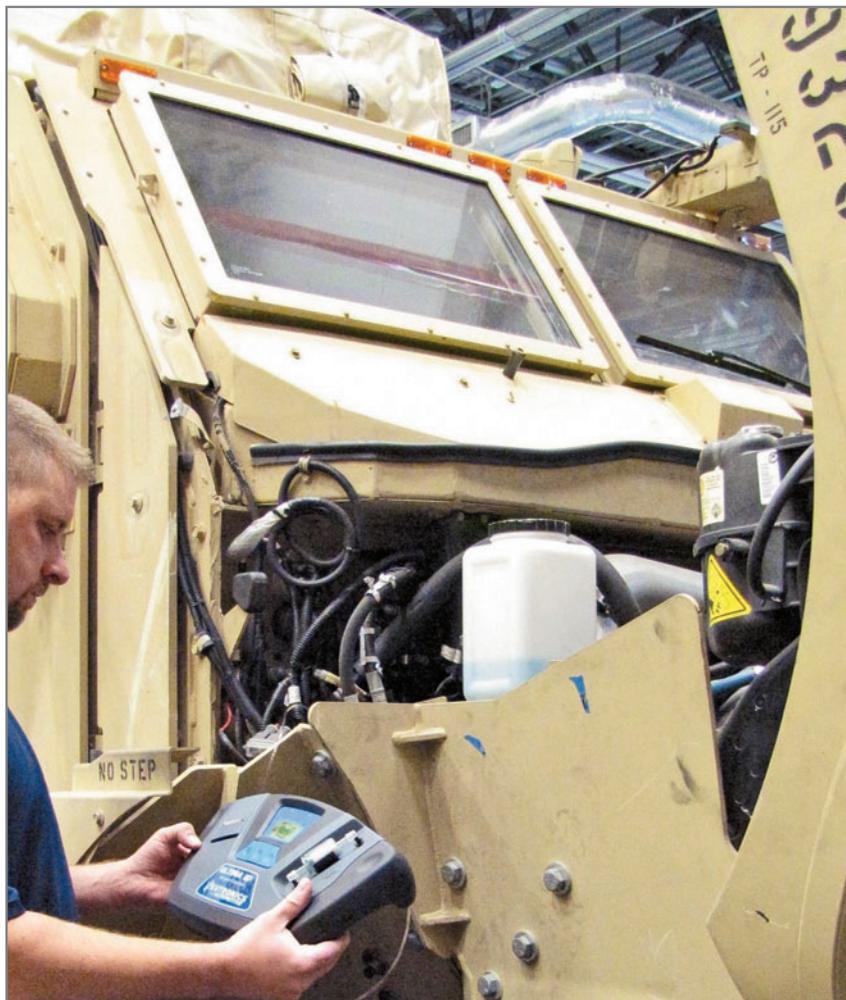
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R40 contamination
warning and
related info at
[MotorAge.com/
R40info](http://MotorAge.com/R40info)

forms a third compound called trimethylaluminum (TMA) that is “pyrophoric” — which means that it is a flammable liquid and vapor that ignites in contact with air.

Kind of like the contact with air you might see in a leaking system, or when connecting your service equipment.

U.S. Army issues alert

As the evidence grew that the use of R40 in formulating counterfeit refrigerants was not limited to a particular geographical area, the U.S. Department of the Army issued a G4 All Army Action (ALARACT) message titled “Counterfeit R-134A



TARDEC Senior Engineer Jeffrey Marcinok uses a refrigerant identifier to field test a vehicle.

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of 021415MAR12,” highlighting the discovery and potential dangers of R40 present in these counterfeit supplies.

Andrew Schultz, lead engineer of Tank Automotive Research, Development and Engineering Center's (TARDEC's) Power Lab, told *Motor*

Age, “When we became aware of the news about counterfeit refrigerant problems, we surveyed our vehicles at various locations. This revealed that we



Sealant is a leading cause of compressor failures and system woes.

Photo: Pete Meier

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had contaminated refrigerant in our [ground] vehicles.”

An Integrated Process Team (IPT) was formed to tackle the problem. There were several issues related to the contamination of military refrigeration systems that had to be determined, including:

- the ability to detect the presence of R40 and other potentially dangerous contaminants;
- understanding how R40 and other substitute chemicals used in the production of counterfeit refrigerant reacted with system components, and the safety impacts related to these interactions; and
- what to do with a system that was found to be charged with these counterfeit blends.

In addition to TARDEC staff engineers, subject matter experts from the aftermarket — including the Society of Automotive Engineers (SAE) and the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) — were also involved in finding the answers to these and other questions.

GOOD DEAL ... FOR WHOM?

While putting this article together, I “Googled” the price of R134a and found a range of cost from just under \$90 for a 30-pound container to over \$200 per jug. That’s a substantial difference in price, but before you log on to eBay and stock up on the cheap stuff, consider just how good a deal you — and your customer — may be getting.

First is the obvious question of quality. Is the manufacturer of that jug you’re buying a reputable one? And as we discussed in the main article, are you really getting 30 pounds of product, or 20 pounds of refrigerant and 10 pounds of sand?

Another reason for the price difference is a practice called “dumping.” Dumping occurs when a foreign company sells a product in the United States at less than its fair market value. Manufacturers in the Far East have easier (and cheaper) access to mineral resources critical to the production of R134a, and may even receive unfair government subsidies to allow them to sell on the global market at a price that places all other manufacturers at a disadvantage.

For those reasons, the U.S. Department of Commerce announced the initiation of anti-dumping duty and countervailing duty investigations of the imports of R134a from the People’s Republic of China. Once it is determined that these Chinese imports “materially injures or threatens material injury to” domestic manufacturers, it may impose import tariffs to level the playing field. But don’t expect that to happen until later this year.

According to Schultz, after the initial discovery, messages were sent to field personnel warning of the problem. All local purchases of R134a were placed on hold, and any needed supplies had to go through normal supply channels. Early contaminated vehicles are said to have been discovered in Afghanistan, and may have been returned to depots in the continental U.S. or shipped to other overseas duty stations. Add in the consideration that when a con-

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taminated vehicle's charge is recovered during a needed service to a previously uncontaminated recovery machine, it becomes clear that a means of isolating and identifying contaminated vehicles was needed.

To date, it has been determined that nearly 25% of the Army's ground vehicles returning from theater contain contaminated refrigerant. And it's not just R40.

"Various other benign and hazardous refrigerants have been found," says Schultz. "The initial risk of R40 has thus far been proved to be a minimal issue in Army ground vehicles. However, flammable contaminants have been significantly more prevalent. Army fielded equipment, which is commercial automotive, is not certified to handle these chemicals and can result in fires. Some of the non-flammable contaminants have been found to destroy seals/hoses causing system failure." That's not good if you're on a convoy mission in the middle of the desert.

Is this strictly an overseas or military problem? Peter Coll, vice president at Neutronics Refrigerant Analysis and vice-chair of the SAE Interior Climate Control Service committee, told *Motor Age* that the processes and protections in place for U.S. imports of refrigerant help keep the occurrence of dangerous

counterfeits at a minimum here.

But it's a serious issue in other parts of the world, particularly in Brazil, Vietnam, Korea, Dubai and the United Arab Emirates — all of which happen to be major shipping ports.

If you think this is more of a shipping industry issue, think again. The container of refrigerant they use is the same one we do.

Many forms

"There are different forms of counterfeiting," explains Coll, noting there's brand counterfeiting — for example, a generic refrigerant in a name brand container. Then there is content counterfeiting — R12 in an R134a container, for example.

And then there is the pure counterfeit where they are calling the product R134a, in a faked "brand name" container or not, but using whatever chemical cocktail they want. "That's the most dangerous one," he says.

So far, the IPT team has found 18 different refrigerants contaminating U.S. military vehicles.

"We've tested about 2,000 contaminated systems from shipping companies, military and other facilities, and we found that every single one of them had a blend of refrigerants. We're talking about things like R22, R142b and a



The European magazine *Auto A/C Reporter* ran stories early on about unexplained catastrophic failures on some EU automotive systems.

Photo: Automotive A/C Reporter

lot of things," Coll says. "More recently, we've gotten word of some new contaminants, including R30. With the focus on R40, the counterfeiters are looking for other refrigerants they could use that we wouldn't be able to detect."

And that's where the challenge grows. Every time a counterfeit is discovered, the counterfeiters learn from their mistakes. The only sure way to tell whether R40 is present is with a gas chromatograph of the suspect refrigerant. So forget using a simple pressure/temperature test. Most counterfeiters learned long ago to use a blend of cheaper refrigerants that would mimic the PT relationship of R134a. Even if you're not concerned about R40 in your shop's supply, the only way to know



It is considered a "best practice" to test and verify what's in the car before servicing.

Photo: Neutronics

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Anything less than a 100% pure test result should be considered a red flag to servicing the system.

Photo: Pete Meier

that you have pure R134a in the tank is to test it with an identifier.

And that great online deal you found? “If I hand you a 30-pound cylinder of R134a, how do you know it’s R134a? You don’t,” Coll says. “Thirty pounds of water weighs the same as 30 pounds of R134a; 30 pounds of sand weighs the same as 30 pounds of R134a.”

Hey, we’re not making this stuff up. It’s happened!

Supply or vehicle charge

Most of our discussion has been centered on the challenges faced by our military in identifying potentially dangerous situations involving counterfeit refrigerant. The need to test supply sources prior to use, and to know what is in the vehicle prior to servicing, is clear when that potential involves the risk of explosion.

But that’s not the entire picture. Consider our fighting men and women caught in a Humvee in 120°F heat and the A/C fails — or worse, leaks a flammable refrigerant into the cabin? Consider the cost to identify, safely recover, repair and then recharge vehicles damaged by the blends used by the counterfeiters.

Those same issues apply to our work here at home. Even if you take all the precautions and buy your virgin refrigerant from a known supplier, there is still one factor you have no control over: What the customer (or

another shop) put in before he brought it to you.

“Anything less than a pure R134a test result is ‘no good,’ and should not be used [or recovered],” says Coll. “This has become a serious enough issue that, going forward, all new RRR (Recovery, Recycle, Recharge) and recovery-only equipment will require refrigerant identification before recovery of the vehicle’s charge.”

And while a refrigerant other than the one you want to install can be considered a contaminant to the system, there are additional ways to contaminate of which you ought to be aware. Air is a common contaminant that has a tremendous impact on system performance. It is also one of the easiest to add. Not performing a system evacuation prior to recharging will ensure air in the system — and who among you is willing to bet that every DIY job that finds its way to your doors has air in it?

Sealant is another common contaminant. “The low cost of sealant additives is attractive to consumers, due to the typical cost of repair,” Coll points out. A customer arrives at your door asking for help in getting his system blowing cold again, and learns that just to find where the leak is coming from may run him \$300. His favorite DIY supply store offers sealant he can put in himself for under \$20. In his mind, what’s the worst that can happen? It doesn’t work

and he’s out the \$20? If it does work, he’s saved himself \$280!

And when it doesn’t work, he’ll either add more (if one can is good, two has to be better, right?) or he’ll bring it to you. Do you honestly think he’ll tell you what he’s done? If you don’t test for the presence of sealant on every car you service, you run the very real risk of damaging your equipment — putting you out of the A/C repair business for at least a few weeks. And if your season is short already, you’ll lose a lot more money from lost sales than you would by purchasing the sealant testing kit and a refrigerant identifier.

Today, procedures and processes are in place to inspect, detect and dispose of contaminated refrigerant in our Army’s ground vehicles. It’s not a bad idea for your shop to do the same. **TL**



PETE MEIER
TECHNICAL EDITOR

Pete Meier is an ASE certified Master Technician and sponsoring member of iATN. He has over 35 years practical experience as a technician and educator, covering a wide variety of makes and models. His primary goal is to bring working techs the information they need.

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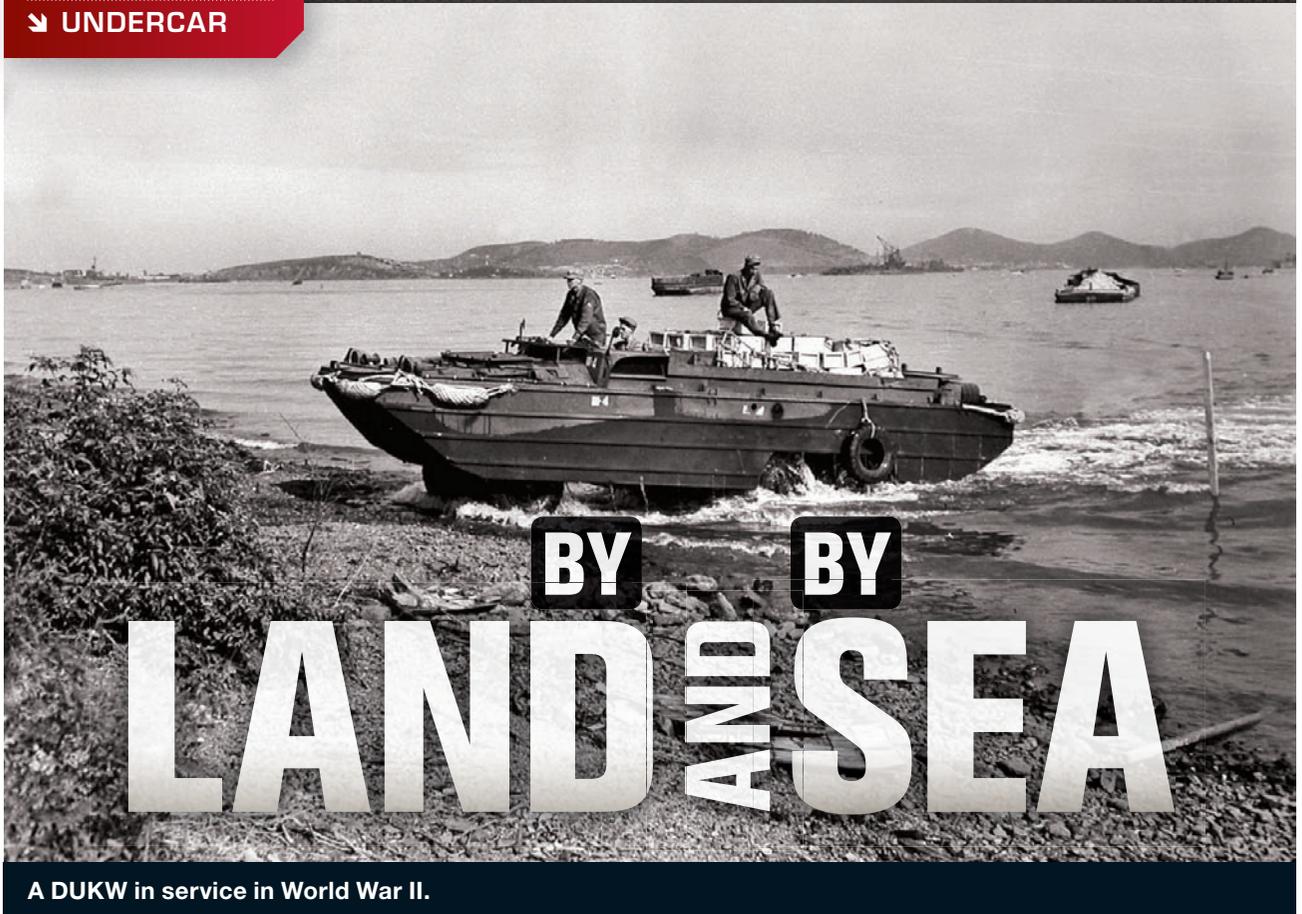
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A DUKW in service in World War II.

FROM THE START, THE DUKW HAS BEEN AN AMPHIBIOUS WONDER.

BY **NORMAN NORVILLE** | CONTRIBUTING EDITOR

If there ever was a vehicle that deserved a little love, it would be DUKW, or more affectionately named "Duck." This amphibious wonder of war has gained little recognition from anyone beyond those who saw it in action, but many people have seen and possibly even ridden in a DUKW. Unbeknownst to them, they were witness to a vehicle that helped to shape the outcome of a World War.

Jim Gilmore, a military vehicle historian, restoration expert and member of the Redball Military Transport Club, recently spoke with *Motor Age* about this amazing vehicle. He owns 18 restored military vehicles ranging from armored cars to Jeeps, and has served as director and Judging Chairman of the Military Vehicle Preservation Association.

"The DUKW was one of those U.S. military innovations that helped to win

World War II," he confirms. Gilmore explains that Armies have always struggled to land an infantry on a beachhead, and vessels made to do so prior to the war were inadequate. While trucks travelled well over land, and boats navigated the sea, there was no true amphibious vehicle that could bridge the gap between the two.

This proved true during the World War I Allied invasion of the German-influenced Ottoman Empire, in the Turkish peninsula at Gallipoli in 1915. Initial attacks were strictly naval in nature. The first naval attack included 12 British and French ships, which attempted to dislodge forward batteries. Met with light resistance, the Allies deemed the attack a moderate success. Subsequent naval attacks, however, were met with stronger resistance as mines were laid in the peninsula. The final attack was

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defeated when five Allied ships struck mines, sinking four ships.

It became obvious after the naval attacks that the Allies needed to deploy ground troops. Thinking that they had softened the resistance with naval bombardments, the Allies deployed rowing boats to carry troops ashore. The boats were woefully inadequate for shore landing, and nonstop Turkish attacks inflicted massive Allied casualties.

It was apparent that precious time



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was lost disembarking
boats and wading to
shore. More than
anything, this battle
proved that more
suitable craft was
needed to expedite
the landing of sol-
diers and supplies.

“The military
really needed a craft
that could come right
out of the water and keep
going,” Gilmore says.



Between the Wars

Remembering the Gallipoli campaign, the British created a vessel called the “Motor Landing Craft” and used it for maneuvers as early as 1926. The craft had a flat bow and was deployed at the onset of World War II. Used until late 1940, it was capable of disembarking troops and equipment from the front, and paved the way for other versions of landing craft. The Motor Landing Craft is said to be the first of its kind.

By the late 1930s, the U.S. Navy’s Bureau of Construction and Repair was requested to build a landing craft that would satisfy the need to disembark on a beach quickly. However, the military grew frustrated with the Bureau’s lack of progress, and contracted boat builder

Andrew Higgins to design
a suitable landing craft.

Higgins’ first design
had drawbacks in
that the boat had to
be unloaded over
the sides, exposing
men to combat fire.

In 1937, the
Japanese built a
landing craft with a
ramp at its bow — and
a picture of that craft pro-
vided an example for Higgins’

next design. He quickly contacted his
designers and had them develop a pro-
totype similar to the Japanese craft.

Testing proved to be successful,
and the boat was dubbed Landing
Craft Vehicle Personnel (LCVP), or
the “Higgins Boat.” The combination
wood-steel landing craft was approxi-
mately 36 feet long and carried up to
36 infantrymen. The front or bow of the
craft was a ramp, allowing for quick
disembarking.

One crucial problem would exist
with these traditional landing craft,
however: Cargo transfers would still
put troops in grave danger, as infan-
try would have to unload cargo on the
beach and then load it onto a truck or
other form of transportation, some-
times while under attack. This process



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was laborious, time-consuming and exposed the infantry to aerial attacks.

The Duck debuts

After the Dec. 7, 1941, attack on Pearl Harbor and the United States' subsequent entry into World War II, increased emphasis would be placed on amphibious warfare. The DUKW would be one of the most improbable success stories of the war.

The DUKW was the brainchild of yacht designer Rod Stephens Jr., British sailor Dennis Puleston, and ROTC Lieutenant Frank W. Speir, in cooperation with the National Defense Research Committee and the Office of Scientific Research and Development. DUKW is GMC's nomenclature description. The D indicates the year the vehicle was designed (1942), U stands for

Utility, K indicates all-wheel-drive and W indicates two powered rear axles. Looking at the name DUKW, however, soldiers could not help but use the term "Duck."

The GMC division of General Motors, known as the Yellow Truck and Coach Co. before the war, was chosen to manufacture the first prototype in April 1942. The prototype was constructed around a GMC ACKWX cab over truck.

"Actually, the military approached Ford Motor Co. first, but they declined," says Gilmore. "They were already heavily involved mass-producing the Jeep and, unlike GMC, did not have a 6x6 vehicle that could be quickly converted."

A watertight rectangular hull with a curved bow was welded around the truck, with special attention paid to



Operators must be thoroughly trained in loading and unloading the DUKW.

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approach and departure angles. The installation of a propeller and rudder system would complete the amphibious transformation. It was 31 feet long, 8-and-a-quarter feet wide, and just under 9 feet tall.

The DUKW cab was equipped with a folding windshield and side extensions. There was room for the driver and co-driver in front on a plywood cab floor. It was powered by a 270-cubic-inch, 94-horsepower straight-6 engine with five forward gears and high-low range. The DUKW was able to reach speeds of 50 mph on land and 5.6 nautical mph at sea. A high-capacity bilge pump kept the vessel afloat in rough water, and it could carry over 2 tons payload or up to 12 troops, depending on equipment. There was no armament, but it was equipped with a mount for a .50-caliber Browning heavy machine gun.

Proving itself

The DUKW performed well on land and at sea during testing, but skeptic military officials considered the vehicle a compromise, being neither a good truck nor a good boat. Surely its ungainly looks would not help its cause, either. Stephens still managed to convince the military to allow him to perform a series of sea demonstrations just off the New England coast.

A few days before testing, a Coast Guard patrol craft ran aground in a

sandbar just offshore. Strong wind and heavy rain prevented a traditional rescue. The DUKW was deployed and was successful in rescuing the crew, performing where other craft could not. As word spread of the endeavor, opposition began to dissipate. Soon, the DUKW would be touted as "the last word in mechanized equipment."

Mass production began in June 1942, with all production versions built around GMC's CCKW "deuce-and-a-half" 2.5-ton 6-wheel-drive truck, which the military had already been using with great success. This ensured that parts were never in short supply.

More than 20,000 DUKWs were built and distributed to the U.S. Marine Corps and Allied forces. Two thousand were supplied to Britain and more than 500 each to Australia and Russia. According to Gilmore, "Even though it was approved for production, the military was slow to utilize the Duck. Once it became popular, though, demand outweighed supply — and there were never really enough Ducks to satisfy the military need."

Training was crucial

Because the DUKW was land- and seaworthy, it required thoroughly trained operators. It was necessary to equally combine the experience of a truck driver, seaman and maintenance man to handle the vehicle. Relying on one



The DUKW proved to be up to the task when transporting cargo and supplies.

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experience over the other could lead to operator error and possible disaster.

The U.S. Navy could not supply enough trainers for the DUKW, so the Army Corps of Engineers First Engineer Amphibian Command created special training schools. Because there was no training template, the First Engineer Amphibian Command had to quickly develop a training program from scratch.

Training was conducted in an aquatic park near Fort Mason (known then as the San Francisco Port of Embarkation), and civilian boat companies were recruited to conduct maintenance training at the General Motors Corp. War Products School. Initial training lasted three weeks, but was later expanded to five weeks because of the extensive preparation that was required.

At the beginning of training, the soldiers practiced driving on land to get used to the vehicle's handling characteristics. Driving in sand was particularly challenging. In sand, lower tire pressure would be necessary for better traction. Once the vehicle was on a harder road surface, higher tire pressure would be needed.

Seamanship was most important, however, and the list of tasks to be implemented before deploying to water was lengthy. Among many other tasks, bilge plugs had to be checked, guards had to be in place and tire inflation adjusted to meet the demands of the landing destination. After all checks are made, the propeller was engaged and the DUKW had to

enter the water squarely with the surf and maintain wheel operation until obstacles were cleared.

When maneuvering the vessel in water, special attention had to be paid to the rear, or stern of the DUKW. Contrary to the operation of a truck, where the front of the vehicle turns when steering, operators of the DUKW needed to get used to steering the Duck with a rudder in the stern.

Because of the exposure to salt-water, routine maintenance had to be performed at all recommended intervals. The DUKW's lubrication points had to be checked daily and all waterproof areas inspected. Trainees were also instructed on cargo loading and offloading safety. Five weeks of extensive driver, navigation, cargo and maintenance training prepared crews to enter battle.

Initially, the DUKW was equipped with a manual tire inflation system. To adjust tire pressure to meet demands, the operator would have to check the specification for the appropriate driving surface, get out of the vehicle with an air hose, and either use the onboard pump to inflate the tires or manually deflate them. This was seen as putting operators in peril and defeating the purpose of having a true amphibious vehicle.

"Later in production, the DUKW was fitted with a central tire inflation system," Gilmore explains. It was the first of its kind, and consisted of an onboard compressor that fed air to each of the tires through a series of hoses and tubing. This system proved to be inval-

able when landing on a beach, Gilmore adds: "Now, the operator could adjust the tire pressure from inside the DUKW according to the driving surface."

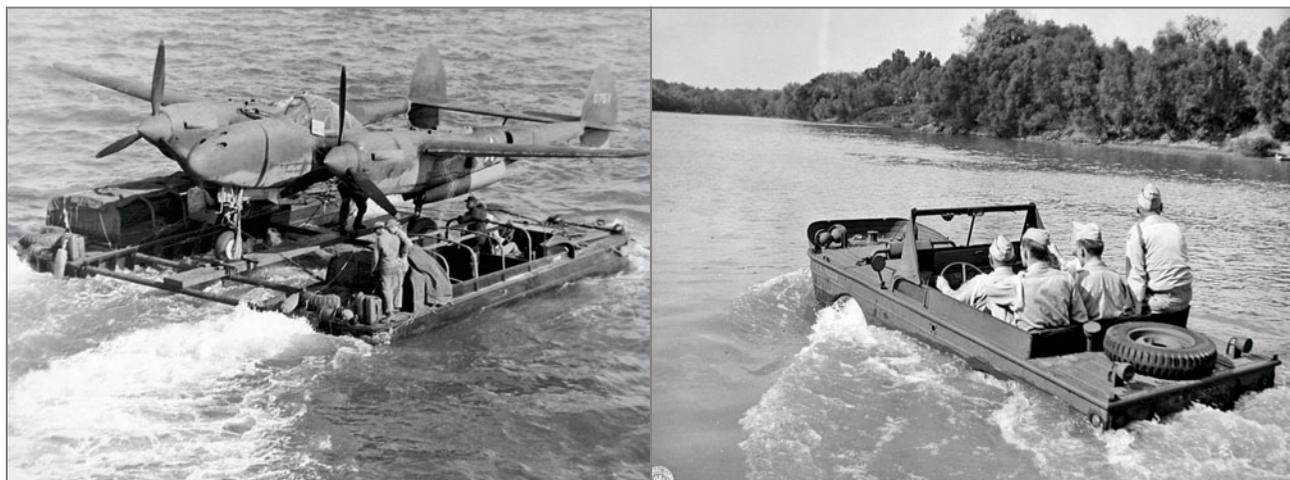
In the unlikely event that it did get stuck, the DUKW was equipped with tools and an onboard winch to help extricate itself from trouble.

Battle stations

The DUKW was involved in both European and Pacific theaters of operation during World War II. It first saw action during the 1943 invasion of Sicily, code named Operation Husky. The Americans and British used approximately 900 DUKWs for the invasions, which contributed to defeating the Axis Powers in Italy. The DUKW delivered most of the cargo to the shore, and its on-road capabilities enabled it to serve as a regular truck, transporting troops and cargo wherever they were needed. British General Sir Harold Alexander wrote later, "It is not too much to say the DUKW revolutionized the problem of beach maintenance."

A DUKW would also be used to transport as many as 12 wounded troops back to hospital ships. Special wire cables lifted the Duck to the deck of the ship, where the wounded were removed. Supreme Commander Dwight D. Eisenhower credited the DUKW as invaluable in helping to capture Sicily, and was so impressed that he recommended its creator for a citation.

The DUKW would also be used in landings up to and including D-Day, where nearly 2,000 of the amphibious



(Left) In the Pacific, two DUKWs are used to transport a Lockheed P-38 Lightning nicknamed by German pilots the "Fork Tailed Devil." (Right) Ford GPA amphibious Jeep in 1943.

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The Seep alongside its Jeep cousin.

Photo: U.S. Army

craft were deployed. Because most ports had been destroyed or still held with token resistance, the DUKW was used to unload supplies on and after D-Day. The last time the vehicle was used in Europe was during Operation Plunder in March 1945, when more than 350 DUKWs were used to move soldiers and supplies across the Rhine River in Germany.

The DUKW saw action in virtually every Pacific assault, including Guadalcanal and the attack on Iwo Jima. The thin hull prevented the vehicle from being used in serious, first-wave combat action, so it was mostly relegated to carrying supplies and transporting wounded troops back to hospital ships. The Japanese were convinced that the barrier reefs would protect against a sustained amphibious attack, but the DUKWs were able to drive over barrier reefs and onto islands with ease. Thirteen companies of DUKWs were used in the invasion of the Philippines.

Seep and Super Duck

As the war progressed in Europe, the Allies consistently witnessed bridges being destroyed — and the idea of an amphibious version of the Jeep arose. Once again, yacht designer Rod Stephens was called upon to design such a vehicle.

Still wanting to take advantage of Ford Motor Co.'s mass production capabilities, the military contracted with Ford to collaborate with Stephens and military vehicle experts Marmon Harrington to build an amphibious vehicle around the GPW Jeep. Called the "Seep," which stood for Seagoing Jeep, its underpinnings were essentially the same as the DUKW, only smaller. Not surprisingly, it looked just like a miniature version of the Duck. (*Editor's*

Note: For the full history of the Jeep, see our Drivability story on page 36.)

The Seep was said to have limitations. While it proved to be capable when crossing small rivers and streams, it could be overcome in choppy water and was more difficult than a Jeep to maneuver on land. The U.S., however, used the vehicle with some success during the landing in Sicily.

"This was one of those times when expectations outweighed reality. The GPA was expected to have the same seaworthiness as the Duck, along with the same maneuverability as a Jeep on land," says Gilmore. It may have been impossible to overcome this perception — and fewer than 13,000 were built by the time production was halted in 1943.

The DUKW, however, kept going on. After the war, the United States, Great Britain, France and Australia kept limited numbers of Ducks in service. The U.S. reactivated and deployed several hundred for use in the Korean War, shuttling supplies ashore during the Battle of Pusan Perimeter and later at Inchon.

In 1953, GMC contracted with the military to produce the XM147 DUKW "Super Duck" prototype. Just like the original DUKW, it was amphibious. Based on the post-WWII GMC M135 series truck, it was capable of carrying up to 4 tons of cargo at 50 mph on land and 5.6 nautical mph at sea.

The Super Duck was produced from 1953 to 1957, but because of mechanical problems, it was never really adopted by the military as a suitable replacement for the original DUKW. The vehicle was said to be underpowered and always suffering from problems with its brake system. The Super Duck was replaced by the Lighter Amphibious Resupply Cargo 5-ton capacity (LARC-V), which was used during the Vietnam War.

Lucky Ducks

"Although the DUKW has not been manufactured since 1945, some are still in use today," says Gilmore. The end of World War II made DUKWs available for civilian and municipal use. Fire departments and the Coast Guard continue to deploy Ducks in emergency rescue situations, transporting victims of such disasters as Hurricane Katrina. Many Ducks are owned and restored by private collectors and museums.

Starting as early as 1946, the DUKW was used for amphibious tours. The first Duck tour company, Dells Army Ducks, was established in Wisconsin Dells, Wis., and is still in operation today under the name Original Wisconsin Ducks. According to Gilmore, "Many companies feature duck tours using the original World War II-era boats, but they have been completely gutted and restored, with new engines, drivetrains and enhanced safety features."

Most Ducks, however, have been replaced by modern variations of the DUKW design. These vehicles are termed "purpose-built" for the intended use of providing amphibious sightseeing. To facilitate tours in all seasons, they can be configured with enclosed or open-air passenger compartments. While the new Duck boats bear a striking resemblance to the classic DUKWs, they are modern, with up-to-date amenities.

Duck boats are now tested and certified by the U.S. Coast Guard using "Guidelines for Certification of DUKW Amphibious Vehicles." These guidelines contain best practices on the inspection and operation of such vehicles, to ensure that they are certified to meet all modern safety standards. Each vehicle must qualify for on-highway passenger, and passenger-use-boat certifications.

Once again, a vehicle produced for a war demand takes on a new responsibility in civilian life. No one could imagine that the DUKW would become what it is today from what it was yesterday. From its multi-faceted military use, to rescuing stranded flood victims, or providing leisurely tours, this misjudged and underappreciated "Ugly Duck" is one of the most uniquely versatile vehicles of our time. **ZZ**



Norm Norville is an ASE-certified editor, educator and automotive/diesel technical specialist. He has worked for various dealerships as a technician/manager, as an editor at Chilton Book Co., and as maintenance and technology editor for *Commercial Carrier Journal (CCJ)*. His experience also includes instruction and administration at two technical schools focusing on automotive and diesel technology.

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DEALING WITH A P0421

WILL YOU GO FOR THE 'FAST FIX,' OR DO THE HOMEWORK AND GO FOR A PERMANENT ONE?

BY **G. JERRY TRUGLIA** |

CONTRIBUTING EDITOR

A 2005 Mazda 6 3.0L V6 came in with a misfire that was noticeable, but had no "Check Engine" light on or any DTCs for misfires. Instead it had two other DTCs: a P0421 (Warm Up Catalyst Below Threshold Bank 1) and a U1055 (Loss of Communication with Instrument Panel ICP Control Module).

The engine had three new coils installed recently, most likely to take care of the misfire. As you know, a

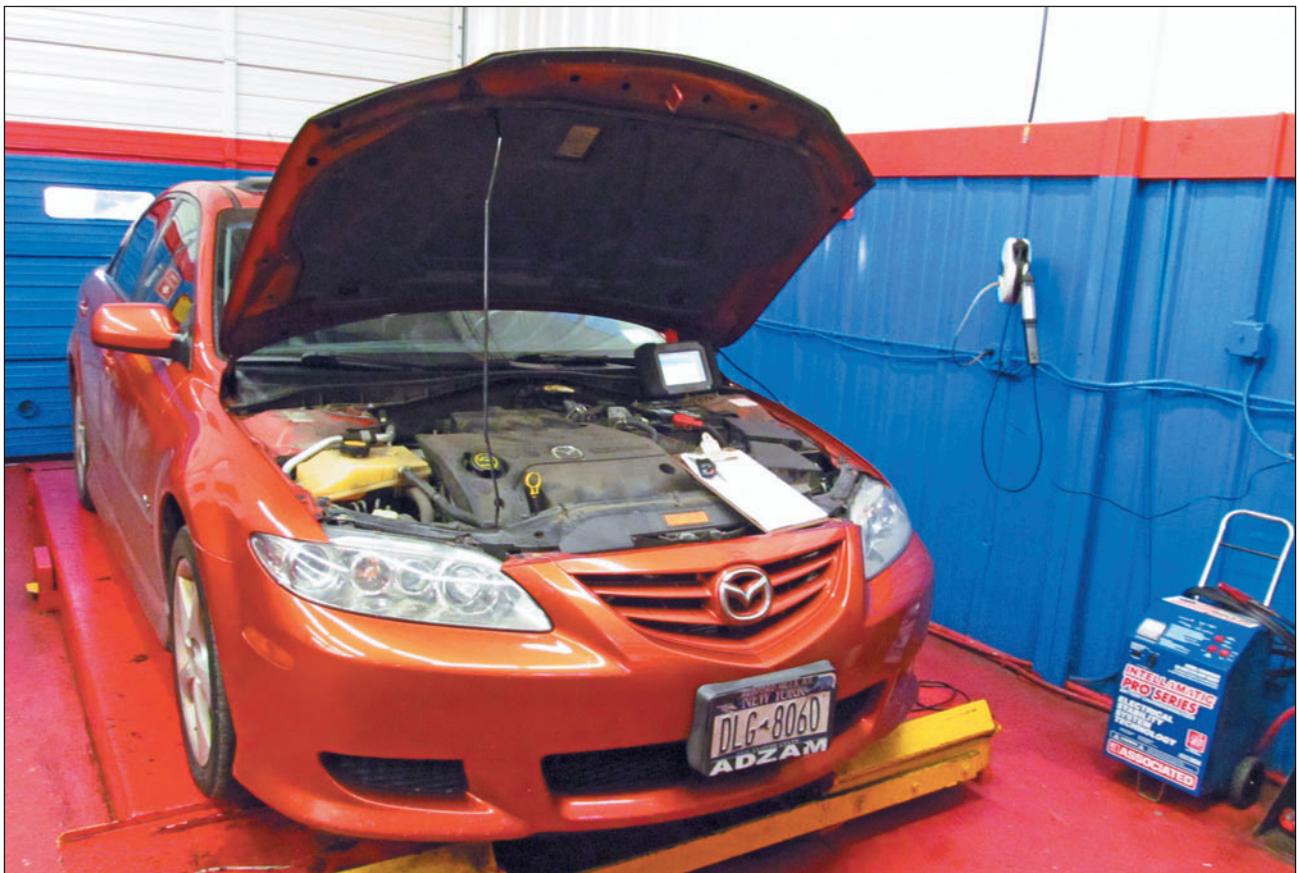
misfire will cause a converter to cook because of the amount of unburned fuel passing through it. Well, the misfires did their job, as witnessed by the DTC P0421 that was set.

Let's take a look why this engine was misdiagnosed. Sometimes techs go with the easy, fast fix, and throw parts at the problem rather than performing a proper diagnosis. The tech who previously worked on the vehicle seemed to have just this problem, because he did not find the root cause of the problem.

Usually when I come across a vehicle with a problem like this, I find there was

not a proper diagnosis done. The tech should have looked up DTC and TSB information on his service information source to come up with a starting point for his diagnosis. Checking basics like engine mechanical condition, fuel trim figures under different engine operating scenarios, and reviewing the data PIDs for sensors that were outside the norm would have been a good place for this tech to start.

In addition, it's never a bad idea to see whether the vehicle required a Reflash update. Start with the basics first before throwing parts at the problem.



This Mazda is suffering from a poorly working converter.

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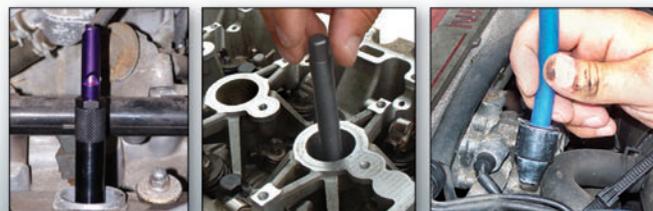
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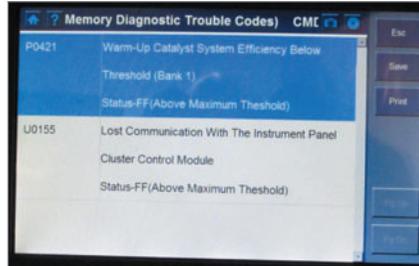


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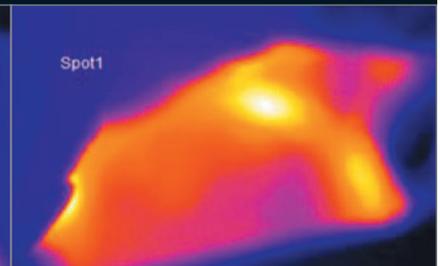
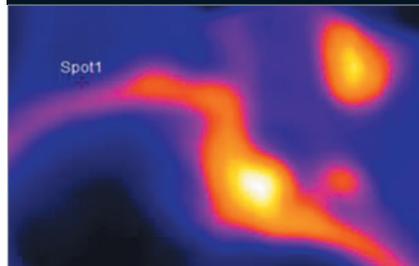
While performing my diagnosis on the engine that had 164K on it, I found that it had a mechanical problem that was overlooked. Take, for example, the Relative Compression test that I performed on the engine: Even though it was performed on an old labscope, the information is still useful, especially when printed and presented to the owner.

Scan tool data PIDS that need to be viewed can be numerous if you don't go into Generic/Global OBD II data. The first areas to take a look at besides the DTCs are Pending DTCs, Freeze Frame, Live Data and then Mode \$06. Each one of the areas are important for different reasons, so let's start with Pending DTCs. If there is a Pending DTC, this information provides you with a closer look on what is going to fail next and possibly illuminate the Malfunction Indicator Lamp (MIL) when it matures into a full-blown DTC.

With Freeze Frame, we have a snapshot of the data when the DTC was set, providing us information on what the important parameters were when it occurred. Moving on to Live Data provides us with a view of what is happening now, such as Fuel Trim, O₂ and



(Left) Be careful on which converter you are troubleshooting. Some vehicles have more than one, and may have two serving one bank. (Right) This may be an older tool, taking an even older test, but it is as valid today as it ever was.



(Left) This thermal image of the bad cat shows little heat being generated, indicating little to no catalytic reaction taking place. (Right) A good cat, on the other hand, is seen in this thermal image.

a baseline of values that we can use as a comparison to the Freeze Frame data.

Checking in with Mode \$06 is an excellent idea, because if it's failing here we could anticipate a problem

Checking the efficiency of two cats at once. Notice how the two O₂ sensor patterns on the left mirror each other (bad), while the two on the right are an example of a properly working converter.

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The screenshot shows the EScan software interface with a table of Mode \$06 data. The table has columns for OBD Monitor ID (OBDMID), Test ID (TID), Test Value, Min Limit, Max Limit, and Units. The data is as follows:

OBDMID	TID	Test Value	Min Limit	Max Limit	Units
\$05	\$04: Oxygen Sensor Monitor B2 - S1	0.552	0.552	0.552	V
\$05	\$05: Oxygen Sensor Monitor B2 - S1	0.045	0.000	0.350	sec
\$05	\$06: Oxygen Sensor Monitor B2 - S1	0.035	0.000	0.495	sec
\$05	\$0A: Oxygen Sensor Monitor B2 - S1	0.890	0.000	2.300	sec
\$06	\$03: Oxygen Sensor Monitor B2 - S2	0.300	0.300	0.300	V
\$06	\$04: Oxygen Sensor Monitor B2 - S2	0.400	0.400	0.400	V
\$06	\$05: Oxygen Sensor Monitor B2 - S2	0.015	0.000	0.180	sec
\$21	\$80: Catalyst Monitor Bank 1	1.375	1.125	255.993	Ratio
\$22	\$80: Catalyst Monitor Bank 2	255.993	1.125	255.993	Ratio
\$31	\$83: EGR Monitor Bank 1	26.810	2.670	655.350	kPa
\$3A	\$80: EVAP Monitor (0.090)	2.051	1.000	255.996	mA
\$3B	\$80: EVAP Monitor (0.040)	2.051	2.043	255.996	mA
\$3C	\$80: EVAP Monitor (0.020)	0.096	0.031	1.999	mA
\$3D	\$80: Purge Flow Monitor	17.223	0.000	17.266	mA
\$A2	\$0B: Mis-Fire Monitor Cylinder 1 Data	0.000	0.000	65535.000	Counts
\$A2	\$0C: Mis-Fire Monitor Cylinder 1 Data	0.000	0.000	65535.000	Counts
\$A3	\$0B: Mis-Fire Monitor Cylinder 2 Data	0.000	0.000	65535.000	Counts
\$A3	\$0C: Mis-Fire Monitor Cylinder 2 Data	0.000	0.000	65535.000	Counts
\$A4	\$0B: Mis-Fire Monitor Cylinder 3 Data	0.000	0.000	65535.000	Counts
\$A4	\$0C: Mis-Fire Monitor Cylinder 3 Data	0.000	0.000	65535.000	Counts
\$A5	\$0B: Mis-Fire Monitor Cylinder 4 Data	0.000	0.000	65535.000	Counts
\$A5	\$0C: Mis-Fire Monitor Cylinder 4 Data	0.000	0.000	65535.000	Counts
\$A6	\$0B: Mis-Fire Monitor Cylinder 5 Data	0.000	0.000	65535.000	Counts
\$A6	\$0C: Mis-Fire Monitor Cylinder 5 Data	0.000	0.000	65535.000	Counts
\$A7	\$0B: Mis-Fire Monitor Cylinder 6 Data	0.000	0.000	65535.000	Counts
\$A7	\$0C: Mis-Fire Monitor Cylinder 6 Data	0.000	0.000	65535.000	Counts
\$E1	\$80: Unknown OBDMID	0.000	0.000	0.402	Ratio
\$E1	\$81: Unknown OBDMID	92.700	71.300	6513.500	C

This scan tool (and many others) offers translated Mode \$06 data, making this much easier to use as a diagnostic aid.

on the horizon. Remember, if it fails enough in Mode \$06, it becomes elevated to a Pending DTC and then on to a DTC that turns the MIL on.

Let's take a closer look at the converter test that I ran on the EScan tool. The test I performed at idle showed Bank 1 as a failure and Bank 2 as a pass. It also showed that the O₂ sensor Bank 1 Sensor 1 is switching normally, and the rear that should *not* be switching is a mirror image of the front sensor. The result shows us that the converter is not working, so now consider Bank 2, where it's a totally different story. The Bank 2 Sensor 1 is switching as it should, and the rear sensor Bank 1 Sensor 2 is a nice straight line that indicates the converter is working.

This can be done on any scan tool that graphs. Granted, you won't get

the percentage of how bad or good, but you will see whether the rear O₂ is moving. Remember to test at a steady rpm — I recommend testing at idle and at a higher rpm because some converters will fail at idle, high rpm, or both. To back up the diagnosis of a bad converter, I used the General Thermal Imager and compared Bank 1 (bad) and Bank 2 (acceptable).

When I get problem vehicles in, I get my camera, scan tool, labscope and thermal imager ready. I do this to capture the information so I can use it as a teaching tool in my classes and here in these articles. The Relative Compression test took about two minutes; the scan data captures from two scan tools, OTC and EScan that included running a cat efficiency test took about 25 minutes; and the thermal imager captures took another two minutes. Always use a test that you are comfortable with and that is easy to use. Try it on a known good vehicle, then on a bad one. Having the right equipment and a good game plan is an easy way to diagnosis converter codes. The complete process, including print-

ing the information, took a little over an hour.

Try saving or printing information, including the comparison of good and bad, so it's easier for the owner to understand what you had to do to repair the problem. Having information to review with the customer provides a relationship-building experience that provides the owner with confidence in your diagnosis and repair. This is something that the vehicle owner will share with his friends, and that's advertising for your shop on which you can't put a price. *TL*



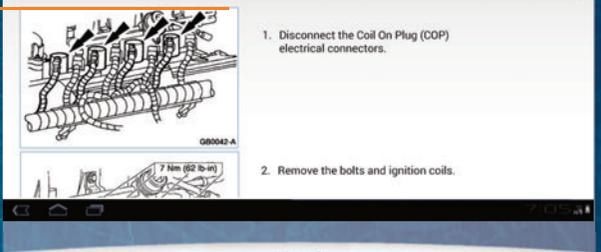
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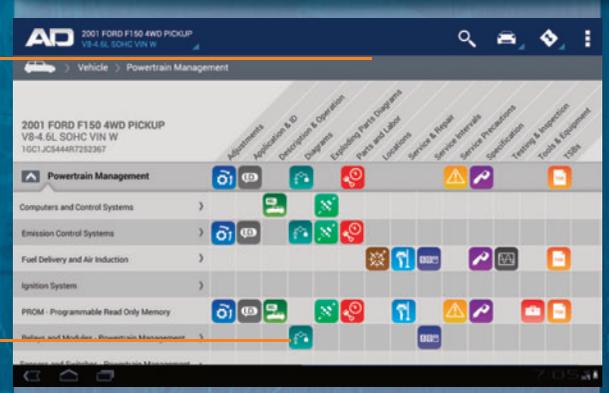
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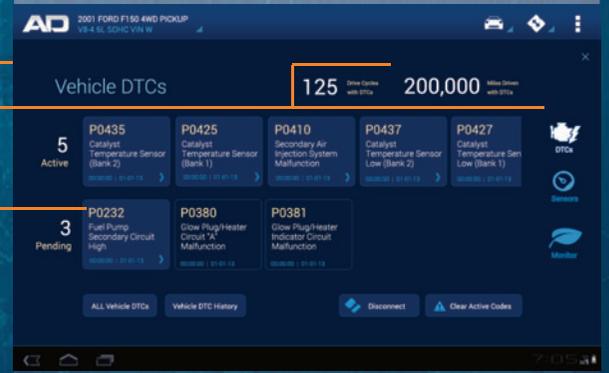
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SURGICAL TROUBLESHOOTING

SUCCESSFUL FAULT-FINDING — WITHOUT SWAPPING PARTS

BY RICHARD MCCUUSTIAN | CONTRIBUTING EDITOR

It has always been interesting to me how a set of jumper cables can look so good and be so dysfunctional when it comes to actually getting a car started. I stopped several years ago to visit a friend of mine. I found him and a teenage boy trying to get a medium-size diesel tractor started with a pair of jumper cables that looked pretty good. They had the pickup truck engine on fast idle with those cables connected, but the tractor starter just wouldn't spin the compression-fired diesel fast enough to light it off.

My personal jumper cables are a set that I built when I was working down on the Texas Coast. Our company had built a brand-new heliport, and there was a 40-foot piece of leftover electrical cable that was about 3½ inches thick. Inside the outside sheathing of that cable were four pieces of 00 gauge wire: one with red insulation, one with black, one with white and one with green. My supervisor gave me a 12-foot piece of that leftover

cable, and I built it with some 500-amp jumper cable clamps I bought from Spence Battery, the Delco parts supplier I used in Port Arthur, Texas.

Thirty-plus years later, those same cables are in my truck toolbox, and they're really heavy. And on that crisp autumn day all those years ago when that tractor wouldn't start, I cheerfully suggested we try my cables. As I dragged them out of my truck toolbox, the teenager snorted at me.

"Them cables ain't gonna make no difference," he muttered. The farmer's son was less skeptical. He and I had a history, you see, and he knew me to be a "can-do" sort of a wrench guy. When we connected my heavy cables and engaged the starter on that Massey Ferguson, it took off like it meant business, spun at normal speed, and rattled to noisy life. It belched a heavy cloud of white fuel smoke from the previous unsuccessful attempts that did nothing but mist copious amounts of diesel fuel into those dark, cool chambers.

Over the years I've done a bit of roadside troubleshooting, just to help stranded motorists, you see. Then it turned out that my own F150 threw

me under the bus one Saturday morning. And since I'm one of those guys who doesn't like to work on the lawn mower when it's time to cut the grass, it was a revolting development to slide into the seat of my pickup and find the battery — a nearly new Motorcraft — so dead that it took my super jumper cables to get the truck started.

Drawing false conclusions

While my own pickup is the title vehicle for this article, I have other stories to tell (as I usually do). We've had a busy few weeks at the shop, and when things go the way they should, my guys and gals learn. They also learn when things go south, even when we're using all our available resources as a hedge against it.

A colleague of mine brought her son's 2007 Sierra to have it looked at with

JUMPER CABLES

2007 FORD F150

Vehicle Year/Make/Model

107,548

Mileage

4.2L

Engine

4R70W

Transaxle

COMPLAINT

Battery goes dead after being parked for a week.

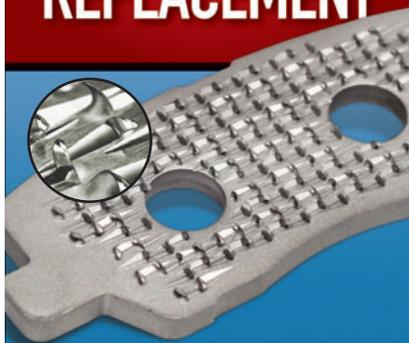
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three concerns. To begin with, her husband had pulled the dipstick on that 5.3L and found it more than 2 quarts low. Well, the oil had fairly recently been changed somewhere, and there wasn't any noticeable smoke, nor were there any visible leaks, but he'd had to add 2 quarts, so they wanted to know what the deal was.

The second concern was that the wipers wouldn't work on intermittent, but were fine on low and high. The third concern was that the cruise control was inoperative.

Yanking the dipstick, I found the oil to be overfull to the tune of about a quart. After removing the extra oil, we poked around and found an Identifix search that turned up cases where sludge had the drain-back holes plugged in one head or the other. We decided to yank the valve covers to see what we could see.

It was clean as a whistle under



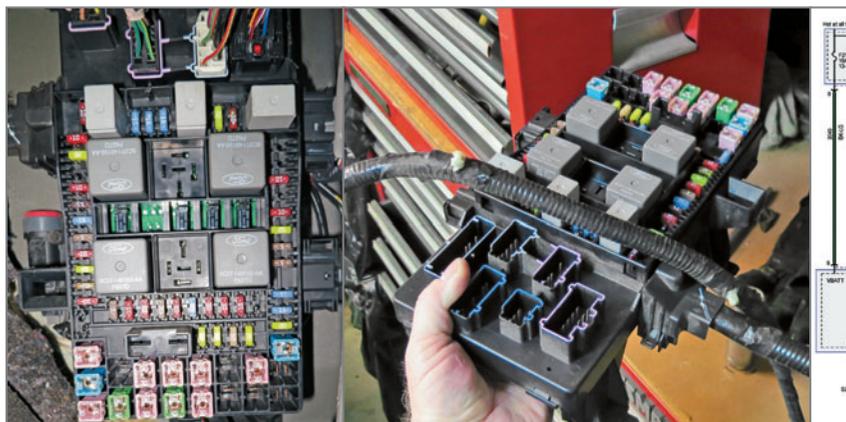
I bought this good solid ride used about four years ago, and have since put quite a few miles on it.

Watch this Trainer video on finding battery electrical drains at MotorAge.com/batterydrain

there, so we replaced the cover gaskets and reassembled everything, then drove the truck for about 20 minutes, parked it, and immediately checked the engine oil. It showed full. Maybe the oil change place left it a quart low, and Dad added too much? Rather than dig deeper on that concern,

I told the owner to have her son keep a close check on the crankcase oil (he is going to college in a town a couple of hours away) and to keep it serviced regularly.

Next, we tackled the inoperative intermittent wipers. Not having seen this concern before, we scan tooled it, and while our tool said the range of intermittent wiper switch positions should be from 1 to 255, we were only seeing switch output from 1 to 5 — and Identifix spoke volumes about bad switches causing this concern. We got a switch from GM (\$29) that didn't change a doggone thing, not even the 1-to-5 datastream switch range. It would have helped to have another truck for comparison, but we were practically flying blind. I called the Identifix hotline and got a tip: We found that when we unplugged the rain sensor module, the wipers would work just fine on intermittent. Rather than pay to have us replace that \$165 module, the customer opted to just leave it unplugged.



This parasitic drain came out of nowhere, and if I had followed the most common pattern (at least around here) on these trucks, I'd have replaced the \$380 cluster. But I eliminated that first and found the CJB to be internally compromised. It had a very large "Made in China" label on it. The replacement unit did not.

Concern No. 3 was the cruise control, and after verifying that it didn't operate and the datastream told us that brake pedal activation had prevented it the last four times, we noted that the Brake Pedal Position (BPP) input was always "APPLIED." From what we could tell, that input comes from a pedal position sensor that is separate from the stop light switch (the stop lights worked fine, and that particular PID came and went with pedal activation).



Good jumper cables aren't hard to build if you can get good leads, but if you buy a really good set of cables, you'll pay through the nose. There are cheap jumper cables that look like really good ones, but the proof's in the puddin', so to speak. If you can't get a really dead one started without letting the alternator on the donor vehicle charge the dead battery first, you need a better set of cables.



This 2007 GMC had been at one of the local GM dealers to have the power steering pump replaced. It came to us with all this stuff swinging. Note the destroyed fluid level sensor by the master cylinder, and the in-line connector that wasn't re-anchored or even routed right. Our initial visual inspection found this.

We got a BPP switch in short order and popped it on there, but to no avail. When I checked the voltage at the BPP switch, it was come-and-go for some reason, which seemed to be the root of our concern. But she had to take the truck and return it to her son cruiseless, so we got a two-out-of-three on that one.

Cause and effect

Gene, one of our maintenance men, always has his eyes and ears open for students with car trouble, and he saw one of our welding students beside the road a mile or so away from the college with the hood up on his 2004 Explorer. Gene dragged the crippled ride back to my shop, where I made a work order and had the driver sign it while the students pattered around with it outside one of the service bays.

That 4.0L SOHC would spin over, but there was no fire in the holes. We had fuel pressure at key on, but neither spark nor injection, even though the injectors and the coils were powered up. There was no security light flashing, and a scan of the datastream failed to produce anything except a big fat zero on the Engine RPM line. So we shoved it into the shop, and I had one of the students roll under there on a creeper to have a look at the crank sensor — which, it turns out, had been destroyed because the harmonic balancer came apart and the pulley belt guide had machined that plastic sensor down to its copper guts.

The pulley part of the balancer had come unbonded from the rubber insulator, and had slid back toward the timing cover — enough so that the serpentine belt had walked off the balancer and was riding on an inch of exposed balancer rubber. He had ignored the belt squeal to his own peril.

Well, the '04 Explorer owner didn't want to spend the \$110 on the balancer I had already ordered from the parts store (which was slated to show up later that same day), so he paid the basic charge and dragged the vehicle to his uncle's house to get a used part put on it.

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Meanwhile, Olivia's 2008 Explorer came wheeling in with a squealing belt and exactly the same kind of balancer failure, except this one didn't totally destroy the crank sensor. This particular 2008 Explorer is charmed, because usually no matter what happens, it seems we're always able to work miracles getting parts to get Olivia out of there in a single day.

This time was no different: Because the other balancer was en route and the first Explorer pilot didn't want it, we used that part to get hers done quick, replacing the belt for good measure.

Two weeks later, the 2004 Explorer driver showed up wanting a full set of used tires mounted on some rims he was pulling behind him on a trailer. We're a college automotive program with a basic charge and no labor, yet he wanted to know how much it was going to cost and wanted to know if we could get the job done before he left at 10 that morning. I looked at my watch, shook my head, and sent him packing. Some people can be ridiculously demanding, and this guy was more trouble than he was worth in one day.

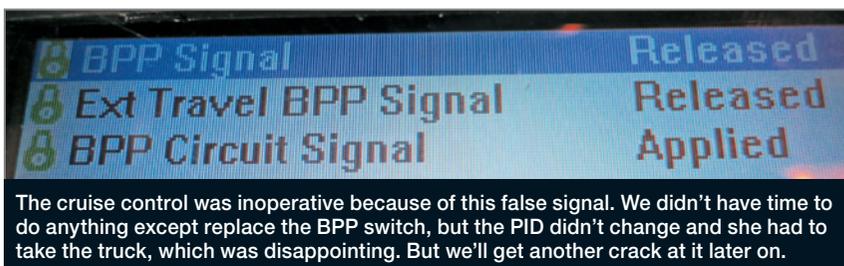
Two no-starts

Regular readers might remember the yellow 2005 Crossfire we fixed for a no-crank concern about a year ago. Well, this time it was a quitter. It had never failed to spin over since the other repair. She hadn't driven it for a while, because now it would stall and not restart while driving. The battery was dead the morning she decided to bring it in for the stall-no-start issue. It'd sit for a half an hour and go again, which is one of the most common symptoms of quits-while-driving issues.

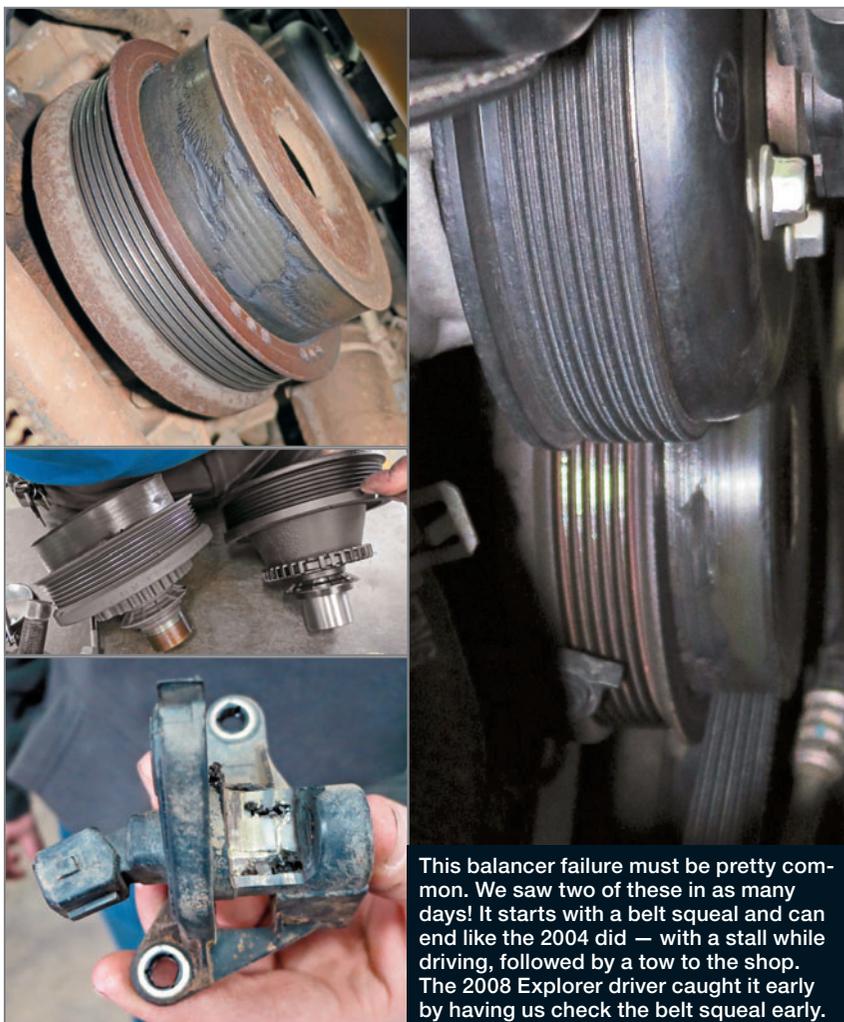
As a matter of fact, when she was on the way to us that morning, it quit close enough to the shop that we could see it from our service lot. Our hale and hearty maintenance guy drove up there with one of my guys, but it started right up and my guy drove it back to the shop.

We weren't able to talk to the enhanced side of the Crossfire PCM, but the OBDII room gave us a crank sensor code. We scoped the crank sensor to find that it would flatline and then the engine would die. We removed the sensor, ohmed it and got 1,050 ohms, then used a heat gun to make it open up right there on the bench. That was easy to do, so it got a new one. Were we done? Not exactly — the alternator was whirring, stinking and barely putting out, so we had to put an alternator on it, too.

No-start No. 2 was a 2002 Saturn that came in behind a pickup. This one is a serious bomb. If we wanted



The cruise control was inoperative because of this false signal. We didn't have time to do anything except replace the BPP switch, but the PID didn't change and she had to take the truck, which was disappointing. But we'll get another crack at it later on.



This balancer failure must be pretty common. We saw two of these in as many days! It starts with a belt squeal and can end like the 2004 did — with a stall while driving, followed by a tow to the shop. The 2008 Explorer driver caught it early by having us check the belt squeal early.



The Sierra's wipers wouldn't work on intermittent until we disconnected the harness from this rain sensor module up by the rearview mirror. It has a dandy plastic cover that has to be removed for access. The module had everything it needed in the way of power and harness integrity, but had gone sour. We left it unplugged at the owner's request.

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to upsell this one, we could work on it for weeks, but this guy won't buy anything he doesn't have to. One way or another, we had spark and fuel injection, but when I had one of the students connect a fuel pressure gauge, he called me over to see what



This Saturn turned out to be a surgical repair in that we checked and found alcohol in the fuel (causing a no-start) before replacing a single part. I had done a lecture earlier that morning on fuel quality and the importance of checking it, and this drove that point home in spades.

I thought of the stuff that wet his fingers when he was fiddling around at the Shrader. It felt really cold and smelled like pure alcohol, and when we transferred some to a graduated container and did the test, it was 20 percent alky — but I know the fuel rail was full of a higher alcohol concentration than that.

We engaged the fuel pump to run steadily by jumping the relay, thus we pumped heavier-than-gas cloudy looking cocktail into a 5-gallon plastic container until the cloudiness cleared up, then we managed to spin the engine to let decent gas push the alcohol on through the injectors and start the car on gas. The guy who brought it in was mystified as to how the alcohol got in there, but I suggested that his sister might have pumped some E85 into the tank. One way or another, that one was a rich example of why fuel sample testing is important: No parts bought.

Closure on my own ride

I drive my F150 on weekends around town and my 2007 Taurus to work for economy. Initially when the battery died, I checked for lights that were left on, and even disconnected the instrument cluster for a week (a known concern on some of these), only to find the battery dead again the following week.

One Friday afternoon, I gave it some priority and found the problem. With my meter connected between the positive post and its corresponding terminal to read amps, I found 0.200 mA leaving the battery even when everything was supposed to be off. More than 0.050 mA is too much. No wonder the battery was dead after a week!

The only fuse panel this base F150 has is behind the right lower kick panel, and I went to work down there, yanking fuses while watching my meter. When I got fuse 21 yanked out of there, the meter registered zero. That fuse provides “Keep Alive” power to the instrument cluster, which I knew wasn't the problem.

I bought a brand-new \$250 central junction box. I've seen these develop internal shorts and opens ever since 1997, when Ford started using those internally laminated boxes. After I replaced the CJB, I've had no dead-battery problems at all.

Conclusions

While it's important to know how to replace parts, it's even more important that we learn (and teach) surgical troubleshooting skills and critical thinking so the guys in the trenches can find out what's wrong and don't replace parts unnecessarily. We can sometimes get in too much of a hurry and throw parts that aren't needed. Usually a bit of cause-and-effect reasoning and skillful information gathering and sorting can save us time and the customer money.

Too many mechanics haven't developed those skills and that kind of thinking. While I don't have all the answers, the writing and hands-on teaching I do represent my attempts to change that trend. **TL**



Caught in the Crossfire again — this time for a quits-while-driving. The P0335 code led us to a crank sensor that was opening up hot, and then we found a bad alternator. We also replaced the \$180 hood lift support at the customer's request, which cost more than the \$169 alternator.



**RICHARD
MCQUISTIAN**
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EDITOR

Richard McCuistian is an ASE-certified Master Auto Technician and was a professional mechanic for more than 25 years. Richard is now an auto mechanics instructor at LBW Community College/MacArthur Campus in Opp, Ala.

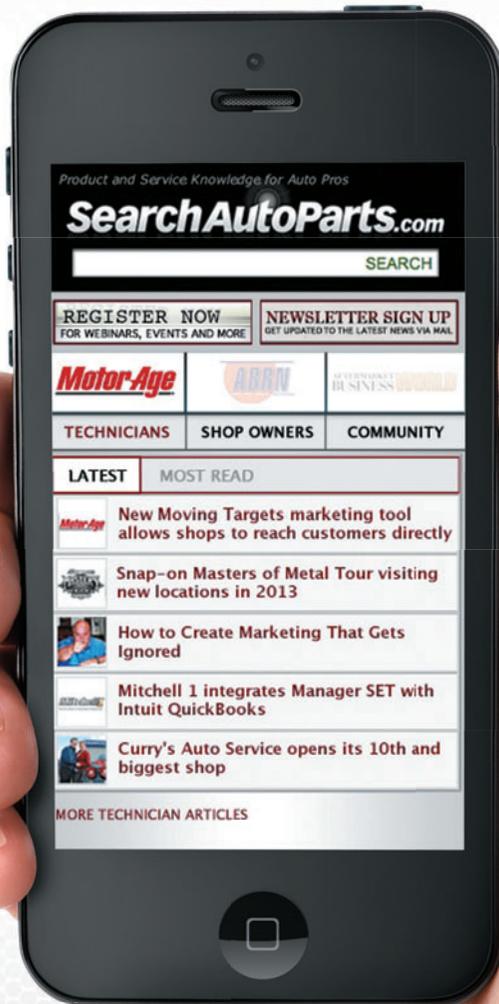
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MAHLE Aftermarket, Service Solutions has announced the availability of its new Arctic PRO® RHS® 980 Series – Americana edition. The company will make a \$50 donation to Operation Support Our Troops – America (OSOT America) for each commemorative unit sold. Sporting the American flag on the front, the unit can be used on R134a vehicles, is compliant with the SAE J2788 standard, and features fully automatic operation. This limited time offer ends on July 4, 2014. Formerly the RTI Division of MAHLE Aftermarket, the division is now MAHLE Aftermarket, Service Solutions with the official name change effective on Nov. 1, 2014.

For more information, visit
www.rtitech.com
MAHLE Aftermarket, Service Solutions

ALLDATA® APPLAUDS BEALE AIR FORCE BASE

"ALLDATA Repair saves us an extreme amount of time getting to the OEM diagnostic and repair information we need." — Judy Pittman, Beale Air Force Base Auto Hobby Center Manager. ALLDATA applauds Beale Air Force Base's Auto Hobby Center for its support of military families. As part of the 9th Force Support Squadron, the Auto Hobby Center offers exceptional auto repair and maintenance services, plus a place for airmen to work on their own vehicles. "It never fails, when someone is deployed everything seems to break," says Judy Pittman. "We're so honored to be able to help families in their spouse's absence."

For more information, visit
www.alldata.com
ALLDATA



SEPARATOR FILTER DRYER

SKF has expanded its air system product offering to include the Separator Filter Dryer (SFD), an air dryer ideal for providing contaminant-free air to pneumatic devices, such as air lines in service bays that use pneumatic tools. The SFD can also be mounted on small air compressors, and incorporates a three-in-one system that typically requires less than 10 percent of air for regeneration. It achieves a -40°F pressure dewpoint for flow rates of up to 40 CFM. Compact and easy to install, the SFD features accessible valves and two spin-on desiccant cartridges for easy maintenance.

For more information, visit
www.vsm.skf.com
SKF

HYDROCARBON CONTAMINATION TEST

The new ACU480508 dip-and-read test is part of ACUSTRIP's FluidDx line, designed specifically to address the need for diesel exhaust fluid (DEF) testing. While it enables early detection of hydrocarbon contamination, these strips are also suitable for testing the presence of hydrocarbons in antifreeze coolant and water. It's available in bottles of 50 tests, 12 bottles per case.

www.acustrip.com
ACUSTRIP Co.



SHOCK/STRUT TOOL KIT



The new 39 Piece Strut/Shock Installation Tool Kit is designed to save technicians time and money when dealing with shocks and struts. Most of the time, technicians will use tools that damage the shock or strut by breaking the seal on the shaft. This may require the shop to warranty the broken shock or strut. This comes in the form of lost pay for the technician or the shop eating the cost. With this kit, this will no longer be an issue: Simply select the bit and the corresponding socket for the strut or shock. When used together with a combination wrench and ratchet with a socket, the removal and installation of shocks and struts is easy.

www.steelmanpro.com
Steelman PRO

REVERSE BRAKE AND CLUTCH BLEEDER

The new V-5 DIY Reverse Brake & Clutch Bleeder features reverse bleeding technology that, combined with vacuum, bench or pressure bleeding, allows for the removal of more air than conventional brake bleeders, the company says. Removing more trapped air is important because it creates a less-spongy pedal, reduces stopping time and increases braking power and responsiveness.



www.brakebleeder.com
Phoenix Systems

3/8-INCH DRIVE AIR RATCHET



The Snap-on 3/8-Inch Drive Air Ratchet (FAR7000) is ideal for working on various applications such as hoods, fenders, mud flaps, intake manifolds, engine brackets, bumpers, transmissions and oil pans, alternators, brake calipers, ERG valves and water pumps. It offers 410 rpm free speed for fast removal/installation; a slim drive head combined with long reach (11.2-inch overall) to get into tight spots more easily; and an adjustable exhaust deflector to direct exhaust away from the work area. It weighs just 2.08 pounds) and features an ergonomic comfort grip handle to reduce fatigue. Its maximum torque is 30 foot-pounds, and it has an air consumption of 2.6 CFM.

www.snapontools.com
Snap-on

POINT/CONTACT CLEANERS



As a professional solution for cleaning and enhancing spade electrical contacts, the Diamond-Coated Point/Contact Cleaners (#8047) are the newest addition to IPA's line of contact care tools. This three-piece pro series set features a highly abrasive diamond coating designed to increase the contact life of electrical connections and reduce diagnostic guesswork. Twice as thin as the smallest available file on the market, these files are also ideal for general filing applications. To cover a large range of contact sizes, the set includes a 6mm, 9mm and 15mm wide, ultra-thin files, complete with non-slip, high-visibility handles for comfortable use.

www.ipatools.com
Innovative Products of America/IPA

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ALLDATA, the leading provider of OEM service and repair information to the professional automotive service and collision industries, understands its responsibilities as a corporate citizen, and supports charities to help make a positive difference in its communities.

In one such effort, Walk4Troops, ALLDATA employees, families and friends have walked more than 9,500 miles and contributed hundreds of dollars toward food and supplies for veterans and their families.



For more information regarding the Walk4Troops program >>> www.walk4troops.com

For more information on ALLDATA's products and services >>> www.ALLDATA.com

HYBRID BRAKE PADS



Brake Parts Inc, the makers of Raybestos brand brakes, presents Element3, the world's first enhanced hybrid brake pad with Enhanced Hybrid Technology (EHT™). The EHT formulations are a proprietary blend of BPI premium friction compounds that deliver the best attributes of ceramic and semi-metallic formulations in a single brake pad, according to the company. The entire product offering of Element3 brake pads with EHT meets the new 2021 legislation for the elimination of hazardous materials and copper reduction. In addition, the brake pads are enhanced with exclusive Quiet Steel® shims for additional noise damping and quiet operation. This provides added performance in a wide variety of temperature ranges, vehicle characteristics and platforms. Also, most Element3 brake pads include premium brake hardware to enable a complete repair, and electronic wear sensors are included where applicable.

www.element3eht.com

Raybestos

BATTERY TESTER

Clare Automotive presents Model No. 1852, a 100 Amp fixed load battery tester, from SOLAR. The 1852 is designed for portable professional use, quickly providing assessment of battery condition and charging/starting system performance for 6- and 12-volt systems. SOLAR fixed load battery testers offer quick, easy analysis of battery condition and starting and charging system performance. The 1852 delivers a true 100-amp load and is calibrated to test batteries up to 1000 CCA. It features an easy-to-read, color-coded meter and a graduated scale for assessing battery condition. The 1852 can be used to test 6- and 12-volt batteries and starting/charging systems.

www.clareautomotive.com

Clare Automotive



CVT FLUID

Beck/Arnley has added a continuously variable transmission (CVT) fluid for Nissan, Mitsubishi and Suzuki to its line of genuine OE quality fluids. It's specially formulated for extreme pressures found in CVTs to minimize metal to metal wear on CVT belts and pulleys, and provides resistance to shudder. Blended from high-performance base oils and carefully selected additives, it offers friction modifiers to protect during metal-to-metal contact, viscosity index improvers for variable temperature extremes, and defoaming agents to minimize foaming

www.beckarnley.com

Beck/Arnley



BIG BRAKE KIT



The new front axle StopTech Big Brake Kit for the all-new 2014 Ford Fiesta ST represents the ultimate brake system upgrade — with stiffer calipers, larger rotors, higher friction pads, braided stainless steel lines and all of the necessary mounting hardware and brackets to complete the job. All StopTech High Performance Brake Kits provide shorter stopping distances, better brake modulation, firmer pedal feel and less brake fade for stronger, more reliable braking performance, the company says.

www.stoptech.com

StopTech

INSTALLER SERVICE KITS



Penray Installer Service Kits are designed for professional use only, taking advantage of the tools, techniques and expertise found in professional repair shops. As such, they provide an attractive profit opportunity for the service shop, while offering substantial value and protection to the customer. Penray offers a variety of system-specific kits that include the chemicals needed to clean, protect and fortify various vehicle systems. These kits include cleaners, protectants, conditioners and lubricants needed to restore performance. They keep vehicle systems working at optimum levels and help extend service life. Penray also offers Installer tools and full lines of automotive, heavy duty and shop chemicals.

www.penray.com

Penray

LOW CLUTCH DRUM

A Chrysler 62TE low clutch drum with Teflon coating that offers improved performance over the O.E. component is now available from Capital Core, Inc. Available for 2007-up applications, the new 62TE low clutch drum features a Teflon coating where the sealing rings fit, minimizing sealing ring wear in the aluminum that can result in leakage. The new and improved low clutch drum, part number A262559A, offers greater durability and performance, extending the life of the drum.



www.cctransmissionparts.com

Capital Core Inc.

AUTO LIFTS

BaseLine by COATS lifts use North American hydraulic units and pre-stretched cables for better performance, longer life and reliability. The BaseLine by COATS line of lifts offers a comprehensive selection of styles, including two-post, four-post, motorcycle/ATV, mid-rise and parking lifts. At 11,000 pounds, the BL211CF is one of the most versatile lifts featured in the new line. The two-post lift can accommodate passenger cars, light- to medium-duty vans, and utility trucks — especially those with uneven load distribution or payload.



www.coatsreveal.com

Hennessy Industries Inc.

MINI PLIERS SET



Monster introduces the MST97608 nine-piece mini pliers set featuring encapsulated spring (ESP) technology with spring-loaded joints for ergonomics in tight spaces. This pliers set is machined to precise tolerances and bolstered by solid joint construction. High alloy steel and precision heat treating ensure sharper cutting edges and optimum strength and durability. Featuring double-dipped, chemical-resistant grips for comfort and control, the set includes bent long nose, long nose with cutter, diagonal cutter, end cutter, needle nose, long reach bent nose (22 degrees), long reach bent needle nose, long reach diagonal cutter, and long reach long nose with cutter pliers for a wide range of applications.

www.isnweb.com

Integrated Supply Network

DYE INJECTION KIT



The new TP-9844 EZ-Ject™ R-1234yf A/C Dye Injection Kit makes adding fluorescent leak detection dye to new R-1234yf A/C systems quick and easy, according to the manufacturer. At the heart of the kit is the EZ-Ject A/C dye injector assembly. It easily overcomes system pressure so the dye can be injected whether the A/C system is off or still running. A turn of the handle injects the exact amount of dye into the system. The kit also contains a 0.5-ounce EZ-Ject R-1234yf/PAG multi-dose A/C dye cartridge that services up to 14 vehicles. In addition, an R-1234 hose/coupler with purge fitting is included.

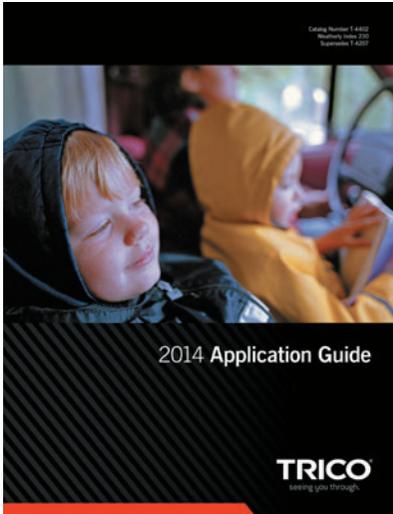
www.tracerline.com

Tracer Products

APPLICATION GUIDE

Trico Products' *U.S. Application Guide for 2014* is now available. Specifically designed for automotive technicians, counter professionals and consumers, the guide provides details on all TRICO® products, which are listed by product line, vehicle year, make and model. The 264-page compilation provides wiper blade and washer pump details for 39 new part numbers including the TRICO Sentry™ hybrid wiper blade, which at press time is preparing for release. The listing also contains an interchange guide, a complete directory of retail merchandisers and cabinets, and comprehensive application details for vehicle models through 2014 — plus nearly two dozen models for 2015.

www.tricoproducts.com
Trico Products



SPRING REWIND REEL

Hannay Reels' N500 Series high-pressure, low-maintenance spring rewind reel is designed for efficient hose handling in applications such as hydraulics, air/water, and chassis grease for all machine and implement needs. A compact frame and narrow base also allows easy installation in almost any location. This model features a heavy-duty spring motor with self-contained rewind power, four-way roller assembly and a declutching arbor to prevent against damage from reverse winding. A non-sparking ratchet assembly locks the reel at the desired length of hose payout, and a pull on the hose unlocks the reel for the spring motor to retract it.

www.hannay.com
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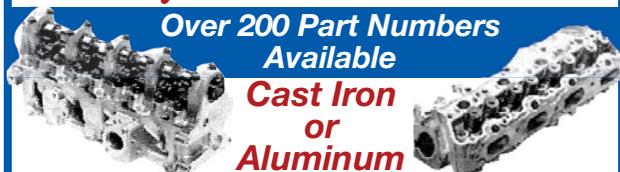
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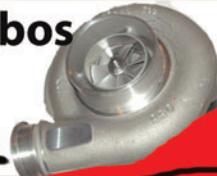
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TOOLS & EQUIPMENT

ORIGINAL HUB MASTER

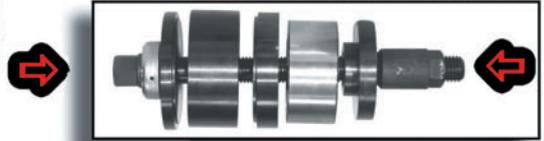
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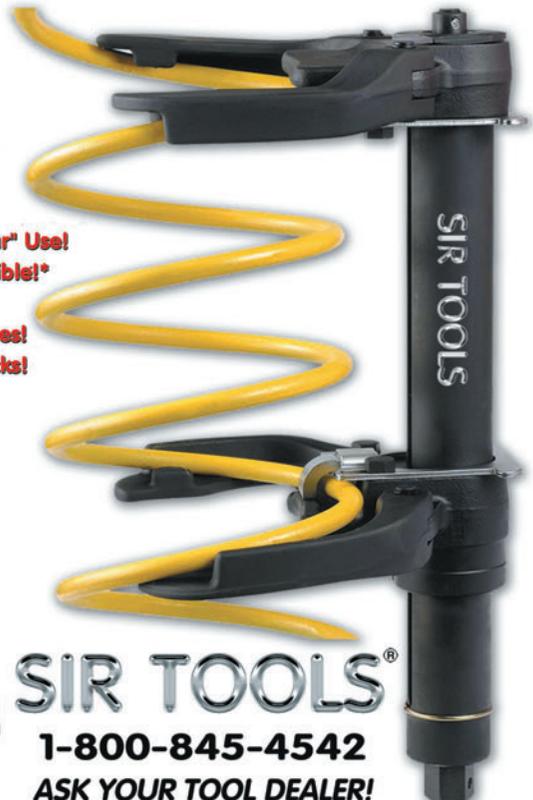
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UP IN SMOKE

WE'VE BEEN USING SMOKE TO FIND EVAPORATIVE EMISSIONS LEAKS FOR YEARS. BUT THERE ARE A LOT MORE USES FOR IT THAN YOU MAY REALIZE.

BY PETER F. MEIER

I may be dating myself a bit here, but I remember when an enterprising iATN member shared his plans for making a smoke machine. Back then, it used an old coffee can, some steel wool, a diesel glow plug and transmission fluid. The glow plug heated the steel wool, which heated the fluid and got it smoking. That smoke was then pumped into the intake manifold to help locate the source of vacuum leaks that our old methods (spraying liberally with carburetor or throttle body cleaner, or hosing it down with propane) couldn't find.

Since then, innovative technicians have adapted their existing equipment to find leaks not only in evaporative emissions (EVAP) and intake systems, they also learned to use it to find exhaust leaks and other problems. Many of us learned how to overcome issues like those faced when filling an exhaust system equipped with catalytic converters by quickly following the smoke with shop air to pump up the pressure and make those stubborn leaks more visible. One manufacturer, Redline, has even developed a smoke machine specifically for use on systems other than EVAP, allowing the user to crank up both the pressure used to deliver the smoke and the smoke volume. This is especially helpful when looking for leaks in turbo-charged system components, exhaust



systems and even when looking for wind or noise leaks caused by failed door or window seals.

In this month's edition of The Trainer, and in keeping with our "Salute the Troops" theme, I visit MacDill Air Force Base, home to the U.S. Central Command and Special Operations Command, as well as serving as home base to the 6th Mobility Air Wing. My host is Tech Sergeant David Merrick, and together, we try out different smoke techniques on a few of the military ground vehicles he had in for service at the base service center.

I hope you find the short monthly videos we produce for you helpful, and want to invite you all to attend any or all of our free, live and interactive webinars.

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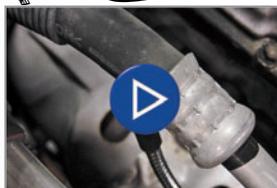
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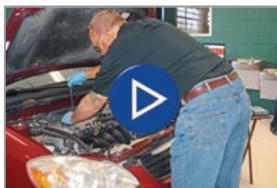


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