

## Color-Shifting Finishes Update —Prism Technology Is Spreading

Our first article on color-shifting finishes left the impression that these finishes would no longer be available within a few years (see "Shifting Colors" in the November-December 1996 issue of the *Advantage*). Now, two years later, at least five major paint makers are producing color-shifting finishes in a wide range of colors. This technology, that was never intended for automotive glamour finishes, now appears not only on several dozen show and pace vehicles, but also on bicycles, boats, snowmobiles, and hockey helmets. Any application where color sells is expected to benefit: packaging, textiles, flooring, electronics, and plastic products. And the steep price of these finishes is expected to drop as the technology becomes even more mainstream.

### Color By Light Interference

Color-shifting finishes are based on a completely different technology than other finishes. Conventional color is seen by the eye when the surface absorbs some wavelengths of light and reflects others. The color may take on a slightly different hue under different types of light,

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## Innovative Lighting Designs —New Styles to Improve Safety



High- and low-beam HID headlamps and neon auxiliary lamps are two innovative lighting ideas shown on this vehicle. (Courtesy of Osram Sylvania, Inc.)

The high-intensity gas discharge (HID) headlamp was only the beginning of a series of innovative lighting designs (see "Gas Discharge Lighting" in the May-June 1996 issue of the *Advantage*). And not only headlamps are involved. Osram Sylvania recently installed a concept lighting system on a new Chrysler Sebring (see above *Figure*). This futuristic system includes low- and high-beam HID headlamps, integral HID running lamps, neon turn signals, and brake-sensitive neon stop lamps. Many of these innovations could become standard on future vehicles.

### HIGH- AND LOW-BEAM HID

One of the innovations is a two-HID headlamp system to replace the

current four-HID system. Four headlamps have always been required on vehicles with HID headlamps because the HID lamps are used only for low beams. The high beams are conventional halogen lamps.

A high-beam HID headlamp could be developed, but the intense white light may be too much for oncoming drivers. And a four-HID system would require at least an additional ballast, and perhaps an additional control module, for each lamp. That would add to the number of parts and already high cost of these systems. Two lamps also offer a styling advantage over four lamps.

It is difficult to make a combined high- and low-beam HID lamp because of the way an HID lamp produces light. Unlike an incandes-

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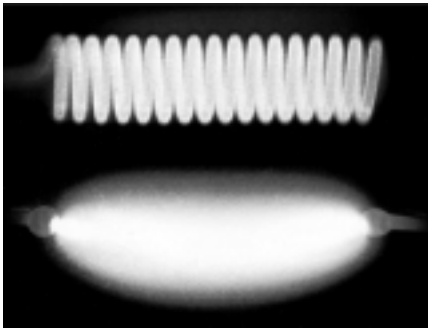


Figure 1—An incandescent filament (top) compared to an HID plasma discharge (bottom). (Courtesy of Osram Sylvania, Inc.)

cent bulb that passes an electric current through a thin wire filament, an HID lamp forms an arc between two electrodes within a gas-filled chamber (see Figure 1). The arc is not well controlled. It's arched and it may even come in contact with the sides of the chamber. Whereas it's relatively easy to add a second filament in a sealed bulb, there's little room to add another gas-filled chamber in an HID lamp.

The solution is to use a magnetic field to capture and stabilize the arc. The arc position can then be precisely controlled by controlling the magnetic field. This changes the pattern of the light. The shape of the headlamp deflector also plays a part, fine-tuning the light beam to achieve both an approved high- and low-beam pattern (see Figure 2).

It's easy to aim these HID dual headlamps by turning a knob to adjust the strength of the magnetic

field. No mechanical aiming is required. This is in addition to the other benefits of HID headlamps: a whiter light for better visibility, and no filament for more ruggedness and longer life.

## HID RUNNING LAMPS

The same HID light source used for high and low headlight beams can also be reflected along glass and plastic tubes for use as daylight running lamps. The Sebring concept system (see cover Figure) shows both the two-bulb HID headlamp system and the daylight running lamps in the center. The light sources for the running lamps are the HID headlamps.

The HID electronic ballast, or ignitor, modifies the power for each of the three lighting functions. The high beam uses 39 watts and the low beam 32 watts. When only the daylight running lights are operating, the power is reduced to 22 watts.

## NEON TURN SIGNALS

The front and rear turn signals represent another innovation in automotive lighting technology: neon tubes. The tube enclosures serve as lenses to magnify the light pattern, the same way the glass tube of a thermometer enlarges the temperature reading.

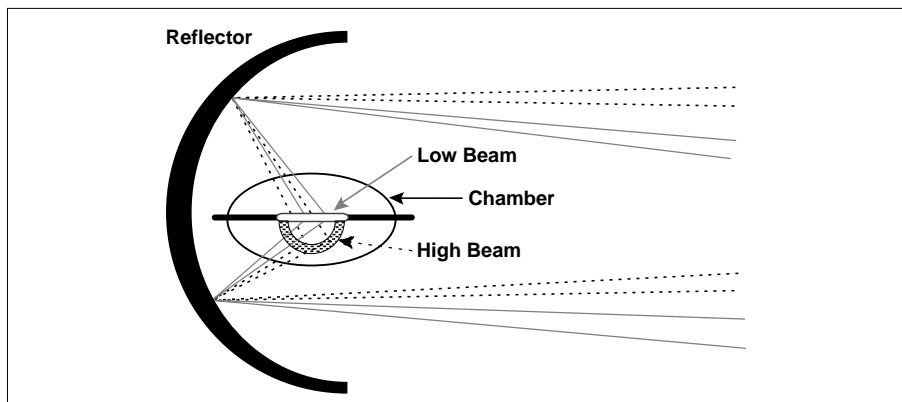


Figure 2—By repositioning the arc using "magnetodynamic positioning," the light can be reflected in both an upper and lower beam pattern. (Courtesy of Osram Sylvania, Inc.)

The neon is sequenced to sweep inboard to outboard when the turn signal is switched on. On the front, the lamps are short with amber lenses. The rear lamps have red lenses and are slightly longer. In all, there are ten neon rear lamps: three brake lamps, a center high-mounted stop lamp, four tail and parking lamps, and the two sweeping turn signals.

## NEON HIGH-MOUNTED STOP LAMP

Energizing a neon tube is quicker than turning on an incandescent bulb. For this reason, neon has long been a desired choice for the center high-mounted stop lamp.

Neon lamps light 200 milliseconds faster than incandescent lamps. That gives a following driver 5.8 meters (23 feet) of extra stopping distance at 105 kph (65 mph). Other

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advantages of neon over incandescent are more ruggedness and longer life.


## Pressure-Sensitive Brake Lamps

Another innovative feature with the neon brake lamps is using the lamps to indicate how hard the driver is braking. When light braking pressure is applied, only the inboard section of the brake lamps light up. As the driver brakes harder, the light sweeps to the outboard section. If the driver performs a panic stop, all three neon brake lamps flash like a strobe light.

This sweeping pattern of both the brake lamps and the turn signals is best done with neon. If an array of incandescent lights were placed in a pattern to show a sweep, the pattern would look choppy. If one of the bulbs burns out, the sweep may even be confusing.

## COLLISION CONSIDERATIONS

The disadvantage of any of these innovative lighting systems, especially the HID system, is the high cost. This becomes an even bigger factor in a collision situation. When a design engineer develops a new idea for a part on a vehicle, lamps or otherwise, it's rare for the designer to consider what happens when the new idea gets damaged in a collision.

The HID headlamps are said to be more rugged compared to halogen lamps "for withstanding road bumps and other shocks." The neon tubes are said to be "more rugged to better withstand shock and vibration." But no lamp will survive a direct hit from another vehicle or other object. And not surprisingly, there are few actual repairs that can be done on these lighting systems, other than splicing a cut wire. 

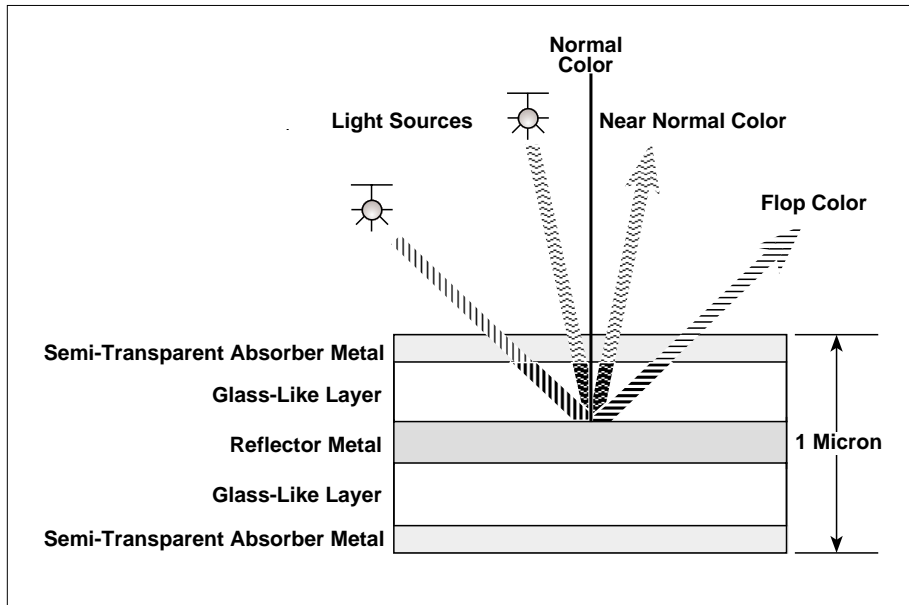


Figure 1—Cross-section of one prism-pigment flake, about 1 micron thick. This is about 1/50 the thickness of a human hair. The flake is symmetrical so the same color shift is visible from the top and bottom of the flake.

but basically the color is constant regardless of the viewing angle or the direction of the light source.

Shifting colors in these new finishes is the result of a prism effect, as different wavelengths of light interfere within the thinly layered flake materials. The materials are colorless by themselves. When either the viewing angle or the angle of the light source changes, the prism effect causes the color to change (see Figure 1). A wide range of prism-pigment colors can be constructed using the same materials, layered in the same order, by varying the thickness of the flake layers. The tolerance of the layer thicknesses is quite small: within a few atoms.

When prism-pigment flakes are examined under an electron microscope, they appear smooth and flat (see Figure 2). This explains, in part, why the color shift is so even and dramatic.

## By Any Other Name

Color-shifting finishes, offered by the various paint makers, differ in their names, color schemes available, and paint formulas. Currently the only source for the prism pigment is Flex Products, Inc. The light-interference or prism pigment is shipped to the paint makers in a pre-wetted form that can be stirred into any formulation using conventional mixing equipment. The

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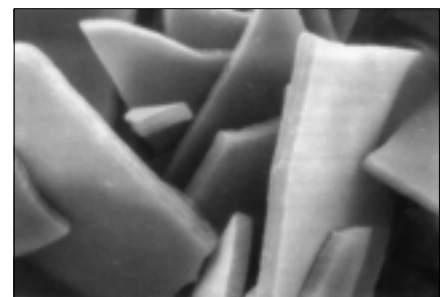


Figure 2—Individual flakes in the pigment, magnified several thousand times. The flakes are shown wiped dry on a microscope slide. When sprayed wet, the flakes are oriented much flatter. (Courtesy of Flex Products, Inc.)

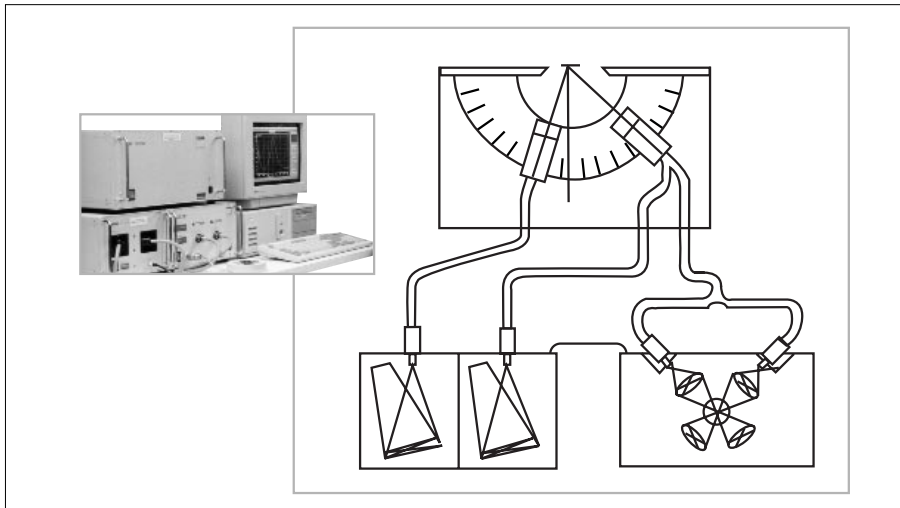


Figure 3—A goniospectrophotometer. This is the only instrument that can fingerprint a color-shifting finish. Twin probes analyze the color range of a finish sample. (Courtesy of Flex Products, Inc.)

pigments are added to the basecoat of two-stage finishes and the midcoat of three-stage finishes. The pigments can also be combined with conventional pigments to offer even more color choices. Tests have also shown they can be used in both solvent-borne and water-borne systems.

The allure of these finishes is not only the color shifting, but also the ease of application and repair. Whereas three-stage finishes, or tinted clears, rely on multiple layers for their color effects, the layers in color-shifting finishes are built into the color pigment. No special techniques or equipment are required to create the shifting effect. A spot refinish is as easy to blend as any other normal metallic basecoat. Also, the inorganic materials used to construct the pigment's layers have excellent hiding and durability characteristics.

The high cost of the paint results from the amount of pigment required. For now, all the prism-pigment finishes are being produced in laboratory batches, so there's also a lot of lab and development costs. As the technology

develops, and prism pigments get mass-produced, the prices are expected to drop dramatically.


### Measuring Color Shifts

It's understandable that conventional color-measurement techniques can't be used to gauge the performance of color-shifting finishes. A new measurement system called Dynamic Color Area (DCA™) metric has been developed to describe how well the color shift is working. The DCA™ metric is believed to be the only perfor-

mance measurement existing today that describes color in terms of both shift in hue and chroma.

Readings are taken with a special spectrophotometer called a *goniospectrophotometer* (see Figure 3). This instrument allows readings to be taken in nearly 300 distinct measurement angles. The readings are taken at angles from 10–60° in 5° increments, and recorded on a special color chart (see Figure 4). A line is drawn connecting the plot points and the 10° and 60° measurements to the 0,0 point. The DCA, shown in the shaded area in Figure 4, represents the color travel of the pigment. The larger the DCA, the larger the pigment's color range.

### CONCLUSION

Prism-effect finishes hold promise as a finish of the future. The prism-pigment flakes have already been combined into several formulations by paint makers for custom finishes. Due to their high cost, the finishes are now mixed only when requested. Vehicle makers are expected to offer more of these finishes in the future. And other industries will continue to demand them. These trends will continue to make color-shifting finishes more mainstream items. 

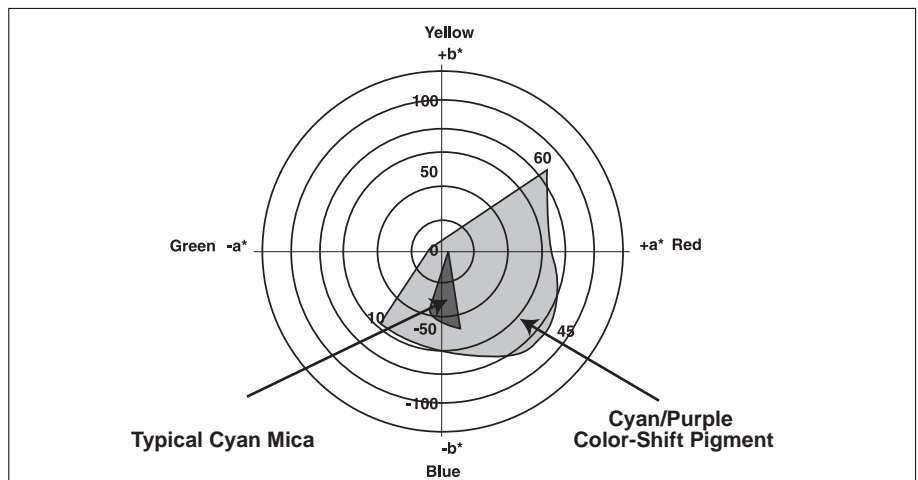


Figure 4—The printout of a color-shifting finish from a goniospectrophotometer. The color range of the finish is shown compared to a conventional mica finish. (Courtesy of Flex Products, Inc.)

# New Computer Management Systems —Systems Allow Tracking Work Flow

## WORK-IN-PROGRESS

Computer management systems usually use some form of “work-in-progress” report to keep track of where each vehicle is in the repair process. The scheduled repair is imported from the shop’s estimating program and passed along for parts ordering.

The work-in-progress report is the focus as soon as the vehicle enters the repair area. One software system, using a work-in-progress report to track work flow, allows comments to be keyed in by anyone who works on the vehicle. This includes customer comments, contacts with the insurance company, or anything else that is of interest to that specific repair (see *Figure 1*). Customers’ comments are included on the invoice, so they can see that their requests were acted upon. Any payments that come in can also be recorded on the work-in-progress report.

Another software program provides a “job status” report that shows all the jobs in process (see *Figure 2*). The production manager can create various status reports in order to track the status of parts received, stages of repair, etc.

*Continued—Page 6*

R/O #	Customer / Vehicle	Location	In Date	Start Date	Schd. Out
3661	MARGARET CUSTOMER 189 95 HOND CIVIC EX 2D BLACK MET	NEC	02/24/1997	02/24/1997	02/25/1997
3717	DAVID DABNEY 98 CHEV FLEETSIDE 2D MAROON	PNT	04/01/1997	04/02/1997	04/15/1997

Tag: EDR269 Day: 410-849-9236- Other: 410-122-4792-0000  
 Labor: LBR, MC2 Paint: PMT Mech: MCH  
 Comment:  
 03/29/97 - Parts Ordered 3/30/98 - Parts in  
 04/02/97 - Customer requested clean up of existing damage on LF Door.

*Figure 1—One part of a “Work-In-Progress” summary page that allows room to add comments on the repair. The repairs are listed in order of when repairs started, or the repair order number. (Courtesy of Jhenn Systems, Inc.)*

When owners of collision repair facilities are asked to state the ongoing challenges with running their businesses, one of the most common answers is tracking work flow. If everyone in the facility, especially the shop owner, is aware of where each vehicle is in the repair process, management becomes a much simpler task. And customers’ inquiries can be answered quickly and accurately.

There are several methods of tracking work flow, but most are not very effective. An oversized white board, for example, is good for visual purposes, but difficult to keep current. Then there’s the “shoebox” approach of trying to stay up to date with lists and stacks of parts orders. Even with a good filing system, the most excellent secretary has trouble with this method. And what happens when the secretary isn’t there?

Many shop owners have turned to a system that was originally designed to manage data: a computer, and one of the several variations of shop management software available. With these systems you can

put data for each job in one time and recall it whenever you need it, in whatever form you need to see it. Jobs can be tracked by part, job cost, payments made, location in the shop, or technician now responsible. When a customer calls and asks how long it will be before the vehicle is ready, the answer is within easy reach.

Most shops already use computer software for at least front-office business tracking, if not for estimating and measuring. Every shop can benefit by using some level of computer management software. This article is about some of the several types of systems available.

RO	Last	Year	Make	Mod	In	Promise	Revised	Today	Status	Pri	Note
1047	LEAGUE	85	VOLV	P1E	10/29/98	11/20/98	/ /		110 Hold-Parts	0	
1049	LANCASTER MOF	91	CHEV	K19	10/27/98	10/31/98	/ /	Y	120 Prep	0	
1067	DOLLENMAYER	36	CHEV	CP	10/27/98	06/30/98	/ /		130 Paint - Leo	0	
1069	PREVENTION	97	FORD	F3E	10/28/98	11/17/98	11/25/98	Y	109 Parts Ordered	0	
1117	CANOY	93	ISUZ	ROI	11/21/98	11/20/98	/ /		040 Need Teardown	0	

*Figure 2—The job status screen updates all repairs at a glance. (Courtesy of ICM)*

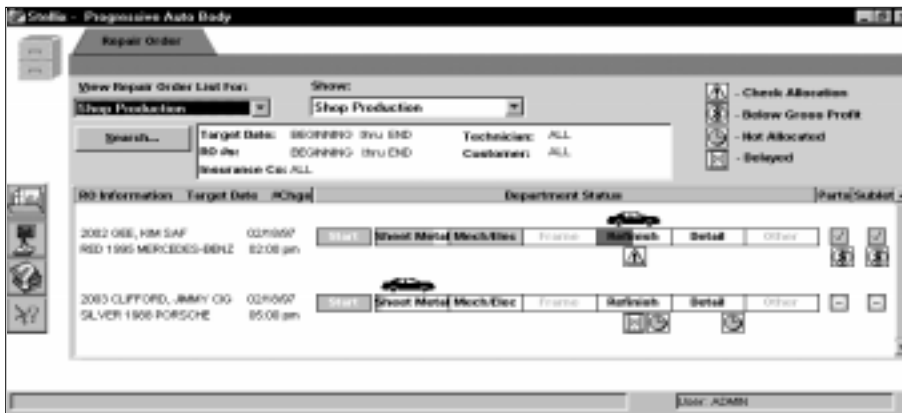


Figure 3—One system offers an optional time clock to key in hours spent on a repair. If your shop uses a time clock, this would be a familiar way of tracking a repair. (Courtesy of ADP, Inc.)

### Time Clock Tracking

One system uses an electronic time clock to update the production status of every vehicle in the shop. Technicians use a touch screen to sign in, report details of the work they did, then sign out (see Figure 3). The information becomes available throughout the shop. This not only enables the shop manager to see the job status at anytime, it enables other technicians to see notes that have been sent to their department related to the repair. This is another way to improve shop communication. If there's a problem with the repair, everyone knows in a timely manner.

### Mobile Tracking

One management software system can be loaded into a laptop computer for use as a mobile job tracker. It can be carried to the back lot to track the status of the vehicles waiting there. The program includes handwriting recognition software, so hand-written notes can be added. Equipped with this mobile job tracker, the production manager can look at each vehicle, take note of the work that's been done, and decide whether or not parts are still required. A display shows each vehicle on the lot, its status, and in

which department it's now located (see Figure 4). When a customer calls in, it's easy to see exactly where the vehicle is and estimate when it will be done. The display screen also shows if there are parts on back order and where the red flags are in terms of production control.

One possible downside of this mobile system is that it's available only as an option with the provider's full-feature, comprehensive management system software, and aimed at the high-volume shop.

### OTHER FEATURES

Tracking work flow is definitely not the only feature of most full man-

agement programs. There are other challenges management software can address:

- Parts tracking
- Profit tracking
- Scheduling

### Parts Tracking

All management software systems feature some level of parts tracking. Parts tracking usually features screens that can be called up to show where each part belongs, the parts that are on back order, part change orders, and parts that must be returned. It also ensures that credit is received for parts that were not used. A parts purchase order is usually one of the first documents created after scheduling the vehicle for a repair. Parts are usually tracked separately, and matched to the proper repair. Besides helping to keep a repair status up to date, a parts tracking record ensures no part will sit on the shelf for six months because no one knows its status.

### Profit Tracking

Profit tracking is achieved by job costing every step of the repair process. Often by the time a shop manager realizes the shop is not



Figure 4—This screen is shown on a laptop computer that can be taken to the back lot to check on the progress of repairs. Written comments can be made with a light pen. (Courtesy of Mitchell, Inc.)

making a profit, it's too late. Management systems forecast profit and do job costing while the job is going on, so a change can be made before it gets too late.

## Scheduling

While work-flow tracking replaces the big white board, scheduling features replace the big calendar on the wall. Screens can be called up that show which technicians are available on each workday and their current workload. Knowing each department's availability can make scheduling much easier.

## Payroll

Just as a management program tracks the technician working on each vehicle and if a profit is being made, it can also allocate payroll system accounts. Most systems allow managers to set up a payroll system using flat, commission, or hourly rates. Different rates can also be set up.

## SYSTEM TRAINING

Computer-based management systems vary widely in how they offer training. Training ranges from several days of personal, on-site instruction, to regional seminars, to a supplied video. All systems offer technical support over the phone.

The extent of offered training sometimes depends on how complex the system is. One software developer that offers a turn-key, comprehensive management package insists on sending a representative to the collision repair facility. The representative not only installs the software, but provides at least three days of on-site training and sets up the program specifically to the business requirements. The

developer's main concern is that no one can absorb everything on their own and be able to take advantage of all the system has to offer without extensive on-site training.

Another software developer provides computer-based training which is bundled into the same software package. A representative installs the software, then shows how each employee can receive a custom-made curriculum. The program asks each employee to provide their role in the facility, then shows how the software can be used for their own purposes. A simulated repair is part of the training program. After everyone receives their orientation, they're invited to a course to finish the training. The courses are held regionally.

## COMPARISON SHOPPING

Once a shop manager has decided a computer management system might be a worthwhile investment, the next decision is which one? There are several systems to choose from.

Companies that offer computer estimating systems also offer management systems, so if a shop has an estimating system, that would be a place to start. But that should not be the only deciding factor. Most software management systems are compatible with any estimating system.

It's best to write down the features that you want the system to do, then look for the system that best fits those requirements. One feature to look for is the adaptability of the program to your own shop's needs.


Use other industry people's experience as much as possible, by asking around and learning from the

successes of other shops. You can do some research on the Internet. Most companies have a web site, and many have a downloadable demonstration version of their program. Contact names and telephone numbers of sales representatives in your area can also be found on the Internet.

Often the company will allow you to use a system on a trial basis. Do this, or use a demonstration version, before purchasing. You want to find a software "look" that is similar to how you do business. For example, the programs may have files in file drawers that you can name just like the existing hard copy files in the shop. Or the parts ordering form may look similar to the one you're used to. The less time you have to spend getting used to the look of the program, the sooner the program will work for you.

Do a cost-to-benefit analysis. It may not be easy, at first, to see how such a software purchase helps your bottom line. However, an actual analysis of time saved when tasks don't have to be done over and over again may justify the system cost.

## CONCLUSION

The white board or shoe box approach to tracking work flow may work with some shops, but sooner or later the benefits of management by software may be the most practical approach. One management system software maker did a market study last year, and found that out of 50,000 body shops in the United States, 8,000 use some type of electronic management system. That leaves a market that is widely untapped. If you're having trouble keeping a handle on the status of the work flowing through your shop, maybe you should consider one of these systems. 

# Formable Aluminum Foam

## —Sandwich Panels Are Food For Thought



Figure 1—A new method of making foam sandwich panels enables the panel to be formed into complex shapes. (Courtesy of Karmann USA, Inc.)

A new type of aluminum foam sandwich panel has been developed that can be stamped into complex shapes. The concept of making a flat panel out of metallic foam sandwiched between sheet metal has been used for several years. What is new is how the foam is made, enabling the sandwich panel to be contoured (see Figure 1).

Aluminum “foam” has traditionally been made by blowing gases into molten aluminum. This results in a flat, rigid structure, like a metallic sponge, out of which the part is cut.

This new aluminum foam panel starts by compacting aluminum powder and a propellant mixture between two pieces of sheet metal. There are no adhesives used. The outer layers are stamped into the desired shape in the same manner as a normal aluminum pressed part. The shaped part is then put into a casting form and heated. This melts the aluminum powder and activates the propellant, releasing gases. The gases are trapped in the sandwich, causing the sandwich panel to expand to its full thickness.

Aluminum foam panels can't be welded. Welding would destroy the sandwich's foam mid-section. The panels have to be joined by adhesive bonding or riveting.

### Applications

Crash tests prove that aluminum foam panels add structural stiffness and energy absorption to a vehicle, but add less weight than steel. As much as 20% of a vehicle structure could contain these panels. Possible applications identified so far include any large sheet metal parts, such as floor pans, roof panels, dash panels, and luggage compartment walls (see Figure 2). Aluminum foam also has potential for passive safety applications due to its energy-absorbing characteristics. This includes pillar and rail reinforcements.

Models of the aluminum sandwich panels were compared to similar steel panels in a simulated stress test (see Figure 3). The aluminum

foam luggage compartment floor on the top in Figure 3 is 10 mm ( $\frac{3}{8}$ " ) thick, compared to the steel panel which is 1.5 mm (19 gauge). The aluminum sandwich panel is 10 times stiffer than the steel panel, yet weighs 23% less. The stress test shows that the foam sandwich doesn't deform as much as the rigid steel panel. In the simulated test, both parts were clamped on the left side and twisted on the opposite side.

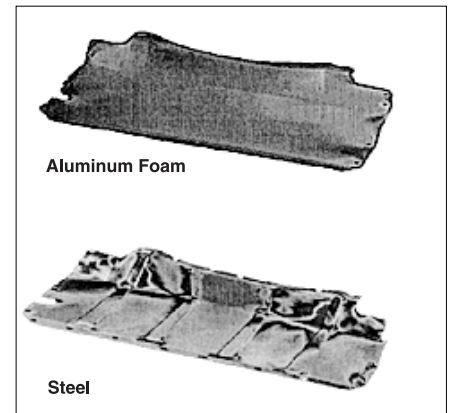



Figure 3—Results of simulated torsion tests on an aluminum foam sandwich panel and a comparable size steel panel. (Courtesy of Karmann USA, Inc.)

A Karmann Ghia concept vehicle, without any closure panels, has been developed using the aluminum foam technology. A full prototype vehicle is expected within a year. Series production is about two years away. 

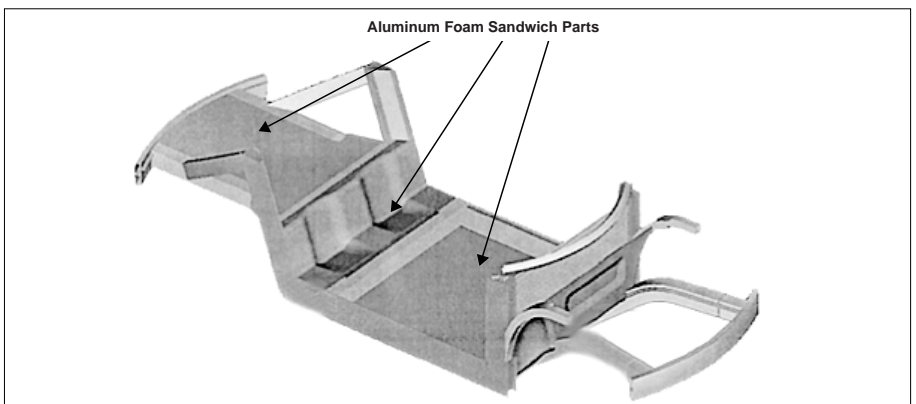


Figure 2—Aluminum foam sandwich panels can add stiffness and reduce weight anywhere a large surface is required. (Courtesy of Karmann USA, Inc.)

# “Smart” Glass

## —Lightens Or Darkens On Command

New “smart” glass technology allows controlling the amount of light transmitted through glass by adjusting the voltage within the glass. The secret is a thin plastic film containing light-absorbing particles that are suspended in 0.03 mm (0.001”) liquid capsules. The film is laminated between two sheets of glass, with electrically conductive coatings on the inner surfaces. There’s just enough liquid in the capsules to allow the particles to orient in random directions and absorb light. This dark appearance is the “off” state of the glass. When the glass is switched “on,” a moderate amount of voltage pushes current between the conductive coatings through the capsules. The particles align and the glass becomes transparent (see Figure 1). The applied voltage can also be varied to make the glass appear anywhere between clear and dark.

### APPLICATIONS

Smart glass technology is being considered for use in eyewear, computer screens, and architectural glass. Clear plastic can use the same technology, expanding the possibilities to such applications as instrument lenses and ski goggles. Instant-dark welding helmets may be possible with this technology, but that market has not yet been approached.

There is no commercial automotive application of smart glass yet, but there are several options being considered. These include sun and moon roofs, back and side lites, the narrow shade on the top of windshields, instrument panel gauge lenses, and a self-dimming rear-view mirror.

The company that holds the patent on the technology is licensing its use to several suppliers, who are working with regulatory agencies to

determine how the glass will be used for specific applications. For automotive side lites, for example, a simple rheostat could be installed to allow a passenger to dim the sun’s glare or block it totally without having to pull down a window shade. Other variable switches could be automatic, such as a photocell to adjust the voltage based on the amount of available light, or a thermostat to adjust the voltage based on temperature.

The film containing the particles can be laminated between two layers of glass or laminated on the outside of the glass. On windshields, which are already laminated with a plastic layer for shatter resistance, the particle film could replace the plastic laminate. The light-absorbing film would be present only in the shaded band across the top, where it’s allowed by law.

Light-absorbing glass will not necessarily be OEM-supplied. Aftermarket sunroofs and windshields should be available. If the windshield shade is made available

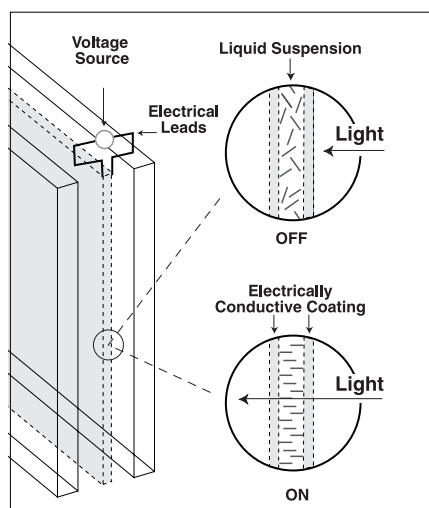


Figure 1—Switching the glass “on” aligns the particles, allowing light through. (Courtesy of Research Frontiers, Inc.)

as a separate part, it would have to be laminated to the interior and a scratch-resistant layer applied to the film. For all aftermarket installations, a wire harness would also be supplied.

### Not Electrochromic

Light-absorbing smart glass looks similar to electrochromic glass, which has been available for several years. Both types of glass are tunable from dark to clear. But there are some major differences. Electrochromic glass requires a chemical reaction, induced by charged ions, to turn the glass clear. This reaction becomes slower with age.

Electrochromic glass requires current to flow from the edge to the center of the glass. The reaction progressively slows with larger pieces of glass, making the lightening effect visible as it makes its way from the edge to the center. With smart glass, size is not an issue, since the current has to flow only across each microscopic particle gap. The whole surface uniformly darkens or lightens instantly. This leads to another difference between electrochromic and smart glass: electrochromic glass requires very high current to generate the electrochemical reaction across the surface. Smart glass uses very low current.

### Repairs

The extent of repairs to electronic, light-absorbing smart glass will likely be limited to only minor wiring repairs. Simple bullseyes or small cracks, which are routinely repaired on windshields today, are not expected to affect the laminate. Even if the film is damaged in one spot, it is not expected to affect the rest of the surface. Still, a damaged film will likely be recommended for replacement.

Though there’s no definite applications yet, look for smart glass to be introduced in the future, beginning on some luxury models. **A**

# Ask I-CAR...

The I-CAR Tech Centre receives many questions on collision repair subjects, as well as articles that appear in the Advantage. Some of those questions, with the answers, are published as a regular feature.

**Q** I'm considering buying a spot welder for the shop. The salesman says we could use the welder on any vehicle. What does I-CAR say about using squeeze-type resistance spot welders?

**A** I-CAR's position is to use squeeze-type resistance spot welders (STRSW) following the vehicle maker's recommendations. Although Asian and European vehicle makers have been recommending the use of STRSW for years, Ford, GM, and Chrysler do not recommend using STRSW when repairing their vehicles in the United States and Canada. This means that if you use an STRSW on a Ford, GM, or Chrysler vehicle, and the joint fails in a collision, the vehicle maker will not stand behind you.

A number of problems with STRSW have been cited by the domestic OEMs. These include inadequate power and pressure, lack of access to some locations, and most importantly, inadequate duty cycle. Duty cycle is basically the maximum number of welds the machine can make in a given period of time (before the transformer overheats).

Whether or not you use STRSW to repair a domestic vehicle is a business decision that should be based on several factors, including the liability risk.

**Q** Has Transport Canada decided on whose side-impact protection standards it will adopt, U.S. or European? Will FMVSS 214 be the standard or will vehicles being built for the Canadian market have to comply with updated side-impact protection standards?

**A** The article in the January-February 1998 issue of the Advantage, "New Designs For Side-Impact Protection," did leave it undecided as to which standard Transport Canada will follow. No, that decision has not yet been made. It's not that Transport Canada isn't trying. Over the past six years, the agency has performed over 50 full-scale crash tests, using both moving deformable barriers and "bullet" vehicles, attempting to identify the most appropriate procedure to test side-impact performance in Canada. In addition, over 100 field investigations have been conducted where

the collision circumstances match those simulated by the U.S. and European side-impact testing procedures.

This indecision by Canada may have caused the U.S. National Highway Transportation Safety Administration (NHTSA) to revisit the subject. The crash dummy used in the European Regulation 95 test gives more information than the crash dummy used in the FMVSS 214 test (see Figure 1). While the two standards are likely to result in different occupant-protection methods, the overall protection to the occupant is similar.

NHTSA was working on a compromise between the two standards, and now the Federal Office of Road Safety in Australia is working towards developing a single side-impact standard, which includes the best of the European and U.S. standards. Both NHTSA and Transport Canada await the results of that study.

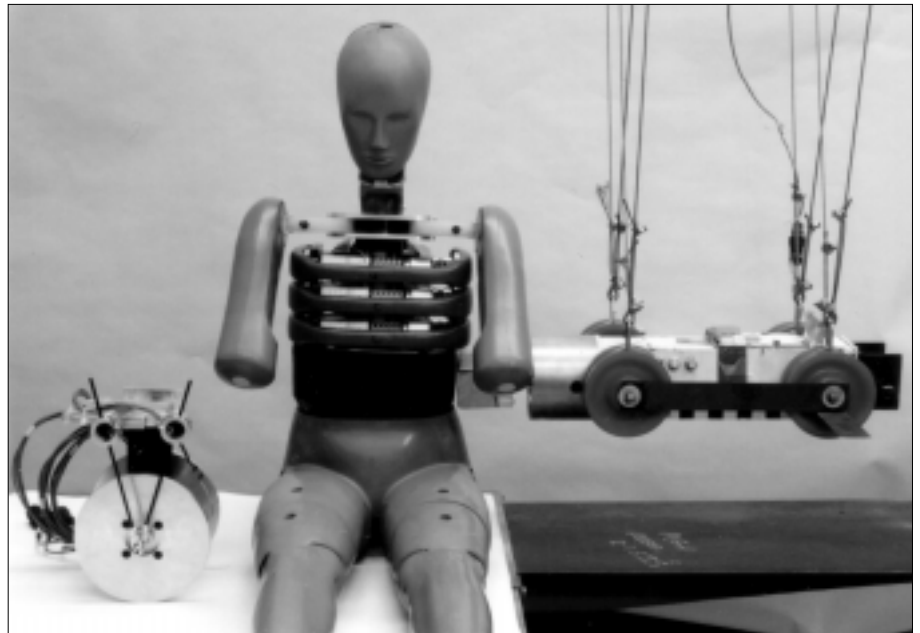


Figure 1—The European test dummy is designed to measure the effect of a side impact at five locations on a human body. The U.S. test dummy measures at only three locations. (Courtesy of MGA Research Corporation)

**Q** We had a hail storm last month and since then there have been a lot of service providers appearing in the area offering paintless dent repair. One of the dent repair technicians told me nearly every repair requires drilling access holes in the back of the panel. What does I-CAR say about this, and paintless dent repair in general?

**A** I-CAR does not recommend any procedure that would require drilling access holes in a panel. This could lead to corrosion problems or even the creation of an unwanted crush zone. There's enough of a concern with paintless dent repair in damaging the corrosion protection on the panel backside when using pry picks to massage the dent out (see Figure 2). Drilling an access hole adds to the problem by creating a corrosion hot spot. This is one reason Toyota recommends against the use of paintless dent repair on its vehicles. If existing holes can't be used, paintless dent repair is not an option.



Figure 2—Paintless dent repair requires prying from the panel backside by inserting pry tools in access holes.

I-CAR does not cover paintless dent repair in any course material at the present time. An Advantage article on the subject (see "The Art Of Paintless Dent Removal" in the May-June 1996 issue of the Advantage) reported on the process and the cautions that must be taken with this approach.

One other point. Some paintless dent repair technicians say that all hail dents can be removed with this process. This is not true. There are several factors, such as possible paint cracking (immediate or future), that requires careful damage analysis before proceeding with this process.

**Q** What does I-CAR say about the use of salvage struts and drivetrain parts?

**A** I-CAR does not recommend against the use of salvage struts or drive axle assemblies, from a technical standpoint, as long as the vehicle warranty is not affected and the part is of the correct design. One concern with both of these assemblies is that they are constructed of some parts that wear. Because of that, there are a number of factors to consider including:

- Struts and drive axle assemblies must be from a vehicle with comparable mileage and condition to the vehicle being repaired.
- A replacement strut must match the type and condition of the strut on the opposite side. Springs must bring the vehicle to the correct ride height, and have the same spring rate.
- Replacing one strut may result in having a combination of a worn strut and a strut with little or no wear. That may cause

handling problems due to side-to-side unbalanced jounce and rebound rates.

- Recycled drive axles must be inspected for damaged boots, corrosion, worn joints and worn outer housings. If axle nuts are one-time fasteners, they must be replaced.

**Q** I've heard that a cartridge-type vapor respirator can become saturated by just leaving it on a shelf, exposed to vapors in the air. Is this true?

**A** Cartridges can lose some service life by surface absorption, but only a small percentage. Cartridges work when a flow of contaminated air passes through the activated carbon or other fill material, in other words when you inhale with the respirator on (see Figure 3). The main concern is moisture. Moisture can severely shorten the life of activated carbon.



Figure 3—Air-purifying cartridge respirators are designed to draw in air only when worn.

Respirators must, by regulation, be stored away from any contaminated area and from high humidity and temperature extremes. The best storage is in the plastic bag the respirator may have been originally packaged in, and in your personal storage area. **A**