TECHNICAL Feature

By Larry Montanez III, CDA
and Jeff Lange, PE

Vehicle Substrates:

The Very Near Future

In the next few years, the Corporate Average Fuel Economy (CAFE) standards to reduce energy consumption by increasing the fuel economy of cars and light trucks will directly affect the types of substrates utilized by the vehicle manufacturers and how the vehicles are designed. These changes will come in an effort to reduce the overall weight of the vehicles produced. Additionally, these changes will affect the collision repair industry as well as the safety of the general motoring public. This month's article will explain how the coming vehicle designs will affect repair professionals, how to prepare for these changes and what training and equipment will be required.

Based on scientific studies, the use of lightweight aluminum lowers fuel consumption, which saves fuel and lowers emissions. Studies show that for every 10-percent reduction in vehicle weight, there is a five- to seven-percent fuel savings. Aluminum powertrain components provide greater benefits, improving fuel economy by 13.5 percent compared to an equivalent vehicle with primarily steel powertrain components. Now, assemble the same vehicle with outer panels comprised of aluminum, and the fuel economy rises to 21.8 percent. Aluminum-intensive vehicles (structural components) will raise that overall fuel economy to over 35 percent when compared to an equivalent vehicle comprised of steel components. The current CAFE standards for average required fuel economy (mpg) are as follows:

Model Year	MPG Passenger Car	MPG Light Truck
2011	30.4mpg	24.4mpg
2012	33.3mpg	25.4mpg
2013	34.2mpg	26.0mpg
2014	34.9mpg	26.6mpg
2015	36.2mpg	27.5mpg
2016	37.8mpg	28.8mpg

On average, most automakers will seek to lower the overall weight of their cars and light trucks by at least 10 percent by 2020. Studies show that factors are already in place that will push aluminum content to 400 pounds per vehicle by Model Year (MY) 2015/2016.

Aluminum is gaining market share at the expense of both traditional and high-strength steels (HSS), which are declining as a percentage of vehicle makeup. Conversely, advanced high-strength steels (AHSS) are growing at the expense of lower-grade steels, but gauge reduction with AHSS provides limited weight-savings potential compared to using lower-density aluminum. Pound for pound, aluminum replaces more than twice as much weight as AHSS. The first mass-produced aluminum intensive vehicle was the Acura NSX, which ran from MY 1990 to MY 2005. In MY 1997, Audi introduced the aluminum-intensive Audi Space Frame (ASF) Audi A8 (MY 1997 - present), and Plymouth introduced the composite monocoque over an aluminum-intensive Frame Prowler (MY 1997, MY 1999 - MY 2002). Although Acura, Audi and Plymouth are popular manufacturers, these models did not sell in every market, and the total sales numbers were not in line with the sales of their steel counterparts. However, this all changed in 2004, when BMW introduced the all-new 5 and 6 Series – the first hybrid constructed (aluminum/steel) monocoque vehicles. These ran until MY 2010, and the 5 Series was a popular vehicle that produced good sales figures. BMW was also one of the first manufacturers to prohibit structural realignment of the aluminum structural components. Since MY 2004, many other vehicle makes have produced aluminum-intensive vehicles, which have very specific repair procedures. Some manufacturers even created collision repair programs that certify collision repair facilities, with a few limiting the sales of the aluminum components to only certified facilities.

In the last few months, car enthusiast websites have reported about rumors of upcoming new models. This speculation includes:

- GM offering the large SUV (Yukon/Suburban) with aluminum body panels by MY 2014;
- Ford offering the F-150 and Expedition with aluminum body panels and frame by MY 2014;
- GM, Ford and Chrysler signing a deal with an aluminum manufacturer to produce aluminum body components;
- 2014 Mercedes-Benz S Class having more aluminum in the structure;
- Porsche adding more aluminum to next-generation vehicles in the next few years, starting with the Boxster in MY 2013;
- More OEMs utilizing aluminum hoods, trunk lids, door assemblies and roof panels on steel intensive vehicles; and
- More OEMs using composite plastics, such as carbon fiber.

We are all aware of the recent usage (in most vehicles) of advanced high-strength steels (AHSS) in B-pillar and rocker panel reinforcements, such as boron alloyed and quenched martensite steel. We will see even more AHSS utilized in the next few years, along with the use of carbon fiber components such as radiator core supports, passenger tubs and pillar inner reinforcements. Additionally, we will see more aluminum closure panels and, in some cases, aluminum roof panels.

So what does this all mean to you? It will mean more training

This Month's Definition from Collisionpedia.org

SUBSTRATE

A solid substance or medium to which another substance is applied and to which that second substance adheres.

and equipment purchases.

Some of the classes your technicians and damage assessors will be required to attend are:

- Damage analysis of mixed substrate vehicles;
- Adhesive bonding;
- Carbon fiber and composite plastic repair;
- Aluminum metal panel forming and shaping;
- Aluminum MIG welding;
- MIG Brazing welding;
- Advanced airbag systems;
- Electronic vehicle systems and components;
- Material sciences and substrates; and
- Understanding of applied collision forces on different types of substrates.

Some of the equipment purchases that will be required by the facility owners will be for:

- Different types of riveting guns;
- Aluminum and silicone bronze MIG welding equipment;
- Dedicated fixture and/or universal structural repair equipment (Car-O-Liner, Celette, CarBench and Global Jig);
- Subscriptions to OEM-specific repair information and/or ALLDATA Collision;
- Separate "Aluminum Only" repair rooms or quarantined areas (curtained areas);
- "Aluminum Only" pneumatic and hand tools;
- Electronic code reading equipment;
- Adhesive material application guns; and
- Different types of sandpaper for "Aluminum Only" vehicles.

As you can see, there is a lot to do to properly prepare for the upcoming changes in vehicle designs to ensure you and your personnel are well-trained and equipped to repair the collision-damaged vehicles that will be in your facility. We are not only faced with AHSS, electronics and computer-controlled components, but we will also be up against components comprised of aluminum and composites. These require different repair procedures than we are trained for. The safety and well-being of the general motoring public are based upon our ability to learn these new procedures and to purchase the proper equipment. We can no longer just guess at a repair procedure; we need to know what the procedure *is*. Additionally, we can no longer ignore the OEM repair procedures, position statements and replacement requirements.

The following is a partial list of aluminum-intensive and/or aluminum-steel hybrid constructed vehicles. Look for a complete list on **www.collisionpedia.org** in the coming

continued on page 30

continued from page 29

months. (The website should launch in December 2012.):

- Acura NSX (MY 1990 - 2005 and MY 2015);
- Audi A8 (MY 1994 - present), TT (MY 2006 - present), R8 (MY 2006 - present) and A2 (MY 1999 - 2005);
- BMW 5 Series (E60) and 6 Series (E63) (MY 2004 - 2010), Z8 Series (MY 1999 - 2003);
- Chevrolet Corvette C6 Z06 (MY 2006 - present), C6 ZR1 (MY 2009 - present);
- Ferrari Enzo Ferrari (MY 2002 - 2004), 612 Scaglietti (MY 2004 - 2011), 360 Modena (MY 1999 - 2005), F12berlinetta (MY 2012 - present);
- Ford GT (MY 2003 - 2006);
- Jaguar XJ (MY 2003 - present), XJ (MY 2006 - present);
- Lamborghini Gallardo (MY 2004 - present), Aventador (MY 2011 - present);
- Mercedes-Benz McLaren SLR (C199) (MY 2003 - 2010);
- Mercedes-Benz S Class (W221) (MY 2007 - present), CL Class (W215) (MY 1999-2006), CL Class (W216) (MY 2007-present), SLS AMG (C197) (MY 2010-present), Maybach 57/62 (W240) (MY 2002-2013) and SL (R231) (MY 2007- present);
- Nissan GT-R (MY 2007 - present);
- Plymouth Prowler (MY 1997, 1999 -2002);
- Porsche Carrera (991) (MY 2012 - present), Panamera (970) (MY 2010 - present); and
- Rolls Royce Phantom (MY 2003 - present).

We hope this article has helped the industry to understand what the future holds for all of us and how to better prepare for it. Feel free to contact us if you have any questions.

Larry Montanez, CDA is co-owner of P&L Consultants with Peter Pratti, Jr. P&L Consultants work with collision repair shops on estimating, production and proper repair procedures. P&L conducts repair workshops on MIG & Resistance Welding, Measuring for Estimating and Advanced Estimating Skills. P&L also conducts investigations for insurers and repair shops for improper repairs, collision reparability and estimating issues. P&L can be reached by contacting Larry at (718) 891 – 4018 (office), (917) 860 – 3588 (cell), (718) 646 – 2733 (fax) or email at **larrygoju@aol.com**. Check out Larry's website at **www.PnLEstimology.com**.

Jeff Lange, PE is president of Lange Technical Services, Ltd. of Deer Park, NY (**www.LangeTech.net**). Jeff is a Licensed New York State Professional Engineer who specializes in investigating vehicle and component failures. Lange Technical Services, Ltd. is an investigative engineering firm performing forensic vehicle examinations and analysis for accident reconstruction, products liability and insurance issues. Jeff can be reached at (631) 667-6128 or by e-mail at **Jeff.Lange@LangeTech.net**.