



The World Wakes Up To Reman

UN Report Puts Remanufacturing on the Global Agenda

**Reman Cartridges
Fighting for Survival**

**Showtime
in Vegas**



**GOOD AS NEW.
STRONG AS EVER.**



Reman Placed on Global Agenda

The UN Environment Programme’s International Resource Panel made October 23, 2018, a historic Day for Reman, when it published a report on remanufacturing and the future of the world economy

Cover story **9**

Milan Home to WRS 2019 **8**



Reman Cartridge Sector Under Attack **22**



Rochester Conference **13**



New Online Tech Hub **18**



Las Vegas 2018 **19**

New Force in UK Reman R&D **21**



Auf Wiedersehen, Rolf People & Parts **5-7**



Once in a Century Opportunity **24**

Remanufacturing Goes Into Orbit

It's so long ago that it's hard to remember: The time when remanufacturing appeared a somewhat chaotic mix of rusty parts, small time repair shops, spray-and-pray solutions, and, perhaps above anything else, the subject of much suspicion of underhand procedures and processes, of "cowboy" practices.

In recent years, the perception of remanufacturing has undergone a complete transformation. So much, indeed, that as we approach 2019, "reman" is starting to receive global recognition outside the industry itself for its contribution to the well-being of the globe and to everyone who populates it. From what seemed more like a cottage industry to current high science. A quantum leap in a remarkably short span of years.

There are many reasons for this and most of them good. The commitment and dedication of people and businesses in the industry is one. The work of scientists and researchers developing new visions and procedures another. The pride in their craft of the industry's specialized workforce and rising global awareness of the need to protect the world from environmental disasters play crucial roles.

As is evident in this edition of Reman World, most of these factors are now coming together. Combining technological and scientific advances, healthy industrial and business progress and human desire to make a better life for ourselves and the generations that will follow, the industry has reached a watershed. It has, indeed, gone to the next level. The new UN report on manufacturing and remanufacturing is the clearest sign of this so far.

The coming of age of remanufacturing has happened at a speed which few would have foreseen just a few years ago. Now let's imagine what the industry can achieve in another few years...

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Borg Automotive Goes to the Next Level in Poland

Denmark-based Borg Automotive, Europe's largest independent automotive remanufacturer, has announced significant expansion of its production facilities in Poland. Having operated a factory in Zdunska Wola near Lodz for several years, Borg will open a new factory in Lublin in Eastern Poland in the first quarter of 2019. Currently, the Zdunska Wola facility employs a workforce of 1300 people, producing remanufactured starters, generators, brake calipers, steering gear and steering pumps.

"Not least in the light of the growth of the

circular economy, the market for remanufactured products shows significant growth," Borg CEO, Kim Kruse Andersen, said in a statement. "According to our projections, capacity at Zdunska Wola will be filled in 2019. As a result, we need to increase capacity at the Polish operations and this is what we're doing with the new factory in Lublin. The new plant will offer us the necessary room for expansion."

In addition to its Polish operations, Borg Automotive, which sells its products under the Lucas, Elstock and DRI brands, has pro-

duction in the UK and a sales and development center in Belgium (See also page 17). Headquartered in Silkeborg in Jutland, Denmark, the company expects to reach a turnover of DKK 1 billion (approximately \$150 million) in its current financial year.

Borg Automotive is owned by Danish industrial group Schouw & Co, following the acquisition of the company from founder Søren Toft-Jensen in 2017. Toft-Jensen, a former Remanufacturer of the Year in Europe, remains an executive with the company. ■

Prestigious Award for Knopf Chairman

Woody Knopf, Chairman, Knopf Automotive LLC, was honored with the second annual Michael Cardone Leadership Award at an event in Troy, Michigan in late September. Created by MERA – The Association for Sustainable Manufacturing, the award recognizes individuals who demonstrate "Exceptional Leadership in Remanufacturing and Sustainability."

"In addition to his outstanding ability to build long-lasting business relationships, Woody Knopf has a passion for giving back," said John Chalifoux,

CEO of MERA. "With this award, we recognize and thank Woody for his dedication to our industry and for his love and support of the people in the communities in which he lives and works."

"It is a great honor to receive the second annual Michael Cardone Leadership Award," said Knopf. "I am humbled that my contribution to our industry and the community have been recognized by the members of MERA and the Cardone family." ■



MERA Chairman David Overbeeke, award winner Woody Knopf and MERA CEO John Chalifoux

MEMA President and CEO Announces Retirement

The Motor & Equipment Manufacturers Association, the influential US motor industry trade association, will be losing its CEO, Steve Handschuh, with effect from the new year.

"Having led MEMA since 2013, Handschuh has decided to leave because of recent concerns with his health," said the association which announced Handschuh's decision "with regret."



Steve Handschuh

In his 40-year career in the automotive

aftermarket industry Handschuh worked for NAPA AUTO PARTS/ Genuine Parts Co, Mighty Auto Parts and AutoZone (as a senior vice president).

Handschuh joined MEMA in 2006 as the president and chief operating officer of the Automotive Aftermarket Suppliers Association (AASA) before

being appointed president and chief executive officer of MEMA in October 2013.

By directly employing a workforce of more than 871,000 people and generating a total employment impact of 4.26 million jobs, MEMA's member companies are the largest sector of manufacturing jobs in the US. MEMA's members are represented through four divisions: Automotive Aftermarket Suppliers Association (AASA), Heavy Duty Manufacturers Association (HDMA), Motor & Equipment Remanufacturers Association (MERA), and Original Equipment Suppliers Association (OESA). ■

ATC Drivetrain Celebrates First 80 Years

In October, ATC Drivetrain of Oklahoma celebrated its 80th Anniversary at the corporate headquarters in Oklahoma City. Recognizing past and present employees, local leaders and business partners, the event highlighted the company's close relationship with its customers.

"We are incredibly grateful for the many people who have made this journey and accomplishment possible, for the trust and

loyalty of customers who have partnered with us over the years, and for our owners and investors," stated CEO and President Joseph Roark.

Established as one of the longest-standing providers of engine remanufacturing, logistics services, and automotive solutions in the region, ATC Drivetrain is a leading provider of remanufactured automotive drivetrain components, such as automatic

transmissions and engines. Longtime ATC Drivetrain customers include such blue-chip automakers as Ford, Nissan, Chrysler, Eaton, and Subaru. ■



ISS Opens New HQ in Portland, Oregon

Instrument Sales and Service recently announced the opening of its new corporate facility in Portland, Oregon. Located close to Portland International Airport, the new facility extends capacity for manufacturing, quality control, customer support, engineering, sales and services in addition to the company's existing facilities in the state of Washington, Arizona, Texas and Michigan.



ISS provides remanufacturing for auto electronics, including auto ECM electronics, as well as other important mechatronic components. Its reman operations include cleaning, testing, failure mode analysis, reverse engineering, development of proprietary testing

equipment and discrete component repair and packaging.

"We are fortunate to have found a perfect new home for our company," said Ron Freeman, CEO of Instrument Sales and

Services, Inc. We have been in business since 1949 in the Portland area and the new facility will allow us to continue to grow, better service our customers, and develop systems to keep pace with our clients' needs." ■

Bendix to Acquire US Remanufacturer of All-makes Steering Components

Bendix Commercial Vehicle Systems (Bendix) has announced the acquisition of steering-systems remanufacturer ProSteering. A member of the Knorr-Bremse Group, Munich, Germany, Bendix is making the acquisition from Tennessee-based JM Engineered Products, a remanufacturer of all-makes power steering systems for the North American commercial vehicle market.

Once completed in six to 12 months, the

transaction will incorporate the ProSteering brand's products, manufacturing, and



sales and service operations into Bendix's steering business and remanufacturing unit.

"With the addition of these top-line products to our lineup, the aftermarket channel will be able to turn to Bendix as a one-stop destination for an even wider range of high-quality products," said Scott Burkhart, Bendix vice president of sales, marketing, and business development. "And customers choosing the steering components can count on the backing of Bendix's long-established post-sales distribution, service, and support network." ■

“Reman Guru” Rolf Steinhilper: Mission Accomplished

An era in European remanufacturing came to its conclusion when scientists, politicians, business leaders and academics gathered to celebrate Professor Rolf Steinhilper at the official end of his tenure as head of the faculty of Environmental Production Technique and Process Innovation at the University of Bayreuth in Bavaria last month.

A legend in the global remanufacturing community and recognised as the father of remanufacturing in Europe, 65 year-old Professor Steinhilper has been at the heart of research and development of remanufacturing for close to 40 years.

Since becoming Professor at the University of Bayreuth in 1989, Steinhilper has built Bayreuth University into the leading depository of expertise for remanufacturing and a source of inspiration for remanufacturers across Europe.

Along the way, he played a key role in creating the new Fraunhofer Institute department in Bayreuth and, thus, contributing significantly to the huge German institute’s expertise in remanufacturing.

As a globetrotting lecturer, speaker, author and presenter Rolf Steinhilper has been instrumental in establishing “reman” as a key component of the drive towards greater sustainability, in particular within the automotive sector. One example of his



Professor Steinhilper saying auf wiedersehen after 40 years at the heart of reman

global reach is his role as a co-founder of the World Remanufacturing Summit, an event which has rotated between Europe, USA and Asia since 2012.

BRILLIANT ENGINEER

For all this and more, close to 200 people, led by Bayreuth Lord Mayor, Brigitte Merk-Erbe, and local colleagues and business leaders met to wish Steinhilper “all the best for the future” on September 21.

Bidding the University “Reman Guru” farewell, Bayreuth University’s Vice-chancellor Markus Zanner told the audience: “For the university it has been crucial to have an interface between science and business. Professor Steinhilper has fulfilled the task brilliantly. Firstly, he has been an excellent professor and, secondly, a genuine engineer. He could well have gone into industry, but fortunately for us he stuck with teaching.” ■



Milan is Home to 2019 World Remanufacturing Summit

“Bringing next year’s WRS to Italy will contribute to familiarizing Italian industry to remanufacturing and its importance to sustainability”

In keeping with the world-wide advances towards greater environmental sustainability of which remanufacturing is a major component, a significant new player is arriving on the scene. In September 2019, Italy will host the European segment of the World Remanufacturing Summit, a series of business-academic conferences designed to promote collaboration between universities and research institutions, and business leaders in the field of remanufacturing world-wide.



Initiated in 2012, the World Remanufacturing Summit has so far been held in Bayreuth, Germany; Rochester, New York, USA; Beijing, China; Singapore, South East Asia; and Amsterdam, The Netherlands. According to its concept, the summits rotate between the US, Europe and Asia every three years.

Designed to demonstrate the importance of and opportunities from scientific/academic research to remanufacturers world-wide, the World Remanufacturing Summit focuses on furthering the link between remanufacturing research and science, remanufacturing and industries involved in remanufacturing and bringing the societal benefits to a broader audience.

SEPTEMBER 2019

Planned for September 2019, the next summit will be organised by Politecnico di

Milano, Italy’s largest educational institute for engineering and related fields, and one of Europe’s 10 top universities. Milan is centrally located in Lombardy, the industrial and financial heartland of Italy, and offers easy access from all parts of Europe and beyond. Accordingly, the 2019 Summit is



destined to attract a wide range of international experts, business executives and researchers from across the world.

“We’re delighted to be part of the World Remanufacturing Summit series,” said Professor Marcello Colledano of the Department of Mechanical Engineering - Manufacturing and Production Systems at Politecnico di Milano.

“Politecnico di Milano is active in a broad range of activities, focusing on sustainability issues of which remanufacturing is a key component. Bringing next year’s World Remanufacturing Summit to Italy will contribute to familiarizing Italian Industry with remanufacturing and its importance to sustainability and preservation of the earth’s dwindling resources. We’re looking forward to welcoming the global remanufacturing community to the first event of this type in Italy.”

GLOBAL REACH

The Global Remanufacturing Summit, now in its seventh year, has gained widespread recognition for organizing high-level exchange of ideas and technology and reman-related knowledge.

Founded by the world’s three leading academic reman centers, Bayreuth University/the Fraunhofer Institute in Germany, Rochester Institute of Technology/the Golisano Institute of Sustainability in New York, and China’s National Key Laboratory in Beijing, the series have lately included Singapore’s Advanced Remanufacturing and Technology Centre.

From 2019 Politecnico di Milano will join this distinguished list. ■

Marcello Colledano

Global Call for "Bold and Brave" Action on Remanufacturing



New UN report: The circular economy is a big part of the future and Remanufacturing is a big part of the circular economy

By Niels V Christiansen
US Editor

After decades of largely flying under the radar, remanufacturing is emerging as a focal point of a healthier economy for the planet and for people. A strong global call was issued on October 23 by a United Nations panel to manufacturers and policy makers around the world to embrace remanufacturing as a central part of the economy of the future.

"Redefining Value – the Manufacturing Revolution. Remanufacturing, Refurbishment and Direct Reuse in the Circular Economy", a report co-authored by Dr. Nabil Nasr and Dr. Jennifer Russell of Rochester Institute of Technology, Rochester, New York, was introduced by Nasr at the World Circular Economy Forum in Yokohama, Japan.

MILESTONE

The report, including findings and recommendations for policy makers and industry decision-makers, was published by the UN Environment Programme's International Resource Panel, IRP, and represents another milestone for the remanufacturing industry.

The growing world population, ever increasing consumption, depleting resources, and threats from greenhouse gases emissions and global warming, require a new economy in which reuse, repair, refurbishment, comprehensive refurbishment and remanufacturing become standard practices, the report says.

"...our research and analysis make clear that remanufacturing is key to any implementation of circular economy..."

Nabil Nasr

Together, these processes, which the report calls "value retention processes", VRPs, break the wasteful linear track of the throw-away society where a product life

originates in the raw material, is born through refining, designing, and manufacture and journeys through consumption before it dies and is buried in a landfill.

CHANGE OF HABITS

"We are using the planet's resources at a faster rate than they can be replenished, while polluting our seas, air and countryside with the waste from our consumption habits," Erik Solheim, Head of UN Environment, said. "This report shows us how we can maintain economic growth while preserving our environment by changing our habits at an industrial level."

In the new circular economy, as described in the report, outputs from every stage of the life cycle become inputs in another, reducing the need for new materials and energy-intensive manufacturing, while cutting emissions and waste.

Whereas this idea is well recognized in and established by the remanufacturing industries, the report notes that current adoption of value retention processes remains low, with remanufacturing account-

ing for only about 2% of USA production and 1.9% of EU production.

GLOBAL SCOPE

The report calls for development and adoption of new practices across industries, countries and borders to multiply these shares and make value retention part of the entire manufacturing economy.

The task of policy makers and regulators is to remove barriers and promote innovative regulations. The task of manufacturers is to build remanufacturing and the other value retention processes into their business models, wherever feasible.

As part of their remit from the UN International Resource Panel, Russell, as a Ph.D student under Nasr's guidance and supervision, spent three years researching and accumulating knowledge and data for what turned out to be the most comprehensive look so far into remanufacturing and the other Rs and circular economy.

The study established baseline values and analyzed practices and government regulations in countries of varying states of development.

Among its important findings and conclusions are:

- Remanufacturing and comprehensive refurbishment can reduce greenhouse gasses emissions by between 79% and 99% in appropriate sectors.
- Compared to traditional Original Equipment Manufacturer (OEM) new production, remanufacturing can reduce new material requirement by between 80% and 98%; comprehensive refurbishing saved slightly more materials on average, between 82% and 99%. Repair saved an even higher share, between 94% and 99%; and arranging direct reuse largely does not require any inputs of new materials.

- Bold and brave change with large-scale adoption of value retention processes is needed for full worldwide mobilization of circular economies.

"For industry, we have shown beyond doubt that strategies to start and expand remanufacturing has significant economic, environmental and logistical value. We quantified this for different products and we articulated how the benefits can be realized," explained Nasr.

"For governments, our research and analysis makes clear that remanufacturing is the key to any implementation of circular economy, because that is where the economics work."

The report also provides a long sought missing link for the existing reman industry – unbiased, scientific, peer-reviewed data to bolster the industry's claims about the benefits and importance of remanufacturing. ■

Another Piece of the Puzzle

Remanufacturing is a great fit in global circular economy conversation

The publication by the United Nations International Resource Panel, IRP, of the comprehensive report on remanufacturing, refurbishment, and direct reuse in the circular economy represents another giant step forward for an industry on the move.

It was not long ago that Nabil Nasr as a leading proponent of the benefits of remanufacturing regularly lectured around the world on "What is Remanufacturing".

"I hope the industry realizes, that in the past, when we spoke about the value of remanufacturing, we were talking among ourselves. We were speaking each others' language. And rightfully so," he said.

"Few outside the industry knew about it. For instance, in the Asia-Pacific even among people discussing circular economy, remanufacturing was not even in their vocabulary."

The report signals a major change in this respect. In some parts of the world the three
Continued on page 11



photo: Alex Tong

Dr. Nabil Nasr, Associate Provost of the Rochester Institute of Technology, RIT, Director of RIT's Golisano Institute for Sustainability and CEO of The REMADE Institute, was named as a member of the United Nations Environmental Program, UNEP's International Resource Panel, IRP, in 2014. With 40 members the panel is widely considered the most authoritative scientific forum in the world for scientists and experts in the area of natural resource management.

Takeaways from a Deep Dive into Remanufacturing

Continued from page 10

Rs most commonly associated with circular economy have been Reduce, Reuse and Recycle. With the endorsement of the IRP of the report Remanufacturing, Comprehensive Refurbishment, and the new term for all of the Rs, Value Retention Processes, VRP, will now become standard in those deliberations.

“The significance of this report is not just that we have answered a lot of questions, that we have quantified the value, proved the economics and calculated the environmental and labor impacts,” Nasr added. “All of it has been subjected to massive reviews by numerous scientists and experts around the world before it received the endorsement and was published.”

With its rigorous scientific standards, its specific recommendations for policy makers and industry and its high level endorsement the report is destined to have immediate as well as longer term effects as a baseline document for the transition to circular economy.

“Remanufacturing is on the global agenda”

Nasr will be embarking on a tour to discuss the report findings and recommendations with officials and experts in different regions and countries around the world, starting with the European Union government in Brussels.

Following the publication in 2017 of the roadmap for the remanufacturing industry, developed at the Golisano Institute for Sustainability at Rochester Institute of Technology, and the formation of the US public/private REMADE research institute, Nabil Nasr sees the IRP report as another key piece in the puzzle of remanufacturing’s future role in the world.

“My goal is to help people understand the value, the potential and the implications of moving in the right direction,” he said. “The roadmap, REMADE, this report, it’s all coming together. Remanufacturing is on the global agenda.” ■



Jennifer Russell

For three years, Jennifer Russell took a deep dive into the past, present and future world of remanufacturing, sustainability and the circular economy as a Ph.D student under the guidance of Nabil Nasr. After playing a major role as Nasr’s co-author of the historic report, she received her Ph.D last summer.

Now a visiting assistant professor at Bard College in Annandale, New York, Russell took a moment to reflect on some of the main takeaways from her work, as her famous mentor presented their report in Japan.

1: Completing the Circle

“Up until now the circular economy has been a really wonderful concept, but businesses have struggled to figure out how they can be part of it. Well, remanufacturing, refurbishment and repair are tangible ways for businesses and industries to be part of the circular economy right now.”

2: Re-defining Value

“We need to help people understand the idea of value in a new way. Value of a product needs to be thought of as something bigger than the price tag and the brand. It’s also what impact the product had on the environment, on the community that produced it, and on the employees

working in that facility. Is it durable? How many lives does it have? How long can we use it for? All of these things reflect value but are not traditionally part of a purchase decision. Redefining value is so important that we incorporated it into the title of the report.”

3: Trusting the Process

“Educating the public needs to go hand in hand with creating a system so that the public can have confidence in the process we’re talking about. An unfortunate amount of negative information has been put out there, and some products that have been branded as remanufactured are actually not. A few bad apples have caused the market to be risk averse to the idea of product reuse, refurbishment and remanufacture. So, alongside educating, there’s a need to have some kind of enforcement that using the term remanufactured actually has to mean that you have passed a set of standards and demonstrated the product’s integrity.”

4: Incredible, Unquantifiable Potential

Determining the full potential of remanufacturing and the other Rs in a circular economy turned out to be much more difficult than we originally thought. There is so much complexity. But we did realize that at the very least there is incredible opportunity within just about every manufacturing segment to design things with considerations for multiple service lives.

5: Expanding the Circle

“The circular economy can exist for other materials than just metals and minerals. Textiles, fabrics and bio based materials can also be cycled through different economies.”

6: No Longer Just B2B

“Talking with so many people in the remanufacturing industry about the wider market place, so many of them would say, “We’re a business to business industry”. Remanufacturing is no longer just b2b. It’s entering into a new era, and in order to grow, a broader set of customers and consumers need to be engaged in the conversation.” ■

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Reman Now and in the Future

Two hundred leading lights of the industry, including remanufacturers, suppliers, scientists and other experts from across the world, took part in two days of presentations and debates at Rochester Institute of Technology, RIT, in Rochester, New York. Centered on the newest developments and progress in the field of remanufacturing, The RIC-RIT Conference 2018 reflected the radical changes currently transforming the industry

During the two days attendees were briefed on main points in the since published, historic UN report (see cover story page 9), and received new insight into best practices, vision and strategies of businesses and institutions operating at the cutting edge of remanufacturing.

Or, as one participant expressed it: “We now see a clear direction for the industry

– one of greater collaboration, more interaction between research and businesses and more focus on the opportunities made possible by the technological advances.”

Consequently, many participants agreed with the billing of the conference as the most important reman event of 2018. By the end of the event at the RIT Inn and Conference Centre in Rochester, New York, attendees departed with an upbeat vision

of the importance and prospects of an industry whose time has come.

Guided along by RIC Chairman John Disharoon and RIC board member, Dr. Nabil Nasr, Director of the host organisation, Golisano Institute for Sustainability, the speakers and panelists varied from scientists and strategists to company leaders. They represented such diverse organizations as REMADE Institute, the new public/private powerhouse for

sustainable innovation, SRC, (Springfield Remanufacturing Company), John Deere, Cummins Inc., Caterpillar, and the Ellen MacArthur Foundation, among many others.

Other notable presentations were made by Amazon, Wabco, the Automotive Parts

Association, APRA, ARTC in Singapore, Nokia, Fraunhofer Institute of Germany and Professors Eric Sundin of Sweden's University of Linköping and Shi Piejing of China's Remanufacturing Institute.

Together, they showcased the future direction of the industry.

All in all, a conference jam-packed with news, views and innovative exchanges of what is becoming an industry destined for greater things. Judging from the two days in Rochester these are just around the corner. ■

Mobilizing the Industry for the Battle for Minds

"Communication will be the top priority of the Ellen MacArthur Foundation, the world's leading sustainability charity, over the next five years," Andrew Morlet, the foundation's CEO told the RIT-RIC conference in Rochester, adding:

"Remanufacturing should follow that example."

In an inspiring call to action Morlet pointed to remanufacturing as an ideal platform for better communication. "The Ellen MacArthur Foundation has had great success in promoting the idea of a circular economy in order to manage the dwindling resources of the earth," he said. "Remanufacturing must be part of this story.

In terms of size, he said, remanufacturing remains a mere rounding error in the world economy accounting for an estimated share in the United States and Europe of just 2% of manufacturing output. "This



Photo: Alex Tong

reman story is a circular economy story, and that's our collective challenge. We want to work with you to make this a sexy story that people are actually excited about."

Going forward Morlet explained how the Ellen MacArthur Foundation is now entering a stage where it transitions from a think tank into a cutting edge media organisation. "We need to win the battle of the minds for the circular economy, particularly of the younger generations.

The significance of the Ellen MacArthur Foundation's quest for stronger communication is illustrated by a few statistics. When the Foundation was formed in 2010 a google search for circular economy would yield about 100 references, according to Morlet. After 12 scientific reports and worldwide publicity generated by the foundation, a similar search this week yielded 79 million references. ■

ought to be ten times as much," Morlet said.

"You have an image crisis, or perhaps I should say, image opportunity," he continued. "Nobody really knows what reman is, and that's a shame. This offers an incredibly exciting opportunity but the challenge is getting it out into the world because people don't understand that the

View from the Top at CAT: How to Win at Reman

As a member of Caterpillar's leadership group and heading the company's reman activities, Tana Utley, Caterpillar Inc. Vice President, Large Power Systems, is a key executive at one of the world's major companies. In her keynote speech she offered a fascinating insight into running the world's largest reman operation.

"What it all boils down to," she said, "is working together towards satisfying the customer."

Cat Reman, she explained, is driven by the needs of the most demanding customer; robust design that keeps the heavy CAT

machinery extremely durable and enables repeated remanufacturing; a strong dealer network that gets the cores back; and the company's people, among them 11,000 engineers, who strive for continuous improvement.

"Those are the strengths that give Caterpillar the "right to win", she said.

Utley stressed the importance for each reman company to likewise understand what drives its business, identify its unique value-proposition and the value-proposition of its customers, and then to pursue this "right to win" for the benefit of all parties. ■



Disharoon, Chenevert, Hudson Win ACE Awards

Two long-time stalwarts of the remanufacturing industry and a new trailblazer in reman education were honored with the prestigious ACE Awards at the RIC-RIT World Remanufacturing Conference in Rochester, New York

ACE stands for Advocate, Collaborate and Educate, the three main pillars of the Remanufacturing Industries Council, RIC.

John Disharoon, Director, Market Access, Caterpillar Inc., received this year's award in the Advocating category after decades of advocating for remanufacturing in front of government authorities in the US and around the world and within the industry. He has done this for decades in multiple capacities at Caterpillar and as one of the driving forces behind RIC itself, currently in the position as chairman of the board.

Donald Chenevert, Jr., Deputy General Counsel, SRC Holdings Corporation, who most recently has been a driving force behind the successful efforts to develop the ANSI standard for remanufacturing through



The 2018 ACE Award winners, left to right: John Disharoon, Donald Chenevert, Jr., and Dr. Matthew Hudson

the American National Standards Institute, was the winner of the award in the Collaboration category.

Dr. Matthew Hudson, Dean of Technical Education at Ozark Technical Community College in Springfield, Missouri, received

the award in the Education category. Hudson has received national attention for the innovative educational programs he has developed in conjunction with SRC, John Deere Reman and others to help close the local skills gap in one of the reman hotspots of the world.

The three winners, were selected by a panel consisting of industry leaders, including partners from the RIC Remanufacturing Association Alliance, among nine finalists and honored at a dinner with the 200 participants in the Rochester conference.

Remanufacturing ACE Awards trophies were presented to each of the winners along with a scholarship, one in honor of each winner, to award within their communities, encouraging future industry leaders to become more engaged with remanufacturing before graduation. ■

Preparing for Reman Day 2019

The launch of the REMAN DAY initiative in April met with an enthusiastic response from remanufacturers across the world. The hope is that the second edition of the concept, on April 11, 2019, will attract even more attention.

"Judging from the reactions, we're certainly optimistic about the prospects for next year," said Jennifer Brake, RIC Director of Marketing and Membership. "We see this as a wonderful way of extending the message of remanufacturing to a new audience – and, in the longer term, to consumers everywhere."

Conceived by The Remanufacturing Industries Council (RIC), the strategic industry alliance dedicated to accelerating the growth of remanufacturing, Reman Day is the first global initiative designed to appeal across the board, from large international companies to smaller, local business-

es, through remanufacturer-hosted events and workforce development initiatives. In 2018, 127 Reman Day events were celebrated in 17 countries across 6 continents. The aim is now to significantly extend the concept beyond this.

Said Brake: "Remanufacturing is a triple win for people, the planet and profits. On average, remanufacturing saves 85% of energy use, 86% of water use, and 85% of material use compared to "new." In the U.S. alone, remanufacturing supports more than 180,000 full time jobs and produces more than \$45 billion of remanufactured goods per year."

T-SHIRT COMPETITION

As part of its preparations RIC will be

organizing a t-shirt design contest that will challenge designers and other artistically minded staff within the reman community.



Jenn Brake

This competition is open to all ages and artistic talent. Specific guidelines, including file format requirements can be reviewed at: <https://remanday.org/t-shirt-design-contest/>

Design submissions are due by close of business on December 11, 2018 and should be submitted to info@RemanDay.org.

Entries will be judged by the Remanufacturing Industries Council's Marketing & Membership Committee and the RIC Remanufacturing Association Alliance. The winner will be notified by email no later than January 3, 2019. ■

Reman Leaders Gather in Rochester



photos: Alex Tong





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High Level Brainstorming for Remanufacturers

Borg Automotive launches new online tech hub



The new tech hub was developed by the Borg Automotive R&D team (pictured above) in the company's Belgium subsidiary

Remanufacturing is characterized by diversity, from very large companies to smaller specialized operators and countless suppliers. While this is a hallmark of the industry it can also be a weakness. The latter is relevant with regard to exchange of ideas and initiatives, technical advances and communications within the remanufacturing community.

Now a prominent remanufacturing company intends to do something about it. After a year of preparations, Borg Automotive, Europe's leading independent automotive remanufacturer, is launching a virtual market, perhaps best likened to a web based exhibition, for the exchange of services, products and know-how for reman businesses. If living up to expectations, the Borg Mechatronics Forum could create an important commercial knowledge-hub for the reman industry.

Launched in September, the Mechatronics Forum aims at providing a communication forum, a market place, where businesses can discuss common issues, exchange advice, guidance or offer components, collaboration or technical knowledge within specific fields. While Borg Automotive does not see the initiative as a profit generator for the company itself, it is hopeful the initiative will become an important service for remanufacturers.

"The hope is that we can contribute to better links between people and companies in the industry," Lorenzo Gaspari, the Mechatronics Forum Project Manager, said. "We believe that the reman industry is undergoing rapid development where new dynamics come into force and creating a wealth of new opportunities. We're confident that this will add a service that has so far been lacking in remanufacturing."

IMPORTANT TRENDS

From Borg's standpoint, the Mechatronics Forum is designed to keep up with current important trends in the remanufacturing industry. "For instance, the transition to emissions free mobility will not be possible without the electrification of the drive train," said Gaspari, who joined Borg last year after graduating from Milano Politecnico.

The Borg concept rests on three pillars, which the company hopes will assist remanufacturers communicate with each other:

The Marketplace, the Virtual Booth and the Open Space.

Of these, the **Market Place** offers an environment in which users get in touch with each other in order to match demand and offers for services and components,

Continued on page 19

Continued from page 18

thus creating relationships between users. Resulting transactions will be concluded between the parties outside the forum

The Virtual Booth is a web-based exhibition with three halls where members can present activities, products and services.

The Open Space is described as an environment where members can engage in discussions, share technical problems and research findings and increase their visibility.

Overall, the concept is based on Borg's view of current trends in the industry, i.e. that Electrification, Autonomous Driving,



Team leader Lorenzo Gaspari

Share Concepts, and the Connected Car are keys to the future of motoring. Realising that the rate of innovation will make cars older at a faster rate than before, the idea is that "Crowd Braining", the sharing of R&D tasks among

differing players, will bring service providers and "demanders" together. According to Borg, this will expand the pool of developers, from whom ideas can be shared beyond traditional R&D departments.

BOOSTING R&D

"All in all, this should result in boosting the participants' R&D activities, widen the scope of available resources, create better working opportunities and sharing of know-how and, in general, increase awareness of opportunities within the industry", said Gaspari.

The development of the Mechatronics Forum has been managed by Gaspari under the supervision of Borg Executive Jan Stokholm. The concept was initiated by Søren Toft-Jensen, the founder of Borg Automotive, who sold the company to Danish industrial group Schouw and Co. in 2017 but continues in his capacity of Head of Development at Borg. ■

BBB Industries to Showcase Two New Reman Product Lines

During this year's AAPEX show in Las Vegas, BBB Industries, one of America's largest remanufacturers, will feature two new reman product lines as well as various packaging news. Held at the Sands Expo from October 30 to November 1, AAPEX (The Automotive Aftermarket Products Expo) attracts around 170,000 attendees from across the World. In terms of attendees, the aftermarket event is exceeded only by the Automechanika shows in Frankfurt, Germany.

The BBB stand will showcase the new, remanufactured OE-TurboPower Turbochargers and remanufactured Electronic Power Assisted Steering (EPAS) products, the company has announced. Visitors will also be able to learn about BBB's Gold Premier Interactive Label, a first in the automotive aftermarket industry.

"As the industry's remanufacturing leader, we are excited to share BBB's latest product and packaging innovations with AAPEX attendees," said Odd Joergenrud, BBB's president and chief commercial officer. "Our Turbochargers, EPAS products and Gold Premier Interactive Label program exemplify our commitment to overhauling the industry one part at a time and engaging customers."



Odd Joergenrud

BBB says that its OE-TurboPower Turbochargers are OE-quality, precisely calibrated, remanufactured and high-performing turbochargers designed to meet the durability, reliability and technological demands of complex engines. "EPAS is the undeniable future of power steering, and BBB's channel partners have access to the broadest coverage and the highest quality Electronic Assisted Steering products on the market," the company said.

The Gold Premier Interactive Label allows users to scan a package with their mobile device using the Gold Premier app. In addition to animating the label, the app lets users enter to win a gold bar and other prizes while allowing BBB Industries to collect important data that can help improve its product offerings.

PROMOTION

As part of its AAPEX promotions, BBB TV advertisements will appear on screens prominently displayed in the lobbies of the Sands Expo, on the show floor and on its own channel in guest rooms at the Venetian/Palazzo, the Mirage and the Westgate Hotel. BBB Industries print advertising will also appear in the AAPEX Express show guide daily. ■

Autopromotec 2019: Strategic Plan For International Promotion

Autopromotec, Italy's biennial trade show for automotive equipment and aftermarket products, will be using the auto shows in Las Vegas at the end of October and beginning of November to strengthen its appeal to an international audience.

As part of its project "Autopromotec Follow Me – International Projects," Autopromotec has coordinated a delegation of companies in the Italian automotive supply chain to exhibit in a 200 sq m

collective area at the SEMA Show in Las Vegas from Oct. 30-Nov. 2.

"International missions are at the core of our strategic plan for the promotion of Autopromotec and its 2019 edition," said Renzo Servadei, CEO of Autopromotec. According to Autopromotec, the 2017 event welcomed 113,616 professionals over its five days, with 23,807 of them coming from outside Italy, a 14 percent increase in visitors from abroad. ■

AAPEX to Feature Large Reman Section

Comprising more than 100 remanufacturing-related booths, a special dedicated remanufacturing section will be located on Level 2 of the Sands Expo at the AAPEX show.

In addition, the section, organised by MERA, the Association for Sustainable Manufacturing, will feature a series of 8 educational tracks under the headline "The AAPEXedu Remanufacturing Track". These represent a fully integrated, multi-faceted education program for remanufacturers, buyers, suppliers and more.

All in all, AAPEX 2018 will occupy more than 52,000-square-feet of remanufacturing-affiliated space, making it one of the world's important reman venues. ■

REMANedu Conference at AAPEX

2018 REMANedu Session Agenda

Tuesday, Oct. 30
10 a.m. - 4:30 p.m.

The Importance of Cleaning Sensitive Electronics

Presented by: Jeff Davis, Senior Vice President, Hubbard-Hall
10 - 10:30 a.m.

Mechatronics: The Marriage of Mechanical and Electronic Reman

Presented by: Pat Muldoon, Chief Engineer, Remanufacturing, AxleTech
10:30 - 11 a.m.

Testing New BSG/ISG Technologies - 12V, 48V, 400V

Presented by: Michael Kelly, Sales & Marketing Manager, D&V Electronics
11:30 a.m. - 12 p.m.

Closing the Technician Gap

Presented by: Matt Gaul, Director of Technical Training, BBB Industries
12 - 12:30 p.m.

Benefits of End-of-Line Testing for Reman

Presented by: Phil Vince, Program Manager - Fuel & Turbo Systems, PurePower Technologies
2 - 2:30 p.m.

Proactive Remanufacturing: A Strategic Plan, Not an Afterthought

Presented by: Cameron Quick, Director of Sales & Marketing, AER Technologies
2:30 - 3 p.m.

Opportunities vs. Challenges: Understanding International Trade Regulations

Presented by: Mitch Zajac, Patent Attorney, Butzel Long
3:30 - 4 p.m.

Outlook & Insight from C-Suite Remanufacturing Leaders

Panel TBA
4 - 4:30 p.m.

The conference is open to AAPEX/SEMA badgeholders at no additional charge.

ATRA's Powertrain Expo: Not Just For Rebuilders

Taking place at Bally's Hotel and Casino, Las Vegas in 2018, the ATRA (The Automatic Rebuilders Association) event has been a key part of the transmission industry for a long time. ATRA CEO Dennis Madden sets the scene for this year's show.

For 25 years ATRA's Powertrain Expo has served the transmission rebuilding industry with top-notch technical and management training. It's major audience focus has been centered on Transmission rebuilders and transmission repair shop owners. The vast majority of exhibitors have been parts suppliers and manufacturers. But that's changed over the past decade or so.

Now, we have more remanufacturers exhibiting and there's a definite market for

a wide range of them. Of course, remanufactured transmissions have been with us



Dennis Madden

for years but we're also seeing remanufacturing of components, including companies like Central Valve Body LLC and Valve Body Pro who remanufacture transmission valve bodies. And it goes beyond that to such as Circuit Board Metrics, a remanufacturer of instrument clusters and control modules. These are just a few of the remanufacturers exhibiting at the 2018 Powertrain Expo in Las Vegas.

Running from October 31st to November 3rd, ATRA's Powertrain Expo, attracts exhibitors and guests from across the globe meeting to compare products and services and learn about the newest technologies affecting the transmission industry. ■

New Force in UK Reman R&D

The University of Cranfield in Southern England – known in the UK for its aerospace automotive and business expertise – is lining up its faculties for a big push in remanufacturing

At a time when remanufacturing is becoming an essential component of the Circular Economy, the concept of CE has become well-established in political circles, is recognised in the boards of major companies and is diffusing out to wider audiences. While recognised in EU policy, much of the supporting action targets the traditional approaches of waste reduction, material recovery and recycling. In Cranfield's opinion, remanufacturing is being short-changed.

"Remanufacturing is a central component of product lifetime extension and value recovery, but support for remanufacturing as a practice is sparse, fragmented and uncoordinated" stated Dr Patrick McLaughlin, head of the initiative. "Our businesses are vulnerable to competitors in the Far East and USA who are better supported by regional initiatives. We need to tackle that."

As part of the initiative, David Parker, principal consultant at the getsetera



David Parker, consultant, getsetera

Cranfield can bring critical mass – and a track record – to developing and applying new processes and practices."

However, remanufacturing is much more complicated to achieve than recycling for



Cranfield University joins the drive for more research into the Circular Economy.

example: it requires disruption of business models, alliances, processes, design and technologies. Cranfield intends to bring together its expertise across technical research, process and systems development as well as business functions such as logistics, product design, business modelling and life-cycle engineering management.

COMPREHENSIVE ONE-STOP SERVICE

McLaughlin added: "We won't run before we can walk. Internally, we're convinced, but we want to get some quick wins under our belt and prove ourselves to businesses. Long term, we want to match our international benchmark organisations and offer a comprehensive one-stop service."

The next step is planned for 28 November, 2018 when Cranfield will host a workshop to kick-start business engagement. "We'll be showcasing some active companies and presenting our themes for R&D, but we're

throwing it open for any committed remanufacturer to come along and influence the direction."

This will be the first of a continuing series of events where companies can club together to identify collaborative projects. McLaughlin lays out the challenge: "You bring the needs, we'll find the resources and funding."



Patrick McLaughlin, Cranfield University in the UK

To find out more about the remanufacturing R&D workshop, contact Patrick McLaughlin at p.mclaughlin@cranfield.ac.uk ■

Imaging Supplies: Reman Cartridges Under Attack from Asian New-Builds

Once an \$8 billion industry in North America alone, sales of remanufactured printer cartridges have dropped by 75%, according to a new study. In the face of an existential threat from a rapidly growing Chinese new-build industry, printer cartridge remanufacturers are finding new allies in the OEMs

By Tricia Judge, Executive Director,
International Imaging Technology Council

In the printer cartridge remanufacturing heyday of the 1990-2000s, it was so easy to promote remanufactured cartridges. The cartridges were the only alternative to new, therefore keeping costs low. Since the cartridges were reused at least once, remanufacturers diverted a significant amount of plastic from landfills. And remanufacturers were small, local businesses, with cartridge return programs often tied to charities.

No one disputed that the key benefit was the cost savings over new original equipment manufacturers' (OEM) cartridges. The industry competed openly and fairly with the OEMs, with fights over killer chips, return programs and other marketing and technological impediments that the OEMs implemented.

On the fringe of the marketplace were the illegal counterfeit cartridges. The OEMs, through the Imaging Supplies Coalition,



hunted down the criminals that trafficked in these supplies. Asia, particularly China, was a key source for these illicit products.

The landscape changed dramatically with a new player: the new-built cartridge. These cartridges gave birth to a huge industry in China. Considerably cheaper than remanufactured ones, new-builds have proliferated and stolen market share from OEMs and remanufacturers alike. The once robust remanufacturing marketplace of the late 90s accounted for as much as \$8 billion in North American sales.

Now, a new study undertaken by the Actionable Intelligence and the International Imaging Technology Council believe that the remanufactured cartridges account for only \$2 billion in sales. In some models,

new-builds have taken 50% share away from remanufacturers.

The internet has exacerbated the problem. These cartridges, many of questionable quality and legality, have proliferated on sites like Amazon and eBay. They are also showing up in the reseller channels with assurances that they are of excellent quality and do not infringe on the intellectual property of the OEMs. This, clearly does not stand up to scrutiny.

“New-builds have proliferated and stolen market share from OEMs and remanufacturers alike”

With their massive patent portfolios, the OEMs were expected to confront these cartridges with patent-infringement suits. Epson, HP, Lexmark and others did bring suits, and some imports were blocked. However, even more new-built cartridges made their way into the country, with no opposition from Canon, the key holder of laser cartridge patent technology.

LEGAL CONCERNS

The right to repair doctrine has long protected remanufactured cartridges from claims of patent infringement. The consumer has a right to repair his car, computer and cartridge. The issue was well-settled in the mid 1990s in a variety of U.S. lawsuits.



photo: Clover Imaging Group

The printer OEMs tried a variety of clever marketing schemes to dissuade consumers from buying aftermarket products, particularly through post-sale restrictions using their intellectual property. This gave rise to a variety of lawsuits as well.

In 2017, the cartridge remanufacturing industry presented the U.S. Supreme Court with the case that would change patent law dramatically. On May 30, the US Supreme Court decided that patent rights on products were exhausted after the first sale, whether domestically or overseas. The decision in *Impression Products, Inc. v. Lexmark International, Inc.*, written by Chief Justice Roberts, specifically involved the sale of printer cartridges.

As a result, cores and cartridges can be freely remanufactured and moved across borders. While remanufactured cartridges have had legal clouds lifted, some ominous ones loom on the horizon for new-built cartridges.

Canon, the largest patent holder of all the OEMs and the primary holder of the patents to laser cartridge technology, has now taken action to further protect its intellectual property. On February 28, it sued aftermarket manufacturers and distributors of new-built cartridges.

Canon had sued manufacturers and distributors of new-built cartridges over one drum-related gear. Ambitious aftermarket manufacturers developed patent workarounds of the gear, which the new-built cartridge makers openly promoted.

This time, Canon has used a continuation application to reach back and erase the patent work-arounds introduced by these manufacturers. Using this technique, Canon will be able to call into question all attempts to circumvent Canon's patents on the dongle gear, now and in the future. So are any cartridges safe? Yes: some remanufactured ones.

So as it was before the arrival of the new-built cartridges, it appears remanufactured cartridges, with reused OEM gears, may once again be the only legitimate competition for new OEM ones. And as workarounds continue to appear, we expect Canon to continue to sue to question them.

QUALITY

The remanufactured cartridge is based on the reuse of the OEM core, or cartridge shell. New-built cartridges have cores that are newly-molded plastics. "New molds use inferior grade plastics that don't come close to the durability or integrity of OEM plastics," said Luke Goldberg, executive vice president of global sales and marketing for Clover Imaging Group.



Luke Goldberg

"There are big variances in quality in new-built cartridges from a fresh mold and cartridges produced once the mold is aging. Molds may be used well beyond their intended duty cycles and mold waste is reintroduced into the process.

"Because of this issue in mold tolerances, the integrity of critical cartridge gaps is nearly impossible to maintain. You can see any of the following issues as a byproduct of inferior plastics: uneven print left to right, banding in grey scales, inconsistent graphics, and backgrounding."

Beyond the cartridge shell, there are important technologies within the components that the domestic market took decades to command, and then there are the chips and other highly-technical

components. A \$3 cartridge can't possibly address all these issues with the requisite quality, nor can it have all the patent-avoiding vetting necessary to be "IP-free."

"How is it possible to work around OEM patents and provide quality products while at the same time continuing to lower prices?" Goldberg asks. "Can you offer a 'patent-free,' quality product for \$2.95? I would venture to say that it's highly unlikely."

In researching new-built cartridges that have come under scrutiny by one OEM, I found a negative review for the product on Amazon in which the buyer said, "the cartridge didn't even fit in my printer, let alone function!" Consumers eventually do grasp that you get what you pay for.

ENVIRONMENTAL BENEFITS

The environmental benefits of a remanufactured cartridge are the same now as they were 20 years ago. Customers, especially large corporate ones, prefer environmentally-friendly products. Clover Imaging Group, the world's largest cartridge remanufacturer, openly touts its products' environmental benefits.

"Clover Imaging Group's remanufactured cartridges consume less materials and natural resources, demand less energy, and ultimately have a smaller total environmental impact than new-built cartridges," Goldberg said. "Also, we rarely see new-built cartridge producers offering reverse logistics for core pickup, much less remanufacturing or recycling, meaning that NBCs usually either find their way into a waste stream or are collected by someone else who must try to responsibly recycle or dispose of them."

CONCLUSION

The once-robust cartridge remanufacturing industry is still hanging tough. And numerous challenges, such as over production, has slowed the tidal wave of new builds that have arrived in the U.S. The Trump administration has also placed China and its questionable trade practices in its sights. So remanufactured cartridges are down, but they are not out.

How to know you're buying remanufactured cartridges? Buy Office Depot, Quill or other private label brands. Or contact me at tricia@i-itc.org ■



photo: Clover Imaging Group

A Once In A Century Opportunity for The Remanufacturing Market

By Ron Giuntini, Founder of G35 Software, Inc and a longstanding observer of the automotive remanufacturing industry

Every way that you turn in the global light vehicle industry, there is intensive discussion of the advent of the autonomous light vehicle - from radar technology, to communication networks, to the savings of lives, to environmental benefits and much more.

But few discussions are focused upon the physical lifecycle management of the vehicle platform.

Below is a chart of the profile of the legacy global light vehicle market, as well as my projections of autonomous vehicles engaged in a business model which embraces remanufacturing. The differences are indeed stark.

The focus of this article is to unpack this chart. The data presented employs a 2017 baseline. Autonomous light vehicle life cycle maturity may only be achieved in 20 to 30 years. However, in turn this will provide an adequate period for the remanufacturing

community to begin a conversation on a path forward on how to become proactive in influencing the vehicle platform manufacturers as well as for vehicle owners to embrace a remanufacturing-focused business model.

The following assumptions are the primary reasons for the dramatic change between the legacy model and that of my projections for autonomous vehicles:

- Autonomous vehicles will not be owned by the passengers, but will be owned by commercial enterprises that will be engaged in an Autonomous-Vehicle-as-a-Service [AVaaS] business model. From vehicle type subscription (i.e. annual fee for x trips or miles/kms for a variety of luxury models), to trip sharing (i.e. annual fee for a daily commuter trip in a specific minivan model), to on-demand transactions (i.e. one way fee from Philadelphia to Washington D.C in a variety of mid-size models) and other business models.

- The employment of the autonomous vehicles will be significantly higher as a result of the enterprise owner's focus upon Return On Investment [ROI]; they will obviously attempt to optimize the revenues generated from each vehicle. Given current demographics, use patterns and geography, it is my projection that autonomous vehicles will be employed 6-8 fold more than currently.



- As a result, it is my projection that the current design of vehicles will not withstand the physical rigors, as well as the maintenance costs, of the employment of an autonomous vehicle for more than 1.0 to 1.5 years before it will be need to be

Profile of the Global Light Vehicle Market			
#	Profile	Legacy	Projected Autonomous; Reman-Based
1	Hours per Day of Use	1-2	8-12
2	Passenger Trips per Day	3-4	10-20
3	Miles/Kms per Year	12K-15K/18K-22K	100K-125K/160K-200K
4	Top speed Miles/Kms per Hour	70/110	100/160
5	Years Registered before Disposition/Retirement	12-15	5-6
6	Ownership	Operator; consumer	Service Providers; balance sheet asset
7	# Registered Globally	1 Billion	300-400 Million
8	Annual Global Production Units	75 Million	25-35 Million
9	Annual Global Vehicle Reman	<5 Million	75-125 Million
10	Price of new Vehicle	US\$15-\$30K	US\$80K-\$100K
11	Depreciation Cost per Passenger Mile/Km	US\$.11/\$.07	US\$.08/\$.05

disposed of, unless they are dramatically redesigned.

The following enables the owner of the vehicle asset engaged in AVaaS to employ remanufacturing in their business model. Note that the vehicle asset owner may not be the provider of the AVaaS; they may be a supplier to the enterprise providing the AVaaS to the passengers.

- Design a vehicle to be remanufactured several times during its economic life. This means that they will be efficiently and effectively disassembled and subjected to a robust remanufacturing process that results in a vehicle whose Capabilities, Employability, Deliverability and Appealability [CEDA] is restored - or is improved to that of a like-kind new production model. A vehicle could be inducted in the remanufacturing process 2-3 times during its life. Note this was the model for the famous US-based Checker Cab.
- Design ruggedized components to assure that they will be sufficiently reliable to be effectively employed between remanufacturing events.
- The above combined creates a materially more expensive vehicle to produce and a focus by the vehicle owner to minimize the depreciation costs per passenger trip by extending the life of the vehicle through remanufacturing.

Now comes the final piece of the puzzle. The dramatic impact of such a remanufacturing-focused business model upon new vehicle production supplying owners engaged in AVaaS will result in an estimated drop of 60-70% in output. But the demand for the induction of autonomous vehicles into the remanufacturing process will be 3-4 fold higher than that of new vehicle output. This will enable the vehicle owner to effectively manage depreciation expenses, which will be a major cost driver for the AVaaS supplier. Note that the remanufacturing process is a Capital Expenditure [CapEx].

In conclusion, all the above is only the first "shot across the bow" in energizing the remanufacturing community. In order to move forward, the following 3 steps should be taken:

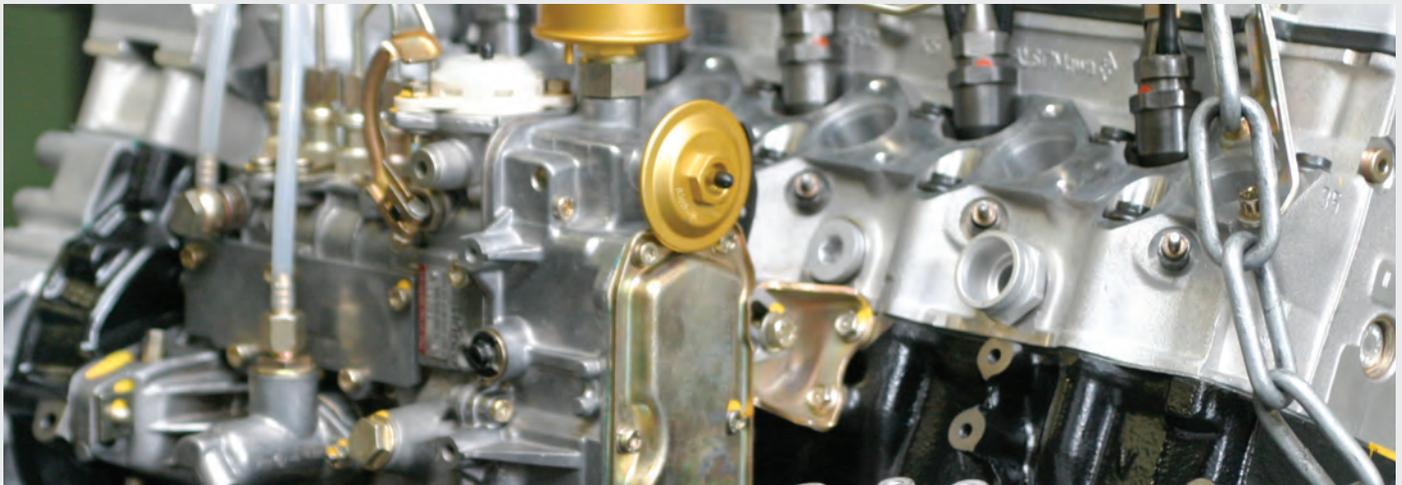
1. The entire reman community should develop a comprehensive white paper on the value of designing autonomous vehicles to be remanufactured
2. A financial model should be established focused on a business case for reman light vehicles employed as autonomous vehicles
3. Working groups should be established to develop a forum for the reman community to develop a consensus of a path forward. ■



Ron Giuntini

Over close to 30 years, Ron Giuntini has consulted on remanufacturing matters with such firms as GE, United Technologies, Oshkosh, Textron, Acer, General Dynamics, Lockheed, Northrup Grumman and many others. During his career he has written numerous articles on remanufacturing and has frequently been quoted in publications as an expert in remanufacturing. He has spoken at over two-dozen international professional conferences and presented at over 100 public seminars. He was a major contributor to the US Department of Commerce's study of the international trade of remanufactured products.

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