

## North America 2015 9<sup>th</sup> - 11<sup>th</sup> of Nov

### AUTOMOTIVE LIGHTWEIGHT

# PROCUREMENT SYMPOSIUM

## Cobo Center, Detroit, USA



### SYMPOSIUM FOCUS

- Aluminum
- Carbon Fibre
- Composites
- High Strength Steel
- Magnesium

The 3<sup>rd</sup> Automotive Lightweight Procurement Symposium to be focused on automotive lightweighting, supply / process chain and procurement management, will take place in Detroit from the 9<sup>th</sup> – 11<sup>th</sup> of Nov 2015. The symposium is held in the days leading up to the "ALUMINUM USA" exhibition taking place at the Cobo Center, Detroit, Michigan (Walking distance to symposium venue)

### ATTENDING COMPANIES:



### ORGANIZING PARTNERS & SPONSORS



AluMag®  
 Europe 2016 27<sup>th</sup> - 29<sup>th</sup> of Nov  
 AUTOMOTIVE LIGHTWEIGHT  
**PROCUREMENT SYMPOSIUM**  
 Hilton Hotel in Duesseldorf, Germany

AluMag®  
 Asia 2016 6<sup>th</sup> - 8<sup>th</sup> of July  
 AUTOMOTIVE LIGHTWEIGHT  
**PROCUREMENT SYMPOSIUM**  
 Jumeirah Himalayas Hotel in Shanghai, China



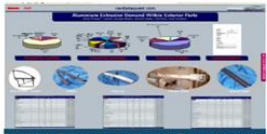
## AluMag® offers the four following services - worldwide:



Market Research

- Aluminium Extrusion Customer Database
- Foundry & Tool Maker Database
- Automotive Application, Material & Process Analyses
- Various Industrial Application Research & Analyses

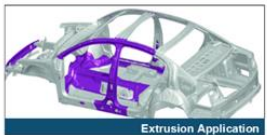
AluMag as your provider of automotive research and forecasting studies, offers you and your business, the market intelligence you need to realize the best strategic decisions



Material - Process - Application Trend Analysis

### Large variety of market access, local & global:

- business database with 6,970+ companies and 18.700+ contacts
- 150+ satisfied customers worldwide
- Arranged 20+ roadshows/events since 2008



Extrusion Application

### Your Benefits:

- Learn about your [potential] clients and competitors
- Obtain an inside view of the market
- Identify opportunities and threats
- Minimize risk and optimize profits
- Position your company successfully
- Based on data off the shelf, secondary re-research and interviews, AluMag generates validated researches



Market Development

- Analysis & Development of Market Opportunities
- Accelerate Market Penetration
- Manage New Product Launches
- Establish a Sales Force Sales on Demand

AluMag guides and supports your organization globally through the different market development phases until we have successfully launched, implemented or executed your project.



Map of activity - SAMPLES

Manage and integrate each aspect of your organization by initiating, planning, controlling, executing and closing out a new project. AluMag offers liaison management services as an addition to our customer's staff by bringing in the resources that define us.



JATCO Head Quarters Meeting in Japan

### Your Benefits

- Analysis and development of Markets
- Realize opportunities
- Accelerate market penetration
- Establish a sales force
- Provide warehousing and distribution services
- Manage new product launches
- Sales on demand



Roadshows / Events

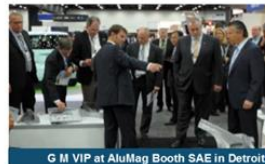
- Organization of Technical & Commercial Roadshows
- Oversea Commercial & Technical Events
- Host In-House Events & Presentation
- Common Technology Booth at Leading Exhibitions

AluMag roadshows, tech-meetings and symposia are the first class events used by exhibitors and guest as a unique benchmark platform.



Daimler Sindelfingen as Roadshow Location

The AluMag think tank events are bringing in decision makers and executives in EUROPE, ASIA and NAFTA.



G M VIP at AluMag Booth SAE in Detroit

### Upcoming Events:

- 2015 Nov: Automotive Light-weight Procurement Symposium in Detroit, USA
- 2016 April Common tech- booth at the SAE World Congress in Detroit, USA
- 2016 Jul: Automotive Light-weight Procurement Symposium in Shanghai, China
- 2016 Nov: Automotive Light-weight Procurement Symposium in Duesseldorf, Germany.



Strategic Localization

- Warehousing & Distribution Service
- Supplier & Tie-up Localization
- Identification & Trade-off of new Technology
- Foreign Market Business Cases and whose Realization

AluMag has the global expertise to search, identify, evaluate and validate potential strategic business opportunities for expansions and partnerships that will assist your business growth plans regionally and globally



On-Site Greenfield Planning Meeting

### Services for:

- Search, develop and present potential acquisition candidates for regional and global business expansions
- Localization of new manufacturing / service sites for business expansions
- Identification of new technology supplier development related to products, processes and materials
- Search, develop and present potential business partners / suppliers to support regional and/or global supply programs
- Evaluate potential competitor profiles for new or existing business in non-presence geographies
- Evaluate new emerging technologies and processes for business expansions

### Are you:

- looking for specific data, information and outlook about product, material, customer, supplier, technologies, ...
- want to discuss your project, increase sales, access new markets, ...
- interested to participate in one of our roadshows / events or organize your customized showcase ...
- looking to localize, expand into new markets, countries, tie-up targets, ...

please contact your AluMag Team to receive a quote or proposal

## CONTACTS & PROJECT TEAM



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## **N. America Automotive Lightweight Procurement Symposium 2015 9<sup>th</sup> – 11<sup>th</sup> Nov**

Cobo Center One Washington Blvd. Detroit, Michigan, 48226 USA



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# **AluMag<sup>®</sup>**

Europe ■ India ■ Americas ■ Asia  
**THE MARKET DEVELOPER**

## Company Speechs by:

Ford Research and Innovation Center

Carbon War Room and Meritor Headquarters

Striko Westofen America

Kurtz

Bharat Forge Aluminiumtechnik

C.P.C. USA

BOCAR Group

Ford Motor Company

Automotive Insight

EJOT Fastening Systems LP USA

UACJ Corp.

Lightweight Innovations for Tomorrow

Aluminum Blanking Company



# Agenda

## Agenda: (Is Continuously Being Updated)

### Monday The 9th Of November – Cobo Center, Detroit

05:30pm - 07:30pm



Pre-registration and Welcome

Reception

### Tuesday The 10th Of November – Cobo Center, Detroit

08:30am – 09:15am



Registration

Morning Coffee / Tea

09:15am – 09:30am



Welcome:

Mr. Jost GAERTNER - Managing Partner At AluMag Automotive GmbH

09:30am – 10:25am



Opening Keynote: Mr. Craig RENNEKER - Chief Engineer, New A/T Programs & Component – Transmission & Driveline Engineering At Ford Research & Innovation Center

**Lightweight Transmission & Driveline Components: Practical Challenges**

10:25am – 11:00am

Break for Refreshments/Coffee/Tea, Snacks, Networking, Tech Exhibition

11:00am – 11:45am



Paper 1: Mr Mike ROETH – Executive Director At North American Council for Freight Efficiency (NACFE) & Operations Leader – Carbon War Room



Paper 1: Mr. Karl MAYER – Director Product Line Management At Meritor

**Lightweighting Heavy Duty Class 8 Tractors and Trailers**

11:45am – 01:45pm

Break for Lunch, Refreshments, Networking, Tech Exhibition

01:45pm – 02:25pm



Paper 2: Mr Ryan BROWN – Director Of Sales At StrikoWestofen America

**Analysis Of Cost Drivers When Buying Lightweight Solutions / Materials & The Elimination Of These**

02:30pm – 03:10pm



Paper 3: Mr. Lothar HARTMANN – Managing Director Foundry Machines & Trimming Presses At Kurtz GmbH

**Chassis & Suspension Weight Reduction By LPDC Aluminum With Hollow Cross Sections**



Mr. Kevin CROY - NAFTA Sales Manager Foundry Machines & Trimming Presses At Kurtz GmbH

03:15pm – 03:45pm



Paper 4: Mr. Jörg MANTWILL – Director Sales At Bharat Forge Aluminiumtechnik GmbH & Co. KG

**HCM And Aluminum Forging – Partnership To Birth Chassis Parts' Safety**

03:45pm – 04:15pm

Break for Refreshments/Coffee/Tea, Snacks, Networking, Tech Exhibition

04:15pm – 04:55pm



Paper 5: Mr. Gary F. RUFF - President and Chief Executive Officer, Ruff and Associates, LLC 8/12 - Present

**Advanced Counter Pressure Casting Process for Light-Weighting of Auto and Truck Chassis and Suspension Components**

05:00pm – 05:55pm



Closing Keynote: Mr. Gilberto SALDIVAR – New Projects Group Manager At Bocar Group

**Key Factors To Achieve Mechanical Properties In Lightweight Structural Parts**

05:55pm – 06:00pm



Summary:

Mr. Roberto BOEKER – Managing Partner At AluMag Automotive LLC

# Agenda

06:00pm - 08:00pm



Dinner Speech:

Mr. Richard KLEIN -  
Responsibility Strategic Planning -  
Business Development & German  
Business At BOCAR

**Wednesday The 11th Of Nov – Cobo Center, Detroit**

08:15am – 08:55am



Mr. Ali JAMMOUL – Global Director  
Body Exterior And Safety Engineering  
At Ford

**Body Lightweighting**

09:00am – 09:40am



Paper 1: Dr. Gerald COLE – President  
At Light Weight Strategies LLC

**Light Weighting the Automotive  
Industry - The Road to 2025 CAFÉ**

09:45am – 10:25am



Paper 2: Mr. Laurence CLAUS -  
President At NMI Training & Consulting  
Inc. & Technical Consultant To EJOT  
Fastening Systems LP USA

**EJOT Fastening Solutions Enable  
Lightweight Body-in-white Assembly**

10:25am – 11:00am

Break for Refreshments/Coffee/  
Tea, Snacks, Networking, Tech  
Exhibition

11:00am – 11:40am



Paper 3: Dr. Akio NIIKURA - General  
Manager R&D Division At UACJ Corp.

**UACJ's Global Strategy And  
Approach To The Automotive  
Aluminum Market**

11:45am – 12:05pm



Paper 4:  
Mr. Lawrence E. BROWN – Executive  
Director At Lightweight Innovations For  
Tomorrow

**Lightweight Innovations For  
Tomorrow!!!!**

12:10pm – 12:40pm



Closing Keynote:  
Ms. Laura ANDERSON – CEO At  
Aluminum Blanking Company

**The Story Behind Aluminum's  
Sourcing Evolution: A North  
America Perspective**

12:40pm – 12:45pm



Summary:

Mr. Jost GAERTNER, Managing  
Partner At AluMag Automotive  
GmbH

12:45 pm – 01:30pm



Reception Speech With Snacks &  
Finger Food

Mr. Michael KOEHLER - Industry Vice  
President At Reed Exhibitions USA

01:30pm – 05:30pm



Individual Or Guided Visit At The  
2015 "Aluminum USA" Exhibition

# EXHIBITOR

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## **TITLE**

**Lightweight Transmission & Driveline Components: Practical Challenges**

## **ABSTRACT**

- OEM conflict: fuel/weight vs. cost
- Audience participation: Poll
- Challenges for Transmission & Driveline
- Ford strategies for weight optimization
- Conclusions

# Short Biography

## **Craig Renneker**

**Title:** Chief Engineer, Front-Drive Systems, Transmission & Driveline Engineering, Ford Motor Company

**Education:** Bachelor's degree in Mechanical Engineering from General Motors Institute (now Kettering University), 1986

Master's degree in Mechanical Engineering from Stanford University, 1987

**Experience:** Mr. Renneker joined Ford Motor Company in May, 2000. Since then he has overseen the development and launch of several automatic transmission programs, including the TorqShift 5-speed, CVT, 6R60, 6F50, 6F35, 6R140, HF35 and DPS6 used in a variety of Ford products. He now has responsibility for the new 9&10-speeds jointly developed with GM.

**Responsibilities:** Mr. Renneker has responsibility for the development of all new automatic and hybrid transmission programs within Ford, as well as all component engineering activities. **Professional activities:** Ford Technical Advisory Board, Society of Automotive Engineers (member, session organizer), Car Training Institute Transmission symposium (advisory board member and speaker).



## Lightweight Transmission & Driveline Components: Practical Challenges



**Craig Renneker**

Chief Engineer – New A/T Programs & Component Engineering  
Transmission & Driveline Engineering

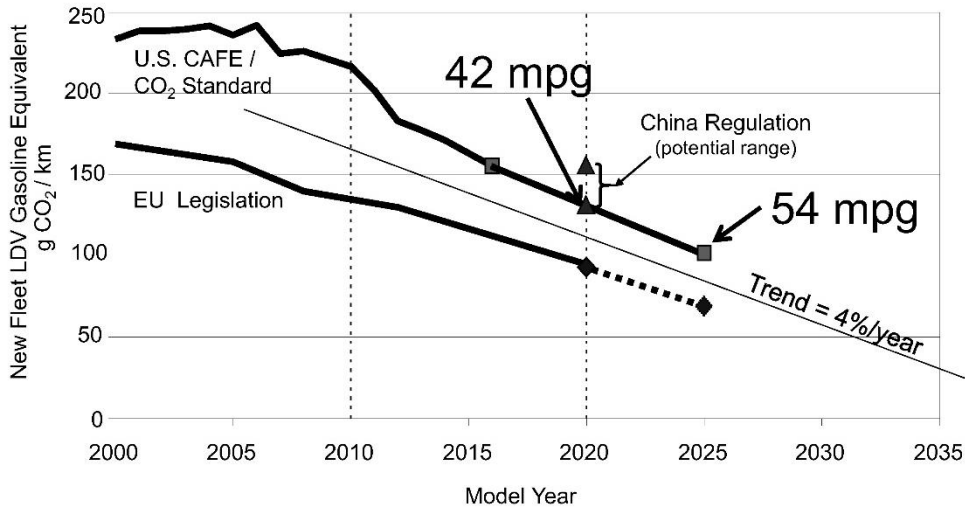
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## Agenda

- OEM conflict: fuel/weight vs. cost
- Audience participation: Poll
- Challenges for Transmission & Driveline
- Ford strategies for weight optimization
- Conclusions

# Ford Research and Innovation Center

## The Driver: Global CO<sub>2</sub> Reduction



**Weight reduction will be needed to meet these goals.**

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- BUT – will customers pay for the required technology?

Manufacturer	June 2013 Transaction Price	May 2013 Transaction Price	June 2012 Transaction Price	Percent Change June 2012 to June 2013	Percent Change May 2013 to June 2013
Chrysler (Chrysler, Dodge, Jeep, Ram, Fiat)	\$29,876	\$29,964	\$ 29,590	1.0%	-0.3%
<b>Ford (Ford, Lincoln)</b>	<b>\$33,272</b>	<b>\$33,089</b>	<b>\$ 31,947</b>	<b>4.1%</b>	<b>0.6%</b>
GM (Buick, Cadillac, Chevrolet, GMC)	\$33,218	\$33,147	\$ 32,824	1.2%	0.2%
Honda (Acura, Honda)	\$27,165	\$27,082	\$ 27,055	0.4%	0.3%
Hyundai/Kia	\$22,529	\$22,608	\$ 22,121	1.8%	-0.3%
Nissan (Nissan, Infiniti)	\$28,311	\$27,816	\$ 28,283	0.1%	1.8%
Toyota (Lexus, Scion, Toyota)	\$29,177	\$29,004	\$ 27,910	4.5%	0.6%
Volkswagen (Audi, Porsche, Volkswagen)	\$33,802	\$33,698	\$ 33,368	1.3%	0.3%
<b>Industry</b>	<b>\$31,125</b>	<b>\$30,978</b>	<b>\$ 30,508</b>	<b>2.0%</b>	<b>0.5%</b>

Source: TrueCar, Inc.

- Customers may tolerate 2% annual price increase = ~\$617
- We need 4% fuel economy increase annually
- \$617/4% = \$154 per % fuel economy increase
- BUT: customers are also demanding additional vehicle content (safety, performance, infotainment, etc.) competing with those \$

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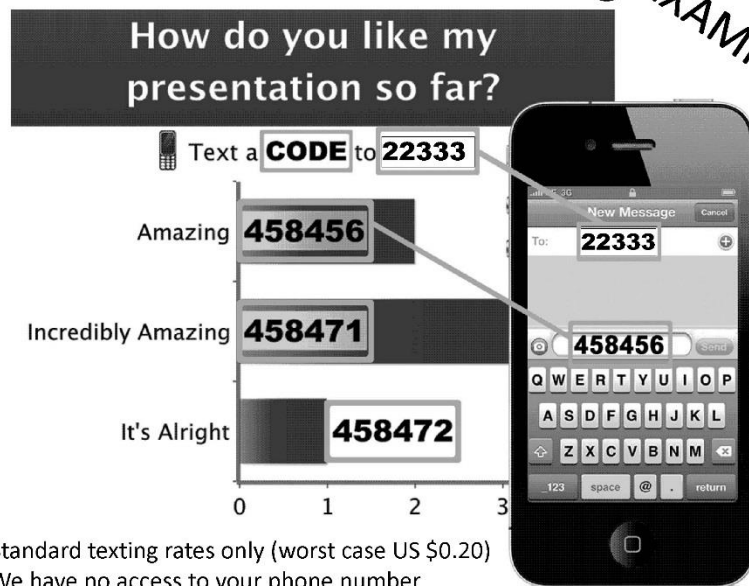


## Audience Participation: Text Message Polling

- Sample question
- How much are OEMs willing to pay for a 1% reduction in fuel consumption?
- How much are OEMS willing to pay for a 1 kilogram mass reduction?

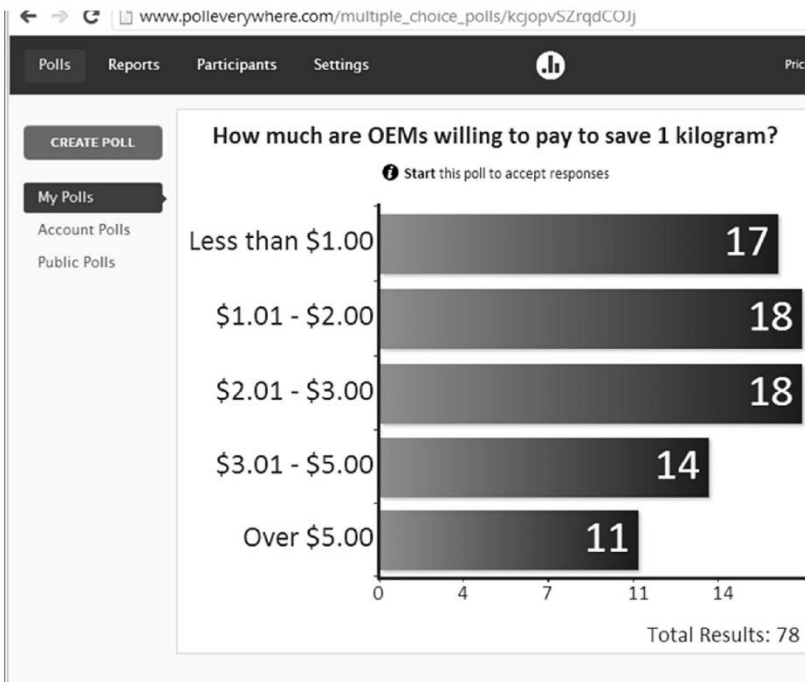
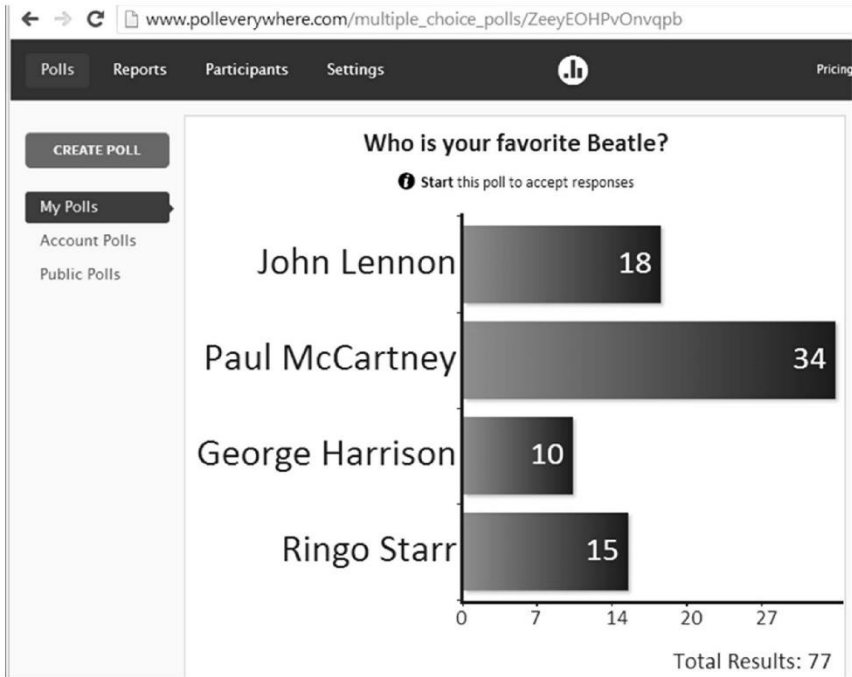
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## How To Vote via Texting *EXAMPLE*

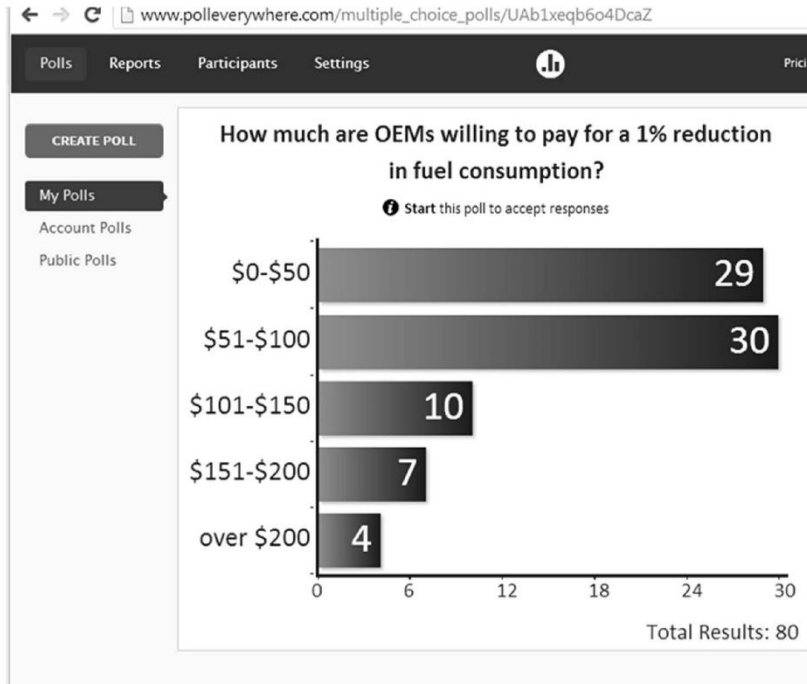


- TIPS**
1. Standard texting rates only (worst case US \$0.20)
  2. We have no access to your phone number
  3. Capitalization doesn't matter, but spaces and spelling do

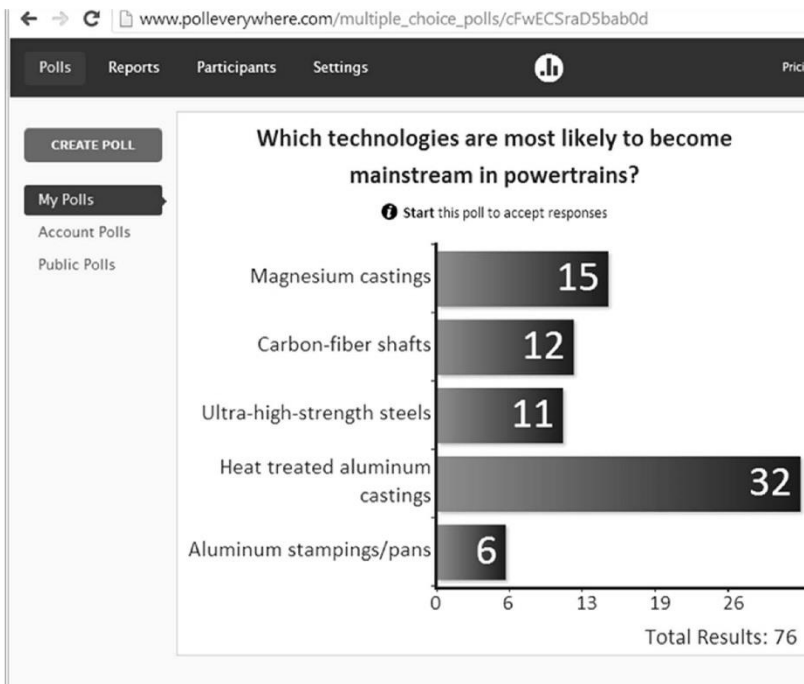
# Ford Research and Innovation Center



# Ford Research and Innovation Center

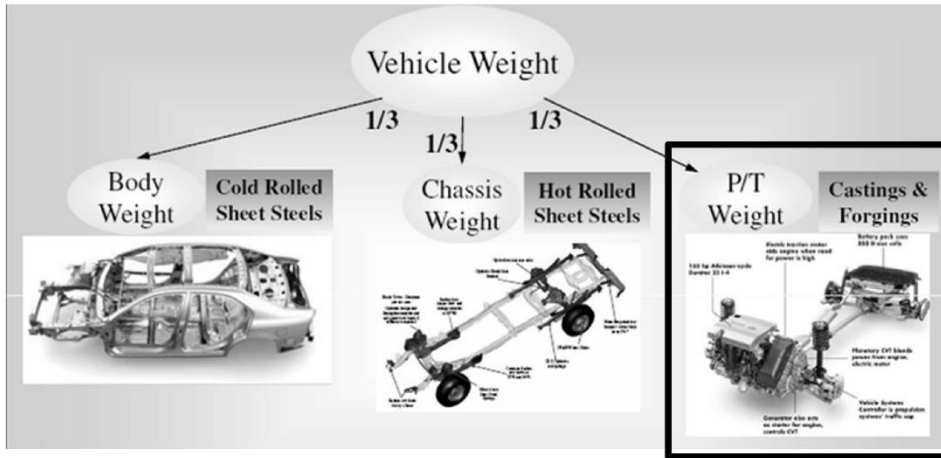


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## Role of Powertrain in Vehicle Mass

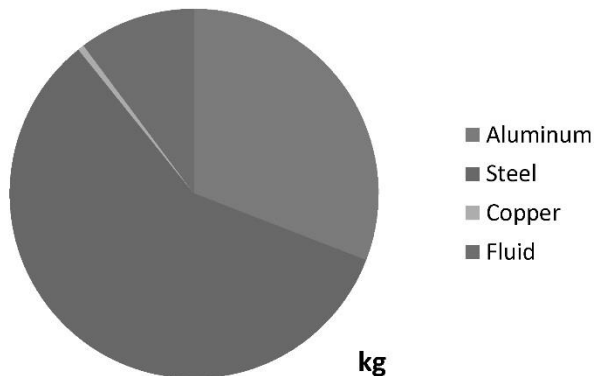


**The Powertrain makes up ~1/3 of total vehicle weight**

9/11/2015

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## Typical Automatic Transmission Weight Split

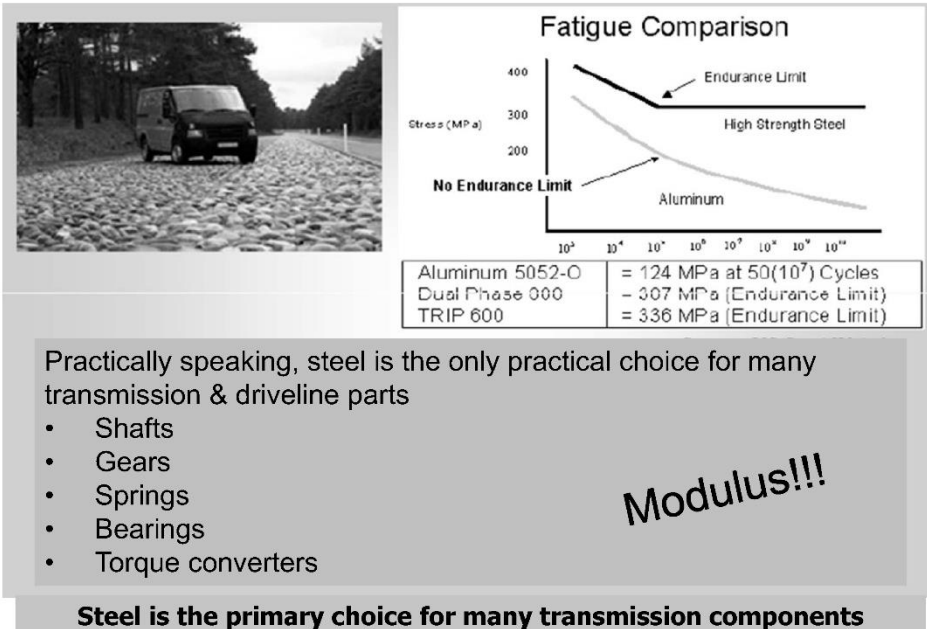


**Steel is still the primary material in a typical automatic transmission**

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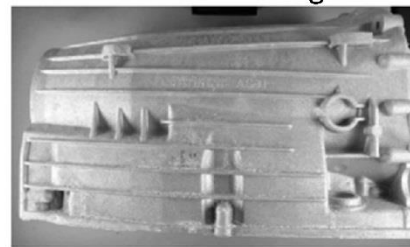
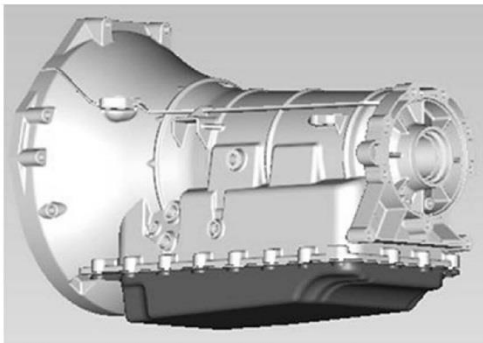
## Duty cycle requirements



9/11/2015

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## Transmission Case: Aluminum or Magnesium?



**AS 31 HP transmission case**

Mercedes magnesium case

- Die cast aluminum is the most common material for transmission cases
  - Mercedes & VW are notable users of magnesium for auto trans cases
- Why don't more OEM's use magnesium?
  - Density/stiffness ratio is only marginally better than aluminum
  - Inherent creep issues limit application to low-stress designs (e.g. RWD)
  - The supply base for large, magnesium castings is very limited
  - Classic magnesium machining concerns

**Magnesium is still relatively rare in high-volume applications**

9/11/2015

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## Ford Magnesium Success: Transfer Case



- Ford's supplier/partner Borg Warner produces a high-volume transfer case with a magnesium housing
- Millions have been produced for F150 pickup trucks and other applications
- Cost/weight trade-off is close – but favors magnesium
  - Enabled by relatively low stress and temperature requirements

**Ford uses magnesium in the driveline: via Borg Warner**

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## Planetary Carrier Construction Options

Carrier construction	Cost	Integral features	Weight	Strength
Welded steel stampings	Low	Simple	Base	Base
Powder metal	Med	Complex	Base	Hi
Aluminum casting	Hi	Simple	Low	Lo



Stamped steel



Powder metal



Cast Aluminum

**Aluminum carriers are likely to be used more frequently**

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## Torque Converters: oil & steel



- Torque converters present special challenges for the use of lightweight materials.
- The housings are generally stiffness-limited – requiring steel modulus
  - High-speed centrifugal load
  - Pressure
- Stators are typically aluminum, (Chrysler has magnesium)
- All available space is filled with oil
- Damper content is INCREASING converter weight (e.g. pendulums)
  - Turbo direct-injection creates torsional spikes similar to diesels

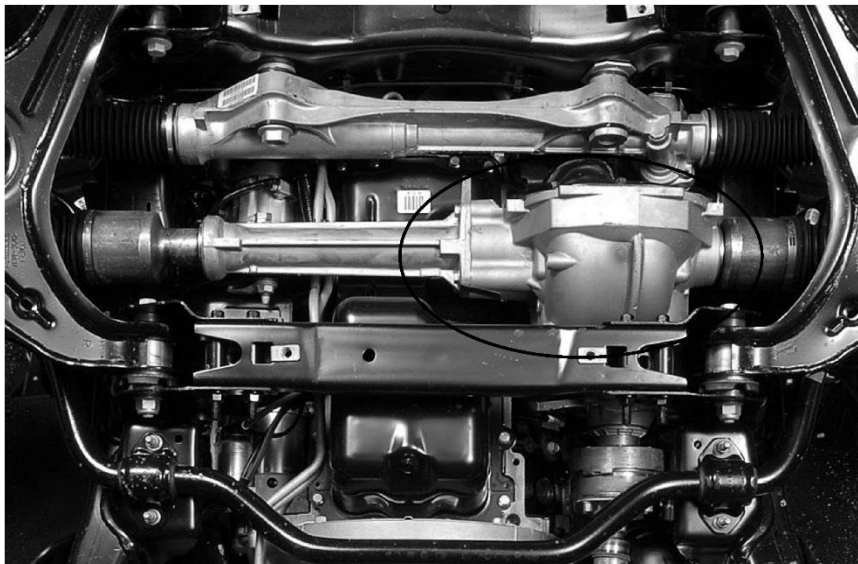


**Torque converters will remain a popular launch device: getting heavier!**

9/11/2015

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## F150/Expedition Front Axle Carrier



**Ford is a leader in the use of high-strength aluminum in truck axles**

9/11/2015

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## Axle housing alternatives

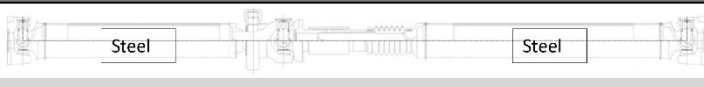
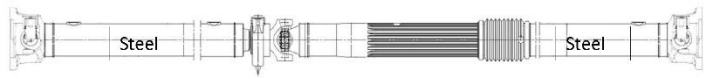
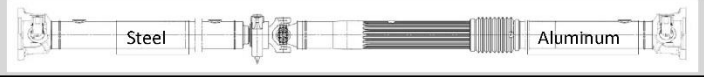
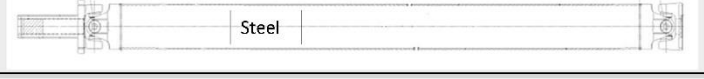

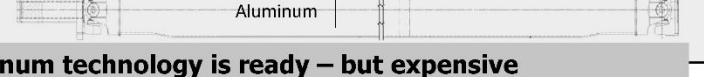
	Magnesium	Aluminum				Iron	
	Die Cast	Die Cast	Low-Pressure Vertical	Squeeze Casting	Semi Permanent Mold	Ductile Iron	Compacted Graphite Iron
Density – gr/cm <sup>3</sup>	1800	2700	2700	2700	2700	7000	7000
Material YTS - MPa	130	160	290	290	179	310	350
Modulus - GPa	45	69	69	69	69	170	150
Density-stiffness ratio	40	39	39	39	39	41	46
Density-YTS ratio	13.8	16.9	9.3	9.3	15	22.6	20.0
Supplier Availability	R	Y	R	R	Y	Y	R

**Heat-treated aluminum castings are good choices: need more suppliers!**

9/11/2015

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## Driveshafts: Aluminum vs Steel

Weight savings (kg)	Cost Increase	Driveshaft Design
base	base	
1	-	
3	++	
5	--	
6	++	
8	-	

**Aluminum technology is ready – but expensive**

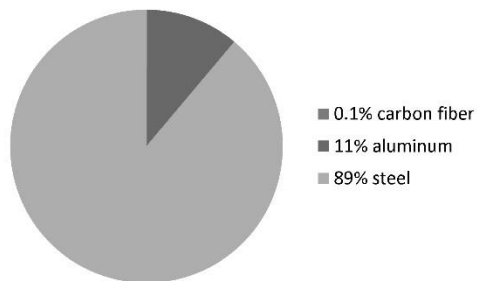


## Driveshafts: Carbon Fiber vs Steel

Weight savings (kg)	Cost Increase	Driveshaft Design
base	base	 Steel
4	++++	 Carbon Fiber

**Carbon fiber is very expensive – not yet ready for high-volume**

## Ford Driveshaft Material Usage



Aluminum use decreased from 18% in 2010 to 11% in 2013

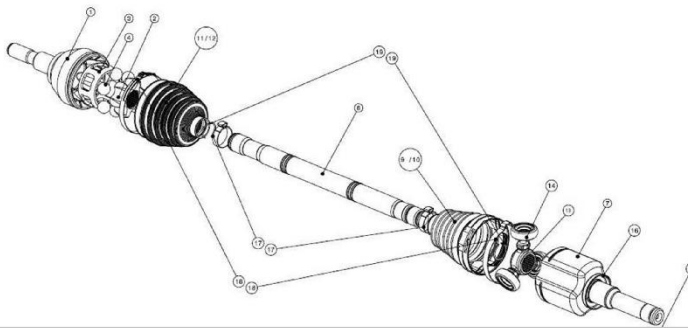
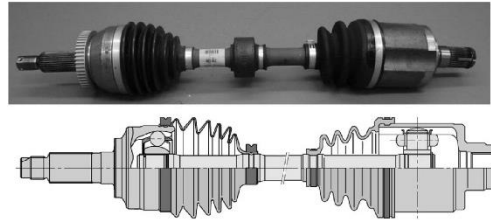
Why don't we use more aluminum driveshafts?

- The weight "buy" is marginal – vehicle teams spend their money elsewhere
- This should change and favor aluminum as "lower-hanging fruit" is exhausted

**Steel will dominate driveshafts until aluminum cost/weight improves**

## Halfshafts: Can they be lighter?

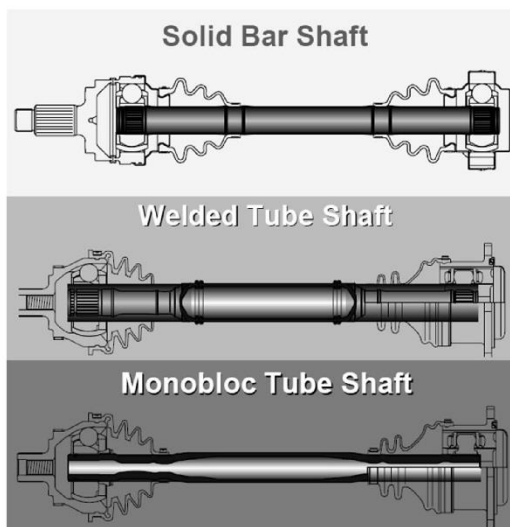
- Halfshafts are very highly stressed
  - High-cycle loads
  - Hard, tough surfaces for sliding elements
- Stiffness is as important as strength
- Package environment is cramped
- Steel is the practical material choice



**Steel is the dominant material in halfshafts**

## Light-weight Halfshafts

- Hollow shafts provide some opportunity
- Two alternatives:
  - Welded tubing
  - Monobloc
- Neither provide a compelling cost/weight “buy”
- Ford volume continues to be dominated by traditional solid-bar halfshafts



**Hollow shafts help – but \$\$\$**

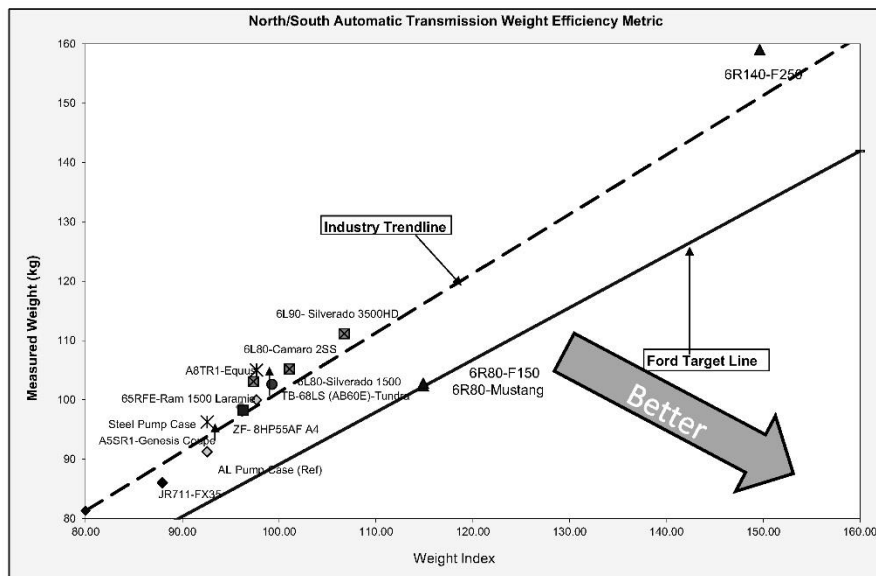
## Ford Strategies to Reduce Weight

- Weight efficiency analysis for every part
- Vehicle duty cycle data acquisition to define customer requirements
- CAE automated weight optimization
- Increased model complexity
- Continued development for lightweight materials

**A structured weight analysis process is needed.**

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## Weight Efficiency Metrics



**Ford uses Weight Efficiency Metrics for every part in the vehicle**

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## Duty Cycle Optimization

- Ford invests heavily in gathering real-world load data for all vehicle systems
- North American and European road systems and drive cycles are well documented. Adding new global regions regularly
- Fully-instrumented vehicles with acquisition systems generate terabytes of data
- Time-history format data; can retrieve damaging events and project to 150K/ 250K miles

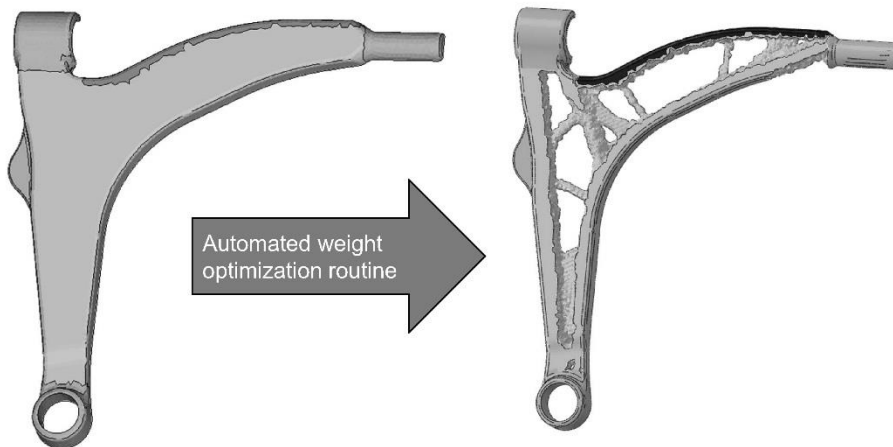
### US-Specific Example

5 Cities	Boston Denver Phoenix Pittsburgh Yellowknife
3 Types of Routes	City Rural Expressway
3 Driving Aggressiveness Levels	Mild Moderate High
3 Road Severity Levels	Smooth Moderate Rough



**We must know how our customers drive – in every global market**

## Weight Optimization with CAE



Example: Front suspension lower control arm

ATOM (Abaqus 6.11)

**Ford makes extensive use of automated CAE weight optimization**



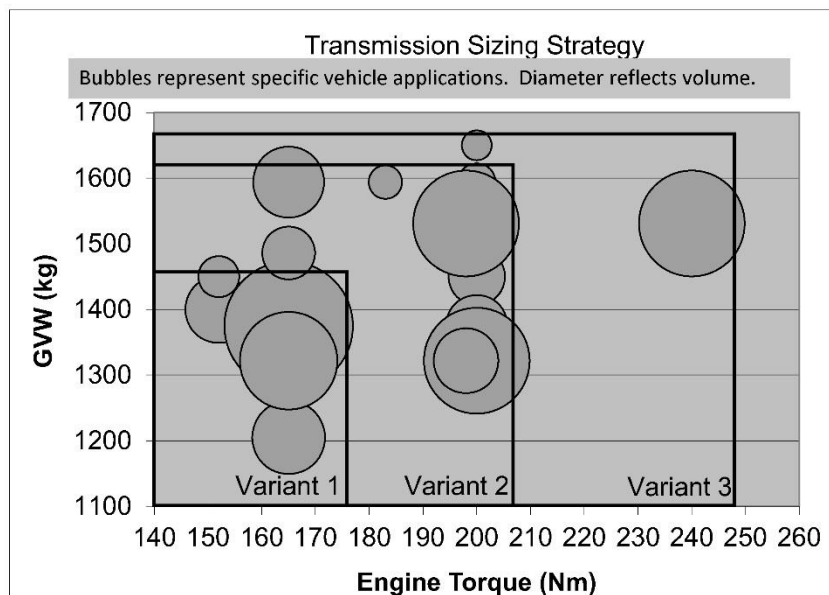
What if we push too far?



**Push to the limit, then add a little back in!**

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Increased complexity for weight optimization



**Pressure for weight optimization will increase model complexity**

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## Conclusions

- The pressure to reduce weight will only intensify
- The pressure to reduce cost will not abate, keeping trade-offs challenging
- We need to expand our supply base for high-strength, low-weight components
- We will continue a structured weight optimization process
- Our product complexity will expand as we optimize size to match customer needs
- There are no easy answers, only opportunities for engineering work
- Ford intends to aggressively push for weight reduction to maintain fuel economy leadership

**Thank you for your attention!**

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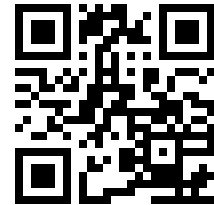
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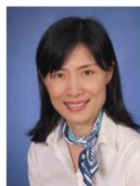
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