### Heavy Truck Efficiency:

Implementing the Opportunities

Rocky Mountain Institute 20 February, 2008 Michael Ogburn <u>mogburn@rmi.org</u> 970 927 7305

### Can We Learn From Our Past?

Rocky Mountain Institute



In 1947 this truck hit a revolutionary speed of 50mph with 135hp

#### Why Are We Here? Fuel Price, Business Climate, and **Rocky Mountain Institute** Customer Awareness of Carbon Emissions Regular Figure 2: ATA's Seasonally Adjusted Truck Tonnage Index; Plus Through January 2007 15% Premium F 10 10% 5% Gasoline 0% Year-Over-Year 03011694 68 Piveto -5% **Percent Change** -10% 2001 2002 2003 2004 2005 2007 2006

Source: Economics & Statistics Dept., ATA



For Every Dollar Created, How Much GHG is Released? Rocky Mountain Institute **GHG Emissions Per \$ of Market Value** 5 metric tons CO2/ billion revenue 4 3 2 Σ truck ship air auto Trucks generate the **most** GHG per \$ of market value Can we do better??

Market Value: retail selling price of all goods/services related to the industry (not including labor)

### **RMI Has Broad Capabilities Integrating Multiple Sectors**

Transportation

Energy

## Integration

Buildings



### RMI's Focus is on Whole System Design

Rocky Mountain Institute

PLATFORM EFFICIENCY	MATERIALS	POWERTRAIN



### **Containers travel the globe under-loaded due to US regulations**

- Safely allowing longer trucks and 110,000 lb GVW would raise max cargo per trip ~53% and cut fuel per ton-mile by 15-20% or more

-Today: Can we lighten the truck to enable some of this opportunity?

### Aerodynamics: Second Generation Designs Avoid Common Hazards

Rocky Mountain Institute

### Adequate clearance for railroad grade crossings





Manufacturers offer **rubber skirting** and flexible thermoplastic construction

#### Aerodynamics: Unconventional Designs Deliver Unconventional Benefit



Rear Drag Devices: quick-fold designs offer 5-6% fuel savings

Cross-flow vortex traps improve stability and reduce fuel use in cross-winds



More Important Than Any of the Previous Technology.... Commitment to Implementation



### Implementation = Competitive Advantage

**Rocky Mountain Institute** 

### What's your fleet's plan?

# Advanced Technologies Need Clear Paths to Market Deployment

Near Term	Medium Term	Long Term
<ul> <li>Reduced Weight</li> <li>Reduced Drag</li> <li>Designed-in Efficiency for reduced costs</li> </ul>	<ul> <li>Electric Propulsion</li> <li>Lithium + Fast Charge</li> <li>Speeds HEV Technology</li> <li>Development</li> </ul>	<ul> <li>New Aerodynamic</li> <li>Strategies</li> <li>Design Integration</li> <li>Tractor/Trailer Interface</li> </ul>
- OEM/Customer "Consortium"	- Profitable in-Port Duty Cycles	- Least-cost-first Technology Adoption

**Rocky Mountain Institute** 



Thank you

Mike Ogburn

mogburn@rmi.org

970 927 7305



Rocky Mountain Institute

Following pages for reference purposes

### Putting Platform Efficiency to Work



RMI MOVE Projects: Lightweight Efficient Trailer Consortium Bringing Manufacturers and Customers Together

> NEAR TERM

Institute



Taking it to the next level: RMI's integrated "Lightweight, EfficientTrailer" design:

- Weighs an estimated 1,500 pounds less
- Achieves a 15% fuel savings + increased payload
- Incorporates a full aerodynamics package
- Significantly reduced cost compared to retrofit
- Even with 3 trailers per truck, estimated 18 mo payback (50% IRR)
- Final design via a "Consortium" of Manufacturers and Customers

### RMI MOVE Projects: EV Yard Truck Zero-Emission Container Transport

### Why EV Yard Trucks?

-Defined location of operation and duty cycle
-Quick charging improves payback period
-Tough proving ground for Lithium Batteries
-Technology path speeds Class-8 HEV powertrain



### **Competitive business case:**

- -Lifecycle cost reduction vs Diesel
- -Reliable, low-maintenance electric propulsion system saves 45% of operational & energy costs
- -Breakthrough Lithium energy storage
- -Proven rapid recharge capability
- -Vehicle-to-grid energy technology
- -Full payload capability

Rocky Mountain Institute

MID

TFRM

### RMI MOVE Projects: "Transformational Truck"

#### LONG TERM

**Rocky Mountain Institute** 



Isuzu: 2007 Tokyo Auto Show

#### **Re-thinking the Tractor-Trailer:**

- -How far can efficiency take us?
- -Reduce aerodynamic weight & drag
- -Explore better tractor/trailer interface
- -Design integration is paramount
- -Advanced diesel/hybrid powertrain
- -Technology adoption using an organized least-cost-first process

### OEM partnership is critical to guarantee an implementation path

### RMI's Focus is on Whole System Design

EFFICIENCY	MATERIALS	POWERTRAIN	
Low <b>rolling resistance</b> to minimize tire drag at all speeds	<b>Part integration</b> for reduced cost and weight	<b>Optimized engine</b> <b>size and technology</b> level to match reduced	
Practical <b>aerodynamic</b>	Use of light, recycleable <b>aluminum</b> where	venicie drag requirements	
improvements that serve form and function	possible	Optimized hybrid architecture for	
Vehicle <b>lightweighting</b> by overall design strategy	Application of low cost <b>Fiber Composites</b> for certain applications	maximum performance and minimum cost.	
for reduced engine load		Incorporation of vehicle electrification	
		strategies for reduced energy use and lower lifecycle cost	

1	2	3

Rocky Mountain Institute

# Rocky Mountain Institute

For more information contact:

Mike Ogburn

mogburn@rmi.org

970 927 7305