



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Heavy Vehicle Materials Strategy

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FreedomCAR and Vehicle Technology

Tuesday, September 13, 2005

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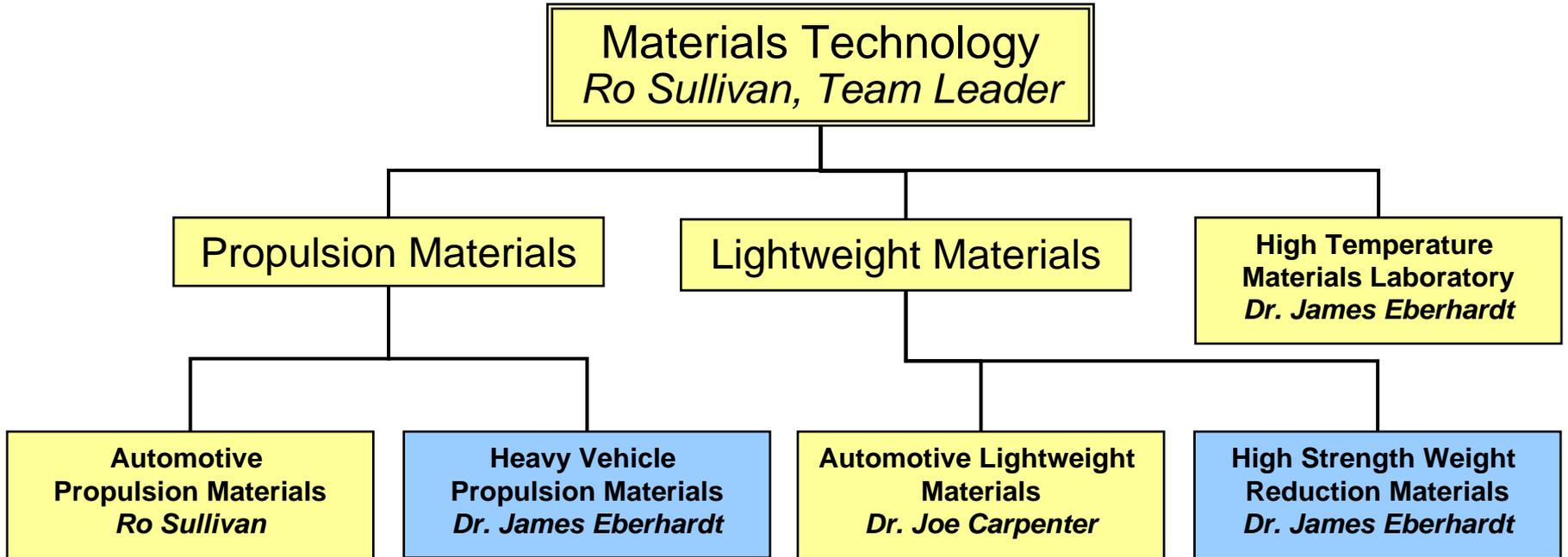


- Inform critical stakeholders of materials strategy and specific program content
- Provide forum for receiving critical feedback and input on future program direction
- Continue series of 21CT technology reviews of FreedomCAR Program
- Satisfy DOE program and peer review requirements
- Provide networking opportunity for program participants and stakeholders





Materials Technology Team



- Air and Thermal Management
- Structural
- Fuel Systems
- Hot Section
- Exhaust Aftertreatment

- Processing Techniques
- Enabling Technologies
- Lightweight Vehicle Structures
- Materials Development
- Application of Innovative Materials



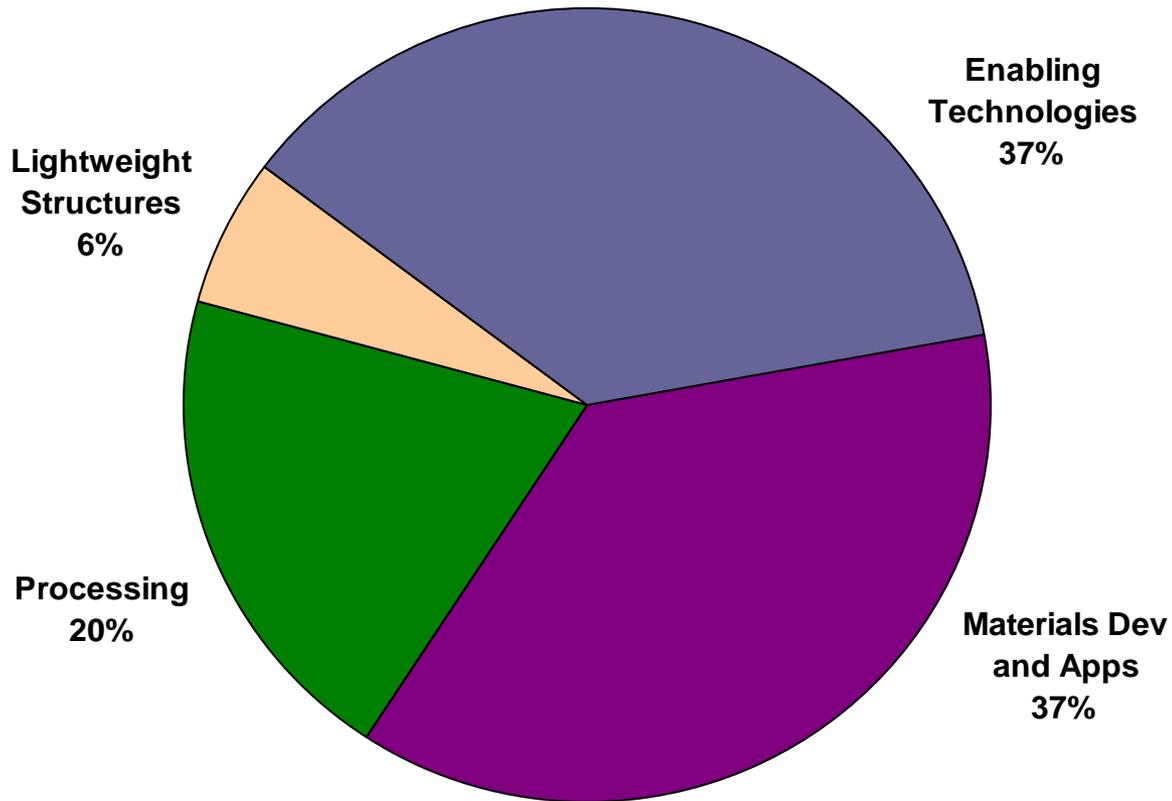
Goals For Heavy Vehicles Materials Program



- Develop and demonstrate lightweight material and manufacturing processes that lead to a 15% to 20% reduction in tare weight (for example, a 5000-lb weight reduction for Class 8 tractor-trailer combinations) by 2012.
- Develop materials technology to support the 21CT goal to improve engine efficiency by 20% (from 42% to 50%) in an emissions compliant engine by 2010.
- Contribute to safety improvement goal.



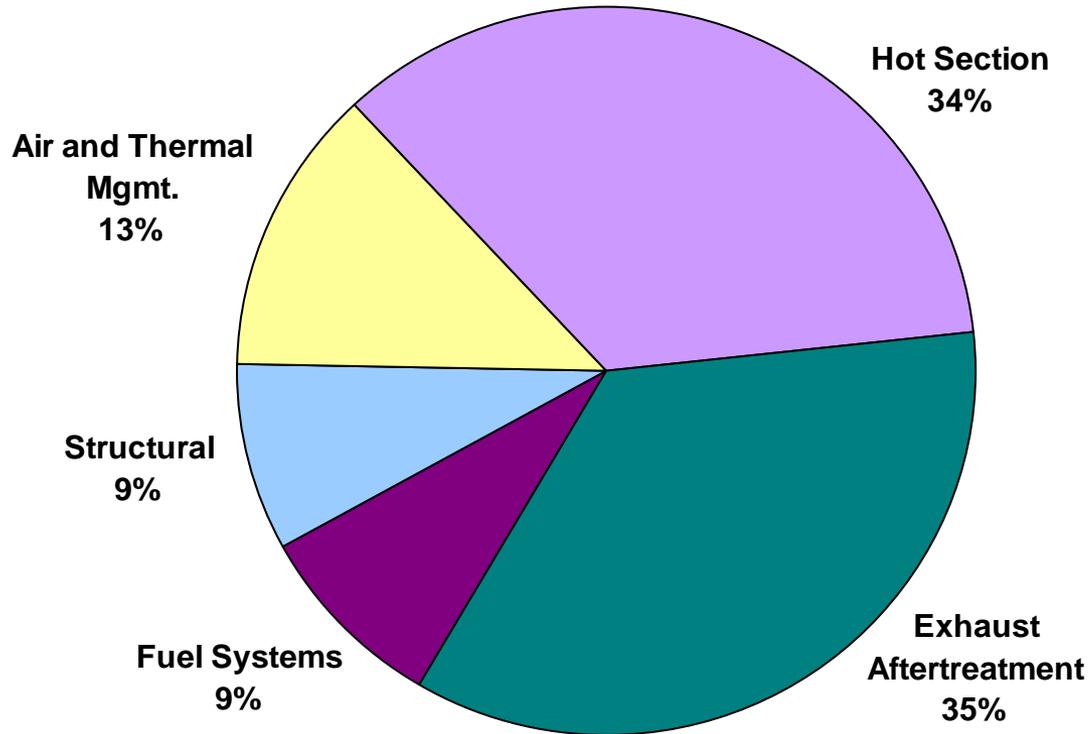
HSWR Funds Allocation



FY 2005 Budget: \$7.7M
FY 2006 (Request) : 7.8M



HVPM Funds Allocation



FY 2005 Budget: \$4.9M
FY 2006 (Request): \$4.9M



GOAL: Eliminate 5000 lbs.

Materials Development and Applications ————— **8 projects**

- Attachment techniques for composite chassis members of heavy trucks
- Advanced composites in large structural components

HSWR Processing ————— **6 projects**

- Lost foam casting of magnesium metal matrix composites
- Thermomechanical processing of titanium leaf spring elements

HSWR Lightweight Structures ————— **4 projects**

- Superplastically formed aluminum body panels
- Friction-stir-joined aluminum sheet for cab structures
- Lightweight trailer and bus

HSWR Enabling Technologies ————— **13 projects**

- Improved steel structures
- Joining technologies and surface treatment
- Carbon foam materials



GOAL: Contribute to a 20% increase in engine efficiency
(increasing from ~42% to 50% can save 2700 million gallons/year)

Aftertreatment ————— **7 projects**

- Effect of catalysts on fuel economy and catalyst degradation
- Sensors for remediation or monitoring of NOx emissions

Hot Section ————— **13 projects**

- Durability of engineered surfaces as thermal barrier coatings for increase engine temperatures
- New materials and inspection methods for lightweight valve trains to increase valve speed and HP

Air Handling & Thermal Mgmt. ————— **6 projects**

- Develop austenitic SS alloys to support higher-pressure and temperature engine operation
- High conductivity carbon foam for use in lightweight compact heat exchangers

Advanced Fuel Systems ————— **6 projects**

- Advanced fuel system materials to support high-pressure fuel injection needed to reduce particulate emissions and maintain/improve fuel efficiency

Engine Structural ————— **5 projects**

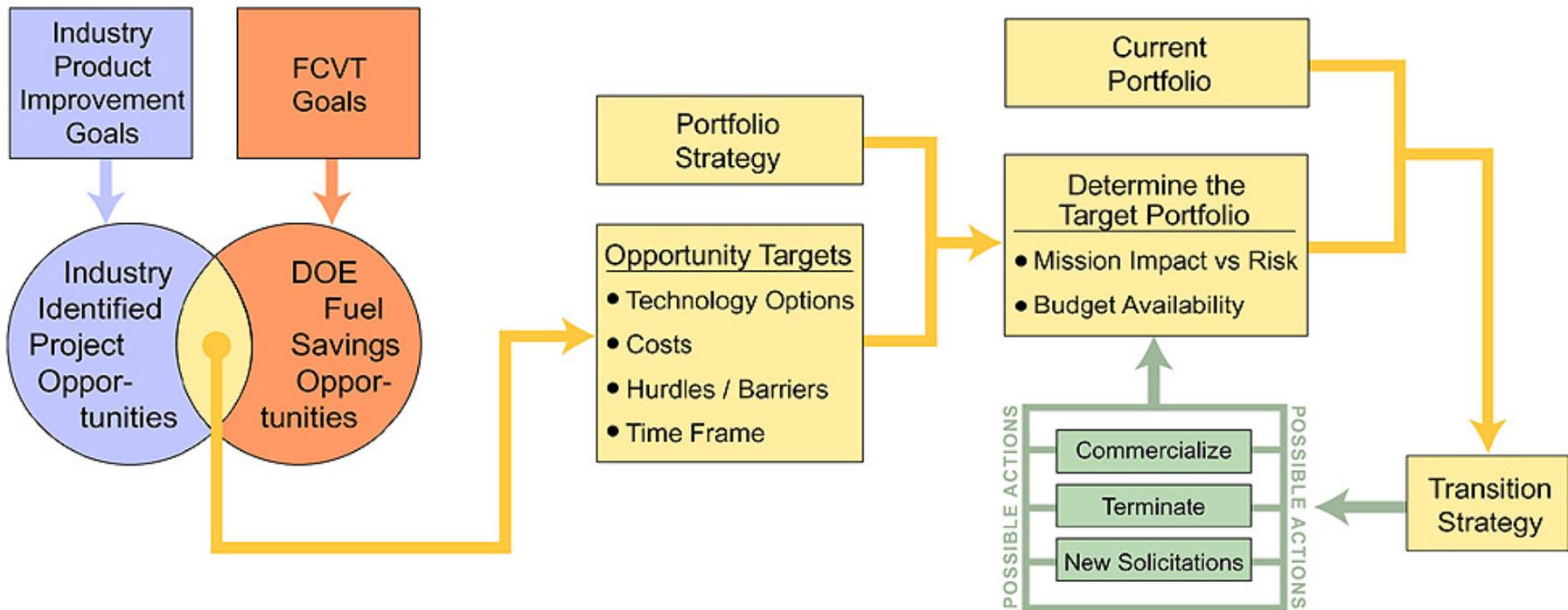
- Ti materials for use in cylinder heads and blocks to increase engine HP



- R&D plans developed based on results of industry/DOE workshops
 - HVPM Workshop; August, 1999
 - HSWR Workshop; April, 2002
 - Tooling for Low-Volume Production Workshops; October & November, 2003
- Create industry/National Laboratories collaborations to perform projects---minimize commercial risk.
- Continuous review of benefit and risk analysis of project portfolio
- Develop multiple materials options for reducing the weight of major vehicle components---minimize technical risk.
- Develop improved performance materials for major engine sub-systems to support the engine efficiency improvement goal.
- Support the deployment of new materials technology by addressing major barriers to commercial use:
 - Processing of conventional and advanced materials
 - Component cost and performance
 - Engineering design data



Portfolio Strategy Development



Benefit / Risk Analysis

DOE Project Bundle Information

Bundle002 - Weight Reduction

General

Risk/Impact Assessment

Market Penetration

Member Projects

Project Risks

Difficulty to Productize	4	Technical Reach	7
Economic Risk	7	Resource Limitations	3
Value Chain Disruption	3	Workplan Constraints	3
Market Hurdles	7	Technical Risk	4.6
Commercial Risk		RISK = 5.35	

About Calculation ?

Project Mission Impact

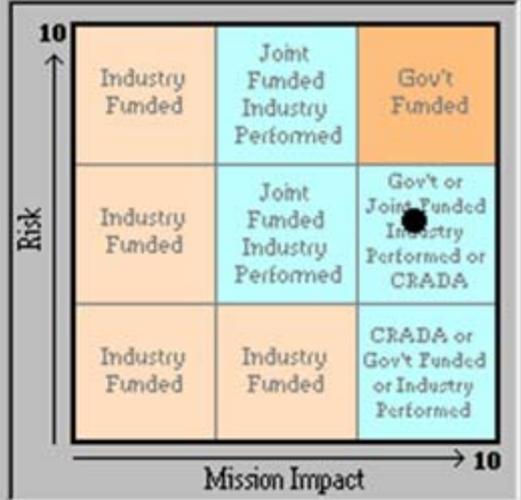
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<input checked="" type="radio"/> 7&8			

Emissions Reduction	Safety Improvement	MGS Rating
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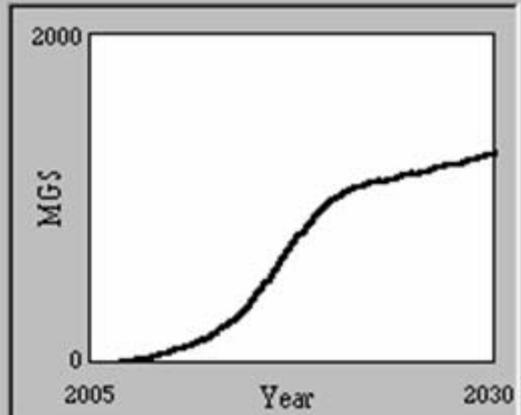
About Calculation ?

MISSION IMPACT = $(w_1 * ER) + (w_2 * SI) + (w_3 * MR) =$ 8

Assessment Version 2/4/2005 9:43



Mission Impact



Year

Save

Close



- Assuming a 21CT “standard truck” (class 7,8), an integrated fleet drive cycle based on VIUS data and average loads, the ADVISOR model estimates that:
 - 5000 pound reduction in tare weight can result in a fuel savings of about 560 million gallons (annual fleet total).
 - 20% improvement in engine efficiency can result in a fuel saving of about 2,700 million gallons (annual fleet total).





- The program provides a balanced portfolio of R&D activities supporting 21CT goals:
 - Technical breadth
 - Balanced risk
 - Industry participation
 - Parallel materials development, processing, and application paths





- General
 - Fewer, larger projects (critical mass)
 - Increase turnover
- High Strength Weight Reduction Materials
 - Improve analytical underpinning of technology priorities
 - Incorporate latest truck use data and modeling tools in portfolio assessment
- Heavy Vehicle Propulsion Materials
 - Align R&D portfolio more closely with Advanced Combustion Engine Program



Acknowledgements

- Kathi Vaughan
- Krista Long
- Brenda Hickey
- Donna Balltrip
- Lisa Starbuck
- Ray Johnson
- Phil Sklad
- Michael Laughlin
- Kenneth Howden