UNITED STATES COUNCIL FOR AUTOMOTIVE RESEARCH LLC

USCAR Presentation to the Commission to Review the Effectiveness of National Energy Laboratories

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United States Council for Automotive Research LLC

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www.uscar.org

What is USCAR?

- The collaborative technology research company for:
  - Chrysler Group LLC
  - Ford Motor Company
  - General Motors Company
- Founded in 1992
- Located in Southfield, Mich.

USCAR by the numbers

✓	3	Member companies
✓	8	Technical research areas
✓	40+	Teams, working groups and consortia
✓	500+	Active participants
✓	<15	Administrative/support staff
✓	>20	Years of experience and success

USCAR Mission

- Expand the technical knowledge and know-how of the domestic auto industry
- Encourage and support collaborative research and development of automotive technologies
- Address the needs of our environment and society, work with public and private stakeholders

USCAR
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Evolution of USCAR

National Cooperative Research Act — 1984

ACC — 1988

ERC 1991-2000 — 1991

USABC — VRP 1991-2014 — 1991

USCAR UNITED STATES COUNCIL FOR AUTOMOTIVE RESEARCH — OCCUPANT SAFETY RESEARCH PARTNERSHIP — 1992

USAMP — EWCAP — 1993

TLC structure — 2004

USCAR LLC — 2007

USCAR 1992-2012 — 20th — 2012

MICHIGAN GREEN LEADERS Detroit Free Press — AUTOMOTIVE INNOVATION — 2014

Key External Partnership Milestones

LEP LOW EMISSIONS PARTNERSHIP 1992-2000 — AIGER — 1992

CERP 1990s-2009 — 1990s

PNGV — 1993

FreedomCAR — DEPARTMENT OF ENERGY — 2002

FreedomCAR Fuel Partnership — ExxonMobil — BP — Chevron — PHILLIPS 66 — Shell — 2003

FreedomCAR Fuel Partnership — DTE Energy — EDISON — 2008

USDRIVE — EPRI ELECTRIC POWER RESEARCH INSTITUTE — TESLA — 2011

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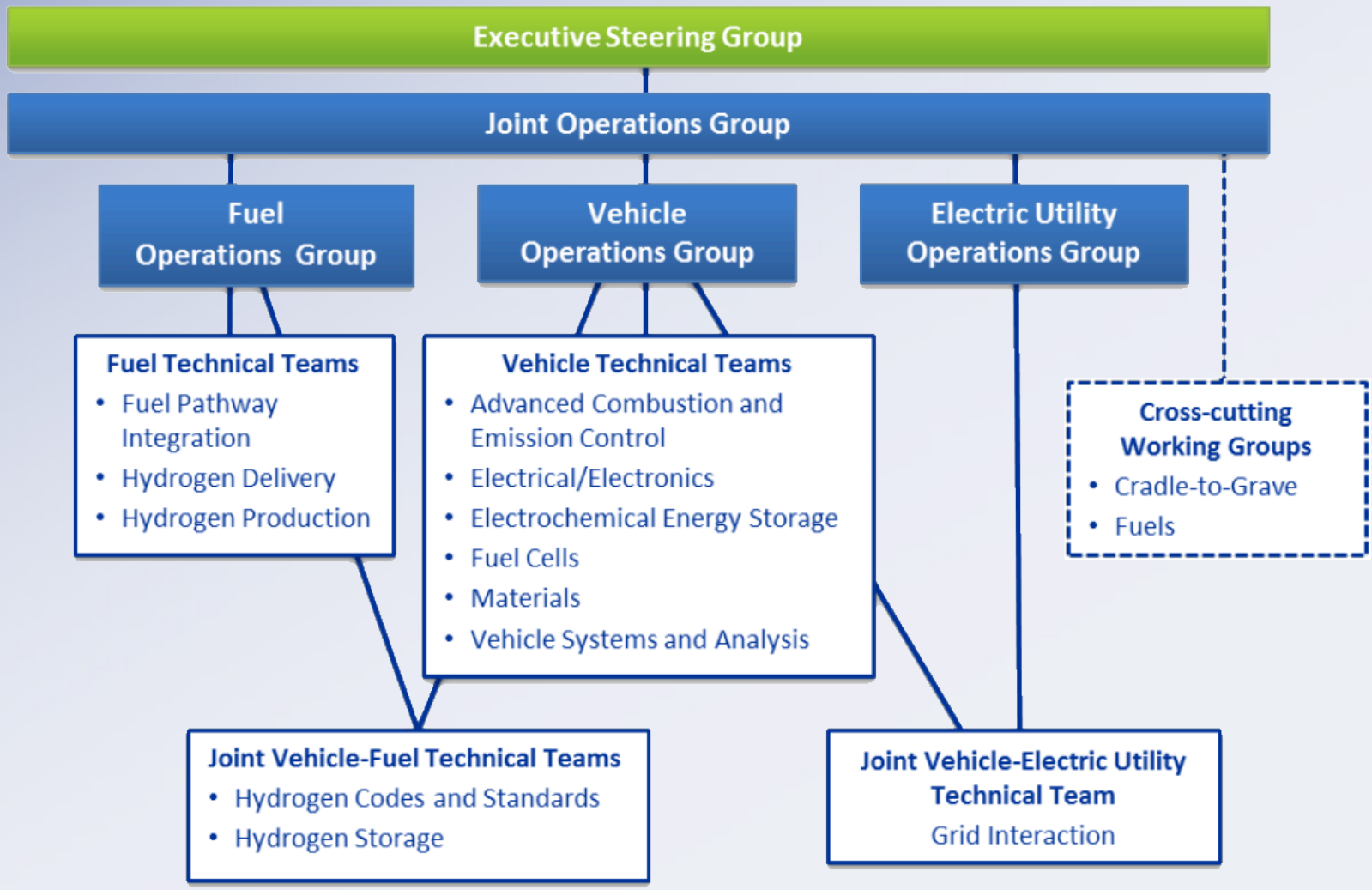
U.S. DRIVE Organizational Chart



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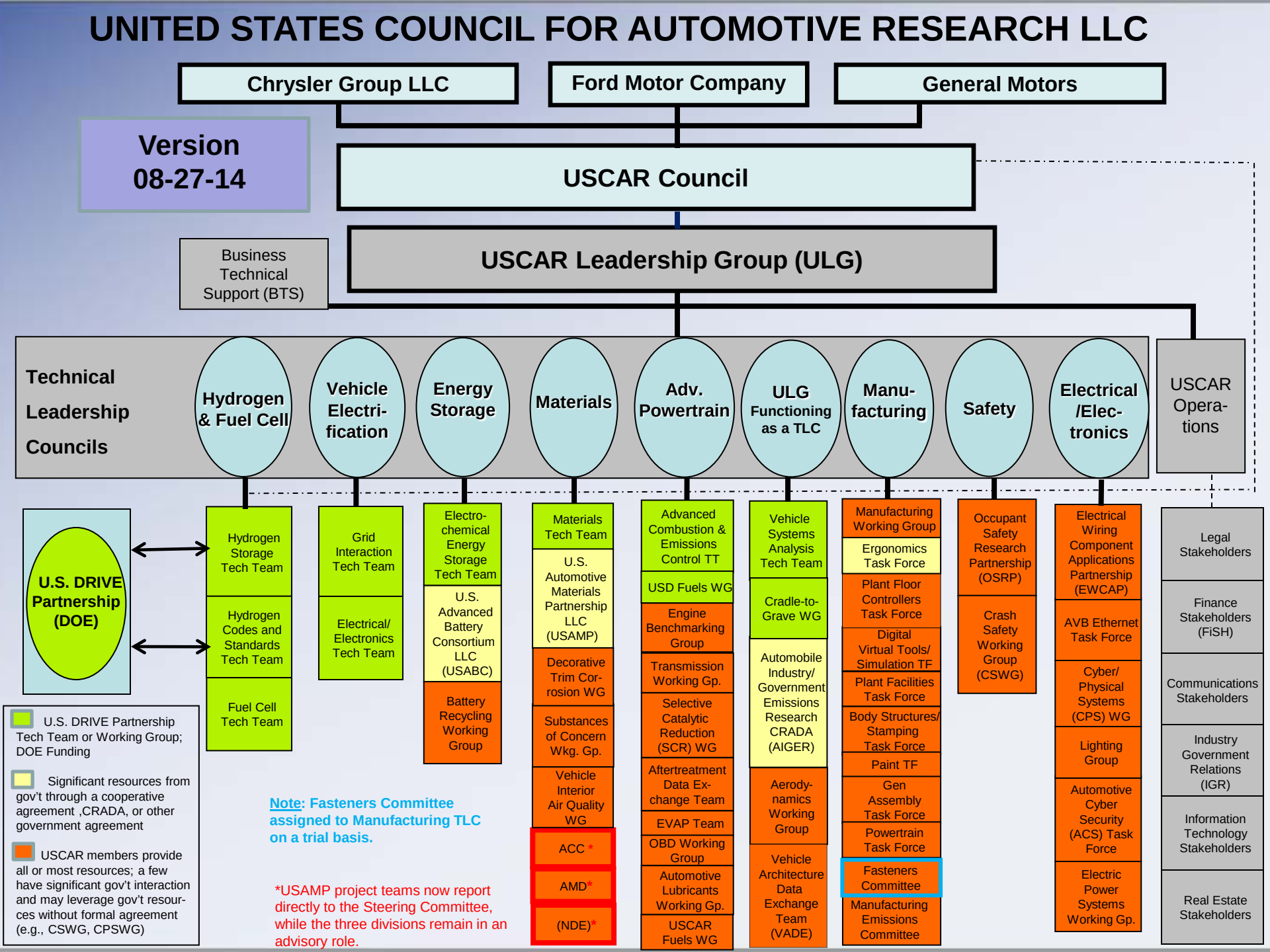

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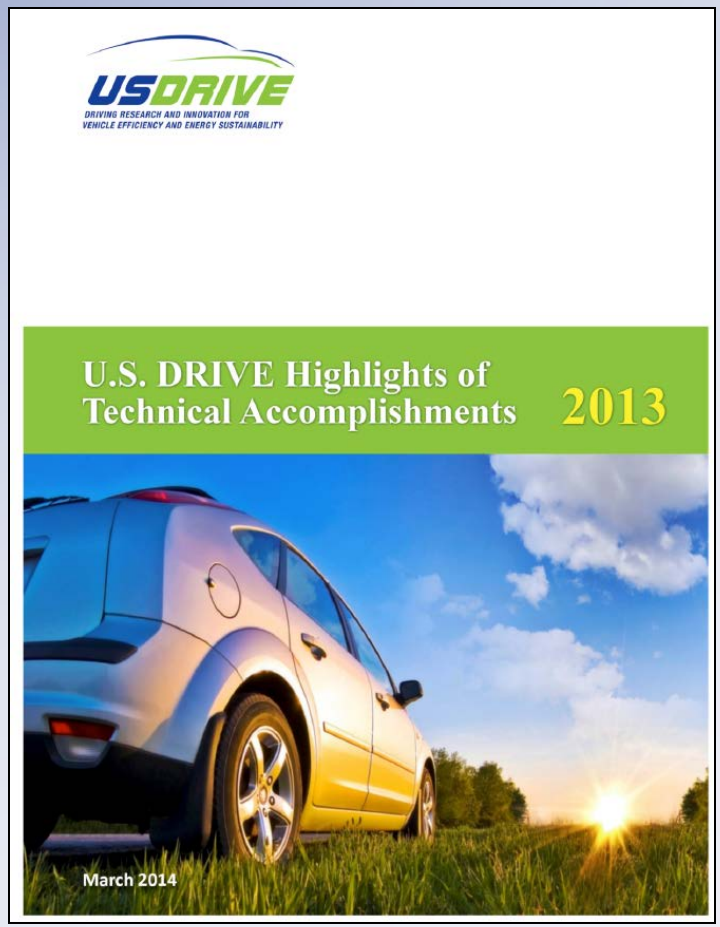
U.S. DRIVE Tech Team Activities

USCAR works with DOE, fuel and utilities companies, and the National Labs to:

- Develop long-term technology goals
- Develop roadmaps to identify technical gaps
- Complete monthly review of existing projects
- Complete annual accomplishments reports

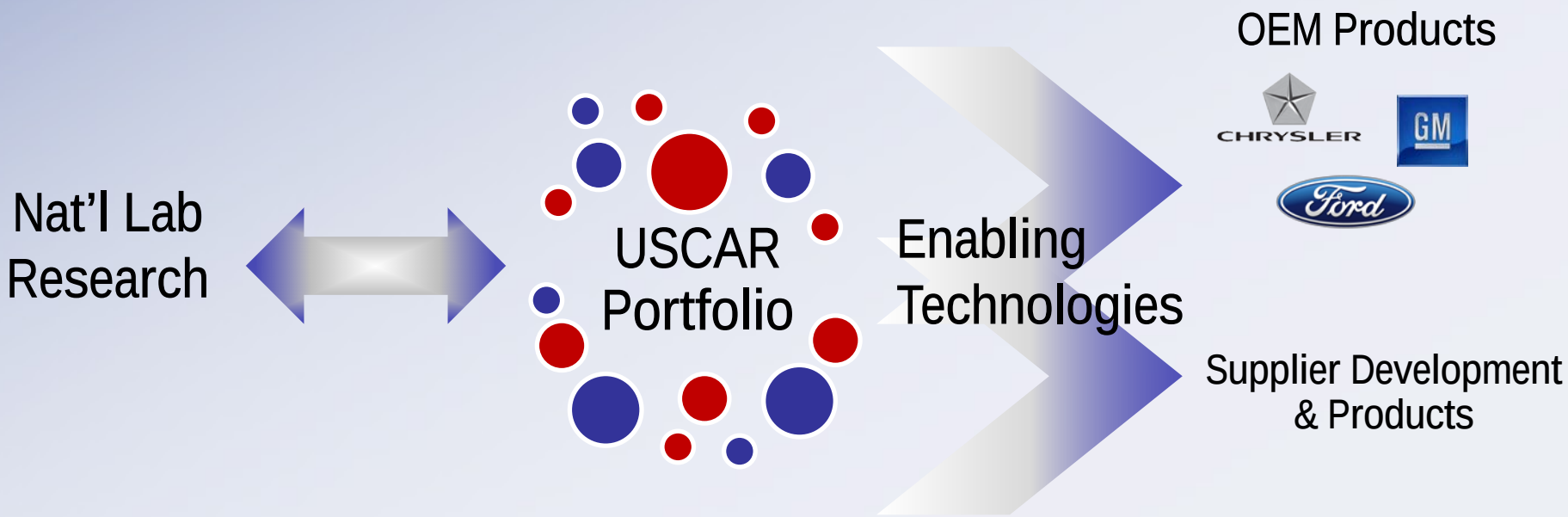
- Provide annual feedback on entire project portfolio
- Perform periodic assessment of lab capabilities

2013 U.S. DRIVE Technical Accomplishments



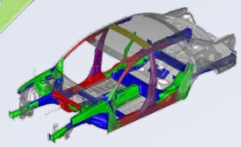
- Highlights in Vehicle, Crosscutting & Fuel Infrastructure Technologies
- 12 specific technical areas
- 57 total accomplishments
- More than 30 completed by or in partnership with a National Laboratory

Labs Contribute High-Risk, Long-Term, Basic Science Research to Commercialization Process

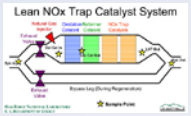


Labs Advance U.S. Competitiveness & Economic Growth

Lightweight Materials



Advanced Combustion, Aftertreatmet and Fuels R&D



Advanced Batteries

Electric Drive Systems

Automotive Hydrogen and Fuel Cells R&D

Implementation Enablers

Substantial Petroleum & Emissions Reduction

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National Lab Technical Capabilities Highly Valued by USCAR

Advanced Combustion and Fuels

- R&D on combustion efficiency, new combustion regimes, and low-temperature aftertreatment (ANL, ORNL, PNNL, SNL-CA)
- Work on measuring progress toward U.S. DRIVE efficiency goals (ORNL)
- Work on low carbon, high-efficiency fuels for light duty SI engines (LLNL, NREL, ORNL, SNL-CA)
- Use of Advanced Photon Source for fuel spray imaging (ANL)

Vehicle Electrification

- Fundamental battery research, especially development of new materials (ANL, LBNL)
- Battery cell, module, and pack testing (ANL, INL, LBNL)
- Characterization of battery materials (ANL, LBNL)
- Battery thermal management system benchmarking and ranking (NREL)
- More facilities to conduct battery pack-level abuse testing and increased dynamic evaluation of battery abuse models (SNL-NM)
- Traction drive, power electronics, inverters, DC-DC converters, permanent magnet motors and alternatives, wide band gap switches, (ORNL)
- Center of expertise for thermochemical reliability of bonded interfaces for power electronics and motors (NREL)
- Electric drive benchmarking (ORNL)
- Increased R&D on rare earth alternatives (Ames)

Lightweight Materials

- Fundamental research on advanced high strength steel, aluminum, magnesium, and carbon fiber and associated joining technologies for like and dissimilar materials, and (ORNL, PNNL)
- Development of ICME tools for materials and process development for improved stamping, casting, extruding, and injection molding of metals, plastics, and composites (ORNL, PNNL)

Fuel Cells

- Fundamental fuel cell inventions, including expanded novel PEM membrane and catalyst R&D (ANL, LANL)
- Large synchrotron radiation for fuel cell catalyst characterization (ANL)
- High spatial and temporal resolution soft x-ray computed tomography for in-situ water analysis in MEA (ANL, LBNL, or ORNL)
- Hydrogen Storage Engineering Center of Excellence provides valuable systems level analysis (SRNL)
- Sorbent materials development and measurement for hydrogen storage (NREL)

Cross-cutting Technology

- Vehicle and fleet information databases on real world operation (NREL, INL)
- Apply improvements in modeling and simulation calculation speeds to commercial tools (LLNL, LANL)

Possible Improvements to Lab-Industry Interface

1. Develop a more commercially competitive price structure at lab user facilities
2. Significantly reduce the response time to user requests
3. Significantly modify the publication requirements for joint-funded projects
4. Adapt licensing structure that benefits U.S. industry and economy

Thank you!