6. Materials Technologies

Advanced materials, including metals, polymers, and composites, can play an important role in improving the efficiency of transportation engines and vehicles. Weight reduction is one of the most effective ways to increase the fuel economy of vehicles while reducing exhaust emissions. The use of lightweight, high-performance materials will contribute to the development of vehicles that provide better fuel economy, yet are comparable in size, comfort, and safety to today's vehicles. The advanced materials research conducted under the direction of the U.S. Department of Energy’s Vehicle Technologies Program will help ensure the nation's transportation energy and environmental future by making affordable full-function cars and trucks that use less oil and produce fewer harmful emissions.

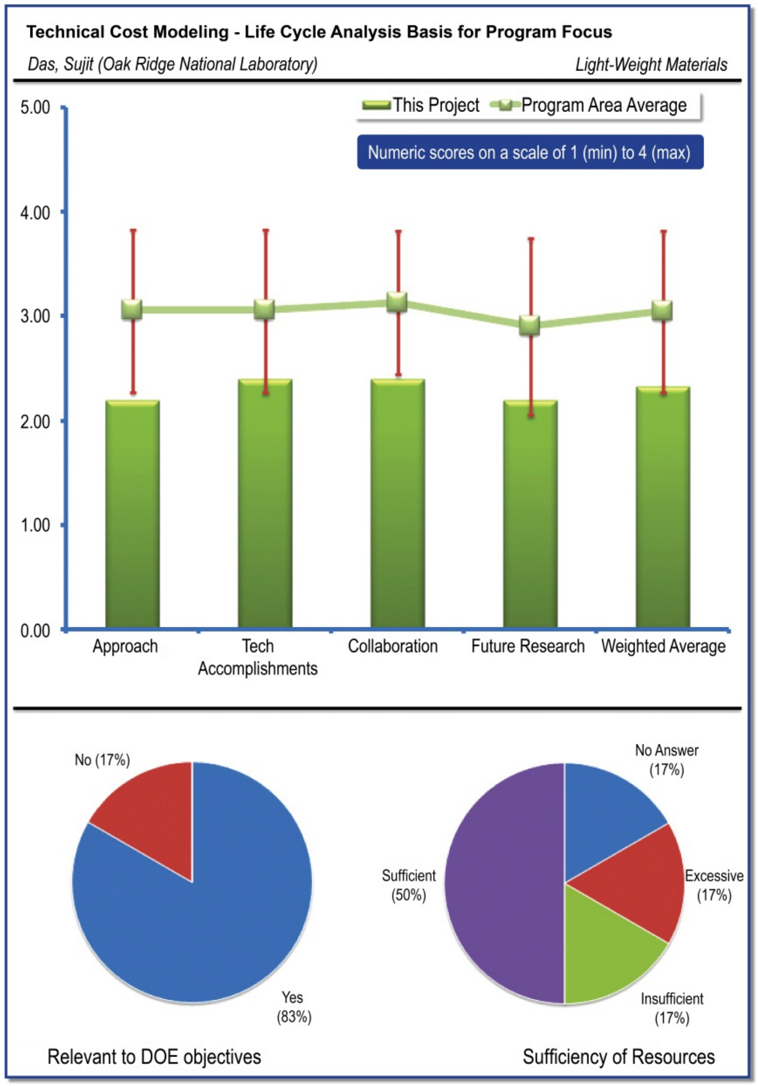
In this merit review activity, each reviewer was asked to respond to a series of questions, involving multiple-choice responses, expository responses where text comments were requested, and numeric score responses *(on a scale of 1 to 4)*. In the pages that follow, the reviewer responses to each question for each project will be summarized: the multiple choice and numeric score questions will be presented in graph form for each project, and the expository text responses will be summarized in paragraph form for each question. A summary table presenting the average numeric score for each question for each project is presented below.

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Technical Cost Modeling - Life Cycle Analysis Basis for Program Focus	Das, Sujit (Oak Ridge National Laboratory)	6-3	2.20	2.40	2.40	2.20	2.33
Low Cost Carbon Fiber Overview	Warren, Dave (Oak Ridge National Laboratory)	6-5	3.40	3.40	3.60	3.40	3.43
Carbon Fiber Technology Facility	Warren, Dave (Oak Ridge National Laboratory)	6-7	3.50	3.25	3.00	3.50	3.31
Lower Cost Carbon Fiber Precursors	Warren, Dave (Oak Ridge National Laboratory)	6-9	3.50	3.75	3.50	3.50	3.63
Advanced Oxidation & Stabilization of PAN-Based Carbon Precursor Fibers	Warren, Dave (Oak Ridge National Laboratory)	6-11	3.00	3.00	2.50	3.25	2.97
Magnesium Front End Development (AMD 603/604/904)	Luo, Alan (USAMP/AMD)	6-13	3.00	3.00	4.00	3.00	3.13
Integrated Computational Materials Engineering (ICME) for Mg: International Pilot Project	Li, Mei (USAMP/AMD)	6-15	3.50	3.00	3.00	3.50	3.19
Fundamental study of the relationship of austenite-ferrite transformation details to austenite retention in carbon steels	Warren, Dave (Oak Ridge National Laboratory)	6-17	2.40	2.20	1.40	1.40	2.05
Dynamic Characterization of Spot Welds for AHSS	Feng, Zhili (Oak Ridge National Laboratory)	6-20	3.33	2.67	3.33	3.00	2.96
Analyzing Casualty Risk using State Data on Police-Reported Crashes	Wenzel, Tom (Lawrence Berkeley National Laboratory)	6-22	2.20	2.20	3.20	2.40	2.35
Materials Characterization Capabilities at the High Temperature Materials Laboratory: Focus on Carbon Fiber and Composites	Payzant, Andrew (Oak Ridge National Laboratory)	6-24	3.25	3.50	3.25	3.00	3.34
Materials Characterization Capabilities at the High Temperature Materials Laboratory and HTML User Program Success Stories	Lara-Curzio, Edgar (ORNL/HTML)	6-26	3.25	3.75	3.25	3.00	3.47
Multi-Materials Vehicle R&D Initiative Lightweight 7+ Passenger Vehicle	Wagner, David (USAMP/NDE Chrysler)	6-29	3.33	3.00	3.33	2.67	3.08

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Friction Stir Spot Welding of Advanced High Strength Steels II	Paxton, Dean (Pacific Northwest National Laboratory)	6-32	4.00	3.67	4.00	3.33	3.75
FSW & USW Solid State Joining of Magnesium to Steel	Warren, Dave (Oak Ridge National Laboratory)	6-34	3.50	3.50	3.00	3.50	3.44
High Strain-Rate Characterization of Mg Alloys	Warren, Dave (Oak Ridge National Laboratory)	6-36	3.67	3.50	3.00	3.50	3.48
Pulse-Pressure Forming of Lightweight Metals	Paxton, Dean (Pacific Northwest National Laboratory)	6-38	3.25	3.00	2.75	2.75	3.00
Ultra-Fine Grain Foils and Sheet by Large-Strain Machining	Paxton, Dean (Pacific Northwest National Laboratory)	6-40	2.67	2.67	2.67	2.67	2.67
Solid Oxide Membrane (SOM) Electrolysis of Magnesium: Scale-Up Research and Engineering for Light-Weight Vehicles	Derezinski, Steve (MOxST)	6-42	3.29	3.43	2.86	3.00	3.27
Diffusion Databases for ICME	Warren, Dave (Oak Ridge National Laboratory)	6-45	3.00	3.00	3.40	2.80	3.03
Southern Regional Center for Lightweight Innovative Design (SRCLID)	Horstemeyer, Mark (Mississippi St University)	6-47	2.00	2.33	2.33	2.33	2.25
Materials Informatics for the ICME Cyber Infrastructure	Paxton, Dean (Pacific Northwest National Laboratory)	6-49	2.20	2.40	2.80	2.40	2.40
Materials Characterization Capabilities at the High Temperature Materials Laboratory: Focus Lightweighting, Magnesium	Watkins, Thomas (ORNL/HTML)	6-51	3.60	4.00	4.00	3.40	3.83
AMD 405: Improved Automotive Suspension Components Cast with B206 Alloy	Osborne, Dick (USAMP/AMD)	6-54	2.33	2.33	3.33	2.67	2.50
AHSS Stamping Project - A/SP 050; Nonlinear Strain Paths Project - A/SP 061	Cullum, Terry (USAMP/ASP)	6-56	2.50	2.50	3.50	2.50	2.63
Advanced Materials and Processing of Composites for High Volume Applications (ACC932)	Houston, Dan (USAMP/ACC)	6-58	3.00	3.00	3.33	2.67	3.00
Low Cost Carbon Fiber Composites for Lightweight Vehicle Parts	Stike, Jim (Materials Innovation Tech)	6-61	3.60	4.00	3.80	3.00	3.75
Overall Average			3.05	3.05	3.13	2.90	3.05

Note: Italics denote poster presentations.

Technical Cost Modeling - Life Cycle Analysis Basis for Program Focus: Das, Sujit (Oak Ridge National Laboratory) – lm001



Reviewer Sample Size

This project had a total of six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer said the project has significant relevance to the DOE lightweight materials program, but did not address the matter of its relevance to DOE's petroleum conservation goal. Potentially, this reviewer continued, it is the most relevant, as it is the tool to access need and accomplishment. A second reviewer expressed the opinion that it is necessary to understand and prioritize various options available to a lightweight vehicle, which are known to improve fuel efficiency. LCA and TCM are known to provide directions for priority setting exercises. The third reviewer was emphatic that this project is not relevant to solving the challenges facing the nation regarding petroleum displacement. Each supplier and manufacturing company is better able than the PI to determine the costs and benefits of each potential technology. This work is not valuable to the industrial companies who will implement the lightweight solutions. One reviewer said it is important to understand the impact of component- level mass reduction on the vehicle-level potential mass, and one said cost is an important factor in any business and technical decisions in vehicle lightweighting. Neither comment addresses petroleum conservation.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers were more or less critical of the project work approach. One said the system-level analysis seems too generic, with a lot of estimates which might affect the sensitivity of the modeling work. Need to provide more details of input and factors considered. A second reviewer found the approach to be slightly scattered, considering that there are too many subjects to address subject to sufficient (needed) level of detail. The benefit is establishing environmental and economic benefit of materials and process. This reviewer felt that with additional resources, scope could be expanded to include further scientific and numerical cost modeling efforts. A third reviewer, noting that the total cost of a process or material was estimated using information available in the literature. Perhaps, this reviewer suggested, it would be better to cross-check with actual data from industry partners. Involving them will be more beneficial. The fourth and final reviewer regarded the project's cost estimating approach as overly simplistic and felt it failed to address the two most important cost drivers - invested capital and assembly costs. Further, the discussion of mass compounding was not accurate. There are numerous ways to approach mass compounding from the historical teardown data, but the PI's discussion was over-optimistic at best.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One of the four comments presented by reviewers in this category addressed project accomplishments and progress explicitly. That reviewer said there had been good accomplishment, but that a tangible basis for a conclusion was lacking. Most papers, this reviewer went on, are written to demonstrate a strategic position of the funding or development agent. The remaining three reviewers' comments spoke as much to the work approach as to technical accomplishments. For example, one reviewer said the cost modeling approach is a mix of supplier input and literature data. A better approach, this reviewer suggested, would be technical cost modeling based on the process fundamentals, and not influenced by literature data which can be misleading. In the same vein, the third reviewer said the data used for the calculations are mostly from open source[s], but this needs to be fine-tuned with confirmation from the actual producers. For example, the information on the Chinese process may be a few years old and should be confirmed. The fourth called the "first order" relationship for the subsystem costs not relevant and often completely inaccurate compared to actual costs. Because this project uses data instead of getting to a legitimate technical cost model, the net results is not understandable from either the technical process or the commercial vantage point. Speaking more specifically, this reviewer continued: For the magnesium solid oxide membrane (SOM) process, the comparison from the small-scale and large- scale production is not legitimate. There is no currently available SOM production source, so comparing to aluminum is irrelevant.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Inter-institutional collaboration in this project, according to the first reviewer, seems to be good, given the sensitivity of cost analysis and the difficulty of data collection. Collaboration with the Canada Centre for Mineral and Energy Technology (CANMET) and other labs adds credibility and peer review opportunity, said the second reviewer, leveraging additional human and financial resources. The third reviewer suggested more involvement from industrial partners, as the data need to be confirmed by partners. The fourth reviewer, however, felt there was little mention of the collaborators or the data sources. How the three groups and the suppliers worked together was unclear, since which information came from which group and how they were reviewed and validated was never discussed.

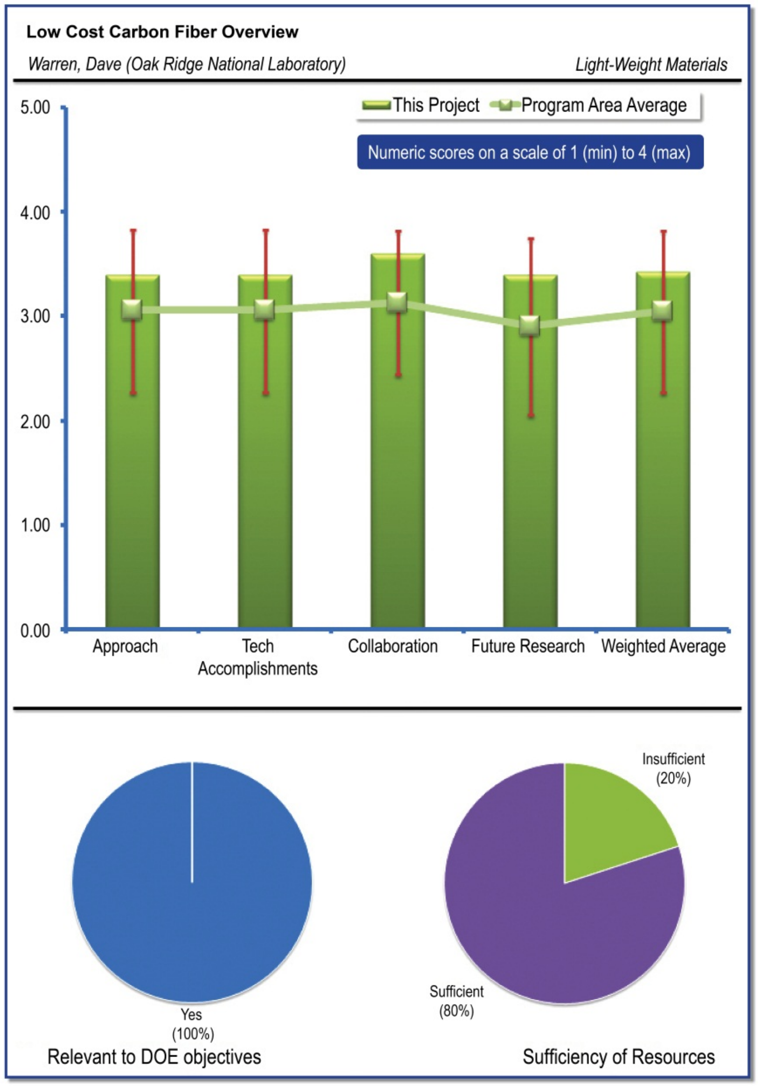
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

In general, the four commenting reviewers were not enthusiastic regarding proposed future research in this project. One recommended use of the Massachusetts Institute of Technology (MIT) technical cost modeling approach, rather than the mixed approach that is less reliable. A second reviewer suggested that sensitivity analysis of the process and materials be carried out, along with work on the multi-material. The third reviewer found the project to be lacking [a] vision for future. This area provides the opportunity for significant documented environmental and cost assessments. The future work, according to the last reviewer, is what "someone" has asked you to investigate. How the new initiatives are related is far from clear.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer opinion on this topic spanned the range of options, one reviewer deeming the resources insufficient, four considering them to be sufficient and one terming them excessive. The reviewer who thought resources to be insufficient recommended expanding project collaboration to include EU and broaden scope from literature review to a documented scientific and financial unbiased multinational resource. This effort would require a six-to ten-person, multi-year commitment. The reviewer who felt the project resources to be excessive said this is too much money to spend on a poorly executed project.

Low Cost Carbon Fiber Overview: Warren, Dave (Oak Ridge National Laboratory) – lm002



REVIEWER SAMPLE SIZE

This project had a total of five reviewers.

QUESTION 1: DOES THIS PROJECT SUPPORT THE OVERALL DOE OBJECTIVES? WHY OR WHY NOT?

While not in all cases directly addressing petroleum conservation, the four reviewers' opinions were generally positive. Two comments did directly relate to the DOE goal of petroleum conservation and the manner in which this project supports it. One reviewer said the project, if successful in reducing cost of CF, would see much wider application of that material to automobiles which would drastically increase efficiency and reduce fuel usage and GHG emissions. Cost reduction, this reviewer went on, is a key enabler of more widespread usage of carbon fiber composites. The second reviewer agreed strongly with that assessment, saying carbon fibers are fundamental to the DOE objective of diminishing petroleum consumption, especially when taking into account that a 10% weight reduction will translate to about a 5% fuel consumption reduction. Any object that can be manufactured with carbon fibers will probably see the largest weight reduction, and thus the better fuel economy. This reviewer added his hope that the current economy would not compromise the future of this project. This reviewer referred to carbon fiber as an enabling material. Carbon fiber, according to the third reviewer, is an important lightweight material worth the investment. The last reviewer said this research, although not having a high impact today on petroleum displacement, could have a high impact in the future if CF composites utilization in the transportation industry increases. The manufacturing elements of this project, on the other hand, do offer energy savings which translates into reduced energy dependence, in this reviewer's estimation.

QUESTION 2: WHAT IS YOUR ASSESSMENT OF THE APPROACH TO PERFORMING THE WORK? TO WHAT DEGREE ARE TECHNICAL BARRIERS ADDRESSED? IS THE PROJECT WELL-DESIGNED, FEASIBLE, AND INTEGRATED WITH OTHER EFFORTS?

Reviewers commenting on this aspect of the project were by and large approving of the work approach. One called it a very focused effort to drive down the cost of CF precursors and must continue only at an accelerated pace to drive the development of pre-preg to enable more CF applications in the transportation industry. The second reviewer said it appears the technical barriers have been identified. However, the program seems to be taking a "shotgun" approach to doing a little bit of everything rather than narrowing focus to critical-path items. The third reviewer thought it clear that the project can continue as structured and be successful in the end. The experimental part is outstanding but it seems to me the modeling effort is not at the same level. The comparison between the two is necessary for the overall understanding of progress to be made. This reviewer recommended that more effort be put into the modeling aspect of the project.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One of the three reviewers offering comments deemed the project to have made great progress, and urged that the technical center be opened and the product put out into the hands of the OEMs in all transportation industries. The second felt that the presentation was just a "stage setting" overview, and so found few specific examples of progress cited. Accordingly, that reviewer thought this question [i.e., on technical accomplishments and progress] did not appear to be relevant to the presentation, and was therefore difficult to quantify. The last reviewer offered the same comment as in the previous section, namely that while the project could continue as structured and be successful, the modeling effort did not appear to be at the same level as the experimental portion. This reviewer therefore recommended increased emphasis on modeling.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer noted simply that many collaborators were listed in the presentation, but the other two reviewers who commented termed the collaboration among the different parties excellent and the other cited outstanding collaboration with domestic OEMs and the U.S. Council for Automotive Research (USCAR).

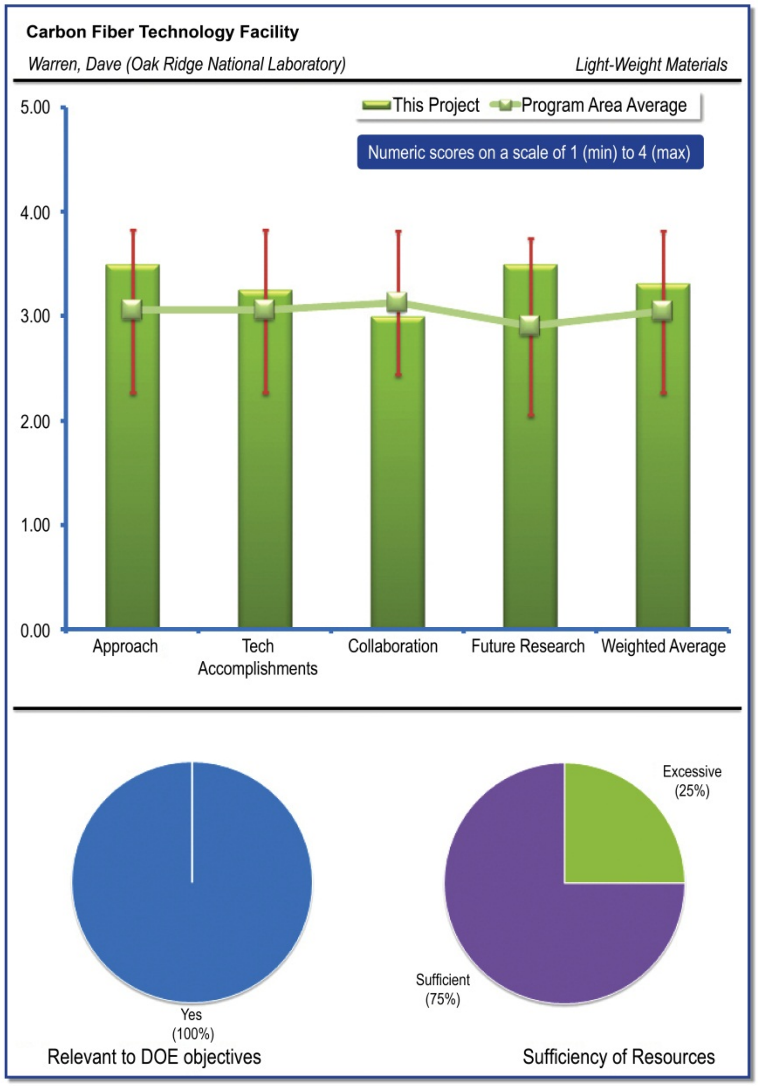
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Two of the four reviewers addressing this question approved the proposed future work in fairly strong terms. One said that overall, it looks very good and recommended its implementation. The second awarded it another outstanding mark and urged that the results be delivered as soon as possible. The third reviewer cautioned that cost is only one small factor in the equation and that the technology of integrating this material (CF) into vehicle structure is more important. The last reviewer was unable to tell what the specific future plans are other than completing the CF Technology Center.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Four of five reviewers deemed project resources to be sufficient; one felt they were insufficient. The latter considered that the researchers needed to have more people to help them reach their goals in a timely manner. Of the reviewers who felt the project's resources were sufficient, one expressed the hope that DOE would continue to support this project as before. The other urged that the project delivery time be shortened, if possible.

Carbon Fiber Technology Facility: Warren, Dave (Oak Ridge National Laboratory) – lm003



Reviewer Sample Size

This project had a total of four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Two of the four reviewers spoke directly to the matter of petroleum conservation and greenhouse gas emission reduction, which are DOE's overarching goals. One said that based on both vehicle weight reduction (fuel economy) and energy reduction technology (infrastructure), this new CF processing facility will directly reduce petroleum dependence in the long term. The other said this facility will expedite development and commercial implementation of new techniques to produce lower-cost CF. That will enable more widespread application of CF in high- volume automotive production. That in turn can significantly reduce vehicle mass, improve vehicle efficiency and reduce GHG emissions. The other two confined their remarks to the commercialization of carbon fiber construction, one saying this small-scale carbon fiber equipment is a great way to verify the findings in the lab and pave the way for productionizing low-cost carbon fibers. The other termed it a necessary step toward commercialization.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

A reviewer said the fact that this is a production scale-up for low-volume production of low-cost carbon fiber makes this very focused on industry needs. But the second reviewer, while noting that the project seemed to have taken into account the ability to implement all major relevant technologies (as envisioned or anticipated by ORNL) in various combinations, expressed the view that it would have been good to get suppliers involved early in the process rather than after the facility is built. Building a $34 million facility assuming suppliers will seek to use it in DOE co-funded demonstration projects, this reviewer said, seemed somewhat presumptuous. The final reviewer commenting termed the presentation a good show and tell. It looked promising, but this reviewer found the presentation to be light on technical details.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One of the three reviewers predicted that this project is on track to be outstanding, after the facility is up and running and producing the CF materials scoped as a part of the project. Further, this reviewer projected, this will be successful and thus, in future reviews, will receive an outstanding ranking. Echoing this, a second reviewer said the project objective is beyond what was presented today [at the AMR]. This reviewer looked forward to the next presentation to see whether the plant will deliver the prize. The third reviewer felt the project has made decent progress in the design and construction of the facility, once funds were received.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Two of three reviewers praised the collaboration exhibited in this project. One was particularly complimentary, saying that, as with all other ORNL projects, collaborations look outstanding. This lab seems to have a good culture to nurture such collaborations. The second reviewer's comment was of like sort: You [the project team] have listened to the transportation industry and are responding with the Carbon Fiber Test Facility (CFTF) scale-up. The third reviewer expressed reservations regarding project collaboration and with coordination, in particular. Collaboration is anticipated, but not demonstrated, adding that it seems it would have been appropriate and prudent to more fully engage suppliers before finalizing plans to ensure that the anticipated needs and concerns of all suppliers were addressed in the design of the facility.

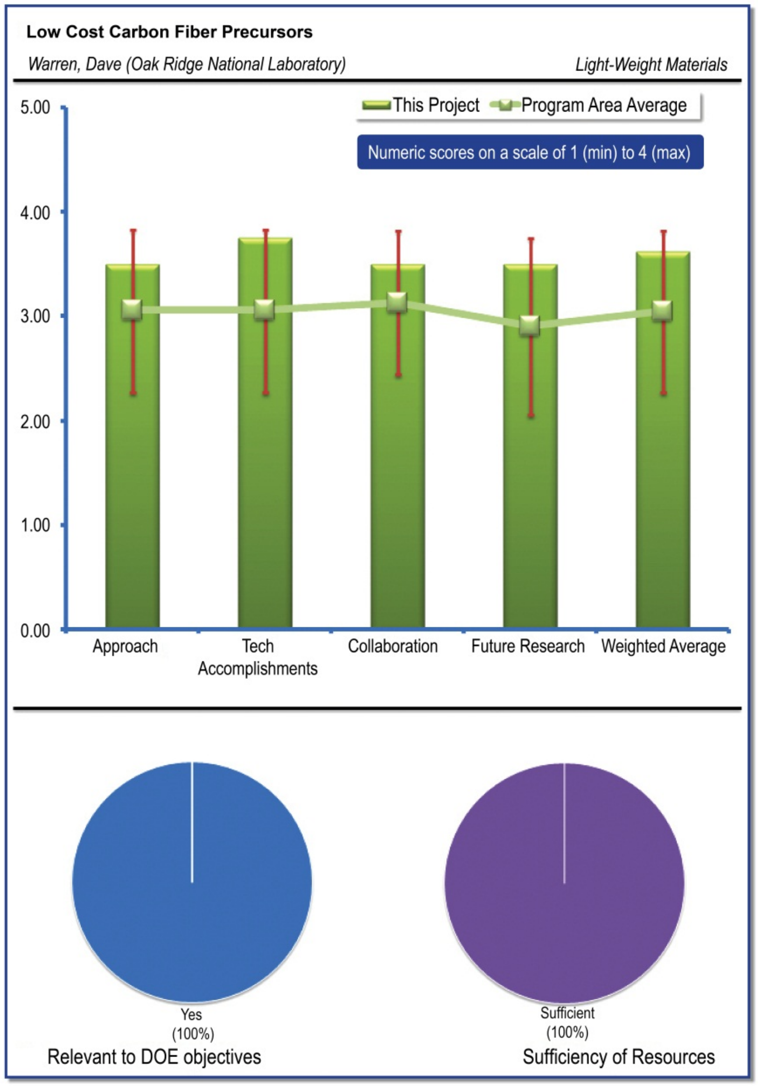
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Once scaled and producing CF materials, one reviewer said, this can become the model for next scale processing lab. There is no question that CF will deliver a 60% weight savings and it starts with the CFTF. The plan is good, in the second reviewer's estimation, if indeed there is supplier pull for the use of the facility, as opposed to technology push by DOE. The third reviewer, however, felt that the project team cannot really envision what they will do with that plant. Openness is the name of the game here, the reviewer continued, expressing the hope that the researchers will remain as open as possible. The project, in this reviewer's opinion, represents a very important endeavor.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Of the four reviewers weighing in on this topic, three felt project resources were sufficient and one viewed them as insufficient. Expanding on this, the reviewer who felt project resources to be inadequate said resources are adequate for building the facility. However, this reviewer did not see a viable plan for sustaining it without a substantial burden on future years' R&D budgets. For this reason, this reviewer deemed resources insufficient to get the job done in the long term. Additional funding should be provided over and above budget for research. Another reviewer described the project as appropriately scoped and sized for the current effort.

Lower Cost Carbon Fiber Precursors: Warren, Dave (Oak Ridge National Laboratory) - lm004



Reviewer Sample Size

This project had a total of four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Of the four reviewers responding to this question, only one mentioned petroleum conservation explicitly. One reviewer said a truly low-cost precursor (as seems possible with polyolefin) would eliminate a major barrier to much more extensive use of CF in high-volume automotive applications, thereby grossly reducing the weight of the automotive fleet. This would improve fuel economy and reduce GHG emissions. Another reviewer said the fact this project is looking at multiple sources for low-cost CF precursors adds to the technology tool box and portfolio of technologies to deliver CF composites. This is significant in delivering low cost carbon fiber (LCCF) to enable weight reduction in the transportation industries. The two remaining reviewers said, in one case, that this is a good collaboration with the industry to bring to production a lower-cost carbon fiber while work is in progress for more innovative and aggressive cost reductions. In the other case, the reviewer cited the project as offering good understanding and a good description of precursors and their physical properties.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Only two reviewers offered comments on this question. One said polyacrylonitrile (PAN) vs. linear low-density polyethylene (LLDPE) vs. lignin are all technologically advanced and delivering a package of low-cost carbon fiber opportunities and urged the project team to press on - good work. The second reviewer was less sanguine. This reviewer is unconvinced that the scale-ups of those precursors will be as "easy" as heard. Scale-ups are always problematic and difficult to master.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

By and large, all four commenting reviewers were complimentary of the project’s progress and accomplishments to date. One, while acknowledging that it is difficult and would be inaccurate to assign one value because all of the projects presented have varying degrees of accomplishment. On average, this reviewer said the suite of projects would be rated "good." For example, polyolefin and textile carbon fiber precursors are very good, while lignin is a poor starting point. The second reviewer labeled project accomplishments and progress as very good. The chemistry of lignin, he continued, is very important and this is explained very clearly and comprehensively. The project team knows where they are going. The third reviewer commented on similar lines, saying that making small prototype batches is the starting point and this project has not lost sight of the long-term goal to scale and test this in the CFTF that is being built.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

In commenting on this aspect of the project, one reviewer reiterated the comment offered in the preceding section, saying it is difficult and would be inaccurate to assign one value because all the projects presented have varying degrees of collaboration. On average, this reviewer judged collaboration overall to be "good." However, the textile-based work seemed to this reviewer to be too focused on a single company (FISIPE). The reviewer questioned how the industry in general will benefit if a unique process is developed for a specific supplier. The second reviewer commenting judged collaboration with universities and other industry research organizations to be excellent. The final reviewer's comment was that collaboration and coordination could probably be considered good, but that better representation could have been made.

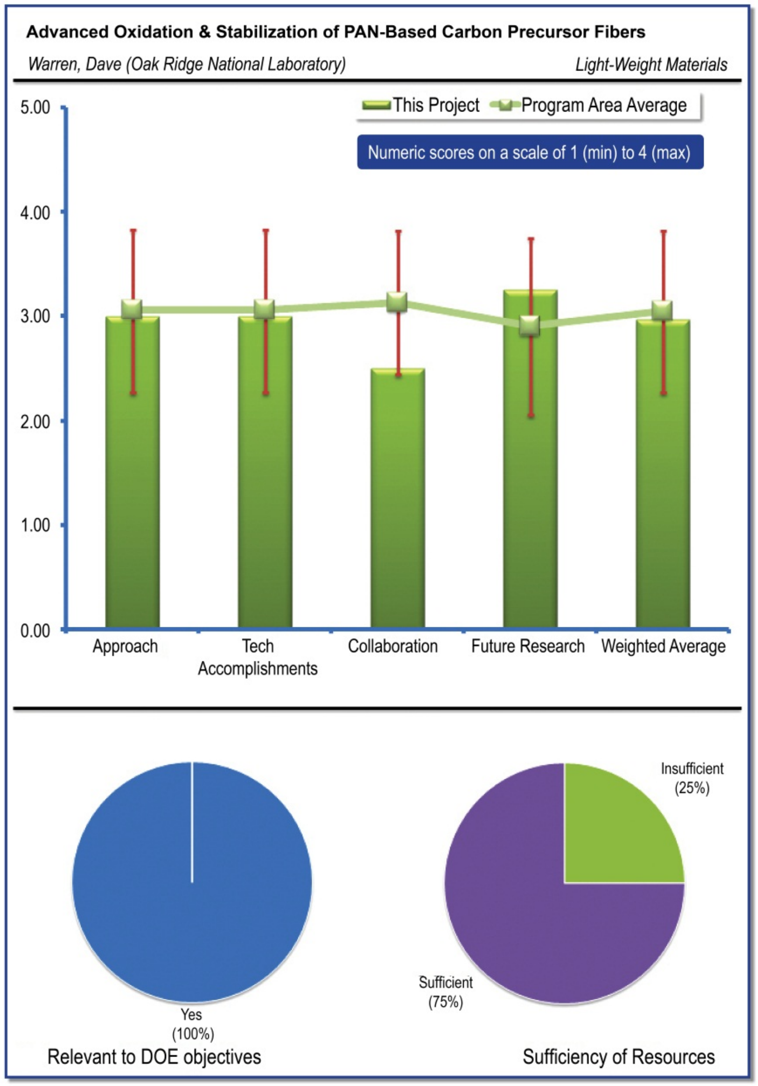
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Again, three of the reviewers offered comments on this topic. One was effusive, saying this project is good, bordering on outstanding. But, there may be too many precursors being studied. This reviewer urged the researchers to choose one or two, to narrow the scope and focus and deliver rather than dilute the R&D efforts. All are excellent projects, keep up the good work. The second reviewer generally concurred, deeming this a well-structured program and its proposed future work plan to be more than good. The last reviewer stated an impression that reviewers had been told that work in the CF Facility will start with a focus on textile-based precursor (e.g., FISIPE). It seemed more appropriate to focus on getting the "biggest bang" possible, which would come from the polyolefin precursor.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

All reviewers considered the project to have sufficient resources to achieve its milestones. One reviewer reiterated an earlier comment in part, urging the project team to focus and deliver with existing resources.

Advanced Oxidation & Stabilization of PAN-Based Carbon Precursor Fibers: Warren, Dave (Oak Ridge National Laboratory) – lm006



Reviewer Sample Size

This project had a total of four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

A single reviewer of the four offering comments was explicit concerning the project's relevance to DOE's petroleum conservation/greenhouse gas reduction goal. That reviewer said the project focuses on overcoming one of the key challenges for producing low-cost carbon fiber. The cost structure appears to be on target for low-cost carbon fiber. Without elaborating on his logic, the reviewer said the project is well aligned with the DOE petroleum displacement goal. Other reviewers' comments related entirely to carbon fiber cost reduction. For example, the second reviewer said reducing the cost of CF is important for the widespread use of the material for lightweighting purposes. This project is trying to reduce the time it takes to produce the final product. The third reviewer agreed, in somewhat greater detail, saying throughput is reflected in cost. Doubling to tripling rate of throughput of an 18% cost content is 10% increased throughput. The final comment was because it is part of making carbon fibers.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One of the four commenting reviewer approved the chemistry-based robust approach, saying it is delivering results for PAN oxidation. Basing the efforts on atmospheric pressure plasma also aligns with the overall goals for low-cost carbon fiber. Excellent efforts to troubleshoot the reactors to find the root cause of the shortfall in the performance of the fibers. The second reviewer said that the project employed a good technical approach to addressing the technical barriers. The final two reviewers offered some criticism of the work approach. One said it appeared to have been painfully discovered, which this reviewer took to be an indication that the model they are using is not at the level of the experimental capability. The last reviewer said the presentation illustrated the trials made to achieve the specification limits set in Phase I, but although those limits had not been achieved, the presentation claims Phase I is completed, something the reviewer said was not evident from the presentation or the discussion that followed it. The project is aimed at reducing the time it takes for oxidation of precursor, which was said to be diffusion-controlled, and thus possibly dependent on the thermal activation available during the process. If the new plasma process is not non-thermal, the reviewer asked, how is the diffusion increased to achieve lower time?

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The four reviewers generally agreed that the project had shown good progress. One said precisely that - good progress - the task/issue was resolved. Another, agreeing, said that in view of the carbonization difficulties, the accomplishment and the progress are outstanding. The third reviewer likewise was approving, commending the great effort to overcome the damage to the fibers. For the plasma-oxidized fibers, the issue is to determine the subtleties of how the mechanical properties are developed in the final carbon fiber. Determining the optimal process parameters for the conventional conversion shows diligent polymer engineering. The final reviewer noted that while the presentation claimed that the oxidation times are reduced, with good mechanical properties, nonetheless the minimum requirements of modulus, strength and strain have not yet been achieved.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

While one reviewer assessed good collaboration with commercial partner, another saw no partners listed. A third reviewer expressed the belief that this project would benefit from increased collaboration with other researchers and industry partners. Taking four to six months to solve a processing issue might lead to problems as the processes are scaled up. The final comment was not directed at project collaboration, per se. That reviewer said the researchers clearly need a better understanding of the processes relevant to this project, opining that they have to augment their modeling effort.

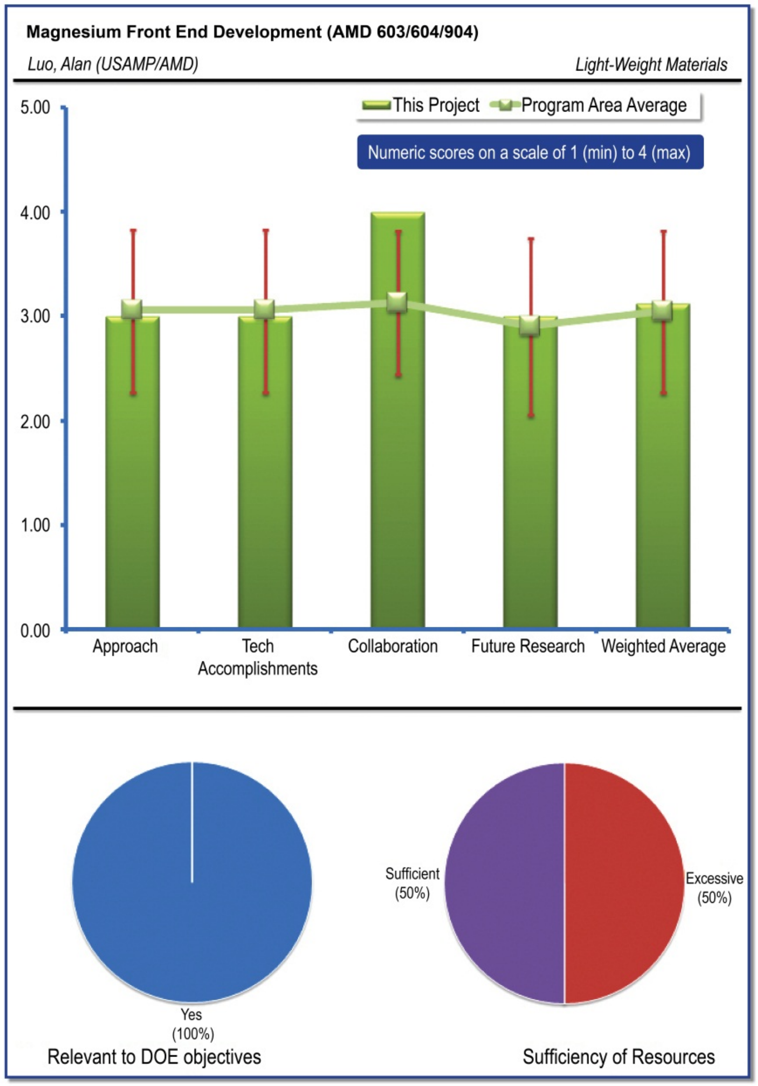
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Noting the expectation that Phase I will be completed, one reviewer saw no plan presented for achieving the minimum requirements. Terming the last results very promising, the second reviewer expressed confidence the ORNL team will be able to produce "industrial quality" fibers as well as the less expensive fibers needed by the car industry, but cautioned that scaling is not guaranteed. A third reviewer noted strong plans for future work. Efforts to scale up these processes will need more diligent chemistry investigations for the pilot line. The final reviewer’s comment was plan to implement in pilot production plant is SUCCESS.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

All but one of the four reviewers felt project resources to be sufficient; the dissenter termed them insufficient. At this lab-scale stage, one reviewer commented, the resources appear appropriate for the research. A second reviewer expressed the belief that the scale-up will require a lot more experimental and modeling work. The final comment regarded an inference drawn from the presentation, namely that additional chemistry resources were included in the plan. This reviewer recommended hiring lab personnel to shadow and adopting innovation style. This style, in the reviewer’s estimation, is not available in academia and can only be attained via shadow training.

Magnesium Front End Development (AMD 603/604/904): Luo, Alan (USAMP/AMD) – lm008



REVIEWER SAMPLE SIZE

This project had a total of two reviewers.

QUESTION 1: DOES THIS PROJECT SUPPORT THE OVERALL DOE OBJECTIVES? WHY OR WHY NOT?

Only two reviewers responded to this question, one briefly and the other at considerable length. The first reviewer said that the project does support DOE's overall objective in petroleum displacement because it lightens structures. The second reviewer listed and described the aims of three separate, but related, task areas which were reported in the Magnesium Front End Research and Development (MFERD) project, specifically AMD 603, 604, and 904. AMD 603 (finished in FY2009) focused on: (1) Mg application in primary load-path body structures for mass saving with equivalent performance; (2) design and engineering simulation of Mg body structures; and (3) technical cost modeling of lightweighting with Mg applications. AMD 604 (finished in FY2010) focused on: (4)improved high-volume manufacturing techniques for Mg casting, extrusion, and sheet forming; (5)improved high-volume manufacturing techniques for joining and corrosion protection of Mg structures; and (6) improved knowledge base in Mg crashworthiness, NVH (noise, vibration and harshness), fatigue and durability. AMD 902 (ongoing) is focused on: (7) demonstration of Mg casting, extrusion, sheet and joining techniques in automotive body structures; and (8) performance validation of Mg crashworthiness, NVH (noise, vibration and harshness), fatigue and durability. This reviewer's conclusion was that these targets are clearly relevant to the DOE objectives for the Vehicle Technologies Program

QUESTION 2: WHAT IS YOUR ASSESSMENT OF THE APPROACH TO PERFORMING THE WORK? TO WHAT DEGREE ARE TECHNICAL BARRIERS ADDRESSED? IS THE PROJECT WELL-DESIGNED, FEASIBLE, AND INTEGRATED WITH OTHER EFFORTS?

Again, two reviewers proffered comments, both in this case commenting at some length. One said this topic was addressed by an enumeration of the milestones to be achieved in each general task area and the combinations of partners assigned to the tasks. Though it would be a stretch to claim that the approach was strikingly novel (and the PI made no such claim), it is clear that the size and scale of this DOE project, the national and international scope of the efforts, and the number of players at work at any given time are all very comfortably within the "normal operating procedures" of GM. The second reviewer felt the work appeared to be good but expressed sharp frustration because the only metric provided was weight reduction. This reviewer wanted to see the technical specifications of the new front end parts versus those of a "standard" front end. After all, such an exercise only works when yield strengths and elongation are optimized for the proposed use.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

In keeping with the trend established so far in the review of this project, two reviewers commented. The first commented that, in summary, the following items were reported for the period under review: (1) Demo Design: generated six concepts and selected one final design for demo simulation, build and testing; (2) Crashworthiness: exercised and validated "best" material model in LS-DYNA for super-vacuum die casting (SVDC) AM60 alloy, and crash testing and simulation of Mg castings; (3) Noise, Vibration and Harshness (NVH): provided Viper dash panel parts (Mg die casting) to China and Canada for NVH analysis; verified acoustic performance (noise reduction) of Dodge Viper dash (bare and with current sound package); (4) Fatigue and Durability: completed round-robin fatigue testing Mg AZ31 friction stir spot welds of four labs in U.S., Canada and China; (5) Corrosion and Surface Finishing: established the model corrosion protection system for "demo" build and testing; completed OEM assessment and developed joint recommendation for cyclic corrosion testing of structural features, and corrosion test results of various fastener coatings; (6) Low-Cost Extrusion and Forming: identified a new high-ductility alloy: ZE20 (Mg-2%Zn-0.2%Ce) developed by GM; improved ductility (125% improvement) in ZE20 alloy; (7) Low-Cost Sheet and Forming: evaluated the formability of various Mg sheet materials produced by direct-chill (DC) cast and CC processes for demo build. (8) High-Integrity Body Casting: identified a high-strength, heat treatable magnesium alloy: NZ30 (Mg-2.5%Nd-0.5%Zn) developed in China; and (8) Welding and Joining: lap shear test results of Mg joints, selected the joining techniques (friction-stir welding, self-pierce riveting with and without adhesive) for demo build and testing; and completed the static testing of typical Mg joints. Having enumerated these eight items that had been reported, the reviewer proffered a one word summary: Excellent! The second reviewer felt the presentation provided insufficient information to permit a judgment, elaborating than an assessment would only be more positive when the reviewer had the necessary data to properly estimate such a work.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Repeating the response to the second question, one of the two reviewers deemed the collaborators in this project an impressive cast of players. The project is coherently defined and the (many) partners are very well co-ordinated. The second reviewer concurred, saying collaboration was extensive and appeared to be very good.

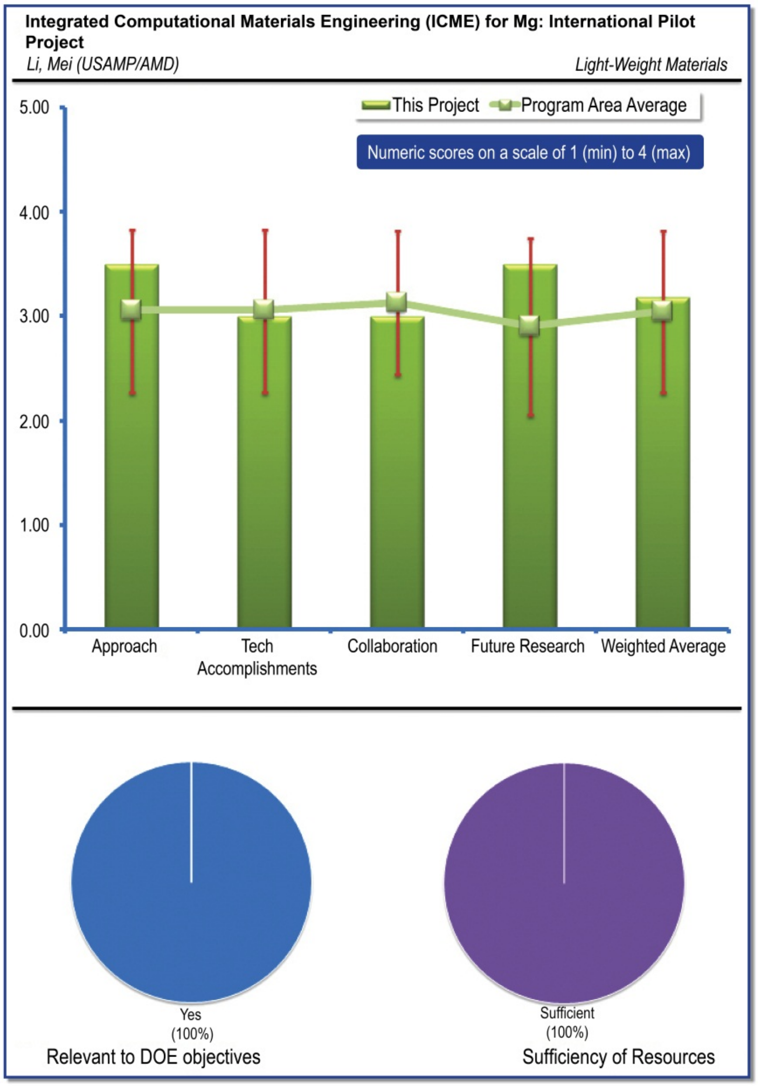
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer described proposed future work in detail, as follows: MFERD Phase II (AMD904): (1) the "shock tower" demo final design, analyses and tested has been awarded to a general contractor; (2) the component manufacturing for the "demo" structure is scheduled for completion in 2011 Q2; (3) the final assembly and testing is scheduled for completion in 2011 Q3; and (4) project completion and reporting is scheduled for completion in 2011 Q3. This reviewer concluded that these plans had been cogently presented and are on target. The reviewer strongly urged DOE to direct special attention – and emphasis – to point (4), since in the final analysis it is the knowledge created by this effort (both scientific and technical/operational) that is likely to be the most valuable outcome. The second reviewer said if the project team continues to work while hiding the dominant factors, this reviewer did not see the point. Everybody, the reviewer charged, is learning something in his/her corner. The reviewer expressed the hope that the community is getting something out of it, but the real progress will only come with a strong and completely open program.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

The two reviewers disagreed on the adequacy of project resources, one viewing them as sufficient, the other as excessive. The first said well handled - no problematic issues noted. The second said that, in view of the specifications presented, it is how it appeared to this reviewer.

Integrated Computational Materials Engineering (ICME) for Mg: International Pilot Project: Li, Mei (USAMP/AMD) – lm012



Reviewer Sample Size

This project had a total of two reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The two reviewers were in general agreement on this aspect of the project evaluation. One commented simply that since Mg is a light material, then it automatically qualifies with DOE objectives. The second commented at extended length, saying that the Integrated Computational Materials Engineering (ICME) for Mg: International Pilot Project describes its relevance as follows: Application of Mg alloys in body applications may result in up to 45% mass savings. The development and utilization of ICME tools will enable an early assessment and optimization of the primary performance characteristics to ensure that key performance metrics are met. Development and utilization of ICME tools will enable optimization of manufacturing processes and design to reduce costs of Mg components. Current Mg alloys have limitations for use in some body applications. ICME tools will enable cost effective development of new alloys to meet cost/performance requirements. In summary, this reviewer found this to be a plausible case.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer described the specific goals of this project as follows: (1) establish, demonstrate and utilize an ICME knowledge infrastructure for magnesium in body applications for microstructural engineering, process and product optimization, and future alloy development; (2) attract materials researchers into Mg field and leverage their efforts by providing a collaboration space for coupling high quality data and models; and (3) identify and fill technical gaps in fundamental knowledge base. This reviewer then went on to list the aims of the proposed future work, the milestones and the dates by which they were to be met: In support of these goals, the project has defined the following milestones: (1) by March 2009: demonstrate a cyber-infrastructure data to enable integration and collaboration; (2) by March 2010: demonstrate substantial progress in all task areas and demonstrate integration with manufacturing simulation; (3) by September 2011: demonstrate ability of ICME tools to link manufacturing and predict performance of MFERD demonstration structure and validate the results by Dec 2012.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

From the accounts given during the review, one reviewer said, it is apparent that the team is making strong technical progress. For example: With respect to the calculated phase equilibria and diffusion task, the project established an extensible and self-optimizing infrastructure and demonstrated a graphical user interface (GUI) for automation of thermodynamic modeling for selected binaries (Al-Mg, Mg-Ni, Mg-Zn) and ternary (Mg-Al-Zn). In the ICME for Mg Sheet task the project reported that it completed warm sheet stamping FEM simulations (with and without adiabatic heating) and developed the capability of simulating sheet stamping in new version of PamStamp2G with material model in numerical format, and also that they developed solute strengthening map of Mg from first principles. The second reviewer felt that such an exercise will only be good if it's compared with HSS (High-Strength Steel), AHSS (Advanced High-Strength Steel), and Twinning-Induced Plasticity (TWIP) steels.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The sole reviewer comment on project collaboration and coordination was positive, the reviewer saying that USAMP has assembled a good technical team, including Ford and GM, five universities, two national labs, and four technology providers. From the technical progress reported, the reviewer concluded, it is clear that this group is well-designed to handle the goals of this project.

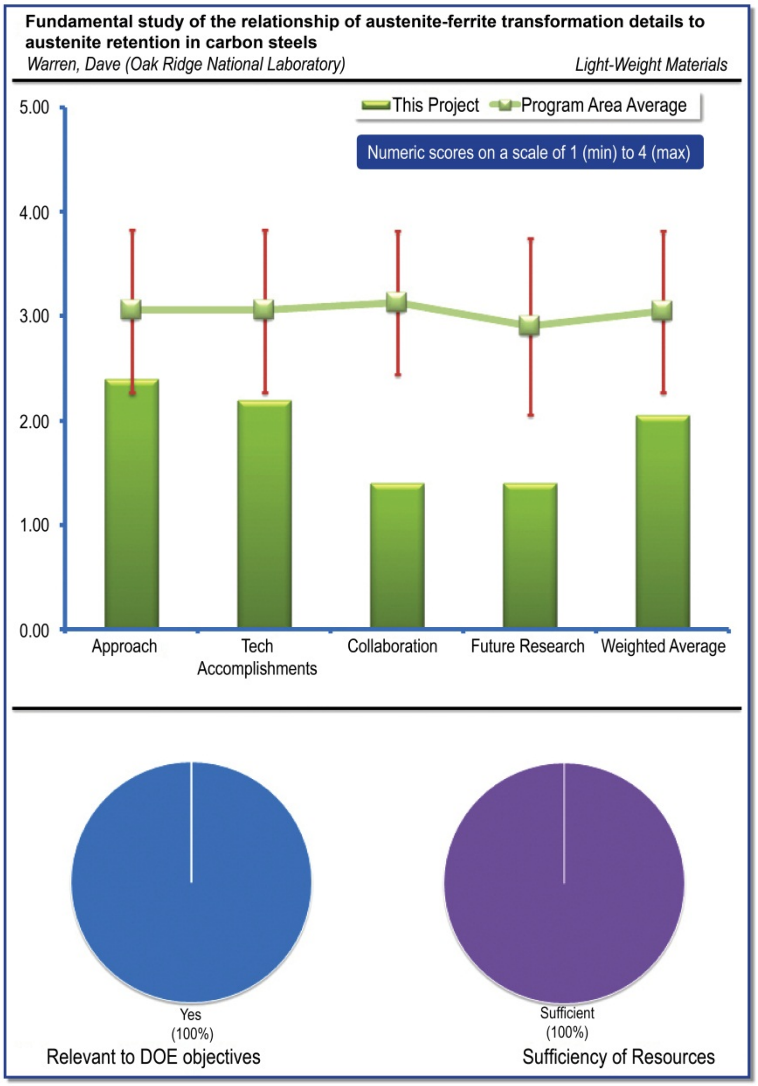
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer offered a summary, and then provided feedback on this project’s future work . In general, the project plans to work with MFERD CAE demo team to implement the local properties (zone method, no anisotropy capability for CAE analysis) and develop user-subroutine to implement the ICME predictions on element level (MSU). Casting Team: process to properties models (yield strength and fatigue strength); casting process simulation (Ford and Tsinghua University); casting microstructure models (Tsinghua University); link MicroModel with Solution Treatment Mode (Ford); aging Model (Ford and University of Michigan); yield strength model (Ford, UofM and Tsinghua University)Fatigue strength model (UofM). Extrusion Team: process to properties to FEA model (post-forming yield strength, fatigue and stress-strain curves); extrusion process simulation (MSU); texture prediction using VPSC model in Hyper-extrude (MSU); develop the stress-strain relationship and yield strength (MSU); and post-forming fatigue strength model (MSU). Sheet Team: processing to properties to FEA model (localization, post-forming stress-train curves); stamping (bending) process simulation (MSU); texture prediction using VPSC model (MSU); develop the stress-strain relationship for AZ31(MSU and CANMET); and post-forming fatigue strength model (MSU). This reviewer commented that a 2008 report of the National Research Council (NRC) has identified ICME as a critically important area for research. They emphasize the potential impact of this technology on the Department of Defense materials deployment, but the civilian applications, such as those being conducted in this project and in others in the DOE Vehicle Technologies Program, are also highly significant. However, adoption of new materials in the vehicle manufacturing sector is a long and complicated process for a variety of reasons. It seems ICME technology, once it is more widely distributed and trusted by working engineers, could well be a key step toward accelerating the new material adoption process. In this reviewer’s opinion, it is very important for both the ICME project participants and the DOE to use the moment to identify new materials rollout strategies. The second reviewer offered the assessment that it is good but comparisons should be a lot more developed.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Both reviewers deemed project resources to be sufficient.

Fundamental Study of the Relationship of Austenite-Ferrite Transformation Details to Austenite Retention in Carbon Steels: Warren, Dave (Oak Ridge National Laboratory) – lm017



Reviewer Sample Size

This project had a total of five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Five reviewers weighed in on this project; only one pronounced it directly relevant to the DOE goal of petroleum conservation. That reviewer said projects that support the development of Gen-III steels directly support the lightweight goals for DOE and petroleum displacement. The second said that the objectives of the project are as follows: (1) real-time characterization of austenite-ferrite transformation behavior during T/t conditions representative of processing advanced high-strength steel (AHSS); and (2) determine conditions that promote retained austenite. The proposers indicate that these goals will contribute to building the scientific foundation needed for the development of 3rd generation AHSS. The reviewer continued that the intent is to deliver: quantitative description of austenite-ferrite transformation behavior during simulated finishing operations, including the effects of carbon, manganese, and silicon; a quantitative description of alloying element partitioning between austenite and ferrite, and an assessment of how retained austenite can be maximized within constraints of normal sheet processing infrastructure. The project milestones are described as follows: (1) experimental and data analysis procedures are re-examined to determine possible sources of errors, and an approach for minimizing the effects of surface reactions will be established (finished October 2010); and (2) experimental alloys will be formulated and analyzed for the possibility of increasing retained austenite over commercial steel grades which generally contain around 10% (ongoing). This reviewer remarked that it was unclear how this project fit within the Vehicle Technology lightweighting initiative, but speculated that if less AHSS were required for an equally strong body build, then, this project could be regarded as relevant. Two reviewers deemed the project relevant to a much narrower goal, one saying the project objective of real-time characterization of austenite-ferrite transformation behavior is relevant to the development of Gen III AHSS, but not explicitly linking that either to lightweighting or to petroleum conservation and the other considering that the project supports the quest for Gen III steels. The final reviewer called the project applicable, but characterized the research as unsuccessful.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer reiterated the technical work approach conducted at the Advanced Photon Source, but offered no estimation of the value or appropriateness of that work. Another reviewer characterized the approach as exploratory. A third reviewer summarized that high-speed diffraction experiments were conducted at the Advanced Photon Source and the austenite-ferrite phase transformation behavior was characterized in situ under rapid heating/cooling conditions. Specimens are heated by resistance in vacuum, thermocouple feedback is used for temperature control, and specimen grip is spring-loaded to maintain positioning. The APS synchrotron permits diffraction patterns at ~ 1 s intervals and calibrated Debye arcs are converted into plots of intensity versus d-spacing. Direct comparison method is used to determine phase fractions. There is a desire to get to the stated deliverables, but this reviewer did not feel there is a clear vision of how to achieve them: quantitative description of austenite-ferrite transformation behavior during simulated finishing operation; quantitative description of alloying element partitioning between austenite and ferrite; assessment of how retained austenite can be maximized within constraints of normal sheet processing infrastructure. Overall this reviewer approved of the approach, calling it good approach, but pointed out that not all the research had been successful. The fourth reviewer felt there was no clear vision of how to get to the stated deliverables, namely a quantitative description of austenite-ferrite transformation behavior during simulated finishing operation; a quantitative description of alloying element partitioning between austenite and ferrite, and an assessment of how retained austenite can be maximized within constraints of normal sheet processing infrastructure. The final reviewer offered comments in a similar vein, saying the approach seemed simplistic given the duration of the project to date. The approach and potential processes should have been much further developed. The obvious approaches of alloying and processing/heat treatment should have been more developed to explicitly describe how steels can be produced in the region of the strength- elongation plot. From the presentation, this reviewer was unclear on how the x-ray diffraction work produces information on the alloying and processing.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer concluded that the reported results indicated negative conclusions, but reiterated that the approach had been exploratory in the first place. The second reviewer, however, called the x-ray diffraction data a good start to characterizing the processing. However, since the project is over 65% complete, there should be more information on the results of the strength and elongation of the prototype systems. The drifting of ferrite volume fraction was shown but not explained against the equilibrium value. There are few clear deliverables that are leading to the stated goal of Gen-III steel developments. The third and fourth reviewers were in general agreement; one said there appeared to have been significant work done, but little substantial progress made, and the other commenting not successful. The final reviewer summarized that high-speed diffraction experiments were conducted at the Advanced Photon Source and the austenite-ferrite phase transformation behavior was characterized in situ under rapid heating/cooling conditions. Specimens are heated by resistance in vacuum, thermocouple feedback is used for temperature control, and specimen grip is spring-loaded to maintain positioning. The APS synchrotron permits diffraction patterns at aproximately 1 s intervals and calibrated Debye arcs are converted into plots of intensity versus d-spacing. The direct comparison method is used to determine phase fractions.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The four reviewers were generally agreed that inter-institutional collaboration in this project was in need of improvement. One reviewer called for collaboration with steel companies and universities. Summaries at AS/P workshops, in this reviewer's opinion, are not sufficient collaboration. A second reviewer could discern no collaboration partners in the project. In the view of a third, the only information on this point is that the experimental techniques need to be improved before collaborations are established. The last of the four reviewers said that although the work was supposedly "summarized at AS/P-organized workshops for projects funded through NSF (National Science Foundation) to develop third-generation steels," there was no indication the work was in any way tied to the other Gen III efforts or was supported /endorsed by the researchers doing the other research.

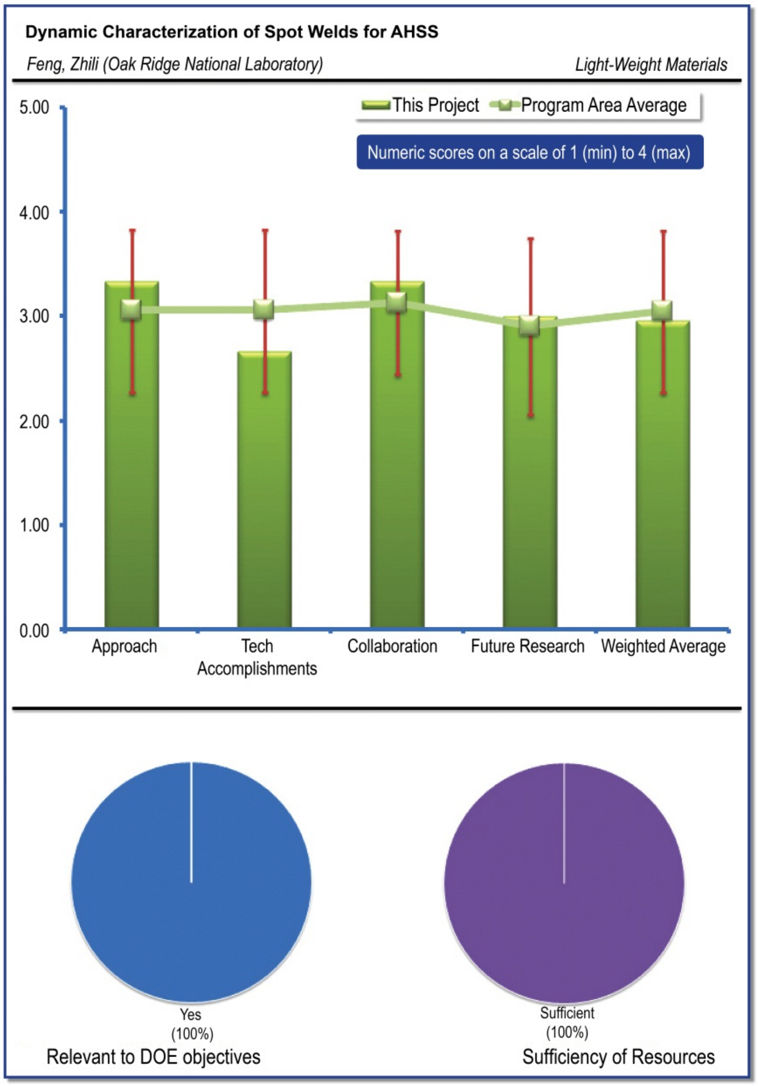
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviewer opinion was virtually unanimous on this question. Most reviewers felt proposed future work was ill-defined and lacking specificity. The first commented that conventional diffraction facilities at the APS/synchrotron do not appear suitable for characterizing ferrite-austenite transformation behavior. Other facilities such as for transmission diffraction may be more appropriate. Use of neutron diffraction is also being considered. The second reviewer's assessment was similar. The project's plans are too general and lack specificity, e.g., they only indicate generalities such as "experimental techniques need to be improved" and "Other facilities such as for transmission diffraction may be more appropriate." The third reviewer was unsure that careful consideration had been given to the potential techniques being proposed. The fourth reviewer's comment was that the proposed future work did not give specifics on the alloying systems and processing steps to achieve the Gen-III steels. The x-ray investigations are interesting to investigate the phases, but how the investigations are tied to achieving the results was not clear from this presentation. The final reviewer concluded that there was no future research proposed.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

The five reviewers were unanimous in declaring project resources to be sufficient. In the view of one reviewer, the amount of work done seemed proportionate to the funding available. However, it was not clear to that reviewer that either the funding or the level of effort was sufficient to accomplish the stated goals of the project. The opinion of a second reviewer was that the research effort was sized for the investigation.

Dynamic Characterization of Spot Welds for AHSS: Feng, Zhili (Oak Ridge National Laboratory) – lm025



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All three reviewers characterized the aims of this project as important, but none made explicit reference to the petroleum conservation and greenhouse gas reduction goal of the Department of Energy. One reviewer said understanding and resolving AHSS joining issues is a very important effort in reducing the weight of vehicles by promoting the use of AHSS. Developing weld models for automotive crash simulation is important for vehicle lightweighting using AHSS, according to a second reviewer. And in the view of the third, advanced high strength steels (AHSS) are one of the essential materials for the weight reduction of vehicles. Before any material is used in vehicle structures it is necessary to understand the performance of the structure. This project is developing the models for predicting the bond strength and performance in AHSS.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Two reviewers addressed themselves to this question, the first saying the approach to establish weld models based on testing results is excellent. The second endorsed the approach, observing that the project was attempting to validate models to predict the weld strength and performance by testing various steels and joining variables. The project, in this reviewer's estimation, covers many of the important factors.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

A single reviewer commented, recommending that models be provided to automotive CAE communities for trial use and feedback.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

To this question, also, only one reviewer provided comment, saying that ASP and OEM partners are involved; the models are evaluated for real use by the OEM users who have access to the models right through the development process.

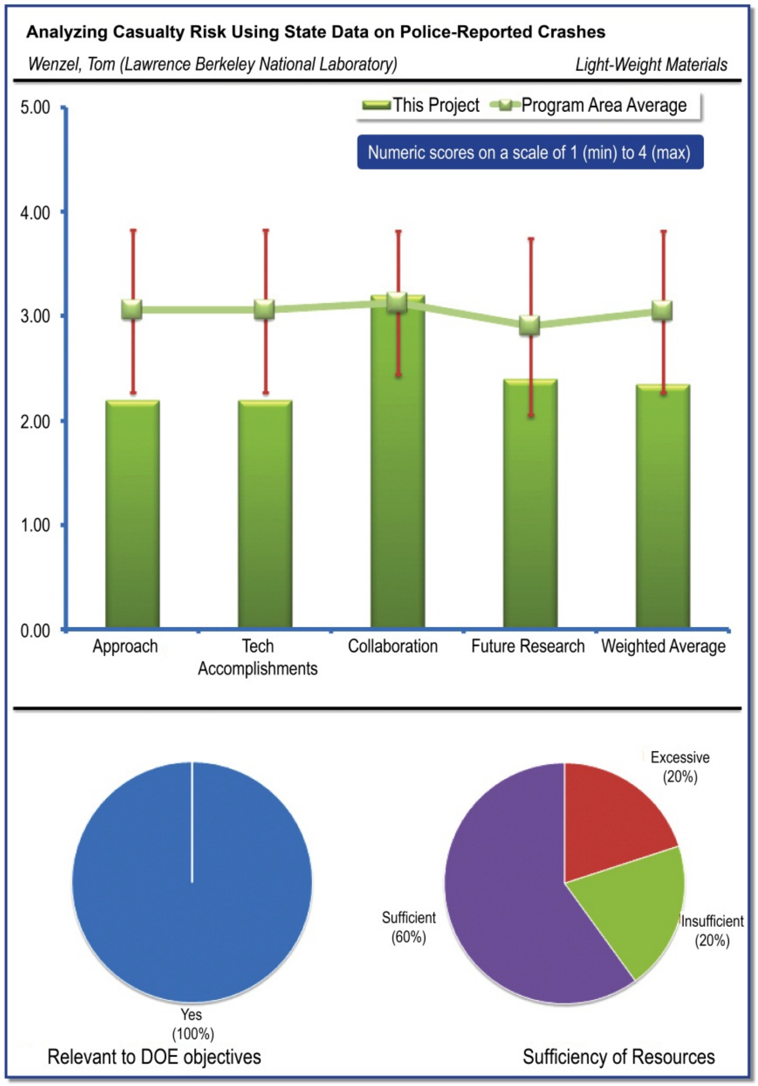
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The sole comment provided was an exhortation to keep going.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

No reveiwers provided any further comment.

Analyzing Casualty Risk Using State Data on Police-Reported Crashes: Wenzel, Tom (Lawrence Berkeley National Laboratory) – lm026



Reviewer Sample Size

This project had a total of five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

In general, reviewers approved of this project, although of the five who commented, only one directly addressed its relevance to petroleum conservation/greenhouse gas reduction. One termed it a proper data gathering exercise, adding that analysis of data can be very beneficial in educating consumers and guiding vehicle manufacturers. A second termed it simply an important area. The third commented at greater length, opining that the policy of lightweighting should be applied with due consideration of passenger safety. This study, he continued, is aimed at developing a model to predict the effect of lightweighting on the likelihood of fatalities occurring in crashes. Although the data are incomplete, this can shed light on the impacts. The fourth reviewer considered the project objectives well founded. The final reviewer identified the difficulty of determining the project's relevance to the broader DOE goals. It was difficult to choose a yes or no answer to the question of that relevance. The reviewer felt sure that looking at how vehicle weight affects project future fatalities and Abbreviated Injury Severity score of severe-to-fatal (AISP4+) injuries is a critical factor to be addressed in CO_2 rulemaking and averred his full support for this work. The reviewer regarded the funding as small compared to projects targeted at overcoming the challenges facing vehicle lightweighting and viewed it as money well spent. Nonetheless, the reviewer found this an almost impossible question to answer. The project will be an important portion of a national dialogue on societal needs for reducing CO_2 reduction as well as fatalities and serious injuries.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Three of four reviewer expressed reservations concerning the approach to this work. One reviewer doubted that the approach to data analysis would lead to any compelling conclusion. The second reviewer pointed out that the data do not take into consideration factors such as number of passengers, operator experience and other causes of crashes. Crashes involving DUI (Driving Under the Influence) are excluded, and other factors such as seat belt use are not considered, resulting in conclusions being skewed against some categories. The data presented in the annex indicate that compact and sub-compact cars are involved in more accidents, which is not explained fully. If more holistic data analysis is not undertaken, this study could be used against lightweighting. The third reviewer found it apparent that analysis of the data will result in inconclusive and statistically insignificant conclusions. Potentially, cooperative states/regions could collect specific data over a multi-year time period. Basically, this reviewer's recommendation was to stop and start over. However, not all reviewers agreed in their assessments of the work approach. The fourth reviewer deemed this solid work on good statistical grounds. It is important, in this reviewer's estimation to detail the assumptions and clearly state the challenges, using historical data to predict future fatalities and injuries. The potential paradigm shift when moving to a different architecture is difficult. The reviewer urged the project team to clearly state the difficulties in making predictions.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

All reviewers agreed that project accomplishments had been meager and/or difficult to evaluate. One reviewer said that not many actual results were presented. A second reviewer was more emphatic: None, this reviewer said, no accomplishment is apparent. Hard to judge the approach and results. A third reviewer described the study as the analysis of information available on the number of fatalities and crashes from 13 states. Even though this reviewer deemed the analysis commendable, the reviewer called for more detailed. The fourth reviewer felt the project team's conclusion so far does not shed light on the effect of lightweighting a given line of vehicles. The final reviewer offered detailed suggestions for modifying the work approach, suggesting the inclusion of "rifle shots" of vehicle performance to see if there is sufficient data to separate NCAP 5-star from 4-star from 3-star vehicles in the crash mode. This reviewer also urged that the total numbers of annual fatalities and serious injuries in the researchers' regressions be compared to the total across the country. An important variable is whether the occupant was wearing a seat belt. Most states supply this data. Since over 60% of fatalities are occupants not wearing seat belts, it was not clear to this reviewer that vehicle weight effect can be separated from seat belt use. The reviewer urged clarity in future reports as to what data is included and what is excluded from the regressions.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Reviewer opinion was mixed on this aspect of the project. Of the three offering comments, two reviewers commended collaboration, one noting good interaction among the government agencies (EPA, NHTSA, etc.) but calling for more consultations with industry associations and other user groups. The second concurred, noting good work with NHTSA and with individual states as necessary. The third observed that the project involved many agencies and data sources, terming this a significant component of the problem.

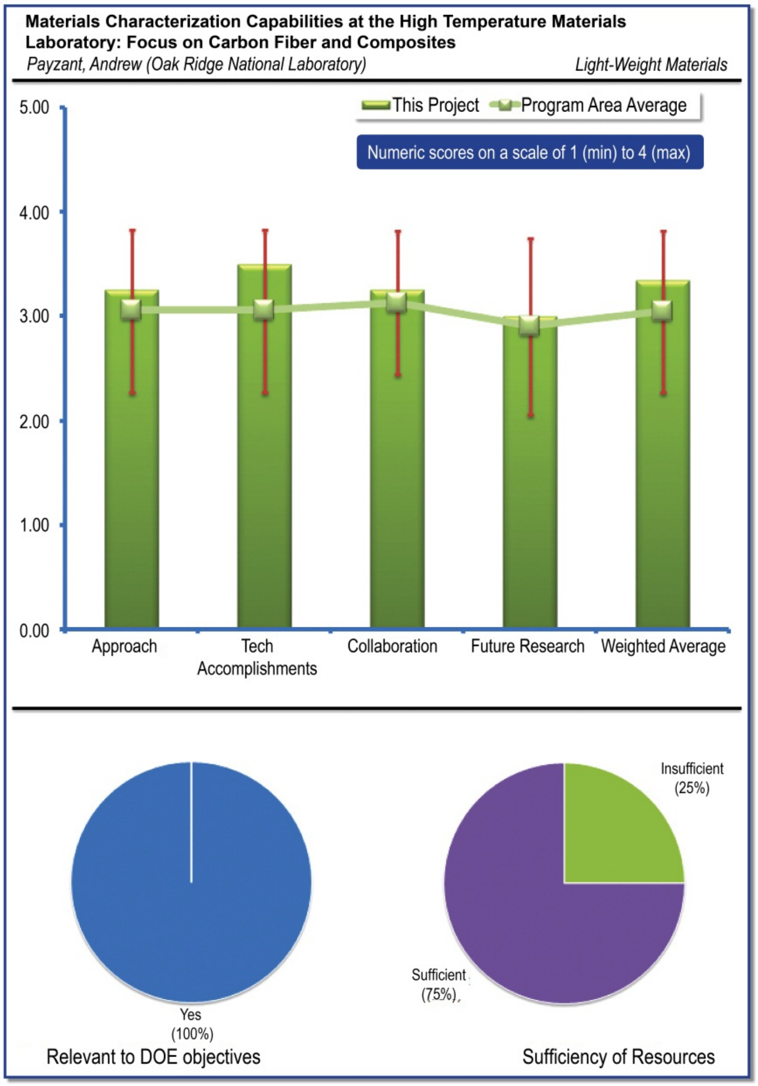
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Again, assessments of the three commenting reviewers were mixed. The first reviewer's comment was "clear on future potential work." Two expressed disappointment with the proposed future work. One reviewer did not see any plans to get to a convincing conclusion one way or another, and the other offering the comment no vision.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer commented that resources are deemed good at this point. However, this reviewer felt there could be much more effort here and suggested detailed "case studies" that might generate much more important data. Another option to address is the engineering evaluation of reduced weight vehicle through analytical models. The second reviewer recommended that all funding be stopped.

Materials Characterization Capabilities at the High-Temperature Materials Laboratory: Focus on Carbon Fiber and Composites: Payzant, Andrew (Oak Ridge National Laboratory) – lm027



Reviewer Sample Size

This project had a total of four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Three deemed the project to be supportive of the primary DOE goal. One said the project's support of the goal was indirect but that the work is required to reduce development time and achieve results using a scientific approach. A second commenter responding affirmatively said testing of carbon fibers is necessary and therefore it fits very well with the DOE objectives of petroleum displacement. The third reviewer commended a good effort on characterizing materials to support the overall DOE goals. The reviewer also praised great collaboration with other ORNL carbon fiber project teams to support the greater goals. The fourth reviewer said that characterization of materials to understand their performance is important. Understanding the relation between the structure and performance allows the materials to be used effectively in lightweighting applications.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Two reviewers expressed enthusiastic approval of the work approach employed in this project. One called it outstanding, an excellent approach to characterizing the fiber oxidation process. Multiple scale analysis/characterization tools and expert scientist produced very positive results. Consideration of incorporating into production process as quality assurance tool is very forward thinking. This concept should be applauded and replicated in DOE methodology. The second reviewer cited a good technical approach for investigating the material properties in-situ. X-ray diffraction is an excellent probe choice. Ability to use multiple and diverse tools gives the HTML (High-Temperature Materials Laboratory) a unique capability along with Raman, XPS (X-ray Photoelectron Spectroscopy), et al. The third reviewer's comment partially seconded that view; the HTML's capabilities enable ORNL to better characterize those carbon fibers, the reviewer said, which bodes well for the future. The reviewer urged improved back-and-forth between the making and the testing of these fibers. The fourth reviewer observed that characterization of materials using various analysis techniques was presented. No problem solving is involved, and the approach is direct.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Of the four reviewers commenting on this aspect of the project, two advanced positive or strongly positive assessments. One called the project outstanding – a new method of oxidation resulted from collaboration with process scientist. The other cited great results to help ORNL carbon fiber team by looking at carbon/graphite formulation under process conditions and under load. The ability to investigate the graphite orientation gives great insight to the formulation process. The third reviewer said it is good but it could be more extensive. Moreover, SAXS (Small-Angle X-ray Scattering) and better Small-Angle Neutron Scattering (SANS) would be more appropriate. Carbon is better "seen" with neutrons than with x-rays. Moreover, ORNL has one of the best SANS instruments in the world, this reviewer said, adding his hope that that facility would be better used for this project. The fourth reviewer noted that the work had revealed internal structure of carbon fibers as it is changed by various processing steps. The team had designed a set-up to study this evolution in-situ.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Only two reviewers commented on this question. One cited great collaboration with the ORNL carbon fiber team and noted good responsiveness to the needs of the carbon fiber processing team. The other expressed the hope that project collaboration would improve with time, but felt that, to date, it was not at the level of that demonstrated by the carbon fiber production team at ORNL.

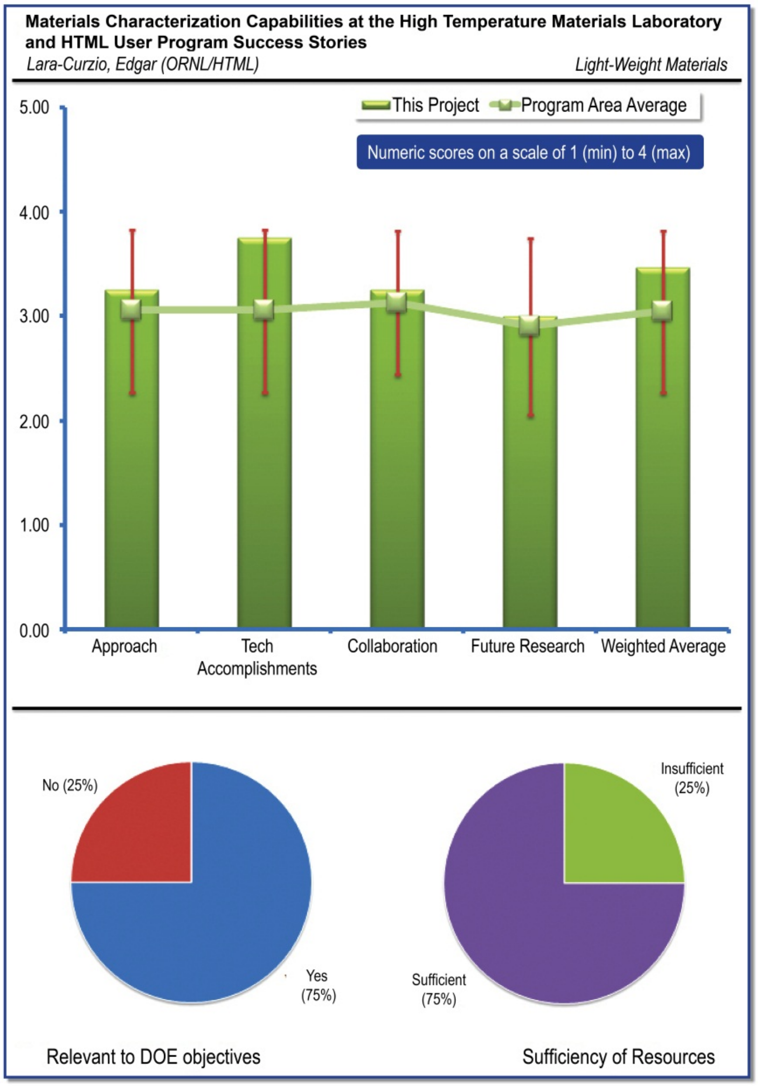
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

As to proposed future research, three reviewers offered opinions. One called that work very promising. Very good and a necessary addition to the carbon fiber project. The second noted that the projects are transient in nature and completed as they come in queue. The requirement for future cannot be anticipated. The third noted that the project researchers have year-over-year commitment to continue support for materials investigations.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer termed them insufficient; two commented that the resources are sufficient. The former reviewer felt the project needs a 15 to 25% increase to keep facilities current and at the state of the art. Resources to continue carbon fiber support will need to grow as the overall CF efforts increase. DOE should invest in FY12, FY13 to have the support infrastructure in place to address as-yet unforeseen issues with the carbon fiber production facility. One of the latter reviewers felt the presentation provided insufficient detail permit a clear assessment of the adequacy of resources.

Materials Characterization Capabilities at the High Temperature Materials Laboratory and HTML User Program Success Stories: Lara-Curzio, Edgar (Oak Ridge National Laboratory/High Temperature Materials Laboratory) – lm028



Reviewer Sample Size

This project had a total of four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Two of four responding reviewers answered this question in the affirmative. One said that through use of its unique expertise and instrumentation, HTML is able to characterize the properties and performance of virtually any material that can be used to reduce the weight of vehicles, thereby increasing their efficiency and decreasing the amount of fuel needed to propel them. The resources are similarly used for propulsion materials, energy storage and thermoelectric conversion, to increase the energy efficiency of transportation. The other agreed, remarking that the efforts of HTML support the DOE goals for lightweight materials for vehicles and therefore the overall goal for petroleum displacement. The third reviewer concurred with a remark made by the presenter that the concentration of the HTML's capabilities and expertise in one location make the HTML User Program a unique national asset. This reviewer offered the following description of the HTML and its work: The HTML is a DOE-Designated National User Facility. The Vehicle Technologies Program funds the operation of the HTML User Program to maintain world-class expertise and instrumentation capabilities for materials characterization to work with industry, universities and national laboratories to address critical technical barriers to achieving the goals of the VT Program. The HTML User Program capabilities are also being utilized to support Vehicle Technologies Program projects at ORNL in the program's technology areas of Lightweight Materials, Propulsion Materials, Energy Storage, Power Electronics & Electric Motors, Emission Controls and Solid State Energy Conversion. The fourth reviewer was unable to discern the relationship of diffusion rate to vehicle lightweighting.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Two reviewers commented favorably on the work approach employed in this project. One said all the examples cited appear to have been well formatted, executed and managed. The other advanced the opinion that keeping the equipment and researchers at the state of the art is critical to continuing to advance the efforts to use lightweight materials in automotive vehicles. The third considered the work to be basic research which seemed to be general data base and knowledge development without specific focus on resolving barriers. The fourth reviewer's comment was a description of the approach HTML users employ in seeking use of the HTML facilities. This reviewer delineated that process as follows: A user agreement (proprietary or non-proprietary) is required prior to starting a user project. Access to the HTML User Program is provided through a formal proposal process. Proposals are reviewed by an internal review committee and evaluated based on technical merit, relevance of the proposed research to the mission of the Vehicle

Technologies program, non-competition with the private sector, organizations based in the U.S. The research is completed within 24 months, and it involves one or more user visits to the HTML.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer found the example accomplishments from the user projects impressive. It is critical to industry to have these investigative tools and researchers available to characterize materials and surfaces. The second reviewer said the presentation included an extensive list of small (mean size about $60K) projects selected according to the criteria set out above and which from all indications were then effectively monitored and conducted. According to the third reviewer, the accomplishments were substantial in a wide array of materials. The last reviewer agreed that capability had been demonstrated but that potential applications need be identified. For example, enhanced corrosion resistance or improved anisotropy need be in the vision

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Two reviewers offered positive assessments of the collaboration exhibited in the projects described in the presentation. One cited extensive collaboration with industry (18 companies), universities (25), and National Labs (6). Another cited great efforts and examples of collaboration. The HTML's open and proprietary projects represent excellent examples of university and industry collaborations, this reviewer concluded. Agreeing with the first reviewer, the third reiterated the examples of collaboration during FY2010 with 18 companies, 25 universities, and 6 national laboratories and expanded on them, citing 68 user projects addressing critical technical barriers to achieving the goals of DOE's Vehicle Technologies Program. Some 96 researchers, 63% of them first-time users, visited the HTML for a total of 716 research days. The HTML also supports the education and preparation of the next generation of scientists and engineers. During FY2010, students and professors from 25 universities participated in the HTML User Program. Five of those students earned their Ph.D. degrees and one earned her M.S. degree based in part on research they conducted through the HTML User Program. Users cost-share projects through direct involvement with HTML staff members during the development of the user project; funding their time and travel to the HTML; costs of materials provided by the user and the research performed prior to the user project; subsequent collaboration with HTML staff and members to analyze and publish the results. The final reviewer termed the presentation an academic exercise.

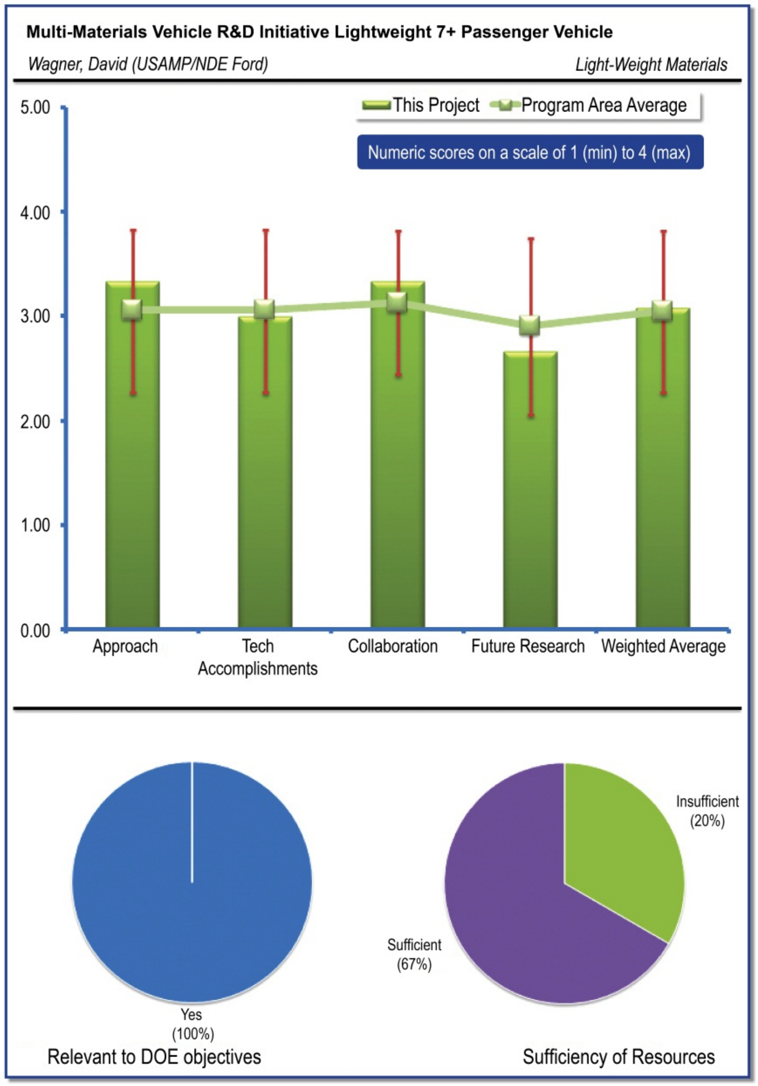
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

According to the first reviewer, marketing efforts will continue to be focused on developing collaborations with Vehicle Technologies Program stakeholders and other sponsors to address the proposed budget reduction in FY12. The HTML User Program will continue its collaborations with industry, universities, and national laboratories to address critical barriers to achieving the goals of DOE and EERE. The development of special tools to enable the *in situ* characterization of materials and processes will continue. These include high-speed extensometry to measure deformation of materials and structures at high strain rates, and hot stages and environmental cells to monitor the evolution of microstructures in physical processes, in real time, with atomic resolution, at elevated temperatures and controlled environments, using electrons, X-rays and neutrons for imaging and diffraction. This reviewer commented that the HTML effort seems to be a well-conceived and very clever way to reduce the administrative "overhead" associated with handling a large number of small, very narrowly defined, short-duration projects. While no direct financial discussion was provided in the review, back-of-the-envelope arithmetic suggests HTML is an effective organization with substantial community support. This reviewer was surprised to learn that a FY12 reduction (of some unspecified amount) is being considered and unclear why this was being contemplated. A second reviewer found difficult to assess the future plans for the user facility due to the uncertainty as to what new work will be proposed. This reviewer endorsed the continued development of the specialty tools to enable the *in situ* characterization of materials and processes, such as the ability to measure deformation of materials and structures at high strain rates, etc. Concurring in part with both of the previous comments, the third reviewer observed that future work strongly depends on the needs of industry. This reviewer encouraged further development of future plans for equipment and capital improvements. The fourth reviewer did not feel that a clear direction in future work had been identified beyond database development.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer deemed resources to be insufficient, and three reviewers considered resources sufficient. The former reasoned that as the automotive industry continues to move to more lightweight materials, the need to understand fundamental material behavior and interactions between materials is critical and that the HTML should therefore be fully funded to maintain the best equipment for material characterization. The second reviewer, who believed current resources to be adequate to proposed work, reiterated a concern about impending funding decreases for FY2012. This concern was echoed by another of the reviewers who regarded current funding to be adequate for current tasking. Saying it was difficult to gauge the sufficiency of funding, this reviewer said funding appeared to have been appropriate and adequate for the past couple of years at around $5M per year). However, the $972K funding anticipated for FY '12 (as shown in Dr. Schutte's opening presentation), seemed unreasonably low. The fourth reviewer noted the need for a financial budget of $200k for rotation device. Human resources seem appropriate.

Multi-Materials Vehicle R&D Initiative Lightweight 7+ Passenger Vehicle: Wagner, David (USAMP/NDE Ford) – lm029



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Two of the three reviewers of this project affirmed the relevance of this project to the DOE's petroleum conservation and greenhouse gas reduction goals. The first reviewer summarized that the overall Multi-Materials Vehicle (MMV) objective is to develop lightweight materials technologies and full vehicle weight strategies for cost-effective, large-scale implementation in vehicles that meet consumers' needs while providing increased fuel efficiency. Continued this reviewer, the focus is to lightweight a 7+ Passenger vehicle and thus to determine weight reduction required, using vehicle performance / fuel economy simulation analysis, to enable a current production vehicles to achieve fuel economy improvements when retrofitted with a smaller current production gasoline engine and a state of the art transmission, while maintaining the performance metrics of the current production vehicles (0-60 mph time, towing on grade, etc) and to achieve 40-45% fuel economy improvement (from 24.3 mpg to 34-35 mpg) for a 7-passenger minivan and an 8-passenger Crossover Utility Vehicle (CUV) to achieve 20-25% fuel economy improvement (from 24.7 mpg to 30-31 mpg). This reviewer called the data provided by this project directly relevant to the goals of the lightweighting effort and increasing energy efficiency. The second agreed that it qualifies with respect to DOE objectives. However, this reviewer felt the study to be limited to an extent sufficient to call its value into question. This reviewer urged that its focus be widened to include consideration of the effect of transmission weight reduction, which he felt may exert a very significant impact. Together with size and weight reductions of the transmission, lubrication will have to be considered. The last reviewer, speaking with respect to the Multi-Material Vehicle (MMV), said this type of precursor analysis is needed to establish scope and achievable goals/milestones. With regard to NDE (Non-Destructive Evaluation), the reviewer noted that structural aluminum castings offer the lowest cost ($/pound) mass savings.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Three reviewers offered comments on this aspect of the project. They were generally positive in the evaluations. The first reviewer summarized that simulations of vehicle performance and fuel economy determined the appropriate weight reductions to achieve the targeted fuel economy improvements. Two engine selections were made for each vehicle, each with different peak power ratings. Each vehicle was simulated at three distinct starting (prior to weight reductions) weight classes. The EPA equivalent test weight (ETW) is the vehicle base curb weight plus an additional 300 pounds rounded to the nearest EPA weight class. The gross vehicle weight rating (GVWR) is the vehicle curb weight plus additional passengers and luggage. The gross combined weight rating (GCWR) is the GVWR weight plus additional weight to account for trailer towing. The six performance criteria required of the newly configured vehicles were four acceleration tests (five-second distance, 0-30 mph, 0-60 mph, and 0-100 mph times), hill climb ability at 55 mph (including trailer tow), and top speed. The newly configured vehicles had to meet or exceed the current production vehicle's performance in these six customer relevant performance metrics. This reviewer called the approach a well thought-out and narrowly focused engineering study which has provided the community with useful data. The second rated the approach to the two parts of the presentation separately. The Multi-Material Vehicle (MMV) work was deemed outstanding, terming the "paper study" methodology a necessary step to determine scope and feasibility of large projects. This reviewer rated the NDE section slightly lower – good. The reviewer found the computer-aided engineering (CAE) predictive approach interesting and recommended the future focus be part-specific, including variable section thickness and complex geometry. The third reviewer said the two authors gave a good description of what they did, and why, for this "small" project. This reviewer felt the project clearly called for much more and that it should be much more comprehensive, to include transmission, lubrication and functionality of, and within, the vehicle.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Of the three reviewers, one repeated the rankings given to the two parts of the project under the previous criterion, rating the accomplishments of the MMV project outstanding. This "paper study" achieved the goal to determine scope and feasibility of large projects. A 2,000 lb. mass reduction seems difficult to achieve and thus OEM interest is limited by time/effort. The NDE section of the work this reviewer rated as good; progress is good, justifying further work. Opportunity to reduce inspection costs associated with detecting shrinkage is enabling, however, ability to detect oxide films and heat treat condition is very enabling and provides significant occupant safety and further mass reduction. Typically, these are critical areas. This reviewer felt that lack of funding and limited time had limited the accomplishments of this project. The second reviewer considered MMV 903 to have completed all project deliverables. According to this reviewer, the minivan must reduce between 500 lb (11%) if aggressive aerodynamic actions can be implemented and 2250 lb (50%) to move from 24.3 mpg to 34.5 mpg with a current production gasoline engine. The uplevel CUV must reduce 2,000 lb (42%) to move from 24.7 mpg to 30.5 mpg with a current production gasoline engine. The weight reductions calculated for the minivan (500-2,250 lb.) and for the CUV or Crossover Utility Vehicle (2,000 lb.), this reviewer noted, are based on simulations to meet fuel economy plus vehicle acceleration, top speed and trailer tow requirements. However, they do not consider meeting safety, durability, noise, vibration and harshness, vehicle dynamics, or other requirements. In the reviewer's opinion, this raises the question of what would happen if "safety, durability, noise, vibration and harshness, vehicle dynamics, or other requirements," or some carefully chosen subset of them, were taken into account. What would happen if we were to approach lightweighting from the ground up, that is, designing it in from the very beginning?

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Only two reviewers weighed in on this topic. Both rated project collaboration highly. One, noting that Chrysler, Ford and GM were OEM project partners and that FEV, Inc. had also collaborated, this reviewer assessed good collaboration on a narrowly focused project. The other reviewer was highly complementary, rating collaboration in both the MMV and NDE areas outstanding. The former is a paper study which included commercially available software to predict vehicle mass and performance of various powertrains. Likewise the NDE the reviewer considered collaboration on the NDE phase of the project outstanding. This reviewer cited excellent involvement of supply-base insuring current methods and short time to commercial application.

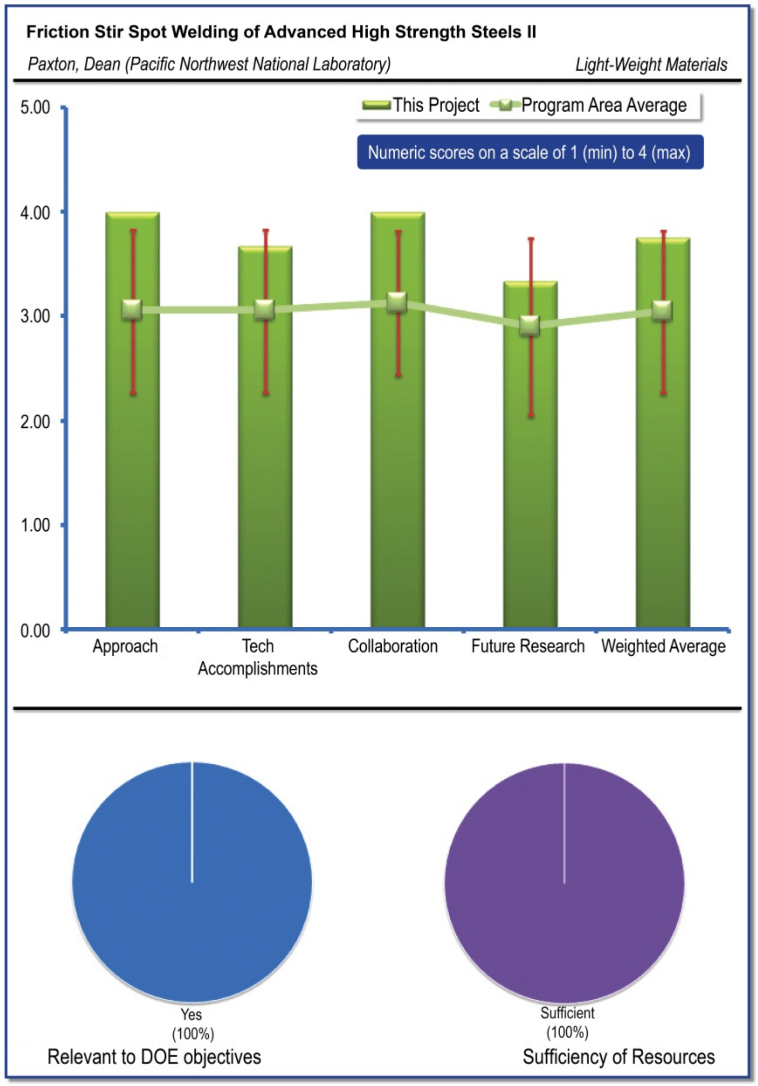
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Noting that there are no plans to continue the project, as the final report on Lightweight 7+ Passenger Vehicle R&D Project has been delivered, one reviewer expressed interest in the final report and the hope that its distribution would not be restricted. The second reviewer rated future MMV work good, and commented that no further action was planned/required. This reviewer gave the same rating (good) to the NDE phase of the work, but felt that area needs improvement and should include a complex casting with variable wall such as an aluminum front cradle. This reviewer recommended focusing on detection of oxide film, shrinkage, gas porosity and the ability to detect age hardened condition (i.e., quenched - T5 vs. F condition) in lieu of CAE predictive modeling. Finally, the third reviewer credited the authors with giving an idea of what remains to be done, but the reviewer was left with the impression that it is over. This reviewer felt this project should be the introduction of a much more involved project in which modeling leads to real testing.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer felt resources to be sufficient, and a second reviewer thought resources were insufficient. The former remarked that the resources were obviously adequate. The latter felt that if DOE’s plans for displacing petroleum use are serious, this project should be restructured and markedly expanded.

Friction Stir Spot Welding of Advanced High Strength Steels II: Paxton, Dean (Pacific Northwest National Laboratory) – lm030



REVIEWER SAMPLE SIZE

This project had a total of three reviewers.

QUESTION 1: DOES THIS PROJECT SUPPORT THE OVERALL DOE OBJECTIVES? WHY OR WHY NOT?

Two of the three reviewers who commented rendered opinions on the relevance of this work to DOE's goals. One said simply that it is very relevant; the other that improving the spot welds on advanced high strength steels (AHSS) supports the DOE objectives for weight reduction and petroleum displacement, offering no support for this judgment. The third reviewer remarked that Future Body-In-White (BIW) assemblies will be hybrids of many materials. Some of those, especially Advanced High Strength Steels (AHSS), are presenting a challenge to conventional joining methods. Friction Stir Spot Welding (FSSW) may enable implementation of additional alloy combinations and stack-ups that provide additional weight and cost savings. The objectives of the project are: (1) to enable joining of AHSS alloys in unequal metal thickness stacks; (2) to develop more comprehensive information about mechanical properties (including T-peel behavior, cross-tension strength, fatigue strength, and impact behavior) of AHSS joints produced via FSSW; (3) to determine comparative information related to stir tool durability, weld quality and supply chain support; and (4) to Identify remaining issues preventing high production deployment. If successful, this project will demonstrate that friction stir spot welding (FSSW) is an acceptable cost-effective alternative for AHSS that are difficult to resistance spot weld (RSW) and that FSSW may enable down-gaging of sheet thickness through unequal/dissimilar material stacks. The project milestones are: to achieve structural joints with FSSWs in AHSS that are problematic to achieve with RSW; to demonstrate tool life of probable materials and the joining cost associated with FSSW based on wear studies to update the comparative cost model; and to complete the evaluation of process deployability, including compatibility with current machinery and manufacturing techniques.

QUESTION 2: WHAT IS YOUR ASSESSMENT OF THE APPROACH TO PERFORMING THE WORK? TO WHAT DEGREE ARE TECHNICAL BARRIERS ADDRESSED? IS THE PROJECT WELL-DESIGNED, FEASIBLE, AND INTEGRATED WITH OTHER EFFORTS?

In this section, two reviewers proffered judgments on the approach to research presented. One termed it a solid technical approach. The other said the approaches taken within this project are great. They are moving the technology toward industrial implementation. The investigation on joint characterization and especially tool life and process deployment are well aligned to get to the best results. The third reviewer remarked that the FSSW process development task initially requires OEM selected alloys, especially alloys with problematic RSW (Resistance Spot Welding) performance characteristics and dissimilar stack-ups (alloy/thickness). The second task is the characterization of the joint interface, specifically to determine the functional relationships between process parameters and joint properties. This task also needs to evaluate the influence of coatings on process and weld strength parameters. The third task is tool durability. The fourth, and final task, is assess process deployment by collaborating with equipment and tool manufacturers and by validating FSSW parameters with respect to existing industrial technology (robots, pedestal stations, etc.).

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Very good accomplishment was the judgment of one reviewer. The other considered that the accomplishments achieved on tool durability/life and tooling cost while watching the weld quality provide important results for taking this technology to the industry. This reviewer regarded the tooling cost results as especially encouraging. The surface wear results versus the strength over number of welds he also found very encouraging. Also, the variety of the stack-ups and material mix show the robustness of this process. The third reviewer predicted that the work on joining of dissimilar AHSS combinations would have near-term impact and applicability. This reviewer remarked that in order to support low-cost tooling development, the direct injection molding of silicon nitride was done. This process does introduce volume sensitivity. Also, PCBN tools are being designed for FSSW. Updated cost comparisons were produced and plots demonstrating the functional relationship between tool cost and durability to reach cost parity with RSW. Tool wear characterization included wear studies of PCBN composite materials. Lap shear strength was maintained above AWS minimum (11.09 kN/ 2,493 lbs) for more than 1000 welds in DP980.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Two of the three reviewers rated project collaboration very good and wonderful, respectively. The second reviewer singled out collaboration with the tooling suppliers for particular praise, saying it has brought a level of seriousness to the results. The third reviewer listed the project collaborators with apparent approval - the USCAR joining team (GM and Chrysler), commercial automotive sheet vendors (ArcelorMittal, GeStamp-HardTech, and US Steel), tool manufacturers and material providers (MegaStir and Ceradyne), and universities (Brigham Young University and the University of Michigan).

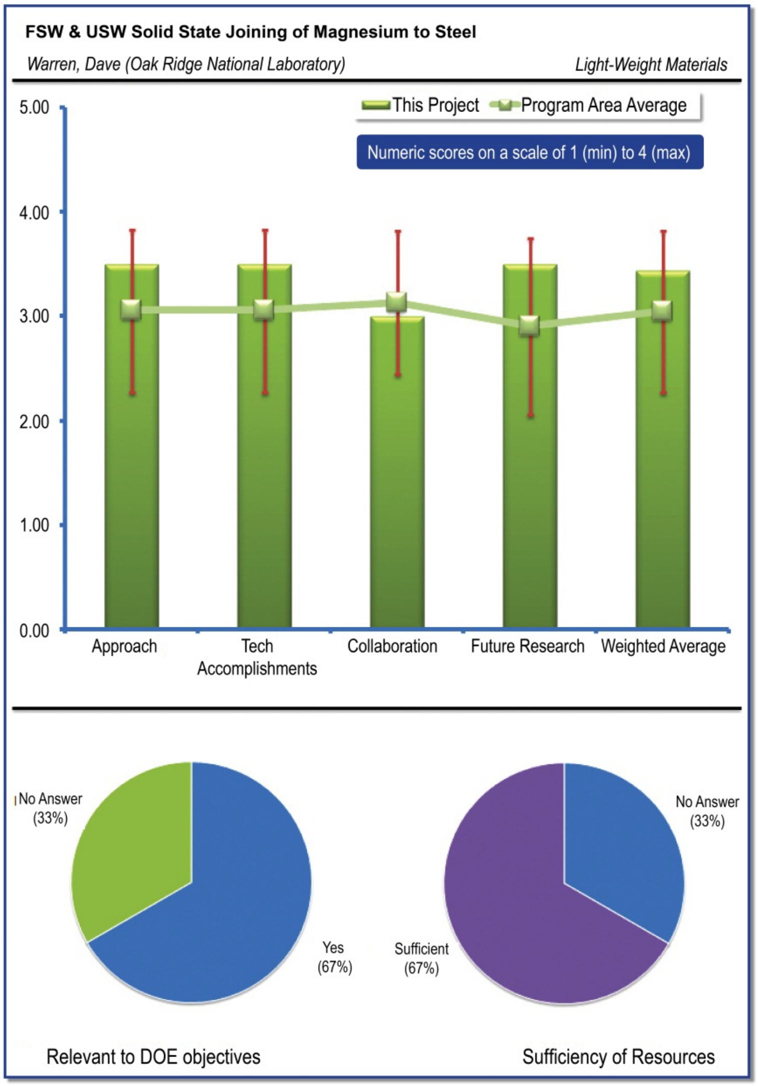
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Three reviewers commented on proposed future work in this project. On reviewer commented that the tool durability characterization effort will complete PCBN variations and test DIM SiN materials. The project will also provide feedback (tool loads, wear characteristics, torque, etc.) to tool manufactures allowing for the next leap in tooling technology. In order to resolve issues for the FSSW joining of dissimilar materials, functional relationships between process parameters, tool materials and joint strength will be determined. The joint interface will be evaluated (including coating effect, and fracture surfaces) to improve overall weldability. Finally, the project team will work with equipment and tool suppliers to outline problems currently preventing deployment and identify final work needed commercialize the technology. This reviewer reasoned that since FSSW is a solid-state process which is known to cause significant changes in the microstructure of the materials, it seems likely in the case of dissimilar metals that the identification and analysis of suitable process parameters (tool rotation speeds, clamping forces, the effects of frictional heating, etc., etc.) will be very difficult. This reviewer, assuming the project team intends to investigate stacked sheet lap joints in order to measure weld strength, asked if any investigation of suitable assembly rules for these structures would be undertaken. The second reviewer recommended that future work focus on robotic application to permit production use of developed welding techniques. The third reviewer noted that the proposed future work addresses the questions raised within this project. Investigating more coatings and more materials is important, in this reviewer's opinion, as is continued focus on tooling life and cost. Continuing efforts on joint characterization and strength and fatigue life from the multitude of materials and stack-ups will be important to getting to a robust process.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer noted that resources are sufficient to get to the end of this project. This reviewer urged that follow-on efforts be fully funded, also.

Friction Stir Welding (FSW) & Ultrasonic Welding (USW) Solid State Joining of Magnesium to Steel: Warren, Dave (Oak Ridge National Laboratory) – lm031



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer felt the project was relevant because effective technologies for Mg-steel bonding will support strategies for vehicle weight reduction. Another said the joining of mixed materials is a critical enabling technology to increase the amount of magnesium that can be included into high volume automotive structures reducing weight of vehicles.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer felt the approach for investigating both the friction stir weld and the ultrasonic welding for magnesium and steel was robust and complete. A second reviewer felt that the current approach of examining the corrosion and microstructure were critical to understanding the joints and suggested examining more stack ups with different grades and coatings on the steel.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer stated ORNL is working very efficiently to better understand the engineering properties of Mg and especially the fracture events at the Mg/steel interface. Another reviewer stated that the achievements to date on fractography, tool design, characterization of the interfaces, the fatigue tests on FSW were all solid and push the project to the end goal The final reviewer voiced concern that there was no information on the corrosion yet and the project was almost over, and offered that it takes over three months to generate corrosion results and a few more months to evaluate and react.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were generally positive. Among the comments were that the there is good collaboration with automotive companies and the USAMP magnesium research team as held regular conference calls are held with OEMs, actively followed by GM and Chrysler and Ford has an open invitation. Guidance is provided for technical activities. Results are shared with Magnesium Front-End Project participants. University of Michigan is supporting fatigue testing, analysis, and modeling. One reviewer offered that there should be more collaboration with friction stir and ultrasonic welding tool suppliers.

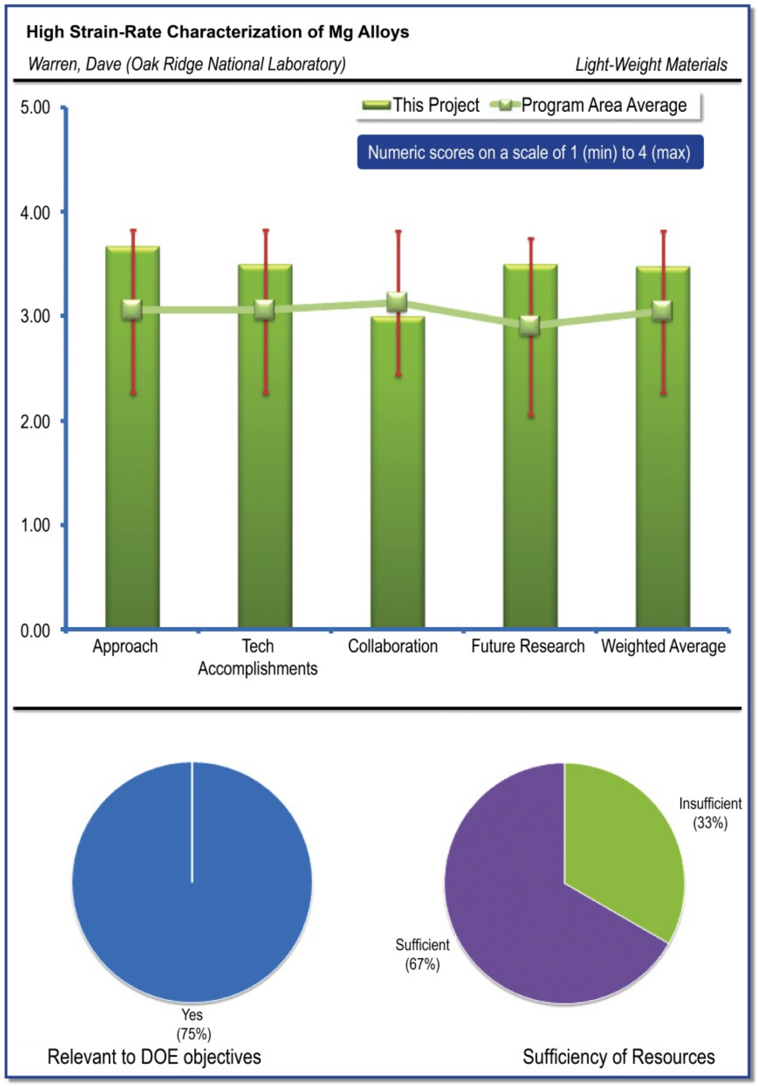
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer recommended the highest priority be placed on corrosion performance and mitigation. This reviewer offered that although all current project tasks are important for the lightweighting effort, the static and dynamic testing of hybrid joints is critical and that the test protocol should also consider the impact of corrosion (and perhaps other aging-related effects) on hybrid joint strength. Another reviewer suggested that additional work should be with AM60B die cast magnesium since it is the most likely for large magnesium parts.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer stated that the project should continue to be supported, and resources for collaboration especially with the auto companies should be expanded.

High Strain-Rate Characterization of Mg Alloys: Warren, Dave (Oak Ridge National Laboratory) – lm032



Reviewer Sample Size

This project had a total of six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer stated that the project develops enabling technologies and material data for the use of Mg alloys in automotive structural applications. Another said understanding the high-rate behavior of Mg alloys is very important in automotive lightweighting. A third reviewer indicated magnesium is one of the lightweight materials and can be used in vehicles to reduce the mass. Understanding of the behavior of magnesium under high strain loads is important. A fourth reviewer offered that high strain rate material properties and correlation of CAE predictive modeling is required for commercialization of lightweight components comprised of Mg alloys. The final reviewer said that this by enabling better material's characterization during catastrophic events, it not only support DOE's goal but also improve on safety.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers felt that the project is using a sound approach to developing test methods suitable for characterizing material performance at high strain rates. One reviewer commented that this experimental approach provides an excellent tool to investigate the crack initiation, propagation and final of Mg alloys under high strain rate which is very important to understand the trustworthiness behavior of Mg alloys. Another reviewer stated that this research may become the prototype of future testing procedure where true on-scale models with proper material's attributes will be tested. A third reviewer agreed with the research observation that in the not-too-distant future new sensors will “gradually take over” and that these sensors will be based on some formulation of multi-function microsystem (nanosystem) technology where the key obstacle will be the development of suitable packaging. The reviewer continued that this project is opening up a very interesting window on (near) real-time in situ materials-based metrology. Some issues and recommendations were also raised. One reviewer noted a need to incorporate CAE and ICME to gain scientific value in order to avoid weakness caused by a lack of documented bases of sample origin and quality. A second reviewer offered that multiple data sources for each measured quantity as well as the ability to verify measurements throughout the range of strain rates of interest.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

All reviewers stated generally that there was good progress on many fronts. One reviewer commented that the high strain rate testing development is unique in nature due to the fact that it can be stopped at any time, and stated that it is important to see the fracture initiation in magnesium since its fracture behavior differs from commonly used materials such as aluminum and steels. Several reviewers found issues with the approach or offered recommendations. One reviewer advised to focus on final stages of fracture to understand the failure mechanisms of Mg alloys to establish the material model for crash simulation and develop new Mg alloys for improved crashworthiness. Another reviewer felt that more progress could have been made quicker if done in conjunction with other National Labs.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were generally positive. One reviewer noted that the project is working on alloy samples provided by the automotive industry and has very good collaboration with industrial and academic partners. A second reviewer said that ORNL knows how to do it! Some reviewers had concerns and offered recommendations. One reviewer remarked that they saw limited "cooperation" but little or no true "collaboration". This reviewer continued that OEMs provided material that is of interest to Magnesium Front End project; however there is no other apparent interaction between OEMS, MFERD, or other related projects such as ICME work at USAMP or Mississippi State University. Another reviewer cautioned even though the project has involved with Magnesium Front End team, additional industrial and academic partners should be included to reduce the redundancy in efforts

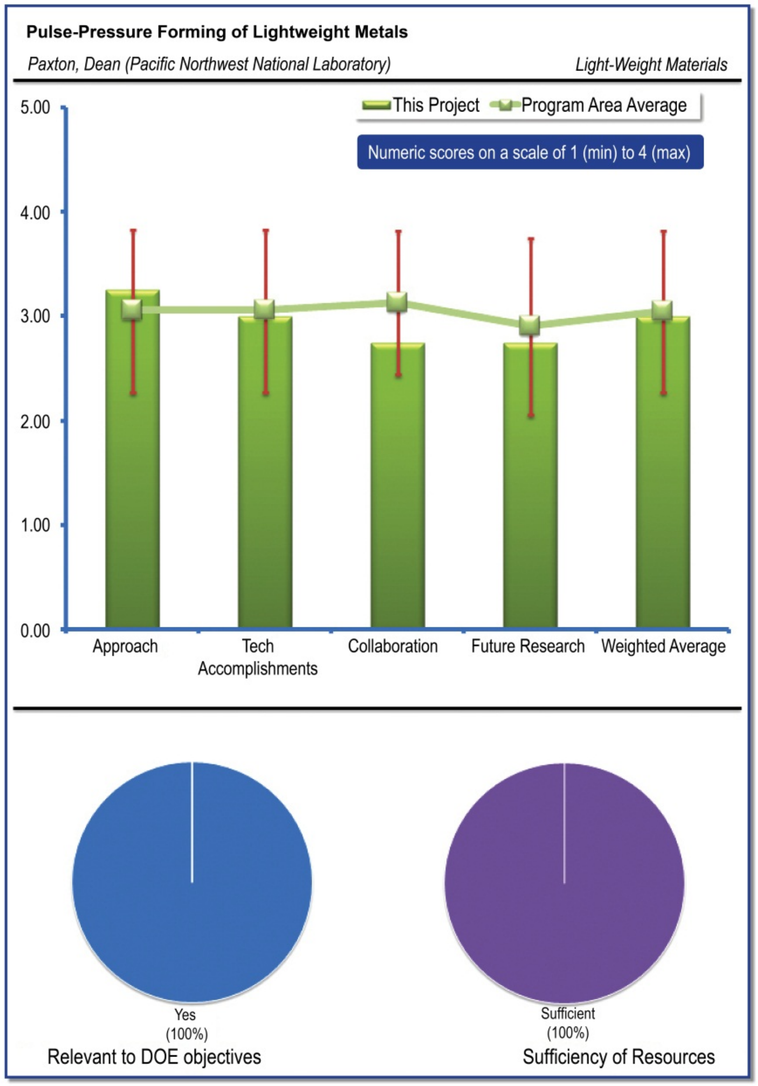
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer indicated that the current plans include 1) in-depth characterization of damage evolution in Mg alloys of interest to automotive designers at various strain rate conditions, loadings and initial microstructures; (2) design new methods for tailored strain application under intermediate strain rates; (3) advance technology for intermediate strain rate testing in tension, shear and multi-axial loading configurations; (4) essential for development and calibration of advanced material models for lightweight materials; (5) the damage models require wide region of stress states and loading paths; (6) support development of forming technologies and new material processes such as asymmetric rolling for Mg alloys; (7) development of methods for characterization of fracture/failure properties of Mg sheet materials; the highest priority placed on gasoline/ethanol work. A second reviewer applauded the good plan going forward and recommended a 5-year program to realize tangible objectives or a focus on multiple activities. A third reviewer asserted focus on establishing failure models and failure mechanisms of Mg alloys. A final interviewer warned of a future limitation in the proposed work involving magnesium only, offering that more work can be done to compare other materials using the newly developed test piece and process.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer commented that additional funding was needed for continued work on AM60 castings and new alloys. Another reviewer commented that the lab resources were sufficient, but that an additional partner was needed to add predictive modeling to the project.

Pulse-Pressure Forming of Lightweight Metals: Paxton, Dean (Pacific Northwest National Laboratory) – lm033



Reviewer Sample Size

This project had a total of four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All reviewers generally supported relevance to DOE objectives. The first reviewer felt any technology that gets aluminum and AHSS into autos in a cost effective manner meets the objectives. Another observed that better formability at a fast rate is a valuable tool. A third reviewer suggested that improving formability of light metals (Al and Mg) is important to vehicle lightweighting. The final reviewer asserted that formability is an issue for magnesium which can be used to reduce the vehicle weight. If the cost of forming of magnesium can be reduced then its use can be increased.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers generally were cautiously critical of the approach. One reviewer indicated that the rapid strain rate deformation processes are evaluated, even though there are no confirmed test methods available to measure the strain rates developed during the rapid strain rate deformation processes studied in this project; the researcher is trying to measure them using conventional test methods; and a new approach may be needed to tackle the problem. The reviewer continued by pointing out that efforts to develop constitutive equations and models to predict the performance are a little premature because there is no way of confirming these models are available now. Another reviewer cautioned that although it was a decent design of test with an interesting indication of increased formability of Mg at high rates, unfortunately there was no not follow up.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers comments were generally not complimentary relative to the accomplishments of this project. One reviewer offered that the accomplishments were relatively limited; off the shelf metrology and a custom tool were used, so the innovation beyond the driver technology is not high. A second reviewer offered that there was a good understanding of the process and short comings of current evaluation technologies; however, further developments are needed to completely understand the strain evolution during PPF processing.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer commented that the coordination was not elaborated upon extensively, but seemed to be there. A second reviewer commented that even though OEM members are involved in the process, their involvement is only technical guidance. This reviewer further recommended that other researchers involved in PPF forming and experts in other pressure assisted processing areas, such as joining or explosives, be approached for collaboration, or consulted for their opinions.

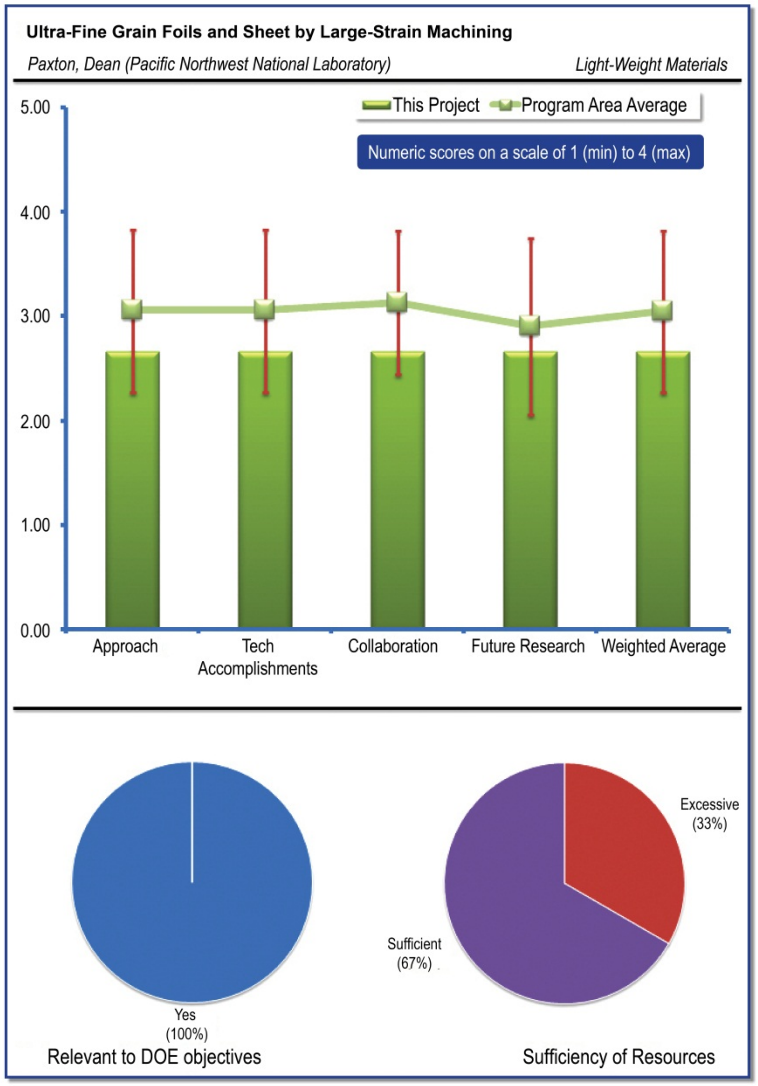
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer suggested testing the formability of Mg alloys to make sure that this technique is beneficial to Mg alloys and cost effective compared to other techniques such as warm stamping.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewers did not comment on resources.

Ultra-Fine Grain Foils and Sheet by Large-Strain Machining: Paxton, Dean (Pacific Northwest National Laboratory) – lm034



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer felt the project was relevant as it could potentially lead to Low-cost and more formable Mg sheets, which is important for vehicle lightweighting. A second reviewer stated that it has a good potential for sheet making. A third reviewer added low-cost and more formable Mg sheet is important for vehicle lightweighting. The final reviewer said development of wrought magnesium is important as the use of magnesium in vehicles will reduce weight and as the project is a long-term, high- risk project, it is relevant to the DOE portfolio.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that the concept is interesting and similar to the equal angular channel extrusion with large plastic strain applied, but probably easier to be up-scaled. Another reviewer said that the project is aimed at developing an understanding of the grain formation in a high shear forming process of magnesium. But the effort is still in small scale and most of the work is carried out in the university labs, and the role of the DOE lab needs to be clear. This reviewer questioned whether the project is restricted to a characterization only.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

A reviewer stated that only limited samples have been made and suggested that large samples be made for formability evaluation. A second reviewer expressed that the formation of fine grains due to large shear stresses developed during machining is proved in this work and further suggested that as the thickness of the machined chip is increased, the shear stress may not be severe in the outer edge and the grain size will be variable. This effect needs to be studied before scale-up is tried.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer commented that the project is aimed to collaborate to understand a process which is patented by the university partners. Even though the material suppliers are involved, their technical contribution will be limited

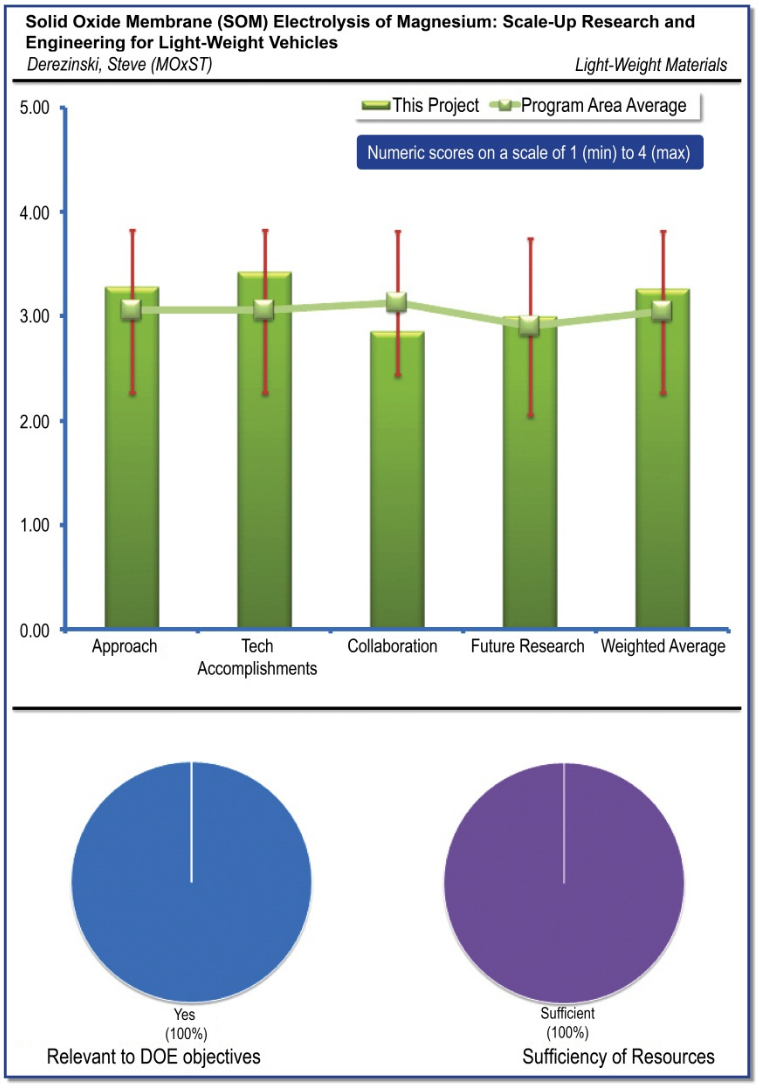
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer recommended testing the formability of the material. A second reviewer cautioned that it is necessary to understand more fundamental issues before scaling-up is tried in future.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

The first and second reviewers thought the project team made good use of resources. The third reviewer had some reservations about resources for this project, considering them excessive. One reviewer voiced a specific concern about resources, stating that the project looks like only characterization in the labs and most of the work is contracted out to universities. The process is patented (not to the labs); total cost need to be shared by the team members.

Solid Oxide Membrane (SOM) Electrolysis of Magnesium: Scale-Up Research and Engineering for Light-Weight Vehicles: Derezinski, Steve (MOxST) – lm035



Reviewer Sample Size

This project had a total of seven reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer felt the project was relevant and stated that the ability to produce a low cost Mg without significant negative environmental impact would significantly increase the attraction of and application of Mg to vehicles, thereby reducing vehicle mass, increasing their efficiency and reducing their emissions. This technology can be a major enabler for such Mg. Another said that low-cost domestic supply of primary Mg is critical to the national interests of the United States. A third reviewer expressed that the commercial use of magnesium and environmental benefits associated with GHG footprint is significantly related to primary reduction of MgO. A fourth reviewer stated that magnesium is proven to reduce the weight of the vehicles and improve the efficiency, so it is necessary to reduce the cost and impact on environment during primary metal production. A fifth reviewer indicated support and concerns, stating yes this project is needed to satisfy DOE objectives in diminishing petroleum consumption because it concerns magnesium, a much lighter than materials currently in use, but no it does not because it is material processing production without any use in mind. This reviewer's understanding of DOE objectives is that magnesium, as a basic material, is the starting point. Otherwise, this reviewer acknowledges that this is a good project, but questions whether this project is at its place here. The final reviewer explained that this project attacks the need for magnesium production. Magnesium at low cost and low emissions will help reduce weight in automotive industry.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most reviewers agreed that this project has a solid approach to scaling from concept to commercial scale. One reviewer indicated that although problems have been identified, they are well understood and are being addressed. Some reviewers also identified concerns. One reviewer commented that the researcher should watch side products of MgCl2 and SO2. This reviewer remarked that SO2 is not environmental-friendly. A second reviewer was complimentary of the current work but skeptical about the scale-up stating that approach is excellent at the lab level. The scale up process is too optimistically presented and it is doubtful that it will be as straightforward as they said.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

A reviewer stated generally that there was substantial progress in areas such as Zirconia robustness, FEA modeling and scale-up. A second reviewer indicated that significant developments has been achieved in increasing the cell operating time and efficiency and that the planned scale up for large scale production is a good step but is a long way from commercial production. Another reviewer commented that achievements with respect to goals are outstanding. A fourth reviewer commented that there was significant accomplishment to date and that the project is totally dependent on third-party funding.

Although most reviewers were satisfied with the achievements, one reviewer offered some concerns and recommendations. This reviewer stated that the durability and robustness testing is not yet at a level to confirm the next scale up step, and remarked that the small scale tests are encouraging but still not convincing for the next step. Additionally, this reviewer remarked that efforts on material impurities based on chemistry look encouraging, but the reviewer would like to see testing to confirm assumptions and estimates. Finally the reviewer suggested the theoretical energy budget is appealing but this reviewer would like to see the measured energy-in and product-out data from the small scale process.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were generally mixed. One reviewer stated that the research team has a limited number of collaborators, but appeared to be the appropriate organizations and fruitful cooperation and collaboration. A second reviewer offered that there was good collaboration with ORNL and Boston University as well as industrial partners MOxST for raw material supply and volume reduction/primary with metal production contingent on successful business negotiations. A third reviewer felt that the work is very promising; however, it is unclear from the presentation whether there was good collaboration or not. One reviewer explained that the collaboration efforts are comparatively less due to commercially sensitive nature as this work is on a patented process. The reviewer further commented that this is out of the scope of pre-competitive research and should be minimally supported by VT.

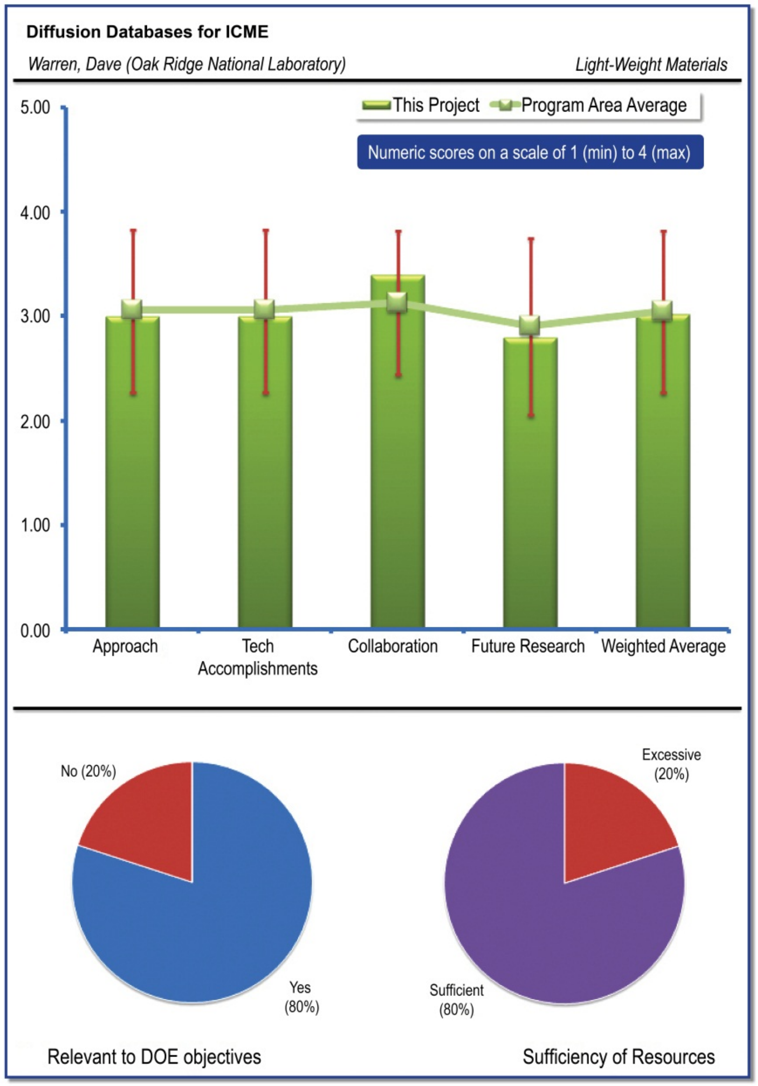
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The reviewers were generally supportive of the proposed future plans tempered by some concerns about the optimism of the scale up and the appropriateness of VT funding for a commercial level plan. The first reviewer commented that this is an excellent project which gives this reviewer a very strong sense that MOxST is committed to the eventual development of an industrial-scale family of devices. The point was made by several reviewers at the review meeting that there will surely be several “big steps” between the current prototypes and anything approximating the quantity of material needed in the end-game. The project team seems to understand the implications of this observation. This reviewer summarized the critical actions as follows: The first task is to optimize zirconia (YSZ) formulation and process for long-term operation in molten salt. A new larger-scale prototype configuration will be designed, built and tested. Then metal will be produced using the prototypes and testing will be done to determine the composition and suitability of the material for vehicle parts. Further refinements will be done for technical, cost, energy, GHG and other emissions modeling. Finally, the project will begin site selection and development for pilot plant. A second reviewer offered that there is a clear vision of the path to scale up to pilot scale and production scale, with a good understanding of, and plans to do, what is needed to make such scale up possible. A third reviewer was cautiously optimistic stating that the project is completed with the future plan including 1kg/day for casting trials, providing a bulk supply of 500 lbs. in 2012, the success of which is critical to demonstrate the capability to scale the process and cost. There were some cautionary concerns also identified by one reviewer: (1) there will undoubtedly be technical issues in the future which will affect the timing of this venture, but (2) the most critical issue now is the securing of “patient” capital. Even though this project is in early days, it is not too early to start working on the “time to profitability” calculations. At this point, the complexities of the current Mg market and other unknown cost factors (such as the transport costs of bulk material, etc.) make it difficult to determine the intermediate-term financial viability of this proposal. Another reviewer had concerns about supporting a commercial venture, saying a primary metal manufacturing project does not necessarily need to be supported by the VT program alone. The fundamental material development can be supported while the scale-up and commercial level production need to seek other partners as this will reduce the support for other projects. A third reviewer offered the critique that the future prospects for the project are very good but the scale-up is not fully estimated; it is being presented as no problem! Scale-ups are always a big challenge.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer commented that this project appears to be a fruitful "investment", in fact achieving a good return for the money spent thus far. A second reviewer commented that the resources are adequate for the work, and a third reviewer stated that the project is over, so the funding was sufficient.

Diffusion Databases for ICME: Warren, Dave (Oak Ridge National Laboratory) – lm036



Reviewer Sample Size

This project had a total of five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer emphasized that verified diffusion data are essential in alloy design, and having this information available is also essential for the ICME formalism to function. Having this information generally available will stimulate research into lightweighting via alloy development. This reviewer commented that the project is working on a technologically relevant alloy system (Mg-Al-Zn-Mn). A second reviewer commented that this could shed light on the micro structure of metals. Another reviewer strongly supported the connection to DOE goals, stating that the ICME project overall and the diffusion project in particular support the DOE goals for weight reduction and petroleum displacement. This information will assist with the development of new magnesium alloys. The final reviewer felt the project was relevant, but with a caveat. This reviewer stated that this project addresses a very fundamental issue of developing data useful for alloy development modeling; however, the problem is far removed from the outcome of petroleum displacement. Even though the research of this nature is needed this should not be the priority for VT program.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers felt that there was value in the research approach but limited innovation. The first reviewer felt that this was a relatively brute force approach using existing technology; plowing through the measurements, fairly low innovation, but the data are of value. A second reviewer offered that the mobility database using diffusion couples is a well-established technique, that the tracer diffusion approach is a newer, more expensive technique, and that the project should try to best use the both techniques in developing "robust" database of computational alloy development. A third reviewer commented that the project uses the state-of the art techniques available as well developing new methods for analysis. A final reviewer offered that using the multiple tracer isotopes for the project provides multiple paths to reach the project goals. The thin film tracer approach appears robust for the magnesium diffusion mechanisms. Using SIMS for the diffusion measurements gives the data necessary for the diffusion characterizations. These tracer diffusion measurements supplies key parameters for the magnesium systems.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

A reviewer stated that there was clear definition of technical accomplishments and progress. The investigations on sputter roughness and the resulting oxide growth give the necessary surface for the process to yield robust results. The efforts on the vacuum equipment and polished angle sampling were creative approaches to overcome the challenges. The second reviewer commented that the new technique to measure the diffusion distances was novel. Other reviewers were more critical. The third reviewer stated that for a program that has been running for a number of years, the output seems small. The presentation had many forward looking plans, and the project is ending in a few months. Some issues were encountered with their measurements that were due to sputtering mechanism problems, but it seems to have taken a very long time to sort these things out. The path forward is not well described. The grain boundary diffusion work seems to have not been started at all. The final reviewer indicated that so far only limited results have been presented with the hope to see more results next year.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were generally supportive. The first reviewer asserted that the project is doing a great job working collaboratively across the large and diverse ICME project web of investigators. The ties to universities and industry are appropriate. A second reviewer said that there was excellent collaboration. A third reviewer applauded the fact that many university researchers were involved; this helps develop new talent for future materials science research which is necessary. The final reviewer found it was very hard to determine how well coordinated the work was from presented material.

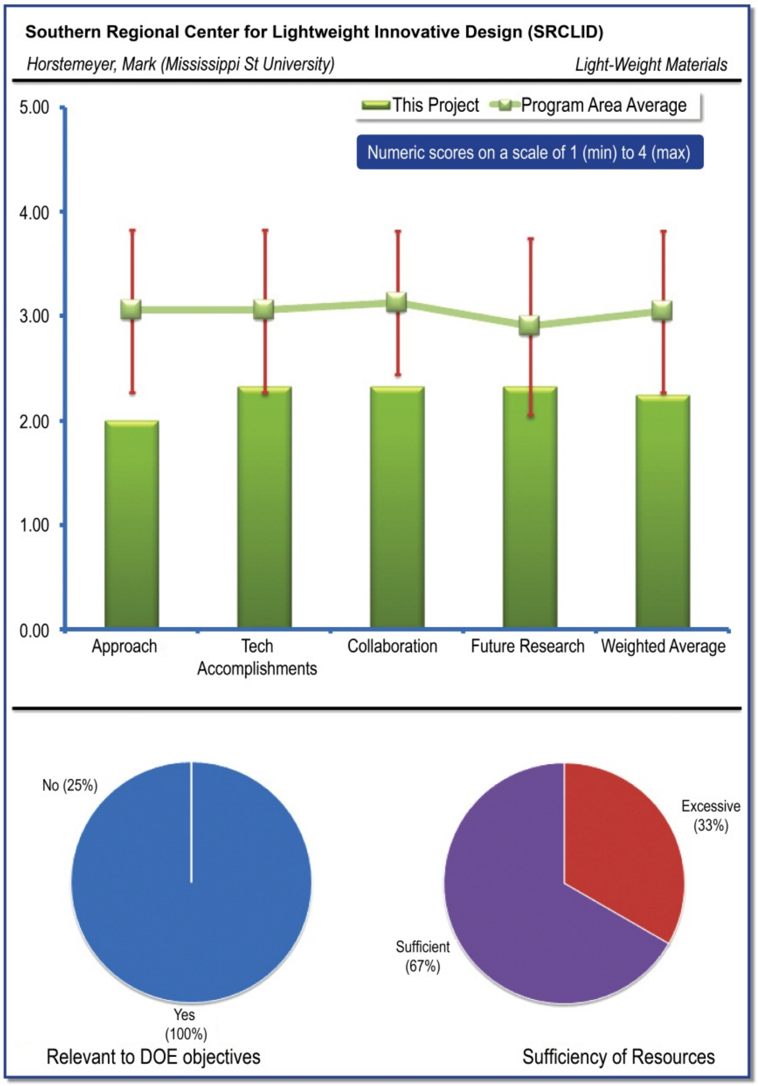
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer affirmed the proposed work on the MG-AL-ZN-MN systems is appropriate and useful indicating that the smaller efforts on the rare earth elements are also appropriate. The second reviewer recommended expanding the Mg-Al-Zn system to include Mg-Nd and Mg-Ce systems as both systems have shown excellent potential for high-strength alloys. Although rare earth elements (Nd and Ce) are expensive, there is a need to understand these systems to develop lower-cost alternative systems for high strength/ductility applications. A third reviewer offered that availability of materials for the proposed testing need to be confirmed before finalizing the plan (such as isotopes of al for tracer) and a final reviewer remarked that the future work plan seems to be only "give us more money and we'll try to finish" a much larger matrix.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

The first reviewer remarked that funding appears sufficient for the project. Another reviewer remarked that the PI mentioned not having $150K for a rotation stage, but other than that the reviewer was unable to discern the resources. The final commenting reviewer remarked that even though the research is good and needed, it does not fit in the mandate of VT; there are no in-kind or cost share partnerships involved.

Southern Regional Center for Lightweight Innovative Design (SRCLID): Horstemeyer, Mark (Mississippi State University) – lm037



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer felt the project was relevant as it addressed many topics related to lightweighting of vehicles. Another reviewer remarked that the project is developing a database for modeling manufacturing of multiple materials. A final reviewer indicated that the project only looks at the design optimization, which is only one small aspect of the challenge of petroleum displacement; the work is only marginally relevant to the DOE objectives. The exclusion of aluminum and multi material joining are significant holes in the project.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that the twelve projects are only loosely aligned to the overall vision and DOE goals. For the computational manufacturing efforts, the approach is not clear and the passing of information is weak from step to step. The approach for the projects was not clearly stated, so the evaluation is difficult. Too much of the approach is still planned in the future. It is not clear what are the near term steps for the current approach. The stated mission is to provide a design optimization and a design methodology for lightweight components and systems but the design aspect was never addressed in this presentation. A second reviewer stated that the project itself is a program with projects on magnesium, steel and composites, with the goal of developing manufacturing database and predictive models to use these materials for lightweighting.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

A reviewer found that the accomplishments of this project are not clear. The information and models appear still to be in the future and are not available now. The presentation was not clear on what has been completed and what are the near term deliverables. The prediction of mechanical properties from tech processing are still referred to in the future tense, what (hopefully) can be achieved sounds great but little has been accomplished at this time. The fatigue models were not clearly compared to the data so the accomplishment cannot be evaluated. Additionally, the results from this project are not clear compared to the USAMP LM012 ICME project. The predictions of the tensile response of AM30, for example, were good but these are particularly difficult. A second reviewer offered magnesium projects are well explained and the roles of the participants are laid out. Modeling to assist manufacturing and design process (casting, extrusion and sheet forming) is important. This reviewer noted that no steel projects are discussed. The final reviewer noted that natural fiber SMC was reported to have absorb of only 1.2wt% in 24 hours. The actual test results showed over 5%. Additionally, it should have been tested for a longer term moisture exposure. The PI should have known better.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer commented that there are many collaborators listed but the connections and the roles & responsibilities of each collaborator were not clearly stated. A full list of collaborators and their roles would have been helpful. A second reviewer offered that in case of magnesium, having MFERD project as the primary partner will enable effective tech transfer.

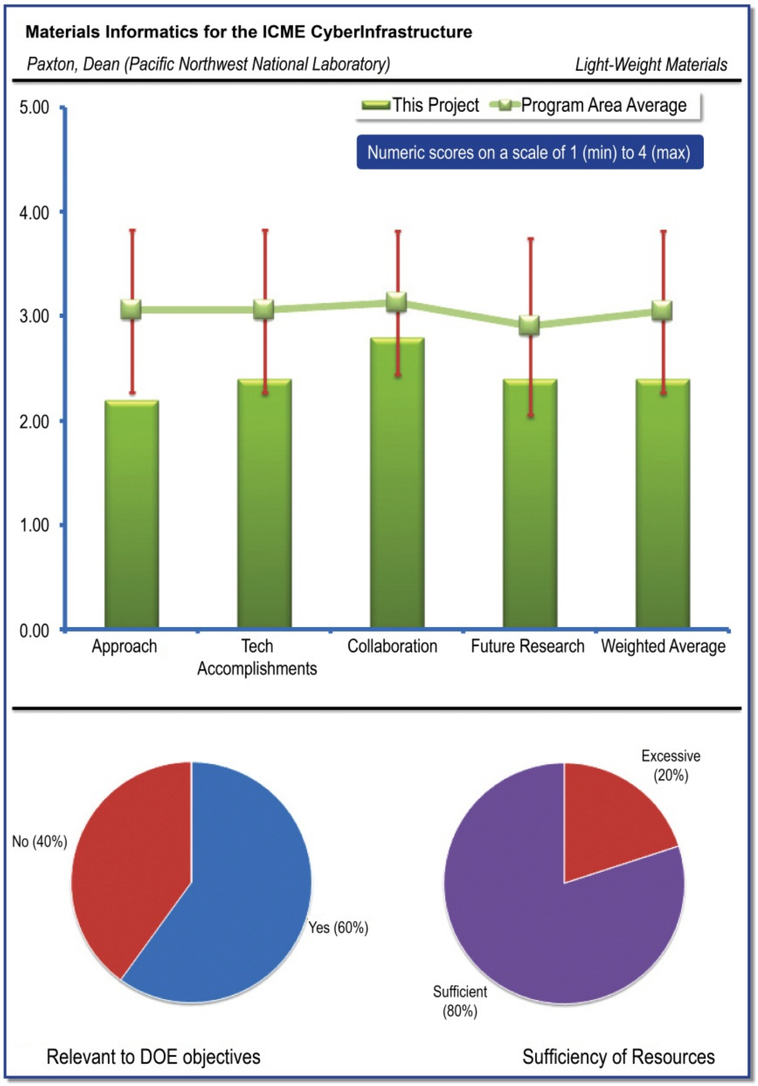
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer observed that the future work seems aligned to the objectives, and asserted that the participation in the magnesium front end project needs to be accelerated so that the information can be of value before the project ends in September 2011. This reviewer added there still seems to be a need for the outside "pull" for certain efforts and technologies. There was no clear discussion of the testing and model to lab comparisons. There was no list for term deliverables. Another reviewer stated that even though the project is aimed to develop a cyber-infrastructure, it is not explained who will be the final user after the end of the project, or how the database will be maintained after the end of the project. An open source will be very difficult to maintain so a partner who can find a market for these datasets need to be identified.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

The first reviewer stated that the presentation did not discuss the resources of either DOE cash or other funding sources. This reviewer commented that since the project has been running for so many years the results showed to date seemed slim regardless of the funding. A second reviewer affirmed that no information was provided for the financial / resources.

Materials Informatics for the ICME CyberInfrastructure: Paxton, Dean (Pacific Northwest National Laboratory) – lm038



Reviewer Sample Size

This project had a total of five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers had mixed feedback. One reviewer remarked that this project is an enabler for managing and transferring data so it supports the base ICME efforts for analysis and computational materials science, and another reviewer remarked collecting materials information for a proper math modeling is a key to reducing confusion in this field. The third reviewer said the notion of having a network of validated models and data has obvious uses and desirability, but this reviewer had no real idea what this project is doing beyond project planning after listening to the PI's intro. Another reviewer was not sure at this point how useful this effort is going to be in helping us given the fact that only limited data are available. The final reviewer remarked the project is far removed from the petroleum displacement. The data set validation is necessary but needs to be addressed by different forums.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers felt there were some good aspects to the approach, but were generally not optimistic about the value of the project. The first reviewer stated that the vision for the materials infrastructure is valuable, but how the project is addressing the needs for informatics is not clear from this presentation. Identifying gaps in a sample problem is interesting but it is not clear that this method will yield a robust set of tools for future projects. A second reviewer agreed that developing a tool to identify the existing gaps in the data sets for materials is a good idea. A third reviewer reflected that this approach would be more useful if a large amount data are available; however, Mg-ICME being at early stage, this reviewer did not see a lot of value in applying this type of techniques. The fourth reviewer remarked I was unable to tell what these researchers actually did.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer remarked that the project proved the process developed is working well, and is identifying the knowledge gaps. Other reviewers generally saw minimal progress. One reviewer remarked that limited results or applications have been presented. A second reviewer remarked that the PI is talking about an unending list of what things need to be or need to have, but this reviewer was unable to tell what the group DID. The final reviewer said the data structure and hierarchy is now in place. The tools to assess completeness are now at the initial level. The tie to the larger ICME efforts is not clear from this presentation. According to this reviewer, the presentation was not clear on the recent accomplishments from this fiscal year or equivalent period. The tools to evaluate and density map of data and materials are valuable for assessing completeness. The tools are not as far along as the time on the project.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were generally mixed. A reviewer applauded good effort in collecting and analyzing the data from many collaborators. Another reviewer remarked that the partners were described but the PI did not go into much detail on what the interaction was other than providing access to data and repositories. A third reviewer added good effort on collaborating with the diverse group that is ICME. This reviewer added concerns with the presentation; for example the lead collaborator was listed as Ford - John Allison. Dr. Mei Li has been the Ford leader on ICME for 1 year.

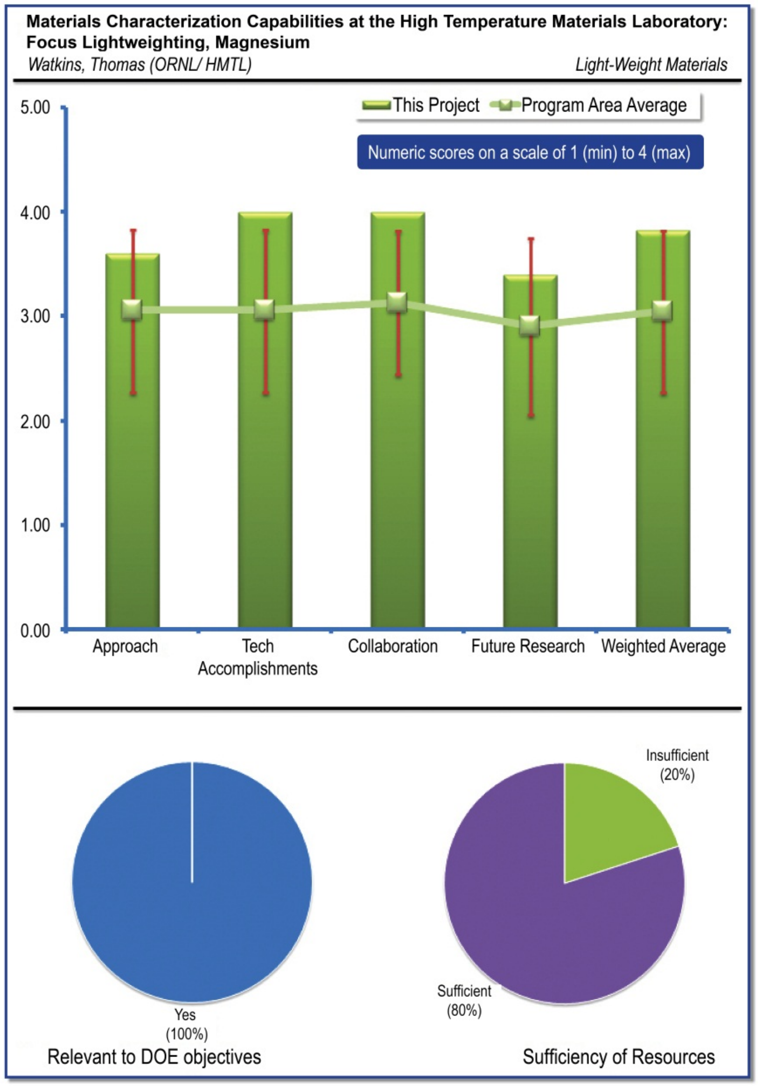
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer offered that the proposed future work on multi repository combining data sets will be the key deliverable from this project. The tools for data completeness and visual representations will give good insights. The project is near completion but there appears to be much work left to accomplish. The second reviewer recommended holding this effort until more and complex data/models are generated for Mg-ICME. Project is a low priority at this time.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer commented that time and money are adequate for this effort.

Materials Characterization Capabilities at the High Temperature Materials Laboratory: Focus Lightweighting, Magnesium: Watkins, Thomas (Oak Ridge National Laboratory/High Temperature Materials Laboratory) – lm039



Reviewer Sample Size

This project had a total of five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers felt that the project supports DOE objectives. The first reviewer felt this effort is directly in line with the Vehicle Technologies Lightweighting effort because the HTML is a DOE Designated National User Facility. The Vehicle Technologies Program funds the operation of the HTML User Program to maintain world-class expertise and instrumentation capabilities for materials characterization to work with industry, universities and national laboratories to address critical technical barriers to achieving the goals of the DOE Vehicle Technologies Program. The HTML User Program capabilities are also being utilized to support Vehicle Technologies Program projects at ORNL in the program's technology areas of Lightweight Materials, Propulsion Materials, Energy Storage, Power Electronics & Electric Motors, Emission Controls and Solid State Energy Conversion. The Magnesium Elektron North America user project, the primary focus of this presentation, is focused on the feasibility of developing industrially viable processes for producing shear rolled sheet. In particular, this project addresses technical barriers related to manufacturability and also adds to knowledge of the performance characteristics of advanced magnesium alloys. The second reviewer stated that HTML in general provides unique capabilities that allow very accurate and detailed characterization of lightweight materials. The example user project that was supported demonstrates the ability to provide information needed to model the performance of Magnesium. Such information will enable more widespread use of Mg, thereby reducing the weight of and increasing the efficiency of automobiles. The third reviewer said the testing and material characterization efforts on magnesium directly support the DOE lightweight vehicle and overall petroleum displacement goals. Having clear understanding of the microstructure and the mechanical properties is valuable to industry. The fourth reviewer expressed the availability of the world-class facilities to public users is very important to advance the technologies in the United States. The final reviewer remarked that this is an excellent program.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers generally applauded the program's approach. One reviewer stated that the project has an outstanding approach to characterize material for potential lightweighting benefit. The second reviewer applauded the project as well thought out and well executed. The third reviewer also felt it was a good approach to work with industrial/academic partners. A fourth reviewer detailed support, saying the investigations on the microstructure and mechanical properties are necessary and sufficient for the project. Using X-ray diffraction and electron back-scattering diffraction to investigate the texture, microstructure and crystallography are good choices for this investigation. Getting to a forming limit diagram for AZ31 is a great goal. The final reviewer also provided detailed praise for the approach, saying that the investigations on the microstructure and mechanical properties are necessary and sufficient for the project. Using X-ray diffraction and electron back-scattering diffraction to investigate the texture, microstructure and crystallography are good choices for this investigation. Getting to a forming limit diagram for AZ31 is a great goal.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers stated generally that there was good progress. The first reviewer commented that the presentation included an extensive list of small (mean size about $60K) projects which were selected according to the criteria set out above and which from all indications were then effectively monitored and conducted. During FY2010, the HTML User Program managed 17 characterization projects in Lightweight Materials, and this poster presentation highlights one of them. The Magnesium Elektron North America user project is focused on the feasibility of developing industrially viable processes for producing shear rolled sheet. In particular, this project addresses technical barriers related to manufacturability and also adds to knowledge of the performance characteristics of advanced magnesium alloys. Magnesium Elektron was able to take advantage of a wide array of materials characterization capabilities available to industry users through the HTML User Program, which maintains world-class expertise and unique instrumentation gathered in one convenient location. The results from this investigation are a fundamental component of the process to produce new materials or materials with improved properties. A second reviewer indicated the accomplishments of getting confirmation on tilting the basal plane confirms the concept for getting better formability. Other techniques confirm orientation and basal plane distribution and size. These techniques will help guide the forming limit development and guide the sheet processing to reach the larger goal of creating more formable AZ31 sheet. A third reviewer commented that the project was customer and results driven. A fourth reviewer felt that the results will provide a better understanding of the benefits derived from sheer rolling, and a final reviewer stated that equipment and manpower to operate scientific equipment will result in innovation in America.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were very positive. One reviewer applauded that during FY2010, the HTML User Program collaborated with 18 companies, 25 universities, and 6 national laboratories on 68 user projects addressing critical technical barriers to achieving the goals of DOE's Vehicle Technologies Program. There were 96 researchers, 63% of them first-time users, who visited the HTML for a total of 716 research days. The HTML also supports the education and preparation of the next generation of scientists and engineers. During FY2010, students and professors from 25 universities participated in the HTML User Program. Five of those students earned their Ph.D. degree and one earned her M.S. degree based in part on research they conducted through the HTML User Program. This reviewer commented that users cost-share user projects through direct involvement with HTML staff members during the development of the user project; funding their time and travel to the HTML; costs of materials provided by the user and the research performed prior to the user project; subsequent collaboration with HTML staff and members to analyze and publish the results. Continued this reviewer, through a project funded by DOE's Industrial Technologies Program, ORNL and Magnesium Elektron are collaborating on implementing industrial-scale shear rolling. The characterization research conducted through the HTML User Program supports a research-scale mill developed by ORNL's Materials Processing research group. Data gathered during the HTML characterization studies will be included in the operations plan for a new Magnesium Electron mill to be scaled up in the summer of 2011. A second and third reviewer commented that it is all about collaboration, and a third reviewer remarked that this is the true definition of collaboration. The fourth reviewer added obviously strong collaboration with Magnesium Elektron North America (MENA) in the example project. Also appears to be strong support from (as evidenced by use by) 18 companies, 25 universities, and 6 national laboratories in FY10. The final reviewer affirmed by saying great collaboration with industry, Elektron Magnesium, on the materials characterization for magnesium sheet.

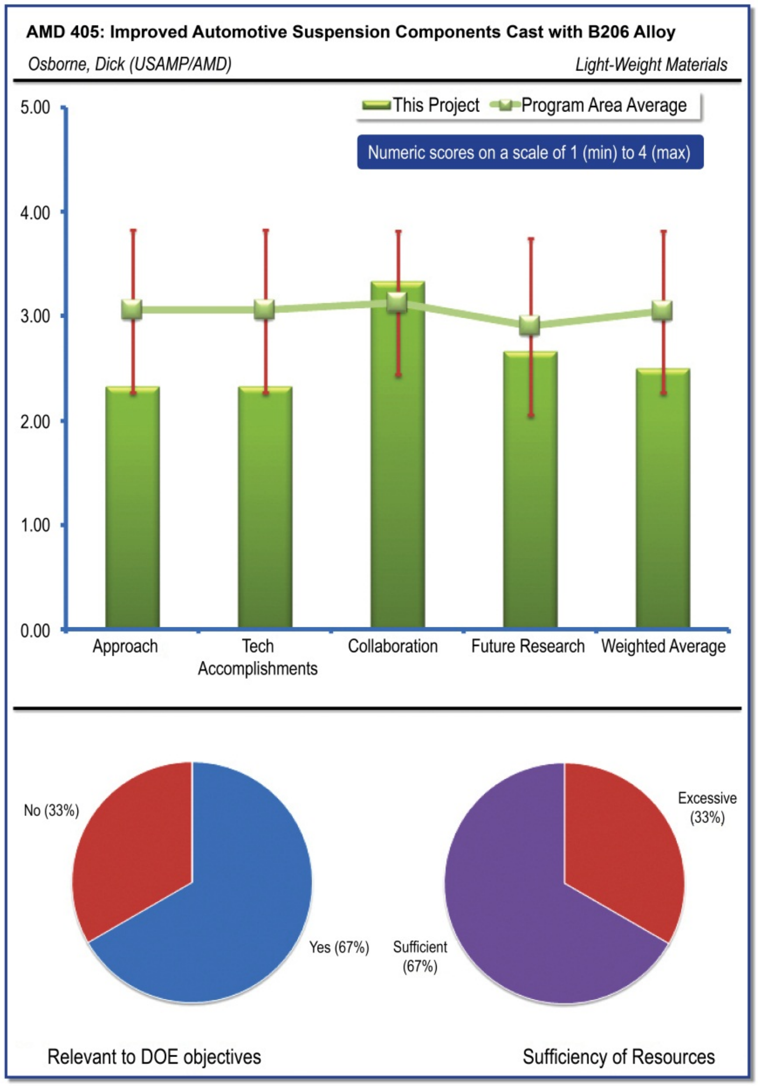
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviewers emphasized the continued characterization of rolled samples. One reviewer commented the project will continue to characterize rolled samples with XRD and EBSD and to complete fabrication of heated biaxial forming dome press for forming limit diagram (FLD). The project will also be involved in technology transfer. A second reviewer stated solid plans for continued characterization for the rolled samples. Generating the forming limit diagram will also be a solid contribution. A third reviewer commented that the plans for next activities are logical and well developed. A final reviewer observed that the User Lab is and will be utilized by the scientific community.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer remarked that the resources for HTML should be expanded as the development of magnesium and other lightweight materials expands. The second reviewer thought that the resources are adequate for the work, and stated that the HTML is organized into six User Centers: Materials Analysis, Diffraction, Tribology Research, Residual Stresses, Mechanical Characterization, and Thermography & Thermophysical Properties. A third reviewer commented that the work should continue, but the resources were not known from the presentation. The fourth reviewer felt that the appropriate level of funding was available to support the unique and useful capability of the HTML, and a final reviewer commented that the project was well equipped, and well–staffed.

AMD 405: Improved Automotive Suspension Components Cast with B206 Alloy: Osborne, Dick (USAMP/AMD) – lm040



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers generally thought that the project supports DOE objectives. The first reviewer commented that high strength aluminum alloys support DOE objectives for petroleum displacement as AMD704 Low cost fasteners are required for Mg applications in MMV systems. A second reviewer stated that the B206 casting is being introduced as a less expensive substitute for 6082-T6 forging. The final reviewer stated that the objective of this project is to facilitate vehicle lightweighting by providing lower cost cast B206 aluminum alloy automotive suspension components with equivalent mechanical properties and performance as forged aluminum. Ferrous material solutions dominate suspension components due to strength, stiffness and cost benefits. Forged aluminum solutions are attractive with respect to strength but are at a disadvantage due to cost and diminished domestic supply base. Castings offer reduced cost and a larger domestic supply base but need improved mechanical and fatigue properties to be considered as an alternative to ferrous solutions. The technical target is to cast automotive control arms with mechanical properties and fatigue equivalent to that of a baseline 6082-T6 forged control arm.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers conveyed mixed opinions about the approach. One reviewer provided detailed assessment of the approach, stating the most common means of attaching magnesium components to automotive steel structures is to isolate the steel from magnesium through use of aluminum washers, spacers and/or fasteners. The difference in electrochemical potential is less between aluminum and magnesium than it is for steel and magnesium, thereby generating less galvanic corrosion. To be considered as an alternative to aluminum isolation, nano-ceramic coated steel fasteners must induce less galvanic corrosion than aluminum. The project established a two phase approach. (1) Apply nano-ceramic coatings to steel coupons, evaluate the galvanic current between the coated steel coupon and magnesium and compare results against aluminum coupled with magnesium. If the nano-ceramic coated steel coupons exhibited less galvanic corrosion than aluminum then Task 2 can begin. (2) Task 2: Apply nano-ceramic coatings to steel fasteners, evaluate the galvanic and general corrosion of the coated steel fasteners against magnesium using a modified VDA test (salt-spray), and compare against aluminum fasteners mounted against magnesium. The VDA test is a European corrosion test. A second reviewer asserted that AMD405 had a very poor approach in that the presentation reflects positive results but no data were presented. For AMD704, the reviewer commented that the fastener corrosion approach was exploratory without an experimental design. A third reviewer commented that in spite of the confusion of the combination of two projects, the authors finally manage to give some coherence to the presentation.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer stated that the Design of Experiments was completed and showed that the SiN nano-ceramic coating has the most significant impact on galvanic current and was not overly sensitive to coating layer thickness. Tested multilayer coating thickness is shown in the slides. Nano-ceramic coated steel using a multi-layer coating of silicon oxide, aluminum oxide and UV curable topcoat exhibited less average galvanic current (0.55 mA/cm2) than 6061 aluminum (1.26 mA/cm2) when coupled with magnesium in a salt water solution. The project demonstrated the concept feasibility of nano-ceramic coatings to isolate steel from magnesium. Initial VDA testing shows less mass loss for multilayer SiN-AlO-UVAlO nano-ceramic coating. About AMD405, one reviewer stated that results were not been presented. Additionally, AMD704 had inconclusive results, with no standard test for the application. A third reviewer stated that replacing aluminum alloy by another aluminum alloy is difficult to rate well as there is no lightweighting benefit, but otherwise, the progress has been good.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were mixed. One reviewer said reasonable collaboration, listing collaborators on this project as USAMP, Alfred University, Kamax Auto Parts Co., Ltd. (KAMAX); Visteon; and General Fasteners. A second reviewer stated that for AMD704, collaboration included fastener suppliers and OEM's. For AMD405, this reviewer felt that the project was prematurely closed. A third reviewer stated that the impression was of reasonable collaboration but that the presenter was not very clear on it.

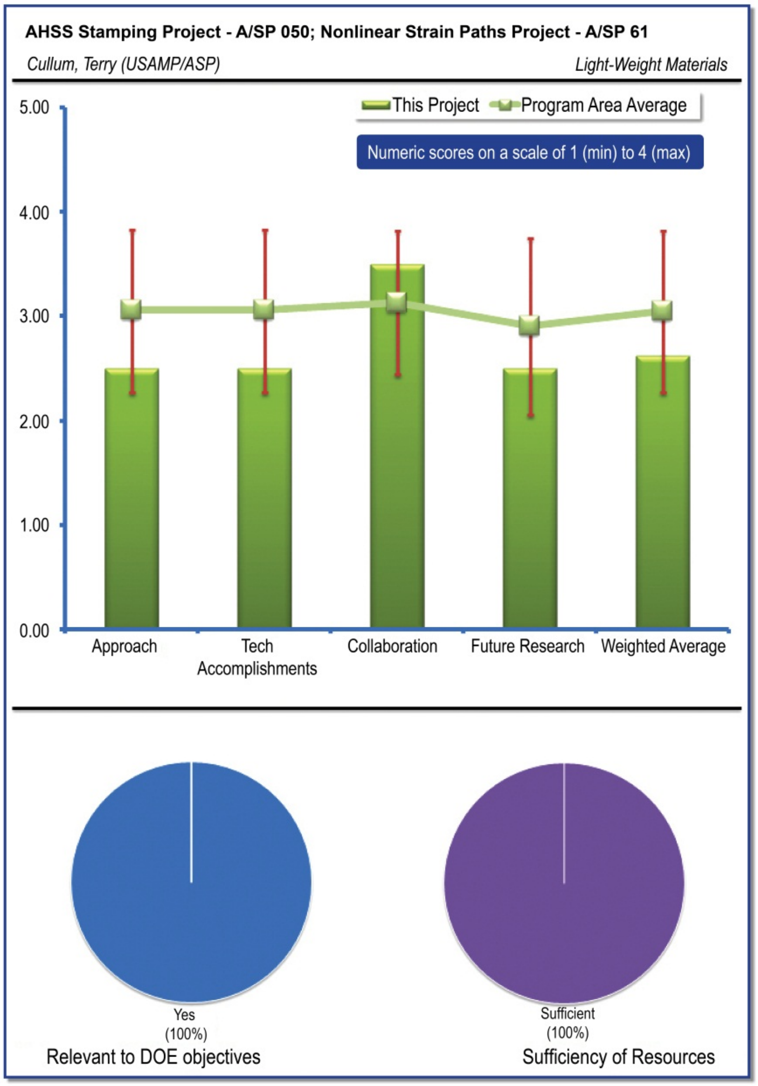
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviews of future plans were mixed. One reviewer indicated that the successful conclusion of this work will demonstrate the concept feasibility of nano-ceramic coatings for use on steel fasteners as a means of mitigating galvanic corrosion between magnesium and steel. Future work would be to demonstrate the technical feasibility of using nano-ceramic coated steel fasteners on magnesium substructures. It will also establish the ability of nano-ceramic coatings to achieve reliable torque/tension requirements. This reviewer recommended a useful next step will be to evaluate residual torque of assembled joints with nano-ceramic coated fasteners and to determine if nano-ceramic coatings have sufficient durability to resist damage induced by handling and assembly as well as assembly stress. The general corrosion performance of nano-ceramic coated fasteners will be evaluated. The second person commented that there should be more projects of this kind because these are the ones which will keep a lid on prices. For AMD405, one reviewer remarked project is closed, no further plan towards commercialization. This reviewer questioned, did we waste tax payers money? For AMD704, this reviewer remarked, no real plan, did we waste tax payer money?

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer thought that resources were adequate to the task. A second reviewer remarked that AMD405 had no tangible results, and that for AMD704 there were minimal tangible results and plan. The final reviewer remarked that work should be continued, but introduced as not being “lightweighting!”

AHSS Stamping Project – A/SP 050; Nonlinear Strain Paths Project – A/SP 061: Cullum, Terry (USAMP/ASP) – lm041



Reviewer Sample Size

This project had a total of two reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers felt the project was relevant to DOE objectives. One reviewer stated that the use of advanced high strength steels in vehicles is an enabler for lightweighting. Both stamping and understanding of material performance after complex forming and heating operations are relevant for applications. A second reviewer acknowledged any project with AHSS supports DOE objectives because higher strength and elongation properties of these materials mean less material while improving on safety.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers felt that although there was some concern in the past, the current approach is clear and effective. One reviewer stated that the non-linear strain path is planned well and the project is aiming to solve a critical material problem. AHSS Stamping is a long running project; even though the current approach is quite clear the past performance could not be judged and in future projects should have limited scope, duration and budget so that the outcomes can be measured effectively. A second reviewer found that overall, the approach is very good. One aspect this reviewer did not hear about was that regardless of the strength, formability, cracking, etc., what is the minimum sheet thickness the industry can work with. This reviewer opined that the potential of AHSS is not fully realized yet.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer commented that the accomplishments are very good; the examples are very telling.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Among the comments were that this is an AS P project with steel manufacturers and OEM participation; however, the stamping project does not have in-kind contributions listed. On the other hand the non-liner strain project is well supported by industry participation. A second reviewer indicated collaborations were very extensive.

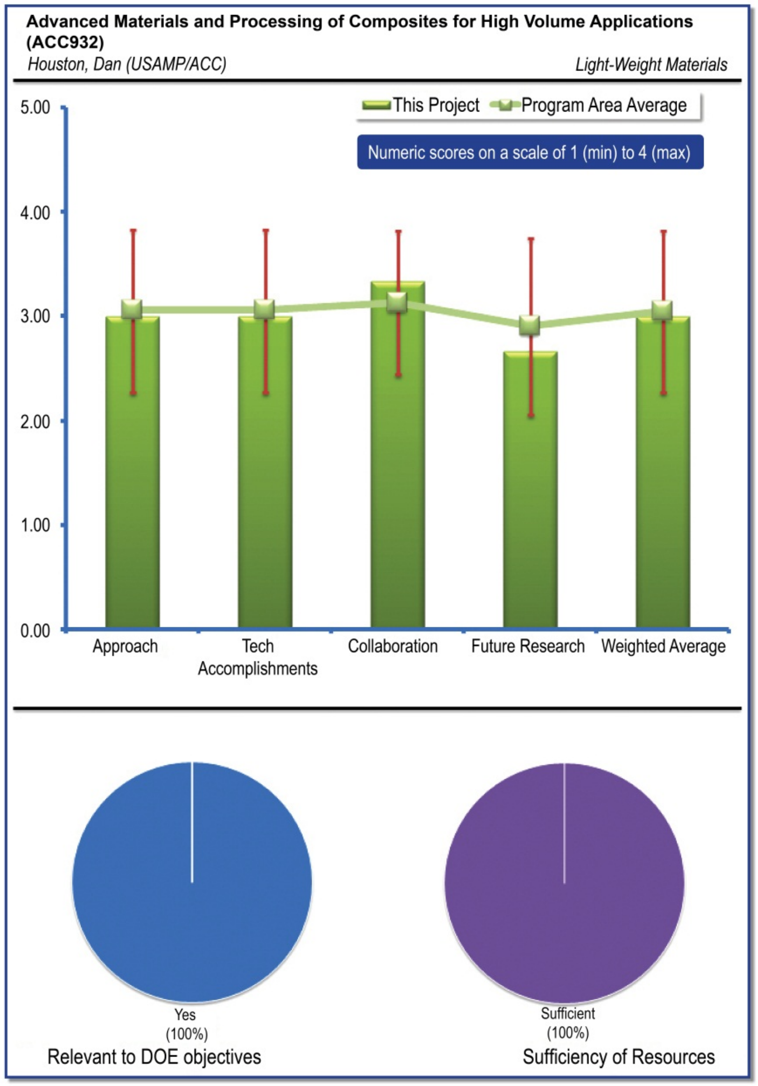
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer pointed out that the stamping project should be completed this year and recommended that any gaps to be studied should be defined and started a new project. A second reviewer also noted that the project is almost over and recommend it should be continued. This reviewer also suggesting seeing comments made in response to question #2.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer commented that since the project is almost over and achieved goals, it should have been sufficient.

Advanced Materials and Processing of Composites for High Volume Applications (ACC932): Houston, Dan (USAMP/ACC) – lm046



Reviewer Sample Size

This project had a total of three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers thought the project supports DOE objectives. The first reviewer stated that the project is in line with the objectives of the Vehicle Technologies lightweighting effort because the objective of this project is to use composite materials to decrease the mass of high-volume automotive structures, at acceptable cost. The reviewer summarized the project goals as: (1) guide, focus, and showcase the technology research of the ACC working groups; (2) design and fabricate structural automotive components with reduced mass and cost, and with equivalent or superior performance to existing components; (3) develop new composite materials and processes for the manufacture of these high volume components. Another reviewer said carbon fiber composites can reduce the weight of vehicles significantly; this project is aimed to optimize the production process. A third reviewer said this project fits DOE objectives given the fact that work represents applications of lightweighting materials and processes into real use.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

This reviewer commented that this is a large project with a great number of focus areas and urges that the structure of the project or review of such projects be broken down into several parts in order to reduce the reviewer effort and to improve project performance. This reviewer was positive about the approach and provided a summary of the approach to this project to substantiate support and concerns. This reviewer summarized the approach as follows: The project targets two automotive structures, a structural composite underbody and a lightweight composite seat, as well as the materials and processes required to produce them. The underbody project will design, analyze, fabricate, and test a structural composite underbody for a large rear-wheel-drive vehicle. The primary research outcomes of this project are: A 2-minute cycle time (100k vehicles per year, 2 shift operation); methods of joining and assembly of the underbody to the vehicle; processes for fabricating oriented reinforcement within the time window; the seat project focuses on a second row seat which combines the functions of a seat (both with and without an integrated restraint system) and a load floor. The seat must save mass, be cost competitive at volumes from 20k to 300k, and the seat back must fold flat to create a load floor. The objectives for Advanced Materials and Processing of Composites for High Volume Applications (ACC 932) are: (1) Carbon Fiber Sheet Molding Compound SMC: develop high-performance, cost-effective, carbon fiber SMC materials and associated processing techniques for high-volume automotive components to implement both Class-A and structural applications that allow significant weight savings coupled with superior mechanical performance. (2) Bond-Line Read-Through (BLRT): enable implementation of minimum thickness composite closure panels to eliminate weight added for appearance by developing a validated FE model that can predict, and therefore allow design optimization of, the severity of BLRT distortions based on part design. (3) Direct Long Fiber Technology direct compounded long fiber thermoplastics (DLFT) & Long Fiber Injection LFI Thermoplastics: determine processing parameters, customize master batch formulations for Nylon material, establish composite material properties, investigate processing equipment and tooling design and develop Tier-1 supplier interface. Another reviewer remarked that the presentation was a multiple-project presentation; at least four projects were coupled together. Projects included structural under-body and composite seat; body line read through; composite fiber SMC; and direct long fiber Technology – thermoplastic. While the first project is a demonstration project others are process optimization in nature. The third reviewer remarked that it was very difficult to present a good approach when so many sub-projects are being summarized. The authors managed to give a flavor but it was somewhat discontinuous.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

A reviewer applauded that the work on this project has been excellent. The reviewer stated that the technical accomplishments for Focal project 4 are: completed final design of composite seat; completed CAE for all loading requirements; completed molding and assembly of 30 sets of seats, 22 of which were tested; and achieved a 23% weight reduction for the seat structure compared to a typical steel seat structure. The technical accomplishments for the Structural Composite Underbody task are: the technical cost model; the manufacture and assembly of the underbody for $5/kg saved, based on TCM of steel and composite systems; the successful mold and delivery of over a dozen underbodies for assembly and testing; and the non-destructive evaluation of impact damage from steel ball drops. The e technical accomplishments for the Carbon Fiber SMC are: molding of full underbody part, which replaces 16 steel parts, saving 11.5 kg mass (31%); development of a high strength glass fabric SMC; weld bonding assembly scenario demonstrated; technical cost model indicates $5/kg mass saved; design methodology demonstrated for crush of surrogate part; design of test methodology and fixturing; final design, CAE, molding and assembly of seats, showing 23% mass savings relative to steel seat; and static and dynamic testing of seat assemblies. The second reviewer stated that the demonstration projects are completed and the parts are being evaluated. In CF SMC project the feasibility of SMC is proven; however, OEM needs to pay for the mold development mentioned in the future work. Also part fabrication should be supported by the OEM funds rather than DOE funds. The third reviewer observed that the presented results show good progress with respect to what is but also the difficulties in combining all these materials. The talks also made clear that a lot more needs to be done before these new materials and techniques can be implemented into productions of "ordinary" vehicles.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

Opinions on collaborations were generally very positive. One reviewer commented that collaborations appear to be very good. The second reviewer remarked that many OEM and Tier 1 suppliers are involved with the ACC and the tech transfer is quite aggressive with plant trials and testing. A third reviewer said that the OEMs GM and Ford are listed by subprojects. The collaborators for the Focal Project 4 are Multimatic, Continental Structural Plastics (CSP), Century Tool and Gage, ORNL, University of Massachusetts-Lowell, IBIS , Camanoe, Composite Products, Inc; Altair Engineering, Chelexa Design, RCO Engineering, and MGA Research. This reviewer remarked that the collaborators for the Carbon Fiber SMC tasks are Continental Structural Plastics (a Tier One supplier), Zoltek (carbon fiber manufacturer), and Huntsman (epoxy resin system).

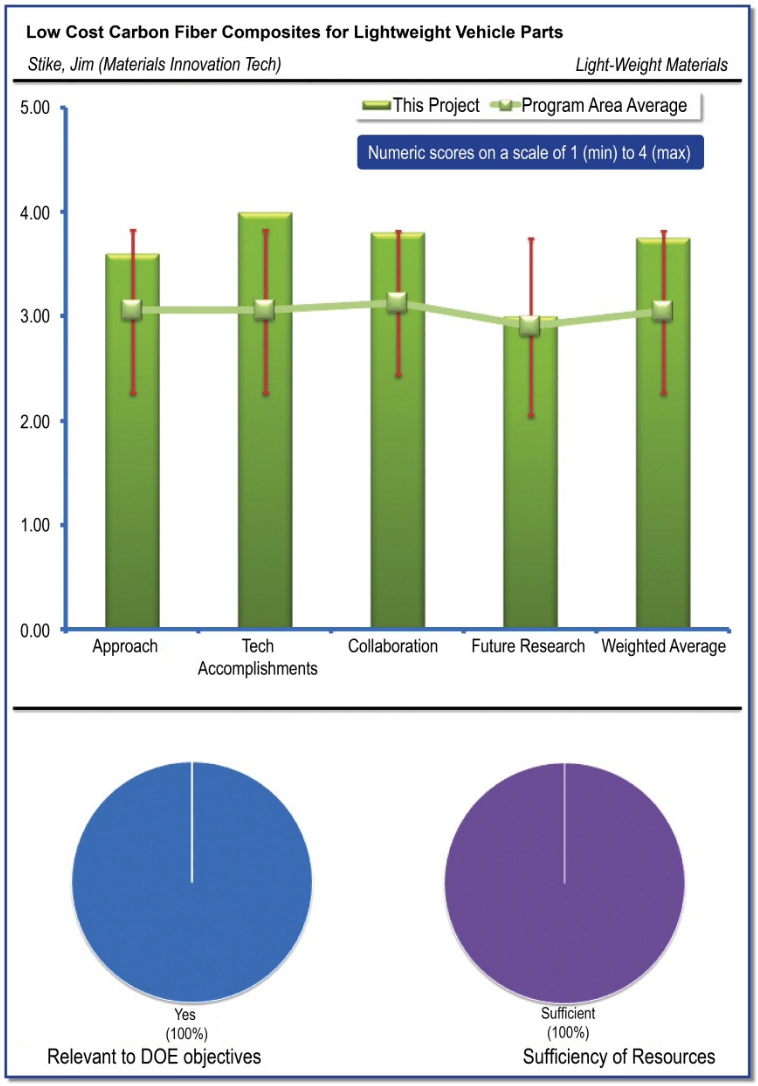
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer remarked that future efforts for Carbon Fiber SMC will be: to continue to refine understanding of critical compounding variables, such as compaction pressure, resin viscosity, and resin/fiber ratios; using lower cost carbon fibers, evaluate low cost methods to de-bundle the carbon fibers, such as bundle spreading, air blasts, de-tensioning, and an alternative chopper system; to study additives and resin modifications to enhance the surface appearance of the molded material; and to mold developmental parts for potential OEM applications. Focal Area 4 future efforts will be: molded underbodies will be assembled and tested in static and dynamic modes, with the results compared to the analysis; develop a realistic automation scenario for efficient high volume preform preparation; complete comparison of test results and analysis of the composite seat; and develop and carry-out work plan for additional testing and verification as needed for automotive integration. A second reviewer noted that all four projects are planned to be completed this FY or shortly after that. While the BLR is complete, DLFT is expected to finish end of this year. The third reviewer said that the case was not clearly made whether this needs to be continued. This reviewer believes that it should be pushed further.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer commented that this effort should be expanded for the industry to start producing such improved vehicles.

Low Cost Carbon Fiber Composites for Lightweight Vehicle Parts: Stike, Jim (Materials Innovation Tech) – lm047



Reviewer Sample Size

This project had a total of five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer felt the project was relevant and stated that this project is well aligned with the DOE goal of reducing petroleum dependence as it investigates the opportunities of carbon fiber composite parts for lightweighting of vehicles. The second reviewer offered that the use of CF in both thermosets and thermoplastic applications offers more opportunities to lightweight the vehicle and Materials Innovations is developing the right next-generation process to enable more, wider application of CF plastics. A third reviewer concurred, stating that it is necessary to prove the capability of a material by conducting a demonstration project; the cost competitiveness of parts manufacturing is an important enabler; this project is aimed at delivering answers to these questions. The fourth reviewer added that the application of carbon fiber components is key to achieving cost reduction goals post-2020. The final reviewer suggested that the three-dimensional engineered preform (3-DEP) technology is a great method to produce net shape preform using virgin or reclaimed carbon fibers.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers felt the approach was sound. One reviewer said that the project is a pilot scale demonstration project, and it is trying to build a large industrial size equipment for trials. The technology is being proven with small size components and seems feasible. A second reviewer felt that it was a very good approach, probably due to commercial opportunities; however, barriers and limitations were not disclosed. This reviewer also recommended a FOA for a larger focused program with clear objectives and deliverables over a 3-5 year period. A third reviewer stated that the 3-DEP attacks the main barrier of net shape production of preforms. The robustness and dimensional stability of the 3-DEP process is a key element for high volume parts. Using the slurry molding process delivers the pre-forms accurately. A final reviewer said excellent progress to date; the project is well on the way to demonstrating low volume applications to prove the process out.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

All reviewers stated that there was very good progress relative to the objectives. One reviewer applauded the great progress on overcoming the barriers and challenges. Good progress on the design and initial forms for the four target parts. The roll goods efforts appear to be ahead of schedule and a success. Congratulations on the Innovation Award. The second reviewer added that the project has proven the process and the properties achieved are comparable to other processes; even though high quality surface finish is not guaranteed, the process has potential for weight saving; also use of recycled fibers in the process will increase the environmental benefits. however, relying on recycled fibers alone will not be advisable as not much source is available for obtaining recycled carbon fibers. This reviewer recommended that the cost analysis needs to be done for new fibers as well. The third reviewer affirmed stating significant effort has been expended designing and fabricating equipment, which is a significant technical accomplishment, but limited material characterization. Possibly, technical accomplishments reflect personnel technical capabilities. A fourth reviewer emphasized success with the due process approach, i.e., developing CF materials using both thermsets and thermoplastic processes.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Opinions on collaborations were very positive, with one concern about differing industry requirements possibly driving diverging objectives. One reviewer applauded the excellent involvement of others, potentially to a fault. Aerospace and automotive have diverging property and cost needs/objectives. Recommend separation of projects to address specific industrial application/needs. A second reviewer asserted good collaboration with the key suppliers for automotive parts. Excellent ties to the supply base for resins, molders, and tier one suppliers, and the success with international automotive components (IAC) is impressive. Good work with the planned CFD efforts. A third reviewer commented that many fiber suppliers and manufacturers are involved in the project along with OEMs, and the final reviewer remarked demonstrated collaboration with government labs, OEM's and suppliers.

Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer recommended the highest priority be to align the needs for three different processing approaches for making parts. Having the hardware available for investigating the processing and dimensional stability of large runs of parts should give the cost and performance data that industry needs for commercial decisions. The second reviewer offered that the duration of funding limits the opportunity for future research proposals and recommended a large FOA focused on development and commercial demonstration. A third reviewer recommended that various thermoplastics should be considered only along with the right-sizing compatibility with the selected thermoplastics. Otherwise the composite will fail in durability and cause a setback in this field. A fourth reviewer stated that it is a scale-up for production so more private investment is needed compared to government funding. The government funding has proven the technology and it is necessary for the industrial partners support the development further. The final reviewer commented that the project had good plans for the future to develop the process… press on.

Question 6: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

One reviewer felt that additional human and financial resources could result in focused application of technology. A second reviewer recommended that the project should be additionally funded to investigate the multiple processes so that the robustness, dimensional stability, and mechanical performance can all be evaluated.