2023 Vehicle Technologies Annual Merit Review
June 12–15, 2023

Guidelines
R&D Posters

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Changes at a Glance for 2023

- All posters must be uploaded through this Google Form no later than **APRIL 14, 2023.**

- For **reviewed** posters, PIs must record a 5-7 minute presentation and upload the video through this Google Form. The videos will be available on demand for reviewers only. All video recordings are due no later than **APRIL 28, 2023.**

- There will be no poster session. For reviewed posters, reviewers will reach out directly to PIs with any questions or comments. PIs must look for and be responsive to reviewer emails from June 12-June 30.

- The AMR will be virtual.

Submission Deadline

Poster presentations must be uploaded no later than

APRIL 14, 2023.

Poster recordings must be uploaded no later than

APRIL 28, 2023.

No exceptions.

Legal Indemnification

FOR INFORMATION ONLY. DO NOT INCLUDE IN PRESENTATION.

By submitting a presentation file to Oak Ridge Institute for Science and Education (ORISE) for use at the U.S. Department of Energy's (DOE's) Vehicle Technologies Office Annual Merit Review Meeting and to be provided as hand-out materials, and posting on the DOE's website, except for employees of the Federal Government and DOE laboratory managing and operating contractors, the presentation authors and the organizations they represent agree to defend, indemnify and hold harmless ORISE, its officers, employees, consultants and subcontractors, and the DOE from and against any and all claims, losses, liabilities or expenses which may arise, in whole or in part, from the improper use, misuse, unauthorized use or disclosure, or misrepresentation of any intellectual property claimed by others. Such intellectual property includes copyrighted material, including documents, logos, photos, scripts, software, and videos or animations of any type; trademarks; service marks; patents; and proprietary, or confidential information.

Employees of Federal Government agencies and DOE laboratory managing and operating contractors collectively represent and warrant that they have acquired the rights and/or permission for use of all intellectual property, as listed above and claimed by others, that is needed for developing and submitting a presentation file to ORISE for use at the DOE's Vehicle Technologies Office Annual Merit Review Meeting, and to be provided as hand-out materials, and posted on the DOE's website.

Creating Your Poster Files

- Your poster is public and will be posted to the DOE Vehicle Technologies Office (VTO) Annual Merit Review (AMR) website.
- You are required to create the following file:
    - A Microsoft PowerPoint file following the instructions and guidelines contained within this PowerPoint template.
    - Once your PowerPoint presentation is complete, you must create a <u>PDF</u> version of your PowerPoint presentation following the instructions in this document.
- You may design your slides on either a PC or a Mac.
- **Naming your files**: Use the file name that ORAU sent you in your presentation request email to name your electronic PowerPoint and Adobe files:

Proj#_PI LastName_2023_p

Example: ACE002_smith_2023_p

Formatting Your Poster

- **Format**: Use a 16:9 format

- **Font**:
  - Do not use proprietary fonts. All fonts in the presentation must be standard across Windows and Mac platforms or information may be lost when creating the Adobe PDF version of your presentation. Use only Arial, Times New Roman, Courier New, Verdana, or Trebuchet MS.
  - Use at least a 12-point font.

Formatting Your Poster (Continued)

- Ensure there is high contrast between text and background for best readability. We recommend a white background along with black or dark text. Light or gray text is hard to read so adjust your template accordingly.

- Please remove any copyright indicia from your company template so that your poster can be posted on the AMR website.

- Spell out acronyms and chemical formulas the first time that you use them.

- Add Alt Text to all graphics, tables, and charts.

- Fill out the Properties box for your presentation.

Adding Images to Your Poster

- Do not copy/paste images into your presentation.
  - On PC: Insert the image using the “Insert/Picture/File name” menu option rather than copying/pasting.
  - On Mac: Insert the image using “Insert/Picture/Picture From File” menu option rather than copying/pasting.

- Crop images in an image processing software. Save the images as an external file (.jpg and .png file formats work well).

- Inserting original images into your presentation works best for preserving image clarity. If originals are not available, it may be an indication the image is copyrighted.

Animations and Videos

- Be aware that animations do not convert to PDF and animated information may not be visible to reviewers or in the final PDF posted on the VTO AMR website.

- Videos do not translate to PDF reliably and will not be posted on the VTO AMR website.

Content Restrictions

- Your presentation is public and will be posted on the VTO AMR website.
- You must include the phrase “This presentation does not contain any proprietary, confidential, or otherwise restricted information” on at least the first slide (you may put on all slides if you wish).
- Do not include any proprietary or confidential information. It is your responsibility to ensure that any subcontractor information is not proprietary or confidential.
- You must remove the copyright indicia on your company template if that indicia is part of the template; otherwise, we cannot post your presentation on the VTO AMR website.
- Your presentation may **not** include any slide that has “Official Use Only” or “Sensitive” or any similar wording, or information that your organization might construe as being in such categories.
- You must include the phrase “Any proposed future work is subject to change based on funding levels.” on all slides with future-looking statements.

Copyright Restrictions

- If you use any copyrighted information or graphics or intellectual property, it must be properly attributed.
- Do not assume subcontractor information may be used without their approval.
- Do not assume that information or images published on a website can be used without permission.
- If you use copyrighted graphics (including copyrighted photos and journal and magazine covers), you must provide written permission along with your submitted file for it to be accepted by DOE for the purposes of the AMR.
- Intellectual property includes copyrighted material, including documents, logos, photos, scripts, software, and videos or animations of any type; trademarks; service marks; patents; and proprietary or confidential information.
- Also see the indemnification statement on p. 7.

Use of Logos

- **Do NOT** use the DOE logo or seal in your presentation. Some examples include:

- **Do NOT** use the EERE slide template.

- If you use corporate logos for organizations other than your own, secure permission for use.

Recommended Slide Order

- **Title Slide**: must include Project ID, name of principal investigator, name of presenter if different, and "This presentation does not contain any proprietary, confidential, or otherwise restricted information."
- **Overview Slide**: must include timeline, budget, barriers, and partners
- **Relevance**
- Milestones (if not included as part of Approach)
- **Approach**
- **Technical Accomplishments and Progress**
- Responses to Previous Year Reviewers' Comments
- **Collaboration and Coordination with Other Institutions**
- Remaining Challenges and Barriers
- **Proposed Future Research**
- **Summary Slide**

You are strongly encouraged to include the slides in bold.

Posters

- Posters are **due no later than April 14, 2023.**
- Posters can be formatted as a complete slide deck or as one poster.
- Poster file formatting:
    - You must submit a .pdf version of your poster
    - Use a 16:9 aspect ratio for best viewing
    - Do not use a transparent background
- Upload your file through this Google Form.
- **There will be no poster session. For reviewed posters:**
    - Reviewers will be contacting PIs directly via email with any questions. PIs must look for and be responsive to reviewer emails from June 12-June 30.
    - Poster presentations must be recorded and will be available on demand during AMR. Your poster presentation recording should be between 5-7 minutes. Upload your video recording through this Google Form.

Late Information Addition

- Information and research updates that become available following the submission of the presentation but before the AMR may be supplied in response to questions submitted via email.

- **No extensions will be granted for poster submission.**

- Any additional information must still adhere to the time limitations.

Preparing your PowerPoint for Web-Publication/PDF

If making your poster in PowerPoint, make sure to create your web-ready PDF file (the file that will be published on the VTO AMR website) using the following instructions on the next pages (p. 20-25) to:

- Add Alt Text
- Add presentation detail information
- Create and verify the final PDF

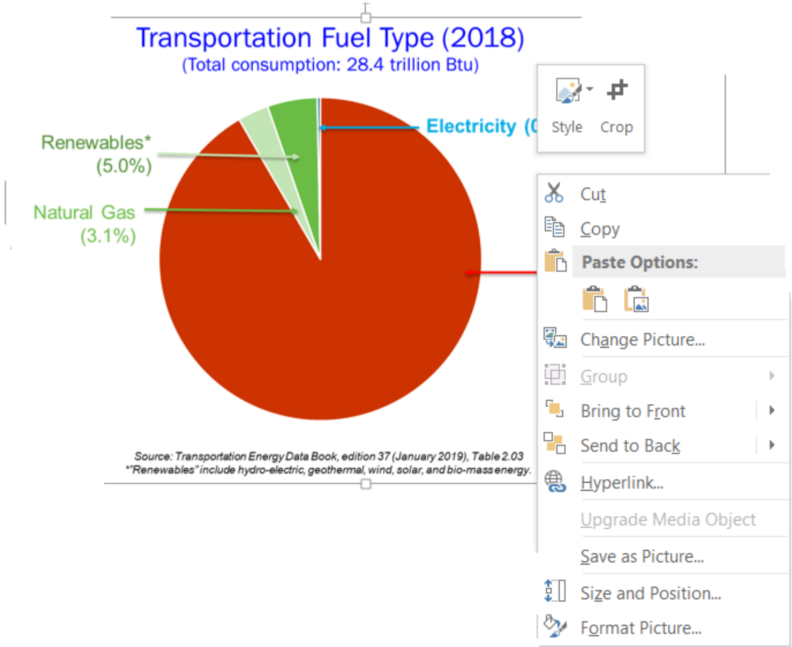
Adding Alt Text to Your Presentation

- You must add alternate text (Alt Text) to key graphics, charts, and tables on each slide.
- Alt Text helps visually impaired people who use screen readers to know what the picture shows.
- Be accurate and succinct. You do not have to say “image of...” or “graphic of....”
- A good Alt-Text example of a picture of a crowd at a basketball game:

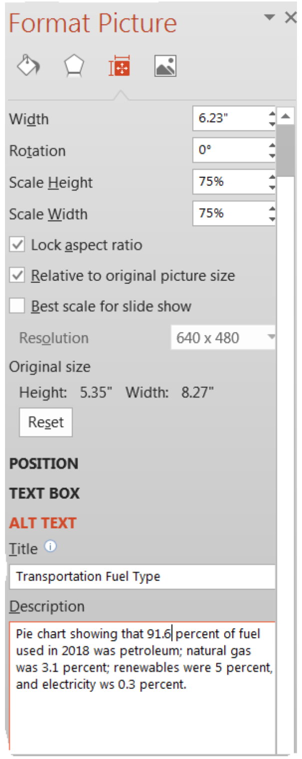
  “A large, diverse group of cheering students, standing up, and fist-pumping on the bleachers of a basketball game.”

To Add Alt Text to a Chart, Graph, or Image

Note: These instructions are for PowerPoint 2013. If you have a newer version, you may be able to right click on the graph or chart and select "Edit Alt Text" directly from the menu.



1. Right click on the graph or chart and select "Size and Position..."

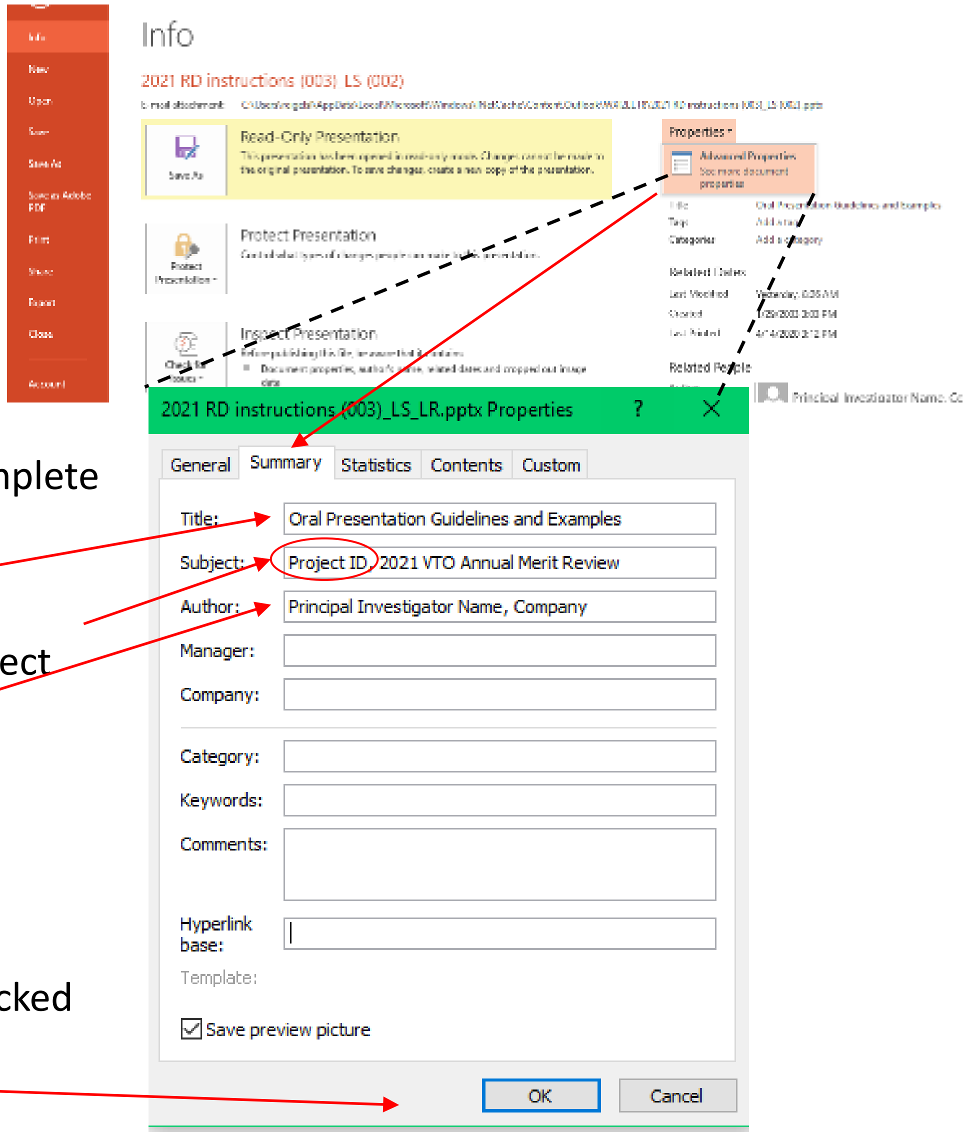


2. Select the "Alt Text" option and enter the Title and a short brief Description of the chart

3. Close the Format Picture pane to return to the PowerPoint slide

Adding Presentation Detail Information

- Under the **File** tab, select **Info**
- Click on “**Properties**” and then select “**Advanced Properties**”



On the “**Summary**” tab of the pop-up window, complete the following fields:

- **Title**: Enter the title of your presentation
- **Subject**: Substitute your **Project ID** into the subject
- **Author**: Enter the **PI Name** and **Company**

- **Save preview picture:** Make sure this box is checked
- Press OK

Creating Final Version of Your Poster (if using PowerPoint)

- Once your PowerPoint presentation is final, you must minimize your PowerPoint’s file size.
- Do this by using the “**Save As**” option to save the final version of your file as a PowerPoint presentation.
- Doing a simple “Save” command will not minimize file size.
- You can “Save As” an existing PowerPoint filename if needed.

Creating PDF Version of Your Presentation

- You are required to submit a PDF version of your presentation.
- After saving your PowerPoint file using the “Save As” option, save the file as a PDF using the same naming conventions as your PowerPoint file.
    - If you have Adobe Acrobat Pro software, you can use the Acrobat PowerPoint plug-in or select “Save As Adobe PDF” to create your PDF.
    - If you do not have Acrobat Pro, click “Save As” and select “PDF” from the Save As type menu.
- Click the “Options” button in the Save As window and make sure to check the box to enable accessibility tags. Look for text that says “Document structure tags for accessibility” or “Enable accessibility and reflow with tagged Adobe PDF.”
- Click “Save”.
- Select “NO” if asked if you would like to convert the presentation’s speaker notes to text annotations in the PDF.

Verifying PDF File

After you create the PDF,

- Scroll through the document and look at every page to ensure the PDF matches the PowerPoint file.

- Look for missing items from charts, such as legends and axis titles, which sometimes disappear due to incorrect object reordering that can result from the tagging process for accessibility.

- If you do find issues that you're not able to fix, a communications or publishing specialist at your organization may be able to help. Or, you can contact VTAMR@ORAU.org to help troubleshoot the PDF conversion.

R&D Evaluation Criteria

All R&D posters follow the same content and design guidelines for reviewer scoring.

Criterion	Weight
Relevance	Adequate/Inadequate
Approach	25%
Technical accomplishments	50%
Collaborations and coordination with other institutions	12.5%
Proposed future research	12.5%
Resources	Adequate/Inadequate

Consider these criteria and weights when creating your poster!

Slide Titles and Key Results

- **Slide Titles**: Except for the mandatory Title, Overview, and Summary slides, <u>all slide titles and headings should relate directly to the evaluation criteria.</u>

- **Key Results**: The key take-home message for each results slide should be communicated as a banner, header, or bullet.

Instructions for Specific Slides

- The following guidelines provide specific information on mandatory slides and the type of information expected within the criteria guidelines.
- **Your presentation should include:**
  - **Title Slide** (mandatory)
  - **Overview Slide** (mandatory)
  - **Review Criterion Slides** (mandatory, one or more slides as appropriate for each review criterion)
  - **Summary Slide** (mandatory)
  - **Technical Backup slides** (optional)
  - **Reviewer-Only slides** (optional)

- **The following slides include:**

Instruction	(Guidance for constructing the specific slides and sections)
Example Slide	(Examples are from previous AMR posters)

Title Slide

Instruction

- Include:
  - Project title
  - Name of the principal investigator
  - Name of the presenter if different from the principal investigator
  - Organization
  - Project ID# (which ORAU will provide to you)
  - Statement: “This presentation does not contain any proprietary, confidential, or otherwise restricted information.”

Instruction for all posters, unless otherwise noted

2023 DOE Vehicle Technologies Office Annual Merit Review Presentation

(replace with your title)

P. I. Name (always include)

Presenter Name (if not the P.I.)

Organization

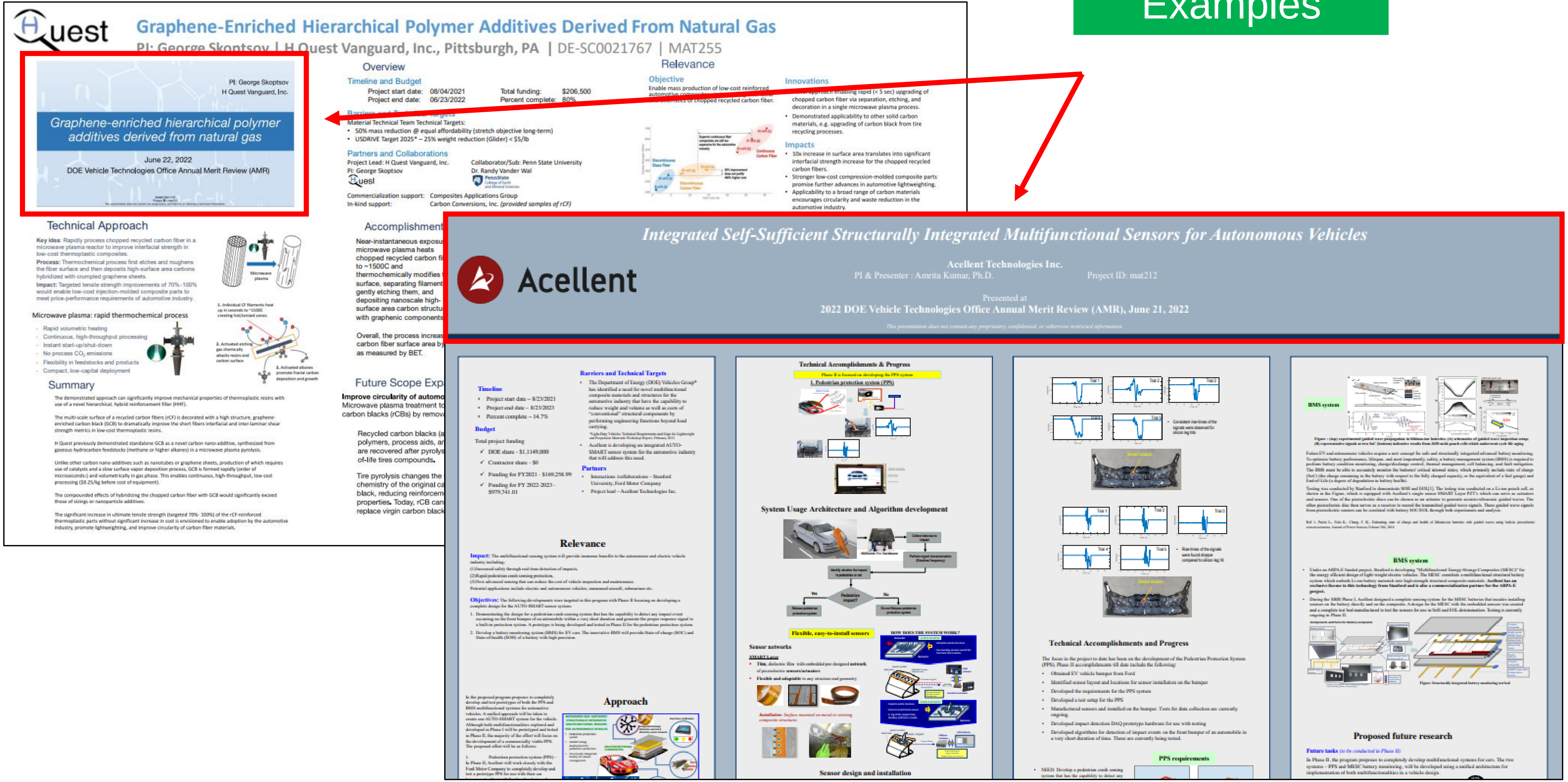
Date

Project ID #

(this will be provided to you)

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Title Slide Examples



Mandatory Overview Slide

Instruction

- Please prepare an Overview slide formatted and containing the information per the following slide:
  - Timeline (please confirm dates with your DOE HQ/NETL manager(s))
  - Budget (please confirm values with your DOE HQ/NETL manager(s))
  - Barriers (please list up to three technical barriers and technical targets from the most recent U.S. DRIVE Roadmap addressed by your project to be found at: https://www.energy.gov/eere/vehicles/us-drive-partnership-plan-roadmaps-and-accomplishments. MAT presenters should use the Light-Duty Workshop Final Report at https://www1.eere.energy.gov/vehiclesandfuels/pdfs/wr_ldvehicles.pdf as their guide. If you don't see a report on your subject matter, please contact the relevant Technology Manager.
  - Partners

Instruction

Overview

Timeline

- Project start date
- Project end date
- Percent complete

Budget

- Total project funding
  - DOE share
  - Contractor share
- Funding for FY 2022
- Funding for FY 2023 (if available)

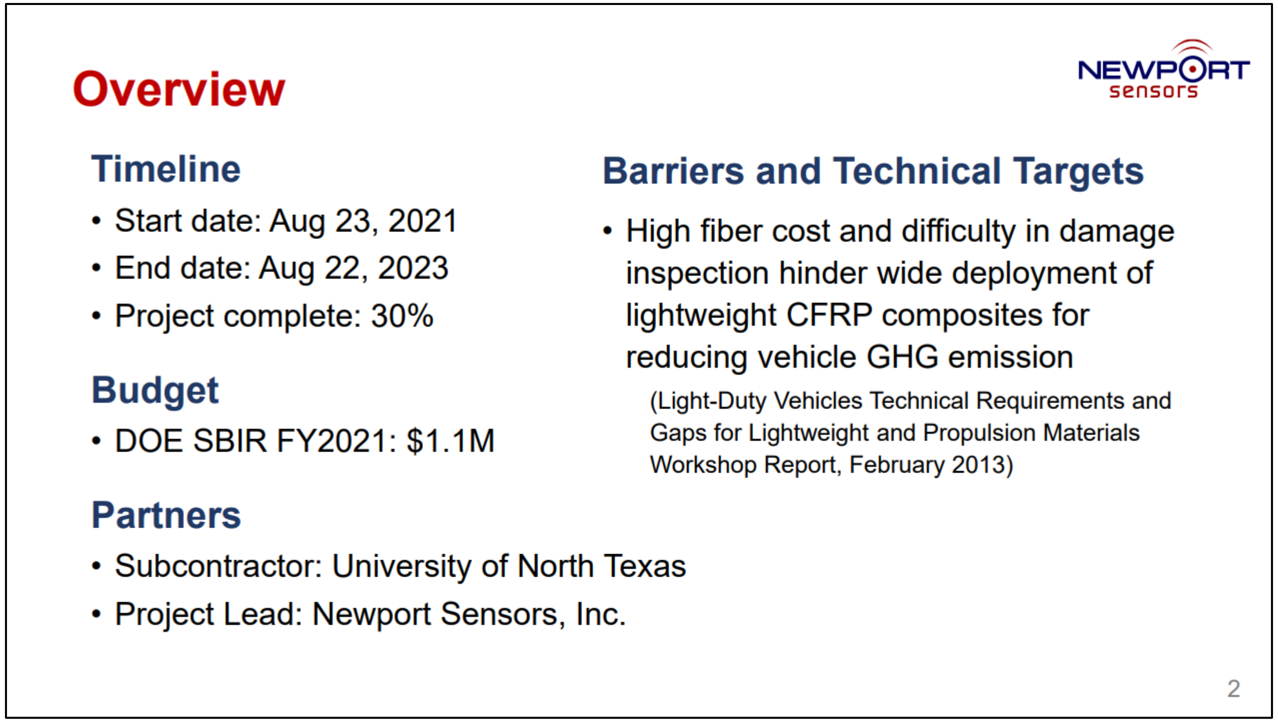
Barriers and Technical Targets

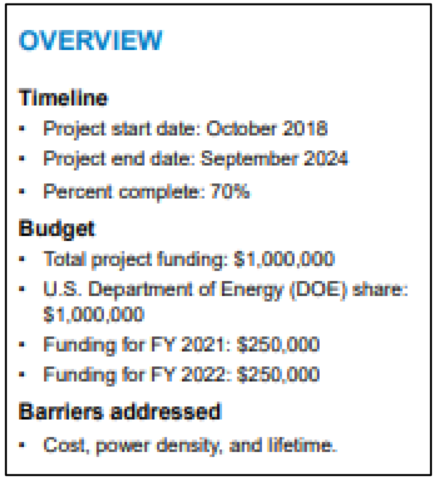
- List up to three technical barriers and technical targets from the most recent U.S. DRIVE Roadmap relevant to your project. For a list of roadmaps by subprogram, please see the link below: https://www.energy.gov/eere/vehicles/us-drive-partnership-plan-roadmaps-and-accomplishments
- If you don't see a report on your subject matter, please contact the relevant Technology Manager.

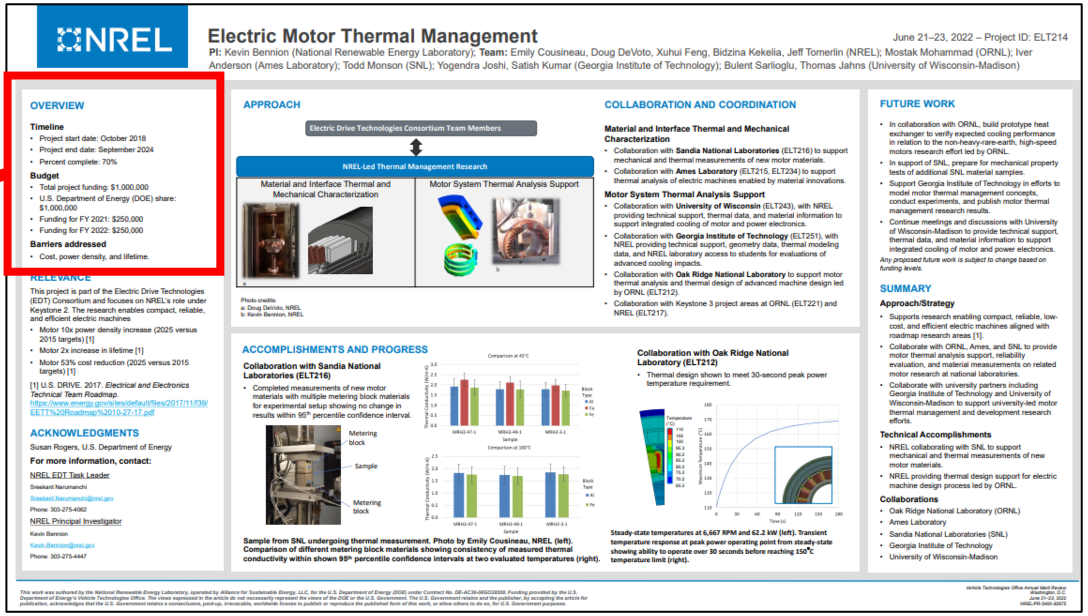
Partners

- Interactions/collaborations
- Project lead

Overview Slide Examples







Relevance

Instruction

- Relevance counts for 10% of your total project score.
- The title of these slides should make it clear that they are your project's **Relevance**.
- Information to include:
  - Describe the objective of your project and what you were to achieve over the past year in the work covered by your presentation.
  - Clearly show **how your project relates to the pertinent VTO subprogram area** and how it will achieve the goals of that area (refer to the subprogram Annual Progress Report goals linked on the next page).
  - Explain how your project will be relevant to
    - Reduction of energy costs
    - Increased energy security
    - Clean energy technology to move people and goods
  - Describe the impact of your project on addressing the <u>barriers</u> identified in the Overview slide and <u>other specific targets and milestones.</u>

Instruction

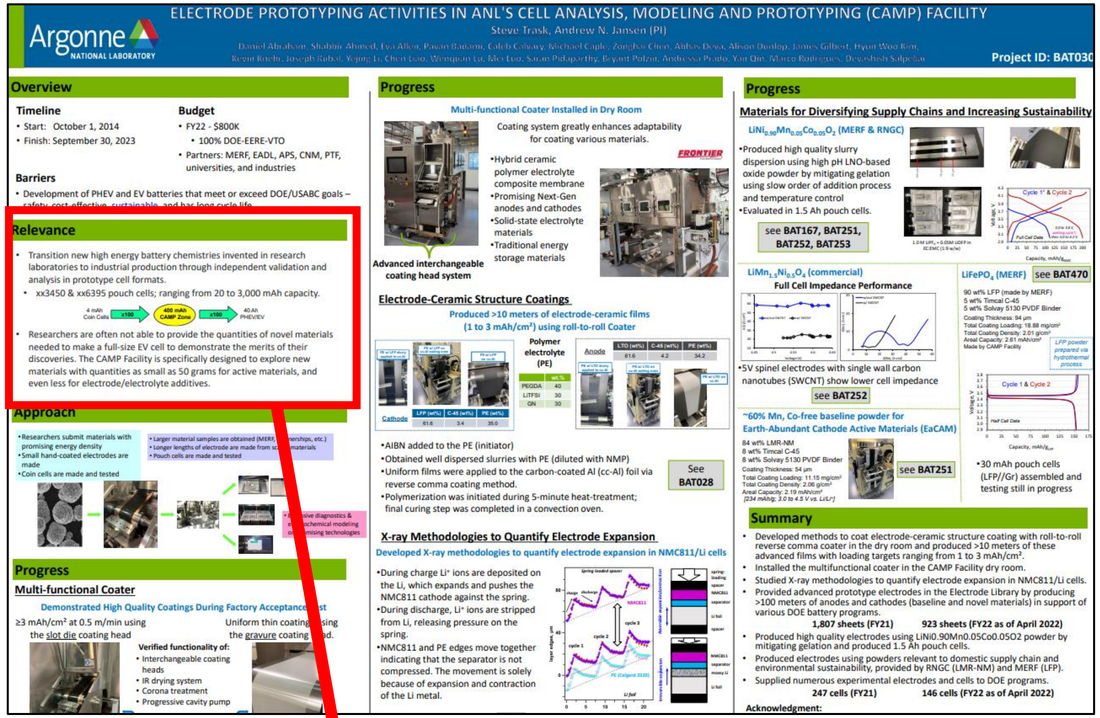
Relevance (Continued)

VTO Subprogram Goals

LINKS TO 2021 SUBPROGRAM ANNUAL REPORTS

- Advanced Engine and Fuel Technologies
- Analysis
- Batteries
- Electrification
- Energy Efficient Mobility Systems
- Materials

Relevance Slide Examples



Relevance

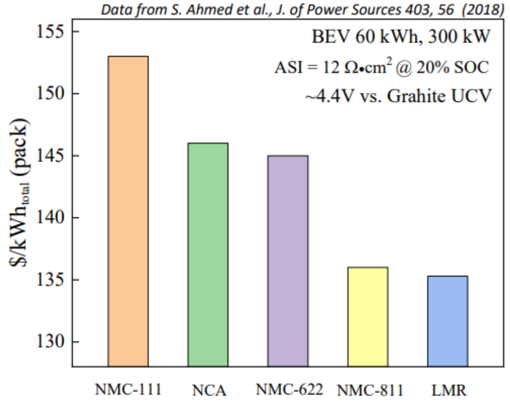
- Transition new high energy battery chemistries invented in research laboratories to industrial production through independent validation and analysis in prototype cell formats.
  - xx3450 & xx6395 pouch cells; ranging from 20 to 3,000 mAh capacity.

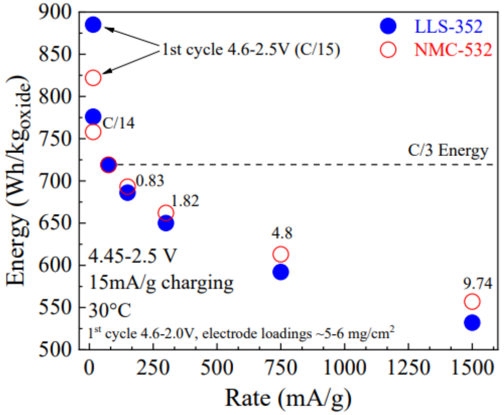
4 mAh Coin Cells → x100 → 400 mAh CAMP Zone → x100 → 40 Ah PHEV/EV

- Researchers are often not able to provide the quantities of novel materials needed to make a full-size EV cell to demonstrate the merits of their discoveries. The CAMP Facility is specifically designed to explore new materials with quantities as small as 50 grams for active materials, and even less for electrode/electrolyte additives.

Relevance

Data from S. Ahmed et al., J. of Power Sources 403, 56 (2018)





- Cost and safety are still the main drivers in the development of EV batteries, Mn-rich oxides offer advantages in both
- Technoeconomic modeling (above, left) shows that Mn-rich electrodes have the potential to reach cost parity with state-of-the-art NMC-811 in terms of pack-level cost
- Work from this project (above, right) has demonstrated that Mn-rich electrodes can achieve similar performance to their NMC counterparts
- Importantly, Mn-rich compositions can be made with little to no cobalt while maintaining performance

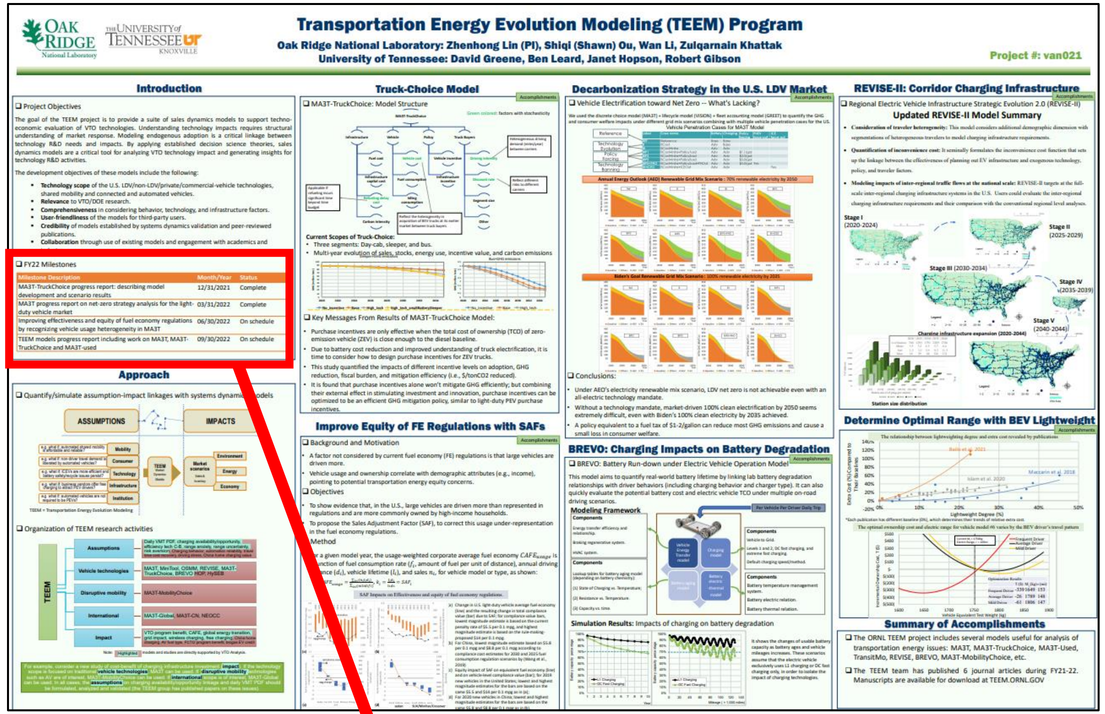
Instruction

Milestones

- Milestones may be presented in a separate slide directly before the Approach section or included as part of the Approach section.

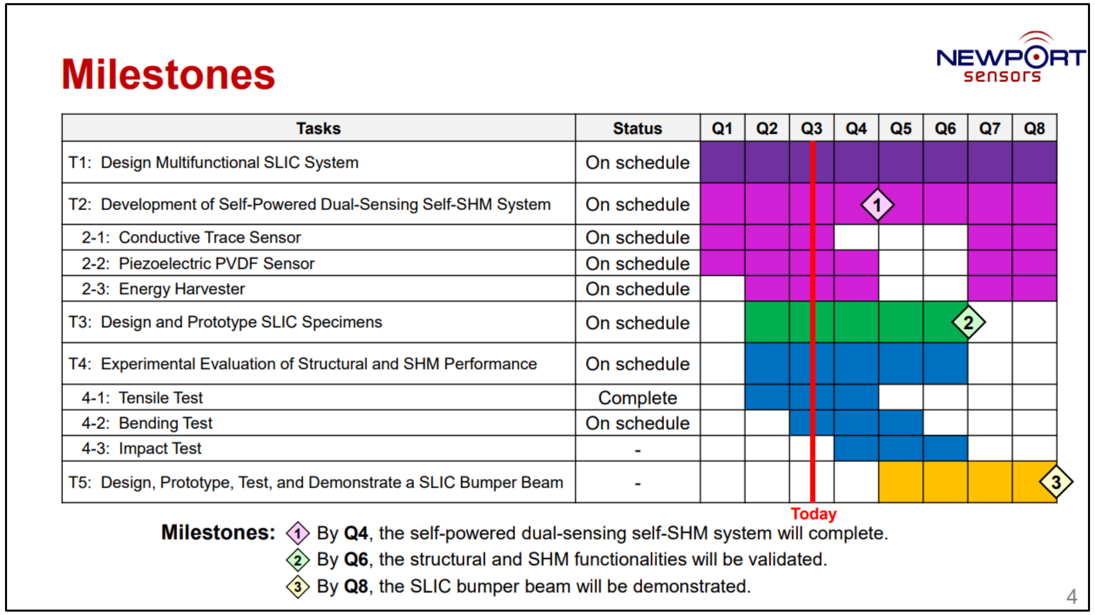
- Include milestones and go/no-go decision points for FY 2023 and FY 2024.

Milestones Example Slides



❑ FY22 Milestones

Milestone Description	Month/Year	Status
MA3T-TruckChoice progress report: describing model development and scenario results	12/31/2021	Complete
MA3T progress report on net-zero strategy analysis for the light-duty vehicle market	03/31/2022	Complete
Improving effectiveness and equity of fuel economy regulations by recognizing vehicle usage heterogeneity in MA3T	06/30/2022	On schedule
TEEM models progress report including work on MA3T, MA3T-TruckChoice and MA3T-used	09/30/2022	On schedule



Instruction

Approach

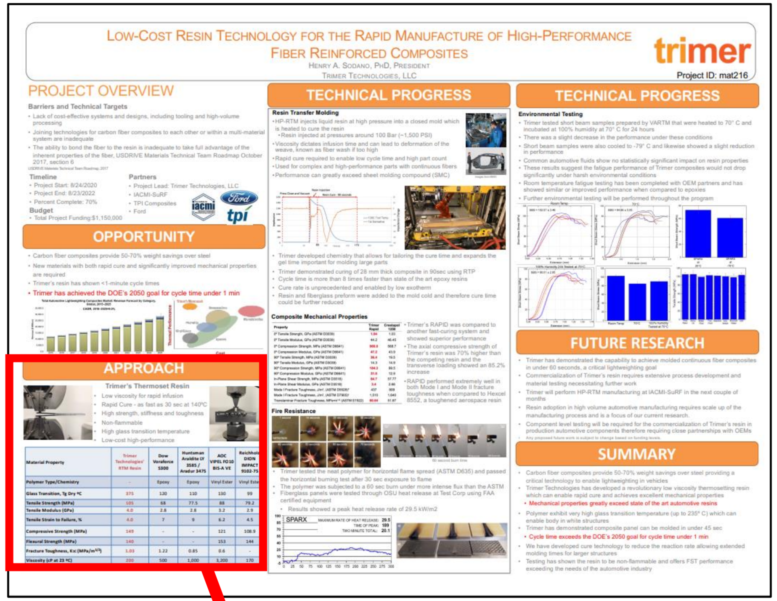
- Approach counts for 20% of your total project score.

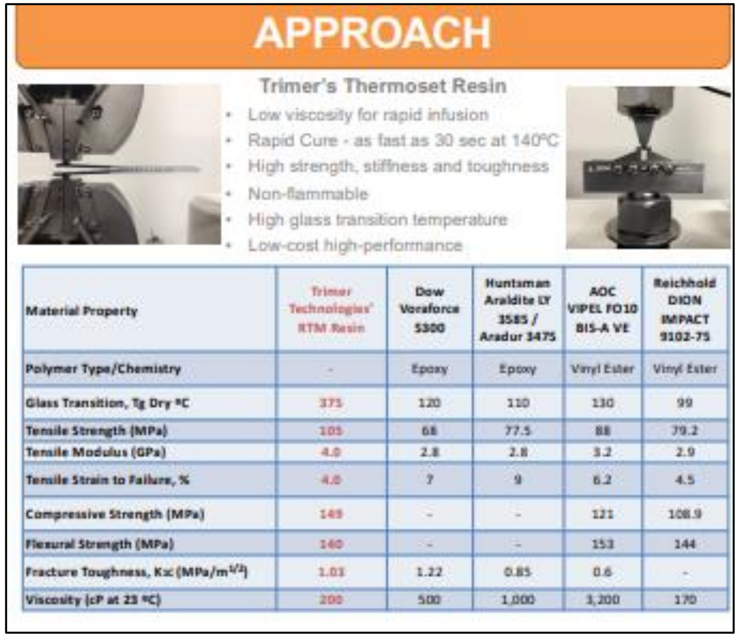
- The title of your slides should make it clear that they are your project's **Approach**.

- Describe overall Technical Approach:
    - Emphasize unique aspects of your work and de-emphasize discussion of equipment used.
    - Discuss how your work addresses the project's technical barriers.
    - Describe how your project is integrated with other research or deployment projects within the pertinent VTO subprogram.
    - Use simple statements so that scientists and engineers, not experts in your area, can readily understand the explanation of your approach.

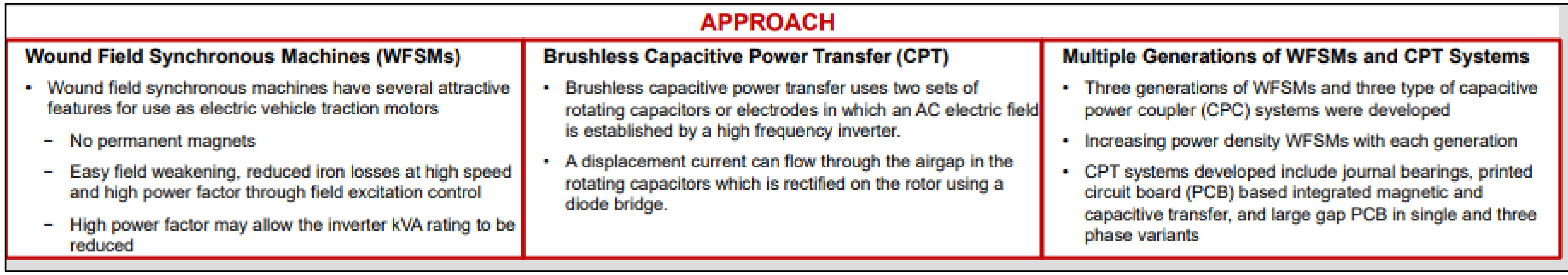
- Include the planned milestones and go/no-go decision points for FY 2023 and FY 2024 and current status towards them (if not shown in a separate Milestone slide).

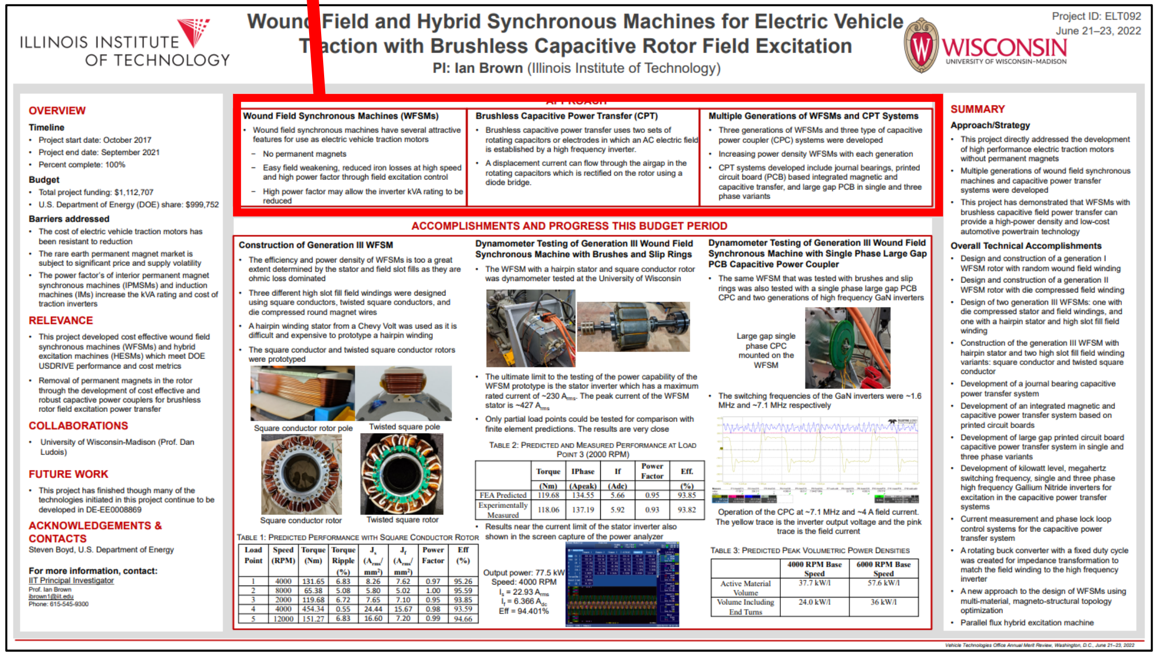
Approach Slide Examples





Material Property	Trimer Technologies' RTM Resin	Dow Voraforce 5300	Huntsman Araldite LY 3585 / Aradur 3475	AOC VIPEL F010 BIS-A VE	Reichhold DION IMPACT 9102-75
Polymer Type/Chemistry	-	Epoxy	Epoxy	Vinyl Ester	Vinyl Ester
Glass Transition, Tg Dry ºC	375	120	110	130	99
Tensile Strength (MPa)	105	68	77.5	88	79.2
Tensile Modulus (GPa)	4.0	2.8	2.8	3.2	2.9
Tensile Strain to Failure, %	4.0	7	9	6.2	4.5
Compressive Strength (MPa)	149	-	-	121	108.9
Flexural Strength (MPa)	140	-	-	153	144
Fracture Toughness, K_{IC} (MPa/m$^{1/2}$)	1.03	1.22	0.85	0.6	-
Viscosity (cP at 23 ºC)	200	500	1,000	1,200	170





Instruction

Technical Accomplishments and Progress

- Technical Accomplishments and Progress count for 40% of your total project score.
- The title of these slides should make it clear that they are your project's **Technical Accomplishments and Progress**.
- Each slide should include a summary "take-home" message, especially those that contain data.
- **Describe the most important technical accomplishments achieved during the reporting period and their significance**. Specifically, address last year's reviewer comments regarding technical accomplishments and progress as well as progress to date for new projects.
- Include relevant data to support your accomplishments.
- <u>Relate the accomplishments to project milestones, barriers, objectives, and technical targets.</u>
- Benchmark the progress versus FY 2022 results, if applicable.

Technical Accomplishments and Progress (Continued)

Instruction

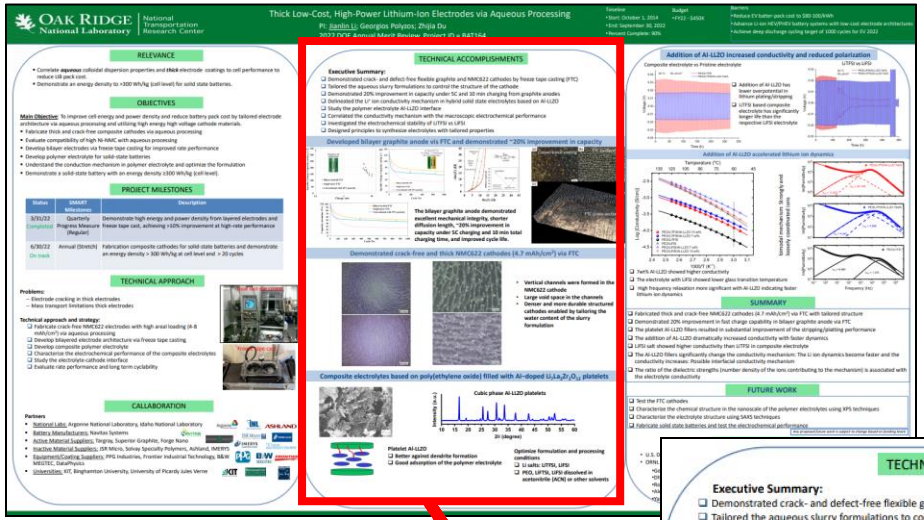
- Include no more than one slide on previous accomplishments and CLEARLY indicate work previously presented versus new work.

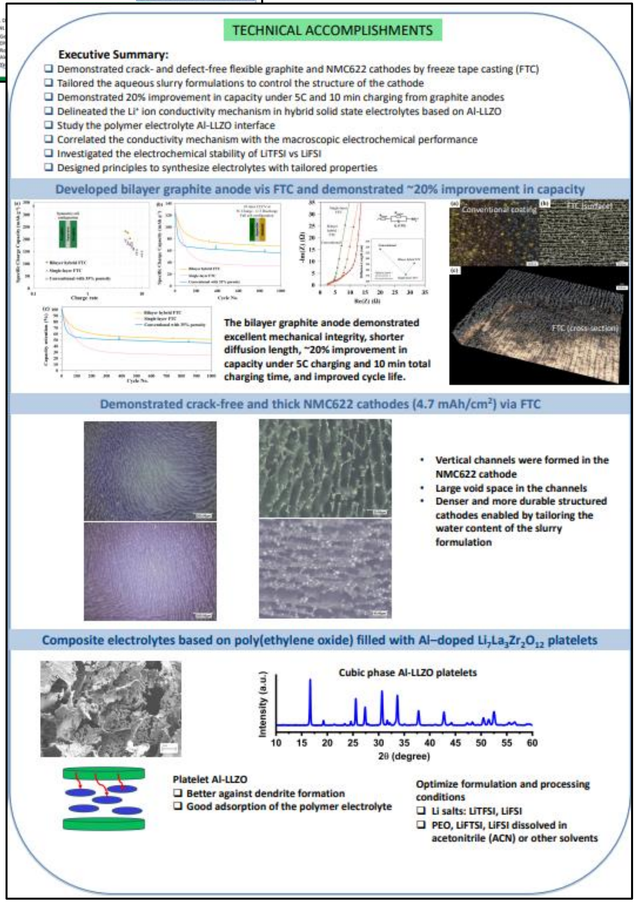
- To assist the reviewers evaluating your work, please include bullet comments of the key points on each slide.

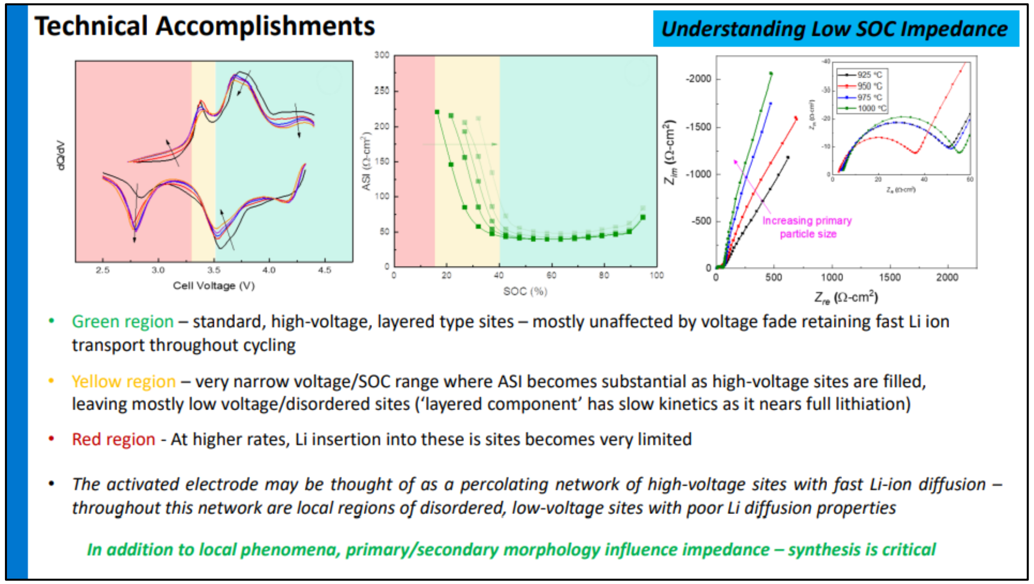
- Include sufficient slides to explain what was done leading to the technical accomplishments.

- Though your presentation will be in color, it is best to choose colors and data symbols that can be easily distinguished in black and white for those reviewers using hardcopies.

Accomplishment Slide Examples







Instruction

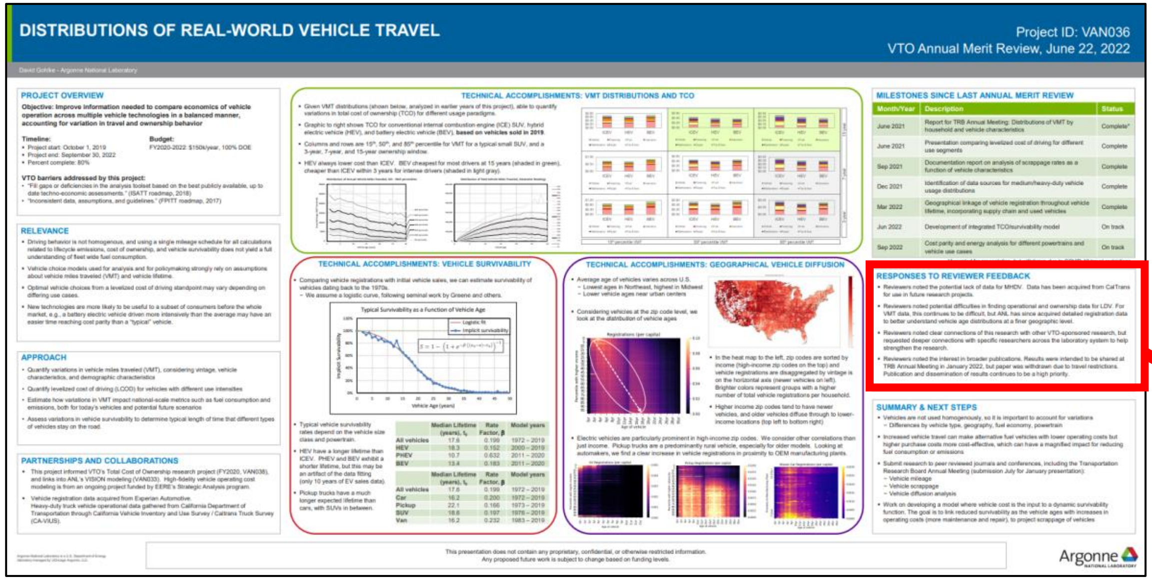
Responses to Previous Year Reviewers' Comments

- All VTO AMR reports are posted on the VTO website along with Annual Progress Reports at https://www.energy.gov/eere/vehicles/annual-progress-reports.

- Last year's presentations can be found at: https://www.energy.gov/eere/vehicles/annual-merit-review-presentations.

- **If your project was not reviewed last year, please indicate as such on the slide.**

Reviewer Comment Slide Examples



RESPONSES TO REVIEWER FEEDBACK

- Reviewers noted the potential lack of data for MHDV. Data has been acquired from CalTrans for use in future research projects.
- Reviewers noted potential difficulties in finding operational and ownership data for LDV. For VMT data, this continues to be difficult, but ANL has since acquired detailed registration data to better understand vehicle age distributions at a finer geographic level.
- Reviewers noted clear connections of this research with other VTO-sponsored research, but requested deeper connections with specific researchers across the laboratory system to help strengthen the research.
- Reviewers noted the interest in broader publications. Results were intended to be shared at TRB Annual Meeting in January 2022, but paper was withdrawn due to travel restrictions. Publication and dissemination of results continues to be a high priority.

Responses to Previous Year Reviewers' Comments

"The impact or other damage sensing needs to be demonstrated using an automotive CFRP to be relevant or, alternatively, the sensing technology could be pursued as a coating or thin layer to be applied to automotive composites to track impact. In that case, it does not need to be composed of CF itself, as CF on the vehicle is for mechanical reinforcement, not for use as electrodes."

- We modified our approach for PVDF film to be applied on the CFRP surface for easier integration into automotive parts
- We still use the CF as the electrode for the purpose of signal ground which should not have any obstacle

"It was not clear to the reviewer if the sensing is a damage detection or an impact detection. The reviewer asked about how the signals differ between an impact without causing damage and an impact with damage. Also, it is not clear if the capacitor circuit and the high pass filter circuit are embedded in the composite structure or they are separate from the composite."

- The piezoelectric sensor can detect initiation of microcracks of the composites.
- We added conductive trace sensor for strain measurement and surface crack detection which further enhances the damage detection functionality.
- All circuits will be separated from the composite

8

Responses to Previous Year Reviewers' Comments

This program was not reviewed last year

Collaboration and Coordination with Other Institutions

Instruction

- Collaborations and Coordination with Other Institutions count for 10% of your total project score.
- The title of these slides should make it clear that they are your Collaborations and Coordination with Other Institutions.
- List your project collaborators, indicating:
  - Relationship (for example, prime, sub, etc.)
  - Industry, university, National Laboratory
  - Within or outside VTO
  - Extent of the collaboration
- Describe the quality of collaborative relationships and their importance in achieving the project's objectives.

Collaboration Slide Examples

Collaboration

University of North Texas (Sub) (Prof. Sheldon Shi)

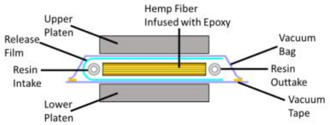
- Hemp/Epoxy Composite Panel Fabrication
- Tensile Test: ASTM D3039
- Bending Test: ASTM D7264
- Impact Test: ASTM D6110

Hemp Fiber Mat

Wabash Genesis Hydraulic Hot Press

Shimadzu AGSX

AMETEK Impact Testing Machine



Vacuum Assisted Resin Infusion (VARI) with Pressing

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Collaboration and Coordination with Other Institutions

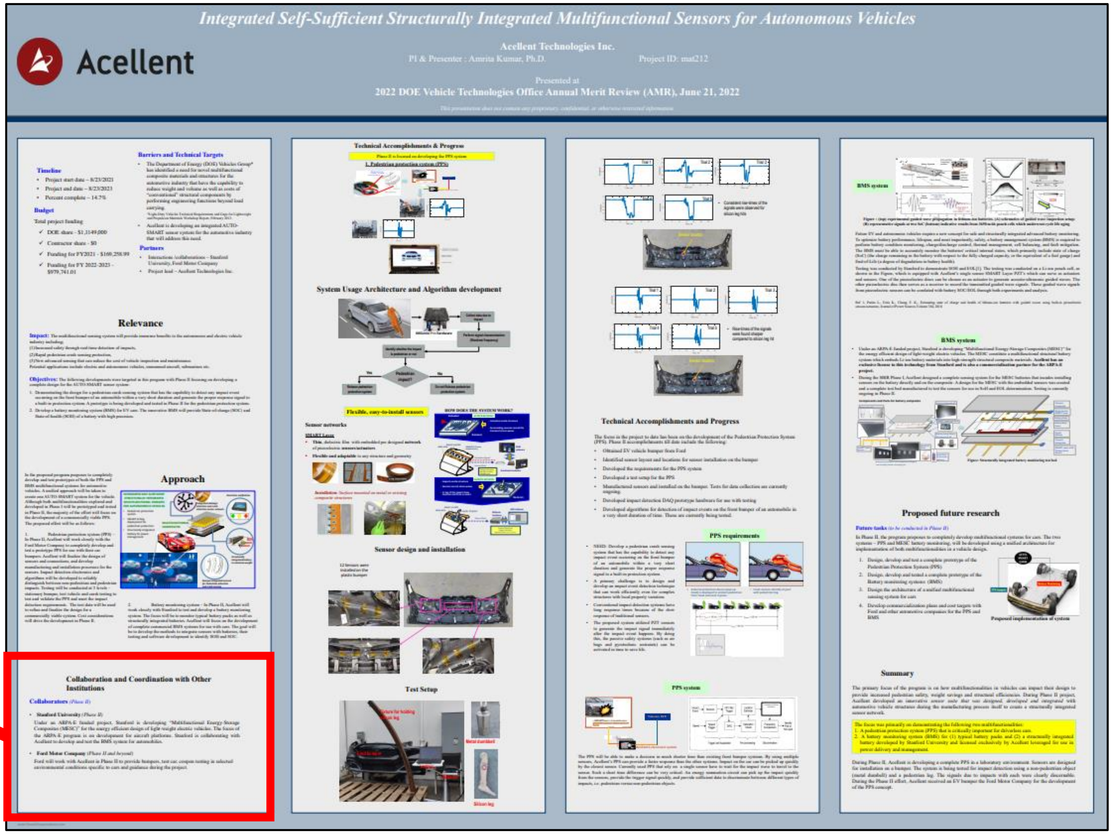
Collaborators *(Phase II)*

- **Stanford University** *(Phase II)*

  Under an ARPA-E funded project, Stanford is developing "Multifunctional Energy-Storage Composites (MESC)" for the energy efficient design of light-weight electric vehicles. The focus of the ARPA-E program is on development for aircraft platforms. Stanford is collaborating with Acellent to develop and test the BMS system for automobiles.

- **Ford Motor Company** *(Phase II and beyond)*

  Ford will work with Acellent in Phase II to provide bumpers, test car, coupon testing in selected environmental conditions specific to cars and guidance during the project.



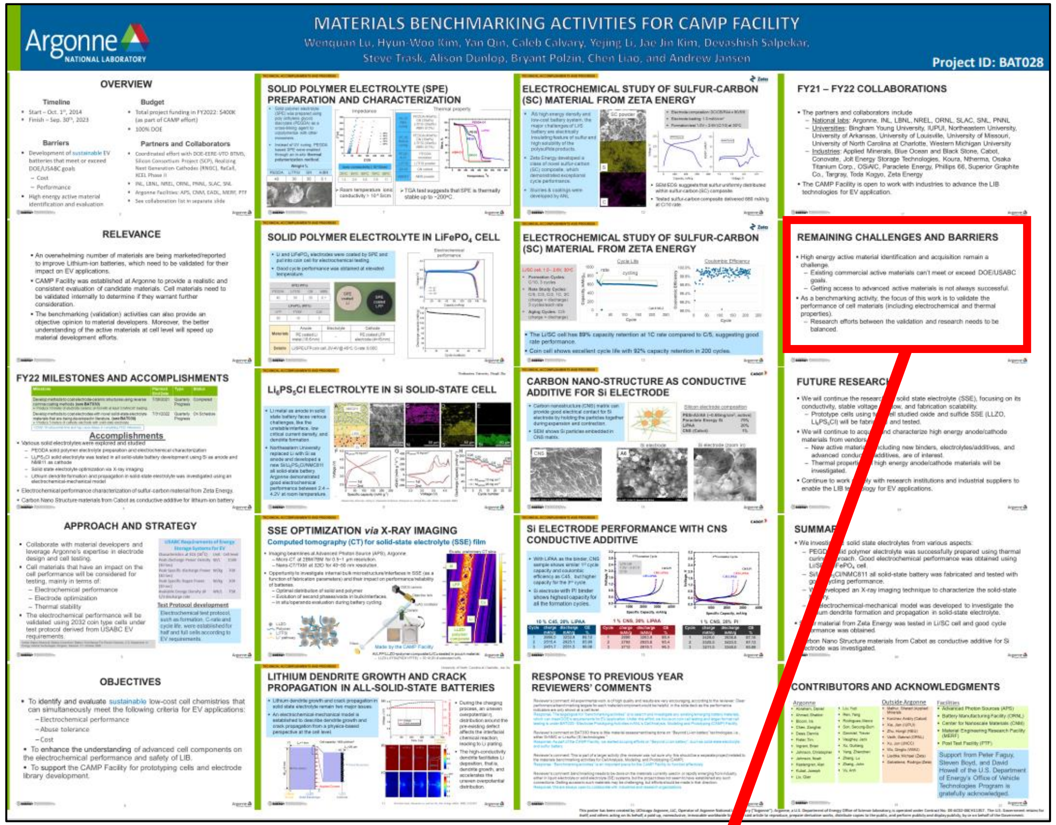
Remaining Challenges and Barriers

Instruction

- Highlight the key remaining challenges and barriers to meeting the project objectives.

- The remaining challenges and barriers should provide justification and support for the future plans in the following slide.

Barriers and Challenges Slide Examples



REMAINING CHALLENGES AND BARRIERS

- High energy active material identification and acquisition remain a challenge.
  - Existing commercial active materials can't meet or exceed DOE/USABC goals.
  - Getting access to advanced active materials is not always successful.
- As a benchmarking activity, the focus of this work is to validate the performance of cell materials (including electrochemical and thermal properties).
  - Research efforts between the validation and research needs to be balanced.

Remaining Challenges and Barriers

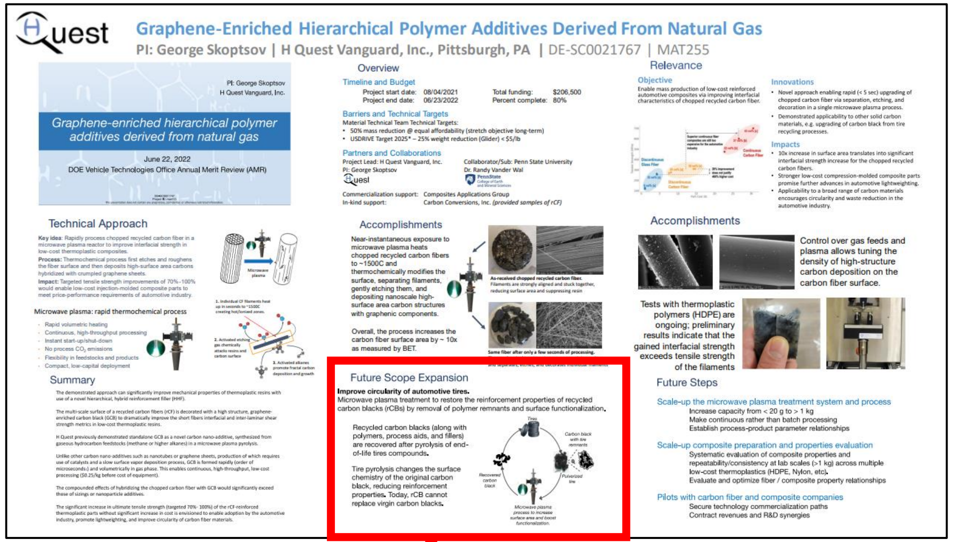
- It is difficult to experimentally confirm the conductivity of novel materials due to the difficulties in finding procedures to create densified pellets on which impedance spectroscopy can be performed. For each material the high temperature stability has to be tested and sintering optimization has to be performed
- We still need to experimentally investigate electrochemical stability for some of the materialss

Proposed Future Research

Instruction

- Proposed Future Research counts for 10% of your total project score.
- The title of this slide should make it clear that the slide shows your Proposed Future Research.
- Explain what you plan to do during the rest of this year (FY 2023) and next year (FY 2024). Provide justification for future plans.
- Add the statement to all slides with future-looking statements, “Any proposed future work is subject to change based on funding levels.”
- Be as specific as possible; avoid blanket statements.
- Highlight upcoming key milestones.
- Address how you will deal with any future decision points during that time and any remaining issues or barriers, including any alternative development pathways under consideration to mitigate risk of not achieving milestones.

Future Work Slide Examples

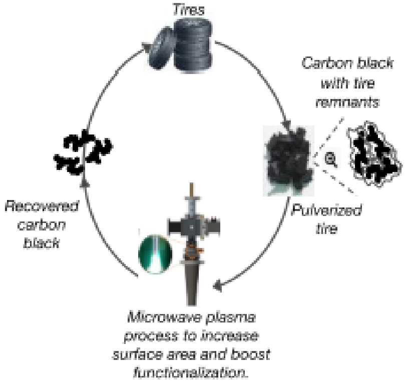


Future Scope Expansion

Improve circularity of automotive tires.
Microwave plasma treatment to restore the reinforcement properties of recycled carbon blacks (rCBs) by removal of polymer remnants and surface functionalization.

Recycled carbon blacks (along with polymers, process aids, and fillers) are recovered after pyrolysis of end-of-life tires compounds.

Tire pyrolysis changes the surface chemistry of the original carbon black, reducing reinforcement properties. Today, rCB cannot replace virgin carbon blacks.



Proposed Future Work

- Experimentally investigate predicted conductivity for the novel conductors by creating densified pellets whenever possible
- Investigate optimal carrier doping for the novel conductors
- Investigate electrochemical and chemical stability of novel conductors
- Develop (with Mary Scott) local microprobe technique to assess Li-ion conductivity at an earlier stage in the development process.

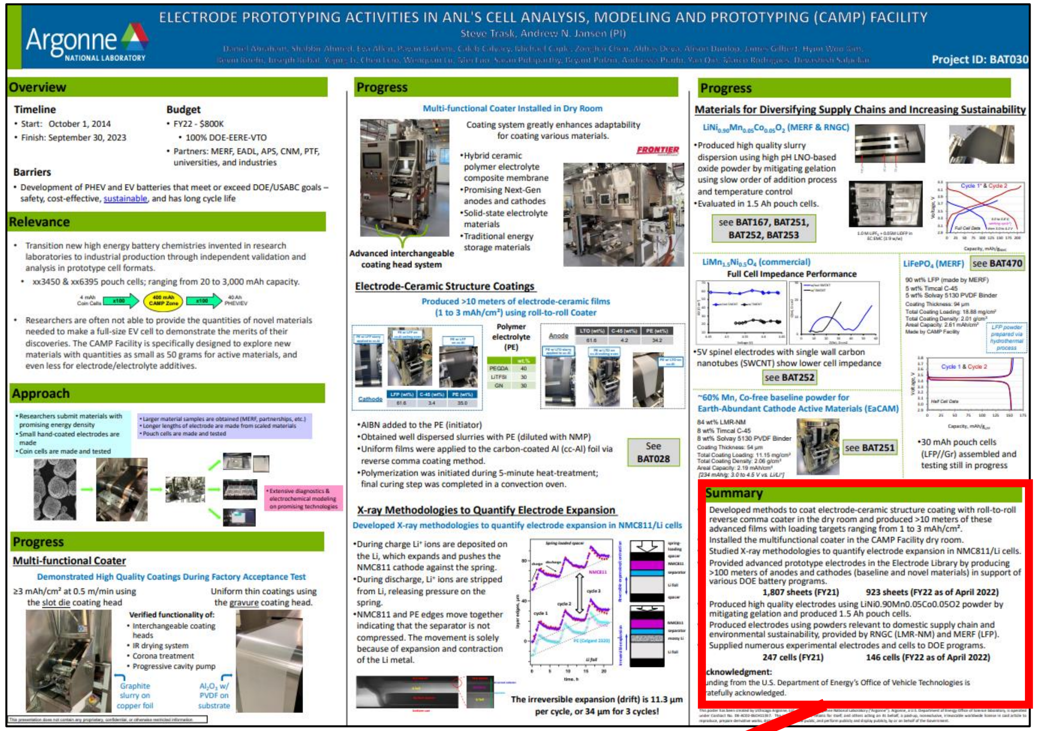
"Any proposed future work is subject to changes based on funding levels."

Mandatory Summary Slide

Instruction

- Summarize the key points you wish the reviewers and the audience to take away from your presentation.
- For those projects that are working toward specific technical targets, include a <u>Summary Table</u> summarizing key technical results to date in FY 2023 compared to FY 2022 results and the technical targets.

Summary Slide Examples



Summary

- Developed methods to coat electrode-ceramic structure coating with roll-to-roll reverse comma coater in the dry room and produced >10 meters of these advanced films with loading targets ranging from 1 to 3 mAh/cm².
- Installed the multifunctional coater in the CAMP Facility dry room.
- Studied X-ray methodologies to quantify electrode expansion in NMC811/Li cells.
- Provided advanced prototype electrodes in the Electrode Library by producing >100 meters of anodes and cathodes (baseline and novel materials) in support of various DOE battery programs.

  1,807 sheets (FY21) **923 sheets (FY22 as of April 2022)**
- Produced high quality electrodes using LiNi0.90Mn0.05Co0.05O2 powder by mitigating gelation and produced 1.5 Ah pouch cells.
- Produced electrodes using powders relevant to domestic supply chain and environmental sustainability, provided by RNGC (LMR-NM) and MERF (LFP).
- Supplied numerous experimental electrodes and cells to DOE programs.

  247 cells (FY21) **146 cells (FY22 as of April 2022)**

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Summary

Work from this program has produced advancements towards understanding and achieving economically-viable, Mn-rich cathodes as alternative, earth-abundant oxides by:

- Systematic studies that separate bulk vs. surface contributions to low SOC impedance in Li/Mn- rich electrodes
- Correlating local ordering, related to composition, to bulk processes the influence low SOC impedance
- Verification of how voltage hysteresis mechanisms effect low SOC impedance response
- Development and verification of novel surface treatments that enable stable, long-term cycling of cobalt-free, Mn-rich compositions, at higher energies than state-of-the-art NMC-622, under standardized protocols in graphite cells
- Discovery of a new class of disordered, lithiated spinel cathodes that are based on MnNi compositions, are cobalt free, and can deliver significant capacities – these new materials may have important implications for understanding oxygen redox in complex oxides
- Correlating theory with experiment to elucidate mechanisms of voltage hysteresis that can occur in the absence of oxygen redox in over-lithiated oxides
- Elucidated effects of particle microstructure on the impedance of Li/Mn- rich electrodes via experiment & modeling
- Systematic investigation on the effect of various synthesis parameters on the resulting morphology of Mn-Ni precursors with on-going computational analysis to provide understanding on greater synthetic control of product

Questions?

Contact us by email:
VTAMR@ORAU.org