EXPLORE THE CHALLENGE QUESTION

2019-20 Resources & Guidelines

HOW WOULD YOU USE TECHNOLOGY TO MAKE THE WORLD A SAFER PLACE?

Scientific research and technology at Los Alamos National Laboratory (LANL) is dedicated to protecting the security and safety of our country. In the 2019-20 NM Governor's STEM Challenge, we invite students to help identify technological safety solutions. Students and teachers can use this document to brainstorm by learning how LANL researchers and organizations sponsoring the STEM Challenge work to solve challenges. Although the following does not represent the full extent of topics student teams could take in developing their project, it can help springboard students into imagining their own technological solution for safety.

Here is a big-picture overview of related topics, but your project does not *have* to fit into one of these categories:

Protecting from Natural & Man-made Disasters
- Illicit materials tracking
- Nuclear operations monitoring
- Asteroids impact prediction
- Earthquake prediction
- Natural disaster impact predicting/monitoring

Safeguarding Food, Water, & Energy
- Developing new energy sources
- Infrastructure modeling
- Resilient energy distribution
- Water availibility
- Agriculture

Conserving the Environment
- Contaminant mitigation and monitoring
- Monitoring environmental resources
- Modeling wildfire behavior

KEEPING US SAFE

Improving Health
- Disease outbreaks and organisms modeling
- Personalized medicine and treament
- Bioinformatics

Securing Information & Data
- Cybersecurity
- Computer network encryption
- Quantum computing

1. Protecting from Natural & Man-Made Disasters

- Illicit materials tracking
- Nuclear operations monitoring
- Asteroids impact prediction
- Natural disaster impact prediction and monitoring
- Earthquake prediction

To protect against natural and man-made disasters (e.g. earthquakes, severe storms, asteroid impacts, and nuclear accidents), Los Alamos scientists study methods to predict disasters and understand how different disasters could impact the infrastructure we rely on such as electricity and energy systems.

They also study ways to detect and monitor nuclear materials to prevent nuclear accidents, and develop ways to safeguard nuclear facilities. Scientists also work to prevent terrorist attacks by developing ways to sense (discover and identify) explosives, illicit materials, and other threats to national safety.

Meet Los Alamos Scientists and Engineers Working in this Area:
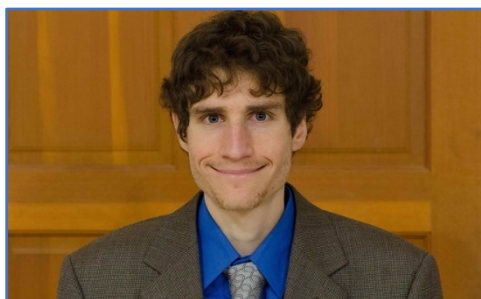
Dr. Daniel Trugman is working on computerized machine learning and experimental techniques that could eventually help predict earthquakes.

https://www.youtube.com/embed/UgYY-AM9Nns
https://www.youtube.com/embed/uSIUHe8LSNc

Dr. Vania Jordanova and her team developed SHIELDS, a space weather modeling platform to predict hazards caused by solar storms.

https://www.youtube.com/watch?v=lXyewpwsam0

2. Conserving the Environment

- Contamination mitigation and monitoring
- Environmental resource monitoring
- Modeling wildfire behavior

Los Alamos scientists monitor and model ecosystems to help predict how contaminants, wildfire, drought, insects, climate changes, etc. could impact the environment. They investigate ways to mitigate, or lessen, effects on the environment and manage it in the best ways for future generations. Additionally, Los Alamos scientists use computer modeling to study the behavior of wildfires.

Meet Los Alamos Scientists and Engineers Working in this Area:

Chuck Hathcock, a biologist, studies birds and other animals on Laboratory property to help minimize impacts from operations and development to sensitive species and their habitats. He conducts annual presence/absence surveys, implements fall migration banding techniques, and writes plans for organizations to help protect and manage birds and other sensitive species.

The **Wildland Fire Management Team** at LANL provides consistent and standardized approaches to enhancing wildland fire response capabilities. The team develops plans and executes activities to keep 900 acres of land around Laboratory buildings safe and defensible. The primary goal of the program is to work with internal and external stakeholders to jointly protect life, property, and the environment from the effects of wildland fires.

Dr. Alexandra Jonko is an atmospheric scientist who studies interactions between wildfires and the changing climate. She uses computer modeling to study wildfire behavior and help prevent loss of life and property. These computational models calculate the effect of topography and many other factors to explore how intense fires burn and spread.
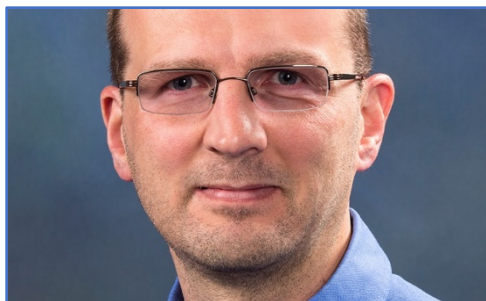
Dr. Richard Middleton developed SimCCS$^{2.0}$ software to optimize carbon dioxide capture, transport, and storage.

https://www.youtube.com/watch?v=YZtbfuKLI34&feature=youtu.be

Dr. Manvendra Dubey developed ALFa LDS, an Autonomous, Low-cost Fast Leak Detection System designed to distinguish natural gas leaks from biogenic methane sources. The lightweight system can be mounted on a drone or vehicle to intelligently locate, attribute, and quantify natural gas leaks.

https://www.youtube.com/watch?v=i1hOEkTmhDc&feature=youtu.be

Jan Frigo developed the Long-range Wireless Sensor Network for easy-to-use remote data collection. The low-power sensor network is used for environmental monitoring in remote, hard-to-reach locations. The technology grew out of the Lab's decades of experience developing satellite components for the harsh space environment.

https://www.youtube.com/watch?v=mtW-CvPkMu8&feature=youtu.be

3. Securing Information & Data

- Cybersecurity
- Computer network encryption
- Quantum computing

To keep computing information secure, Los Alamos scientists develop ways to identify, characterize, and prevent cyber-attacks and the misuse of computer data. This work includes analyzing computer network traffic and developing new techniques for network encryption (a type of data protection). Scientists research ways to improve the security and protection of the ever-increasing amount of computerized data in the areas of medicine, commerce, security, and science. For example, scientists are researching a high-tech type of computing called *quantum computing* to help keep computer data and networks safe long into the future.

Meet Los Alamos Scientists and Engineers Working in this Area:

Neale Pickett, computer scientist, is developing ways to fight cybercrime, or any criminal activity on the computer or Internet. At the Laboratory he works to develop techniques to defend against different threats, and trains others to adapt the same agility and responsiveness.


Dr. Brad Settlemyer developed Delta FS, a distributed file system that creates updates, and manages extreme numbers of files in high performance computing. His specialty is researching and developing ways to quantitatively specify, procure, and operate storage systems throughout a data center.

4. Improving Health

- Disease outbreaks and organisms monitoring
- Personalized medicine and treatment
- Bioinformatics

To improve health, Los Alamos scientists research the mechanisms of disease (how organisms function and evolve); study how to improve diagnosis; and observe and track disease outbreaks in populations to help prevent their spread. Scientists also provide tools and computer models to help researchers improve personalized medicine, so individuals can receive treatments designed to work specifically with their bodies.

Meet Los Alamos Scientists and Engineers Working in this Area:
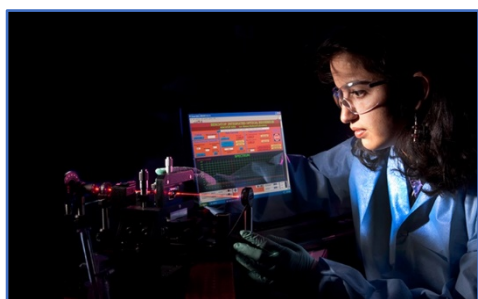
Dr. Harshini Mukundan is working on a universal bacteria sensor that mimics the human immune system to recognize bacterial pathogens. The sensor requires only a small volume of sample to detect all pathogens quickly, simply, and efficiently without prior knowledge of what they might be.

https://www.youtube.com/watch?v=11rVz3rBd7s&feature=youtu.be

Dr. Patrick Chain and his team developed EDGE Bioinformatics to make genomics available to everyone. The open-source software essentially "democratizes" the genomics revolution by enabling any researcher or physician to quickly and easily analyze complex genomic data.

Dr. Pulak Nath, **Dr. Jennifer Foster Harris**, and **Dr. Rashi Iyer** developed the Pulmonary Lung Model (PulMo). The invention is a miniature, tissue-engineered artificial lung that mimics the response of the human lung to drugs, toxins, particles, and other agents.

https://www.youtube.com/watch?v=ia7dfk8l8h8

Dr. Alina Deshpande and her team developed Retro Rx, rapid, easy tools for responding to disease outbreaks and re-emergence events.

https://www.youtube.com/watch?v=8uEabZAmThQ&feature=youtu.be

5. Safeguarding Food, Energy, and Water

- Agriculture
- Developing new energy sources
- Infrastructure modeling
- Resilient energy distribution
- Water availability

The science and technology performed at LANL play an important role in developing new energy sources, securing our country's current energy supply, and ensuring access to clean and abundant water sources. This scientific area at LANL includes researching the production of new biofuels; reducing the impacts to the environment from fossil energy production; improving the efficiency of energy production and distribution, such as studying energy storage options and impacts to energy disruptions; learning how our vehicles can run better by modeling a more efficient combustion engine; and improving the reliability and resiliency of electricity distribution by modeling our electrical grid infrastructure.

Meet Los Alamos Scientists and Engineers Working in this Area:

Dr. Hari Viswanathan, an environmental engineer, develops computer models of three-dimensional fracture networks in underground rock and simulates how gases and liquids (like natural gas and oil) flow and transport through rock.

https://www.youtube.com/watch?v=xuss3OBidxs
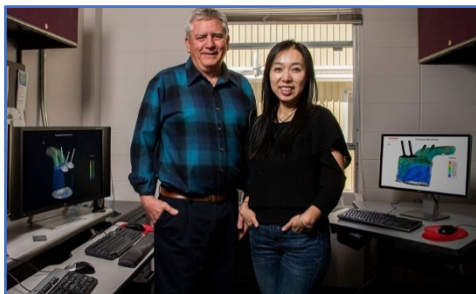
Scientists **Dr. David Carrington** and **Dr. Jiajia Waters** developed computer modeling to improve the combustion engine for better fuel efficiency and lower emissions engines. The software models turbulent mixing and chemical reactions in internal combustion engines.

https://www.youtube.com/watch?v=S8OXZWxpWdM&feature=youtu.be

Dr. Carleton Coffrin developed the Severe Contingency Solver for Electric Power Transmission Analysis. The invention is a new, open-source software that reliably predicts how damage from hurricanes, ice storms, earthquakes, and other extreme events will restrict power delivery from utility grids. It is the only software available—commercially or open-source—that reliably supports analysis of extreme events that cause widespread damage.

https://www.youtube.com/watch?v=toLSJX_swFU&feature=youtu.be

RESEARCH OVERVIEW OF THE STEM CHALLENGE SPONSORS

The STEM Challenge would not be possible without the generous support of sponsoring employer partners. Continue reading to learn about the research and development performed by these companies, and gain inspiration for how your own project and prototype might relate.

Air Force Research Laboratory is the Air Force's only organization whose entire mission is dedicated to leading the discovery, development, and integration of warfighting technologies for air, space and cyberspace.

AFRL is comprised of nine national directorates, and AFRL-New Mexico (NM) is the proud home to two of those directorates: *Directed Energy* and *Space Vehicles*. This research includes:

- High power electromagnetics; Laser systems; Electro-optics
- Space component technology; Satellite space experiments

In addition to laboratory work, AFRL is dedicated to advancing technology through partnerships with the private sector, academia and entrepreneurs through our various economic development initiatives.
To learn more, visit: https://www.afrlnewmexico.com/

Boeing is the world's largest aerospace company whose research and development extends into the commercial, defense, space, environment, and technology arenas.

In NM, Boeing supports the U.S. Air Force scientists and engineers who experiment with lasers and an 11.4-foot telescope at the Starfire Optical Range to better monitor human-made objects in orbit. As satellites get smaller and more and more objects occupy space (including debris), imaging and identifying space objects is crucial.

The Albuquerque Boeing site houses researchers who are continually developing ways to enhance modern civilization, space navigation, and military technologies to protect freedom. These include:

- Satellite and defense concepts
- Lasers, sensors, and cameras for space transportation
- Defense against unmanned airborne systems

To learn more, visit: https://www.boeing.com/innovation/

Chevron is a multinational energy corporation headquartered in the United States. As the second largest of their kind worldwide, Chevron produces oil, natural gas, and energy-related products.

Chevron is also one of the largest producers of oil and gas in the Permian Basin, which extends into Southeastern NM. In order to improve development in the Permian while also supporting its communities and the environment, Chevron advances innovative technology for safer and more efficient drilling, infrastructure, and production. These include:

- Predictive analysis for exploration strategy, resource characterization, and well construction
- Advanced mapping of rock layers to better understand where resources are located
- Machine learning and artificial intelligence to optimize well spacing and production preparations
- Advanced modeling and analysis for drill assembly that lengthens bit life and effectiveness

To learn more, visit: https://www.chevron.com/projects/permian

Descartes Labs is a technology company developing a data-refinery on a cloud-based supercomputer to apply machine-learning techniques to massive data sets. They "teach" computers how to analyze massive amounts of data, which creates an infrastructure to model and predict resources and connected factors.

Descartes Labs has offices in Santa Fe and Los Alamos, NM, and their work includes:

- Providing business tools to apply data insights across a range of industries
- Environmental modeling and comprehension
- Impact science work around natural disasters, disease spread, and food security

Descartes Labs also uses their technology abilities to process satellite imagery from major NASA and ESA satellite constellations for real-time Earth monitoring.
To learn more, visit: https://www.descarteslabs.com.html

Deloitte is a network company comprised of over 245,000 professionals in independent firms worldwide, providing service-based technology solutions for businesses. Deloitte hosts an office in Santa Fe, NM, and supports numerous sectors from financial consulting and tax services to cognitive technology and artificial intelligence. The company's research also includes:

- Audit, assurance, consulting, and risk advisory and management
- Big data, analytics, visualization, machine learning, and healthcare
- Infrastructure, cybersecurity, electric power, and automotive
- Customer experience, social modeling, and organizational dynamics

To learn more, visit: https://www2.deloitte.com/us/en.html

El Paso Electric is a utility company providing electric generation, transmission, and distribution across a 10,000 square mile area of the Rio Grande Valley in NM. El Paso Electric generates energy from sources such as nuclear fuel, natural gas, and solar and wind turbines. Their development and projects include:

- Preventative and responsive safety systems
- Power grid infrastructure and stability
- Outage Center: logistics, coordination, tracking systems
- Greener energy: renewable systems installed in homes, electric vehicles, solar and natural gas

El Paso Electric was the first utility company in NM and Texas to stop using coal-based power. They continually invest To learn more, visit: https://www.epelectric.com/

Facebook is globally known as a social networking platform, but the company's mission is to develop tools that support people in building communities and staying connected. From technology that checks user safety during natural disasters to systems that optimize blood donation logistics, Facebook's research goes beyond social media and business development/advertisement tools, to include technology such as:

- Facebook Connectivity Lab: aircraft, satellites, and wireless communication systems
- Artificial intelligence: image recognition, language processing, speech recognition, and associated infrastructure

In NM, Facebook recently opened a new data center in Los Lunas that runs off 100% renewable energy. For more information, visit: https://newsroom.fb.com/company-info/

Freeport-McMoRan is a leading international mining company headquartered in Arizona. They operate long-lasting assets with reserves of copper, gold, and other metals. Recent technology development includes:

- Cloud-based software based on real-time data to reduce machine downtime and effectively track asset utilization and yields
- Advanced data analytics and visualization for decision-support software and intelligent operations
- Drone technology to scout and map areas, provide aerial safety, and document blast sequencing

In Southwestern NM, Freeport-McMoRan operates the Chino and Tyrone copper mines near Silver City. For more information, visit: https://fcx.com/

Intel is a multinational corporation and technology company headquartered in California. Known widely for their processor production, Intel's innovation and development also extends into cloud capabilities, memory and programmable solutions, and 5G connectivity. Intel established a campus in Rio Rancho in 1980, NM, where they develop:

- Microprocessor technology for data centers and smart and connected devices worldwide
- Intel Silicon Photonics: high-speed optical connectivity using fiber optics for data communications
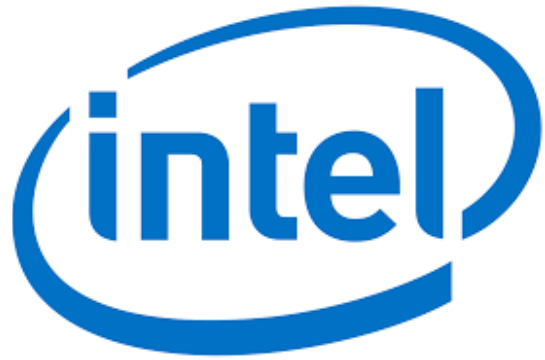
Intel is the leading employer in Rio Rancho and invests into policy, diversity inclusion, and education initiatives both in direct local communities and worldwide.
For more information, visit: https://www.intel.com/content/www/us/en/homepage.html

Meow Wolf is an arts and entertainment group based in Santa Fe, NM. A collective of 400+ employees create immersive and interactive experiences using a variety of media including:

- Architecture, painting, and sculpture
- Video production and photography
- Cross-reality and augmented experiences (like VR)
- Audio engineering and music
- Novel and previously unreleased digital products

In addition to creatives, Meow Wolf bridges art and technology by also employing engineers, architects, electrical technicians, and software experts to create and manage their interactive experiences.
For more information, visit: https://meowwolf.com/about

N3B is an environmental remediation organization that manages the 10-year Los Alamos Legacy Cleanup Contract for the U.S. DOE. Comprised of multiple companies, N3B performs cleanup operations through LANL's Environmental Management Office. Their expertise includes:

- Complex nuclear facility management
- Resource management and waste disposal
- Water and wastewater engineering and remediation
- Nuclear safety and radiological control
- Sampling technology for air, soil, and water

For more information, visit: https://n3b-la.com/

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Pattern Energy is a leading US-based independent renewable energy company supporting innovation in multiple industries including solar, wind, storage, transmission, and advanced energy technologies. Pattern Energy manages a diverse portfolio of operations, including:

- Environmental management: land reclamation, regulatory and public policy, stewardship
- Safety practices and routine training, equipment optimization and reliability
- Advanced data analytics and predictive software, proprietary resource and financial modeling

Pattern Energy has a prominent presence in NM, including their recent investment in expansive wind energy capacities in the East-Central part of the state.
For more information, visit: https://patternenergy.com/learn/our-company

PNM is NM's largest energy provider, serving over 525,000 residential and business customers. In support of their renewable energy mission, PNM has built solar centers, installed private solar energy systems for customers, and implemented environmental upgrades to reduce emissions and preserve bird habitats. PNM operations also include:

- Installing over one million solar panels in NM
- Combining geothermal, wind, and solar energy to produce clean power and reduce emissions
- Energy efficiency programs to reduce power and water consumption

For more information, visit: https://www.pnm.com/web/pnm.com/about-pnm

Presbyterian is a locally owned and operated nonprofit health care system known for their experience in integrating healthcare financing and delivery. Their expertise includes:

- Cancer care and research
- Women's health
- Heart and vascular care
- Neuroscience
- Neonatal and pediatric intensive care

As part of their outreach mission, Presbyterian conducts community health needs assessments to identify the priority healthcare issues facing NM communities, and collaborates with local health councils and forums to understand the drivers behind local health issues and develop solutions.
To learn more, visit: https://www.phs.org/about-us/Pages/default.aspx

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Sandia National Laboratories is a U.S. Department of Energy (DOE) laboratory that supports numerous federal, state, and local government agencies, companies, and organizations. Maintaining the safety, security, and efficiency of the U.S. nuclear stockpile is Sandia's primary directive, but their role also encompasses research and development in:

- High-performance computing and cybersecurity
- Satellites, engineering and materials for U.S. space exploration
- Ensuring safe and reliable power source capabilities and technologies
- Neutron generation lifecycle, qualification, production, surveillance, dismantlement, and disposal
- Climate security research, discovering and harnessing domestic energy sources

Sandia is a major proponent of STEM education and inspiring the next generation of scientists and engineers. To learn more, visit: https://www.sandia.gov/about/index.html

URENCO is a nuclear power company with plants worldwide. Their U.S. location in Southeastern NM plays a crucial role in the nuclear fuel supply chain to support sustainably generated electricity. Urenco's mission-supporting research and expertise includes:

- Nuclear fuel cycle and enrichment
- Waste management through all cycles
- Decommissioning and repurposing of facilities; rationalization of service infrastructure
- Environmental responsibility and innovate solutions to maximize waste hierarchy
- Uranic materials management: facility design, operating solutions, materials treatment

Urenco also collaborates with local communities and regional initiatives to support education, health, and the environment through sponsorships, volunteering, workshops, and internship programs. To learn more, visit: https://urenco.com/global-operations/uusa

Virgin Galactic is a company in the Virgin Group developing commercial spacecraft. In Southern NM, Virgin Galactic built Spaceport America, a headquarters for human spaceflight, flight operations, and astronaut training. Their research and development include:

- Aerospace, systems integration, spacecraft assembly
- Telemetry, communications, engineering software
- Rocket mechanics, power sources, safety operations
- Flight planning, astronaut training, flight crew operations
- Non-destructive testing methods, application, and analysis

Virgin Galactic also creates opportunities for the research community to explore inaccessible regions.

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DELIVERABLE EXPECTATIONS
PROTOTYPE CONSIDERATIONS & ANATOMY OF THE PROPOSAL PACKET

Pt. 1: The Prototype:

The prototype is the physical demonstration of your idea, the tangible representation/rough model of your solution. Each team's prototype will take a different form, from a computational model to a digital simulation to a mechanical apparatus. Here are some things to consider when designing your prototype:

Space:

- At the Statewide Showcase, your team will have a 10'x10' area in which to stage your prototype for demonstrations and judging. Special requests for accommodation may be made and will be considered, but your prototype should be as self-sustaining as possible and not need an excessive amount of electricity, space, etc.
- Your prototype will need to be transported to the Showcase, so smaller is better. Will it need to be dismantled? Make sure your team brings the necessary tools to rebuild it morning-of the Showcase. Does your prototype have fragile or breakable pieces? It is a good idea to bring replacements and think about packaging.

Materials:

- Your prototype does not need to be made in a fab-lab or maker space; it can be created from cardboard, recycling bin items, household supplies, etc. Think about your resource consumption as you design the prototype, and remember that total cost cannot exceed $500.
- When listing your material cost in the written plan portion of the proposal packet, common recycled items such as glass jars or plastic tubs may be assigned a zero cost value. Other used, donated, or borrowed items must be assigned a fair market or salvage value.
- Be sure and review the White Paper/Program Overview document for a list of prohibited items.

Functionality:

- Your model does not have to be functional, but you need to be able to explain how it *could* work and why you were unable to make it work in the time given.
- The Judges will have **10-15 minutes** to see your demonstration and interview your team. How can you best use that time to display your project? Make sure your team conducts practice rounds and mock interviews to prepare for the judging portion at the Showcase.
- Anticipate potential problems and be prepared to improvise/adapt if your demonstration does not go as planned. Remember that Judges are not expecting perfection, but rather a commitment to the scientific process and creative abilities to problem solve and overcome challenges.

d. Test Model and Evaluate:

Discuss troubleshooting, testing, and redesigning through all iterations

Discuss the strengths and weaknesses of the design

Discuss modifications/refinements made to improve or adjust the design

Share your test results, and explain if/how the design effectively addresses the problem

e. Collaboration:

Discuss how the *team* created the project; how were roles and responsibilities decided?

Communicate how members contributed in their unique ways

3. The Slide Deck

This is where your team should apply their creativity to **visual engagement** and use photos, diagrams, drafts, short videos, animations, etc., to present the prototype using multimedia. Think of the slide deck (also called a "pitch stack") as if your team were presenting their idea to a room full of investors: how would you give them all the information and keep their attention? Remember that the slide deck will be submitted digitally with the proposal placket, and judges will review it electronically. Your slide deck should not take longer than 10 minutes to go through, so design the presentation with that length in mind. [Many helpful websites have examples of great pitch stacks.](#) As you start designing your slides, here is an outline to help guide you:

a. **Cover:** grab their attention! If your team created a logo or branding for your project, this is a great opportunity to debut it!

b. **Problem**: when stating the problem that your model solution addresses, avoid relying on debatable arguments. State agreed-upon facts to build a firm foundation for your project.

c. **Solution**: show your prototype model! This could be done through pictures, simulations, drawings, blueprints, etc.

d. **Demo**: show how your prototype works. For this part, you may want to incorporate video, graphs, collected data, instruction plans, etc.

e. **Effect/Influence**: discuss the positive and negative effects if your model were mass-produced and used on a large scale. How would it affect its relevant area of science?

f. **Feasibility/Constraints**: discuss the practicalities of your project. How is it better than what already exists, if it were implemented? Would there be any unintended effects?

g. **Team**: talk about how your team brings knowledge and skills that are crucial for the development and the function of the model solution/prototype.

h. **Future Plans**: This is your opportunity to imagine, and go big. Given more resources and time, how would you develop and grow this project?

ADDITIONAL RESOURCES

The American Industrial Hygiene Association (AIHA) is a national organization that supports workplace safety and health through research, education, and resources. The AIHA conducts assessments to identify emerging issues to strategize and guide their research. Many of their identified topic areas for further research present intriguing opportunities and may help students brainstorm ideas for creating their own technology to make the world safer. The AIHA's current research priorities are:

1. **Occupational Exposure Limit (OEL) Identification and Control.** Many workers interact with hazardous chemicals every day; how can we best track and identify the amount and occurrence of worker exposure to even small amounts and use this data to improve workplace safety?
2. **Sensor Technologies.** Using specified sensor technology collects great amounts of personalized data on a diverse range of activities. Instruments can track exposure and aid real-time response. How can we design and implement sensors to enhance safety communication and monitor both short-term and long-term hazards?
3. **Global Standard of Care.** The ever-expanding global economy means that companies can have supply chains all around the world, in countries that follow different standards for safety and health. Given this globalization, how can we best manage issues and threats that cross borders (such as pandemics) when not everyone operates using a universal model of healthcare?
4. **Industrial Hygienists' Value.** Industrial Hygienists (IH) are the professionals who work in the science of workplace safety and health. How can these professionals help management consider workplace safety at the beginning of a project and integrate it throughout, rather than addressing it after the project is complete?
5. **Total Worker Exposure.** As the work force ages, many employees have held multiple careers. How can we best keep track of a given employee's exposure to different elements (from hazardous chemicals to physically straining activities) over the course of their career and create comprehensive systems to address any possible concerns?
6. **Big Data Management.** Many of the previously mentioned research topics include a component of "big data"—analyzing extremely large datasets to find trends and patterns in a variety of topics, but especially human behavior. How can we use such information to create tools that improve workplace health and safety?

For more information, visit: https://aiha.org/public-resources/research-priorities

Expert Roundtable Panelists:

Do you want to learn more about the roles of people who work in areas of national safety and/or work in the partnered industry companies for the STEM Challenge? Explore the careers of these scientists and professionals: (from the September 14-15 Teacher Professional Learning workshop in Albuquerque)

1. PROTECTING FROM NATURAL AND MAN-MADE DISASTERS

DR. VANIA JORDANOVA Los Alamos National Laboratory	Dr. Jordanova is a space scientist whose areas of expertise include: • Using theory, observation, and numerical analysis to study the Earth's magnetosphere and geomagnetic storm dynamics • Development of numerical models • Theoretical plasma physics studies • Data analysis and interpretation • Computer simulation and visualization Dr. Jordanova's team developed SHIELDS, a platform to model space weather and predict hazards caused by solar storms. She also worked with two Instrument Teams on NASA's Van Allen Probes to study plasma structures and dynamic processes in Earth's radiation belt, and has researched how extreme space weather can impact power grids.
MATTHEW FETROW Air Force Research Laboratory	Matthew directs the Technology Engagement Office at AFRL in New Mexico (NM). He leads technology transfer, STEM outreach, commercialization, innovation, and community engagement in the state such as the annual Robotics Challenge Expo hosted last year. Matt has led numerous technology programs for the Air Force on: • Space remote sensing • Laser remote sensing • Advanced photonics. Prior to his years of federal service, he worked in optical systems research, development at industry startups, and in academia.

2. CONSERVING THE ENVIRONMENT

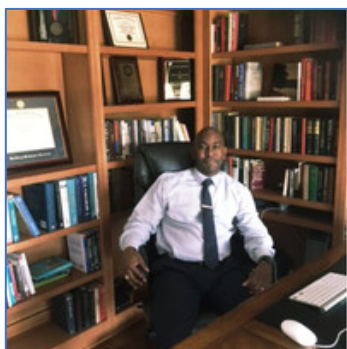|	
Chuck Hathcock Los Alamos National Laboratory	Chuck is a wildlife biologist and task lead for LANL's Biological Resources Management. This position includes: • Conducting impact analysis of proposed construction activities on federally listed species, wetlands, and migratory birds • Conducting annual presence/absence surveys of certain species and monitoring bird populations using the Monitoring Avian Productivity and Survivorship protocol, point counts, and fall migration banding • Writing and updating institutional management plans for migratory bird protection and sensitive species protection Mark's research specialty is avian studies, and how bird populations are affected by impacts like habitat fragmentation or climate change.

DR. ALEXANDRA JONKO Los Alamos National Laboratory	Dr. Jonko is an atmospheric scientist from LANL currently studying interactions and feedbacks between wildfires and the changing climate. Dr. Jonko's past experience and expertise includes: • Working with climate model data • Using various climate feedback quantification methods • Building climate energy balance models • Modifying and running more complex global climate models She is currently working with the computational software HIGRAD/FIRETEC to explore the effects of complex topography on wildfire behavior, something not yet included in projection models.
DR. DORIAN NEWTON N3B	Dr. Newton is the director of the technical services division within engineering and nuclear safety at N3B, an organization contracted by LANL to manage legacy cleanup operations. His role includes responsibility for multiple programs including training, apprenticeship, and facility support programs. Dr. Newton's areas of expertise include: • Engineering management • Systems engineering • Nuclear science • Naval science • Program management Dr. Newton also worked previously as a Naval Nuclear Propulsion Plant operator.

3. SECURING INFORMATION AND DATA
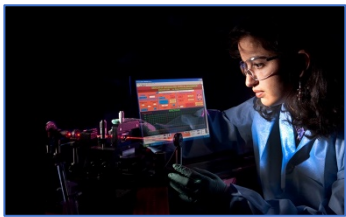
Erika Edgerly Intel	Erika manages government affairs at Intel Corporation. Her extensive leadership background in the technology industry includes 15+ years of experience in: • Strategic planning • Program/project management • Organizational restructuring and building • Developing and leading teams • Process improvements to increase productivity and efficiency Erika has been recognized for influencing, motivating, and driving change throughout large organizations along with developing strategic plans to drive business initiatives and operational excellence.

Azin Mehrnoosh Meow Wolf	Azin is an entrepreneur and product manager at the immersive art installation Meow Wolf. He has 15 years of experience designing, building, and shipping technology products as a startup founder, working with international clients like LEGO and the World Economic Forum. Azin's expertise includes: • Mobile applications and digital strategy • Social entrepreneurship and start-ups • Web design and web applications • Digital strategy and information architecture • User interface design Azin is currently bringing novel and previously unreleased digital products to market with the Meow Wolf creatives and technologists.
Neale Pickett Los Alamos National Laboratory	Neale Pickett is a computer scientist who fights cybercrime. At the Laboratory he works to develop techniques to defend against different threats, and trains others to adapt the same agility and responsiveness. His information technology expertise includes: • Systems design and computer architecture • Programming languages • Systematic analysis of a computer's defenses and vulnerabilities Neale developed a cybersecurity program for students to learn to deal with cyberattacks using simulations based on real incidents.
Ronald Tafoya RESPEC	Ron is a principal consultant and cybersecurity specialist for a database management company, and the resident technologist for a high-technology business accelerator (HD3). Ron has 25+ years of experience in computer software application development and deployment, including: • Software system development and security • Scientific research strategies and system design • Technology transfer • Intellectual property development and management • Medical device development and product commercialization Ron previously worked as a Security Champion for Intel, and holds professional certifications in Project Management, Ethical Hacking, and Information System Security. He also has broad experience in small business development and technology, sits on various boards for public and private sector organizations.

4. IMPROVING HEALTH

Dr. Denise Gonzales Presbyterian Healthcare Services	Dr. Gonzales is a pulmonary physician, critical care physician, and biomedical engineer. She works with patients with breathing disorders and those needing critical treatment. Her specialties include: • Healthcare management • Critical care and ICU • Healthcare information technology and informatics • Clinical research and medical education • Patient safety • Internal medicine Dr. Gonzales is the Medical Director for both Adult Medical Specialties and Neuroscience at Presbyterian Medical Group, leading complex teams who deliver highly specialized care.
Dr. Jennifer Harris Los Alamos National Laboratory	Dr. Harris is a bioengineer and toxicologist whose team developed the Pulmonary Lung Model (PuLMo), a tissue-engineered artificial lung that mimics the response of the human lung to drugs, toxins, particles, and other agents. Her expertise includes: • Biosecurity and public health • Drug toxicity assessments • Prediction of pharmaceutical success • Organ culture and tissue In 2016, PuLMo won a prestigious R&D 100 award given to the most innovative and significant inventions worldwide.
Dr. Harshini Mukundan Los Alamos National Laboratory	Dr. Mukundan works in microbiology and biomedical sciences and leads a multidisciplinary team to develop new methods to detect infectious diseases. Her team developed a universal bacteria sensor that mimics the human immune system to recognize bacterial pathogens, and won an R&D 100 award. Her expertise includes: • Biotechnology and biosensor capabilities • Infectious disease modeling and cancer research • Multi-disciplinary detection, diagnostics, and biosurveillance Dr. Mukundan also worked on sensor development to detect bio-warfare agents, and explored complex challenges in epidemiology and diagnosis.

5. SAFEGUARDING FOOD, WATER, AND ENERGY

Mark Gaiser New Mexico State Energy Office	Mark is the Clean Energy Project Manager at the NM State Energy Office, where he is responsible for promoting solar energy resources across the state. His expertise includes: • Engineering and management • Solar energy and photovoltaics • Semiconductors • Electrical engineering • Semiconductor industry Mark also has experience in statistical process control and failure analysis.