Physics as a foundation for a successful STEM career

Camron Proctor, Ph.D.

September 15th, 2020

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA-0003525. SAND2018-8688 HR **Equal opportunity employer/Disability/Vet/GLBT** **08/2018**

SAND No. SAND2020-9605PE

Agenda

About Me
- Time at USD
- UC Davis Research

Sandia
- National Security
- Opportunities to Connect

Mk21 Fuze Program
- NNSA's Role
- Mk21 Story
- Thunderpipe Video

ParaChoice
- What is ParaChoice?
- Why do we trust it?
- How is it used?

Lessons Learned

A little about me

Started at USD in 2006

Knew I wanted to be a physics major

Worked at the:

- The UC
- Physics Department
- ROTC

A Founder of Phi Kappa Theta

Summer research as part of:

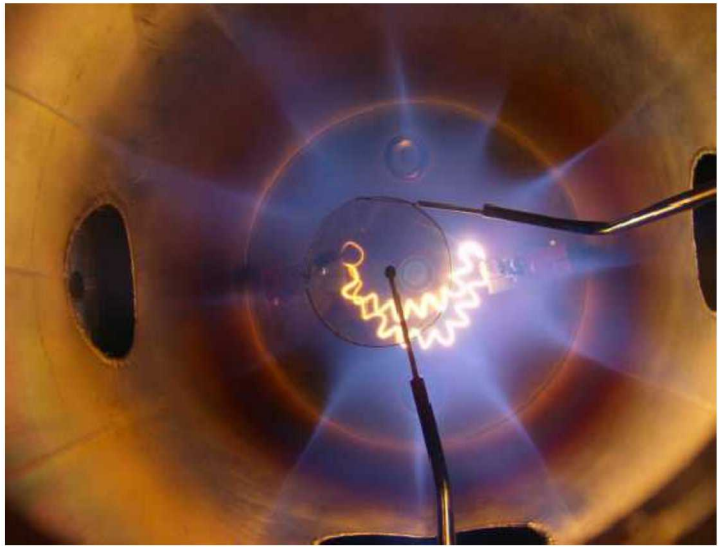
- SURE program
- McNair program

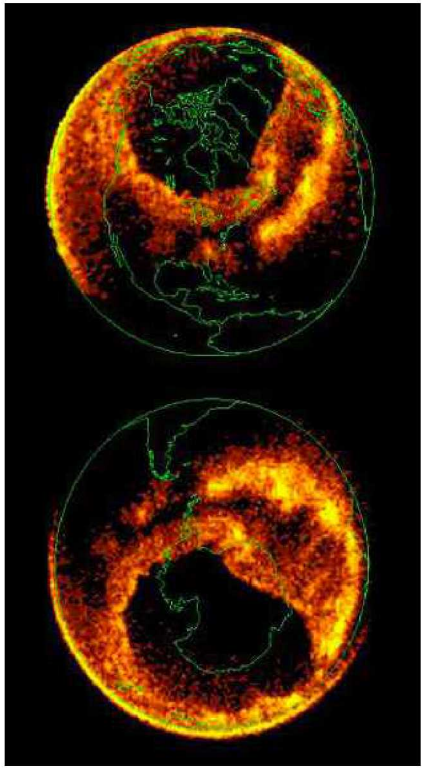
The summer research with Dr. Severn opened doors and taught important lessons

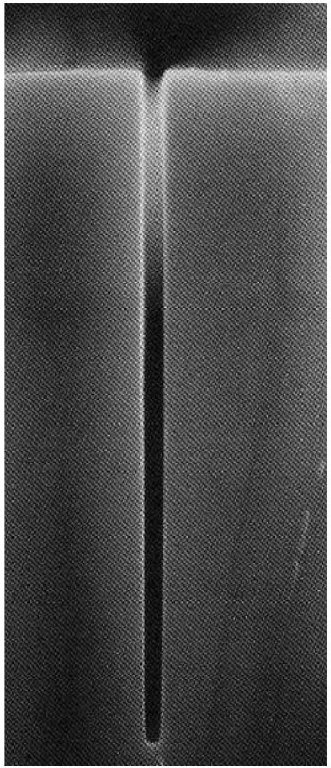
Using Ion Acoustic Waves to study negative ion fraction

Wanted to calibrate laser photo detachment as a better method

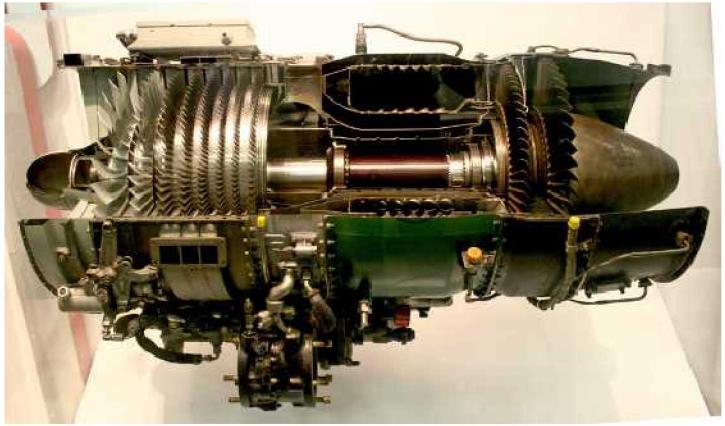
Presented the work at APS DPP (2009)

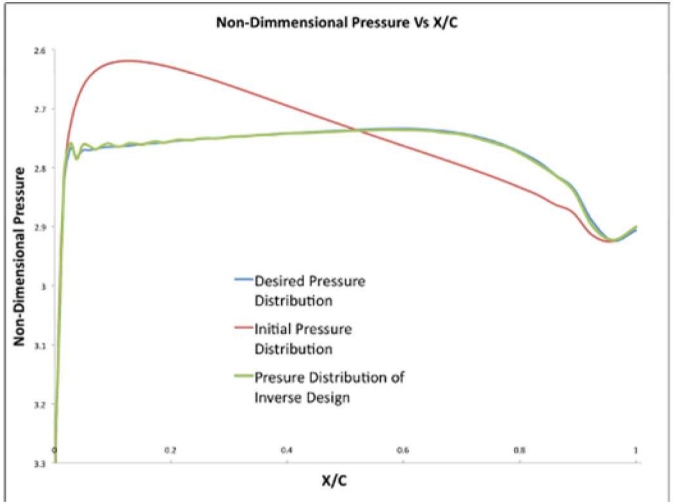


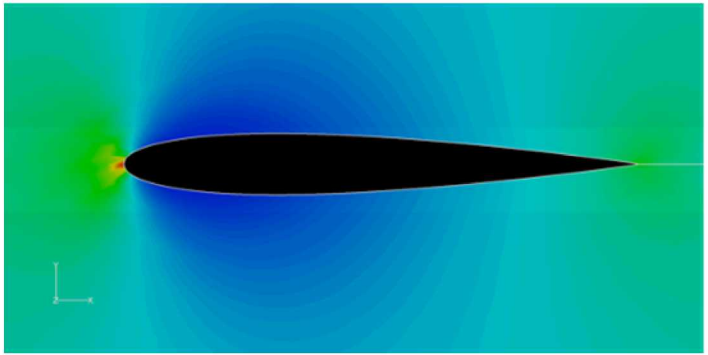


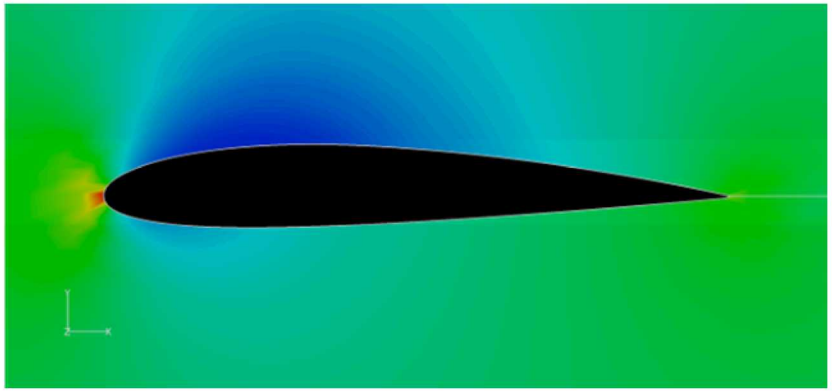


I pivoted from experimental plasma physics to computational fluid dynamics (CFD).









Agenda

About Me
- Time at USD
- UC Davis Research

Sandia
- National Security
- Opportunities to Connect

Mk21 Fuze Program
- NNSA's Role
- Mk21 Story
- Thunderpipe Video

ParaChoice
- What is ParaChoice?
- Why do we trust it?
- How is it used?

Lessons Learned

Fulfilling Our National Security Mission

Nuclear Deterrence

Defense Nuclear Nonproliferation

National Security Programs

Energy & Homeland Security

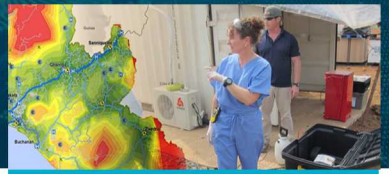
Advanced Science & Technology

We [illegible] of life.

Sandia's Impact

As a multi-faceted national security laboratory, Sandia develops advanced technologies to ensure global peace.

Sandia is often called upon to respond to high-profile events, including 9/11 and the Ebola outbreak.



Ebola Outbreak

Sandia contributes to global response of Ebola outbreak by developing a sample delivery system cutting the wait time and potentially fatal exposure.

Cleanroom invented 1963

$50 billion worth of cleanrooms built worldwide. They're used in hospitals, laboratories and manufacturing plants today.

9/11

Sandia sets contingency plans for release of materials and aircraft attacks on critical facilities immediately after 9/11. Search dogs are equipped with cameras for search and rescue K-9 handlers. The capability allowed search efforts to be carried out in spaces inaccessible to humans.

Detecting IEDs

Combat personnel now have a new tool for uncovering improvised explosive devices: Sandia's highly modified miniature synthetic aperture radar system, which is being transferred to the U.S. Army.

Internships

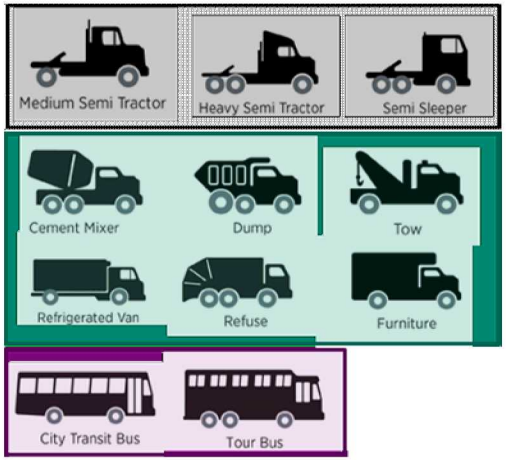
Encourages qualified students to develop interests in critical skills areas related to our mission, with the ultimate objective of developing our pipeline for our future. Available for Summer, Year-Round and Co-op.

Eligibility Criteria

- Min. cumulative GPA (3.0 Undergrad/Grad)
- Have U.S. citizenship for positions that require clearance or as stated in the job posting
- Full-time enrollment status at an accredited college, university, or local high school
- At least 16 years of age

Sandia has given me the opportunity to work on a wide variety of projects

SF BREEZE



ParaChoice

Thunderpipe

Agenda

About Me
- Time at USD
- UC Davis Research

Sandia
- National Security
- Opportunities to Connect

Mk21 Fuze Program
- NNSA's Role
- Mk21 Story
- Thunderpipe Video

ParaChoice
- What is ParaChoice?
- Why do we trust it?
- How is it used?

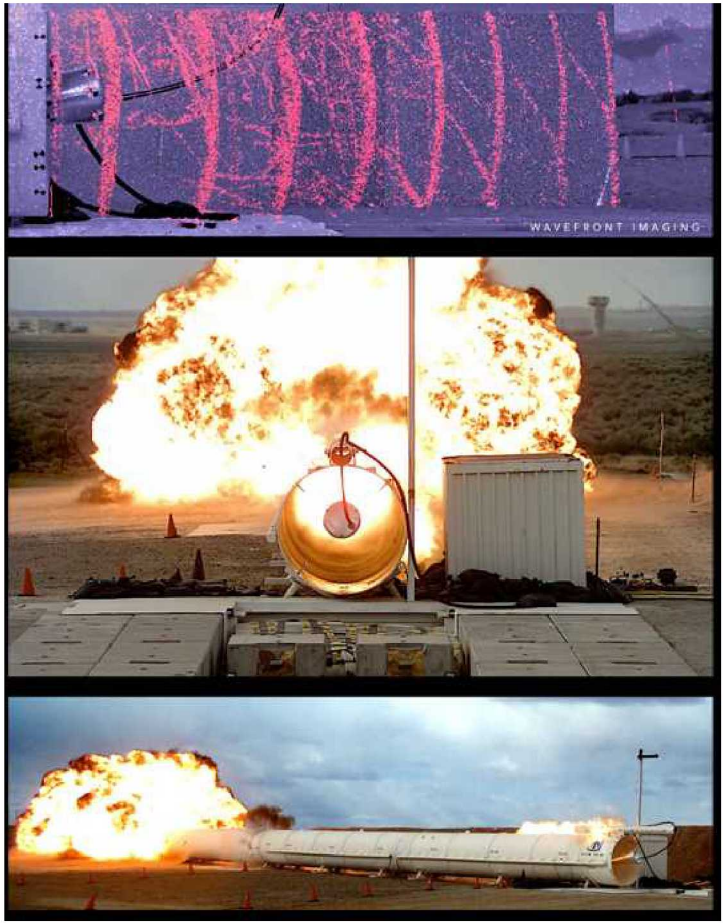
Lessons Learned

As the nation's NNSA Engineering Lab, Sandia is responsible for a large portion of Stockpile Management

- NNSA Core mission is to ensure safe secure & reliable nuclear stockpile.
- Most weapons were produced during 1950s & 1960s
- The United States Voluntarily ended underground nuclear explosive testing

Sandia provides an opportunity to work on complex multidisciplinary projects, like the Mk21 Fuze.

- Fuzing means sending the signal to detonate
- DOD has responsibility of Arming and Fuzing
- For Safety, Security and Reliability reasons a drop-in replacement is being designed for the Mk21/W87



Thunderpipe Test Video

https://www.youtube.com/watch?v=EM0oRPcEO6c

Agenda

About Me
- Time at USD
- UC Davis Research

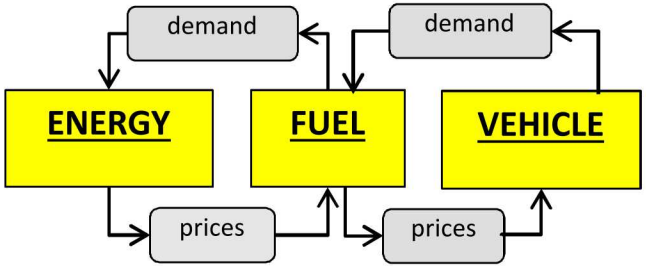
Sandia
- National Security
- Opportunities to Connect

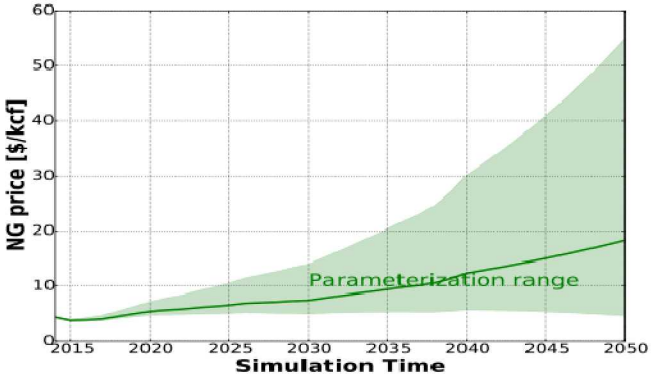
Mk21 Fuze Program
- NNSA's Role
- Mk21 Story
- Thunderpipe Video

ParaChoice
- What is ParaChoice?
- Why do we trust it?
- How is it used?

Lessons Learned

ParaChoice projects the adoption of new technologies, emissions, and petroleum consumption out to 2050

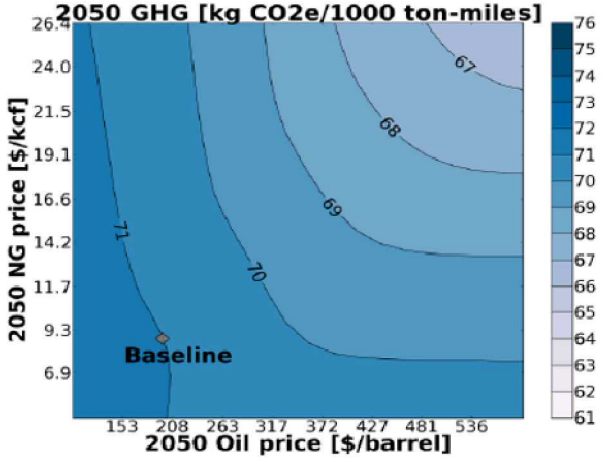




Takes a full system model approach leveraging the interrelated nature and complexity of the transportation space

Understand and Mitigate the inherent uncertainty from data sources and simplifying assumptions

Identifies Trade Spaces Tipping Points and Sensitivities



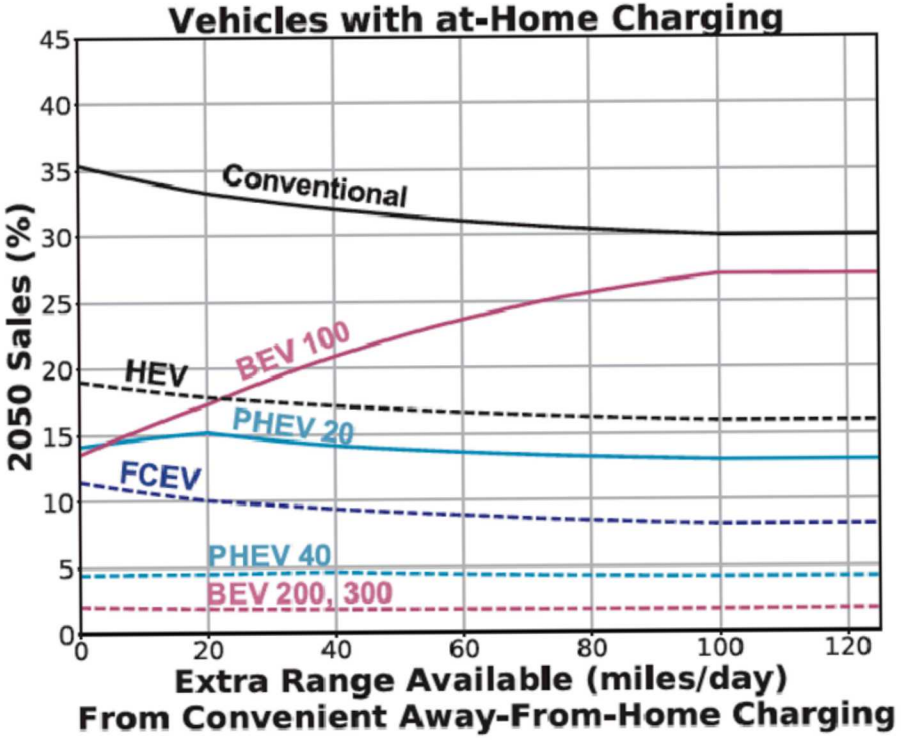
We investigated the effects of Convenient away-from-home charging (CAFHC) to understand the investment opportunity.

Close correlation between being able to charge a PHEV/BEV and purchasing

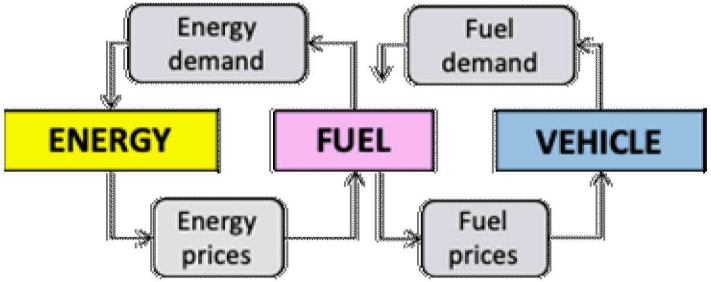
Enabling new infrastructure will therefore need to precede adoption

Infrastructure is a significant financial investment

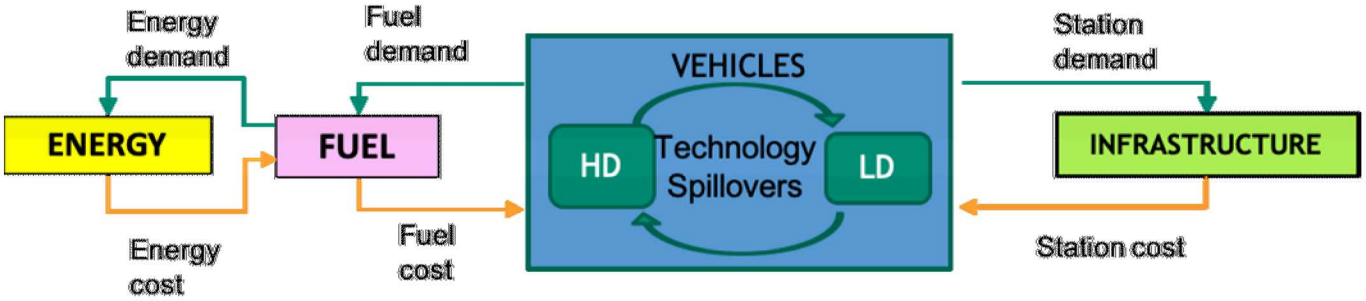
- How much is enough?
- Is there a point of diminishing returns?



In the real-world technologies and infrastructure are shared between segments.



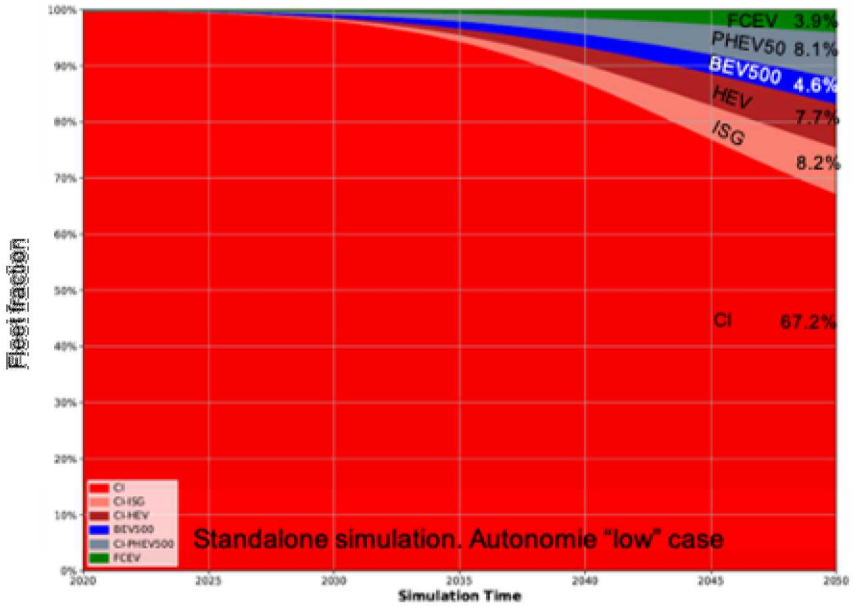
Combining the models amplifies the value of endogenous fuel, energy and infrastructure modeling.

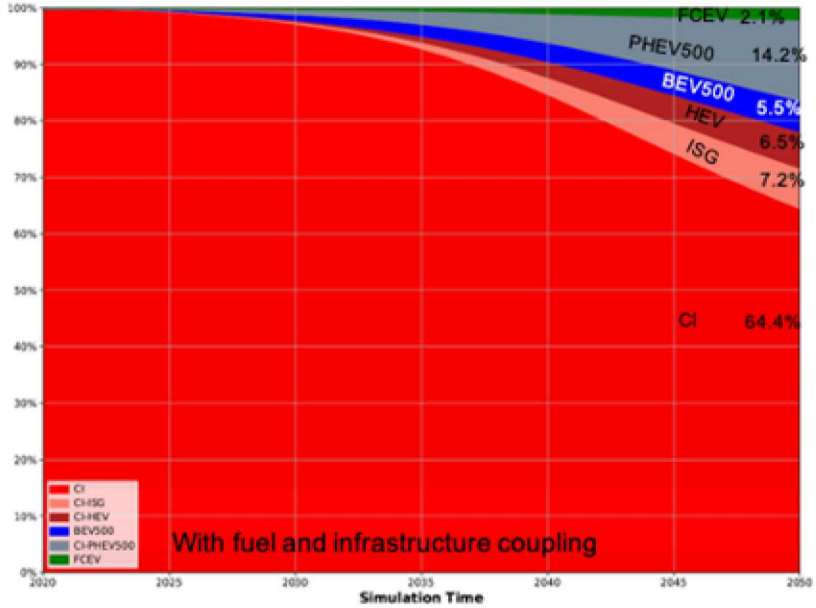


The Integration of the ParaChoice models allows us to better capture the complex interactions between choice, infrastructure, fuels and energy.

Fuel, infrastructure and technology spillover may be physical vectors by which increased adoption of AFVs can manifest

The changes in adoption can mean reduction in petroleum consumption and vehicle emissions.





Agenda

About Me
- Time at USD
- UC Davis Research

Sandia
- National Security
- Opportunities to Connect

Mk21 Fuze Program
- NNSA's Role
- Mk21 Story
- Thunderpipe Video

ParaChoice
- What is ParaChoice?
- Why do we trust it?
- How is it used?

Lessons Learned

Unsolicited Advice

1. Take all broad/general advice with a grain of salt.
2. Find mentors and champions.
3. Don't worry about the time that it will take to do something you are passionate about – the time will pass anyway.
4. Interviews are a two-way street.
5. It's ok to not be the right fit.
6. Make sure that your energy is getting you where you want to go.
    1. Take time to look up and make sure your destination is still what you want.
7. You don't know what you don't know.
    1. There are so many resources, opportunities and options out there.
8. Don't be afraid to be you, there are many ways to be successful.


Thank You!

Summary

National Security mission encompasses nearly all STEM fields

Numerous openings for graduate students and Postdocs

Sandia is hiring for Nuclear Deterrence work like the Mk21 Fuze

Non-nuclear work is available on projects like ParaChoice.