



## Year in Review for the Blunck Research Group at Oregon State University

### Dear Colleagues and Friends,

How do we describe 2021.... “The fun continues!” or “Is it over yet?” In all seriousness, 2021 was great for the research group and we continue to make progress in both research and student development. None of our accomplishments occur without the support of collaborators, mentors, and funding agencies. I am sincerely grateful for my associations and friendships with all of you.

### Overview

At our peak in 2021 the research group had 9 graduate students, 1 post-doctoral scholar, and several undergraduate students. Our portfolio includes research into the physics of detonations, how wildfires spread (see Figure 2), burning of living trees/shrubs, and ignition for propulsion applications (e.g., augmenters). I like to describe our research as taking complicated combustion processes (e.g., wildfires or combustors) and then developing experiments to better understand key aspects of those processes.



**Figure 1.** Picture of the some of the 100+ students who joined the OSU Space Race Program that I started this past year. The program seeks to improve student development and retention by engaging students in an effort launch a liquid-liquid rocket to the edge of space.

### Successes of Students and the Group:

- Our research was featured nationally on a segment with National Public Radio. It was fun (and a little strange) to receive emails from colleagues from as far away as Maryland who heard about our research “out of the blue”. <https://www.marketplace.org/2021/07/23/as-wildfires-intensify-in-the-west-scientists-look-at-how-they-spread/>
- Our group continued to lead two efforts worth over \$4M studying burning of live fuels and smoldering of natural fuels (e.g., Figure 4). We are collaborating with colleagues from OSU and the U.S. Forest Service.
- We are grateful to have received a large grant from ONR to buy one of the fastest infrared cameras on the market, which will allow us to collect radiation intensity measurements up to 100 kHz. We certainly would be glad to travel and collect measurements at your facility.
- Kaz Teope successfully defended his PhD thesis evaluating the ignition behavior of jet-fuels. He is currently a Major in the US Air Force and is working at the Air Force Research Laboratory.
- Jonathan Bonebrake, a recent PhD graduate, started a job at NASA (Marshall Flight Center). At least 9 former or current graduate students have interned or worked at national laboratories.



**Figure 2.** Burning of chamise to study firebrand production.

- Our team was selected with others at OSU for a multi-million-dollar project funded by the DoE to reduce smoke pollution from wood burning stoves. We will focus on identifying key physics that control/influence smoke production. Ironically, we will be drawing on knowledge and approaches used in gas turbine engine combustor design.
- Andrew Ross (MS graduate) successfully defended in August his work related to the influence of particle size on smoldering behavior. This work builds on our work evaluating the efficacy of creating surrogates to



represent duff (i.e., piles of needles underneath trees). He is starting a job at Boeing; presumably he was not hired for his expertise in smoldering ☺.

- The group was able to publish an extensive review paper about applying infrared thermography to study flows with participating media.  
<https://www.sciencedirect.com/science/article/pii/S0894177721001473>
- Students published multiple research articles, several of which were very well received.

### Other Accomplishments:

- My family and I still love each other and enjoy being together (usually)—despite a pandemic and having 4 energetic boys!
- I “launched” a new initiative called the OSU Space Race targeted at engaging younger engineering students in developing a rocket to launch to the edge of space. In the first term, + 100 students participated (see Figure 1) and the impact on student retention and progression was excellent. This is part of my broader efforts as an Associate School Head to increase student graduation rates and professional preparation.
- My family’s farm had a u-pick pumpkin patch in the fall (see Figure 5). It was a great experience and profitable (personally and, to an extent, financially) for my sons. This activity contributed to our family being featured on the front page of the College of Engineering website.  
<https://engineering.oregonstate.edu/engineering-success-farm> I am not sure if their highlighting us is a positive or negative reflection on the College, but my family thought that it was great.

### Looking Forward:

In 2022 I am looking forward to several graduate students graduating and applying their experience in industry or national laboratories. I believe that they are well prepared to have a positive impact in the world. I also look forward to multiple published papers. I think that it will be possible to have 10 published or accepted as we conclude several research projects. Finally, I am excited to continue to serve as the Associate School Head and to positively influence the 1700 undergraduate students in our program. Please be sure to stop by and visit the group when you are in the Pacific Northwest.

Best Wishes,

David

Feel free to follow us on social media platforms for current updates about the research group.

Facebook: <https://www.facebook.com/osupropcirelab/>

Instagram: <https://www.instagram.com/osupropcirelab/>



**Figure 3.** Students work on a liquid oxidizer, liquid fuel rocket motor at the laboratory.



**Figure 4.** Smoldering to flaming transition in a wind



**Figure 5.** Pictures from the family pumpkin patch.