Ember Generator for Forest Fire and Facility Component Testing

Sponsor: UI CNR, Alistair Smith & Doug Hardman

Would you like the opportunity to work with fire? If so, this might be the project for you. We are looking for some talented engineers to update the design and build the next generation of the Idaho Dragon (aka Dragon 2.0) ember generator. This project is an opportunity to contribute to protecting our forests and living areas. This apparatus will also be a key feature in future recruitment and marketing of the fire program to future Vandals.

Additionally, the equipment can be used to further research into the risks posed to structures in the wildland-urban interface from wildfire and prescribed fire generated embers. This research will provide invaluable data and videos that will also be used in FIRE 450.

Project Goal: The main goal of this design project is to update an invaluable teaching demonstration apparatus used in FIRE 450: Fire Behavior, a required course in the B.S. in Fire Ecology and Management. When using the original version of the Dragon we found some areas that need an update or modification to make the device easier and safer to use. Further, Dragon 2.0 will need to connect to a wind-tunnel in a similar fashion to Dragon 1.0. Use of the original design is not required, but lessons from Dragon 1.0 may save some time and costs.

Funding: FRFS will provide up to $3,000.00 in funding for the ember generator project.

Key Objectives: The original specifications to produce an "ember storm" via an ember generator are listed in characteristics 1-10 below. Items that need updates are highlighted in bold; new characteristics are listed in items 11-18.

1. Design the equipment materials for safe operating temperatures in the burn and output portions.

2. Configure the output for either open generation or into a wind tunnel as needed for the experiment.

3. Design so the ember generator can safely receive fuel without fire feeding back into the fueling mechanism.

4. Develop shut down, emergency shut down, and **fire suppression (mechanical options are preferred)** procedures.

5. Can sustain a focused stream of embers for at least 15 minutes without reloading the supply mechanism.

6. Provides an airflow output speed ranging adjustable from 0-5.0 meters per second.

7. The wind tunnel should be portable and transportable on up to two carts. Final design will influence the dimensions of the carts. Carts should be able to move across slightly rough surfaces (e.g., compacted gravel parking lots) for short distances.

8. Be vibration resistant to allow transportation in the bed of a truck or in a trailer.

9. Design for 120 VAC and try to keep amperage at or below 15 amps. If this is not possible, provide alternatives (e.g., 240 VAC or two separate electrical feeds at or below 15 amps).

10. Proposed a reasonably available fuel supply for the embers. This should be developed with input from the FRS representative.

11. Provide a more remote ignition system for the propane burner (e.g., not a lighter).

12. Similar to items 3 and 4 above, design a new or updated feeding system that greatly reduces or eliminates fire burning back from the burn chamber into the feeding mechanism.

13. Provide propane leak detection with audible and visual warnings.

14. Provide a mechanism to regulate propane pressure to the burner from 0-3 psi (target) with a desired range from 0-1 psi. Provide a larger size, approximately 3-inch, analog gauge commensurate with range of the propane regulator. The gauge must be rated for propane. Caution, from experience, using an adjustable propane regulator with a range larger than the gauge will damage the gauge and make it unusable.

15. Provide better sealing of the tubing joints to eliminate embers escaping from the sides of the pipes.

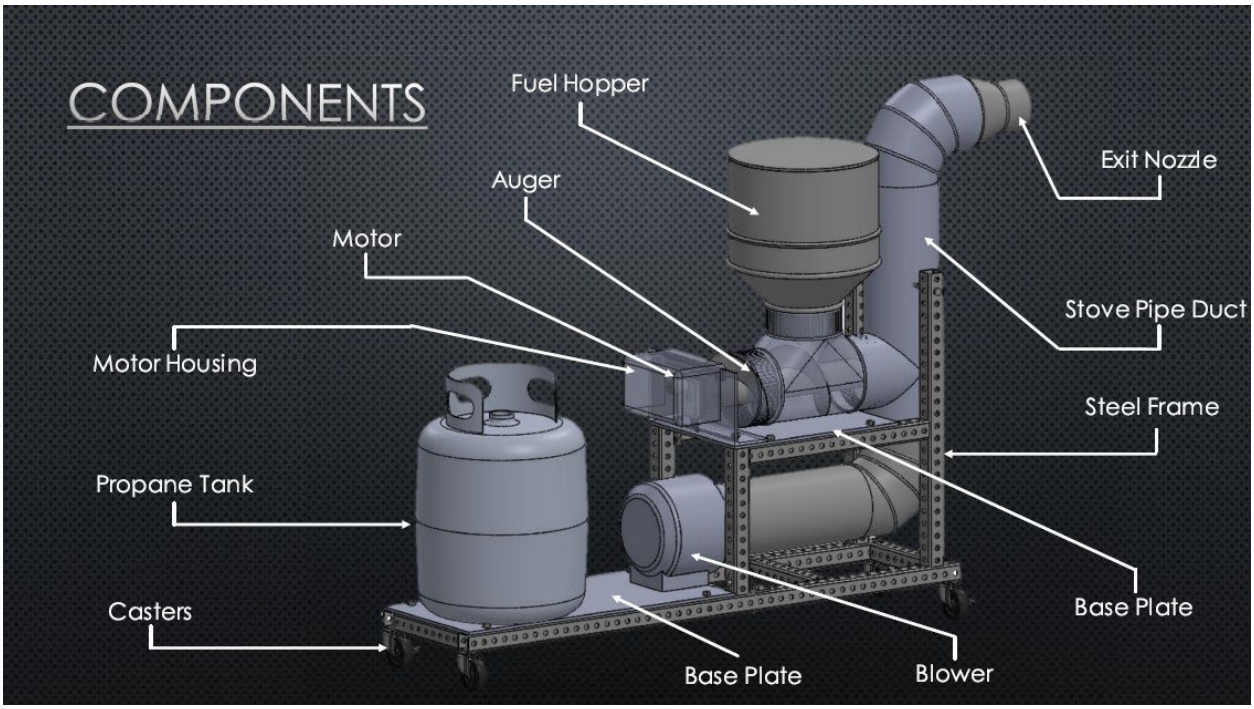
16. Include an adjustable output angle for the embers, similar to Dragon 1.0.

17. Include thermocouple mounting devices for the tubing adjacent to the burn chamber, the feeding mechanism, and the outlet section.

18. Provide an efficient mechanism for cleaning out unburned wood chips below the burner assembly and the fuel feed.

Project Rationale: As devastating wildfire become more prevalent it is important to understand how fires spread ahead of the main fire front through spotting, which is mainly through fire embers being transported by winds sometimes kilometers ahead of the front. This project will be used to demonstrate the impacts of ember storms from wildfires and in experiments to understand how embers ignite various vegetation and building structures.

The points of contact for these efforts will be Dr Alistair Smith, alistair@uidaho.edu, 208-885-1009, and Douglas Hardman (PhD candidate), hard6997@vandals.uidaho.edu, 208-416-1652.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Exit Nozzle
Auger
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Steel Frame
Propane Tank
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Base Plate
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