IGEM Grant Report

☒Progress (due January 1) ☐ Annual (due July 31) ☐ Final (due August 31)

IGEM Grant # **IGEM26-002** Principal Investigator **Ken Cornell, Ph.D.**
Name/Full Title of Project [*Proof of Concept Project*]:
Improving Idaho Seed Crops with Cold Atmospheric Pressure Plasma (CAP) Technology

Submission Date **12/30/2025** Primary Institution **Boise State University**

Instructions: Complete each section of this report directly on this template. Completed reports must be limited to 1 page for Progress Reports in 12 pt Arial or similar font, excluding the expenditure report.

Section 1: Provide a short one paragraph summary describing the project and its goals

This project focuses on the development of a cold atmospheric-pressure plasma (CAP) array for use in seed processing. The goals of this project are to: ***(1)*** *engineer a 10cm x 10cm array device and deploy on a conveyor or gravity separator to treat seeds and surfaces during processing, and* ***(2)*** *determine CAP treatment parameters that eliminate 90-99% of pathogens from seeds and surfaces.*

Section 2: Summary of project accomplishments and plans for the upcoming reporting period.

During this reporting period (7/1/25-12/31/25) the following has been accomplished:

1. *Plasma array is fabricated with gas recovery manifold to scavenge ionized products [milestone A].*
2. *Operating conditions (voltage, current, gas flow) determined for uniformity [milestone A].*
3. *Prototype device has been deployed on a conveyor belt [milestone B].*
4. *Manuscript accepted for publication (IEEE Transactions Plasma Sci, Dec 2025) [milestone C].*
5. *Device shown to kill 91-94% of the plant pathogen Ps. syringae on surfaces [milestone D].*

During the upcoming reporting period the project plans will focus on ***(1)*** *expanding studies on the types of seeds and plant/foodborne pathogens (to meet milestone D),* ***(2)*** *demonstrate device activity while on a conveyor belt (milestone E), and* ***(3)*** *submit 2nd manuscript for publication (milestone F).*

Section 3: High-level summary of budget expenditures, explain why and plans for expending...

Expense Summary (7/1/25-12/31/25): Expensed Budget: ***$28,953*** *(22.7% of $127,800 budget)*
Encumbered budget: ***$87,079*** *(68.1%) Remaining unencumbered budget:* ***$11,768*** *(9.2%)*
The total budget for the initial 6-month period is underspent by approximately 37%. This is due to: ***(1)*** *salary/fringe being deferred to the second 6-month period,* ***(2)*** *reduced experimental supply costs as prototype operating conditions were determined and leveraging of supplies paid from summer student fellowships. Expenditures (salary, fringe, tuition, insurance) have been encumbered for the 2nd project period. The remaining unencumbered budget will be used for supplies during the 2nd 6-month period.*

Section 4: Demonstration of economic development/impact, including: patents, copyrights, etc.

1. *One patent disclosure filed: Large Atmospheric Pressure Plasma Array (P15236US00 / BSU-316)*
2. *Industry/Private sector engagement: The PI presented the project during the 2025 Futurama - Winter Idaho Eastern Oregon Seed Association (IEOSA) conference.*
3. *Applications for external funding: Grants submitted to the USDA, NIH, and NSF. All pending.*

Section 5: Number of faculty & student participants, and brief description of student efforts.

Number of Faculty: **4** Number of Students: **1** Ph.D. student, **14** undergraduates.
Student Efforts: **11** undergraduates worked under the guidance of the PI and the Ph.D. student to perform antimicrobial and germination experiments, and presented their work at 4 scientific venues. **3** business students in an entrepreneurship course presented their work on CAP economic benefits to the seed industry during a BSU competition. They won 1st prize ($1000).

Section 6: Updated details on project long-term sustainability plan for the project,,,

The PI (Cornell) and coPIs (Browning, Pearlman) are actively pursuing external grant funding to continue to support the project. Planned grant applications in 2026 include NSF TTP-T and USDA NIFA and USDA SBIR/STTR applications that include translational projects to commercialize the technology for incorporation into the seed and food processing industries.

Section 7: Expenditure Report – see attached.

Section 7. Budget Expenditure Report (IGEM26-002, Cornell PI)

Line Item Request	***Original:***	***Expended:*** *(7/1-12/31)*	***Encumbered:*** *(1/1/26-6/30/26)*	***Unencumbered:***
Personnel (Salary)	***$ 79,600***	***$ 16,406***	***$ 63,194***	***-***
Personnel (Fringe)*:*	***$ 19,100***	***$ 4,008***	***$ 15,092***	***-***
Equipment	*$ 0*			
Travel	*$ 0*			
Participant support	*$ 0*			
Other Direct: Supplies	***$ 14,000***	***$ 2,946***	***-***	***$ 11,054***
Other Direct: Grad tuition	***$ 11,900***	***$ 5,593***	***$ 5,593***	***$ 714***
Other Direct: Grad insurance	***$ 3,200***		***$ 3,200***	***-***
Total:	***$ 127,800***	***$ 28,953***	***$ 87,079***	***$ 11,768***
(%)	*(100)*	*(22.7)*	*(68.1)*	*(9.2)*

Explanation of Expenditures:

Personnel Salary and Fringe. In the first six months of the project $16,406 in salary and $4,008 in fringe was expended supporting the efforts of Drs. Browning (co-PI), Pearlman (sr personnel), and Hay (sr personnel).

Some initial salary savings during the first six months of the project were due to:

1. The PI (Cornell) received summer salary from other grant sources that had to be allocated for use during the 2025 summer months. He has a 9-month appointment at BSU that covers his salary during the academic year. The salary encumbered for 0.5 mo of PI effort will be spent during the May/June 2026 time frame, so will be expensed in the second 6-month grant period.
2. The graduate student (Rood) received a graduate research assistantship salary for the Fall 2025 semester from another grant source to work on the germination and antimicrobial studies, Her salary will be covered in the second 6-month grant period from the IGEM-HERC grant.
3. Other salary expenditures for Drs. Browning, Pearlman, and Hay will increase during the second 6-month grant period to fully expend this budget category. These changes will reflect annual minor salary increases for Drs. Browning and Hay, and a salary rate increase for Dr. Pearlman to reflect his recent promotion to Sr. Research Scholar.

Despite the initial underspending of in this budget category by approximately 29%, the remainder of the salary encumbered for the project will be expended during the next project period.

Materials & Supplies. The materials and supplies budget was underspent by approximately 29% as well. This largely reflects: **1)** many materials and supplies for the project were purchased using supply funds that were awarded to 6 undergraduate students who received summer fellowships from the NSF SARE and Ralph Jones Premedical fellowship programs, **2)** the focus of the project during the first 6-month period on optimizing device operating parameters and preparing a publication. The remaining supply budget will be completely expended during the second 6-month project period for experiments to characterize the antimicrobial effect of the plasma device while deployed on a conveyor belt system.

Graduate Tuition. A small change to the graduate tuition rate charged by BSU in the 2025-26 academic year led to a $ 714 savings. These savings will be applied to either supply or salary/fringe categories and expended during the second 6-month project period.

Graduate Health Insurance. The annual graduate health insurance charges are due in the second 6-month project period and will be fully expended.