

ABSTRACT

- Student Payload Opportunity with Citizen Science (SPOCS) is a program funded by NASA to inspire the Artemis generation
- Scientific Question: How does microgravity impact the efficacy of bacteria resistant polymers?
- Experimental apparatus to be sent to ISS with 2 polymer chemistry candidates coated on Al 6061 alloy coupons
- *Staphylococcus Epidermidis* bacteria strain to simulate growth of superficial dermal bacteria

CITIZEN SCIENCE

- Utilized citizen scientists grades 3-5 as a resource to determine the two best polymer candidates
- A total of 220 citizen science kits distributed containing polymer chemistry and control agar growth trials
- A total of 98 citizen science data sets returned

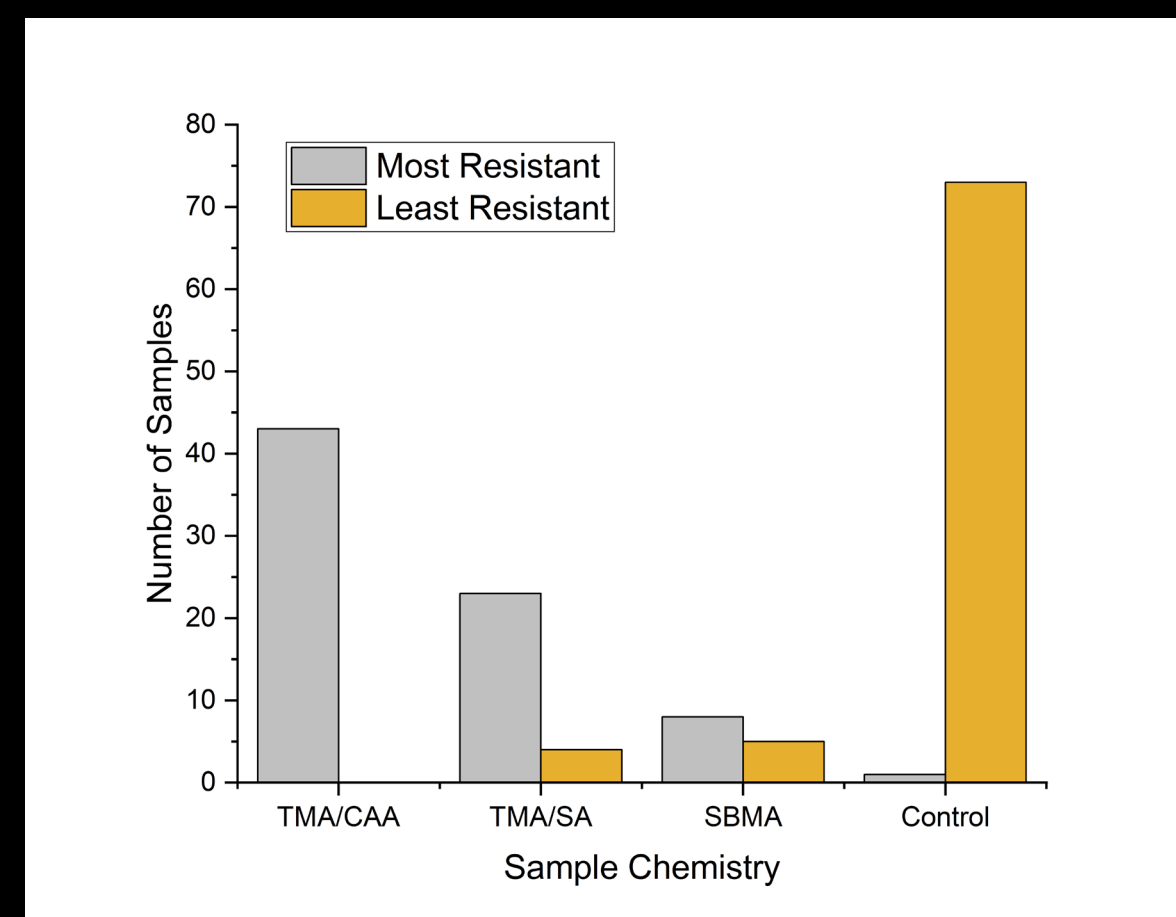


Figure 1: Results from citizen science experiments

OUTREACH

- Created focal project website that features details and weekly update blog posts
- Facilitated @uidaho Instagram takeover that reached 9,543 users
- Created and handed off an adapted project for Engineering Ambassadors high school visits
- Official NASA Tumblr Answer Time planned for July 2021

idahospocs.org



EXPERIMENTAL BUILD

- The build is constrained to 10cm x 10cm x 15cm and 1.5 kg per program regulations
- Two compartment design made of Delrin with a dry electronics space in the top, and wet nutrient broth space below
- Total of 16 Al 6061 coupons for replicate trials of selected polymer coatings and control
- Three bacteria introduction devices (BIDs) for redundancy in design
- The BID mechanism uses compressive force from a spring to drive piston downward, introducing stored bacteria to the nutrient broth compartment

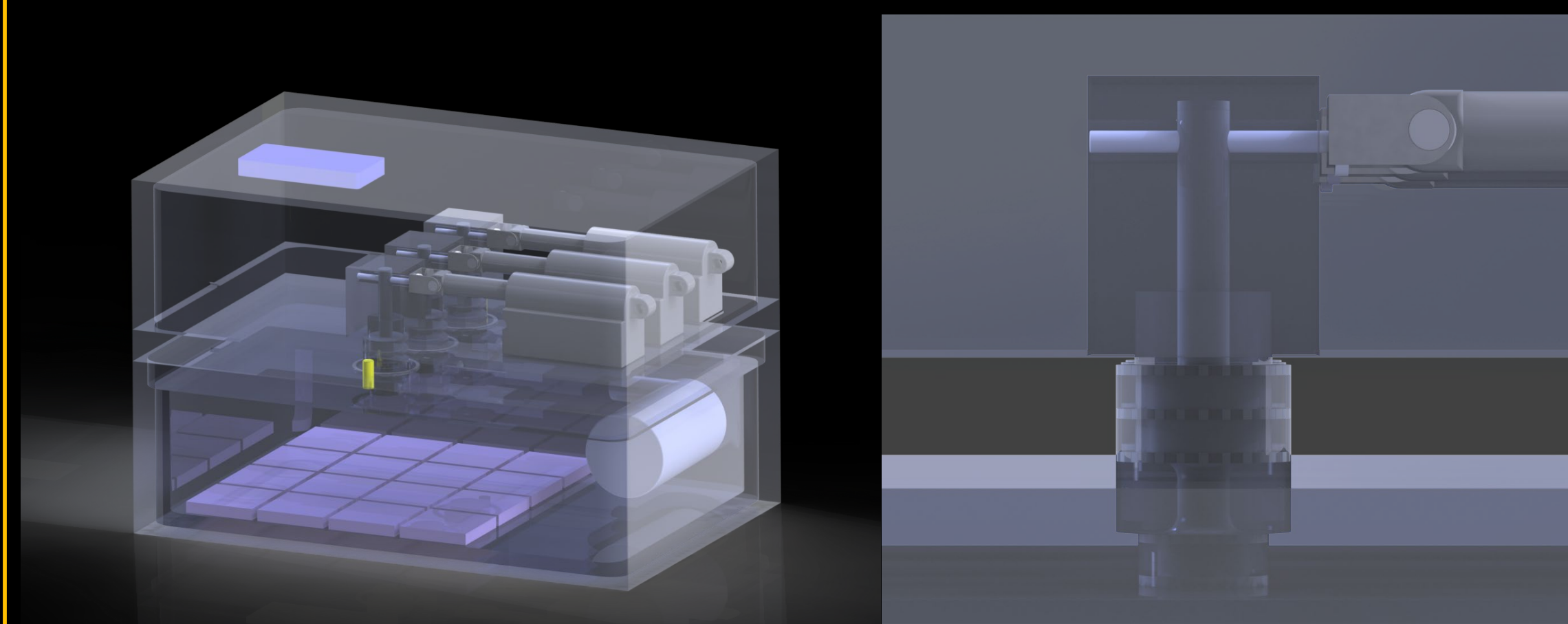


Figure 2: CAD of overall build (left) and BID mechanism (right)

ELECTRICAL SCHEMATICS

- Operational Constraints
- 5V Power source
 - 400 mA maximum current
 - Full automation required

- Components utilized
- PJRC Teensy 4.0
 - Actuonix PQ12-4 Micro Linear actuators
 - Gikfun DC microfluidic pump

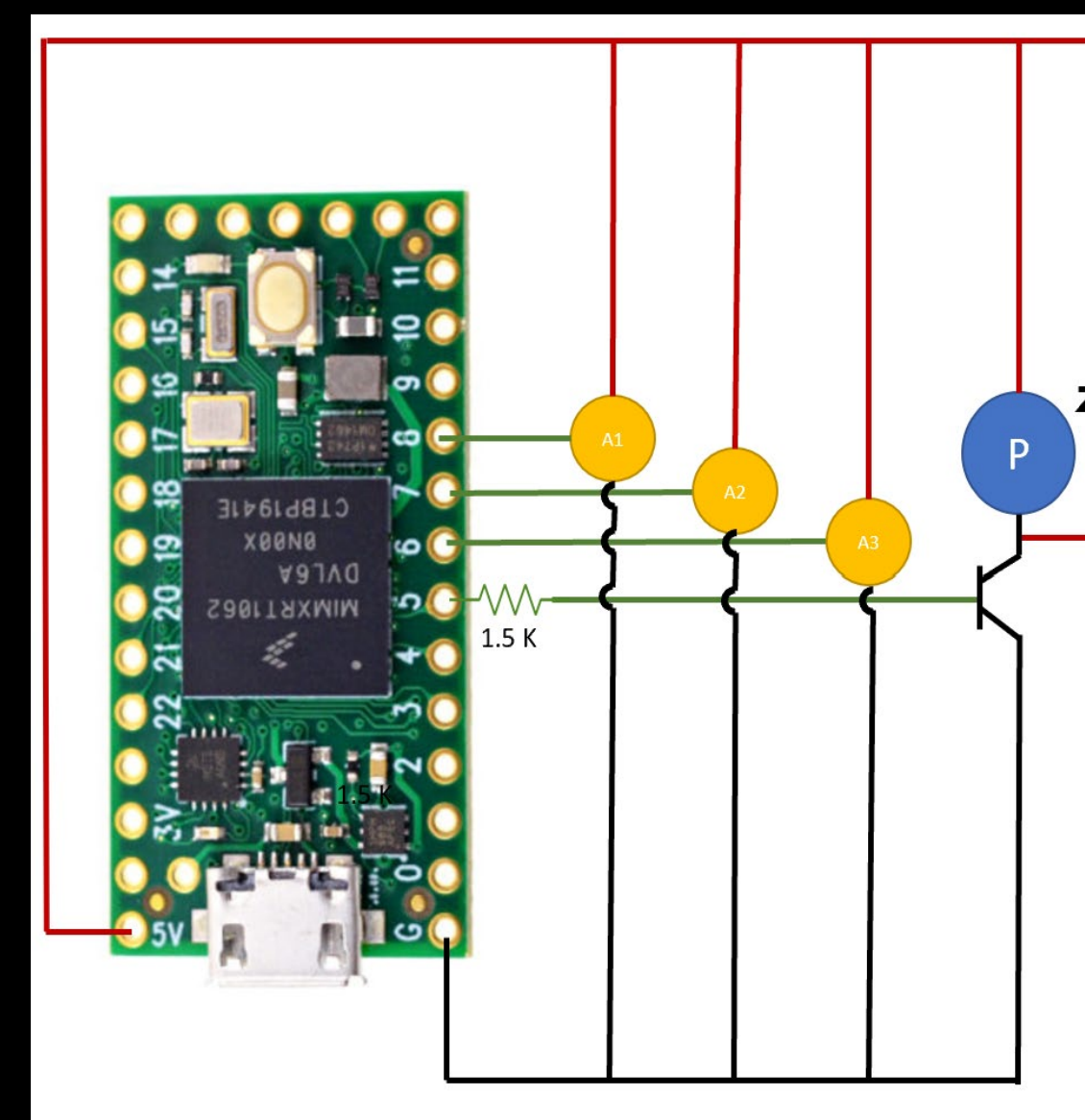


Figure 3: Experiment circuit diagram

POLYMER COATINGS

- Polyampholyte and zwitterionic polymer coatings have been shown to resist bacteria adhesion
- A silane initiator is used for surface modification of Al 6061 for adhesion of the polymers to aluminum
- FTIR verifies successful polymerization on Al 6061 substrate

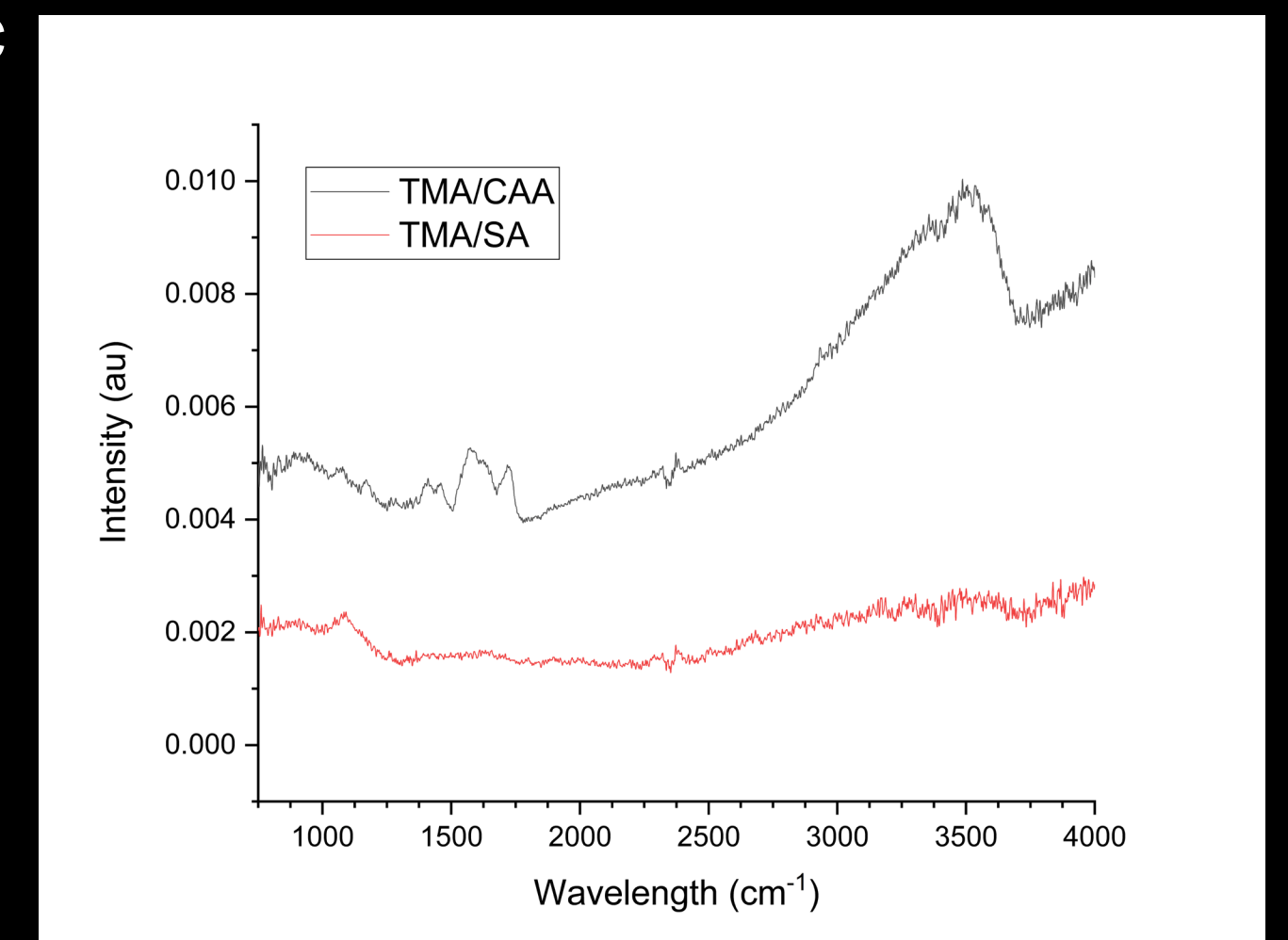


Figure 4: FTIR of polymer coatings on Al 6061

BACTERIA TESTING

Staphylococcus Epidermidis

- Biosafety Level 1 (BSL) requires two levels of containment on ISS
- Facultative anaerobe
- Human microbiome presence
- Isolated from ISS surfaces

Factors being tested:

- Storage stability
- Gas production rate
- Acid production

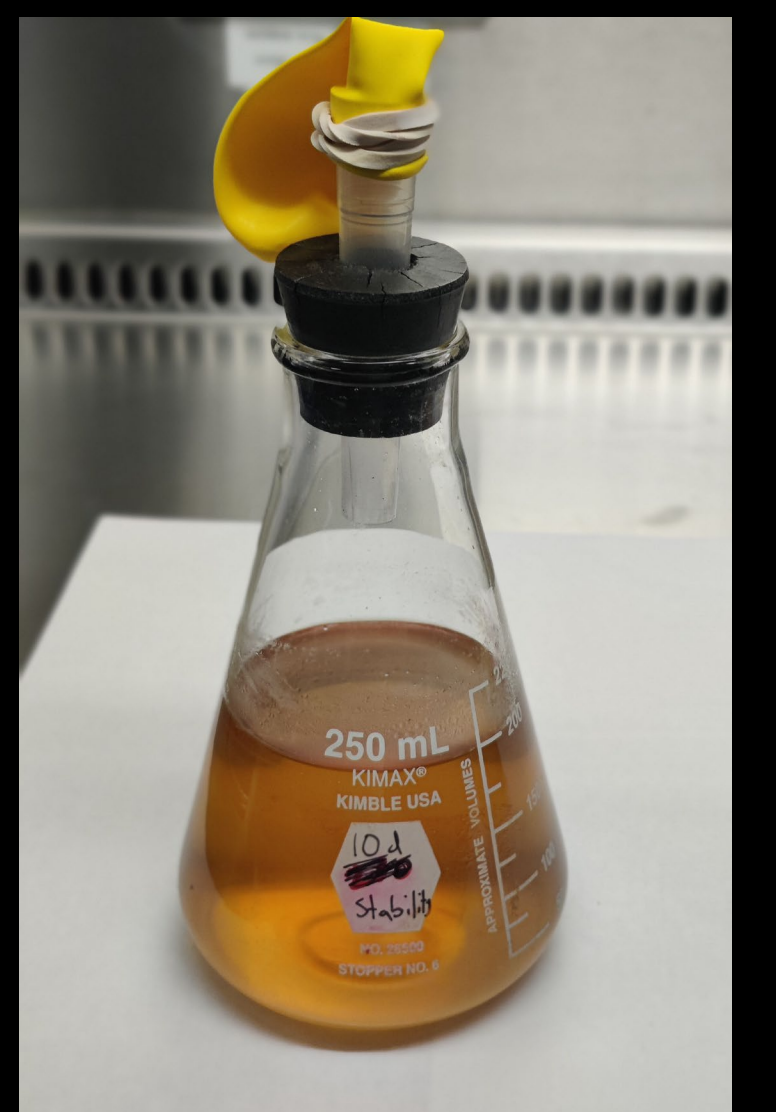


Figure 5: Bacteria stability experiment

THE TEAM



Figure 6: Front row (left to right): Dr. Bernards, Travis Lindsay, Niko Hansen, Kael Stelck
Back row (left to right): Roslyn McCormack, Hannah Johnson, Adriana Bryant

Acknowledgements: Dr. David MacPherson, Charles Cornwall, Stephanie Haag

LAUNCH DECEMBER 2021

Kennedy Space Center – SpX-24