SESSION 1J

UNDERSTANDING OUR WORLD: DATA-BASED APPROACHES

Session Moderator: Walter Andrews, Near Eastern Languages and Civilization
MGH 251
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

How Community Based Programs Are Aiding the Peace Process in Myanmar
Claire Eleanor (Claire) Branley, Junior, Public Health-Global Health
Mary Gates Scholar
Mentor: Mollie Pepper, Comparative History of Ideas
Mentor: Kimberly Roberts

Myanmar has been enveloped in seemingly endless civil strife since their independence from British colonization in 1949. The country is comprised of a wide array of ethnic minorities, each with their respective language and culture. Myanmar's government may publicly announce its pride at the country's diversity, but within, human rights violations committed by the military abound. The peace process towards a federalist state is long and hard, and has seen many cycles of ceasefires and armed conflict. My time in Thailand during CHID's Gender, Peacekeeping and Human Rights program addressed this conflict from a myriad of perspectives. As a result, I have learned about the silent heroes of Myanmar's peacekeeping process: the community based organizations that are actively changing the power landscape of rural areas within the ethnic minority states. There are several community-based organizations operating from the Thailand-Myanmar border that are addressing and spreading awareness of the human rights violations inside ethnic states. Most importantly, they are addressing maternal and child health in high risk areas where maternal mortality rates are some of the highest in the world. Through meetings and interviews with various community-based organizations, I am exploring the relationship between family planning and maternal health programs on the ground and women's participation in the peace process in the country overall. I am also using content analysis of reports done by the organizations, who have obtained valuable, on the ground data from remote areas within Myanmar. I am interested in whether investing in these programs and supporting this communtiy-based approach could be one possible solution to creating multilateral agreements that last in Myanmar because of the additional involvement of women in politics and leadership.

SESSION 1M

HEALTHCARE

Session Moderator: Geoffrey Gottlieb, School of Medicine
MGH 284
12:30 PM to 2:15 PM

* Note: Titles in order of presentation.

Development and Validation of a High-Fidelity Urethral Catheter Simulator
Alyssa L. Schul, Senior, Bioengineering
Mary Gates Scholar
Mentor: Robert Sweet, Urology and Surgery
Mentor: Alex Gong

Approximately 25% of inpatients in a hospital setting receive a catheter during their stay. This statistic corresponds to a diverse group of practitioners inserting catheters which, if done improperly, can lead to urethral trauma and catheter associated urinary tract infections. My undergraduate research at the Center for Research in Education and Simulation Technologies is aiming to address the gap between practitioners in the hospital by developing a high-fidelity urethral catheter simulator, CREST Sim. Modified elastomeric materials were developed to simulate the male genitourinary anatomy and mechanical behaviors. Quantitative studies between the CREST Sim and LifeForm Male Urethral Simulator were conducted using a uniaxial load cell to measure the force of insertion of a lubricated Bardex catheter. In collaboration with the UWMC OR nursing staff, the integration of CREST Sim in the onboarding training of nurses provided feedback in the form of a survey. Similar insertion forces were observed between CREST Sim and LifeForm Male's simulator. Preliminary results from the survey have reported positive training responses regarding the state of the CREST Sim. Through our collaboration with UW Willed Body, we will characterize the biomechanical properties from genitourinary tissues of deceased males in-situ. This data, along with more robust survey data, will be integrated into

the next generation of CREST Sim.

POSTER SESSION 2

Commons West, Easel 5

1:00 PM to 2:30 PM

Investigation of Vitamin B12 Vaping Products

Lilliana Lopez, Senior, Health Science, Portland State University

McNair Scholar

Mentor: Robert Strongin, Chemistry, Portland State University

The objective of this study is to evaluate vaping products that contain vitaminB12 (cyanocobalamin). Breathable vitamin supplements claim to be moreeffective than oral and injectable methods. Vitamin B12 is known to bechemically unstable when exposed to certain variables such as heat, light,oxygen, etc. in biochemistry related studies. The recent popularity of usingvaping devices as delivery methods for flavorings and other substances(including vitamins) prompts the need to study the chemical composition ofe-juices after vaping conditions to evaluate their safety.

SESSION 2A

ART'S HISTORIES AND FUTURES

Session Moderator: Sonal Khullar, Art History

MGH 171

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Approaching Architecture from an Interdisciplinary Perspective: Architecture as Demonstrative Art

Alexandra Carter (Sasha) Savenko, Senior, Art History

Mentor: Robert Peña, Architecture

As it stands today, there is a disconnect between the world of architecture and that of "art" - fine art, outsider art, and similar. This disconnect accounts for the loss of information on a grand scale, as each field continues to analyze itself from an insular perspective, rather than recognizing the interdisciplinary potential inherent in combining these studies. I am developing a foundation for understanding the built environment's role in shaping society and the world, one that highlights the connective role architecture plays between all the various components of contemporary life. By examining various interdisciplinary examples such as political theory, art scholarship, outsider manifestos, etc., I am synthesizing an understanding of how architecture has historically been approached and interpreted in industrial society, while drafting a manifesto to propose a new methodology for approaching architecture in the contemporary age. In the future, analysis like this could have impact on political or social policy, as well as construction and development, if we utilize this more thorough, interdisciplinary analysis to better understand the implications of what we build and how we will experience it as both art and architecture in contemporary society.

POSTER SESSION 3

Commons East, Easel 68

2:30 PM to 4:00 PM

Ice Crater Analysis Using Advanced Surveying Techniques

Logan Schuyler Guillet, Senior, Earth and Space Sciences: Geology

Mentor: Mariah Danner, Earth and Space Sciences

Mentor: Robert Winglee, Earth And Space Sciences

This research focuses on using advanced surveying techniques as well as hand mapping to analyze force distribution during laboratory impacts of man-made projectiles into ice. This is done in the hopes of characterizing substrate damage surrounding an impact crater created by a proposed hard landing system. Knowing where these different deformation zones occur is useful in determining where the lander could sample. The landing system, the Subsurface Ice Plume Sampler (SIPS) utilizes ejecta (broken up debris thrown from the crater) to create a transient atmosphere - decelerating a secondary instrument package through momentum transfer. Small-scale experiments were done on one-ton buckets of ice using scale-sized projectiles. Between two hundred and five hundred images used to 3D models of the ice craters using the structure from motion imaging technique. Hand mapping of the deformation zones (areas of different types of fractures) was conducted to compare to the 3D model to help show the directionality of force distributions through the crater. Using both the 3D models and a hand mapping analysis of the craters, we were able to determine that the crater shapes were atypical. In a typical crater, the force disperses radially outward from the impactor; however, we determined that the majority of the force was focalized directly below the impactor. Future work includes using Rhinoceros 3D computer software to quantitatively analyze each crater's individual morphology, curvature, and volume and compare them to traditional impact craters.

POSTER SESSION 4

Commons East, Easel 66

4:00 PM to 6:00 PM

Buildup of Large Scale Field Test for Asteroid Sampler
Joshua Hae Soo (Josh) Lee, Senior, Earth & Space Sciences (Physics)
Marcquis De Shawn Harris, Senior, Astronomy, Physics: Comprehensive Physics
Dominic C. (Nick O.) Ongoco, Senior, Earth & Space Sciences (Physics)
Mentor: Robert Winglee, Earth And Space Sciences
Mentor: Mariah Danner, Earth and Space Sciences

Our current research with the Kinematics and Impacts Lab at the University of Washington entails the design, buildup, and field testing of an asteroid sampling system. These field tests include the buildup of two stage closer rockets, which are highlighted in this presentation. This asteroid sampler field testing helps characterize the sampling process of impacting an asteroid at high speeds- necessitating our rocket system be capable of stable, high speed flight, even at an inverted trajectory. The booster stage, or primary stage, of the system consists of a single large motor to allow the system to reach between 3000-4000 feet above the ground. The sustainer, or second stage, consists of eight smaller motors clustered around a central body tube, allowing the second stage to be hollow. Finally, a hollow point steel nose cone caps the sustainer. Inside the nose come assembly a sample dive is attached, designed to eject during impact. Field testing of this system occurred in December 2018, with preliminary results being compiled.

POSTER SESSION 4

Commons East, Easel 70
4:00 PM to 6:00 PM

Initial Characterization of the Dielectric Barrier Discharge Thruster
Kaito Jonathan Durkee, Senior, Aeronautics & Astronautics
Mary Gates Scholar, NASA Space Grant Scholar, Undergraduate Research Conference Travel Awardee, Washington Research Foundation Fellow
Andrew Harrison (Andrew) Kullman, Senior, Chemical Engineering
Mentor: Robert Winglee, Earth And Space Sciences
Mentor: Keon Vereen

Electric propulsion is becoming an increasingly important field due to the rise of microsatellites in education, research, and industry. Because chemical propulsion is impractical for these small-scale satellites, the need for an efficient, long-term electric propulsion solution has become apparent. In response to this, the Dielectric Barrier Discharge (DBD) Thruster was developed. The DBD is a novel electric propulsion system that uses a low power input to ionize Argon gas and accelerate ions to produce thrust. For initial characterization, thrust values and plasma characterization parameters were collected in the far field of the plasma using electric propulsion diagnosics. The experiment was repeated for multiple operational spaces, and data was collected, compiled, and analyzed. Preliminary results indicate thrust values and plasma characteristics comparable to those of other propulsion systems at similar electrical power levels. Further testing with different high voltage parameters as well as implementing additional diagnostic equipment will help fully characterize the DBD system and assess its potential usefulness in a satellite architecture. To increase the versatility of the DBD system, research will be done on developing multi-DBD arrays and incorporating a nanoparticle injection system for demonstrating future space resource utilization.

POSTER SESSION 4

Commons East, Easel 67
4:00 PM to 6:00 PM

Designing a Reliable Asteroid Sample Retrieval System
Connor Geiman, Senior, Mechanical Engineering
Kenneth G (Ken) Aragon, Junior, Pre Engineering
UW Honors Program
Mentor: Robert Winglee, Earth And Space Sciences
Mentor: Mariah Danner, Earth and Space Sciences

Asteroid sample return has potential to impact research and how humans collect resources, but sample return missions remain prohibitively expensive and complex. We propose a device to retrieve a preexisting sample container from the surface of an asteroid or other extraterrestrial body, focusing on simplicity, repeatability, and reliability. Taking inspiration from a classical design, the bear trap, we created a functional 3D printed prototype, which is mechanical and capable of capturing a 1.5x15 in cylinder resting on a flat surface. Consideration was given to potential rocky terrain or an awkwardly positioned return container, and to sealing the sample container to prevent contamination upon return to earth. Future prototypes will be constructed from stronger, lighter weight materials and will be further developed during active field tests on debris at a penetrator impact site in Eastern Washington.

POSTER SESSION 4

Commons East, Easel 68
4:00 PM to 6:00 PM

A Numerical Modeling Approach to Analyzing Man-Made Impact Craters
Callum Joseph Farrell, Senior, Physics: Comprehensive Physics
Mentor: Robert Winglee, Earth And Space Sciences
Mentor: Mariah Danner, Earth and Space Sciences

The computational modeling aspect of the Kinematics and

Impacts Lab seeks to create accurate models and predictions of ice/penetrator interactions during high velocity collisions of the proposed Subsurface Ice and Plume Sampler (SIPS) lander. These penetrator collisions create a collumized plume of ejecta (ice shards and water vapor) that can be used to land an instrument package. Using the data from the models, the ice penetrator design is streamlined. The models are created using ANSYS's Autodyn software, a hydrocode designed to simulate large material deformations. Generally, the models we create describe the impact of a small, hollow, cylindrical projectile traveling at 1 km/s impacting a stationary block of ice, which necessarily results in severe loading and large deformation as the surface of the ice is pulverized by the impact. Accurate representations of this "pulverization" are desirable for several reasons. First, we would like to know what happens physically to the projectile (depth and deformation for example). Second, we would like to understand how the projectile's deformation during impact influences the properties of the ejecta produced. Understanding the behavior of the ejecta is an essential part of the modeling - this ejecta plume and it's geometry are necessary for successful landing of the instrument package. A model that accurately describes the impact process is invaluable, as it allows easy analysis of different projectile designs and impact velocities at different scales without conducting expensive and time-consuming experiments. Once the plume interaction is properly constrained using ANSYS, future work will focus on more accurately modeling the crater morphology using a separate numerical modeling program, iSale.

POSTER SESSION 4

Commons East, Easel 69

4:00 PM to 6:00 PM

Air Breathing Pulsed Plasma Thruster for High Altitude Atmospheric Satellites

Corwin Akeru Hansen, Junior, Electrical Engineering
Mentor: Robert Winglee, Earth And Space Sciences
Mentor: Manuel Azuara Rosales, Aeronautics and Astronautics

In this research, we looked at the possible use of an Air Breathing Pulsed Plasma Thruster (AB-PPT) for propelling an aircraft that could potentially act as an atmospheric satellite at atmospheric altitudes > 25 km. One of the advantages of operating at such altitudes is that the aircraft is not subject to highly variable weather conditions. An atmospheric satellite is an aircraft that can perpetually fly around the same area, and can be launched at significantly reduced cost when compared to conventional satellites while providing similar services such as communication and imaging. At the desired altitude, conventional blade-based propellers are too inefficient due to low background pressure, but it is still too low of an altitude for conventional space propulsion, prompting the use of AB-PPT. The AB-PPT is an adaptation of the conventional PPT which is a pulsed device that uses an electric discharge to ionize and expel the solid propellant such as PTFE at high speeds. For the AB-PPT, a large amount of voltage discharge generated across the two coaxial electrodes ionizes and expels the background air instead. In order to identify the most efficient AB-PPT design, three different configurations were tested using a pendulum-based thrust stand to measure the thrust efficiency, a Rogowski coil to measure the current per discharge, and high-speed video. One configuration has been identified, and we are currently investigating an alternative electric connection to further increase the amount of thrust per discharge. Future work includes plasma diagnostics of the AB-PPT such as Langmuir probe, and B-dot probe, in addition to the development of more robust electronics capable of delivering higher power, and the development of the final version of the AB-PPT for patenting purposes.

POSTER SESSION 4

Balcony, Easel 98

4:00 PM to 6:00 PM

Negative-Pulse Partial Modulation using a Pulse Flow Valve for Comprehensive Two-Dimensional Gas Chromatography

Dong Hyeok Song, Senior, Chemistry
Mentor: Robert Synovec, Chemistry
Mentor: Derrick Gough

A method of negative-pulse partial modulation for comprehensive two-dimensional gas chromatography (GC×GC) using a pulse flow is studied. The capability of a pulse flow valve modulator has been shown to enhance many aspects of GC performance such as chemical selectivity and reduced analysis time, allowing complex GC×GC analysis in a shorter time scale. In our study, we explored a particular configuration of a pulse flow valve that periodically (specified by modulation period, P_M) disrupts the carrier gas flow to achieve partial modulation. This disruption of flow creates a "plug" of higher concentration on top of the primary GC signal, which is further separated in a secondary column. The size of the plug determined by pulse width, P_W, has a direct relationship to chemical selectivity and sensitivity. For our experiment, we determined the ideal P_W to be around 8 ms. Therefore, a 20-component mixture was evaluated using P_W of 8 ms and P_M of 100 ms, producing an average peak width, ${}^2W_b$, of 12 ms and approximated ideal peak capacity, ${}^2n_c$, of 8 on the second dimension. All 20 compounds were separated in a 12 second separation window. This powerful partial modulation method was achieved by the unique concept of the flow disruption with short modulation period, demonstrating high peak capacity and improved selectivity between compounds and chemical sensitivity. Due to the significant increase in GC performance, this form of partial modulation

using a pulse flow valve allows efficient and faster GC×GC analysis that can be implemented in a variety of GC×GC applications.

POSTER SESSION 4

Commons East, Easel 65

4:00 PM to 6:00 PM

Computer Modeling of Europa Rocket Penetrator Ice Impacts

Eric Jordan Racadag, Senior, Aeronautics & Astronautics
Kavic Raman Kumar, Senior, Aeronautics & Astronautics, Physics: Comprehensive Physics
McNair Scholar
Mentor: Robert Winglee, Earth And Space Sciences
Mentor: Mariah Danner, Earth and Space Sciences

This purpose of this project was to investigate the impact of a rocket penetrator for sample-return missions focused on Jupiter's icy moon, Europa. In particular, primary analysis used the kinetic energy from the ejecta plume of the impact crater to halt the momentum of the primary payload to model the impact. To do so, steel alloy projectile impacts in a material with properties of ice (so as to simulate the surface of Europa) were simulated using ANSYS Autodyn computational dynamics software. ANSYS Autodyn makes use of both Lagrangian and Hamiltonian meshes, as well as smooth particle hydrodynamic mesh-less modeling with cross-coupling so as to best represent the impact of the projectile, the material deformation, and the projectile deformation. This analysis of elastic and plastic behavior, as well as bulk failure and separation, resulted in accurate depictions of deformation in both the projectile and target material, validating it as a model with the potential to simulate the impact of a Europa sample-return rocket penetrator. This analysis serves as a basis for future progress, and will soon be enhanced via further simulation in conjunction with ISAIL simulations so as to accurately depict the material deformation and ejecta plume. The data from these computer simulations can eventually be compared to physical experiments and field tests that are to be conducted under the University of Washington's Kinematics and Impacts Laboratory (KILa).