

Poster Design Workshop



Presented by the
Undergraduate Research Program

Spring 2007

Things to Remember...

- A good poster will not make up for bad research, but a bad poster can ruin good research! So...think ahead. Prepare.
- Because of limited space, it's important to be selective and choose your words carefully

Programs

- PowerPoint
- Adobe Illustrator
- Adobe Photoshop
- Adobe InDesign
- Macromedia Freehand
- Macromedia Flash
- Paper, scissors, glue stick, and a typewriter

Purpose

- Academic posters are a summary of what you did, how you did it, and what you learned
- Roughly divided into four parts:
 - Introduction (*what you did*)
 - Design or methods (*how you did it*)
 - Results
 - Conclusion & Future Research (*what you learned and how you might continue to pursue your question/s in the future*)

Design

- Size: **40''w × 32''h**
- Simple and informative
- Include graphics
- Left to right, top to bottom
- Use bullets to summarize information => Avoid long paragraphs!
- Use Columns and/or line breaks to divide the poster into smaller sections

Content

- Introduction
- Methodology/Research Design
- Findings
- Conclusion/Future Research/Implications of your Research
- References
 - In-text citation
 - Separate “references” section
- Acknowledgements your mentor, collaborators and others who have helped you or funded your research.
- Don't forget your title, name, mentor and department!

Fonts

- Someone standing 3-4 feet away should be able to read everything on your poster
 - Title: 72-point
 - Headings/Section Titles: 40-point
 - Body Text: 28-point
 - Captions: 24-point
- Limit yourself to 2-3 types of fonts in order to create consistency and unity
 - Serif (e.g., Times New Roman) for text/title
 - Sans-serif (e.g., Arial) for titles, headings, graphics
- Spell Check!!!!

Images

- Use graphs, charts, tables, and photos to summarize and present data
 - Include captions
- Use high resolution images (200 dpi or higher)
- Resize or crop your images so they fit
- No pics? Graphics such as clip art can highlight aspects of your poster

Characterizing the Dielectric Constant of *Listeria monocytogenes* Using Optical Interferometry



Mei Liu

Professor Lih Y. Lin

Dept. of Electrical Engineering, University of Washington

Background

Non-invasive manipulation/rotation of biological particles is attractive for various biomedical applications, including constructing biofilms and human tissue engineering. Currently, there are two approaches to non-invasive manipulation of micro- and nano-biological particles with rotational capability, but each method has its own disadvantages and limitations.

The first method is using dielectrophoresis which relies on micro-electrodes configured in fixed positions to manipulate biological particles (Fig. 1). The control is coarse using this approach, since the fixed electrodes limit the resolution of rotation, and the area of bio-construction and manipulation is also constrained.

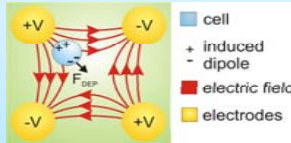


Fig. 1: Dielectrophoresis occurs when a neutral particle is placed in a non-uniform electric field. As charges are induced on the particle by the electric field, there will be a difference in field strength on the two sides of the neutral particle, which in turn propels the particle to the side with the larger force. [Courtesy of Prof. Joel Voldman's group of MIT Electrical Engineering and Computer Science Department]

The second method is using optical tweezers which utilizes radiation pressure from a focused optical beam to trap and move small particles. The disadvantage of this approach is that it requires high optical intensity to create enough force, which can cause photodamage to biological cells.

Opto-Plasmonic Tweezers

Our research group is proposing a new approach for optical manipulation and rotation of micro- and nano-biological particles by utilizing polarized light to excite resonant oscillating dipoles on a conductive surface such as gold.

The principle of this method is illustrated in Fig. 2. By changing the polarization of the incident light, the radiation pattern caused by the resonant oscillating dipoles will change, which results in fine orientation control of the biological particle.

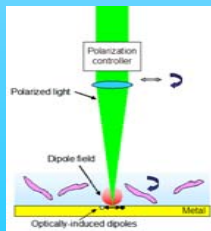


Fig. 2: The micro or nano objects are manipulated by the fine orientation control from the polarized light.

The main advantages of this proposal are: 1) non-invasive manipulation and rotation of biological cells and molecules by light; 2) fine orientation control of optical manipulation with high resolution; and 3) low optical intensity requirement (approximately two or three orders of magnitude lower than conventional optical tweezers).

The magnitude and direction of the light-induced dielectrophoresis force depend on the dielectric constant of the object that is being manipulated, which in our case is *Listeria monocytogenes*. The dielectric constant of a material also affects how electromagnetic signals, such as light, moves through it. For example, light travels slower in a medium with higher refractive index. Therefore, it is critical to be able to characterize the dielectric property of the object to be manipulated.

Michelson Interferometer

A schematic drawing of a Michelson interferometer is shown in Fig. 3. It consists of an input laser light, a beam splitter, two reflecting mirrors, and a photodetector at the output to measure the light intensity as a result of two-beam interference. The position of one mirror can be adjusted.

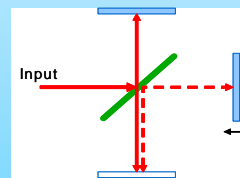


Fig. 3: Schematic drawing of a Michelson interferometer.

Listeria monocytogenes

The opto-plasmonic tweezers will be used in proof-of-concept studies to manipulate *Listeria monocytogenes* and ActA-coated nanoparticles. *Listeria monocytogenes* is an intracellular bacterial pathogen that rapidly invades host cells by hijacking the host cells' actin polymerization machinery for motility.

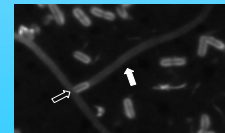


Fig. 4 *Listeria monocytogenes* (open arrow) is propelled in cell extract by polymerized actin comet tails (closed arrow). Comet tails are observed by addition of fluorescently-labeled actin to the extract. [Courtesy of Prof. Suzie H. Pun's group of UW BioEngineering Department]

Dielectric Constant

The relative dielectric constant ϵ_r is defined as the ratio:

$$\epsilon_r = \frac{\epsilon_s}{\epsilon_0}$$

where ϵ_s is the static permittivity of the material in question, and ϵ_0 is the vacuum permittivity.

Methodology

The Michelson interferometer is built using a He-Ne laser as the light source. The measured output intensity versus mirror translation distance will generate a graph similar to Fig. 5.

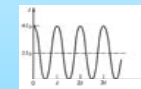
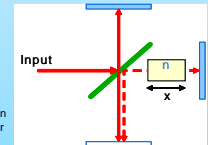


Fig. 5: Two-beam interfering intensity versus mirror translation distance.

Fig. 6: Schematic drawing of a Michelson interferometer after a dielectric material is inserted between the beam splitter and one of the mirrors.



The next step is to insert the dielectric material (Fig. 6), and measure the intensity change. The different dielectric constant (thus the refractive index) of *Listeria monocytogenes* from the surrounding air results in effective optical path length difference, which causes the intensity to change.

The measurement is very sensitive and can detect small effective optical path length difference, which can be the result of either small refractive index change, or small quantity of samples. The effective thickness of *Listeria monocytogenes*, the variable x from Fig. 6, will be measured by a microscope first. Then this value will be combined with the measured intensity change and the dielectric constant can be computed for *Listeria monocytogenes*.

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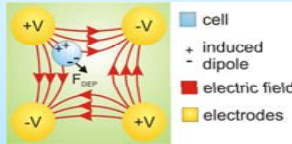


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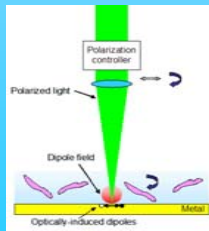


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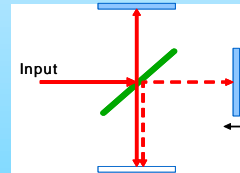


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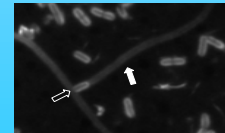


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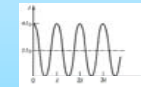
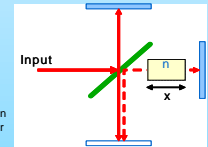


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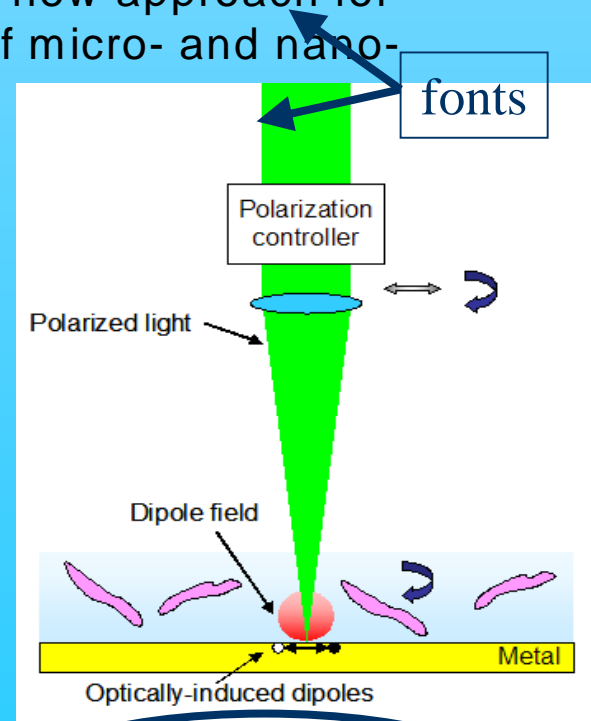


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Group Critiques

In your group, review the sample poster and look for the following:

- Strengths
- Areas of improvement

The Deliberative Potential of Computer-Mediated Communication: The Effects of Incoherence, Anonymity, and Time on the Interpersonal Requirements of Deliberation

By Andrew Waits. Mentor: Professor Kirsten Foot

Introduction

Internet technologies can help democracy, but only if configured to support meaningful interaction and only in terms of the paradigms and political theories that inform the program (Barber, 1999). Unless we are clear about what democracy means to us, and what kind of democracy we envision, the Internet is as likely to stunt as to enhance the civic polity.

If deliberative democracy is desired, environments must be programmed and designed according to tested theories of deliberation. While this idea has been embraced in offline environments with the creation of the National Issues Forum, the National Issues Convention, and citizen juries, online environments have received far less structural attention. Instead, research into the deliberative potential of the Internet has focused primarily on the limitations imposed by computer messaging systems. However, computer-mediated communication (henceforth, CMC) should not be expected to be deliberative if it is not placed within an environment that is purposely designed to foster deliberation.

Purpose

The purpose of this project is to examine the possible affordances of asynchronous CMC in fulfilling the communicative and participatory requirements of deliberation, given that it takes place in a structured environment informed by deliberative theory.

H1: Incoherence is not an innate quality of CMC, but, rather an effect of an environment lacking proper structure and purpose.



RQ 1: What effect does anonymity have on the interpersonal communicative requirements of deliberation?



RQ 2: What effect does time have on the interpersonal communicative requirements of deliberation?

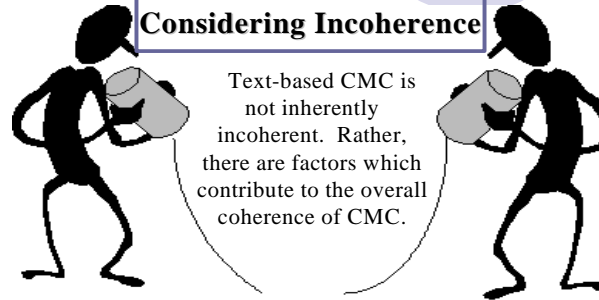


Underlying Assumptions

•Political deliberation is a structured, uncomfortable, and often difficult process in which to engage (Schudson, 1997). Without an environment specifically designed for deliberation, citizens will likely choose to engage in what is called political conversation.

•Political conversation should not be called or considered a substitution for deliberation (Witschge, 2002).

Considering Incoherence



Text-based CMC is not inherently incoherent. Rather, there are factors which contribute to the overall coherence of CMC.

Messaging Systems Matter

Similar to the importance of audio-visual cues in mediating offline communication, the way in which a computer mediates communication is equally important. If the computer messaging system is "rich" in tools of mediations (or structure), then the communication will be far more coherent.

User Adaptations Matter

Users contribute to the overall coherence of discussion by innovating alternative methods of signaling listenership and negotiating turn alternation, despite the absence of traditional forms of feedbacks (Herring, 1999).

Considering Anonymity



I examine two social-psychological results of anonymity and discuss what effects they will have on the interpersonal communicative requirements of deliberation.

The Absence of Gender and Social Status Cues

Anonymous CMC can help to eliminate the evaluative apprehension, perceived expectations, and prescriptive roles associated with social status and gender, thus, increase the quantity and range of ideas, and the equality of influence and participation in a discussion (Craig & Sherit, 1986; Meeker & Weitzel-O'Neill, 1977; Carli, 2001; Berger, Fisek, Norman, & Zelditch, 1977; Klein, 2003; Herschel, 1994; Klein, 2000; Klein & Dologite, 2000).

Anonymity Continued...

For a discussion to be deliberative, participants must provide all relevant information available upon which they base their deliberative claims (Burkhalter et al., 2003). Race, gender, and age may become substantive, relevant information in understanding the perspectives and evaluative criteria of participants.

Deindividuation

Anonymity may lead to deindividuated, antisocial or reckless behavior do the an absence of accountability and social norms (Jessup et al. 1990).

While there may be a loss of personal identity when an individual is submerged in a group setting, social identity may be accentuated (Lea and Spear, 1991; Spears et al, 1990). Participants may be more inclined to engage in communicative action (Habermas, 1982, 1992, 1996) rather than strategic or self-interested communication.

Considering Time



Asynchronous Groups With Loose Time Constraints:

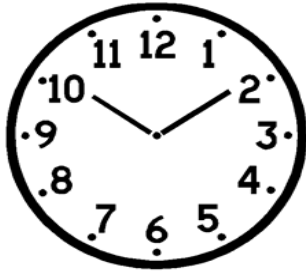
- + Allow participants to reflect and propose more informed (Chu & Spires, 1999), thoughtful comments, decreasing the likelihood of emotional outbursts.
- + Help to acknowledge, respect, and embrace differences among participants rather than privileging dominant forms of speaking.
- + Mention more issues and have broader discussions than their face-to-face counterparts (Benbunan-Fich et al. 2002).
- Experience problems with overlapping messages (Herring, 1999).
- Often provide single messages containing two or more moves which are not functionally adjacent (Herring, 1999).

Designing Deliberation Online

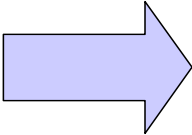


- Messages should lack any connection to participants allowing for the disclosure of personal information without jeopardizing the affordances of anonymity.
- User identities should be disclosed only to a neutral discussion moderator, reducing the possibility of reckless behavior.
- To reduce message overlap and improve group coordination, messaging systems should be rich in tools of mediation (Herring, 1999).

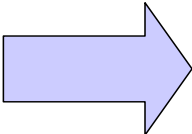
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Union Democracy Project

Union Democracy Re-Examined

Adam Goodwin, Devin Kelly, Nowell Bamberger, Natalie Quist



Early Political History

The Scrap Iron Dispute:

The scrap iron dispute, with its most significant events occurring in December 1938, was a demonstration by the ILWU that, to an extent, dictated American foreign policy. The dispute regarded the loading of scrap iron onto ships headed to either Japan or China, or ships contracted by Japanese companies. It was believed that these pieces of scrap metal would leave the United States only to return in the form of munitions against Americans in the looming World War II. Thus, the ILWU took action to prevent this from happening. When five hundred sympathizers to the acts of war being committed in China by Japan formed a picket line on San Francisco's waterfront between ILWU members and the Greek ship "Spyros" that was to be loaded with scrap iron and sail off to China, Longshoremen refused to pass through the picket line. This intense demonstration was resolved two days later when an embargo was placed on exporting to Japan. Demonstrations of the refusal to load scrap iron also occurred in Everett, Bellingham, Coos Bay, Astoria, Portland, Seattle, Puget Sound, and San Pedro.

Waterfront Worker Screening Programs by Army, Navy, and Coast Guard: 1947-1953:

With the passage of the Labor Management Relations Act in 1947 (commonly known and referred to as the Taft-Hartley Act) by the United States Congress came a new threat to the ILWU's existence, and that was the so-called Waterfront Worker Screenings. These screenings required signed affidavits by union members that they were not members of the Communist party if the union wanted to be recognized and have access to the National Labor Relations Board. The ILWU saw this "screening program" as a tool to oust militant leaders in their union, and have the program instead become a blacklist. This is not to say that the ILWU did not support the screenings; they initially did for security reasons until it became clear that the screenings would instead be used to break up the union. Originally, the screenings were only supposed to occur on military docks, and thereby be enforced by the Army and the Navy.

Immediately after the Taft-Hartley Act was passed on June 23, 1947, President Harry Bridges called for a caucus to occur a month later to deal with the issue of the waterfront screenings, as well as other issues created by the Act. It was decided by the attendees of that caucus to by-pass the NLRB as reconstructed in the Taft-Hartley Act so affidavits would not be required of the ILWU members. However, screenings and blacklisting continued on military docks until July 1950 when President Truman signed an executive order extending the screening program to commercial docks, which were under the jurisdiction of the Coast Guard. It gave the Coast Guard more of a policing role to play, having it issue identification cards to eligible waterfront workers. The ILWU responded with a number of caucuses and even a coast-wide vote regarding the waterfront worker screenings. The results of the rank-and-file vote were in favor of the ILWU National Executive Board's proposal on a Screening Resolution.

About the Project

The International Longshore and Warehouse Union (ILWU) has represented western longshore and warehouse workers since 1934. Given the union's diverse makeup, it is not surprising that it is characterized as one of the most militant and socially active labor organizations. In addition, the union is known for its commitment to democratic governance, particularly as expressed by Harry Bridges, former Union President. This project has examined controversies in the history of the ILWU for evidence of democratic governance by studying union documents and third party records.

Efficiency versus Democracy

Term Limits:

ILWU members debated International Officer term limits from the union's creation until 1977, when then-76-year-old Harry Bridges retired after 40 years as International President. Supporters of term limits wanted to see "new blood" elected, and to politicize younger generations of ILWU leaders. Some were also dissatisfied with Bridges' style of leadership and negotiating, which they saw as careerist and both sectarian and compromising. However, Bridges' himself actively supported a number of failed term limit resolutions throughout the 1960s and 70s, and voted himself out of office when the resolution finally passed in 1975. It appears that his longevity was not dependent on careerism or sectarianism. Rather, it depended on the desires of the rank-and-file members, who overwhelmingly supported him during elections, and on union delegates, who went against his wishes when voting down term limits resolutions on more than one occasion.

Pensioner Voting:

ILWU pensioners had voting rights in ILWU International Officer elections from 1953 until 1981. During that period, some ILWU locals had high pensioner turnout and others had minimal pensioner turnout. This created a wide voting disparity and ballot budget allocation problems. The International Officers sought to rectify this in 1981 by banning all pensioners from voting in future elections. The proposal created a heated debate within the union: one that divided members based on their age, location and politics. The pensioners and their allies (who often are among the ILWU's most politically active and vocal members) protested the decision bitterly, claiming it was a direct infringement on their rights as union members. Others were more supportive of the resolution, which ultimately passed. Unfortunately, pensioners can no longer vote, but they still have speaking rights at conventions and remain more politically active than do those in most other unions.

Special thanks to Professor Margaret Levi, Professor David Olson, ILWU Archivist Gene Vrana, and the Harry Bridges Center for Labor Studies



A painting commemorating the '71 Strike



The M&M Agreements

Union and Employer Goals:

Since its inception in 1934, the ILWU sought to obtain economic and social justice on the docks of the West Coast. Their main weapon in achieving these goals has been the restrictive work rules the union won in the 1934 strike. Along with ensuring the safety of longshoremen, these rules have promoted full employment by spreading work around the docks. Through united action the ILWU controlled the pace of productivity, and thus established a foothold from which to bargain with the employer. Over time West Coast employers, collectively known as the Pacific Maritime Association (PMA), began to circumvent union control of productivity by mechanizing shipping operations. With the introduction of containerization and unitized cargo, shipping began to take fewer laborers to do more work.

Negotiation and Agreement:

The International Officers of the ILWU, foreseeing a dramatic drop in the number of longshoremen utilized in West Coast operations and an ensuing labor crisis, entered into unofficial talks with the PMA in the late 1950s regarding the subject of mechanization. The main objectives of longshoremen in these negotiations were to preserve the number of registered longshoremen on the West Coast (circa. 1957), to share a portion of the net labor savings caused by mechanization or removal of restrictive work rules with the registered longshoremen of the West Coast. Several years of negotiations culminated in the Mechanization and Modernization agreements of 1960 and 1966. These agreements stated that the ILWU would remove restrictive rules that dictated the terms of manning and cargo handling from their Coastwise Contract with the ILWU, and welcome any mechanization to the industry that did not constitute a health hazard to the workers. In return, the PMA would develop a "mechanization fund" for the ILWU membership that would guarantee full pay when full employment was not available.

Reaction:

The M&M agreements were considered by many in the labor and academic community to be revolutionary for various reasons, the largest being the completely voluntary nature of the M&M negotiations. These agreements were reached without the use of strike or lockout in the bargaining process. Although revolutionary in scope, the agreements were met with heavy resistance on both sides of the industry, and the agreements were terminated after a coastwide strike in 1971. Even though they were terminated, the spirit of these agreements live today in contracts and understanding between the ILWU and the PMA.

Preliminary Findings

The Union Democracy Project has found that the ILWU has historically taken great strides to ensure its democratic tradition by taking progressive business and political stances. The willingness of the ILWU to affiliate with unions domestically and internationally demonstrates a commitment to worldwide labor solidarity. Union rank-and-file efforts have entrenched the same ethic in the character of the ILWU.

Affiliations

The Congress of Industrial Organizations:

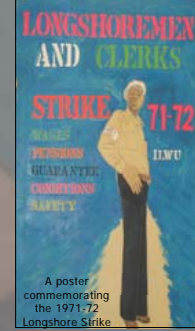
After splitting with the east coast International Longshoremen's Association (ILA) in 1937, the ILWU became a member of the more syndicalist and radical CIO. This tenuous relationship became strained in the 1950s when the CIO, under the crushing pressure of the McCarthy-era red scare, expelled the ILWU from its ranks, and threatened to begin raids of its membership. The claim was that the ILWU was Communist-dominated, the truth was that it, as a powerful socially-active union, presented a challenge to the domestic and international policy of the CIO. Despite efforts to destroy it, the ILWU was an anomaly in that it survived, and thrived, under CIO expulsion.

World Federation of Trade Unions:

The CIO, the British Trade Union Congress and the Soviet Central Council of Trade Unions organized the WFTU in 1945 as labor's answer to the newly-formed United Nations. International solidarity was the goal, but was soon split by Cold War hostilities. When the CIO and TUC left the WFTU in 1949 to form the International Confederation of Free Trade Unions (ICFTU), the ILWU remained as one of the few members from a non-socialist country. It continued to play a role in the international trade union movement until, under extreme anti-Communist pressure, it was forced to withdraw in 1950.

The International Transport Workers Federation:

The ITF, formed in 1896 by European dockworkers and seafarers, was similarly pulled apart by the Cold War. Aligning itself with the ICFTU against the perceived Communist domination of the WFTU, the ITF and the ILWU suffered a tenuous relationship for decades. This ended in 1986 when ILWU International President James Herman and ITF vice-president Tas Bull came together to bring the ILWU into the international dockers community. This is yet another example of the ILWU's efforts to bridge the divide left within the labor community by the Cold War.



A poster commemorating the 1971-72 Longshore Strike



A vessel carrying containerized cargo



A crane operator, circa 1964.

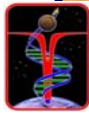
Carrier Bus for the Translife Mars Gravity Biosatellite

Introduction

The Translife Mars Gravity Biosatellite began with a proposal by the Mars Society to build a small research satellite that would study the effects of Martian gravity on mammals.

The University of Washington responded to this proposal when the Aero/Astro Engineering Department's senior design class put together a conceptual design for the satellite.

Shortly thereafter, the UW team, along with students from the Massachusetts Institute of Technology and the University of Queensland, Australia embarked on a journey to engineer, build, test, and eventually launch what came to be called the Mars Gravity Project.



Translife Logo

Partial Gravity and Trips to Mars

Partial gravity is any level of gravity between Earth gravity and space (micro-) gravity. Mars gravity exists in this range, at approximately 3/8 the gravity of Earth.

Although numerous studies have been done on the effects of microgravity, almost nothing is known about the effects that partial gravity would have on the human anatomy. Microgravity has adverse effects on the body, including bone and muscle loss.

Whether or not partial gravity will do the same is an important question that we must have answered as we venture further out beyond our world. Will humans be able to physically endure an extended stay on Mars?

QUICK FACT:
If you weighed 150 pounds on Earth, you would weigh only 57 pounds on Mars.

Prolonged exposure to microgravity would prevent the human race from venturing far out into our solar system and our universe. However it has been hypothesized that artificial gravity could be implemented in order to prevent the debilitating effects of microgravity. Could partial gravity be used as an adequate substitute for full Earth gravity?

These are the questions that the Translife Mars Gravity Biosatellite will attempt to answer. In order to simulate Martian gravity in our experiment, our satellite will spin, using centrifugal force to generate an artificial gravitational force.

Mice In Space

The Mars Gravity Project will launch a small crew of "micronauts" who will live in specially-engineered cages for a duration of approximately seven weeks. Some of the mice that we will launch will be pregnant and will give birth early in the mission. These will be the first mammalian births in space. The newborn mice will grow up to maturity before the mission ends and the mice are returned safely back to earth.

By studying the mice both throughout the duration of the mission and after they come back—also observing the effects on future generations of mice, the offspring of the returned micronauts—and comparing the results with a earth-bound control group, we hope to determine what effects (if any) partial gravity had on these mice.

This should give us and the rest of the scientific community insight into the possible effects partial gravity would have on humans.



Engineering the Spacecraft

The engineering work for the Mars Gravity Project has proved and will continue to be a formidable challenge. The Mars Gravity Biosatellite will be the most complex satellite to have ever been built by a university team.

The satellite is made up of three major components (see Figure 1): the Payload Module, which houses the animals and the life support system; the Return Vehicle, which encloses the payload and provides a means of safe return to earth; and the Carrier Bus, which provides power and structural support to the rest of the craft. The

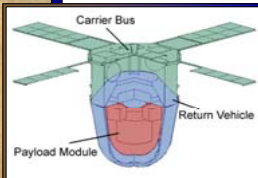


Figure 1: Components of the Satellite

bus also houses the propulsion and orbital maintenance system as well as several other vital elements.

MIT is engineering the life support system and is focusing on the science and management aspects of the project. The University of Queensland team is responsible for the satellite's re-entry and recovery. The primary concern of the

University of Washington team is with the engineering of the Carrier Bus and in-flight operations—including among other things orbital maintenance, communication, and supplying power to the entire spacecraft.

The Carrier Bus

As mentioned earlier, the carrier bus provides the structural support to the craft and houses all of the essential systems that both support the payload and allow the satellite to operate in space. The University of Washington engineering team is therefore broken down into several subgroups all working on individual systems within the bus.

The subgroups and their brief descriptions are as follows:

- Attitude Determination and Control—responsible for determining spin and angular orientation of the craft. Works closely with other subgroups such as Propulsion.
- Communications—provides the link between the satellite and Earth. The project hopes to include real-time images of the mice as well as a constant feed of data from the craft and the payload.
- Orbits—responsible for maintaining the proper orbit during the space phase.
- Power—provides all the power needs of the entire spacecraft, including a solar power system.
- Propulsion—enables attitude control as well as orbital maintenance and the re-entry burn.
- Structures—the bones of the spacecraft. Responsible for structurally supporting the entire craft and the components of the bus.

Mice photo courtesy of www.the-science.com, Man photo courtesy of www.science.com, Earth photo courtesy of <http://www.nasa.gov>
The following images used on this project were taken from the UW Biosatellite and the Mars Gravity Biosatellite. Individual credits for the images used in this presentation are as follows: Figure 1: Thomas Collins, MIT; Figure 2: James Brookbank, UQP; Figure 3: Study Lamotte, UW; Translife Logo: James Brookbank, UQP.
All figures not mentioned and any are.

Providing Structural Support to the Satellite

The structures subgroup is the group that I worked with this summer. Structures is responsible for engineering the carrier bus so as to protect the rest of the crafts and other systems from the harmful stresses of space and launch. It is also responsible for optimizing the craft's dimensions, mass, moments of inertia, and, of course, structural integrity.

The greatest stress placed on the craft occurs during launch because of large vibration loads. All components must be properly secured in order to ensure that nothing is broken or damaged during launch. The structures team is also charged with providing the interfacing between the spacecraft and the launch vehicle and between the bus and the return vehicle.



Figure 4: Three Configurations

Trade Studies

Trade studies are an integral part of the spacecraft design process.

In trade studies, various options are weighed based on certain pre-determined criteria. For the purposes of the Mars Gravity Project the criteria are as follows:

- Risk
- Cost
- Mass
- Power

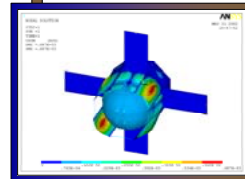


Figure 3: Finite Element Analysis

Trade Study 1: Satellite Configurations

The design of a spacecraft is a highly iterative process. The spacecraft must constantly adapt as new requirements are made and new components are added, changed, or removed. Figure 3 shows a process of development as a new idea replaced the old (top) design.

In order to determine which configuration was best, an extensive trade study was completed in which the craft was modeled and analyzed for mass and moments using the CAD program Unigraphics and was tested for structural integrity and thermal properties using the Finite Element Analysis program ANSYS. (See Figure 4)

This same process is used whenever an iteration is made in order to ensure that structural requirements are met.

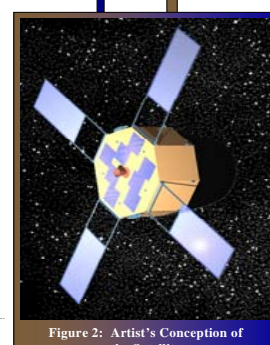


Figure 2: Artist's Conception of the Satellite

Trade Study 2: Solar Panel Deployment Mechanisms

Previously, a simple door hinge was baselined for the deployment of the satellite's solar panels. However, we felt it necessary to investigate other options—especially if longer, folding panels become necessary.

The solar panels must be able to be safely stowed upon launch, and must also be able to deploy to full length without excessive shock to the craft or compromising any of the subsystems. Several devices have been looked into so far, but all of the options must be fully analyzed before a mechanism can be chosen.

Figure 5 shows extended-panel models of two of the different methods using a standard (though now obsolete) model of the satellite.

Weighted Panel	Dimensions & Mass	Weight	Length	Area	Mass
Center of Mass	0.000	0.000	0.000	0.000	0.000
Moments of Inertia	0.000	0.000	0.000	0.000	0.000
Weighted Panel	0.000	0.000	0.000	0.000	0.000
Center of Mass	0.000	0.000	0.000	0.000	0.000
Moments of Inertia	0.000	0.000	0.000	0.000	0.000
Weighted Panel	0.000	0.000	0.000	0.000	0.000
Center of Mass	0.000	0.000	0.000	0.000	0.000
Moments of Inertia	0.000	0.000	0.000	0.000	0.000
Weighted Panel	0.000	0.000	0.000	0.000	0.000
Center of Mass	0.000	0.000	0.000	0.000	0.000
Moments of Inertia	0.000	0.000	0.000	0.000	0.000

Figure 5: Panel Deployment Comparison

Future Work

The Translife Mars Gravity Biosatellite is still under development, being currently in its preliminary phases. The satellite design will continue to progress towards increasingly higher-fidelity designs and will then be prototyped and tested extensively before final acceptance and launch.

Other trade studies in many of the systems are currently in the works as we develop our designs for the upcoming preliminary design review. Also, a small-scale model of the satellite will soon be built, primarily for PR purposes.

Conclusion

The Translife Mars Gravity Biosatellite is an important project that will give us insight into the possibilities of living in partial gravity environments. When the mission is complete, it will have broken spacecraft records and accomplished several firsts in the field.

Working with the Mars Gravity team this summer has been a wonderful opportunity, providing me with an opportunity to help to further the effort to expand the borders of mankind beyond our earth. I have also gained skills and knowledge that will prove invaluable to the rest of my learning career.

I would especially like to thank my mentor, Dr. Bogdan Urdrea, and my teammates for all of their help and support this summer.

Designing a HIFU Transducer to Stop Gastrointestinal Bleeding

Robyn Greaby, Joo Ha Hwang M.D., Shahram Vaezy Ph.D.

Introduction

Acute gastrointestinal (GI) bleeding is defined as any bleeding of the gastrointestinal tract detectable by the presence of blood in the stool or emesis [1]. Although many treatments including thermal therapy, injection therapy, and mechanical devices [2] are available to treat this condition, they have limited effectiveness in certain situations. High-intensity focused ultrasound (HIFU) may provide a new method for treating GI bleeding.

HIFU operates under the same general principle as a magnifying glass focusing light. High frequency sound is focused at a single point causing thermal and mechanical effects at the focus. There are minimal effects at all other points [3].

[1] "Gastrointestinal Bleeding." *Medlineplus Health Information*. Dec. 3, 2001. National Library of Medicine. June 26, 2002. <http://www.nlm.nih.gov/medlineplus/gastrointestinalbleeding.html>

[2] Hwang H, Vaezy S, Martin R, et al. High-Intensity Focused Ultrasound: A Potential New Treatment for Gastrointestinal Bleeding. In progress.

[3] Chan, Arthur H. "Image-Guided High Intensity Focused Ultrasound Device for Treatment of the Uterus: Potential for Minimally-Invasive Leiomyoma Therapy". General Examination Department of Bioengineering University of Washington 2002.

Piezoelectric Crystal



Figure 1: Picture of 1cm 5 MHz Piezoelectric crystal

The piezoelectric crystal is the element that produces the ultrasound waves. The crystal is composed of a ceramic that was heated above its Currie temperature while in a magnetic field. This process lined up the dipoles so when the crystal is subjected to an electric field the dipoles attempt to line up with the field and the thickness of the crystal changes slightly. This process is illustrated in Figure 2. The slight change in crystal thickness creates mechanical vibrations when the crystal is subjected to an alternating field.

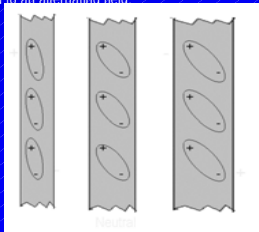


Figure 2: Exaggerated diagram of how crystal responds to different electrical fields

The crystal used in this transducer is 1 cm in diameter. This diameter was chosen so the entire device could be small enough to be inserted into the the GI tract attached to the end of an endoscope.

Electrical connections

In order for the crystal to produce sound waves it is necessary for one side of the crystal to be connected to ground and the other side connected to the positive lead. The positive connection is made by soldering the positive wire of the coaxial cable to the back side of the crystal. The ground connection is slightly more complex. The ground wire in the coaxial cable is soldered to the back of the handle. Conductive epoxy is used to connect the handle to the lens and the lens to the front side of the crystal.



Figure 3: Diagram of electrical connections in the transducer. Grey represents ground and represents positive, white represents black, and yellow represents the crystal.

Lens

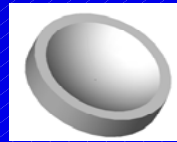


Figure 4: SolidWorks model of the lens

The lens is the element that focuses the ultrasound. The inside curve of the lens is a parabola so theoretically the lens should focus the sound to a single point. The lens is made of aluminum. This material was chosen because it is causes low attenuation and has favorable acoustic impedance. It is also easily machined.

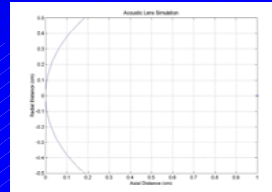


Figure 5: Math graph of inside curve of lens

The curvature of the lens was designed using a Matlab program. The text file output by the lens designer program was imported into SolidWorks to make a complete model of the lens as shown in Figure 4.

Handle

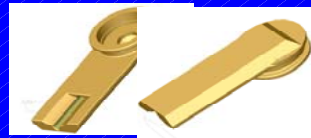


Figure 6: SolidWorks model of handle

The handle provides a place for all the other parts to attach. The lens sits inside the large circular hole and rests on the small ledge. The coaxial cable used to make electrical connections fits in the small hole on the straight part of the handle. The groove in the round section of the handle is designed to fit an ring that will attach the cone. The handle is made out of brass because it is a good conductor and can be soldered to.

Acknowledgements

Space Grant Summer Undergraduate Research Program
Center for Industrial and Medical Ultrasound

Construction



Figure 7: Front and back of transducer (back view)

The process of assembling a transducer begins with gluing a lens and crystal together. A dot of silver epoxy is placed in the center of the lens surrounded by a ring of nonconductive epoxy. When the epoxies are dry, the outer shielding is removed from the coaxial cable. The center conductor and insulation are threaded through the handle. The center conductor is soldered to the crystal and the ground is soldered to the back of the handle. The crystal and lens are lowered into the bowl of the handle and the gap between the front of the handle and the lens is sealed with conductive epoxy. Any remaining holes, where water might get inside the transducer, are sealed with nonconductive epoxy.

Cone



Figure 8: SolidWorks model of the cone

The cone serves two purposes. The crystal is damaged by high temperatures. The cone provides a place to add water channels to cool the crystal. Also to achieve maximum acoustic power there cannot be any air between the target and the crystal. The cone provides a way to attach water or a gel for coupling.

Future Work

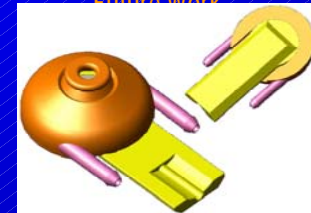


Figure 9: Complete transducer with cone

Preliminary tests indicate that the transducer works correctly. The next step in the process is to build electrical impedance matching networks for each transducer. Then the transducers must be characterized using Schlieren images, acoustic field mapping, and the efficiency must be determined. If the characterization confirms that the transducer operates as anticipated, the transducer will be tested on phantoms and possibly used in animal testing.

Printing & Mounting Your Poster

- By Wednesday, May 9th !!!!!!!
- Health Sciences Photographic & Digital Imaging - uwposters.com
– (\$30-\$50) T-271 HSB - (206) 543-9275
- MGH CRC (\$1 setup plus \$.50 per inch)
- Tip....Request a contract proof, because \$7 can save you a big headache. Contract proofs are guaranteed!

Mounting:

- You can get foam board from the UW Book Store. If possible, do not permanently affix your poster to the foam board.
- Health Sciences will mount the poster for you, but at an extra cost:
~\$37
- Other things to consider – matte & semi-gloss or economy bond?

The Day of your Presentation

- Prepare a two- to five-minute summary for visitors using your poster as a visual guide.
- Check-in between 8 and 11 am in MGH.
- You'll receive a bag lunch.
- Poster should be freestanding.
- The URP will provide the easels, which are assigned at random.
- Presenters are asked to remain at their posters during the formal session times (12-1:30 & 3-3:30).
- Please pick up your poster by 5:30.
- In Seattle, it rains – consider a garbage bag for Friday

Final Thoughts

- Reading and understanding the information on a poster takes time and effort
- Make it as quick and effortless as possible
- A good poster has balance
 - Too much text or graphics can make it overwhelming
 - Lack of organization and unity make it hard to follow
- *Again, a good poster will not make up for bad research, but a bad poster can ruin good research!*

References

- Undergraduate Research Program
 - <http://www.washington.edu/research/urp/courses/posterdesign.html>
- Washington NASA Space Grant Consortium
 - <http://www.waspacegrant.org/posterdesign.html>