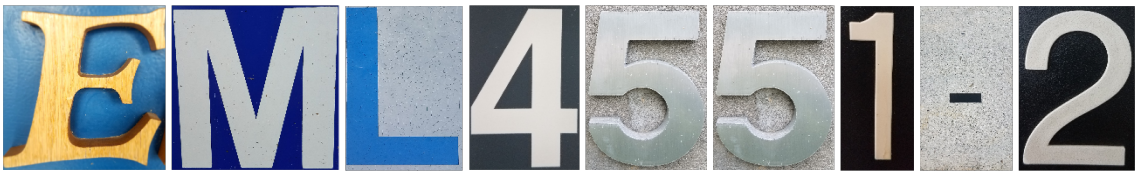
9/9/2022



Team 511: Microgravity Machine

Samuel N. Duval, John T. Tietsworth, Pedro N. Simán, Collin C. Gainer, Thomas E. Lenz

FAMU-FSU College of Engineering 2525 Pottsdamer St. Tallahassee, FL. 32310

Abstract

The abstract is a concise statement of the significant contents of your project. The abstract should be one paragraph of between 150 and 500 words. The abstract is not indents.

Keywords: list 3 to 5 keywords that describe your project.

Disclaimer

Your sponsor may require a disclaimer on the report. Especially if it is a government sponsored project or confidential project. If a disclaimer is not required delete this section.

Acknowledgement

These remarks thanks those that helped you complete your senior design project. Especially those who have sponsored the project, provided mentorship advice, and materials. 4

- Paragraph 1 thank sponsor!
- Paragraph 2 thank advisors.
- Paragraph 3 thank those that provided you materials and resources.
- Paragraph 4 thank anyone else who helped you.

Table of Contents

List of Tables

List of Figures

Notation

A17	Steering Column Angle
A27	Pan Angle
A40	Back Angle
A42	Hip Angle
AAA	American Automobile Association
AARP	American Association of Retired Persons
AHP	Accelerator Heel Point
ANOVA	Analysis of Variance
AOTA	American Occupational Therapy Association
ASA	American Society on Aging
BA	Back Angle
BOF	Ball of Foot
BOFRP	Ball of Foot Reference Point
CAD	Computer Aided Design
CDC	Centers for Disease Control and Prevention
CU-ICAR	Clemson University - International Center for Automotive Research
DDI	Driver Death per Involvement Ratio
DIT	Driver Involvement per Vehicle Mile Traveled
Difference	


FLORIDA AGRICULTURAL MECHANICAL UNIVERSITY
HEAD
HEART
HAND
FIELD
1887
FLORIDA STATE UNIVERSITY
1851

Chapter One: EML 4551C

1.1 Project Scope

Project Description

Design an easily replicable air vehicle that can simulate microgravity conditions for 3-4 seconds when dropped from a drone and be recovered for multiple uses. The device must contain a payload consisting of a CubeSat and GoPro camera to record data.

Key Goals

The primary end goal of this project is to increase the availability and quality of microgravity sources in the state of Florida.

To achieve this goal, the microgravity machine must be designed to allow the payload to experience zero gravity for up to 4 seconds or longer. The design must accommodate a 3U class CubeSat payload while weighing less than 25 pounds. The design must also accelerate downward at 9.81 m/s^2. The design must be easily reproducible, affordable, and reusable.

These key goals must be implemented to successfully accomplish the needs of the Florida Space Institute (FSI) which include increasing space awareness and science amongst middle school, high school, and college students and furthering research opportunities.

Markets

The primary market for this device is researchers who wish to run experiments in a microgravity environment which fits within the dimensions of a 1U or 3U CubeSat.

The secondary markets for this device include middle and high schoolers who wish to replicate our design and conduct microgravity experiments of their own. Further secondary markets include private companies/organizations that wish to purchase/use our design for testing.

Tertiary markets include individuals seeking hands-on experience with a microgravity environment for recreational purposes.

Assumptions

The assumptions for this project are as follows: the vehicle's freefall path will be clear of obstacles, weather conditions will be calm during testing, air drag will be negligible for the first 0.5 seconds of free fall, device will be lifted and dropped without malfunction of drone, vehicle will be tested in standard earth atmosphere.

Stakeholders

Stakeholders for our project include our project sponsor Mike Conroy, our senior design professor Dr. Mcconomy, our advising professor Dr. Ali, the colleges Florida Polytechnic University and University of Central Florida for putting on the competition and providing test fields, and the Florida Space Grant Consortium for providing the funding for this project.

1.2 Customer Needs

1.3 Functional Decomposition

1.4 Target Summary

1.5 Concept Generation

Concept 1.

Concept 2.

Concept 3.

Concept 4.

Concept n+1.

1.6 Concept Selection

1.8 Spring Project Plan

Chapter Two: EML 4552C

2.1 Spring Plan

Project Plan.

Build Plan.

Appendices

Appendix A: Code of Conduct

I. Mission statement

The mission of our team is to design a microgravity machine, test it, and compete against other schools to see who can achieve the most time under microgravity conditions while maintaining structural integrity.

II. Modes of Communication

Microsoft Teams and email. A distribution list was created on OneNote, this should be used for team email communications regarding assignments. Text or phone calls if needed for rapid communication. Email response time should always be as soon as possible.

III. Team Roles

Samuel Duval: Flight dynamics and propulsion. Deals with the flight dynamics and required propulsion aspects of the project design.

Pedro Siman: Recovery engineer. Test the recovery system of the projectile and research the best way to recover it without damaging it, allowing us to reuse the case and lower our total costs.

John Tietsworth: Materials Engineer. In charge of material selection and ensuring durability for the product.

Thomas Lenz: Test and Safety Engineer: Testing of the system and analyzing the data. Ensures all components are safe and meet the requirements.

Collin Gainer: Body design and propulsion. Primarily focused on the design of the dropped body and propulsion systems with contribution to all aspects of the project.

Other Duties: Team members will be asked to volunteer for new duties. This will be discussed at team meetings.

IV. Outside Obligations

Samuel Duval: I will work full time on MW and a couple of hours on Fridays. So, I will work until 4-5pm on MW and be busy with class on TR until Senior Design. I will not be available most Fridays. I will be able to work on Fridays and weekends as needed later in the year. Generally available after 4-5pm M-TR.

Pedro Siman: Monday: free after 5PM, Tuesday free after Senior Design, wednesday free after 5PM, Thursday free after Senior Design, Friday free after 3PM. Also willing to work on the weekends and meeting at the COE to work on Senior Design. Will miss classes Thursday Oct 13th, Tuesday Oct 17th, and Thursday Oct 20th for my sister's wedding, will be available through zoom meetings but not for any after class meetings.

John Tietsworth: Monday: 3:30PM -4:45PM. Tuesday and Thursday: 9:30AM 12:30PM and after 7:45PM. Wednesday 9:00 AM -11 AM and 3:30PM - 4:45PM. Friday before 1:00PM. Saturday 1:30PM – 4:30PM.

Thomas Lenz: Monday: 8:00AM-10:00AM, 3:30-4:45PM. Tuesday and Thursday: 9:30PM-10:45PM, 3:30-7:30PM. Wednesday: 3:30-4:45PM. Friday: 12:30-3:15PM. Available any other time. Out of town November 16th-November 20th

Collin Gainer: Tuesday and Thursday 11:00AM-3:15PM, Friday 3:00-6:15PM

V. Meetings

Weekly meeting times: During class time (TR)

As Needed meeting times: Afternoon MW after 5:00, weekends.

Notify the team at least two days before you need to miss a meeting.

VI. Team Rules

Do assigned tasks or give notification two days before missing a task.

Be professional when representing the group.

Notify the team after submitting an assignment.

VII. Dress Code

Design Reviews: Business Professional; Suit and tie.

Sponsor Meetings: Business Casual; Button down shirt/Polo with slacks/Khakis.

Team Meetings: Casual

VIII. Attendance Policy

Attend every meeting unless you have another commitment at the same time. If you know you will miss a meeting let the other team members know through either email or the team's chat. Before meetings, attendance will be taken and uploaded to team's page for archiving.

IX. Conflict Resolution

1st offence: We will reach out in over predefined methods of communications.

2nd offence: We will reach out in over predefined methods of communications **AND** cc Dr. McConomy.

3rd offence: Dr.McConomy will be contacted directly with an explanation of the issues.

Offences include missing team meetings without an excuse, missing deadlines assigned by group, failing to respond to team members in a timely manner,

For all subsequent offences, Dr. McConomy should subtract 1% from the team member's total grade.

X. Making Amendments

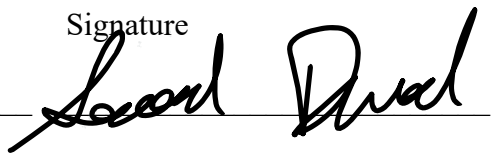
4 people must agree on every amendment.

Amendments should be added at the end of the Code of Conduct

Amendments should include the date they were added

XI. Statement of Understanding

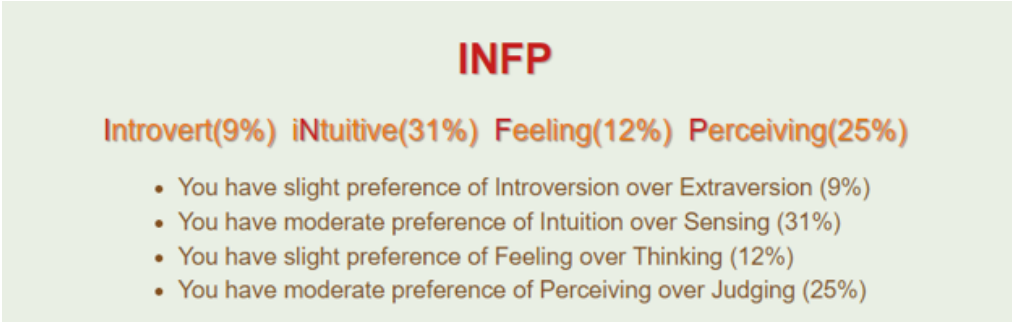
By signing this document below, I affirm that I have read the rules and principles stated above and agree to the terms listed.

Print Name	Signature	Date:
Samuel Duval		09/08/2022
John Tietsworth		09/08/2022
Thomas Lenz		09/08/2022

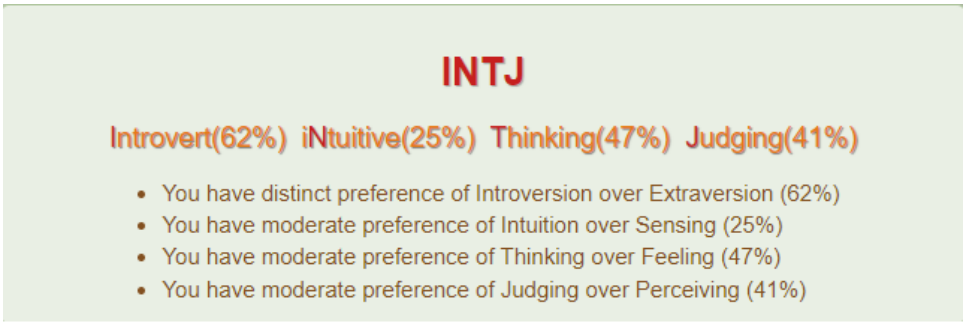
Collin Gainer		09/08/2022
Pedro Siman		09/08/2022

XII. Personality Test Results

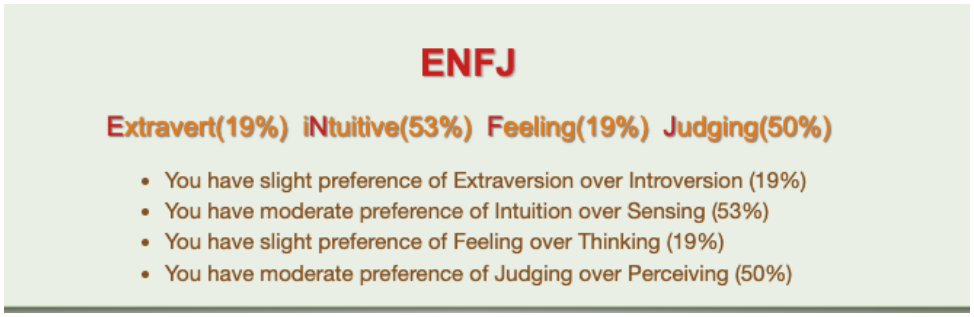
Samuel Duval:



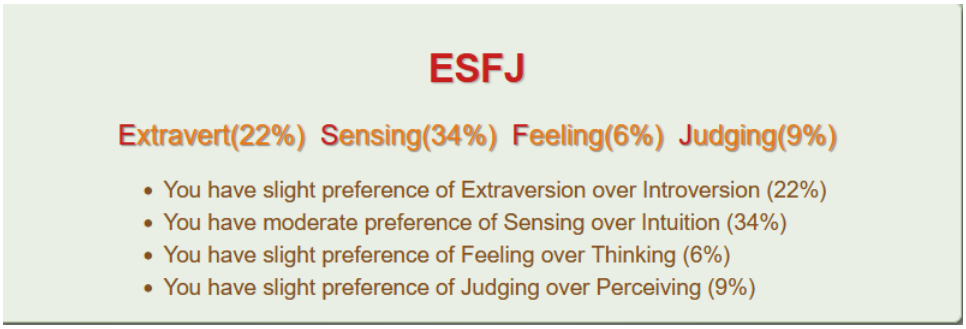
Collin Gainer:



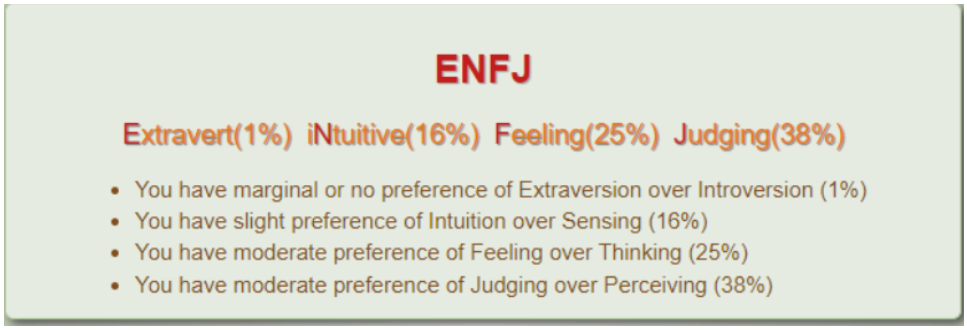
John Tietsworth:



Thomas E. Lenz:



Pedro Siman:



Appendix B: Functional Decomposition

Appendix C: Target Catalog

Appendix A: APA Headings (delete)

Heading 1 is Centered, Boldface, Uppercase and Lowercase Heading

Heading 2 is Flush Left, Boldface, Uppercase and Lowercase Heading

Heading 3 is indented, boldface lowercase paragraph heading ending with a period.

Heading 4 is indented, boldface, italicized, lowercase paragraph heading ending with a period.

Heading 5 is indented, italicized, lowercase paragraph heading ending with a period.

See publication manual of the American Psychological Association page 62

Appendix B Figures and Tables (delete)

The text above the cation always introduces the reference material such as a figure or table. You should never show reference material then present the discussion. You can split the discussion around the reference material, but you should always introduce the reference material in your text first then show the information. If you look at the Figure 1 below the caption has a period after the figure number and is left justified whereas the figure itself is centered.

Figure 1. Flush left, normal font settings, sentence case, and ends with a period.

In addition, table captions are placed above the table and have a return after the table number. The second line of the caption provided the description. Note, there is a difference between a return and enter. A return is accomplished with the shortcut key shift + enter. Last, unlike the caption for a figure, a table caption does not end with a period, nor is there a period after the table number.

Table 1

The Word Table and the Table Number are Normal Font and Flush Left. The Caption is Flush Left, Italicized, Uppercase and Lowercase

Level of heading	Format
1	**Centered, Boldface, Uppercase and Lowercase Heading**
2	**Flush Left, Boldface, Uppercase and Lowercase**
3	***Indented, boldface lowercase paragraph heading ending with a period***
4	***Indented, boldface, italicized, lowercase paragraph heading ending with a period.***
5	*Indented, italicized, lowercase paragraph heading ending with a period.*

References

There are no sources in the current document.