9/28/2018

Team 521: Housing/Chassis Design for Engine Electrical Accessories

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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 between the calculated and measured
Difference	BOFRP to H-point
DRR	Death Rate Ratio
DRS	Driving Rehabilitation Specialist
EMM	Estimated Marginal Means
FARS	Fatality Analysis Reporting System
FMVSS	Federal Motor Vehicle Safety Standard
GES	General Estimates System
GHS	Greenville Health System
H13	Steering Wheel Thigh Clearance
H17	Wheel Center to Heel Pont
H30	H-point to accelerator heel point
HPD	H-point Design Tool
HPM	H-point Machine
HPM-II	H-point Machine II
HT	H-point Travel
HX	H-point to Accelerator Heel Point
HZ	H-point to Accelerator Heel Point
IIHS	Insurance Institute for Highway Safety
L6	BFRP to Steering Wheel Center

Chapter One: EML 4551C

1.1 Project Scope

The objective for this project is to develop a precise assembly method for the ignition unit housing on a turbine engine, while maintaining a durable housing design and reducing the manufacturing time needed to assemble the housing. The assembly method created will need to provide support against effects of vibration, thermal expansion, normal part dimension variation, manufacturing tolerances and electrical insulation from operating voltages. A prototype ignition unit assembly will be produced. The assembly will undergo full vibration and thermal stress analysis to test the strength and durability of the unit. The second objective and goal for the project is to make sure that the design reduces manufacturing time and increases ease of assembly. This will be verified by presenting the assembly in a hands on trial to Unison Manufacturing Engineers.

The primary market of the project is Unison Industries, and their customers. Customers of Unison Industries are within the commercial, and military branches of the aviation industries. The secondary market of the project could be any industry or company that could benefit from the assembly design. For example, the automotive industry or boating industry. The stakeholders of the project are Unison industries, senior design professor Dr. Shayne McConomy, team advisor Dr.Mohd Ali and the General Electric Company. The General Electric Company is the parent company of Unison Industries. The improved assembly design will allow for the company to cut down on manufacturing time and most importantly improve

on the design of the units and minimize error. Because of the importance of the ignition units, any error could cause a decrease in reliability, efficiency and performance.

The project assumptions are that all materials that need to be in the ignition unit will be provided for accurate testing, testing apparatus will be provided by Unison Industries, specs of current ignition unit housing will be provided.

1.2 Customer Needs

An interview was conducted with the customer to gather valuable data and develop a better understanding of what the design should accomplish. Based on the information given by the sponsor, a list of interpreted needs was created and organized in table 1 below:

Questions	Customers Response	Interpreted Needs
What are typical uses?	This product is used in turbines for the Aviation industry.	The housing assembly will be used in both commercial and military branches of aviation.
	We need to minimize the movement of the ignition unit while preventing damage.	The housing assembly provides vibration stability and protection to main components of ignition system.
What do you like about the current design?	I like the shape of the design in that it conforms to the desired specifications of the overall system.	The housing unit will remain the same shape.
What are dislikes about the current design?	The current design takes too long to assemble.	The housing assembly will reduce manufacturing time.
	Some parts are bonded to the assembly with silicone adhesive.	The housing assembly holds components in place without the need of adhesive.
	The assembly cost is too high.	The housing assembly will cut down on manufacturing cost.
	The current design doesn't allow easy disassembly or repairs to be done.	The housing assembly can be easily disassembled to allow for repairs and modifications

What are improvements that can be made?	The manufacturing process can be improved by minimizing the opportunity for errors.	The housing unit will improve the efficiency of the manufacturing procedure to minimize errors.
	Would like to move away from using bonding adhesive and brackets to hold parts in place.	The housing unit will provide support for components without the need for any adhesive.
	A more robust design to help prevent failures from occurring.	The housing assembly will allow for protection under extreme conditions and be reliable.
What are some constraints and requirements for the design?	Design must be capable of function in a temperature range of 250°F to -40°F.	The housing assembly will operate normally within the temperature range 250°F to -40°F.
	The present housing and cover weigh about 1.4 LBs combined- 0.03 thick stainless steel about 5" * 5"3, plus some added weight for mounting brackets.	The improved housing assembly will be under the current weight of 1.4 lbs and keep the same dimensions as the previous design.
	The proposed design must be capable of supporting the com-opponents under a sinusoidal vibration input of 10Gs across an input frequency range of 10- 1000 Hertz.	The housing assembly operates within the appropriate vibration range.
	Use a labor rate of at least $125 per hour.	Manufacturing of assembly will be less than $125 per hour.
What type of testing will the design have to go through?	Proposed methods must have some technical substantiation that they will survive prior to a full vibration test analysis, sub level test or some combination or alternate test approach.	The housing assembly will meet all test requirements and standards.

Table 1: Questions, Customer Response and Interpreted Needs table

The interpreted needs section of the table was used to synthesize the customer need and eliminate extra information that is not important to the overall product. Interpreted needs help narrow the focus of certain requirements of the design, such as, manufacturing time, cost or design constraints. However, they are not overly restrictive and allow for freedom in the design.

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

Mission Statement

Team 521 (Housing/Chassis design for Engine and Electrical Accessories) is dedicated to providing a work environment that promotes innovation, positivity, and respect throughout the entirety of the project. Each team member will contribute to the project as much as possible to provide a great product for the customer while gaining experience in the field of mechanical engineering.

Team Roles

Team Roles			
Austin Watson	**Matthew Marshall**	**Marcus Cowan**	**Mosad Elsankary**
Design Cost Analysis Engineer:	Design/CAD Engineer:	Materials Engineer/ Team Leader:	Analysis/Systems Engineer:
Manages the project budget and keeps a record of all transactions and materials purchased throughout the course of the project.	Takes charge of the mechanical design aspects of the project.	Responsible for the cohesiveness and functionality of the team; providing positivity, problem solving and resolution to the team.	The system engineer will be responsible for creating the website, and updating all the reports and presentation.
Will work in coordination with the advisor to look at cost effective alternative approaches to the design.	Keeps line of communication with the sponsor in terms of needs/changes	Facilitating, and organizing weekly meetings as well as keeping track of tasks.	This website will show all the project details for the sponsors and the faculty of engineering college
Is responsible for finding the cheapest vendor for parts and making sure orders go through on time.	Responsible for knowing details of the design, and presenting new design ideas	Overseeing the project and any modifications.	Analyzes ways to improve manufacturing efficiency.

Keeps a record of all receipts and changes in the design budget and notifies team of progress.	Records all design information and CAD files.	Verify structural proficiency and materials.	Ensures calculations and formulas used for design are correct.

All team members:

- Responsible for completing scheduled deadlines in a timely and professional manner
- Maintaining professional demeanor
- Attending scheduled meetings and presentations
- Respect project decisions and ideas made by the group
- Communicate professionally with all team members and advising/sponsor personnel.

Communication

Throughout the course of this project several forms of communication will be used in order to ensure tasks get accomplished within a timely manner. A group chat via text messaging will be established to allow members to quickly receive a response to a question or concern they may have. Subjects not related to this project or any off topic discussions will not take place inside of this chat. All sharing of files and documents such as presentations, deliverables, reports and worksheets will take place through Google Drive. Here, each member of the team will be able to markup documents and share new information with the group. Email will be a crucial role of communication as well as a means of sending documents back and forth. Every member of the team will be required to have a working email that they make sure to check regularly for upcoming events. Pertinent information from the sponsor, along with every meeting date and time will be sent to each member of the team through email. The team leader will do his best to respond to

emails within a 24 hour notice. If a meeting has to be canceled or postponed to a later date the team leader will notify the group via email within a reasonable time prior to the meeting. All members of the team will strive to use proper etiquette and grammar when conducting emails, and all outgoing emails will go through a review process before being sent out.

Team Dynamics

The team will work together to ensure each team member has a chance to share their suggestions or constructive criticisms without fear of being ridiculed and/or embarrassed. All assignments are to be done as a team; all team members are responsible for all assignments even if done individually. If a team member is working on a specific assignment and needs assistance, they should not hesitate to contact another team member for additional support. It is each team member's responsibility to voice their opinion. If any one team member feels that they are not being respected as part of the team it is their responsibility to bring it to the attention of the group. Everything done is for the benefit of the project and together everyone achieves more.

Decision Making

Although there is a team leader who will oversee the team and help keep things on track; everyone will have a say when it comes to decision making. All decisions should reflect what is best for the team as a whole, and should be made in regard to reaching the overall goal of the project. There will be many ideas that come into mind from the beginning of the design process till the end. Weekly meetings will be put into place to hear these ideas and decide on the best course of action to take. After a brief discussion final decisions will be determined through majority vote and put into place. Research and analytical evidence will be used to help make certain decisions that may seem tough such as which materials are best to use for the design. The

design process will be closely followed all the way from gathering information about the product and customer, to implementing the design and performing test. The customer will also have some say in the decisions that are made and the group will do their best to accommodate their needs while still acting in the best interest of the team.

Ethics

Each team member should be familiar with the ethics information given in the Engineering Design Methods class as well as the NSPE Code of Ethics for Engineers. If any information is confidential and given to the team by the sponsor, that information will only be discussed within the group.

Dress Code

Team members will dress in casual attire during team meetings. Team members will dress in business casual attire when attending sponsor meetings and advisor meetings. Any professional interactions such as company tour, or business lunch will require business casual attire. Lastly, presentations will require each team member to dress in formal attire.

Weekly and bi-Weekly Task

Meetings with the team's sponsor, advisor, and instructor will be attended by all team members. All ideas, conflicts, due dates, and timelines, as well as budget and current project progress will be discussed during the aforementioned meetings. Team members will also be assigned tasks during meetings that they will be expected to follow through to completion.

Attendance Policy

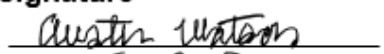
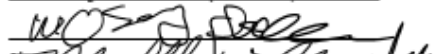
Attendance and participation in all group meetings, lectures, presentations and events will be mandatory and is expected to be taken seriously among all group members. Based off of everyone's schedules, a weekly meeting will be held on Tuesdays to discuss important project details. Progress meetings with the team sponsor will be conducted on Thursdays at 5 PM as needed. The team will also meet with the assigned Advisor at least three times a semester. At every meeting each member will be required to sign in showing that they were present. All meeting times will be announced through email, any member that cannot attend a meeting must give at least 24 hour notice prior to the meeting. There should be a valid reason for a team member's absence, and multiple unexcused absences will not be accepted. If problems continue to persist with a team member not showing up and contributing to the team; administration will become involved and a meeting will be arranged to try to resolve the issues at hand.

Conflict Resolution

In the case in which two members disagree, the following steps will be taken if necessary. Each member will get a chance to fully explain their view without interruption. Then, the team will vote on which way to go with the project. In the event that this doesn't work, the instructor will facilitate in conflict resolution. It is the team leader's responsibility to initiate the conflict resolution.

Statement of Understanding

By signing this document the members of Team 521 agree to all of the above and will abide by the code of conduct set forth by the group.

Name	Signature	Date
Austin Watson		9-19-18
Mosad Elsankary		9-19-18
Matthew Marshall		9-19-18
Marcus Cowan		9-19-18

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

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