

Design Challenge 1: Machine Anatomy

Preview: Wed Jan 14

Assigned: Fri Jan 16 (Lab)

Due: Sun Jan 25 (11:59 PM)

Grade Weight: 10%



Design Challenge 1: Machine Anatomy



Background

EGR Corp. is considering entering the potentially lucrative and exciting remote-control action toy marketplace. Before investing in this venture, the Corporation wishes to perform a thorough analysis of market-leading products in various market categories to help guide their product positioning, design, and manufacturing planning.

Request for Services

To qualify proposal teams for an upcoming contract, EGR Corp. is soliciting preliminary product design and benchmarking-related analyses from qualified firms, based on the service terms outlined here.

Design Challenge 1: Machine Anatomy



Deliverables

Teams are expected to provide a report in **report memo format** (see *Example A.*) documenting their analysis findings. The documentation must be structured using the format described here:

Documentation Format and Content

1. Executive Summary (see *Example B.*)

2. Description of Approach

- What did you do and how did you do it?

3. Summary of Findings: minimum deliverables, but not limited to:

- Innovative or otherwise notable design features
- Suggestions for design improvements including cost reductions
- Post-Use Environmental Responsibility: how might you Recycle, Reuse, or Repurpose (R³) project materials?
- Costed Bill of Materials (BOM) (see *Example C.*)
- Structured Assembly (see *example D.*)
- Exploded Assembly view sketches (see *example E.*)

4. Summary and Conclusions

5. Appendix (see *example F.*)

Design Challenge 1: Machine Anatomy

Other Documentation Requirements



1. ALL FIGURES (i.e., pictures, tables, graphs...) must be individually and sequentially numbered and include an “action caption” such as:

Figure 7 – Pressing latch button unlocks the housing pivot allowing the user to....

2. All figures must be referenced by number in document body text:

*As seen in *Figure 7* below, depressing the latch button allows....*

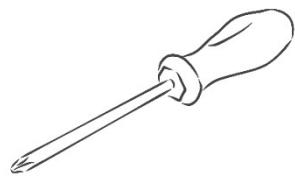
3. Figures are best placed if possible after and as close as possible to the text that refers to them

4. Document authors must have their names on the proposal cover!

5. Document must appear as a single team document. Avoid having document appear as a collection of unrelated items (i.e., the ‘ransom note’ appearance)

6. Authors should strive for a ‘one document’ look/feel throughout (structure, fonts, formatting, etc.)

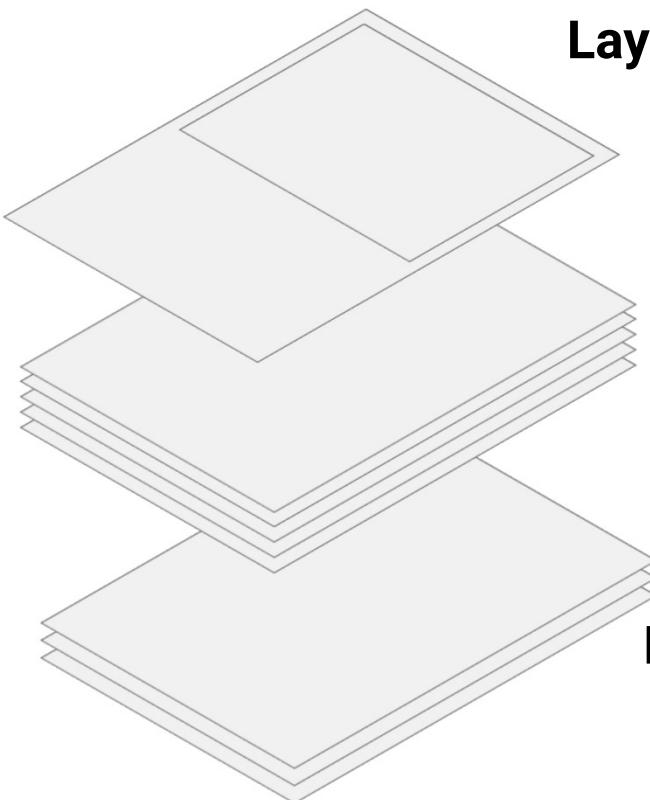
Tools / Materials Required



Mini Phillips-Head
Screwdriver

Documentation Requirements Examples

Think of your document as having three layers that support different audiences and their needs:



Layer I. Executive Summary

Captures and succinctly summarizes the “Why, What, How, Where, and When” informational elements, and conveys the conclusions and recommendations of your activities described in the Core Document

Layer II. Core Document

Captures your expanded problem statement (what is to be done), methods (how you did it), results (what you found), and conclusions (what your results mean, proposed actions, and other recommendations)

Layer III. Appendix

Contains information that supports and validates the Core Document. Appendix items should be referenced in the Core, but they may contain data that is either too detailed and/or may contain other information that is not essential for inclusion and discussion in the Core text.

Example A: Memo Format

To: EGR Corporation
From: I.M. Engineer and U.B. Designer ← **Please remember to include your names!**
Subject: Request for Design Analysis and Benchmarking Services
Date: January 25 2026

Proposal Evaluation Board:

The purpose of this memo is to provide a response to your recent request....

Executive Summary

The.....

Description of Approach

The team.....

Analysis Findings

The....

Summary and Conclusions

The...

Example B: Executive Summary

The “Executive Summary” is a typically brief section at the very beginning of the document that provides a summary of the entire document. It is intended to help readers become rapidly acquainted with the larger report background, methods, results, and conclusions without having to read every detail in the report.

It should usually contain:

- (1) a brief statement of the problem to be solved,
- (2) important background or other vital contextual information,
- (3) a concise analysis description (e.g., key methods, techniques, and tools used), and
- (4) a summary of main conclusions and/or recommendations

For EGR121 DC reports, the Executive Summary is generally 1/4 – 2/3 of a page long. **Concise, complete and specific** is always better than being long-winded or verbose!

Example C: Costed Bill-of-Materials (e.g., for a Powered Screwdriver)

| Part Number | Part Name | Material | Qty | Est. Part Cost (\$) | Est. Total Cost (\$) |
|------------------------|----------------------|-------------|-----|---------------------|----------------------|
| 1 | Grip, Left Hand | ABS Plastic | 1 | 0.75 | 0.75 |
| 2 | Grip, Right Hand | ABS Plastic | 1 | 0.75 | 0.75 |
| 3 | Screws, Housing | Steel | 3 | 0.15 | 0.45 |
| 4 | Motor | N/A | 1 | 1.25 | 1.25 |
| 5 | Switch, Motor | N/A | 1 | 0.75 | 0.75 |
| 6 | Clip Power Cord | Steel | 1 | 0.20 | 0.20 |
| 7 | Controller, Speed | PC Plastic | 1 | 0.15 | 0.15 |
| 8 | Controller, Rheostat | N/A | 1 | 2.25 | 2.25 |
| 9 | Screws, Chuck | Steel | 4 | 0.07 | 0.28 |
| 10 | Key, Chuck | Steel | 1 | 0.27 | 0.27 |
| Part Total = 15 | | | | Total Cost = | 7.10* |

- As a very rough estimate, assume that manufactured cost equals 20-35% of retail price (e.g., if retail = \$20.00 so, as a preliminary check, assume **\$4.00 - \$7.00** total mfg. cost)

Example D: Structured Assembly

Assembly
Level

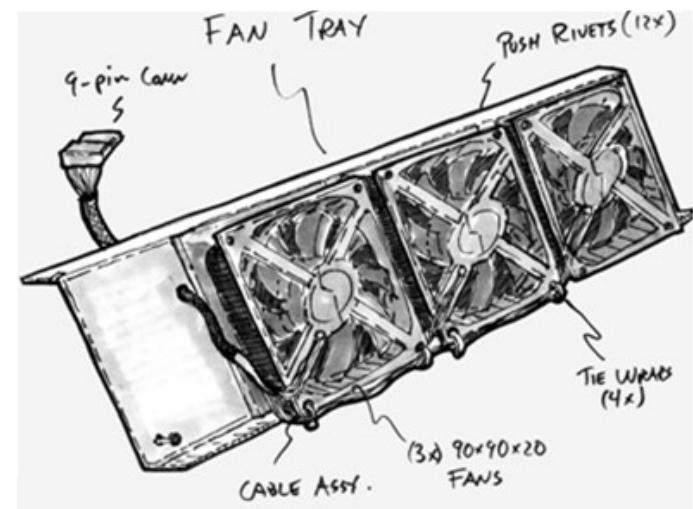
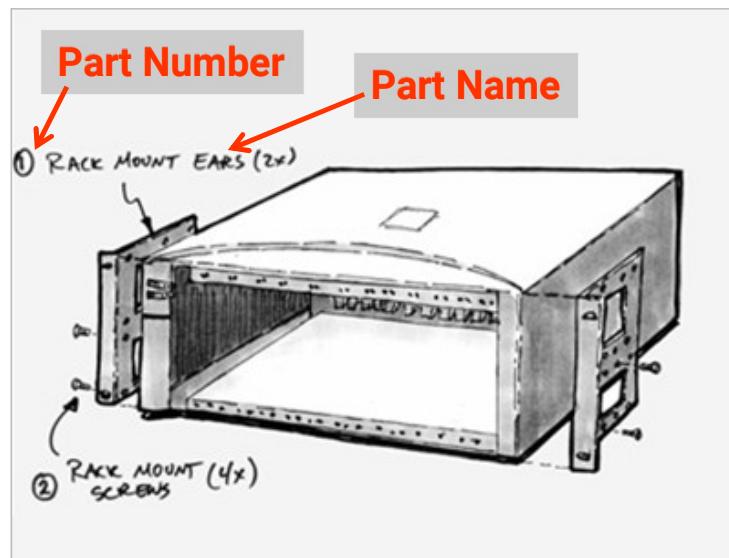
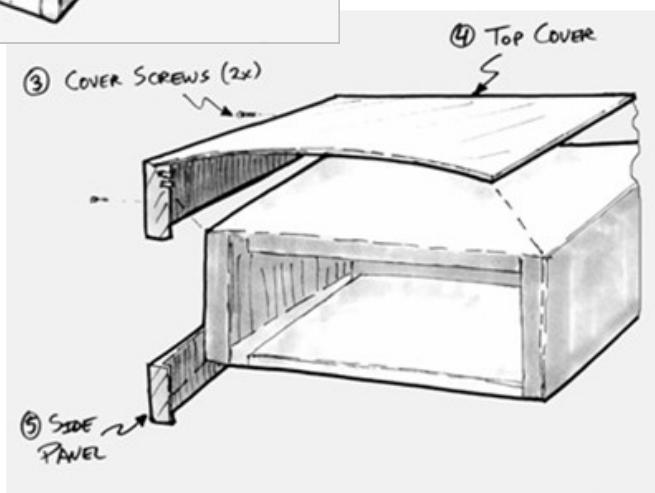
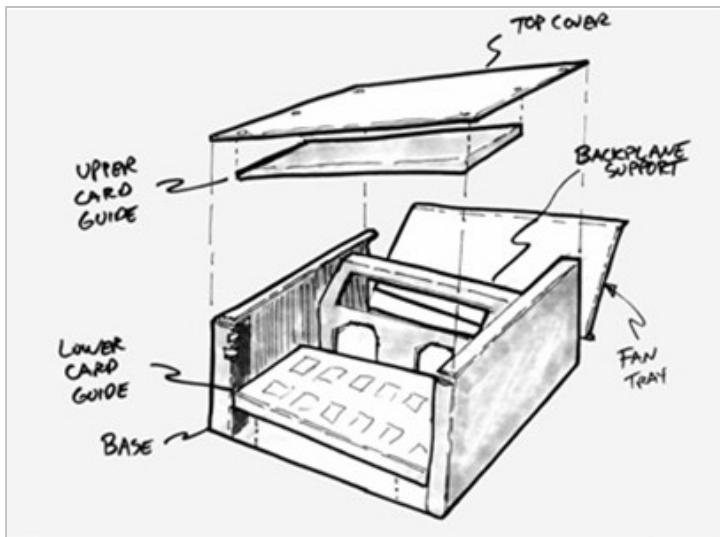
Parts
Level

| | | | | | | |
|---------------------------|---------------------------------|---------------------|--|-------------------|----------------|--|
| Power Supply Assembly (2) | | | | | | |
| Chassis Assembly | Mounted Chassis Assembly | Rack Mount Assembly | Ear, Rack Mount (2) | | | |
| | | Facia Sub-Assembly | Screw, Rack Mount (4) | | | |
| | | | Top Cover Assembly | Cover, Top | Cover, Top | |
| | | | | | Lightpipe, Top | |
| | | | | | Badge, Logo | |
| | Sheetmetal Chassis Sub-Assembly | | | Screw, Cover (2) | | |
| | Backplane Fan Tray Assembly | | Cover, Side | | | |
| | | | Fan (3) | | | |
| | | | Cable | | | |
| | | | Tray, Sheetmetal | | | |
| | Chassis | | Screws (2) | Screws (2) | | |
| | | | | Rivet, Push (12) | | |
| | | | Cover | Cover, Sheetmetal | | |
| | | | | Card Guide, Upper | | |
| | | | Base | Base, Sheetmetal | | |
| | | | | Feet, Rubber (2) | | |
| | | | | Label, Regulatory | | |
| | Power Supply Assembly | | Sppt, Backplane Card Guide, Lower Rivet, Pop (33) | | | |
| | | | PS, Cover PS, Doghouse PS, Front PS, bracket PS, Bottom PS, EMI Finger PS, PCB | | | |

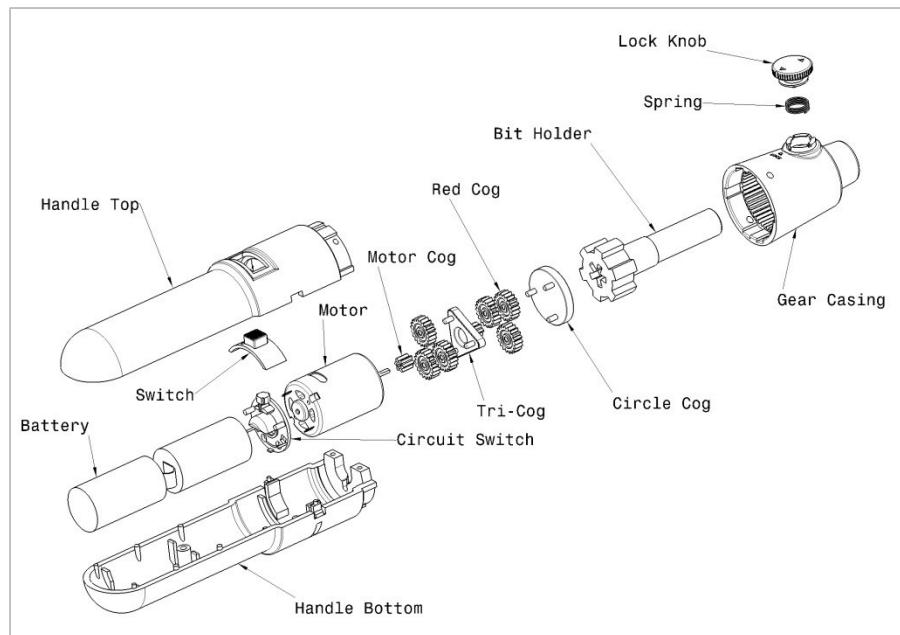
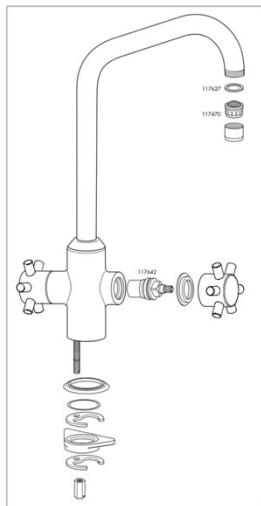
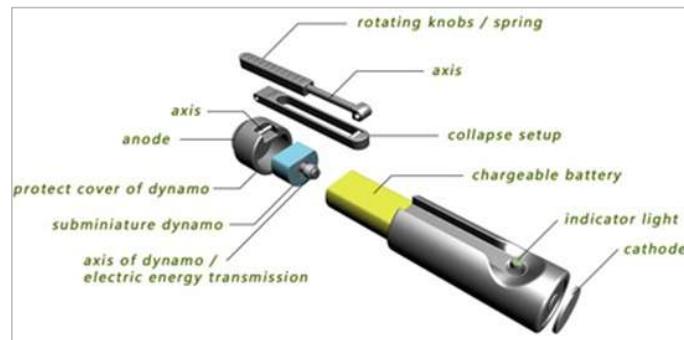
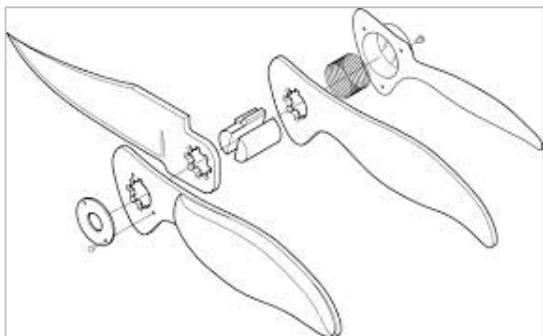
Disassembly

Assembly

Example E: Exploded View



Example E: Exploded View, Other Examples



Example F: Appendix

The Appendix is a section usually placed at the very end of a document. It is intended to contain information that is relevant to and supports the main document, but may be too expansive, detailed, or mixed with other less-relevant material that precludes its placement in the main text. The Appendix is also a nice way to showcase (and get credit for!) the research or other investigative work you accomplished without cluttering, derailing, or defocusing the main document text's narrative.

For reading ease, individual Appendix content should be separated into titled sections, such as “Appendix A: Raw Data”, or “Appendix 1: Full Brainstorm List”. Each Appendix section should be referenced at some point in the main document (or else why have it there?). Such a reference might read, for example, as: *“Shown here are the top three final design options. The reader is referred to Appendix 3 for the complete list of 75 options identified in the initial brainstorming session”*.

Typical EGR121 appendices often include, for example:

- (1) a full list of ideas generated in brainstorm session(s),
- (2) copies of sketches or other conceptual drawings,
- (3) lists of research observations, raw test results, or
- (4) manufacturer specifications and component, material, or product data sheets