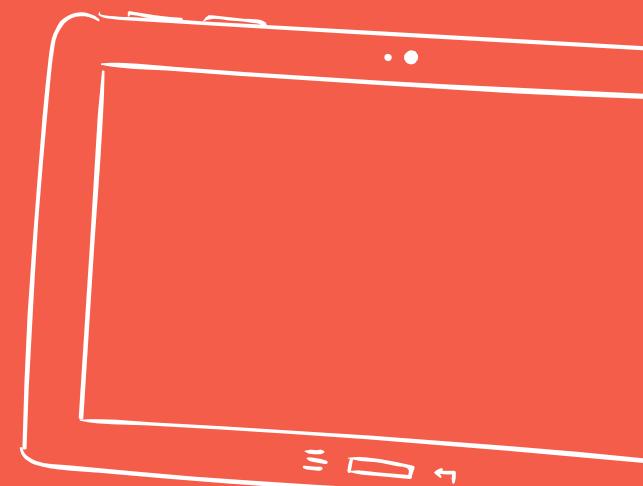


ENGINEERING DESIGN AND DOCUMENTATION PROTOCOLS



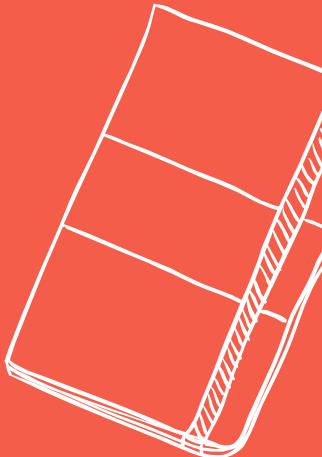
WELCOME!

Louisa: Co-captain, Engineering Compliance,
& Drive Team

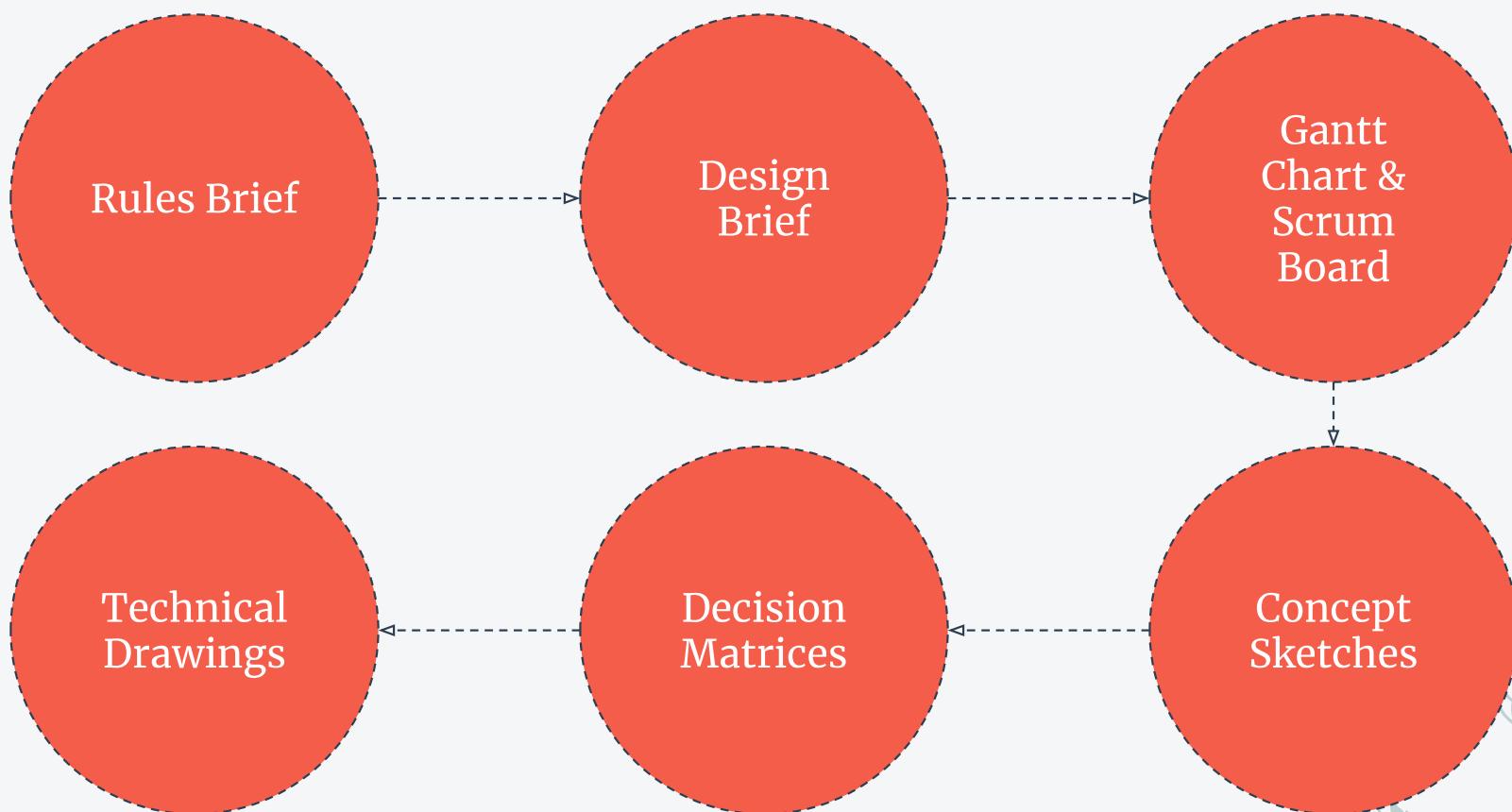
Carly: Research, Reconnaissance, & Blogger



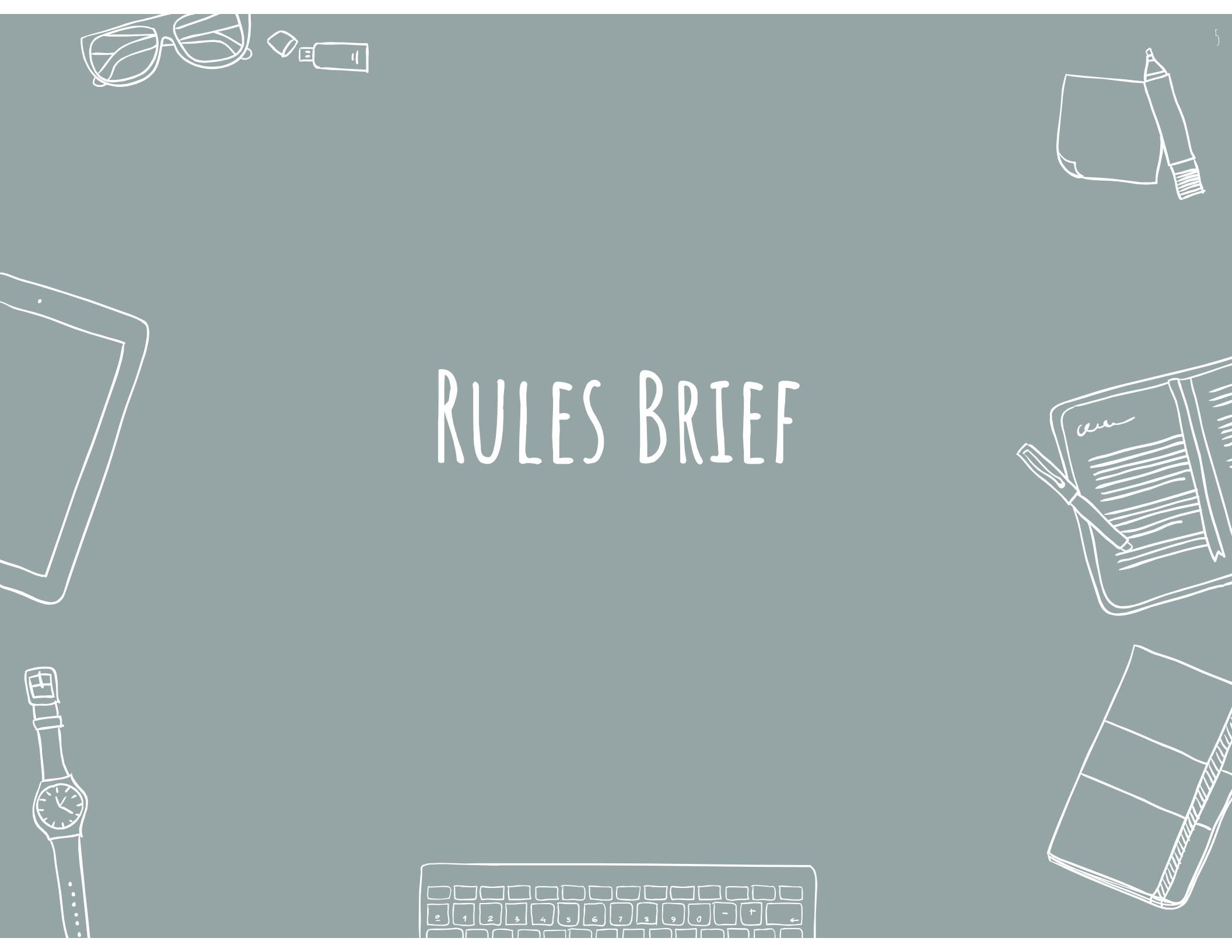
ENGINEERING DESIGN PROCESS



PRE-BUILD PROCESS SEQUENCE



RULES BRIEF





INITIAL BRIEF

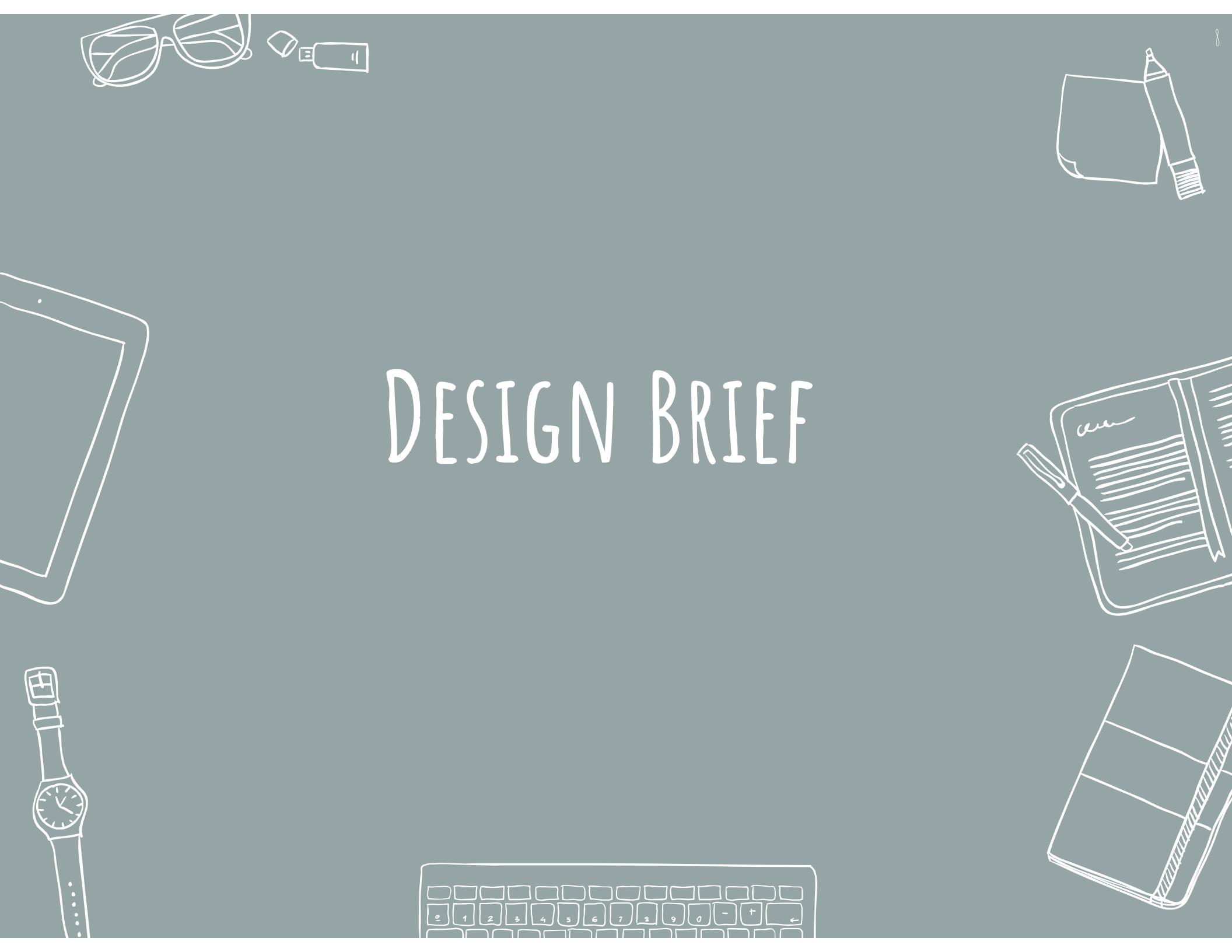
Rules Briefing - 9/13/18

Pre-Match:

Starting locations for the robot:

- Latched to the lander
 - The robot must be completely latched to the lander support bracket on their alliance's specific side. The lowest point on the robot and team marker may not be any closer than 4 inches to the floor.
- Deployed from the lander
 - The robot must be in the landing zone within the vertical projection of the lander support bracket. A portion of the robot must be below the bracket. The robot can not start in the opposing alliances landing zone.

DESIGN BRIEF



DESIGN BRIEF

Team #14479 Design Brief Layout

Client:

FIRST Tech Challenge – Rover Ruckus

Designer(s):

Mark, Zach, Louisa, Ella, Carly, Dell, Jonas, Jake, Kishan, Matt, Yeveen, Rebecca, Matthew and Brandon

Problem Statement:

To create a robot that can efficiently maneuver field, pick up objects (ex. Gold and Silver), bring them to the lander, and sort the objects in the lander properly. Additionally, it is desirable for the rover to be able to lift itself up on the lander and put itself down from the lander.

Design Statement:

The design must be efficient, lightweight, strong, and properly built and engineered in order to solve the problem. The design must also be unique and original. Lastly, the design should display some form of team spirit. Given that our team is strong in coding, we will focus the majority of our efforts on the autonomous period. The goal is to lower the robot from the lander, identify and move the gold field object without disturbing the silver whiffle balls, move to and deploy our marker to our alliance space and strafe to the edge of the crater.

Constraints:

Budget is limited.

- Need to use existing VEX inventory for structure
- Need to integrate VEX, REV and Andymark components
- Not all students are in every day. Thorough documentation is key.

GANTT CHART & SCRUM BOARD

GANTT CHART

- Strategy Formulation
- Concept Sketching
- Formulate Solution
- Technical Sketches
- Concept Testing
- Software Flowchart
- Modeling
- Chassis Build
- Lift Build
- Marker Manipulator B...
- Component Integration
- Software Coding
- Integration Testing



SCRUM BOARD

2018_2019 Robotics ★ | Personal | Private | JC K MN RT SK 5 | & | + | ⚡ | JC | ... Show Menu

To Do

- Triangle Chassis testing - Zach
- Robot lift 3d models - Jonas
- Robot lift testing - Zach
- Robot lift integration
- Payload 3d models - Jonas
- Payload build
- Payload testing - Zach
- Payload integration
- Marker/deployment 3d models - Jonas
- Marker/deployment build
- Marker/deployment testing - Zach Battleman
- Marker/deployment integration
- Integration testing

Backlog

- Problem Statement - Louisa
- Design Brief - Louisa
- Modify Thingiverse Parts for VEX structure - Jonas

In Process

- Technical sketches: marker and deployment
- Technical sketches: robot lift
- Technical sketches: payload gathering and scoring
- Outreach program description - Yeveen
- Web Template - Zach
- Outreach program updates - Yeveen
- Triangle chassis build - Yeveen & Dell
- Triangle Chassis 3d models - Jonas Kolker
- X-drive Chassis Build - Ella, Carly & Kishan
- Robot lift build - Jake and Jonas

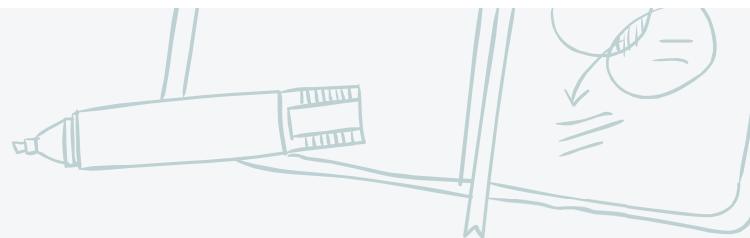
Ongoing

- Rules updates - Jake
- Research into other FTC Designs - Carly
- Onbot Java component testing - Matt
- Manage parts inventory - Brandon
- Order parts - Mr. C
- Team blog - Carly

Completed

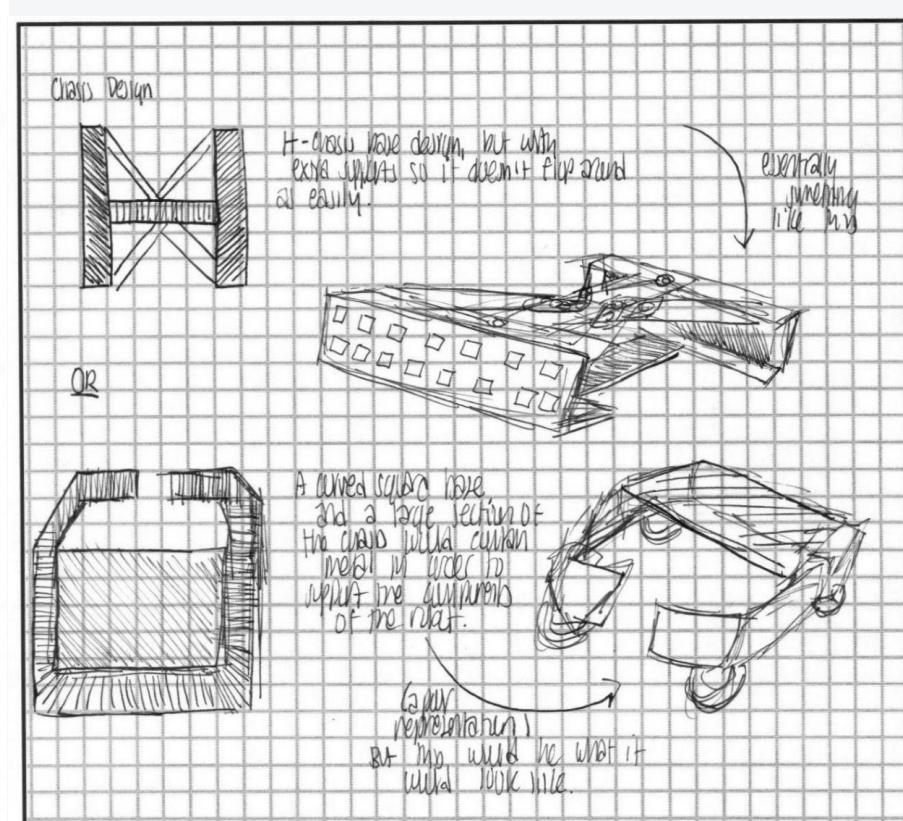
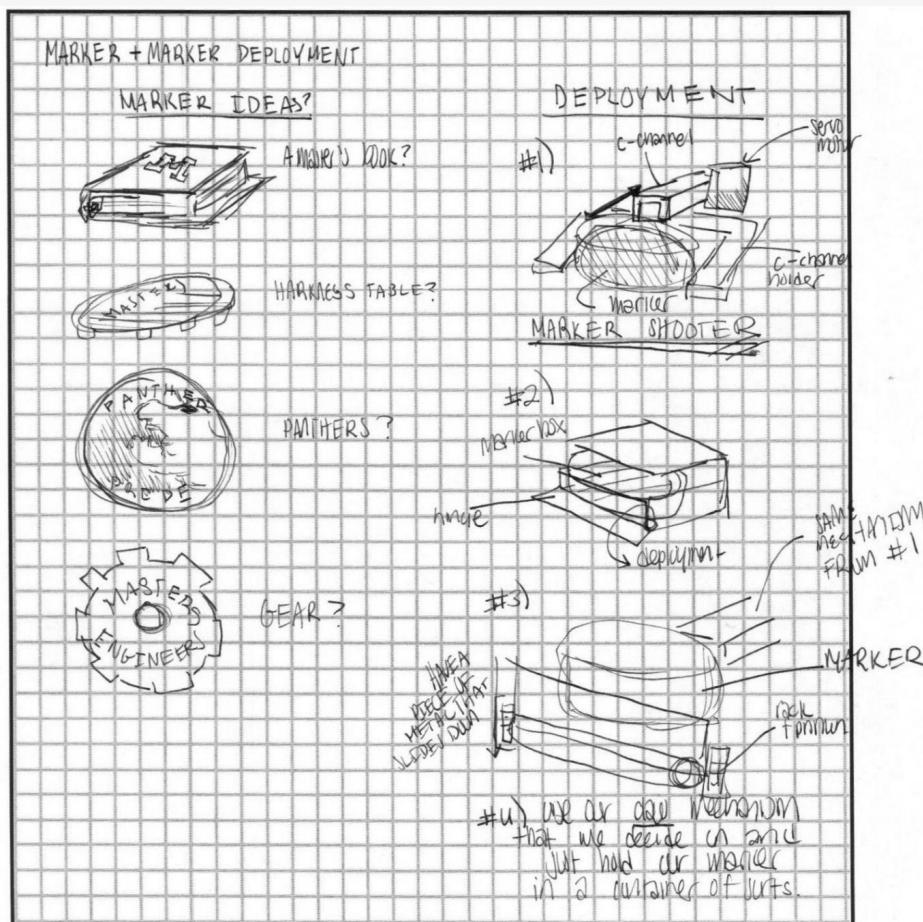
- Decision matrix: chassis - Louisa
- Decision matrix: payload gathering and scoring - Louisa
- T-shirt order - Mr. C
- Flier for 10/27 workshop event - Mr. C
- Decision matrix: marker and deployment - Louisa
- Sweatshirt order - Mr. C
- Web banner & page for 10/27 workshop - Zach
- Decision matrix : robot lift - Louisa
- Sweatshirt design - Evelyn
- Wiring to use VEX accelerometer and gyroscope sensor with REV hub - Brandon
- Concept sketches: chassis - all

CONCEPT SKETCHING



14

CONCEPT SKETCHES



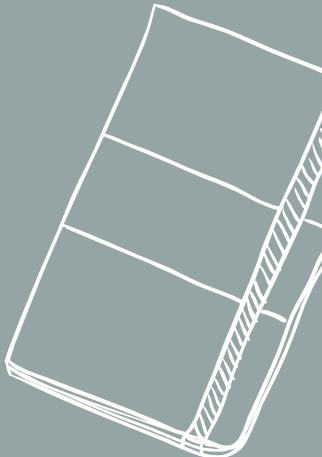
DECISION MATRICES

DECISION MATRICES

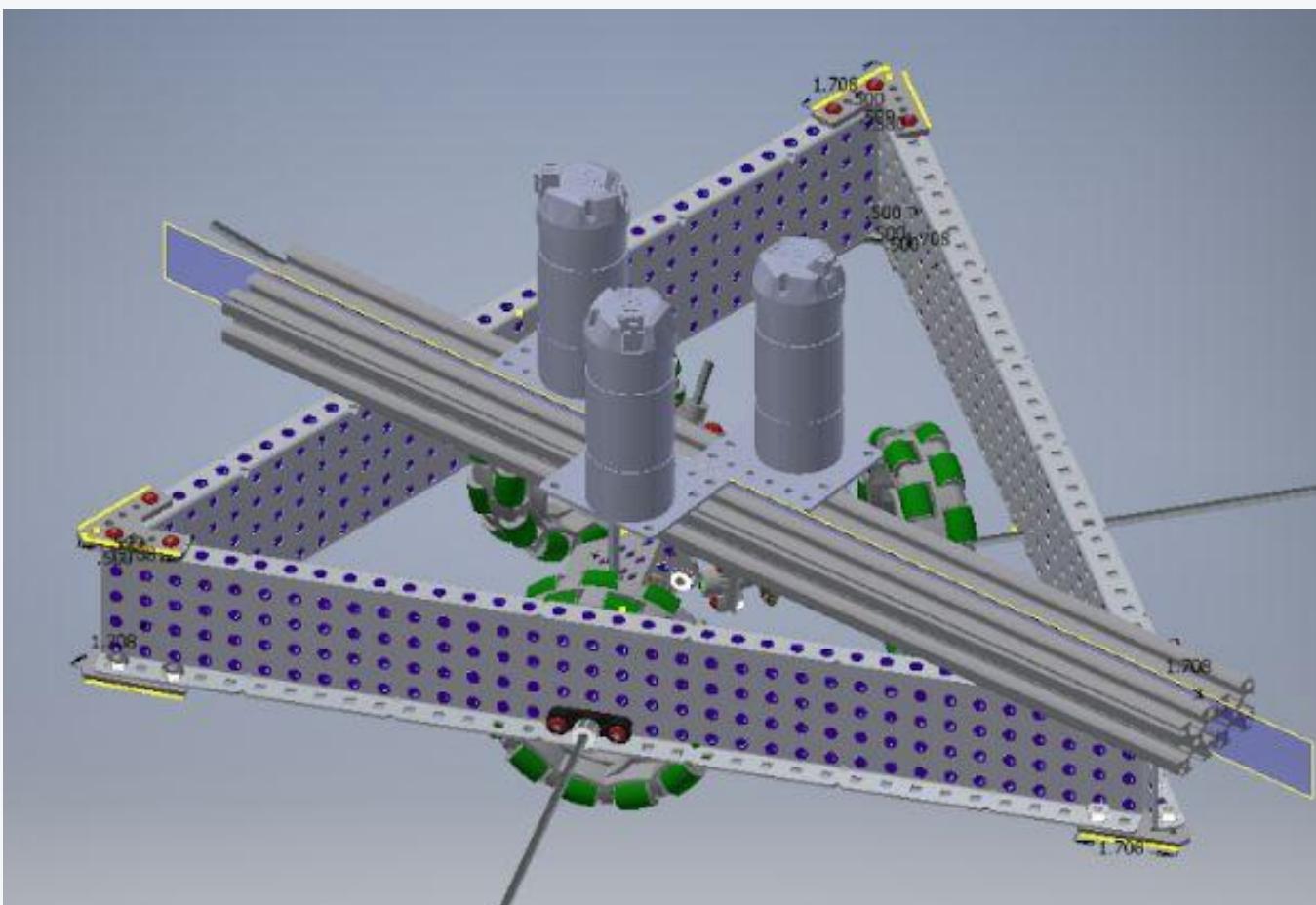
Ideas/Concepts	Creator(s)	Build Difficulty	Strength	Accuracy	Weight	Materials	Creativity	Total
Idea #1: One-Arm Lift	Carly	5	2	2	3	5	2	19
Idea #2: Swing Arm Lift	Carly	4	2	2	0	5	2	15
Idea #3: Rack and Pinion Claw Lift	Carly	4	3	2	3	4	3	19
Idea #4: Cylindrical Lift	Jake	2	4	3	2	0	5	16
Idea #5: Elevator Chain Lift	Carly	2	3	3	3	3	3	17
Idea #6: Three Sided Scissor Lift	Ella	2	4	4	4	3	2	19
Idea #7: Simple Scissor Lift	Carly	2	4	4	3	3	2	18
Idea #8: 1 Motor Scissor Lift	Rebecca	1	2	4	4	3	2	16
Idea #9: Simple Lift	Jake	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A. (Impossible to build)

Ideas/Concepts	Creator(s)	Build Difficulty	Strength	Accuracy	Weight	Materials	Creativity	Compatibility	Total
Idea #1: H-Shaped Chasis	Louisa	3	3	3	2	3	3	3	20
Idea #2: Curved Square Base	Louisa	2	2	3	3	3	4	0	17
Idea #3: Wide H-Shaped Chasis	Brandon	2	4	3	3	3	2	0	17
Idea #4: Tank Chasis	Allen	3	3	4	2	3	3	2	20
Idea #5: Square Chasis	Jake	5	2	3	4	3	2	1	20
Idea #6: X-Shaped Chasis	Jake	5	1	2	4	3	2	0	17
Idea #7: Reinforced Square Chasis	Carly	4	3	4	3	3	3	3	23

TECHNICAL DRAWINGS & 3D MODELS



3D MODELING





DOCUMENTATION PROTOCOLS



MAJOR COMPONENTS

Formatting

Sections

Quality

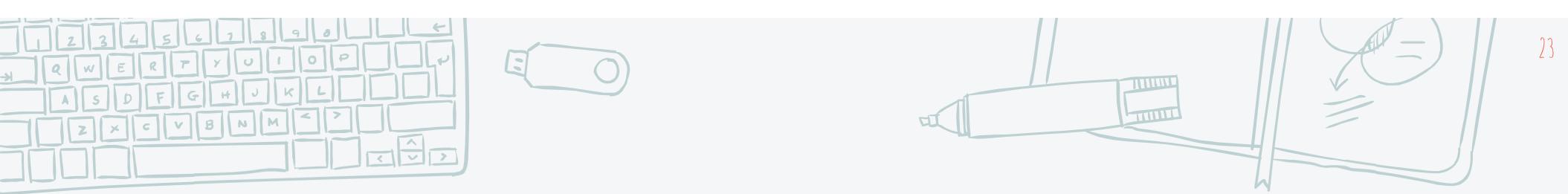
FTC FORMATTING STANDARDS

- No more than two binders
- Team name and number on front
- Neat organization and presentation
- Page numbers*
- Table of contents*
- Labelled section dividers*
- Double-sided*

**FTC Optional*

TMS FORMATTING STANDARDS

- No more than two binders
- Team name and number on front
- Neat organization and presentation
- Page numbers
- Table of contents
- Labelled section dividers
- Double-sided
- Bound notebook(s) within a binder
- Handwritten in black or blue ink (pencil is acceptable on sketches)
- Other printed items and photographs taped onto pages



TMS FORMATTING EXAMPLES

56 Continued from page

Research

- Zener Diodes
 - Allows forward bias, as well as reverse bias, when the voltage is above a certain value: the breakdown voltage known as the zener voltage.
 - The zener voltage of a standard diode is high, but if a reverse current above that value passes through it, the diode is permanently damaged.
 - Zener diodes are designed with a lower zener voltage.
 - The voltage drop across a zener diode is equal to the zener voltage regardless of how high the reverse bias voltage is.

current

The graph shows current on the y-axis and voltage on the x-axis. A curve starts at a low voltage, remains flat (forward bias), then rises sharply (reverse bias). A horizontal dashed line marks the breakdown voltage V_z . A vertical dashed line marks the avalanche current point on the curve.

- The voltage vs current graph shows forward bias as well as reverse bias when the voltage exceeds the breakdown voltage (V_z).

Zener diodes can be used to regulate voltage

+ Min. Unstable voltage IN R stable voltage out

The circuit diagram shows a zener diode connected between the input voltage source and ground. A resistor R is connected between the output node and ground. The output voltage is labeled as 'stable voltage out'.

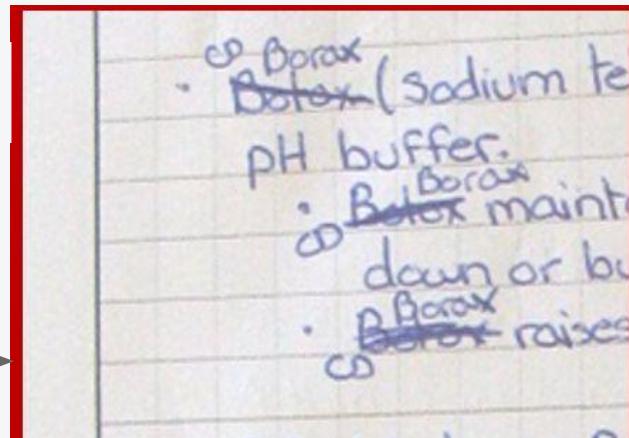
- The output voltage is fixed at the zener voltage of the zener diode used.
- As the input voltage increases, the current passing through the zener diode increases, but the output voltage remains constant.
- Found on www.reuku.co.uk (Reference 84)

Christopher D. Dunn

SIGNATURE: Christopher D. Dunn DATE: 12-9-10
DISCLOSED TO AND UNDERSTOOD BY: PROPRIETARY INFORMATION

YOU CAN CROSS OUT BLANK SECTIONS AND SIGN ON THE LINE SO IT IS CLEAR THAT THE SECTION WAS MEANT TO BE BLANK.

DON'T USE WHITE OUT IF YOU MAKE A MISTAKE! CROSS OUT THE MISTAKE AND SIGN WITH YOUR INITIALS.



Continued from page 126

Picture of Prototyped Wheel and Axle Sub System

String and Bucket not shown

taken 5/17 with digital camera and cleaned up in Photoshop

wheel_axle_subsystem.jpg



127

WHENEVER YOU PASTE IN A PHOTO, SKETCH, ETC. MAKE SURE THAT IT IS SIGNED IN WITH A SIGNATURE.

5/17 I finished machining the wheel and axle, and tossed together a mock-up of an idea for the mini car that I will attach to the chassis. The car

FTC SECTIONS STANDARDS

- Team summary page
- Engineering section
 - Documents the design, build and testing
 - Includes code development process (not just copy of the code)
- Team section
 - ‘Deeper dive’ into Team summary
 - Outreach section*
 - Awards and recognitions received*
- Business plan, strategic plan or sustainability plan*
- Control Award Control Sheet*

*FTC Optional

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 - Outreach section
 - Awards and recognitions received
- Business plan, strategic plan or sustainability plan
- Control Award Control Sheet
- Section for original concept sketches
- 3D Models section
- Final technical sketches section
- Charts and Diagrams for code, processes, and more

FTC QUALITY STANDARDS

- Notebook includes Team growth and development
- Notebook includes Team Leadership and organization
- Notebook includes Team struggles and failures
- Every team member contributes to the engineering notebook
- One notebook entry per meeting
- Includes pictures, text, and drawings
- The notebook must be accurate and be a representation of the team
- Explain why changes are made

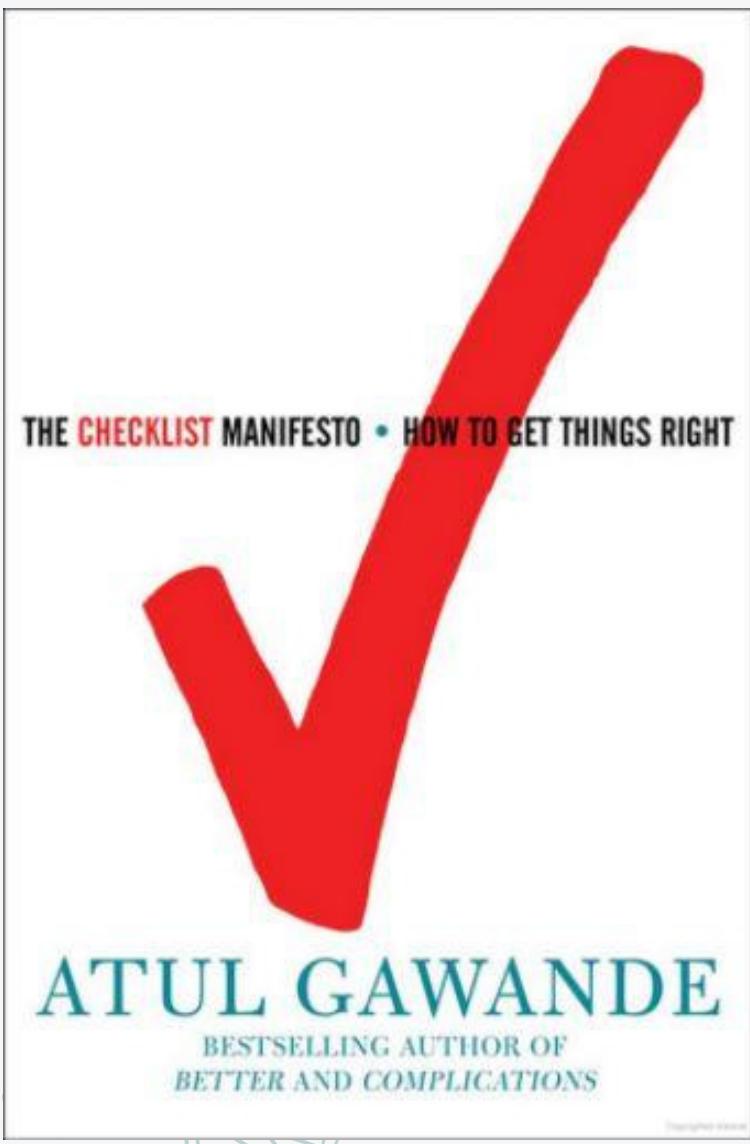
TMS QUALITY STANDARDS

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- One notebook entry per meeting
- Includes pictures, text, and drawings
- The notebook must be accurate and be a representation of the team
- Explain why changes are made
- Index key pages
- Write full sentences and provide detail
- Include math and equations that have aided you in the design and testing
- Use simple and understandable language
- “If it isn’t in the engineering notebook, it never happened”*

OTHER THINGS TO REMEMBER

- ❑ The engineering notebook is a live document - from start of season to end of season
- ❑ Tournaments notes should be a part
- ❑ Every revisions goes through the entire design and documentation process
- ❑ Organization is key

THE CHECKLIST MANIFESTO -ADOPTED 2015



- Introduced by a 2015 robotics graduate.
- The volume and complexity of knowledge today has exceeded our ability as individuals to properly deliver it consistently, correctly, and safely.
- We can do better, using the simplest of methods: the checklist.
- They bring about striking improvements in organization and efficiency.

THE CHECKLIST MANIFESTO

- Parts/tools packing
- Afternoon before tournament
- Pre-departure from school
- Arrival at venue
- Parts loaned
- Pre-match
- Post-match

IN REVIEW!

Engineering Design Process

Always refer to the engineering process and pre-build process sequence!

Concept Sketching

One of the most important ways to generate concepts that will aid in the engineering and design process. Concept sketching will dictate what appears in the *decision matrices* leading to *technical drawings*!

Rules Brief

Always check the rules and simplify them for your team. As well, continuously check for updates to the rules.

Create a Gantt Chart and Scrum Board

These charts and boards will help keep the team organized and on task. In addition to being a great way to organize tasks, it is also professional!

Design Brief

The design brief is always the best way to concisely approach the problem and generally state what needs to be done through problem/design statements and constraints.

Use Proper Documentation Techniques

Whether it comes down to consistent formatting, high quality or thorough content, all three of these aspects of the engineering notebook must be attained for a proper notebook.



32

THANK YOU!

The Masters website homepage is displayed within a red-bordered frame. The page features a banner image of students in purple sweatshirts hugging. Overlaid on the image is the text "INNOVATION, ENGINEERING & ENTREPRENEURSHIP". The website navigation bar includes links for ADMISSION, ABOUT, ACADEMICS, ARTS, ATHLETICS, CAMPUS LIFE, BOARDING, and ALUMNAE/I. There are also "INQUIRE" and "GIVE" buttons. Below the banner, there are links for Team Blog, Coaches' Blog, Outreach, Rules, FTC Workshop, and Part Files.

VISIT OUR WEBSITE

<http://www.mastersnyengineering.org/>

