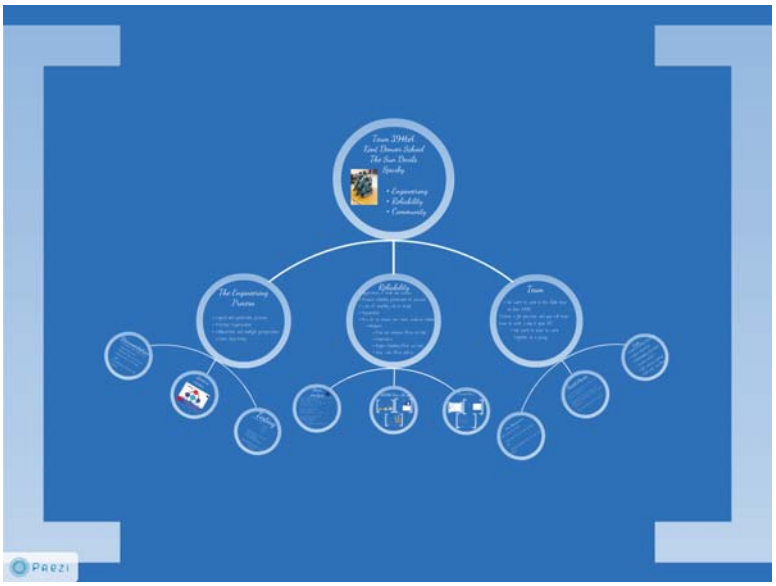


Team 3946A
Kent Denver School
The Sun Devils
Sparky

- Engineering
- Reliability
- Community

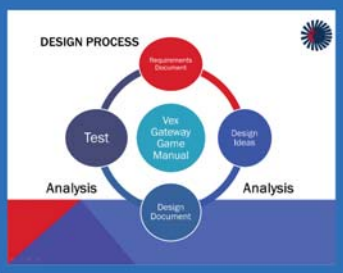
The Engineering Process

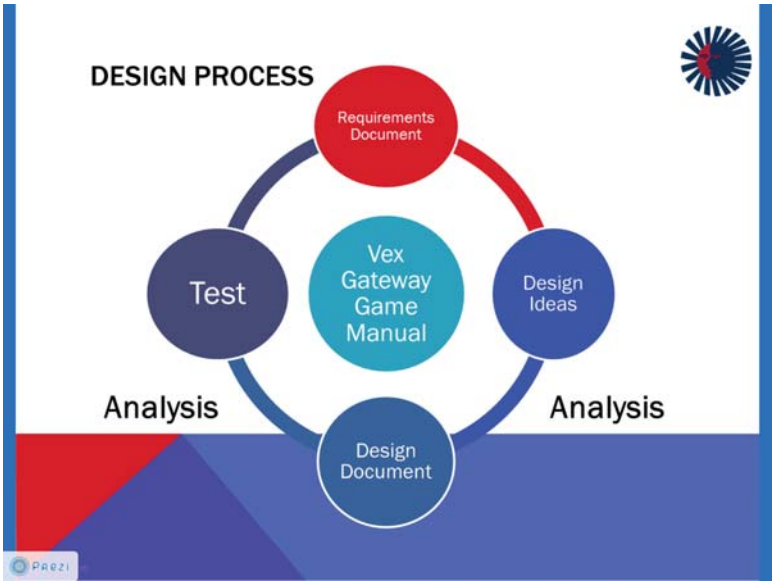
- Logical and systematic process
- Prioritize Organization
- Collaboration and multiple perspectives creates objectivity

Documentation

- Document every step of the engineering process
- Remember what we have done
- Keep everyone on the same page
- Accessibility for future club members

Iterative process





Testing

- Redundant checklists
  - Safety
  - Robot
  - Field
- Record purpose of experiment
- Revise hypotheses
- Robot Testing Field Manual
- Real environment testing occurs at competition

Reliability

- Application of math and science
- Product reliability paramount to success
- Lack of reliability can be deadly
- Reputation
- How did we ensure our robot would be reliable?
  - Analysis!
    - Four bar analysis (first red tab)
    - Kinematics
    - Height reliability (first red tab)
    - Gear ratio (first yellow)

Chain Analysis

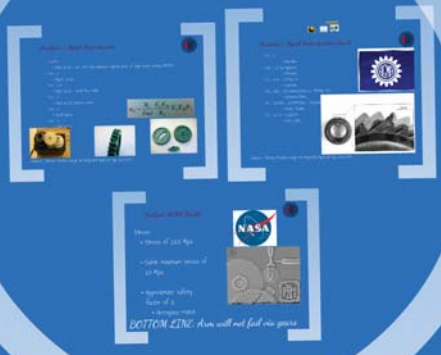
- Each side drive through 2 coupled 3135s (high strength gear to couple)
- Torque = 13.5 in-lb x 2 = 27 in-lbs
- Diameter of small sprocket = 1 in, ½ in radius
- Torque = force x radius Force = torque / radius
- Force = 27 in-lbs/0.5 in = 54 lbs

- Stress = load / cross sectional area
- Smallest area = 0.0248 in2
- 54 lbs / 0.0248 in2 = 2177.41 psi = 15.012 MPa

- Assume Delrin - Ultimate Strength of 23 MPa
- Safety factor = strength/stress = 1.5
- Matches aerospace safety factor

BOTTOM LINE: Drive is 50% stronger than required

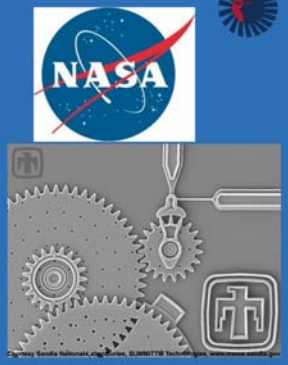
AGMA Gear Stress



Analysis-AGMA Results

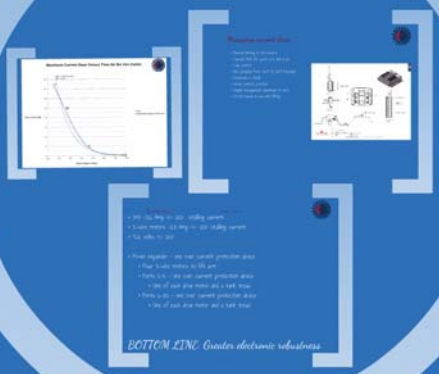
Stress

- Stress of 12.5 Mpa
- Delrin maximum stress of 23 Mpa
- Approximate safety factor of 2
  - Aerospace match



BOTTOM LINE: Arm will not fail via gears

Current Draw



BOTTOM LINE: Greater electronic robustness

Current draw

- 393 -3.6 Amp +/- 20% stalling current
- 3-wire motors -1.8 Amp +/- 20% stalling current
- 7.2 volts +/- 20%

- Power expander - one over current protection device
  - Four 3-wire motors to lift arm
  - Ports 1-5 - one over current protection device
    - One of each drive motor and a tank tread
  - Ports 6-10 - one over current protection device
    - One of each drive motor and a tank tread

BOTTOM LINE: Greater electronic robustness

Team

- We want to work in the fields that we love: STEM

"Choose a job you love, and you will never have to work a day in your life"

- We want to learn to work together as a group

Time Management

-Hourly breaks every meeting

- Eating Pizza Rolls, Four Square, and Video games

- Good time management keeps the whole team efficient

Gantt Charts

- Gantt is a free program that creates calendars for the team and each individual member

- Keeps the team on track for robot construction, documentation and programming, with collaborative deadlines made by the team

- Keeps everyone organized and on the same pace

Prezi

Code

- Dead reckoning (2nd red)
- Varied structure
- Multitasking (2nd blue)
- Version control
- Edit code as a group
- (full code- 1st Blue)

Prezi

Prezi