

CAREER READINESS CHALLENGE

VEXIQ: Preparing STEM Leaders of Tomorrow

*Examining the Design of
Remote Controlled Aircraft*

Peter & Eloise

821A

El Lago, Texas

WHY R.C. AIRCRAFT?



Rumpus Room Labs

We build Remotely Controlled Aircraft, Drones, Planes and Nerd things that Fly! Sound like fun? We think so!



Mark Dollard, Rumpus Room Labs

- I'm a second year VEXIQ student who loves driving robots, anything that flies, and building things.
- I live by NASA; their jets flying overhead have always sparked my imagination. I enjoy flying simulators, drones with Grandpa, and we never miss the Airshow. I like WWII planes because Great-grandpa repaired them in the Navy.
- A favorite memory is when I "met" NASA's humanoid robot in their Engineering Lab. He was chained. Why? They said he destroys the lab at night!
- In middle school they offer a Rocket Launch program where students launch rockets one mile high. I'm torn between Robotics/Rockets.
- I've shared my interests with you only to illustrate why I chose **Remote Controlled Aircraft**. It combines all my passions and the Engineering Design Process.
- I worked with Rumpus Room Labs in Orlando, FL.
- Rumpus Room began as a hobby then evolved into a business. I hope to turn my passions into a career too.
- Today I'll share with you similarities/differences between 821A's design process and Rumpus Room's. (Sneak peak - we both make LOTS of mistakes & that's okay!

FLAMING GEARS

MEET OUR TEAM 821A

 KIM 

I am in 4th grade and I am the co-builder and the co-coder.



 ASHER 

I'm in 4th grade and I am the main coder and co-builder.

 PETER 

I'm in 5th grade and I am the main builder and co-Notebooker, and driver.

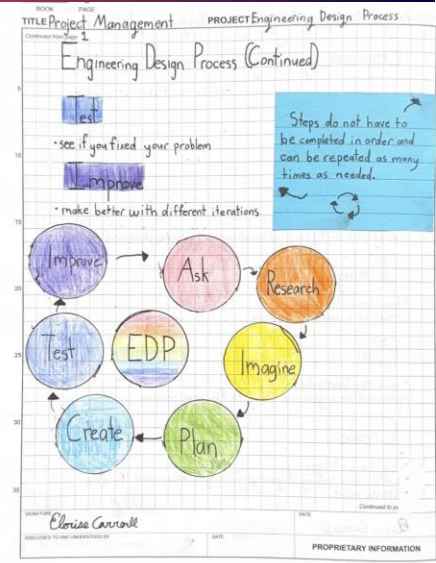
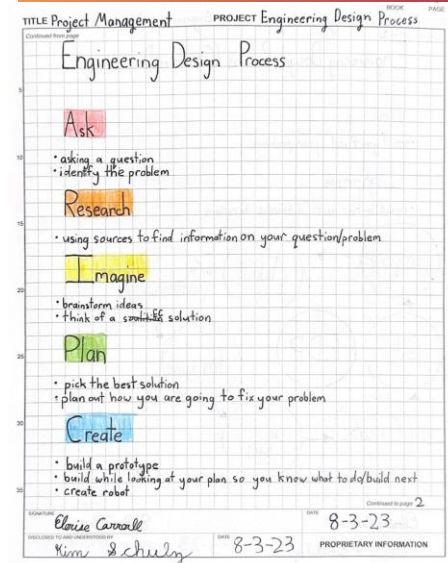


 ELOISE 

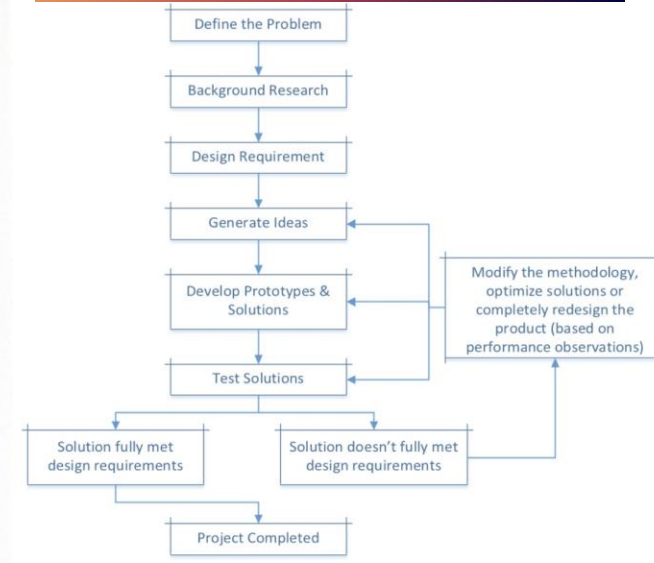
I am the main Note-booker, help build, & a driver.



821A ENGINEERING DESIGN PROCESS



RUMPUS ROOM LABS ENGINEERING DESIGN PROCESS



Similarities	Differences
We ask questions, identify and define the problem	
We research challenges, find information sources	
We imagine, brainstorm, generate ideas	At this stage Rumpus Room considers their client's design requirements and other considerations such as aerodynamic principles that don't apply to our robot
We develop solutions, pick best option, develop a plan	NOTE: Rumpus Room's planning process is within their prototyping process. 821A breaks it into two parts. Minor technicality because the overall process is same. Planning stage for Rumpus Room is time consuming because they hand-draw plans ("pencil and ruler to paper") at small-scale, build and test small-scale aircraft until operates as intended, then create hand-drawn LIFE-sized plans (up to 16 feet wide), CAD, build, then testing starts again.
We create/prototype	
We test/improve prototypes. This sends us back to drawing board to generate ideas then develop/test new solutions. We go through this design loop MANY times! Mark said, "Embrace the suck! That's where learning happens."	

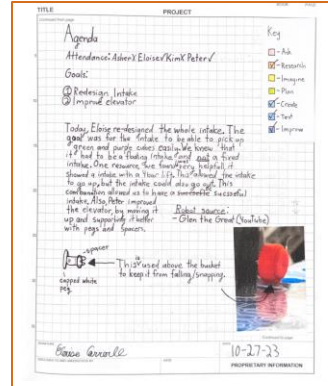
SIMILARITIES & DIFFERENCES

RC Aircraft & Robotics

ENGINEERING DESIGN PROCESS SIMILARITIES

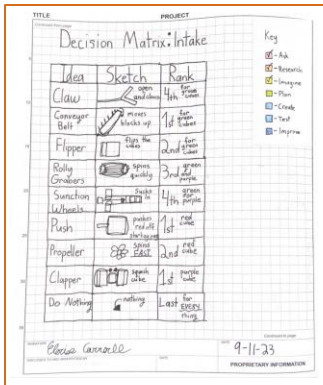
IDENTIFY PROBLEMS:

Getting the "Hitman" Combat Plane built. Starting with a balsa kit. The Wild Thing and heavily modifying just about everything but the two fuse sidewalls, wing ribs and spars. So far the kit itself has sucked. Not one of the prefabricated bits, aside from the ribs, has lined up or been cut properly to size and the plans are off by as much as an inch in places. Not a beginners kit for sure. I could have scratched this build faster. Regardless it's coming together quickly.

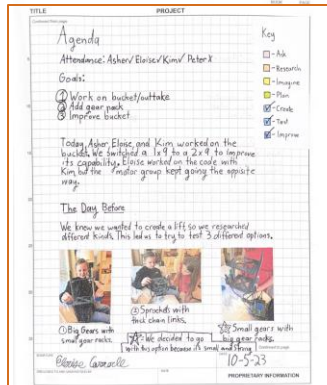


RUMPUS ROOM – Kit didn't meet expectations, had to make-do due to sunk costs/required many problems to be solved & time-consuming
821A – Realized a "fixed" intake was HUGE problem, redesigned to floating intake with 4-bar lift

BRAINSTORM/ANALYZE/COLLECT DATA:



821A – Collecting Data on 9 potential intakes, analyzing using Decision Matrix



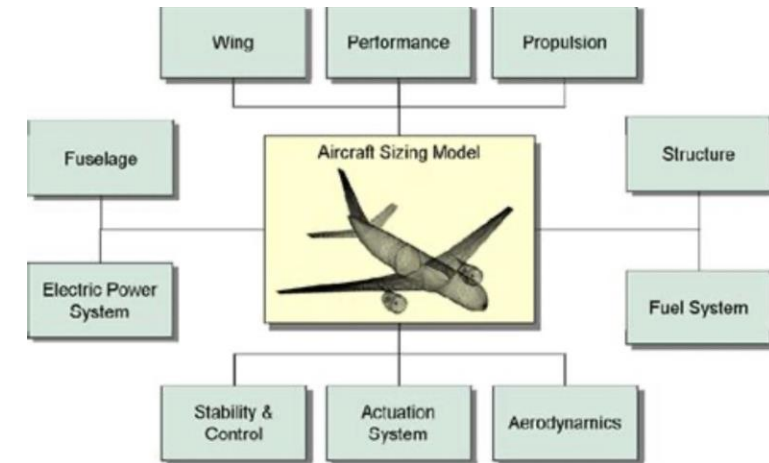
821A – Analyzing 3 Elevator Lifts, chose strongest, smallest one



821A – Brainstorming initial robot designs – early season

ENGINEERING DESIGN PROCESS DIFFERENCES

- RC Planes have more subsystems than VEX robots. They also need fuselage, wings, propulsion, fuel system, rudder, ESC, Servo, brushless motor, propeller, etc.



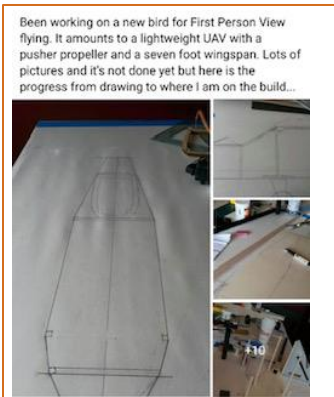
- RC Planes are subject to laws of aerodynamics; robots are not.
- Engineering Notebook – 821A documents our EDP more formally than Mark. It's important for VEXIQ judges to verify processes & demonstrate we're kid-centered. Mostly it's for ourselves; our notebook is our most valuable tool & keeps us on target.

SIMILARITIES & DIFFERENCES

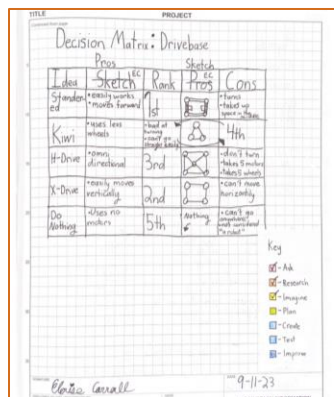
RC Aircraft & Robotics

ENGINEERING DESIGN PROCESS SIMILARITIES

- DEVELOP SOLUTIONS / SELECT DESIGNS / PROTOTYPE & BUILD:

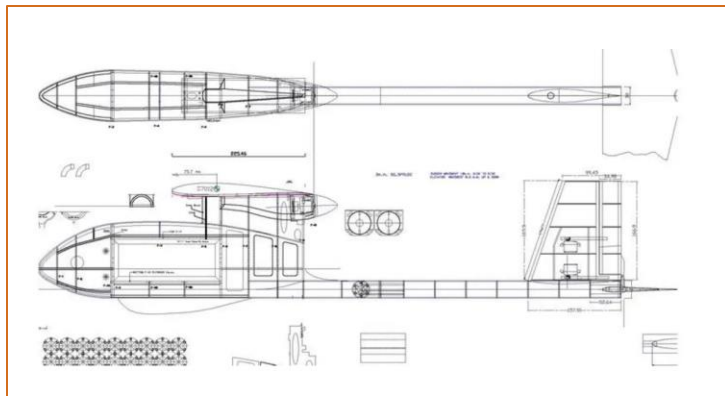


RUMPUS ROOM – From initial design to building first prototype

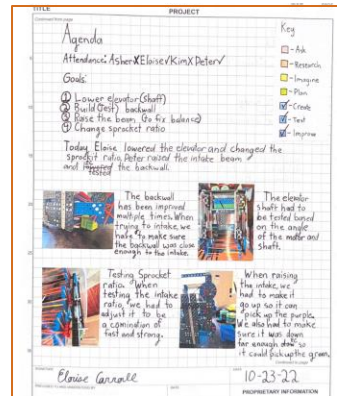


821A – Developed 5 drivetrain solutions

- TEST / EVALUATE:



RUMPUS ROOM
RQ-11B RAVEN Prototype Model Aircraft. Tested & refined.



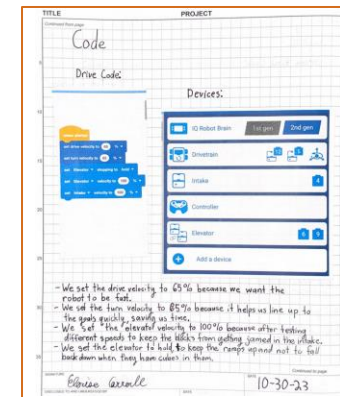
821A – Tested/redesigned backwall & sprocket ratios for speed/strength, adjusted intake & elevator

ENGINEERING DESIGN PROCESS SIMILARITIES

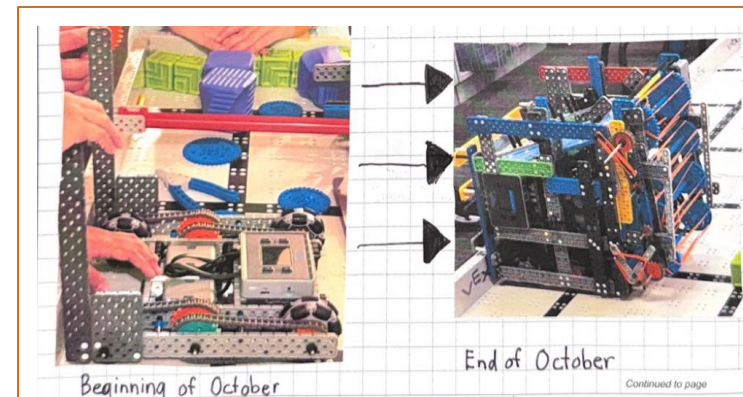
- REFINE & IMPROVE:



RUMPUS ROOM – After 8 months' refining she's ready for her maiden flight



821A – Constantly refining code



821A – Changed robot's style in October; total redesign.

COMMONALITIES *BEYOND* EDP

RC Aircraft & Robotics

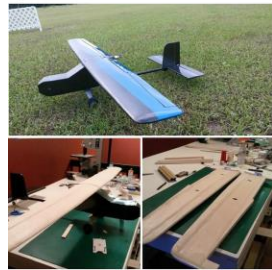
- SAFETY: Protocols must be followed
- PRACTICE: Must practice skills for proficiency/confidence
- THINGS BREAK!

The Helios 2 is complete. Went for maiden last weekend but the ESC failed about two minutes into the flight. Landed safely and installed a new, higher power one. In bench testing it worked fine.. Here are the rest of the build pics...



RUMPUS ROOM – ESC failed 2 minutes into flight

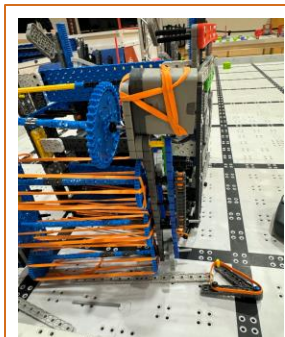
Rumpus Room Labs scratch build Asporto 2. Took it up today and burned the motor out on the second flight. Came in dead stick to a 3 point landing.. Gonna have to visit Graves RC for a new motor and speed control...



RUMPUS ROOM – Burned motor on 2nd flight



821A – Elevator broken for 1hr+ mid-competition



821A – Intake fell off

- BUILDS DESTROYED/FIRES STARTED!

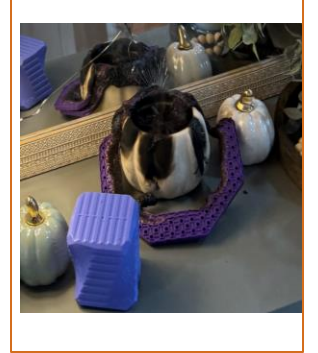
I've been working on this Biplane for over a year. The rescue pup, Miss Vivi, who I ironically found in near death condition at an RC Airstrip, chewed up a great many critical components of this kit, which I had to fabricate by hand. It's nearly finished and I can't wait to put it in the air.



RUMPUS ROOM – Dog ate my biplane!



821A – Toddler vs Bot. Toddler wins.



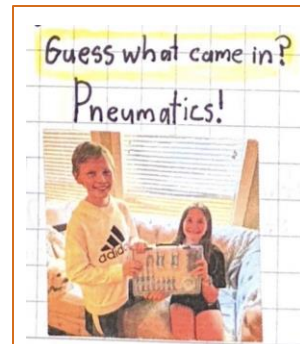
821A – Same toddler sets VEX parts on fire.

- EXCITED FOR PARTS!

The Scorpion 6530-180kv is in my hand! My entire hand. This electric motor has the same power as an 80cc moped. The motor for the RX3-1.



RUMPUS ROOM – New motor is here!



821A – Pneumatics are here!



Robotic engineers are
modern-day magicians, bringing
inanimate objects to life.

- Ayanna Howard.

IN CONCLUSION, WE'VE SEEN HOW VEXIQ CORRELATES WITH CAREER PREPAREDNESS

- VEXIQ equips us with skills relevant to marketplace
- Coding, project management & engineering skills = marketability
- Robotics is multidisciplinary & inspires many career choices
- Greatest personal benefit has been mastering lifelong soft skills, specifically public speaking
- I 'm confident explaining my reasoning with peers/authority figures
- VEX has deepened my understanding of working in teams
- VEX fosters creativity & critical thinking – robotics is imaginative AND logical
- VEX sped up my mathematical computation time
- VEX has taught me how to pace myself during long projects & how to divide tasks into manageable pieces