



Research Experiences for Teachers

Enhancing Teacher Knowledge and Skills
in Modern Manufacturing
(Summer 2022)

Challenge Quad Proposal

By: Robert Thomas
Facilitator Eagle Innovation Center
2211 North Austin Ave.
Georgetown, TX 87626

Supported By:

Bretton Schulz
Director of Career and Technical Education
Georgetown Independent School District

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Proposed By:



07/25/22

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Background:

Last school year marked the “launch” of a first of its kind year long class in my district on the subject of Unmanned Aerial Systems (UAS) commonly referred to as Drones.

This “Drone Class” as it came to be known covered a wide range of topics relating to the drone industry. We began the year with a historical overview of drones and their utilization then moved into student lead research regarding such topics as career paths, related degrees and the disruptive nature of drone technology.

We prepared students to take the Federal Aviation Administrations (FAA) Part-107 small aircraft exam. Passing this exam granted students a Certified Drone Pilots License making it legal for them to offer commercial drone services.

Once getting their “wings under them” students began working on the creation of videography and aerial photography content. Students were then placed in groups and tasked with creating their own Drone Services Small Business. Including the development of a business name, logo, website, and a portfolio of work.

Once students had their small business websites online and were gaining competency with video editing. We reached out to the community and offered our services to local small businesses. Each student lead drone co. created several successful social media campaigns working in partnership with their clients!

The class was by all accounts a great success.

But something was missing! There needed to be a more hands-on learning experience!

Curriculum Plan:

The experiences and new skills acquired while attending the NSF funded Research Experiences for Teachers (RET) Program at Texas A&M University.

Will enable the expansion of the UAS/Drone Class offering to include the design and fabrication of a drone frame.

The drone frame will be designed and fabricated by students utilizing Autodesk Fusion 360 3D modeling software and 3D Printed via Material Extrusion technology.

Students will use this frame as the platform to assemble other needed components (flight controller, motors, fpv camera, etc.) to complete a fully functional drone.

Drone frame will be designed with the intent of competing in the “Challenge Quad Championships” a series of challenges the student built drone must complete for their final grade.



Example of Drone with 3D Printed Frame

Implementation:

Tentative Schedule: (90min Class/2x's Week/Year Long) Students on STE(A)M Pathway

→ Design Process

- ◆ Introduce class to engineering design process via drone project
- ◆ Brainstorm ideas based on established project needs and constraints

→ Metrology

- ◆ Train students in the function and proper use of calipers and micrometers
- ◆ Explain dimensioning including tolerance, accuracy, precision and resolution

→ 3D Modeling

- ◆ Train students in use of Autodesk Fusion 360 3D modeling software
- ◆ Students design multiple prototype drone frames of unique dimensions
- ◆ Evaluate and revise designs based on actual component dimensions
- ◆ Select final design and export for material extrusion process

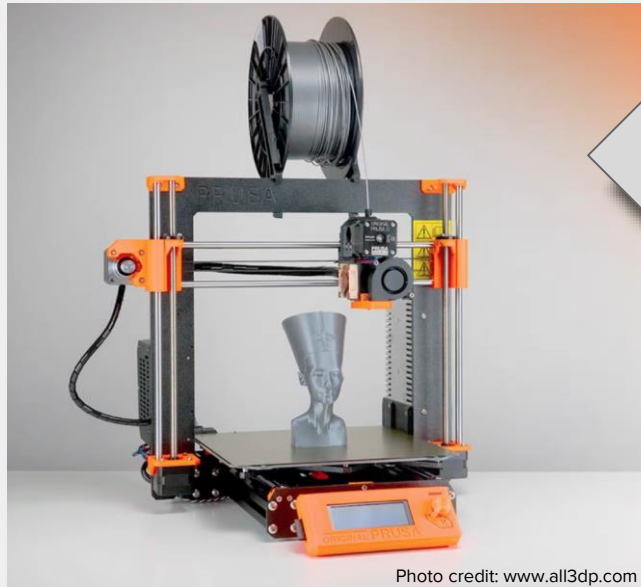
→ Additive Manufacturing

- ◆ Train students in Material Extrusion process including optimization of slicer settings
- ◆ 3D Print students modeled drone frames via Fused Filament Fabrication (FFF)
- ◆ Assemble all drone components and test for flight worthiness and safety

Equipment & Budget:

Existing Equipment and Tools:

- Autodesk Fusion 360 Software
- Dial/Digital Calipers



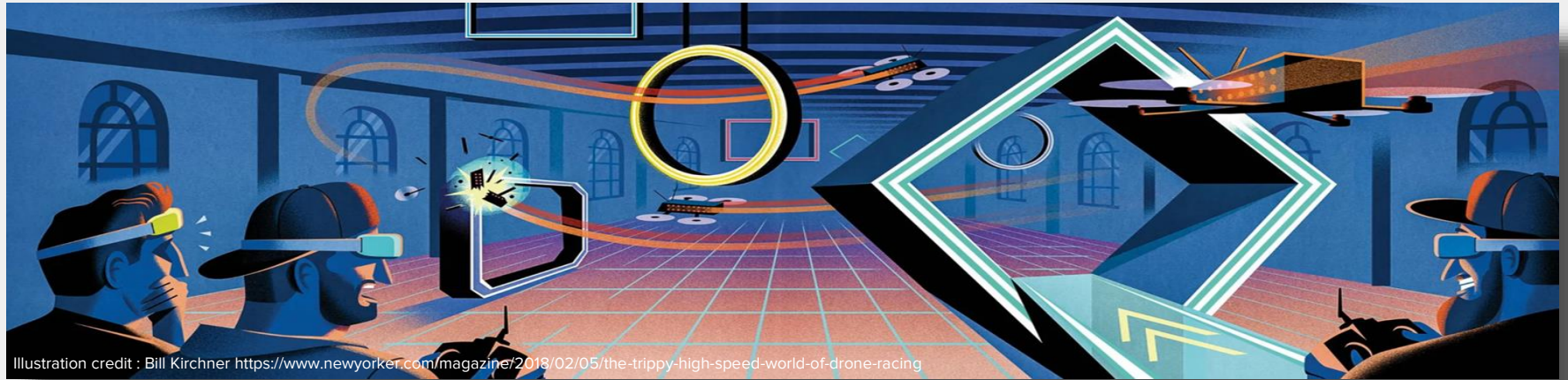
Prusa Mini+

Prusa MK3S+



Quantity	Item	Cost	Source
6	1kg Spool PLA Filament	\$110	Matterhackers.com
1	Prusa Mini+ 3D Printer	\$599	PrintedSolid.com
1	Prusa MK3S+ 3D Printer	\$899	PrintedSolid.com
		Total	\$1608.00

Assessment Plan:



This is Where it Gets FUN!

Once all student designed and fabricated drones are complete. We are going to host a in class “Challenge Drone Championships!”

Assessment Continued:

Championship Challenges:

- Top Speed Challenge
 - ◆ Fastest 3 laps around shop LED hoop track
 - ◆ How smooth can you fly

- Agility Challenge
 - ◆ Accurately navigate through agility course
 - ◆ How well can pilot and drone work together

- Flight Time Challenge
 - ◆ Total time drone is able to stay airborne per charge
 - ◆ How light can you make your drone

- Cargo Challenge
 - ◆ Total number of nickels drone is able to lift
 - ◆ How much lifting power does your drone have

- Style Challenge
 - ◆ Overall aesthetic appeal of completed drone
 - ◆ How good does it look



Final grade will be based on student participation, periodic exams and overall performance in challenges listed above.

Impact & Exposure:

How I will Measure Success:

- Student Grades and Enrollment
 - ◆ Already seeing upward trend year over year
- Instructor & Administrative Engagement
 - ◆ Instructors have returned excited for new challenges
 - ◆ Administrative Staff & Counselors are All In
- Skills Assessments
 - ◆ 10 Question Pre and Post Instruction Quizzes
- Tracking Underrepresented Group Engagement
 - ◆ 3 girls and 6 minority students currently enrolled
- Tracking Degree/Career Field Interest
 - ◆ Increased student interest in STE(A)M career fields and degree programs
- Student Engagement
 - ◆ Participation in “Challenge Quad Championships” Targeting 100%



Impact & Exposure Continued:

Community Matters:

- Continued Growth with Community Partnerships
 - ◆ Student internships with TxDOT
 - ◆ Student employment at local companies
 - ◆ Community support with student drone service offerings

- Future Grant Awards and Program Donations
 - ◆ Continued financial support from GISD Education Foundation

- Expanding Partnerships with Other ISD's
 - ◆ Participation in drone club race events
 - ◆ Regional drone competitions



Drone Class Students with Education Foundation Donation

Impact & Exposure Continued:

Field Trips:

- Class Visit to SkyGrid/HyperWerx facility in Jarrell, TX
 - ◆ SkyGrid's vision is to become the world's most trusted airspace management system that integrates all unmanned aircraft in the global airspace.
 - ◆ Website: <https://www.skygrid.com/blogs/hyperwerx-building-the-future/>

- Visit to DroneSense Headquarters in Austin, TX
 - ◆ DroneSense products are designed by a diverse team of technologists in close collaboration with leaders within public safety. The DroneSense platform provides decision-quality, real-time data through industry-leading collaboration tools, and an end-to-end management solution for unmanned aircraft programs of all sizes.
 - ◆ Website: <https://dronesense.com/>

“You Can’t Be It if You Can’t See It!”

Summary:

The initial UAS class offering was a fantastic experience for all involved and provided the confidence to expand into additional drone specific curriculum. Attending the Research Experiences for Teachers (RET) Program has provided the opportunity and experience to do just that.

Future drone class students will benefit from this experience via additional hand-on design and fabrication techniques in a myriad of ways. Including a deeper understanding of the correct use of metrology equipment and the direct application of 3D modeling software.

Students will also leave the class with a better understanding of how to utilize design thinking in their future projects and endeavors. I also expect they will better understand how various components are assembled and can be manipulated to create desired outcomes and meet unique needs of future challenges in their education and work lives.

Thank You!