Webster Groves School District Foundation
Major Grant Application
2017-2018
(Please submit application in both PDF and Google Doc/Word Format)

Applicant's Name: Greg Fick and David Kilstrom

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School Webster Groves High School   Grade Level: 9-12

Position: Coordinator/ Teacher   School Phone: 314-918-4159

Project Title: Makerspace Takes Flight!   Budget Requested: $4,622.91

Please include a summary of your project that incorporates **ALL** of the Major-Grant Criteria listed on the application form. The Criteria is spelled out in the questions below:

1. **Please explain how the project is innovative, unique, and how it creates a new experience for students**

This project will have two major strands. One will focus on STEM and engineering while other will focus on physics, flight and careers. There will be an overlap of skills between the two strands, but the main focus will be different. Both of these programs will be housed in the WGSD Makerspace, but all district students will have access.

STEM Flight Strand

Under the STEM strand, students will have the opportunity to scratch build, design and engineer their own aircraft. Students will apply physics and mathematics in teams to create planes and drones, ranging from simple glider to complex quadcopters. Through applying the principles of powered flight (i.e., lift, weight, thrust and drag), students will complete challenges and solve problems.

Sample PBL problems could range from simple to highly complex. On the simple end, students could be required to create a glider that would carry an egg 30 feet without breaking the egg. On the complex end of the spectrum, students could be tasked to create an aircraft with enough power and lift to ferry a glider (also student designed) to a preset attitude, using servos to release the glider and have it land safely into a landing pad target.

This first strand will focus on STEM skills and aircraft design and construction. The goal is to provide a differentiated entry to the program from simple gliders to complex quadcopters. Scratch build aviation, mechanical engineering, computer science and electrical engineering skills would be included. The program also stresses people skills, such as communication and teamwork.

The company we are working with, Flite Test is providing a curriculum to help guide the early application of this program. The innovative, STEM-driven hands-on aircraft curriculum engages learners at every level and provides real-world learning opportunities that exposes students to careers in science and technology. The goal of this program is to provide students an experience that will prepare them for studying engineering at the college level.

Drone Flight and Career Strand

The second strand of the project will focus on drone flight and careers. The goal to create an experiential learning environment where students will be trained in the basics of drone flight. Experiential students must be over the age of 16 to be trained in flight. Students will also study the remote pilots regulations and policies from the FAA. Students can then take their fight test and earn a part 107 remote pilot certificate issued by the FAA. They will need to register as a drone pilot thought the FAA and take the 107 test at a testing center. There are a number of high school flight schools throughout the country with a variety of educational and career applications (examples provided on the links page).

The drone pilots will be able to apply their abilities in a variety of ways. After consulting FAA regulations and Missouri law, we found that operating a drone on campus, following FAA guides, is permissible by non-commercial pilots (i.e., students). Their applications to film and photograph include geography, studying traffic patterns, building inspection and a variety of others. The drones we chose where the most functional while also being extremely safe. They have rotor guards, obstacle avoidance and a tether that limits the distance it can fly from the pilot. Additionally, they will be flown with a "buddy" box system where, with the flip of a switch, the teacher can take control of the drone.

2.   Please explain the project timetable/schedule of activities/events that support the project for the academic year

The grant project will be part of the Makerspace initiative. If the grant is awarded we will "pilot" the STEM strand in a summer workshop. Additionally, Dr. Fick will earn a drone pilot certification to be qualified to fly a drone.

In the fall, this will be part of the Makerspace class, specifically how we teach electronics and connect to other Makerspace projects. Both strands of the flight program will be available through the Experiential Learning Center as an independent study. **ALL** teachers will have access to the STEM strand in classes at all levels. Science teachers in the building have expressed an interest in using it as part of their physics curriculum. Middle school and elementary school teachers could take a field trip to access the program. Curriculum for sample projects, ranging from short projects to entire semesters, are included. After the first year, this could be expand to an entire semester class.

The program could host other events as well, such as an air show on Selma Field for students to exhibit their designs. Flite Test recently bought a golf course in Ohio to host events. We could take a trip, similar to a robotics competition, where students can meet others with similar passions.

3.   Please explain how creativity is applied in the approach to teaching the subject.

The STEM strand of this program is project-based learning and STEM learning at its finest. The project itself is a creative way to learn about science, engineering and applied mathematics, along with other skills. Students will apply mathematics and physics and the results of their theories will play out right before their eyes. Students will have unique problems to solve and variety of ways to apply solutions.

The drone flight strand will have a number of real world applications. Students will be able to explore the emerging market of drone flight. There are a variety of software programs that will allow drones to perform GIS, mapping and weather functions that have a variety of applications.

4.   Please explain how the project impacts learning.

Under the STEM program, skills practiced include scratch-build aviation, mechanical engineering, computer science, electrical engineering and STEM-related skills. This strand will teach the concepts of scratch build aviation for 21st-century learners using an engineering design model process. Students will apply units of measurement, geometry, and force and motion. The innovative, hands-on aircraft curriculum engages learners

at every level and provides real-world learning opportunities that expose students to careers in science and technology. Flite Test supplies a curriculum that applies these skills throughout K-12.

Curriculum samples:
- [Lower Elementary](#)
- [Upper Elementary](#)
- [Middle School](#)
- [High School](#)

Under the flight program, we will create an experiential learning environment where students will be trained in the basics of drone flight. In addition to learning how to fly and apply drones in real world situations, students will learn about geography, weather patterns and the atmosphere. Students will also learn remote [pilots regulations and policies](#) from the FAA in order for students to take their fight test earn their part 107 remote pilot certificate.

5.   Please explain how the project can be shared across classrooms/grades/district.

This program will be housed within the WGHS Makerspace. A primary goal of the Makerspace is to function as an innovation and STEM lab for the high school, along with the rest of the district. All high school teachers and students have access to the Makerspace. Science classes could use this grant as part of a physics project, students could access it as in independent study around electronics, and experiential learning students could access the program though careers that use drones. The Makerspace is also available to students and faculty in other buildings for field trips to access this program.

6.   Please explain how the project can be sustained, repeated over time

Within the STEM side of the program, there are a variety of opportunities in the Makerspace. This program will be able to take advantage of the equipment and expertise of the Makerspace teachers and students. The Makerspace has similar technology that Flite Test uses to manufacturer products (For example, Flite Test uses a laser cutter to cut their airplanes bodies. This will allow us to cheaply create designed aircraft from raw materials with our production tools. The aircraft electronics can be used in a variety of ways, then reused and reconfigured. Flite Test provides [aircraft designs and blueprints](#) for free. Our laser cutter that can cut low cost foam board into different shapes and designs in the Makerspace. This would allow students to create a variety of aircraft from Flite Test plans, modify Flite Test plans, or make their own design. Students can design and redesign their own aircraft inexpensively. We can apply the same concept with our 3D printers by using the electronics and motors from the drones, then 3D print a variety of [quadcopter bodies](#) with different flight characteristics. We also have a CNC router to fabricate things like wooden props for airplanes.

The sustainability of the flight program will largely depend on the life of the drones. The full- scale drones should have an approximate lifespan of a laptop if properly maintained. This will depend of a variety of factors such as the how many charges the lithium ion battery can sustain, hours of flight, motor failure, correct use, etc. We also plan on buying insurance for both drones though DJI in order to turn to the manufacturer for serious problems.

We are taking advantage of a variety of educational discounts. Apple's discount will save the district $50 on an iPad. Flite Test is offering 20 percent off on all items except for the curriculum. DJI is offering a 10 percent discount on drones.

See the [budget spreadsheet](#) for line item details.

7.   Please explain how the project is able to be shared and can communicate experience with other colleagues across the district

The lab is open and available to district teachers interested in learning how to bring ideas like these to their classrooms. The Makerspace [website](#) will post all materials and project information. We are happy to present

at buildings or district PD. We are also happy to hold seminars at the Makerspace to train other teachers and will use Cathy Vespereny's media outlets to advertise public events.

8. **Please explain any general impressions of the project / how it fits within the WGSD Foundation's Mission**

We believe this STEM flight program is innovative and an exciting way to learn applied math and science. The drone flight program will prepare and introduce our students to emerging careers in drone piloting. Having drones and drone pilots at the high school will create exciting opportunities around film and flight and open the door for creative applications in a variety subject areas.

I grant to the Webster Groves School District Foundation the right to use this proposal and the results of this project, if funded, for public information purposes or to help other educators.

Date: _____ Applicant's Signature _____

Date: _____ District Coordinator Signature (if applicable):_____

Date: _____ Principal's Signature _____