MIDDLE SCHOOL STEM SOLUTION

Flite Test STEM* Curriculum
A Flite Test Connections Solution
*Science, Technology, Engineering and Mathematics

About the Flite Test STEM Curriculum Solution

About Flite Test

Entertaining, Educating and Elevating the World of Flight!

Flite Test was created for people passionate about flight. We created a show for the people that build and fly planes and helicopters as a hobby. They are the dreamers and engineers that are thrilled by the first launch of a maiden flight. The show personifies the veteran and the beginner alike, giving them a chance to share common experiences with others and in turn, enhancing the R/C community. The goal was to develop a creative outlet that allows us to work in our passion daily. Flite Test was designed to empower our audience. It has just enough humor, technology and information to appeal to the R/C flight crowd as a whole. We hope to entertain, educate and elevate our viewers as we move forward with quality content.

About Flite Test Connections

Flite Test Connections is the driving force that connects the schools, churches, flight clubs and hobbyists through the lens of scratch build remote control aviation. The cornerstone of the program is a common goal for collaboration, fellowship and community guided by the Flite Test STEM Curriculum.

The Question:

With Flite Test becoming a leader in remote control scratch build aviation, how do we implement this progressive concept as a STEM option for students of all grade levels?

Solution: The FT STEM Curriculum

Constructing STEM literacy through the lens of scratch build aviation for 21st-century learners is the foundation of Flite Test's K–12 Curriculum Solution. Using a modified engineering design model process, the innovative, STEM-driven hands-on aircraft activities engage learners at every level and provide real-world learning opportunities that expose students to careers in science and technology. The program also stresses critical 21st-century skills, such as communication and teamwork. Students of all learning styles (interventions, talented and gifted programs, and extended learning instruction) have success in our Flite Test Clubs all across the world, and our hands-on approach provides a variety of flexible implementation models. Our curriculum involves both student-directed and teacher-led curricula to create a powerful and effective STEM experience.

The Flite Test STEM Learning Strands

Learning Strands outline what students are expected to know and be able to do at a specific stage of the FT-Curriculum. Learning Strands describe educational objectives, such as what students should have learned by the end of a course, grade level or grade span. They do not describe any particular teaching practice.

FT-Workbench	Build 2 Fly	Inquiry and Design	Engineering and Design
Description: The Flite Test Workbench lays the foundation of the skill sets students will learn in order to further themselves and succeed in the curriculum. Each level of the Flite Test Curriculum will include a progression of the following skill sets: • Scratch Build Safety • Fundamentals to Flight • Fundamentals to Design • Flite Test Engineering and Design Model (FT-EDM)	**Description:** The Build 2 Fly strand allows the students to delve into the hobby by building Flite Test-designed build kits specific to grade level curriculum. Each build kit of the Flite Test Curriculum will include a progression of the following skill sets: • Scratch Build Safety • Build Techniques • Power Systems • Flight	**Description:** The Inquiry and Design strand allows the students to review their current FT-Builds and alter their design to test for function and performance. This process prepares the students for the Engineering and Design of their very own aircraft. Each build kit of the Flite Test Curriculum allows the students to explore and alter its design to learn about the following: • FT-EDM Implementation • Build Techniques • Aerodynamics and Design • Power System Applications • Flight	**Description:** The Engineering and Design strand allows the students to create an original piece of work. This category requires the student to demonstrate all curriculum elements with fidelity: • Scratch Build Safety • Build Techniques • Power System Applications (with the exception of Level K–3) • FT-EDM Implementation
Suggested Execution: The FT-Workbench strand should be introduced to the students before they begin working on scratch builds. This includes students who learned these skills the previous year. These skill sets are the tools the students need to complete the adjacent strands, and the skills should be practiced and assessed throughout the curriculum's implementation.	**Suggested Execution:** The Build 2 Fly strand should be implemented after the FT-Workbench skill sets have been taught. This strand could be used as an all class unit or be confined to a student-working module. For middle and high school grade levels, this category can be embedded throughout the year to allow for student discovery and learning connections. Embedding Build 2 Fly throughout the curriculum allows for differentiation of the content.	**Suggested Execution:** The Inquiry and Design strand can be implemented in the following ways: **Modular and an All Class Environment:** Executed after Build 2 Fly kit is completed and tested. **Creator Space Environment:** Executed by returning students after review of the FT-Workbench Unit.	**Suggested Execution:** The Engineering and Design strand can be implemented in the following ways: **Modular and an All Class Environment:** Executed after Inquiry and Design exploration. **Creator Space Environment:** Executed by returning students after review of the FT-Workbench Unit.
Flite Test Resources to Support Strand: • FT-Safety Posters • FT-Lesson Related Worksheets • FT-Design templates for Drafting and CAD applications • FT-EDM Templates • FT-Design Brief	**Flite Test Resources to Support Strand:** Each level encompasses a specific set of build kits (see level curriculum for build kit options). Each level beyond Level K–3 has an option for student flight training support curriculum. This includes a simulator with controllers and a remote control aircraft for live training by way of buddy boxing.	**Flite Test Resources to Support Strand:** Each level encompasses a specific set of build kits (see level curriculum for build kit options). • CAD Designs for Secondary Level Curriculum • Level K–3 Design Templates • FT-Foam Board • FT-PDF Plans	**Flite Test Resources to Support Strand:** Each level encompasses a specific set of build kits (see level curriculum for build kit options). • CAD Designs for Secondary Level Curriculum • Level K–3 Design Templates • FT-Foam Board • FT-PDF Plans

Choosing the Best FT-STEM Fit!

THE BREAKDOWN

Each classroom environment will take on the Flite Test Curriculum in a way that is best suited for the class. Below are three possible flight paths a classroom can follow. Each Flite Test Learning Strand will be designed around these options.

The following curriculum layout is designed for the classroom, which in this case will follow the "CO-OP Missions" and "Fly as a Pack" options.

Flying Solo	CO-OP Missions	Fly as a Pack
Description: Flying Solo is designed for the classroom environment in which the curriculum is meant to operate as a standalone module. Lessons are designed for a two-week rotation. The educator can select which aircraft from the Build 2 Fly kit options will be constructed and flown during that assigned rotation. The modules are student-driven and the online Flite Test STEM Curriculum module helper will guide the students through the curriculum.	**Description:** Co-Op Missions is designed for the classroom environment in which the curriculum is split amongst the students for the FT-Workbench designed units. This option will be paired with Fly as a Pack, and lessons will be designed to accommodate both. Educators will see partner guides and suggestions on how to execute lessons.	**Description:** Fly as a Pack is designed for the classroom environment in which the curriculum is one to one during the FT-Workbench designed units. This option means that every student will be assigned their own FT-equipment.
Suggested Execution: Flying Solo should be assigned to a pair of students at a module. At the end of the modular rotation, students will have to demonstrate flight using the Build 2 Fly or created aircraft. It is highly recommended that the instructor buddy box with the pair of students when flying the aircraft.	**Suggested Execution:** Prior to the start of the Flite Test Curriculum, assign partners who will conduct the Flite Test Curriculum together and be able to share the materials assigned. The educator decides how to organize the distribution of the equipment.	**Suggested Execution:** Each student will have an FT-Power System assigned to them prior to the start of the Flite Test Curriculum. The educator decides how to organize the distribution of the equipment.

Flite Test 2 STEM (CO-OP Missions and Fly as a Pack Scheduling)

THE BREAKDOWN

The best schedule and layout for Flite Test in your classroom: Below are proven exemplars of how the Flite Test STEM Curriculum Solution can look in middle and high school settings, depending on your schedule options. In looking at the Flite Test Learning Strands, the ultimate goal is "Flite Test to STEM:" to have your students learn and promote themselves over the course of the year and achieve the highest strand, "Engineering and Design." If your site chooses to conduct the "Entrepreneurial Element" of the curriculum, incorporate that unit within the FT-Extension/FLITE TEST days.

IMPLEMENTATION PHILOSOPHY

The execution of the curriculum is based on the educators' classroom management approach. The FT-STEM classroom solution promotes the students' complete immersion into the curriculum. The student should receive the FT-Workbench Fundamentals throughout the semester/year each week while working on the building of, testing of or the engineering of scratch build aircraft. This approach fosters natural student inquiry in the content of the class, from learning and applying the fundamentals, to generating questions from firsthand experiences. This keeps the students moving and motivated, fostering a natural differentiation of the curriculum for the students even if they are all working at different paces. Assessments can be accomplished by grading the student on a design brief per project, participation or portfolio for review at end of semester.

IDEAL CLASSROOM EQUIPMENT

The curriculum will see the most success if equipped like a Fabrication Lab. A Fab Lab is a technical prototyping platform for innovation and invention, providing stimulus for local entrepreneurship. A Fab Lab is also a platform for learning and innovation: it is a place to play, create, learn, mentor and invent. To be a Fab Lab means connecting with a global community of learners, educators, technologists, researchers, makers and innovators—a knowledge-sharing network that spans 30 countries and 24 time zones. Because all Fab Labs share common tools and processes, the program is building a global network, a distributed laboratory for research and invention.
("What is a Fab Lab?" http://www.fabfoundation.org/fab-labs/what-is-a-fab-lab/ accessed April 15, 2015).

Typically a Fab Lab includes the following equipment:
- Computers with 2D and 3D design software
- Machine and Hand Tools
- Laser Cutter
- 3D Printers
- Computer Numerical Control (CNC) Mills or Routers

Traditional classrooms with limited equipment can still successfully implement the curriculum. However, the replication and entrepreneurial element will be more difficult to incorporate. Sites in these situations should include:
- Space for storage of equipment and student projects
- Basic machine and hand tools
- An assortment of X-acto or utility knives along with hot glue guns

IMPORTANT: Any classroom environment conducting this curriculum should house a first aid kit and perform safety procedures prior to starting coursework.

OPTION 1: SEMESTER SCHEDULE

This option is perfect for a school implementing an elective schedule for a semester. This curriculum is acceptable for all grades.

The FT-Curriculum is designed around a 45 minute to hour-long block or period, and the Units should scaffold and progress over time. The curriculum ACTIVITIES can be chosen for the assigned days and are provided in the pages attached. FLITE TEST means time given to the students to conduct either their Build 2 Fly, Inquiry and Design or Engineering and Design models.

DAYS	ACTIVITIES
Monday	FT-EDM and Design
Tuesday	Fundamentals 2 Flight
Wednesday	FT-Extension
Thursday	FT-Skill Sets/FLITE TEST Day
Friday	FLITE TEST Day

MONTHS	FT-STRANDS ATTAINED
1	FT-Workbench/Build 2 Fly
2	FT-Workbench/Build 2 Fly/Inquiry and Design
3	Build 2 Fly/Inquiry/Engineering and Design
4	Inquiry/Engineering and Design

OPTION 2: YEAR LONG SCHEDULE

This option is perfect for a school implementing an elective schedule for a complete year.

The FT-Curriculum is designed around a 45 minute to hour-long block or period, and the Units should scaffold and progress over time. The curriculum ACTIVITIES can be chosen for the assigned days and are provided in the pages attached. FLITE TEST means time given to the students to conduct either their Build 2 Fly, Inquiry and Design or Engineering and Design models.

FIRST QUARTER

DAYS	ACTIVITIES
Monday	FT-EDM and Design
Tuesday	Fundamentals 2 Flight
Wednesday	FT-Extension/Entrepreneurial Element
Thursday	FT-Skill Sets/FLITE TEST Day
Friday	FLITE TEST Day

SECOND QUARTER (Gradual Release of students running the curriculum)

DAYS	ACTIVITIES
Monday	Usage based on students' needs
Tuesday	Usage based on students' needs
Wednesday	FLITE TEST Day
Thursday	FLITE TEST Day
Friday	FLITE TEST Day

MONTHS	FT-STRANDS ATTAINED
1	FT-Workbench/Build 2 Fly
2	FT-Workbench/Build 2 Fly
3	Build 2 Fly/Inquiry and Design
4	Build 2 Fly/Inquiry and Design
5	Build 2 Fly/Inquiry/Engineering and Design
6	Build 2 Fly/Inquiry/Engineering and Design
7	Inquiry/Engineering and Design
8	Inquiry/Engineering and Design

Flite Test STEM Curriculum Map for Middle School

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Intro Unit "What is Scratch Build Aviation?" Scratch Build Safety	How does safety help produce a quality worker who enjoys their discipline?	• Scratch build aviation leads to connections in science, technology, engineering and math. • Improvement in safety leads to improvement in productivity.	**The following National Standard Groupings of STEM will be implemented in this module.** • Next Generation Science Standards • International Society for Technology in Education Standards • Science and Engineering Standards of NSTA • National Council of Teacher Mathematics Standards **INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION** **ISTE STANDARDS FOR STUDENTS** Technology Operations and Concepts ISTE-S-6	1 week Safety continued throughout semester/year	**Lesson:** Introduction and Flite Test the Room! **Product Application:** • FT-STEM Online • FT-Safety Posters • FT-Crafty Kit	Students will understand and execute the safety in construction and flying of aircraft.
FT-Engineering Design Model (FT-EDM) Middle School	How do we get better at solving problems?	Using a process of design makes for an improved product and function.	**INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION** **ISTE STANDARDS FOR STUDENTS** • Technology Operations and Concepts • Critical Thinking and Problem Solving • Creativity and Innovation • Communication and Collaboration **NEXT GENERATION SCIENCE STANDARDS ENGINEERING AND DESIGN** • Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. MS-ETS1-1	• Every designated day scheduled. • EDM would then be used throughout the semester or school year.	**Lesson 1:** Transport of Weight **Lesson 2:** Ongoing EDM and Beyond **Product Application:** • FT-STEM Online • FT-EDM Guide • FT-Design Brief	Students will be able to achieve processes of engineering design: defining a problem, developing solutions and comparing solutions by testing them to see which best solves the problem.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
FT-Engineering Design Model (FT-EDM) Middle School (continued)			• Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ETS1-2 • Analyze data from tests to determine similarities and differences among several design solutions in order to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. MS-ETS1-3 • Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved. MS-ETS1-4			
Fundamentals 2 Design Middle School	How can I use drawings to communicate, create and solve problems?	Computer Aided Design (CAD) or drafting ideas graphically enable solutions for problems.	**INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION ISTE STANDARDS FOR STUDENTS** • Technology Operations and Concepts • Critical Thinking and Problem Solving • Creativity and Innovation • Communication and Collaboration **NATIONAL COUNCIL OF TEACHER MATHEMATICS STANDARDS** **MEASUREMENT** • Understand both metric and customary systems of measurement. • Understand, select and use units of appropriate size and type to measure angles, perimeter, area, surface area and volume.	• Every designated day scheduled. • Design would then be used throughout the semester or school year.	**Lesson 1:** Pick a Unit of Measure **Lesson 2:** Thumbnail Designs **Lesson 3:** Create the Puzzle **Lesson 4:** Using 2D software **Lesson 5:** Ongoing Design **Product Application:** • FT-STEM Online • FT-EDM Guide • FT-Design Paper • FT-Thumbnail Design Template • FT-Foam Board • FT-Delta Puzzle • CAD Software • Computers • Drafting Supplies	Students will be able to CAD/draw an idea graphically on paper to communicate their understanding of measurement and basic aircraft design.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Fundamentals 2 Design Middle School (continued)			• Select and apply techniques and tools to accurately find length, area, volume and angle measurements to appropriate levels of precision. • Develop strategies to determine the surface area and volume of selected prisms, pyramids and cylinders. **NUMBERS AND OPERATIONS** Work flexibly with fractions, decimals and percents to solve problems. **GEOMETRY** Use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume.		• FT-Power Pod Measuring Template	
Fundamentals 2 Flight	How can a plane fly?	Given specific forces on an aerodynamically correct object can result in flight.	**NEXT GENERATION SCIENCE STANDARDS** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and on the mass of the object. MS-PS2-2 **INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION STANDARDS** • Critical Thinking and Problem Solving • Technology Operations and Concepts **NATIONAL COUNCIL OF TEACHER MATHEMATICS STANDARDS** **MEASUREMENT** • Carry out simple unit conversions within a system of measurement, such as from centimeters to meters. • Understand both metric and customary systems of measurement.	• Every designated day scheduled. • Fundamentals 2 Flight would then be used throughout the semester or school year.	**Lesson 1:** Basics of Flight **Lesson 2:** Testing the Basics **Lesson 3:** Control Surface Effect **Lesson 4:** Control Surfaces in Action **Lesson 5:** Center of Gravity **Lesson 6:** Airfoils **Lesson 7:** Wing Configurations **Lesson 8:** Aerobatics **Lesson 9:** Multirotor **Product Application:** • FT-STEM Online • FT-Tiny Trainer • FT-Explorer	Students will understand how basic flight aerodynamics work within their aircraft designs and builds.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Fundamentals 2 Flight (continued)			**DATA ANALYSIS AND PROBABILITY** Formulate questions, design studies and collect data about a characteristic shared by two populations or different characteristics within one population.		• FT-Crafty Kit • FT-Basics 2 Flight WS • FT-Testing the Basics WS • FT-Control Surfaces WS • FT-Testing the Control Surfaces WS • FT-Wing Configuration WS	
Power Systems CO-OP or PACK	What provides energy and propels our aircraft in flight?	Mechanical power acting as a component of propulsion.	**NEXT GENERATION SCIENCE STANDARDS** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. MS-PS4-3 **INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION ISTE STANDARDS FOR STUDENTS** Technology Operations and Concepts	• 3–4 lessons during the FT-Skills designated days as scheduled. • Power Systems would then be used throughout the semester or school year.	**Lesson 1:** Power Equipment **Lesson 2:** Power Safety **Lesson 2:** Power Installment **Product Application:** • FT-Power Pack • FT-Crafty Kit • FT-Tiny Trainer • FT-Transmitter/RX • FT-Power Systems WS	Students will understand the usage and how the electronic components work with the construction of the FT-Power Pod.
Batteries and Safety CO-OP or PACK	How does the LiPo work?	Longevity of a scratch build aircraft is dependent upon the understanding and safety of LiPo batteries.	**INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION ISTE STANDARDS FOR STUDENTS** • Critical Thinking and Problem Solving • Technology Operations and Concepts **NATIONAL COUNCIL OF TEACHER MATHEMATICS STANDARDS COMPUTATIONS** **COMPUTATIONS** Develop and analyze algorithms for computing with fractions, decimals and integers, and develop fluency in their use.	• 2–3 lessons during the FT-Skills designated days scheduled. • Batteries and Safety would then be used throughout the semester or school year.	**Lesson 1:** LiPo 101 and Safety **Lesson 2:** LiPo Charging **Lesson 3:** LiPo Bunker **Product Application:** • FT-Power Pack • FT-Charger • FT-Transmitter/RX • FT-LiPo Battery • FT-LiPo 101 WS	Students will understand the LiPo battery and its usage and safety when dealing with scratch build aircraft.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Batteries and Safety CO-OP or PACK (continued)			**ALGEBRA** Develop an initial conceptual understanding of different uses of variables.			
Flight Training	How does the use of R/C equipment affect the performance of an aircraft?	Correct finger placement along with controlled stick movements translates to better performance in aircraft during flight.	**INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION** **ISTE STANDARDS FOR STUDENTS** Technology Operations and Concepts	Ongoing practice embedded and organized by the instructor.	**Lesson:** Flight Training **Product Application:** • FT-Simulator • FT-Transmitter	Students practice and understand how an R/C plane flies using the FT-Simulator.
Build 2 Fly CONDUCTING AN FT-BUILD	How does the building of FT-Aircraft create an understanding of how scratch build aviation works?	Precision in measurement increases successful function of a product.	**FLITE TEST EDM CREATE STANDARDS** The student creates the solution using appropriate technology and strategies while following the developed design. It is important for the student to constantly reflect on the progress of the solution. **APPLYING STANDARDS OF UNITS:** • Fundamentals 2 Flight • Power Systems • Batteries and Safety **INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION** **ISTE STANDARDS FOR STUDENTS** • Technology Operations and Concepts • Critical Thinking and Problem Solving • Communication and Collaboration **NATIONAL COUNCIL OF TEACHER MATHEMATICS STANDARDS** **MEASUREMENT** • Understand both metric and customary systems of measurement.	Ongoing during FLITE TEST days	**Lesson:** Build 2 Fly **Product Application:** • FT-STEM Online • FT-EDM • FT-Crafty Kit	Students will understand the basic scratch build approach to creating an FT-Aircraft and the importance of measurement in the aircraft's overall performance.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Build 2 Fly CONDUCTING AN FT-BUILD			• Understand, select and use units of appropriate size and type to measure angles, perimeter, area, surface area and volume. • Select and apply techniques and tools to accurately find length, area, volume and angle measurements to appropriate levels of precision.			
Build 2 Fly FT-Swappable CO-OP or PACK	What wing design performs best at low speeds?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	1–2 weeks	**Lesson:** FT-Swappable **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.
Build 2 Fly FT-Tiny Trainer CO-OP or PACK	What aircraft design can be classified as a "trainer?"	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	1–2 weeks	**Lesson:** FT-Tiny Trainer **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.
Build 2 Fly FT-Versa Wing CO-OP or PACK	How does a Delta Wing Design fly with no rudder?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	1–2 weeks	**Lesson:** FT-Versa Wing **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.
Build 2 Fly FT-Bloody Wonder CO-OP or PACK	What wing design performs best at low speeds?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	2–3 weeks	**Lesson:** FT-Bloody Wonder **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Build 2 Fly FT-Old Fogey CO-OP or PACK	What does a cambered wing do to add lift?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	2–3 weeks	**Lesson:** FT-Old Fogey **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.
Build 2 Fly FT-Mighty Minis CO-OP or PACK	What are the effects on performance when scaling down an aircraft?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	2–3 weeks	**Lesson:** FT-Mighty Minis **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.
Build 2 Fly FT-Simple Storch CO-OP or PACK	Why is a shoulder wing perfect for light aircraft designs?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	3–4 weeks	**Lesson:** FT-Simple Storch **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	Students will be able to create the specific glider build kit, understand the build process, prepare for flight and test foam gliders.
Build 2 Fly Optional Aircraft CO-OP or PACK	What are the effects on performance when creating a more scaled design?	Building with focus creates a quality product.	**SEE BUILD 2 FLY STANDARDS**	4 weeks	**Lesson:** FT-Aircraft **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack • See sales rep for an individual or classroom set of other desired FT-Aircraft	Students will be able to create the specific glider build kit, which requires understanding the building process, preparing for flight and testing of foam gliders.
Inquiry and Design Conduct as a class or individually CO-OP or PACK	What are the effects on performance when designs are altered?	Altering a product can lead to new developments in its design and performance.	**INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION** **ISTE STANDARDS FOR STUDENTS** • Creativity and Innovation • Research and Information Literacy • Critical Thinking, Problem Solving and Decision Making • Technology Operations and Concepts	Dependent upon educator/advisor usage	**Lesson:** Inquiry and Design **Product Application:** • All FT-Build Kits • FT-Foam Board • FT-Design Templates of Aircraft	Through discovery, students will be able to apply the Flite Test Fundamentals (Design, EDM and Build 2 Fly) to alter the designs of current aircraft build kits.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Inquiry and Design Conduct as a class or individually CO-OP or PACK (continued)			**NATIONAL COUNCIL OF TEACHER MATHEMATICS STANDARDS** **MEASUREMENT** • Understand both metric and customary systems of measurement. • Understand, select and use units of appropriate size and type to measure angles, perimeter, area, surface area and volume. • Select and apply techniques and tools to accurately find length, area, volume and angle measurements to appropriate levels of precision. • Develop strategies to determine the surface area and volume of selected prisms, pyramids and cylinders. **NUMBERS AND OPERATIONS** Work flexibly with fractions, decimals and percents to solve problems. **GEOMETRY** Use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume. **FLITE TEST EDM STANDARDS** Research, Design, Create, Test		• FT-Aircraft • FT-Crafty Kit • FT-Power Pack	
Inquiry and Design Aircraft Solution FT-Explorer CO-OP or PACK	What are the effects on performance when designs are altered?	Altering a product can lead to new developments in its design and performance.	**SEE INQUIRY AND DESIGN STANDARDS**		**Lesson:** FT-Explorer **Product Application:** • FT-Aircraft • FT-Crafty Kit • FT-Power Pack	

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Engineering and Design Individual Student	Do my creations function and represent me well?	Engineering new designs can lead to the development of new technologies.	**INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION** **ISTE STANDARDS FOR STUDENTS** • Creativity and Innovation • Research and Information Literacy • Critical Thinking, Problem Solving and Decision Making • Technology Operations and Concepts **NEXT GENERATION SCIENCE STANDARDS ENGINEERING AND DESIGN** • Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. MS-ETS1-1 • Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ETS1-2 • Analyze data from tests to determine similarities and differences among several design solutions in order to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. MS-ETS1-3 • Develop a model to generate data for iterative testing and modification of a proposed object, tool or process such that an optimal design can be achieved. MS-ETS1-4	Dependent upon educator/advisor usage	**Lesson:** Engineering and Design **Product Application:** • FT-Foam Board • FT-Design Templates	Students will be able to apply the Flite Test Middle School Fundamentals (Design, EDM, Build 2 Fly, Inquiry and Design) to the creation of new aircraft design.

Unit	Unit Question	Significant Concept	National Standards	Length	Lesson/Product Application	Evidence of Outcomes
Engineering and Design Individual Student (continued)			**MEASUREMENT** • Understand both metric and customary systems of measurement. • Understand, select and use units of appropriate size and type to measure angles, perimeter, area, surface area and volume. • Select and apply techniques and tools to accurately find length, area, volume and angle measurements to appropriate levels of precision. • Develop strategies to determine the surface area and volume of selected prisms, pyramids and cylinders. **NUMBERS AND OPERATIONS** Work flexibly with fractions, decimals and percents to solve problems. **GEOMETRY** Use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume. **FLITE TEST EDM STANDARDS** Research, Design, Create, Test			

*This unit breakdown can be designed to start at the Middle School level and progress to the High School level. This linear progression only works if the school has aligned its STEM implementation by grade level. In an isolated case, a teacher can start the curriculum at any grade level with success. A school could also choose to use the Build 2 Fly Strand only and build activities for the students. If a school has a specific engineering model that they have to follow, they can easily replace the FT-EDM implementation with their own to meet building or district standards.

Flite Test Engineering Design Model 6–8

THE BREAKDOWN

USAGE: For FT-Activities and any problem-solving application.

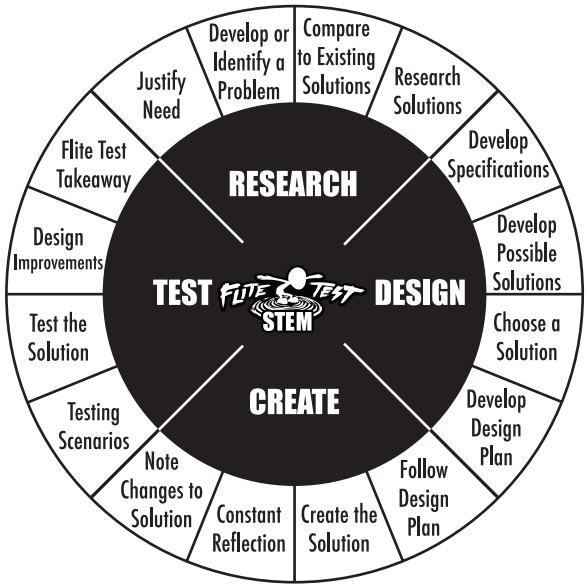
FLITE TEST DESIGN

Design, or the "The Process," as Flite Test calls it, is the foundation of the development of new technologies. Design is the driving force that forms our societies, and it renovates how we see and process information, adapt to our surroundings, and communicate and solve problems. The design process leads us to plan, create and evaluate as we push for constant progression in the workings of our lives.

Design is the bridge between creativity and innovation, and it is not in the hands of only a selected few. It is in all of us. It starts with your students sitting in your classroom. Your students could design the next big solution for our future. Let's give them a solid foundation for how to create and solve problems.

Flite Test design requires the use of the FT-Engineering Design Model (FT-EDM) as a tool, which provides the approach used to structure the research and analysis of problems, the development of possible solutions, creation, and the testing and evaluation of the solution.

The FT-Design Brief will organize the students' journey through the process and can be used as an assessment tool for the educator and/or a portfolio option for students in the future to demonstrate their growth.



Level 6–8 Flite Test Engineering Design Model

FT-EDM (ENGINEERING DESIGN MODEL) LEVEL 6–8

DIRECTION: The FT-EDM is designed to guide the students though the process of creating a solution. The student has free movement within the FT-EDM in order to achieve the best results. Students will not only use this method for solving Flite Test STEM Curriculum problems but should also be able to transfer this knowledge across contents and to real life applications.

RESEARCH: In this stage, the student is given a problem to identify. The student should justify the need and compare to existing solutions while conducting research. In special circumstances, a student can develop his or her own problem. The research can be student-led or guided to help this initial stage.

DESIGN: After the students research possible solutions for the problem, they need to identify or develop the design specifications to follow. They need to communicate their understanding of the problem by creating a series of sketches, drawings or physical models. After analyzing all possible solutions, the student must choose one to justify, develop a Design Plan and continue on in the process.

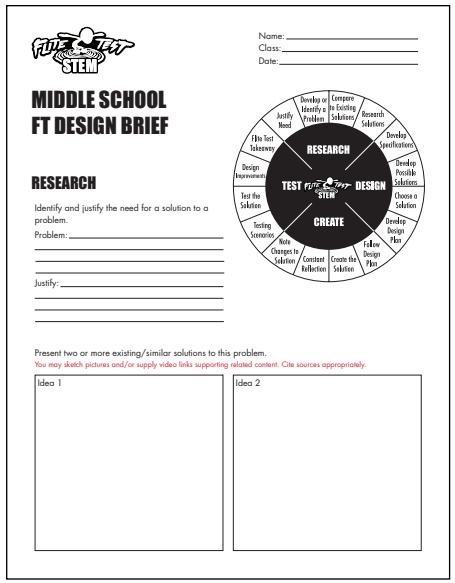
CREATE: The student creates the solution using appropriate technology and strategies while following the developed design. It is important for the student to constantly reflect on the progress of their solution and to follow their Design Plan while noting any changes made to their overall solution.

TEST: The final stage of producing a solution: putting the solution through a series of designed or assigned tests. The students will compare their solutions to others and suggest ways of improving their solution while discussing the impact or takeaway from the project.

Flite Test EDM Design Brief 6–8

THE BREAKDOWN

What is a design brief? In the engineering field, a design brief is a written work for a design project developed by a single designer or design agency for a client. Design briefs organize the process that is followed to complete a product. Below is the modified FT-Design Brief 6–8 students will use to solve a problem during the Inquiry/Engineering and Design phases. The FT-EDM Design Brief can be used as a grading tool for concept understanding. Please see the rubric after the diagram below. This brief was also designed to take into account other STEM-related problem-solving applications. The 6–8 EDM brief can be done electronically using the FT-STEM Online Student Hangar Option or printed and used as hardcopy.



Name: _____
Class: _____
Date: _____

MIDDLE SCHOOL FT DESIGN BRIEF

RESEARCH

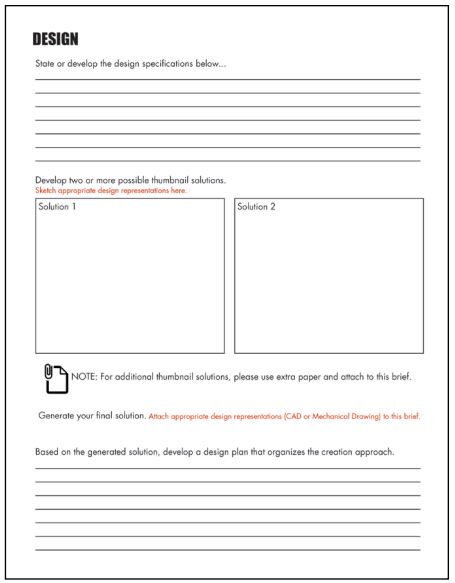
Identify and justify the need for a solution to a problem.

Problem: _____

Justify: _____

Present two or more existing/similar solutions to this problem.
You may sketch pictures and/or supply video links supporting related content. Cite sources appropriately.

Idea 1	Idea 2



DESIGN

State or develop the design specifications below...

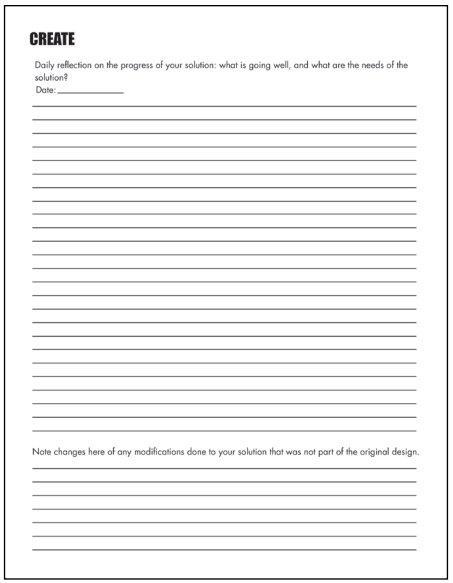
Develop two or more possible thumbnail solutions.
Sketch appropriate design representations here.

Solution 1	Solution 2

NOTE: For additional thumbnail solutions, please use extra paper and attach to this brief.

Generate your final solution. Attach appropriate design representations (CAD or Mechanical Drawing) to this brief.

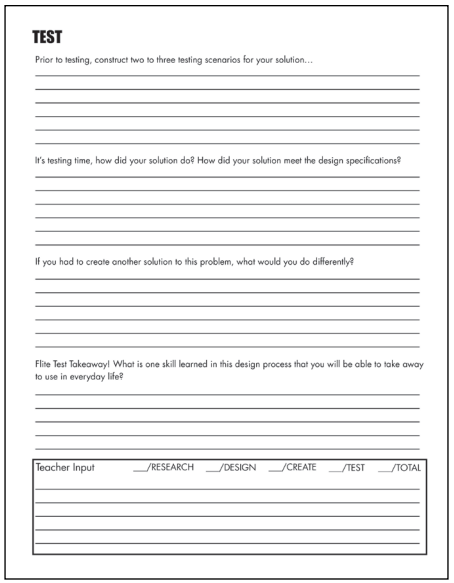
Based on the generated solution, develop a design plan that organizes the creation approach.



CREATE

Daily reflection on the progress of your solution: what is going well, and what are the needs of the solution?
Date: _____

Note changes here of any modifications done to your solution that was not part of the original design.



TEST

Prior to testing, construct two to three testing scenarios for your solution...

It's testing time, how did your solution do? How did your solution meet the design specifications?

If you had to create another solution to this problem, what would you do differently?

Flite Test Takeaway! What is one skill learned in this design process that you will be able to take away to use in everyday life?

Teacher Input ___/RESEARCH ___/DESIGN ___/CREATE ___/TEST ___/TOTAL

Flite Test EDM Design Brief Rubric 6–8

THE BREAKDOWN

Using the Design Brief as an Assessment Tool to Measure Achievement and/or Growth: Below is a simple approach for assessing your students against the FT-EDM. This rubric can and should be adjusted to accommodate your school/district grading systems. No single grade level has to be assessed using the FT-EDM Design Brief Rubric. However, by the end of each quarter or semester, a modified assessment or the one below should be used to show data of student achievement or growth. The FT-EDM can be used for every build the students complete. The instructor can decide how they would like to orchestrate this requirement.

Lesson 1: Transport the Gremlin

Lesson 2: Ongoing EDM and Beyond

Best Practice: Start slow, assess every other project and orally conduct the FT-EDM. For final quarter or semester-ending projects, make the students accountable for executing the FT-EDM against the following criterion.

EDM Stage	Evidence of Outcomes	Achievement	Qualifiers	Instructor Comments
RESEARCH	In this stage, the student is given a problem to identify. The student should justify the need and compare to existing solutions while conducting research. In special circumstances, a student can develop his or her own problem. The research can be student-led or guided to help this initial stage.	Advanced 5	□ The student states the problem. □ The student justifies the need. □ The student investigates the problem. □ Research shows evidence of comparison to existing solutions. □ Student responses have appropriate handwriting and spelling.	
		Proficient 3–4	□ The student states the problem. □ The student justifies the need. □ The student investigates the problem. □ Student responses have appropriate handwriting and spelling.	
		Partially Proficient 1–2	□ The student somewhat states the problem. □ The student attempts some research on possible solutions.	
		Non-Proficient 0	The student does not reach a level described above but has attempted to research a solution.	

EDM Stage	Evidence of Outcomes	Achievement	Qualifiers	Instructor Comments
DESIGN	After the students research possible solutions for the problem, they need to identify or develop the design specifications to follow. They then need to communicate their understanding of the problem by creating a series of sketches, drawings or physical models. After analyzing all possible solutions, the student must choose one to justify, develop a Design Plan and continue on in the process.	Advanced 5	□ The student identifies and/or develops the Design Specifications. □ The student generates the assigned amount of ideas___. □ The student picks one design to justify. □ The student develops a Design Plan based on project specs. □ Student states their next steps.	
		Proficient 3–4	□ The student identifies and/or develops the Design Specifications. □ The student created a design. □ The student picks one design to justify. □ The student has attempted a Design Plan.	
		Partially Proficient 1–2	□ The student attempts to identify the Design Specs. □ The student has attempted a design.	
		Non-Proficient 0	The student does not reach a level described above.	
CREATE	The student creates the solution using appropriate technology and strategies while following the developed design. It is important for the student to constantly reflect on the progress of their solution and to follow their Design Plan while noting any changes made to their overall solution.	Advanced 5	□ The student expertly uses techniques and equipment. □ The student completes product with good quality. □ Student followed their Design Plan. □ Students noted any changes to their overall solution. □ Student reflects on progress of product.	

EDM Stage	Evidence of Outcomes	Achievement	Qualifiers	Instructor Comments
CREATE (continued)		Proficient 3–4	□ The student uses appropriate techniques and equipment. □ The student completes product with appropriate quality. □ Student somewhat follows their Design Plan. □ The student attempts to reflect on progress of product.	
		Partially Proficient 1–2	□ The student attempts to appropriately use techniques and equipment. □ The student attempts product.	
		Non-Proficient 0	The student does not reach a level described above.	
TEST	The final stage of producing a solution is putting your solution through a series of designed or assigned tests. The students are to compare their solutions to others and identify methods for improving their solution.	Advanced 5	□ The student appropriately tests their product conducting 2 or more testing scenarios. □ The student evaluates their product performance. □ The student identifies methods for making improvements. □ Student discusses impact or takeaway from the project.	
		Proficient 3–4	□ The student tests their product. □ The student evaluates their product performance. □ Student somewhat discusses the impact or takeaway from the project.	
		Partially Proficient 1–2	□ The student tests their product. □ The student attempts a final testing response.	
		Non-Proficient 0	The student does not reach a level described above.	