Mathematics, Science & Technology

PART II.8

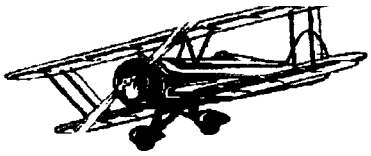
NOTE: This document is a work in progress. Parts II and III, in particular, are in need of further development, and we invite the submission of additional learning experiences and local performance tasks for these sections. Inquiries regarding submission of materials should be directed to: The Mathematics, Science, and Technology Resource Guide, Room 681 EBA, New York State Education Department, Albany, NY 12234 (tel. 518-474-5922).

NEW YORK
THE STATE OF LEARNING

http://www.nysed.gov

INTERMEDIATE

Standards & Performance Indicators



Introduction to Flight

MST 1
- ▲ identify technical solutions
- ▲ alternative solutions
- ▲ construct model solution
- ▲ test solution

MST 2
- ▲ spreadsheets and data base

MST 5
- ▲ technical solutions
- ▲ develop plans
- ▲ test solutions
- ▲ thorough investigation
- ▲ information resources
- ▲ work schedules/plans
- ▲ modeling tool
- ▲ system control

MST 6
- ▲ answers or solutions

MST 7
- ▲ design solutions
- ▲ observe phenomena
- ▲ work effectively
- ▲ gather/process information
- ▲ generate/analyze ideas
- ▲ observe common themes
- ▲ realize results
- ▲ present results

Ernest R. Ruiz, Tom Salemi,
John Glaessgeh, Ann Denise Engellis,
Rita T. Scher, James P. Vitello
Smithtown Central School District
Smithtown Middle School
10 School street
St. James, NY 11780
(516) 361-2500

Grade 7

SUPPLIES

The following is a list of supplies and equipment that are required to carry out this activity, but may not be commonly available in many middle schools.

1. **One - Basic Wind I tunnel, Kelvin Catalog #840580 - $345.00**
2. **One - Strain Gauge and Data Acquisition Interface (IBM), Kelvin Catalog #840471**
3. **Two - Analog Wind Speed Meter, Kelvin Catalog #720101 - $59.00 each**
4. **Twenty - French Curves, various suppliers - $4.00 each**
5. **Supply of balsa wood for wing spars and ribs**
6. **Digital scale, various suppliers (Prices vary according to kind, quality and accuracy.)**
7. **Flight stanchion (can be made by staff or purchased through Kelvin Electronics)**

A Math, Science and Technology Integrated Project

The airplane has had a profound effect on world history. Look at how wars have been fought since the invention of the flying machine. The world has shrunk and communications are instant, thanks to airplanes and aerospace developments. What does the future have in store? Could *Star Trek* become a reality? These are fertile areas for investigation along with ecological and social issues. Topics like these, and others, could be studied in a broad school curriculum.

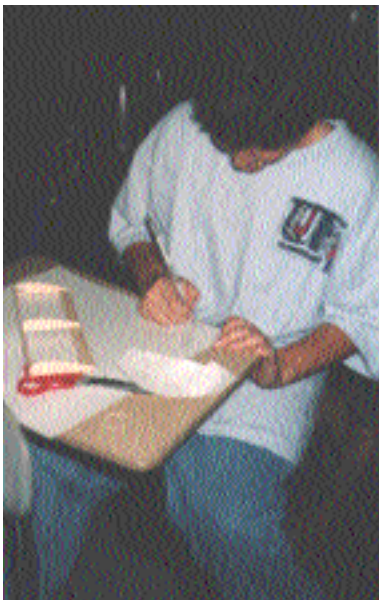
To succeed in this activity, students should be able to do the following:

1. Measure using both the English and metric systems.
2. Carry out appropriate math computations.
3. Graph coordinates.
4. Prepare and enter data into a computer spread sheet.
5. Follow directions.
6. Work with scientific apparatus.
7. Use appropriate tools and machines.
8. Communicate ideas.
9. Work cooperatively.
10. Work independently.
11. Work safely.

Integrated activities allow students to understand that subjects are not isolated and that math, science, and reading and writing skills are as important in technology as technology is, directly or indirectly, in those areas.

Teacher

To initiate the program, the students are given the problem statement which clearly defines the problem and states the parameters that the students must consider in seeking a solution. To help them understand the task, the steps in problem solving are reviewed. These activities can be presented in either, or all, of the subject areas.



Under the tutelage of the math instructor, the students go over graphing procedures and the locating of points using x and y coordinates. This information is then used to plot the profiles of various airfoils using coordinates given by the instructor. Using French curves, students connect the points in order and the end result is a wing or airfoil profile. Coordinates for the wing profiles are prepared beforehand. They are designed to show relative lift possibilities and in some cases negative lift or no lift at all. The next step, again under the tutelage of the math instructor, is to calculate the areas of the top and bottom surfaces of the airfoil (In most instances they are not symmetrical.) for a wing cross-section three inches in length. At this point, a paper mock-up of the three-inch cross section could be made to show in three dimensions the surfaces of the wings, or to help calculate the surface areas. Students need to keep a record of the information they have gathered relating to the shape and surface areas of the wings. This data will be useful later in understanding lift and Bernoulli's principle.

Smithtown Middle School

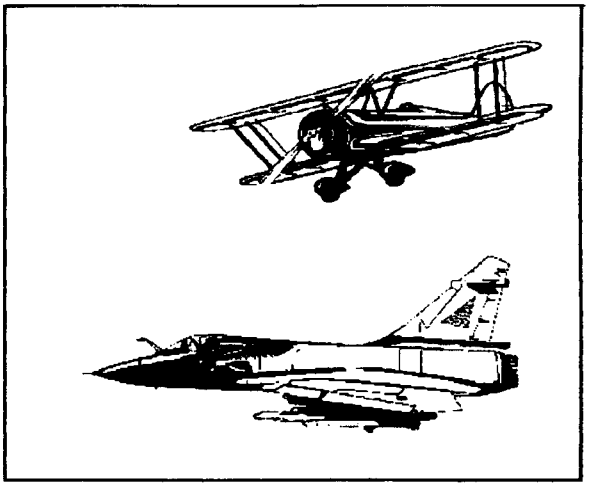
Math, Science and Technology Integrated Activity

Introduction to Flight

Problem Statement

BACKGROUND

Around the turn of the century, Wilbur and Orville Wright were experimenting with kites and gliders with the hope of developing a powered, heavier than air, craft that could fly. Today we take flight, by craft heavier than air, for granted, but back then it almost seemed impossible. The Wright Brothers were successful, not because of luck, but because of their willingness to work on a task until completion and their application of Math, Science and Technological concepts. In this project we will incorporate these same skills and concepts to design, test, redesign and construct model planes that we will fly in class.



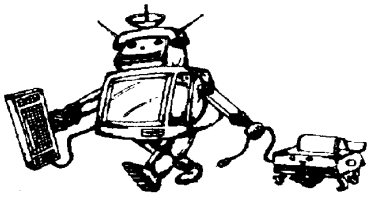
PROBLEM

In teams of two you will plot out the profile for an airfoil from prescribed coordinates. Working with this shape you will determine the surface area for a portion of a wing three inches long. You will then construct a model of the airfoil and test it to determine its lift capabilities. After analyzing the results of the test for your wing section and those of your classmates you will determine what makes for an effective airfoil and design your own. This airfoil will be attached to a fuselage with stabilizers that you will build in the Technology Lab. Your goal will be to design, test and construct the most efficient airplane, that is, the one that will fly the highest and/or fastest.

RELEVANT INFORMATION

1. In Math, Science and Technology classes you will be asked to perform different activities related to this problem. These activities must be done in a timely fashion to allow for integration between the subject areas.
2. You might find yourselves doing things in a fashion that is different from what you are used to. Be flexible and allow the teachers to assist you in this activity.
3. You might find yourselves working with people that you do not know. This happens in the real world. It is imperative that you learn to work with others. That, too, is required in the real world.
4. Computers will be used to record and analyze data.
5. A contest may be held at the end of this activity. The winners will be the team that produces the plane that flies the highest and/or fastest.
6. Any problems that arise which require a judgement to be made, will be solved by the teacher(s) and that decision will be final.

SMITHTOWN SCHOOL DISTRICT
TECHNOLOGY EDUCATION DEPARTMENT



DESIGN / PROBLEM SOLVING BRIEF

Name(s) Marcia

Activity Title Flight

Date

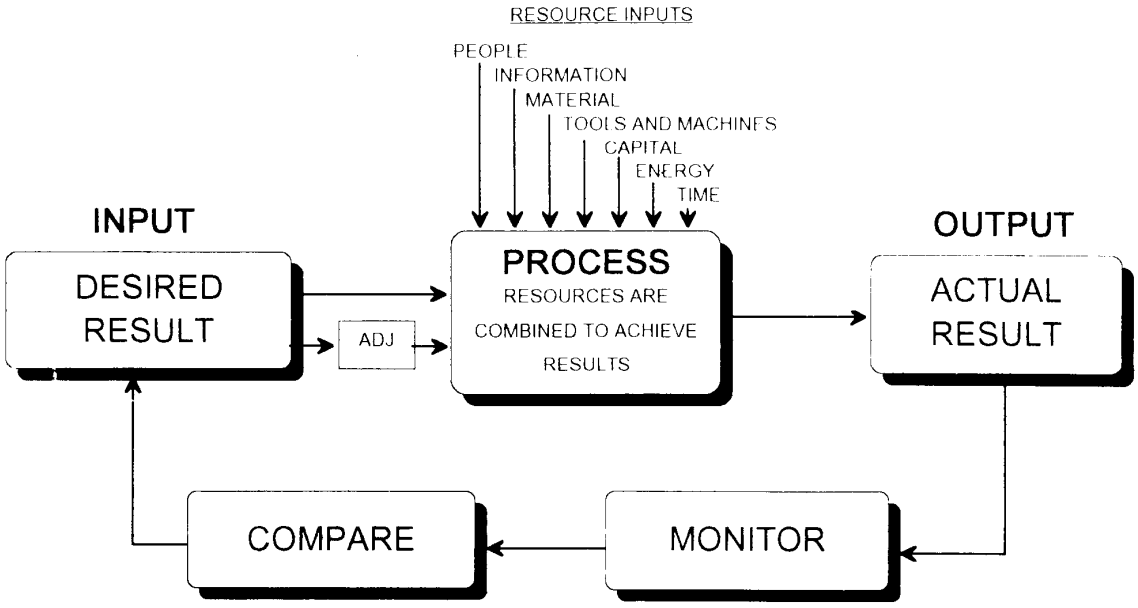
Period 2

Grade Level 7

WRITE A DESCRIPTION OF THE PROBLEM YOU ARE TO SOLVE.

Design a plane with an air foil that will fly using the class equipment.

USE THE SYSTEMS DIAGRAM TO HELP PLAN YOUR SOLUTION



STEPS IN PROBLEM SOLVING

1. Define the problem
2. Gather resources
3. Develop alternative solutions
4. Select the best solution
5. Implement the best solution
6. Evaluate the results and make necessary changes

THINK ABOUT YOUR ASSIGNMENT AND LIST THE CRITERIA THAT YOUR SOLUTION MUST SATISFY IN ORDER TO SOLVE THE PROBLEM

	satisfies yes or no
1. The plane must ~~fly~~ fit ~~using~~ the lab stanchion and power supply.	yes
2. The wing design should be aerodynamic to supply lift.	yes
3. The tabs must be properly adjusted for the most efficient flight.	yes

WHAT RESOURCES WILL I NEED TO SOLVE THIS PROBLEM?

1. HOW CAN PEOPLE HELP ME WITH THIS PROBLEM?

People can give me advice on how to get my plane to fly higher.

2. WHAT TOOLS AND MACHINES WILL I USE TO EXTEND MY ABILITIES?

To extend my abilities I will use the ban saw, a ruler, wood, sandpaper, hot glue, paper, colored pencils, staples, drills, an eyelit and apparatus used to fly plane.

3. WHERE WILL I FIND INFORMATION TO REACH MY GOALS?

I will find information to reach my goals from my Tech. Ed. teacher, other people, books, and notes

4. WHAT MATERIALS ARE AVAILABLE TO USE ON THIS PROJECT?

The materials that are available to use are the ban saw, wood, sandpaper, hot glue, paper staples, drills, an eyelit , and apparatus used to fly planes.

5. WHAT FORM(S) OF ENERGY WILL I USE?

I will use human energy to make the plane. I will use electrical energy for the machines and to fly my plane.

6. HOW WILL I USE CAPITAL TO COMPLETE THIS PROJECT?

I will use capital by using the bought building, bought machines, bought tools, bought wood and other supplies.

7. WHAT TIME LIMITATION(S) AM I FACING?

I had a limit of about fifteen (15) forty(40) minute periods for construction and testing.

FEEDBACK

1. EXPLAIN WHY YOU WERE, OR WERE NOT, SUCCESSFUL IN SOLVING YOUR PROBLEM.

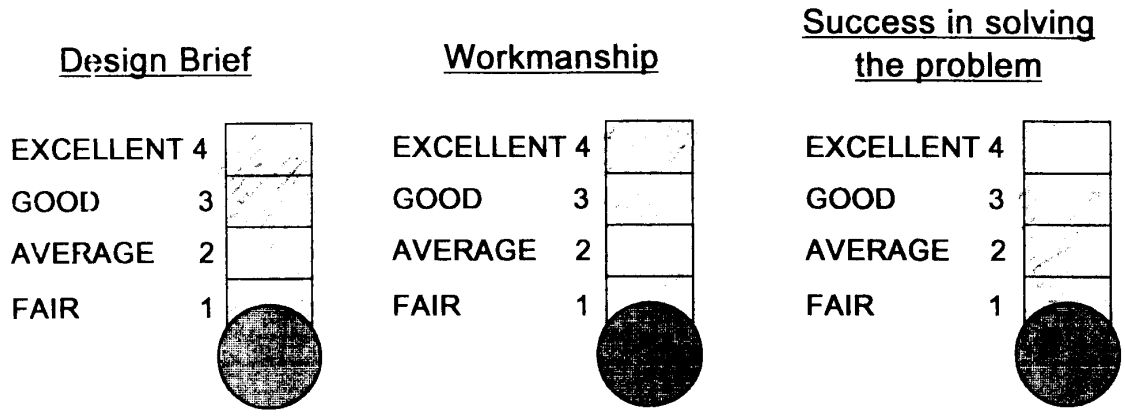
I was successful in solving my problem because my plane took off and flew to the height of 9 on the measuring board. A 9 is an A.

2. DESCRIBE SOME OF THE DIFFICULTIES THAT YOU HAD TO OVERCOME IN SOLVING THIS PROBLEM.

One difficulty I had was that my plane's front was pointing up so that my plane did not fly very high. To overcome this problem I cut a small square of wood and glued it to the front of my plane so that the weight is balanced.

SELF ASSESSMENT

DARKEN IN THE THERMOMETER FOR YOUR RATING



In technology, the students construct a test model of the airfoil that they had planned earlier. In preparation for this portion of the activity, safety information and the use of appropriate tools must be presented. After the airfoil models are completed, they are tested for lift and air flow properties in a wind tunnel. The data collected from these tests is used to study and reinforce Bernoulli's Principle. Further, this data is studied by students to determine what qualities they would consider in designing wings for their model plane. Science and technology teachers guide students through these steps.

After testing, students can use spreadsheets to analyze and chart the results. With this data they design and plot the airfoil for the model airplane. The new airfoil design and model airplane are constructed in the technology lab. After construction is completed, the models are tested and modified to achieve the best possible flight.

As an additional highlight, the models, after final modifications have been made, are entered in a fly-off. The goal is to fly the highest and/or fastest using the flight stanchion. As closure, the activity is analyzed and reviewed in the various subject areas to have the students explain what they have learned, their reactions to the activity, and suggestions for the future.

PLOTTING COORDINATES – WING DESIGN

EXCELLENT (4-5)

1) Sets apppropriate scale

2) Plots all points correctly

3) Makes smooth curve to complete points

4) Does all work neatly and accurately

FAIR (2-3)

1) Sets a scale

2) plots most points correctly
3) Makes reasonable curves to connect points

4) Work is reasonably neat and accurate

POOR (0-1)

1) Sets inappropriate scale

2) Does not plot points correctly
3) Connected points do not generate appropriate curve

4) Work is not neat and accurate

FINDING THE SURFACE AREA OF THE WING – AVERAGING METHOD

EXCELLENT (4-5)

1) Accurately places sheet of graph paper over airfoil

2) Accurately finds the surface area of the foil by averaging interior and exterior squares

3) Work is neatly done, ideas are clearly shown

FAIR (2-3)

1) Places graph paper over airfoil

2) Finds the surface area only by estimating squares inside the airfoil

3) Work is neat and well organized

POOR (0-1)

1) Places sheet of graph paper randomly over airfoil

2) Only counts full squares to estimate the interior area of the airfoil

3) Work is unorganized, ideas not clearly thought out

TECHNOLOGY ASSESSMENT
FLIGHT

Problem Solving

ABILITY TO RECOGNIZE A PROBLEM **1.** **Rarely notices any sort of problem**	**2.** **Notices obvious problems**	**3.** **Maintains questioning attitude, intelligently curious**	**4.** **Consistently identifies problems**
TENDENCY TO STICK TO A PROBLEM **1.** **No capacity for sustained attack on most problems**	**2.** **Solves simple problems efficiently**	**3.** **Is reluctant to leave a problem without completing it**	**4.** **Is unusually persistent in all problem solving**

Work Skills and Habits

SAFETY **1.** **Frequently needs to be reminded about proper safety procedures**	**2.** **Usually uses proper safety procedures**	**3.** **Regularly uses proper safety procedures**	**4.** **Consistently uses proper safety procedures**
ORGANIZATION **1.** **Poorly organized, loses or misplaces supplies**	**2.** **Usually organized**	**3.** **Organized almost all of the time**	**4.** **Consistently has supplies and materials organized**
ACCURACY **1.** **Shows no concern for measuring and working accurately**	**2.** **Works accurately on easy tasks**	**3.** **Works accurately on most tasks**	**4.** **Works accurately on all tasks**
SELECTION OF TOOLS AND/OR MACHINES **1.** **Uses any tool or machine without concern for appropriateness**	**2.** **Usually selects appropriate tools/machines**	**3.** **Uses appropriate tools and machines regularly**	**4.** **Always uses appropriate tools/machines**
COOPERATION **1.** **Difficulty working with others**	**2.** **Works with others under teacher supervision**	**3.** **Works well with others**	**4.** **Works well both as a leader and a follower**

REFLECTION

REFLECTION:

As with all learning activities, this one will benefit from modification through practice and development. The needs of all learners will be better met if they are taken through the activity in an organized fashion, allowing the faster students to do tasks at their own pace and yet not pulling too far ahead of slower students. Keeping the students on task can prevent boredom on the one hand and feelings of inferiority on the other.

This activity utilizes integration and has students apply theory to practice and do hands-on work as they solve problems and construct a working model.

Students enjoy this activity and have an opportunity to apply, in a practical manner, what they learn in school. They employ skills from various subject areas and use technical and engineering concepts to reinforce or prove principles and theories that they learn about, rather than just accept them as being true.

Rich

- *Flight*
-

This year in Tech Ed. my favorite project was about flight. My teacher ,Mr.Ruiz ,taught us about it .The first thing he told us about was Bernoulli's Principle. He taught us about how the wind goes under the wing slower ,which makes more pressure.The wind going over the top curved part of the wing has to go faster because it has a farther way to go.This causes less pressure over the wing which creates lift.This is how planes are able to fly.

Knowing this important information ,we were told to design a plane of our own.We had to make two wing tips exactly alike.We also had to make a fuselage with two two inch pieces of wood which hold the engine given to us.We had to make a trailing edge .We took that and a split dowel rod.We attached all of that together with hot glue in the shape of a wing.We then covered that with a sheet of paper.The next thing we had to build was a horizontal and vertical stabilizer.Mr. Ruiz gave us a pattern and we cut it out of cardboard.Every thing we built was attached the way he showed us .

When we were done building our planes ,we were able to see if they flyed and how high.Mr. Ruiz had previously made a system that would make our planes fly.He had a radio transformer which was hooked up to a post.At the top of the post was a device which would turn with the moving plane atached to the wire.

This was a great project Mr.Ruiz.Thank you.