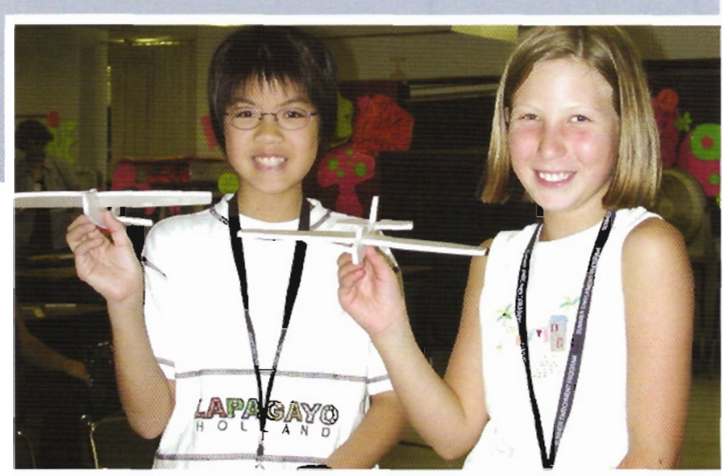
A Simple Cessna — For About 5 Cents, Your Class Can Be Introduced To The World Of Aviation

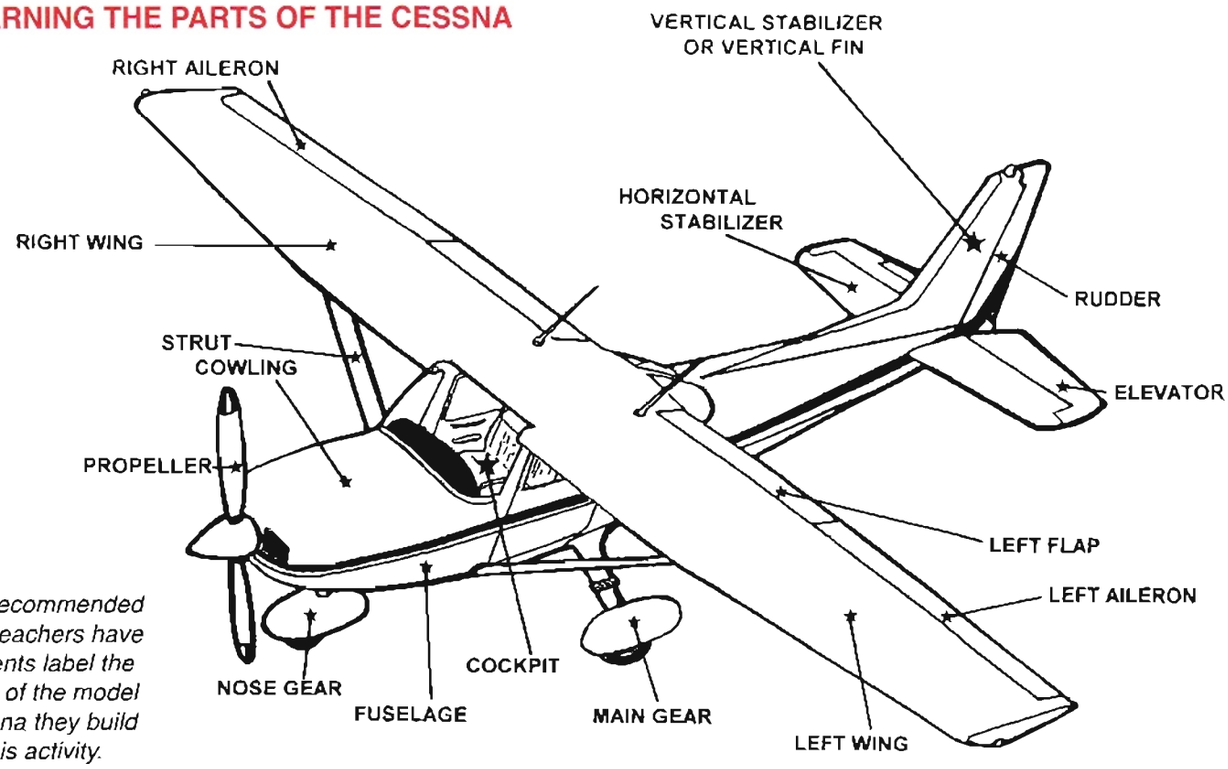
OBJECTIVE – To introduce students to the science of flight by building and flying a model of the legendary Cessna monoplane (one wing). The reason the Cessna is featured in this activity is not because it's a "hot" military fighter, or multi-passenger airliner, or exotic spacecraft; rather it is a very real, relatively simple flying machine that can be accessed and experienced by every child.

The Cessna 182 Skylane is used by the Civil Air Patrol for much of its air search and rescue mission.



Like the real one, a foam Cessna is simple, easy to fly and a starting point for many careers in aviation.

LEARNING THE PARTS OF THE CESSNA



It is recommended that teachers have students label the parts of the model Cessna they build for this activity.

NATIONAL STANDARDS

Science Standards:

Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Standard B: Physical Science
- Position and motion of objects

Standard E: Science and Technology
- Abilities of technological design
- Understanding about science and technology

Unifying Concepts and Processes
- Evidence, models, and explanation
- Form and function

Technology Standards:
- Understanding of the attributes of design.
- Understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
- Ability to apply the design process.

MATERIALS The instructor will need:

1. 30 template sheets
2. 30 foam meat trays
3. A separate area [table] dedicated to hot glue gun use
4. Six or more small hot glue guns
5. It is suggested that at least 15 utility snap-knives be provided

BACKGROUND

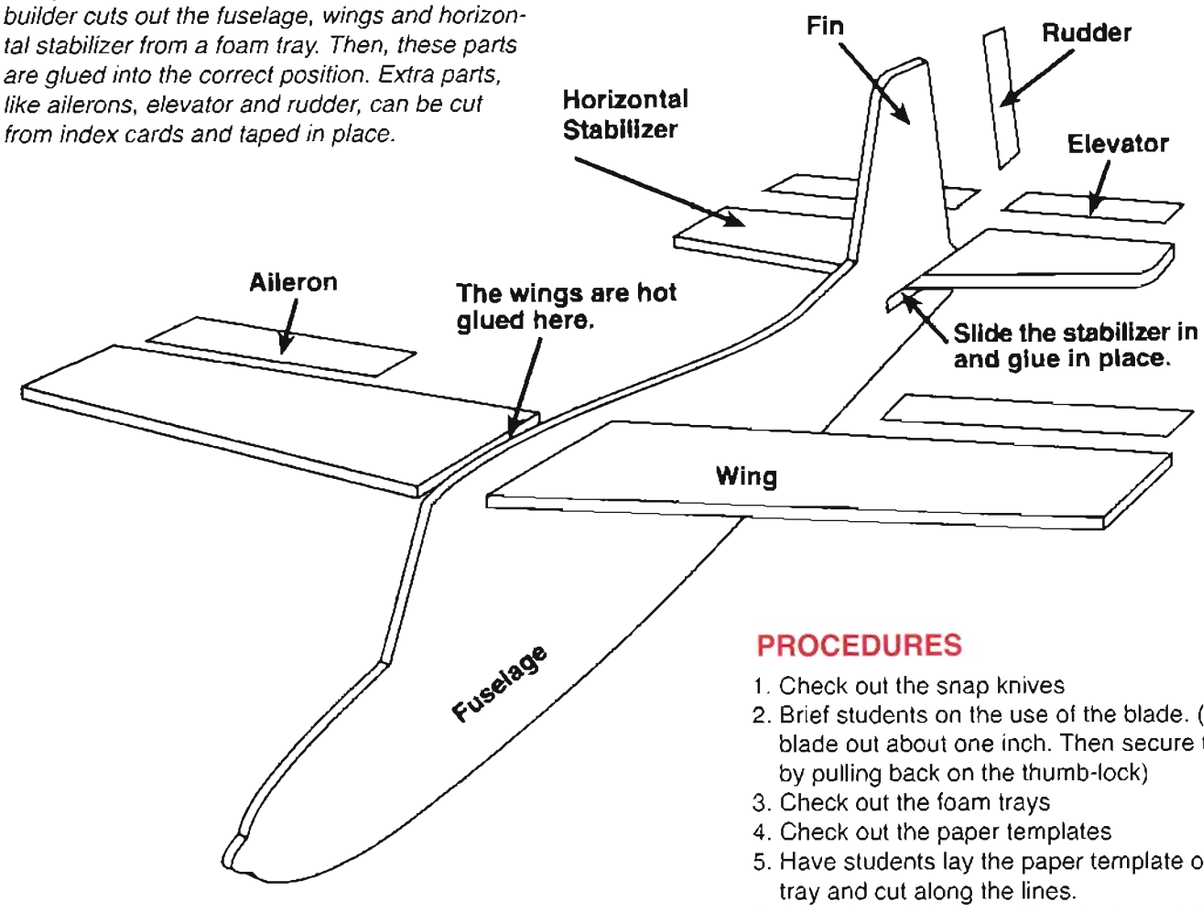
The name Cessna has been around since the 1920s and has become a benchmark in the world of general aviation. Cessna is a Wichita, Kansas company that was named after its founder, Clyde Cessna. In its manufacturing history, over 180,000 aircraft have been built. This means that half of all airplanes flying the world today are Cessnas! Cessna airplanes have been used to train more pilots than any other in history and one of their airplanes, the 172 Skyhawk, is the best-selling light plane of all time. More than 37,000 of them have been built. The little foam airplane that will be built in this activity looks very much like the Skyhawk, or its slightly larger brother, the 182 Skylane.

For about the cost of a tank of gasoline in the family automobile, a child can actually go flying in a Cessna. Parents are encouraged to take children to a local **fixed-base operator** (or FAA certified flying school) and make arrangements for what it called an "orientation flight." This experience will usually last between 30 to 60 minutes and in most cases, instructors will allow the child to take the controls and fly the airplane for a short time. It is an experience they will never forget.

Flight in a real Cessna is not an arcade game, nor is it some kind of a computer-generated virtual-reality simulator. It is a real machine capable of harnessing the energy of the atmosphere and the benefits it is has given mankind are incredible! The Cessna model in this activity is made from a foam meat tray. By using classroom-proven techniques, the child creates a little flying machine, which resembles the Cessna, has most of the parts of a real airplane, and best of all, it flies. The child will say, **"It's my airplane."**

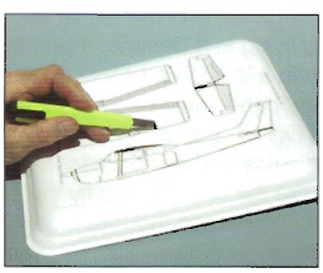
CONSTRUCTION DIAGRAM

Study this construction illustration first. The builder cuts out the fuselage, wings and horizontal stabilizer from a foam tray. Then, these parts are glued into the correct position. Extra parts, like ailerons, elevator and rudder, can be cut from index cards and taped in place.



PROCEDURES

1. Check out the snap knives
2. Brief students on the use of the blade. (push blade out about one inch. Then secure the blade by pulling back on the thumb-lock)
3. Check out the foam trays
4. Check out the paper templates
5. Have students lay the paper template on the foam tray and cut along the lines.
6. Sometimes it is better if students work in teams of two. Student A watches while student B cuts. This is a safety precaution and it seems to work well.
7. Once the parts are cut out, have students take them to the hot glue area for bonding.
8. First glue one wing in place.
9. Have students site the wing so that it is perfectly perpendicular to the fuselage.
10. Then, once the glue is set, have them glue the other wing in position making sure that it is in perfect alignment with first wing.
11. Finally, have them glue the horizontal stabilizer into position making sure that it is perpendicular to the fuselage. If these parts are aligned properly, the little model will fly better!



The template is first copied from this text. The next step is to place the template on a foam meat tray. Notice that the foam tray is slightly larger than the standard sheet of paper. This allows all parts to be cut out flat. The foam meat tray can be obtained from most meat markets.

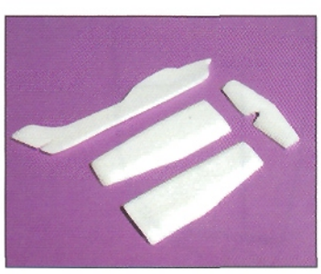
Teachers should assist younger children in the proper use of a snap knife. These knives are by far the safest, and foam is easy to cut, but accidents can happen. It is recommended that children work in teams, one can monitor while the other cuts out the parts. Notice also that the teacher has a cardboard flat under the work area. This keeps children from cutting the top of the table.

Once the parts have been cut from the foam tray, a sanding stick can be used to shape the parts. These are made of a wooden paint stirring stick and #100 dry sandpaper. The sandpaper is glued to the back of the stirring stick and allowed to dry. This procedure is discussed further in the WingTips section of the AEX booklet.

Experiment with the flight of your Cessna.

Change one variable at a time to see what affect it has on the airplane.

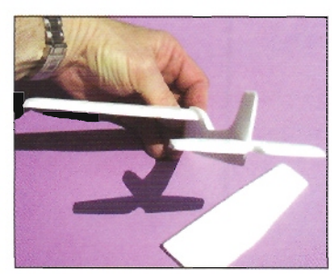
Trial #	Adjustment made	Results
1		
2		
3		
4		
5		
6		



This is what the parts look like when cut out and shaped with a sanding stick.

Using the components diagram shown above, students should label parts before assembly.

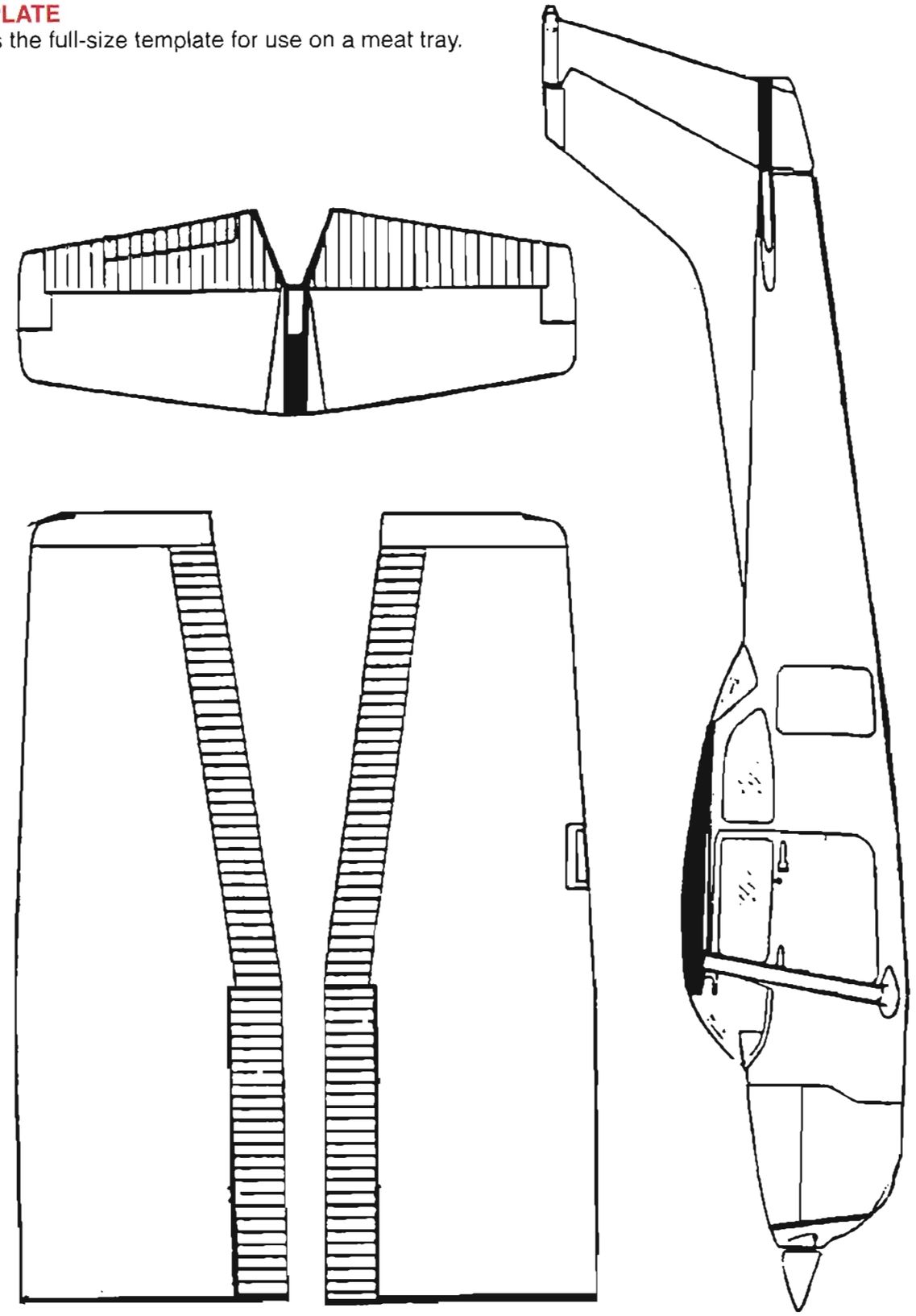
The components are hot glued into the position shown in the construction diagram.



To give the best flight characteristics, make sure students install wings and tail so that they are perpendicular to the fuselage. Note the alignment of the tail to the wing. This is how the real Cessna looks.

TEMPLATE

This is the full-size template for use on a meat tray.



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It is highly recommended that teachers take a completed airplane to the meat market to show managers what the class is doing with the tray. The teacher can also offer to hang the childrens' models in the market after the project is over. This tells the public that the manager is a supporter of science and technology education.

Notice the penny glued to the nose; this makes the model fly better. Shyh-harn Huang, a Summer Enrichment Program student from Taiwan, is ready to fly it from the balcony. This is her very first experience with aerospace education and she loves it! This is not just any airplane, it is her airplane!

ROCKET SCIENCE 101

Learning the language of airplanes and basic flight.

It is recommended that the teacher go over the parts of the airplane so students can learn the new "language." The airplane is totally different from, say, an automobile and learning the basic components of a Cessna will help establish a vocabulary base that applies to all aircraft.

The instructor can use the model airplane for building a working scientific and technological base for understanding flight. The little foam Cessna is a small flying machine. It can capture the energy of the environment to glide, turn, dive and climb. It should be pointed out that this model would react totally different on the surface of the moon, for instance.

The students should be taught how to make it glide long distances in a straight and level attitude. This may require slight changes in the wings and tail. Experimentation is encouraged.

Control surfaces [ailerons, elevator and rudder] can be added by using tape and pieces of filing card stock [see illustration].

Students should be encouraged to see how changes in the control surface settings change the flight characteristics of the Cessna.

This is a perfect example of Newton's Third Law of Motion. When a control surface is changed, this is the example of an "action." The reaction occurs during the flight.

The other Newtonian laws can be dramatically demonstrated using the simple teaching tool.

By carefully shaping the upper surface of the wing, Bernoulli's Principle can be taught. A hairdryer can be used as a "wind tunnel" to provide the "relative wind." When blown over one side of the wing, it will cause the airfoil to provide lift!

Teachers and AEOs are encouraged to have the students bring the Cessna during a field trip to a local airport. When a flight instructor, or other tour guide, is demonstrating the airplane to the students, parts of the model can be compared to the real one. This makes an indelible impression on the class.