AEROMODELING-AN AVIATION LEARNING EXPERIENCE

Historically, models have played an important role in the development of airplanes. Today, aeromodeling is a worldwide Air Sport which appeals to all ages.

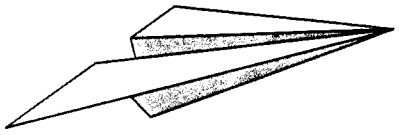
Even the simple paper gliders can offer a challenge and a hand-on learning experience for young people. They can explore the basics of flight and even have enjoyable flight competitions.

Millions of students have made and flown a variety of paper gliders and the simple rubber band powered B.M.F.A. or Delta Dart models. Both are shown in this file.

From this begining, a young person can move into aero-modeling activities which range from unpowered sailplanes, and finely crafted rubber band powered airplanes to those powered by very small gasoline engines. Radio controlled models become a higher level of challenge at much more expense.

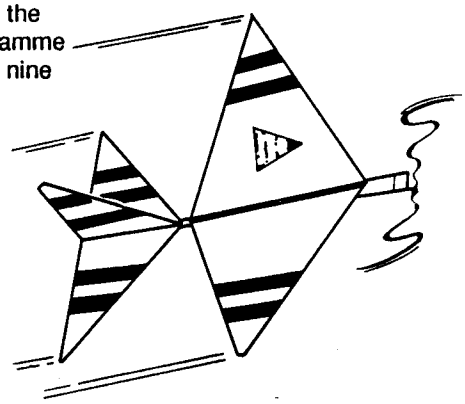
Numerous competitions are regularly held as local, national and international events with many categories available.

The material included in this file will offer a brief introduction to the simplest level of model flying which should appeal to the 8-12 year old young people.

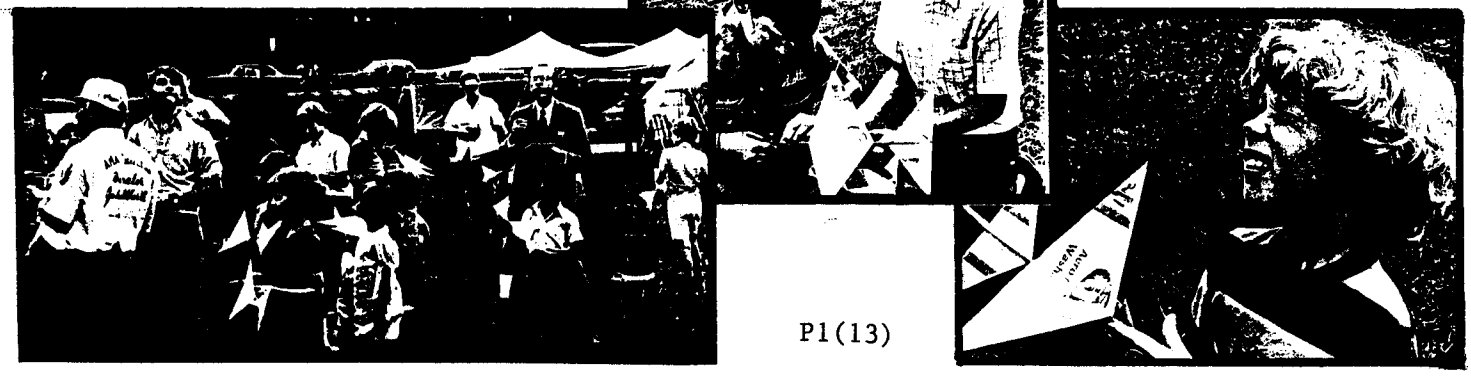


- Fold and fly paper airplanes, or construct balsa or foam gliders and fly them in the playground or gym. Have contests for the farthest distance flown. Discuss the action of the four forces, and how the control surfaces of the gliders affect flight (climb, stall, roll, etc.).

The **BMFA DART** ... Is a simple rubber powered aircraft with a wingspan of 30cm. It is derived from an American design. Millions have been successfully built and flown, in a sports hall or outdoors on a calm dry day. This model is the 'Corner Stone of the Education Programme it can be built by nine year old (under supervision) and upwards



A CLASS COMPETITION



BACK TO THE BASICS: PAPER AIRPLANES

OBJECTIVE

This time we are going to create an aerodynamic lesson around the paper airplane. This is not some wonderful new design, nor is it a glider that will go forever -- no, it's the basic dart-shaped airplane that you've been flying since way back when!

BACKGROUND

The first recorded "airplane" shape was a model built by Sir George Cayley. This forward-thinking Englishman started experimenting with gliders in 1789, at the age of 23. He is credited with the discovery of the forces of lift, drag and thrust. His "airplane" shape resulted from his recognition of the need for stability. Cayley observed birds soaring and this gave him the idea for a fixed-wing glider. In 1809, he published a scientific paper in which one sentence laid the foundation for all of modern aeronautics -- "The whole problem is confined within these limits, namely to make a surface support a given weight by the application of power to the resistance of air."

The delta configuration of this paper airplane stands at the leading edge of today's technology. Delta shaped military aircraft have been around since the fifties and the dart-shaped Concorde supersonic airliner still flies between the European continent and the United States. Even automobiles with their "cab-forward" design have a modified delta shape.

For this activity, we will take the classic delta-shaped paper glider and make it perform like a real one. By introducing aerodynamic control surfaces to the glider, it can be made to roll, pitch, yaw, stall, and land after making a very nice controlled descent. Amazing!

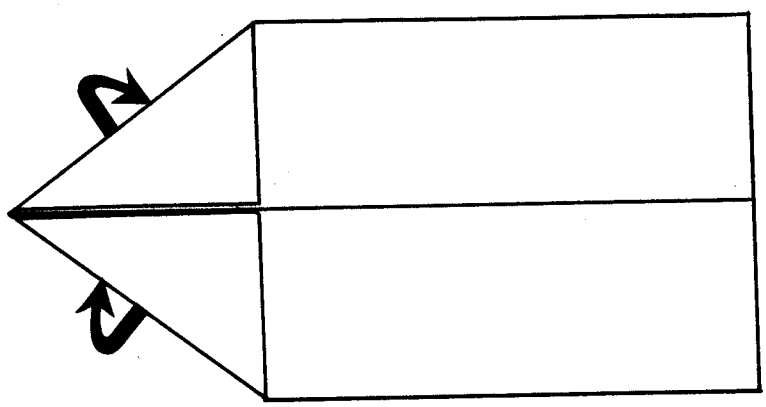
MATERIALS

1. A sheet of good quality paper – like typing or computer laser print bond.
2. A roll of masking tape.
3. A stapler.
4. A pencil or marking pen for labeling the glider.

PROCEDURE:

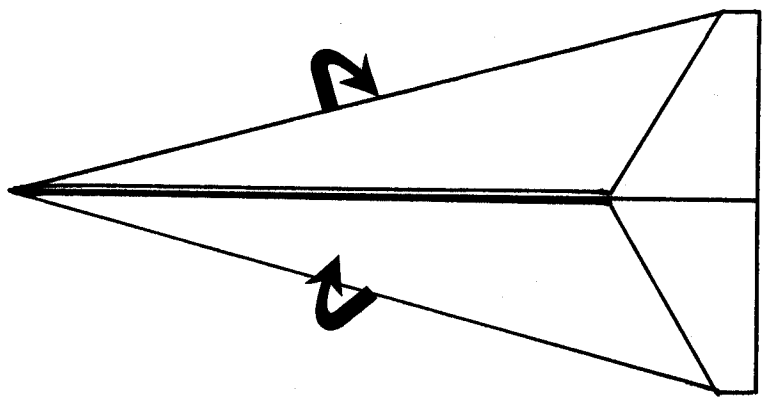
1. For a cadet squadron activity, it is necessary that everyone construct the same type of glider.
2. Using the illustration shown, fold a delta shaped paper airplane.

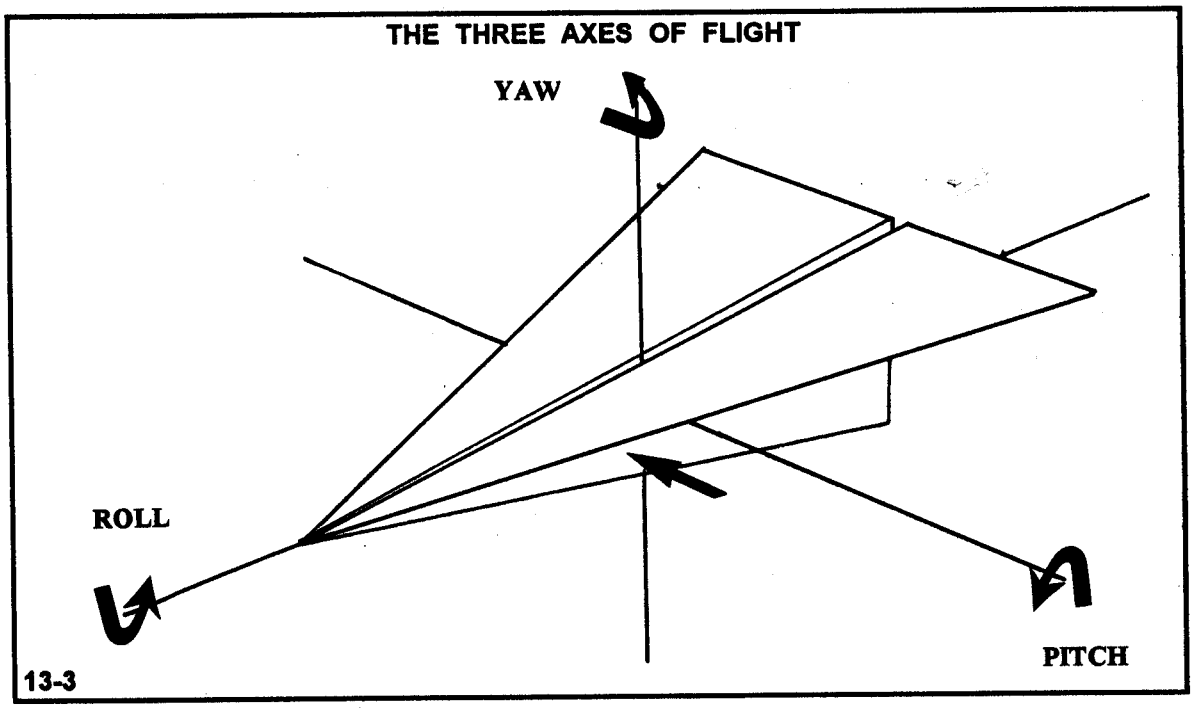
FIRST FOLD



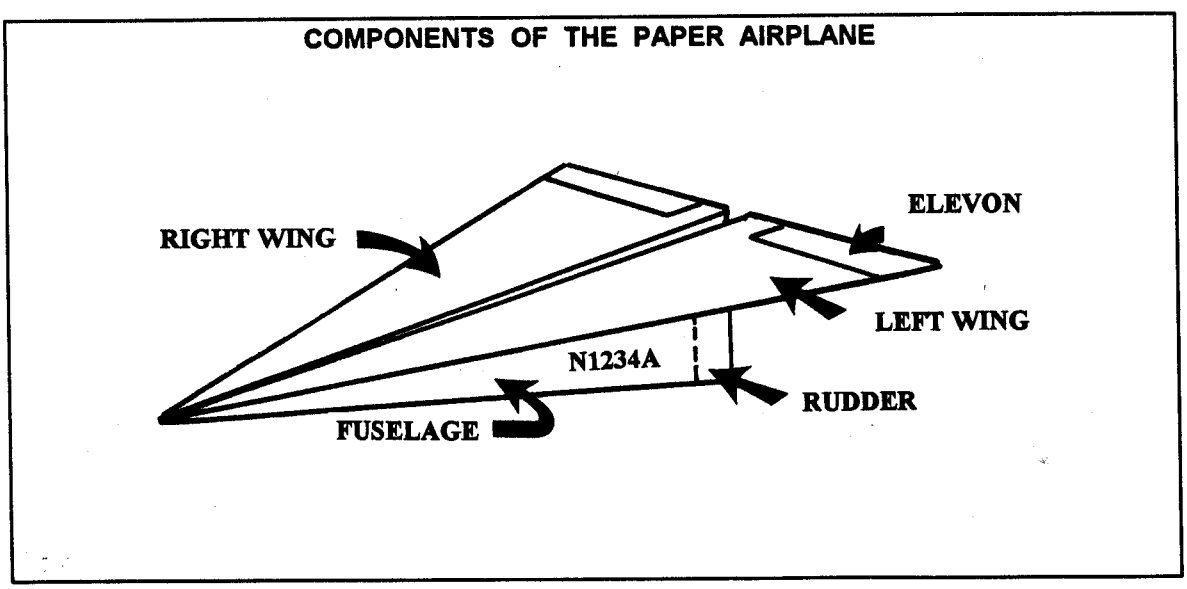
13-1

SECOND FOLD





3. Have the cadet put the folded airplane on their index finger to determine a point close to the center of gravity.
4. Just ahead of this point, have the cadet staple the fuselage sides together.
5. The cadet should now label these parts of the aircraft:
   a. Right wing
   b. Left wing
   c. Fuselage
   d. Rudder
   e. Elevons



6. The cadet should now choose a registration number. It should be pointed out that the registration should begin with an "N" for United States. (**N1234A**). Examples of registration numbers should be given.
7. A line should be made on the floor with a piece of masking tape. This line should parallel an area at least 30-50' long and 20-30' wide. This is going to be the flight test area. The tape line is the launch point.
8. Tell the cadet(s) to set their model up first by cutting (scissors) two 1" elevons on the back of the wing. These cuts will be inboard next to the fuselage.

9. **FLIGHT TEST**:

   a. Have each cadet set their airplane for a roll to the left. This is done by putting the left elevon up and the right one down.
   b. Let each demonstrate that they have done it correctly.
   c. Now have each cadet set their aircraft up for a stall. This is done by both elevons in the slight up position.
   d. Let each demonstrate.
   e. At a distance of about 15-20 feet from the launch line, make a "runway" using masking tape. The runway should be about 2 feet wide and 5 feet long.
   f. Tell the cadets to set their aircraft up for a straight line approach to a soft landing . . . within the lines of the runway.
   g. Let them practice several times to get just the right settings on the paper aircraft.
   h. Let each cadet demonstrate their glider and their skill at landing it.
   i. The final challenge is to get them to make the glider fly in a long sweeping turn.

SAFETY PRECAUTIONS

About the only thing you have to worry about with this activity is something getting knocked over or someone getting poked in the eye. There should be a safety officer monitoring the activity and it the cadets get rowdy, it should be halted.

MISCELLANEOUS

The cadets may complain and want to use their own design. Tell everyone that creativity will be a part of another activity. This one is for learning three basic outcomes: (1) nomenclature, (2) control, and (3) predictable flight maneuvers.

PAPER AIRPLANE DISTANCE DATA

TEST PILOT _____

MAKE 5 PAPER AIRPLANES. GIVE EACH OF THEM AN "N" NUMBER. PREDICT WHICH OF YOUR PLANES WILL FLY THE FARTHEST. LIST YOUR PREDICTIONS.

PREDICTION	PLANE'S "N" NO.	DISTANCE TRIAL 1	TRIAL 2	TRIAL 3	TOTAL	AVERAGE
1st						
2nd						
3rd						
4th						
5th						

MY BEST PLANE FOR DISTANCE IS _____.

GROUP DISTANCE COMPETITION

CHOOSE YOUR BEST PLANE FOR DISTANCE AND COMPETE WITH YOUR SQUADRON.

	PILOT	PLANE	DISTANCE TRIAL 1	TRIAL 2	TRIAL 3	TOTAL	AVERAGE
1.							
2.							
3.							
4.							
5.							
6.							

(BEST AVERAGE DISTANCE)

PILOT	PLANE	DISTANCE

(BEST DISTANCE)

PILOT	PLANE	DISTANCE

THE "I-DONT-BELIEVE-IT" LOOP AIRPLANE

OBJECTIVE

The idea here is build a flying machine that defies all of the known concepts of aerodynamics -- yet still flies quite well!

BACKGROUND

From the very beginning, man has had some pretty weird ideas of what a flying machine should look like. The idea was, ". . . if it looked like a bird, it had to fly." In the early nineteenth century, Sir George Cayley came up with a glider that had a remarkable resemblance to the aircraft of today. It had wings up front, a stick fuselage and both a vertical and horizontal "stabilizer" set up in back.

Other pioneers tried to build flying machines that would hop into the air; corkscrew into the air, or flap into the air. Unfortunately, few of these early machines were successful. As time marched on, it was the scientific method of postulating and testing that worked. Men like Samuel Langley, Otto Lilienthal, Octave Chanute, and the Wrights finally made it all come together. That doesn't mean, however, that the conventional wings, fuselage, and empennage shape is only way to fly. And this little oddity proves that point. Here's how:

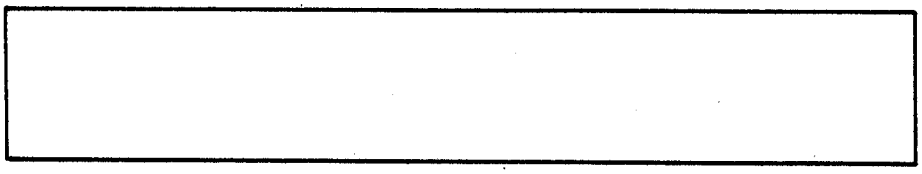
MATERIALS

1. You'll need some plastic soda straws like the fast food places have.
2. A sheet of plain paper will be needed.
3. To cut things out, you'll need scissors.
4. Household tape, like Scotch , will be used to bond the parts.
5. You'll need a ruler to correctly measure things.

PROCEDURE

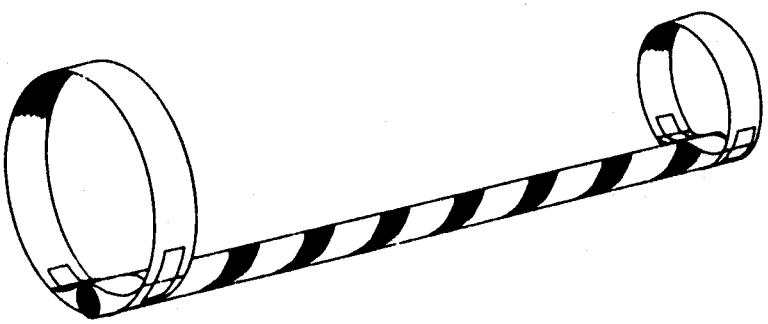
1. Make a loop out of strips of paper as shown in **34-1.**
2. Overlap the ends and tape them inside and outside of the loop.
3. Make it so the overlapped ends form a pocket.
4. Slip the loops over the straw, as shown in **34-2** and you're ready to fly.

LOOP TEMPLATE



34-1

THE FINISHED LOOP PLANE SHOULD LOOK LIKE THIS



34-2

DISCUSSION

The AEO should challenge cadets with questions like these:

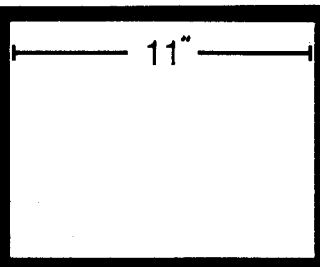
1. Where is the center of gravity on this glider?
2. Where is the best place to hold it when it is launched?
3. Does it make a difference that the straw is hollow?

CREDIT

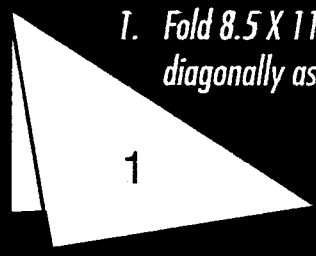
This concept was taken from a NASA aerospace education instructional activity on research aircraft.

Ring Wing Glider

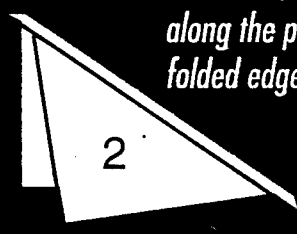
This wing demonstrates the great room there is for aeronautics innovation. Can you design a better wing?



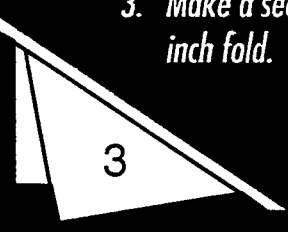
1. *Fold 8.5 X 11 inch paper diagonally as shown.*



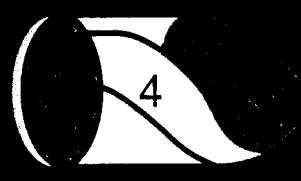
2. *Make a 1/2 inch fold along the previously folded edge.*



3. *Make a second 1/2 inch fold.*

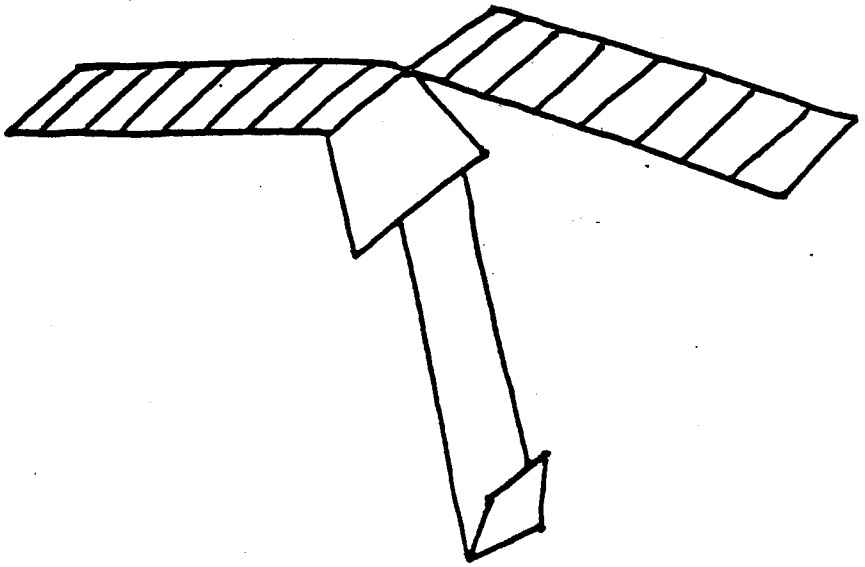


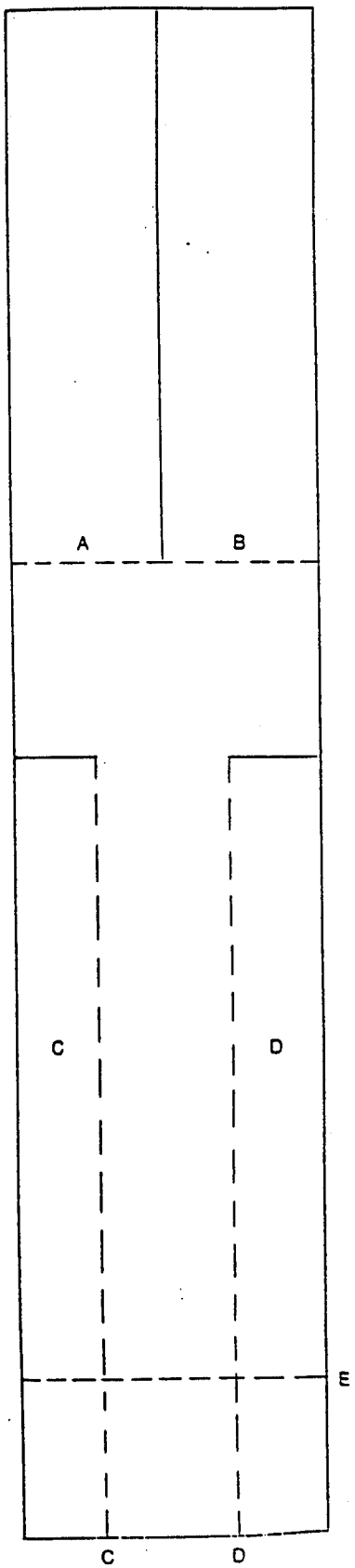
4. *Curl the ends of the paper to make a ring and tuck one end into the fold of the other.*



5. *Gently grasp the "V" between the two "crown points" with your thumb and index fingers and toss the glider lightly forward.*

PAPER HELICOPTER





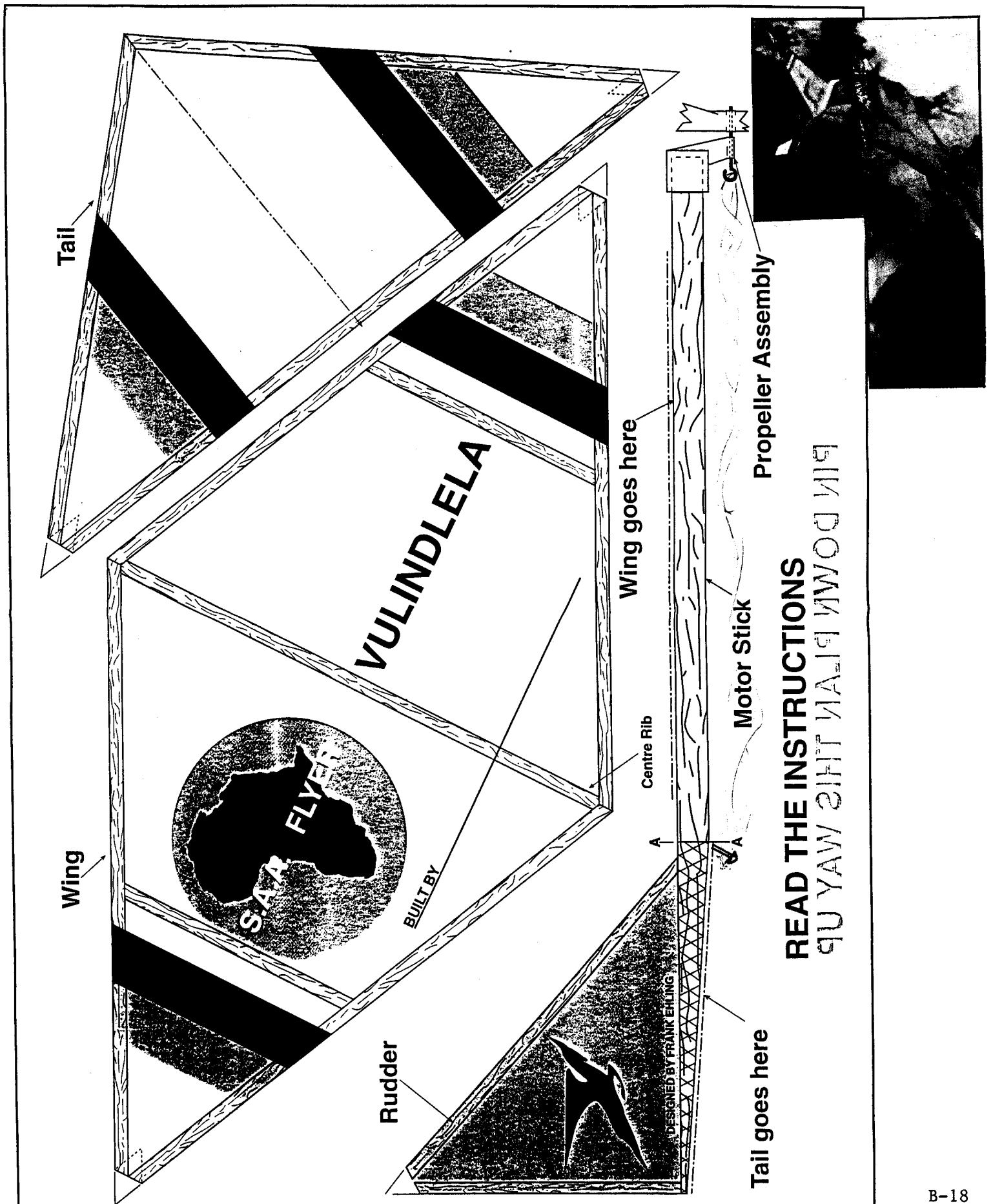
HELICOPTER: AN AIRCRAFT THAT DERIVES ITS LIFT FROM BLADES THAT ROTATE ABOUT AN APPROXIMATELY VERTICAL CENTRAL AXIS.

Instructions:

- Cut along all solid lines.
  Fold A forward. Fold B backward.
  Fold C in and overlap by folding D.
  After folding C and D fold up at E.
- Launch by dropping from high position.

BMFA DART TYPE MODEL EXAMPLE

TISSUE COVERED BALSA WOOD FRAME----RUBBER BAND POWERED



British Model Flying Association

EDUCATION PROGRAMME

B.M.F.A. Education Programme

A programme of modelling education within the National Curriculum.

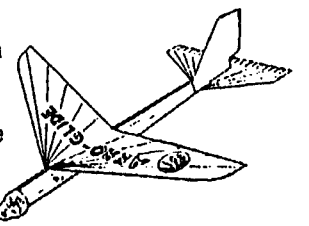
The BMFA Education Programme aims to encourage youngsters to build and fly model aircraft and so develop new skills and gain an insight into the science and technology of flight. The programme is constantly expanding and improving. The present range of kits is specially designed to improve the youngsters knowledge and skills as well as give improved flying performance. The kits are listed here from the simplest to the most complex. The programme can equally well be used by the Air Training Corps, Scouts, Guides and other groups to incorporate in to their training programmes.

The **BMFA TEACHERS GUIDE** is a 19 page booklet and is designed to familiarise the instructor or teacher with the basic theories of flight. It gives a short history of flight, shows different types of aircraft both full size and models and explains how an aircraft flies. The guide also suggests alternative activities and contains a glossary and bibliography.

BMFA MODEL KITS

The **BMFA SHORT TUCANO** ... This is a fast build card profile model glider, in full colour of the RAF primary turbo prop trainer. It has a wingspan of 18cm. It only requires a pair of scissors, a knife, and a glue stick or a tube of glue to make it.

The **AERO-GLIDE** ... This simple card and balsa glider has a wingspan of 20cm. and is designed specifically to be made without the use of a modelling knife. This model will fly better than the Tucano and can be built by 8 year old (under supervision) and upwards.



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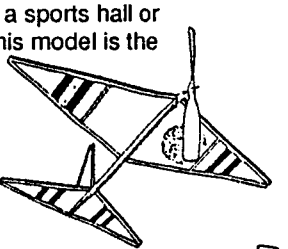
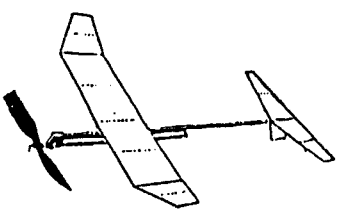
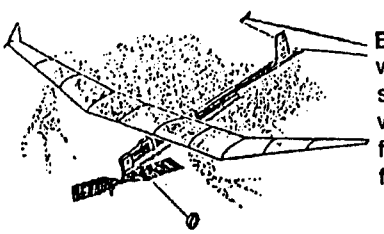


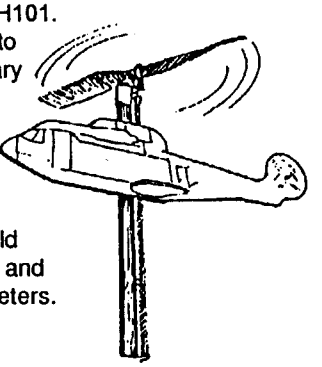
GYMINNIE CRICKET ... is a 38cm wingspan, rubber powered, model. It requires a little more skill to build than the BMFA DART but should give double the perfomance.





BMFA FROG ... is a 51cm wingspan model fitte with an undercarriage so it can take off from a smooth surface. The kit includes some printed wood to teach the builder how to cut out parts from sheet. It is recommended as a follow on from the GYMINNIE CRICKET.

The **BMFA HELICOPTER** is a profile scale, rubber powered model helicopter based on the Agusta/Westland EH101. It can be decorated to depict a naval, military or civil version. The rotor diameter (prop) is 15cm. and the overall length is 24cm. It is about as hard to build as the BMFA DART and can fly to over 10 meters.



FOR INFORMATION

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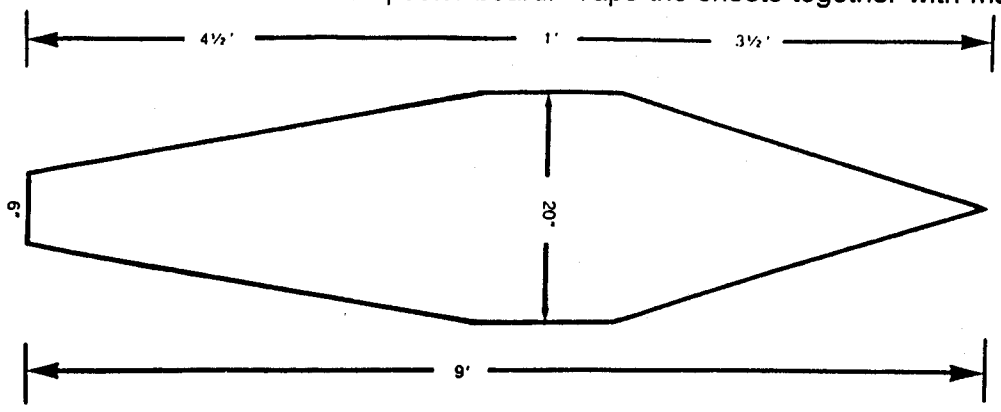
TISSUE PAPER HOT AIR BALLOONS

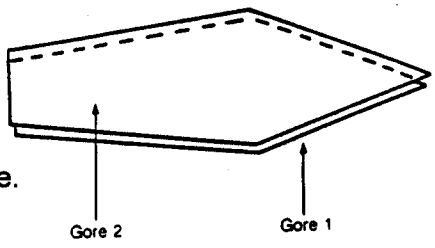
APPROXIMATE SIZE WHEN COMPLETED: 9 FEET TALL

1. Use poster board to make a template the size and dimensions shown in Figure 1. This requires four sheets of standard size poster board. Tape the sheets together with masking tape.



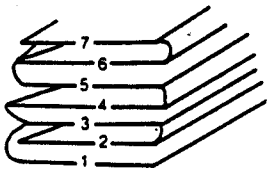
(FIG. 1)

2. Roll out ten sheets of tissue paper, each nine feet long, exactly on top of each other.
3. Lay the template, which represents one gore of the balloon, on top of the ten sheets of tissue paper and trace around the template.
4. Cut on the line so you cut through all ten gores at once.
5. Use markers to decorate the gores.
6. Stack all ten gores on top of each other as they originally were.
7. Refer to the gores as numbers 1 - 10, from top to bottom.



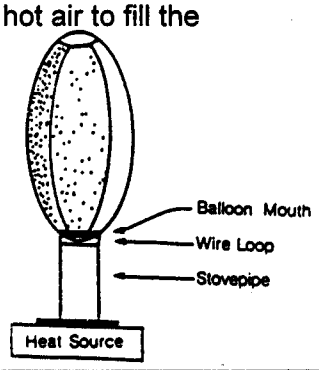
(FIG. 2)

8. Take gores 1 and 2. Lay gore 1 on top of gore 2 so that gore 2 sticks out about ½ inch along the edge of gore 1. [See figure 2.]
9. Use a glue stick and put glue on the edge of gore 2. Fold it up over gore 1 and make sure the seam is sealed.
10. Now move to the opposite side of the gores and have the edge of gore 3 stick out. Put glue stick on it and fold it up over gore 2. Be sure the seam is sealed.
11. Continue this procedure, moving side to side and always putting glue stick on the bottom gore and folding it up over the gore above it. [See figure 3.]



(FIG. 3)

12. Join the unglued edge of gore 1 with gore 10 and glue them together.
13. Use string to tie off the top of the balloon about 6 inches from the pointed end.
14. Use lightweight wire or hangers and make a hoop to fit inside the bottom of the balloon. Secure it with masking tape.
15. Hang the balloon from the ceiling and check for open seams or tears. Make repairs with scrap tissue and glue stick. Do not use tape for repairs as it adds weight to the balloon.
16. To launch the balloon, use a Coleman stove along with a 2-foot section of stove pipe. Place the bottom of the balloon just above the stove pipe and allow the hot air to fill the balloon. Count 5 . . . 4 . . . 3 . . . 2 . . .1 . . . LAUNCH! Allow the balloon to fly freely. [See figure 4.] **



** Cool, calm weather conditions work best for launching. You may tether the balloon if you wish, but it is not necessary. Launch them over and over for lots of high-flying fun!