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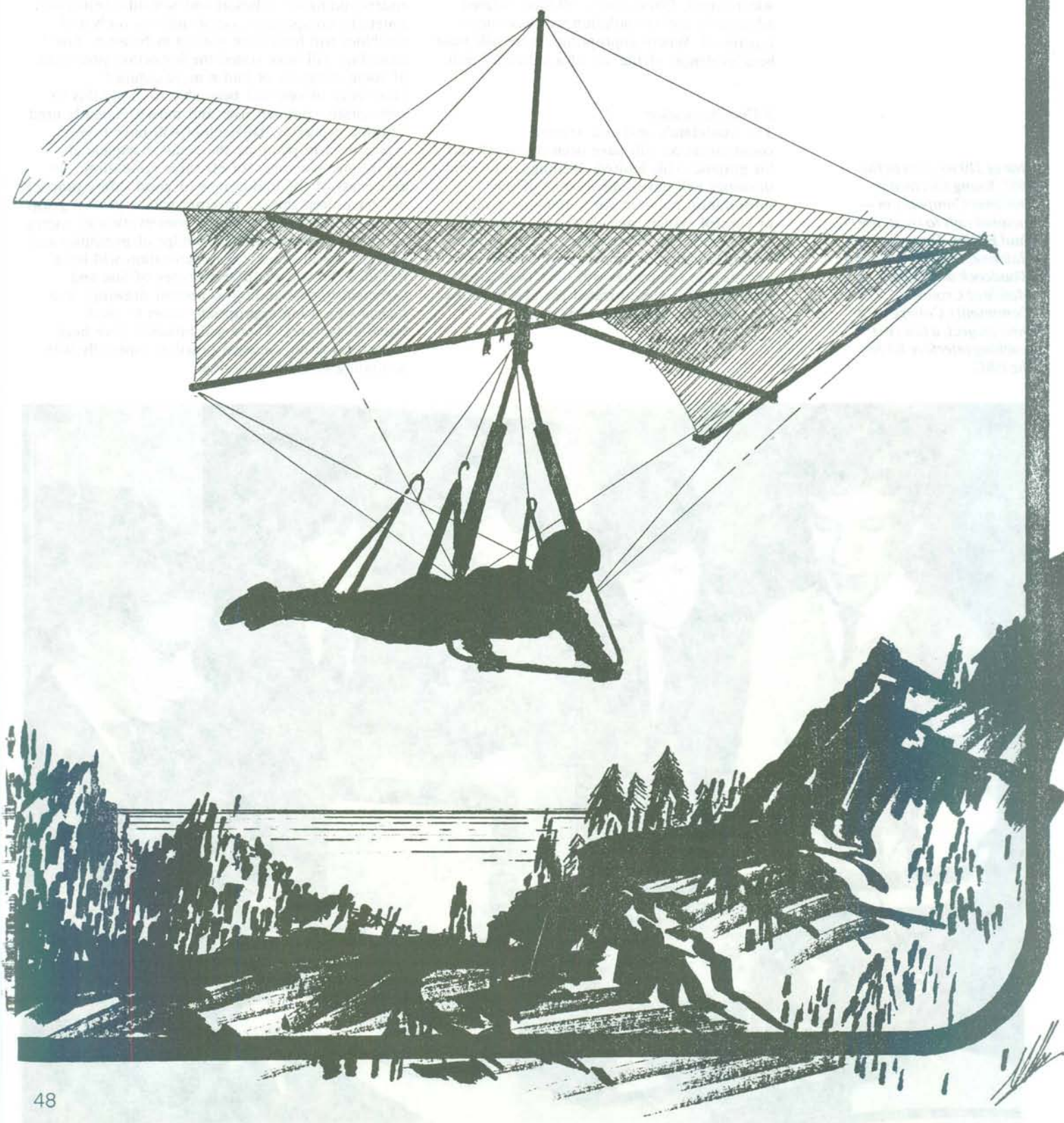
# Hang Gliders

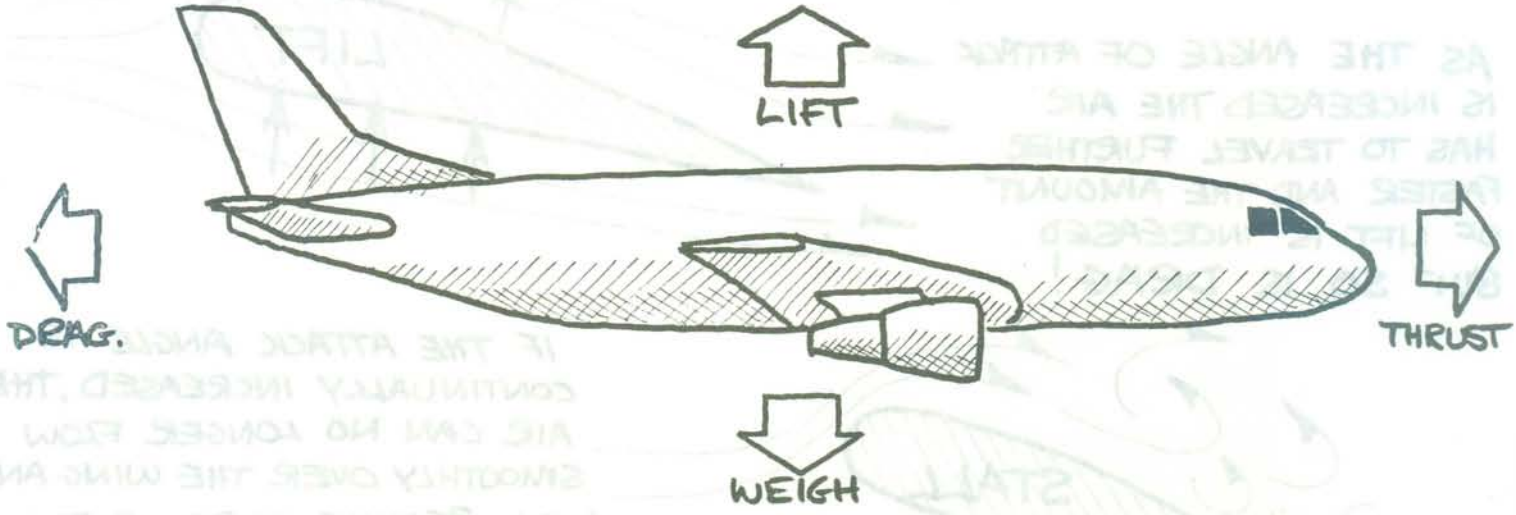


# A SCALE MODEL HANG GLIDER.

FOR THIS PROJECT YOU WILL BE ASKED TO DESIGN AND MAKE A SCALE MODEL HANGGLIDER. WHICH WILL FLY AND BE CAPABLE OF CARRYING A SMALL LOAD.

BEFORE CONTINUING IT IS IMPORTANT THAT WE UNDERSTAND HOW AN AIRCRAFT FLIES AND WHAT AFFECTS ITS FUNCTIONING.

## BASIC PRINCIPLES OF FLIGHT.




THERE ARE FOUR BASIC FORCES ACTING ON AN AIRCRAFT IN FLIGHT. THESE ARE: LIFT (FROM AIRFLOW OVER THE WINGS). THIS OVERCOMES WEIGHT (AIRCRAFT & PASSENGERS). DRAG (CAUSED BY THE RESISTANCE OF THE AIR) OPPOSED BY THRUST (FROM THE AIRCRAFTS ENGINES OR PULL OF GRAVITY.). WHEN THE AIRCRAFT IS FLYING STRAIGHT AND LEVEL THESE FORCES COUNTERBALANCE EACH OTHER.

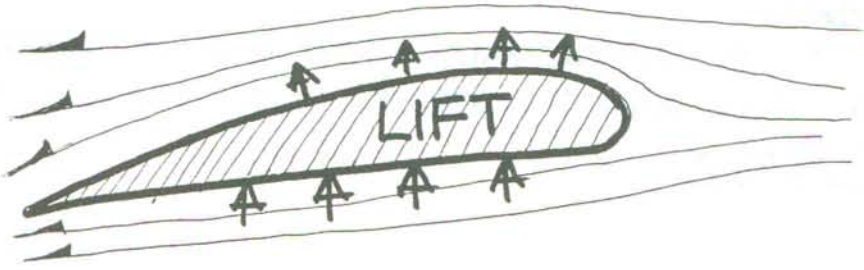
A WING CROSS.SECTION.

A WING IS REALLY CALLED AN AEROFOIL AND ITS SHAPE IS VERY IMPORTANT, CURVED ON TOP AND STRAIGHT UNDERNEATH.

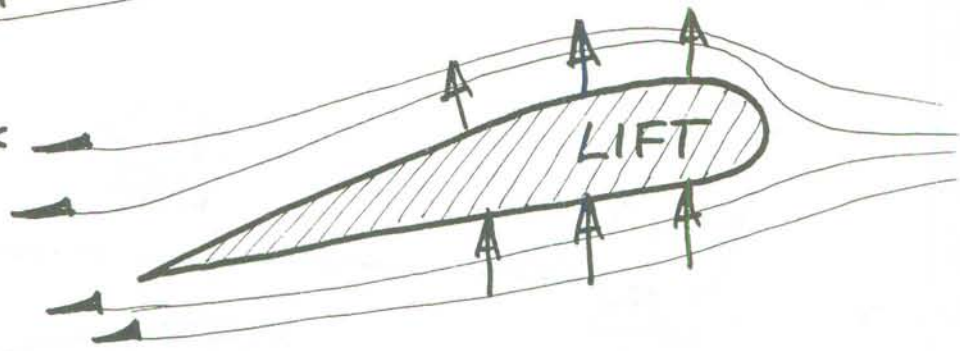
LIFT IS GENERATED BECAUSE THE AIR FLOWING OVER THE TOP OF THE WING HAS TO TRAVEL FASTER THAN THE AIR FLOWING UNDER THE WING. IT HAS TO TRAVEL FASTER BECAUSE OF THE CURVED SHAPE WHICH IS A LONGER ROUTE.

THE LAWS OF PHYSICS STATE THAT WHERE VELOCITY (SPEED) OF FLUID OR AIR IS HIGH, THE PRESSURE IS LOW.

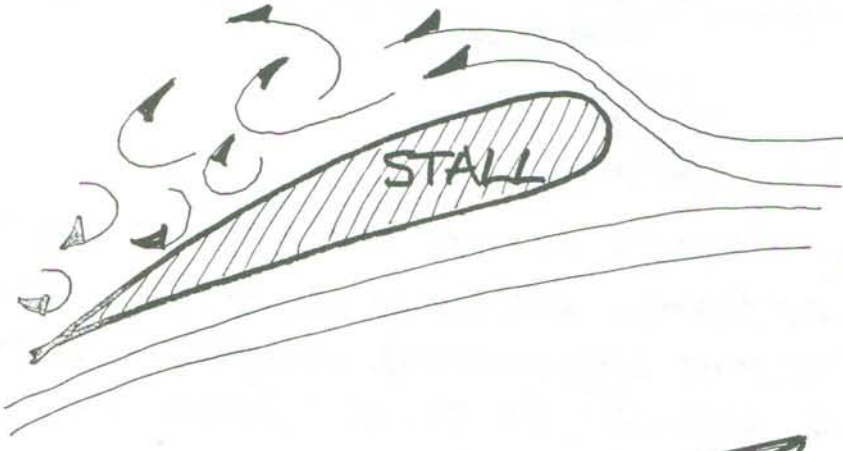
AND THAT WHERE VELOCITY IS LOW, PRESSURE IS HIGH.
WE CAN SEE THEN THAT THE TOP SURFACE OF THE WING IS SUCKING IT UP AND THAT THE BOTTOM (HIGH PRESSURE) IS PUSHING IT UP. THIS IS LIFT.



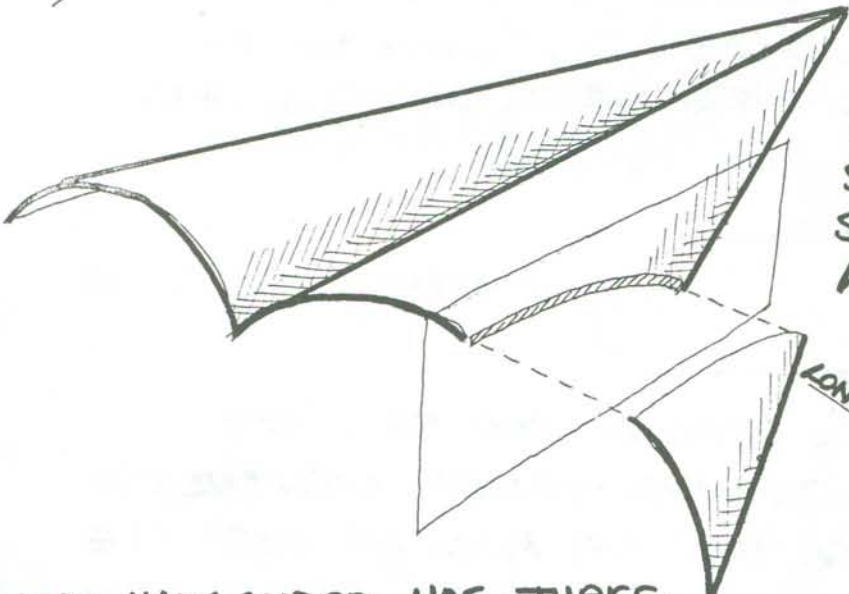

THIS DIAGRAM SHOWS A WING WITH NORMAL AIRFLOW AND LIFT.



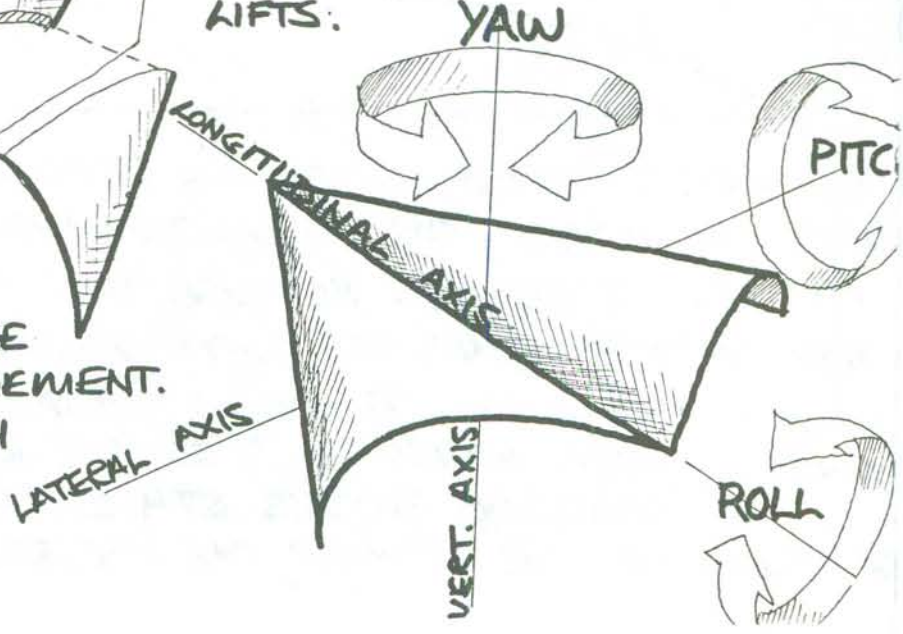

AS THE ANGLE OF ATTACK IS INCREASED THE AIR HAS TO TRAVEL FURTHER FASTER AND THE AMOUNT OF LIFT IS INCREASED BUT SO IS DRAG!




IF THE ATTACK ANGLE IS CONTINUALLY INCREASED, THE AIR CAN NO LONGER FLOW SMOOTHLY OVER THE WING AND WILL BECOME TURBULENT AND LIFT WILL BE LOST.



IF WE CUT THROUGH THE WING OF A HANGGLIDER WE CAN SEE THE CURVED SHAPE OF THE WINGS TOP SURFACE, THIS IS WHY IT LIFTS.




THE HANGGLIDER HAS THREE SEPERATEE PLANES OF MOVEMENT. YAW, PITCH AND ROLL WHICH TAKE PLACE AROUND THREE AXES, VERTICAL, LATERAL AND LONGITUDINAL.

THE HANG GLIDER WING IS CALLED A 'ROGALLO' WING BY HANG GLIDER ENTHUSIASTS, AFTER ITS INVENTOR FRANCIS M. ROGALLO WHO PATENTED HIS INVENTION 'AN AIRCRAFT WITH FLEXIBLE WINGS' IN 1948. N.A.S.A HAS SPENT A GREAT DEAL OF MONEY PERFECTING THE ROGALLO WING FOR USE WITH SPACE ROCKETS TO BRING THE ASTRONAUTS BACK TO EARTH SAFELY.

## THE MODEL HANGLIDER.

WHEN IT IS FINISHED WE WILL FLY IT, SEE HOW WELL IT FLIES AND HOW MUCH WEIGHT IT CAN CARRY. BUT FIRST.....

## BRIEF:

1/ DESIGN AND MAKE A MODEL HANGLIDER, USING AS A BASIS THE PLAN AND MEASUREMENTS INCLUDED ON THIS SHEET.

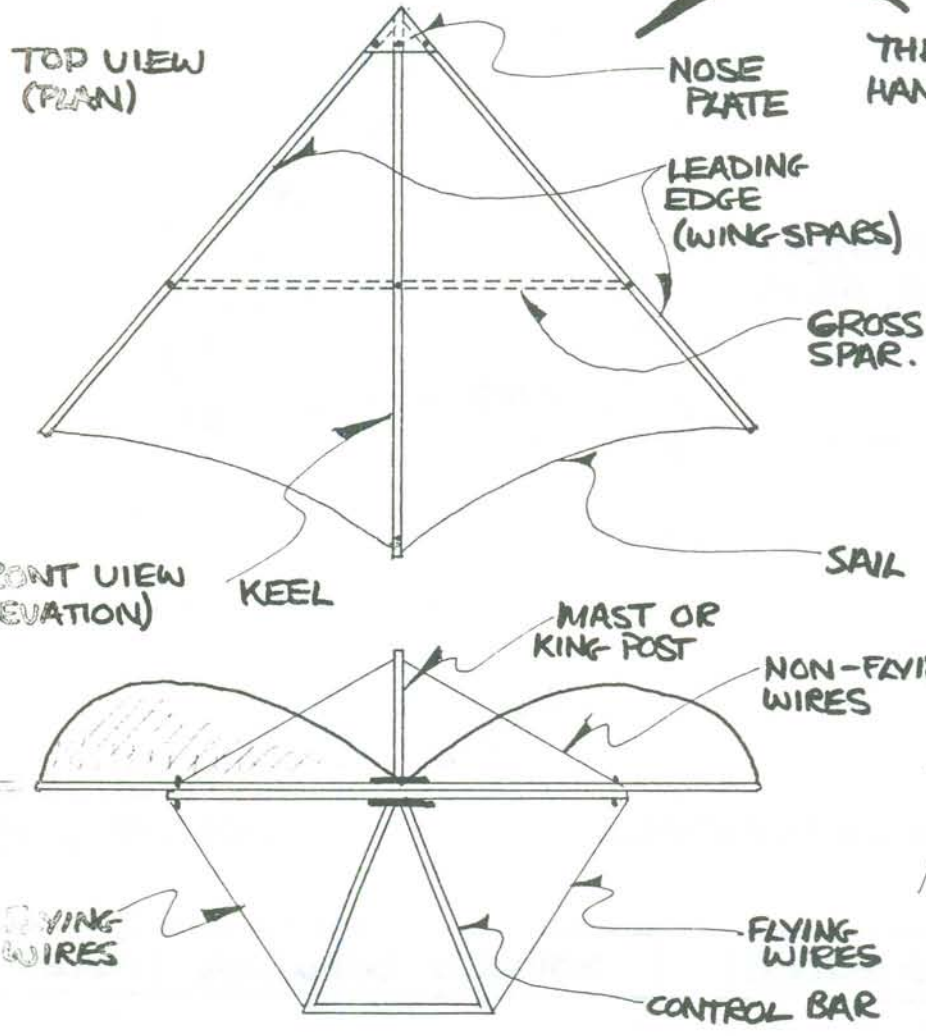
2/. YOUR GLIDER SHOULD BE BRIGHTLY COLOURED SO THAT IT CAN BE EASILY SEEN FROM A DISTANCE! DESIGN SOME GRAPHIC DECORATION FOR IT.

3/ YOUR DESIGN SHOULD USE A SQUARE OF PLASTIC ABOUT 800 mm SQUARE FOR THE SAIL, AND TIMBER SPARS CUT TO SIZE. OTHER MATERIALS ARE UP TO YOU!

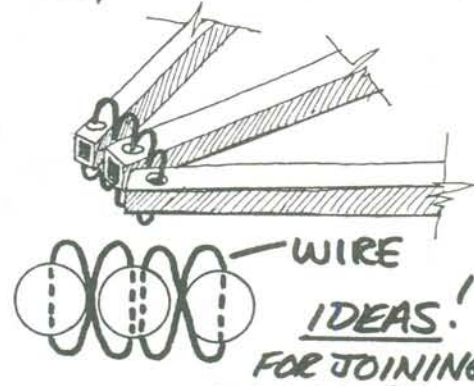
4/. TRY TO THINK OF SOME METHOD OF JOINING THE SPARS TOGETHER AND FASTENING THE PLASTIC SAIL TO THESE. COULD YOU MAKE IT COLLAPSIBLE FOR TRANSPORTATION?

5/ THE GLIDER SHOULD BE AS LIGHT AS POSSIBLE, REMEMBER THIS!

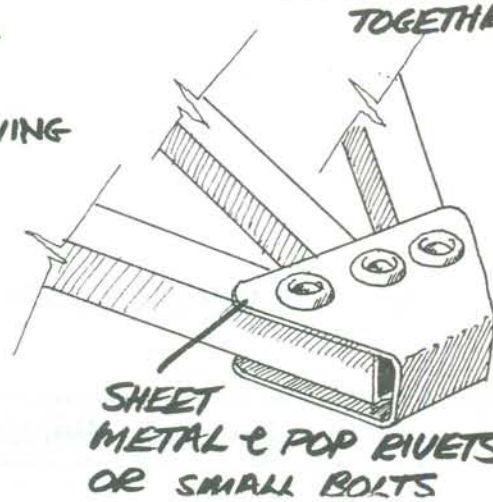
6/ COULD IT BE POWERED, OR TETHERED TO USE LIKE A KITE?



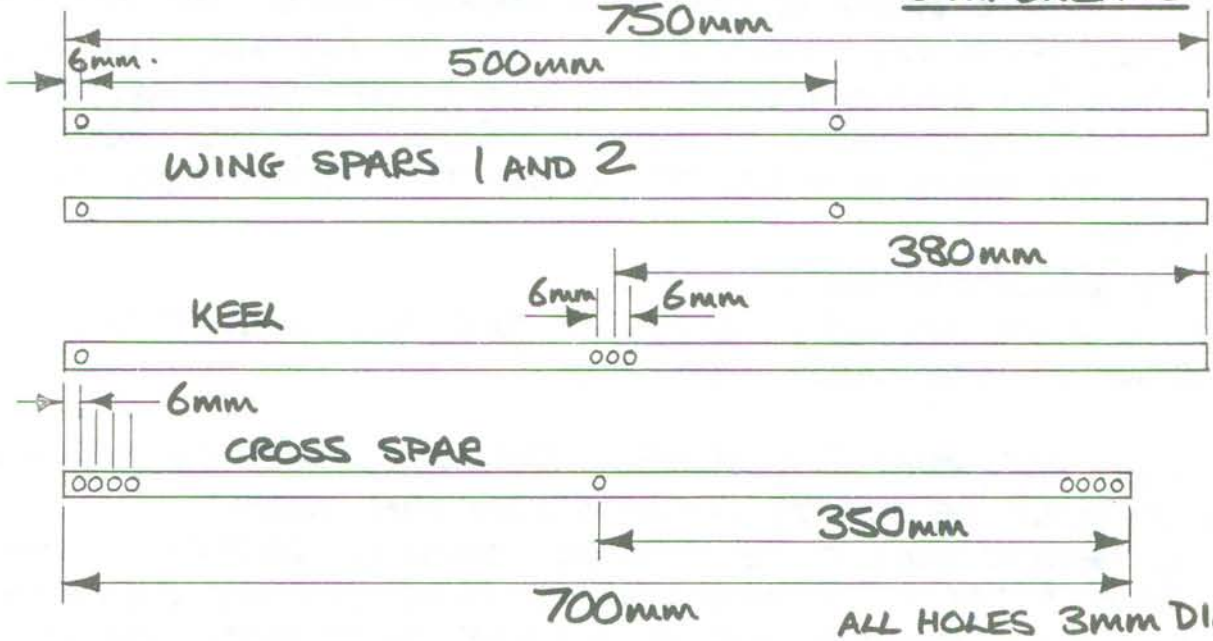

THIS DIAGRAM NAMES THE IMPORTANT PARTS OF THE HANGGLIDER, TRY TO USE THEM.




IDEAS! FOR JOINING NOSE SPARS TOGETHER.

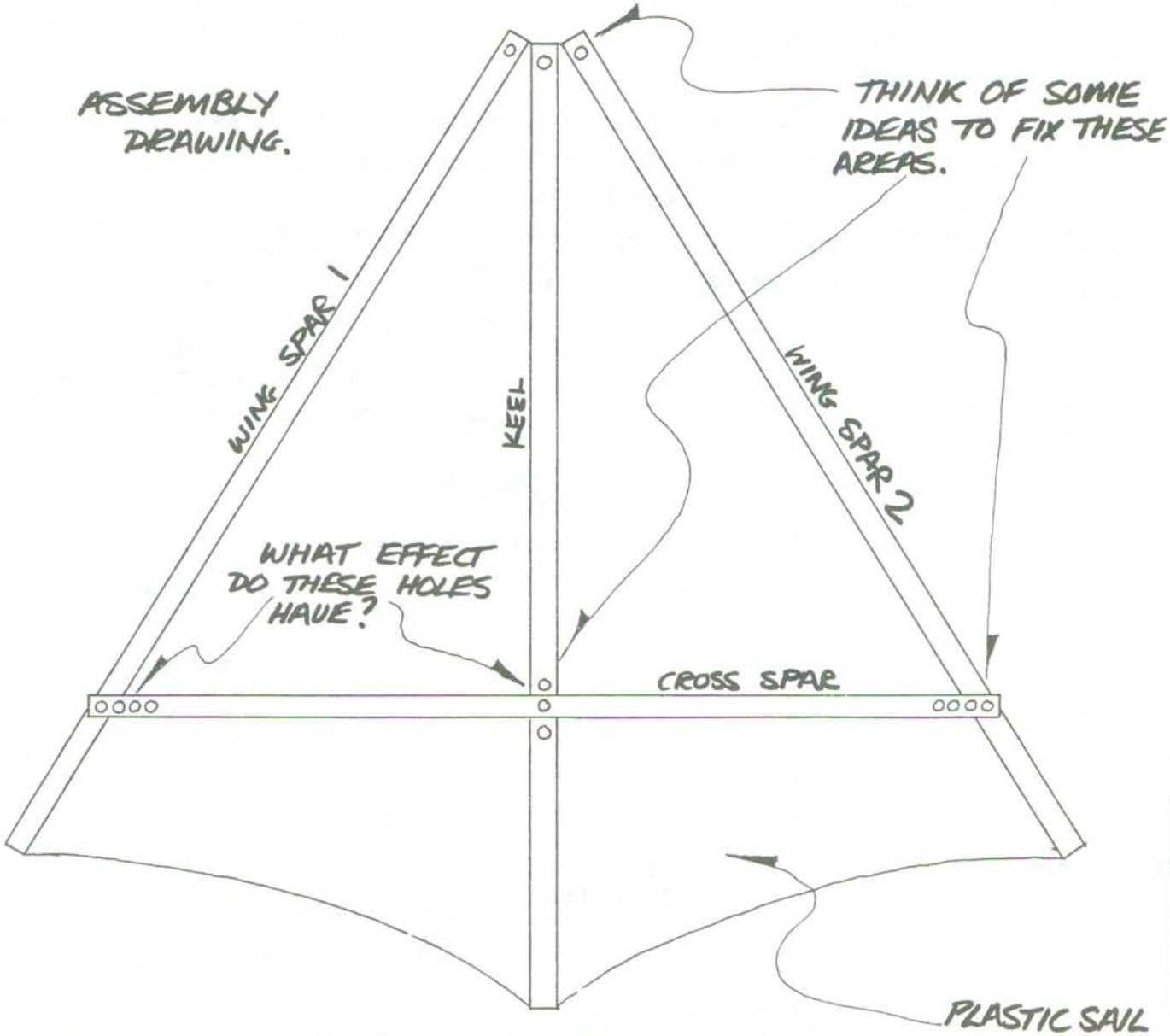


## COMPONENTS




ALL HOLES 3mm DIAMETER.

ASSEMBLY DRAWING.




ALL DIMENSIONS IN MILLIMETRES

| A SCALE MODEL HANG GLIDER | WORKING DRAWING | SCALE 1:5. |
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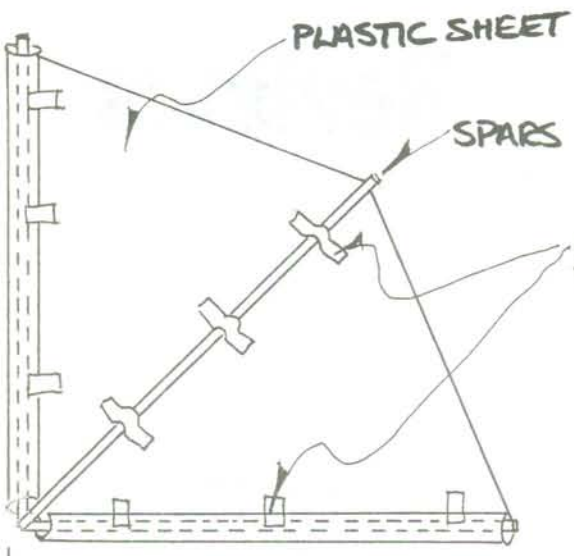
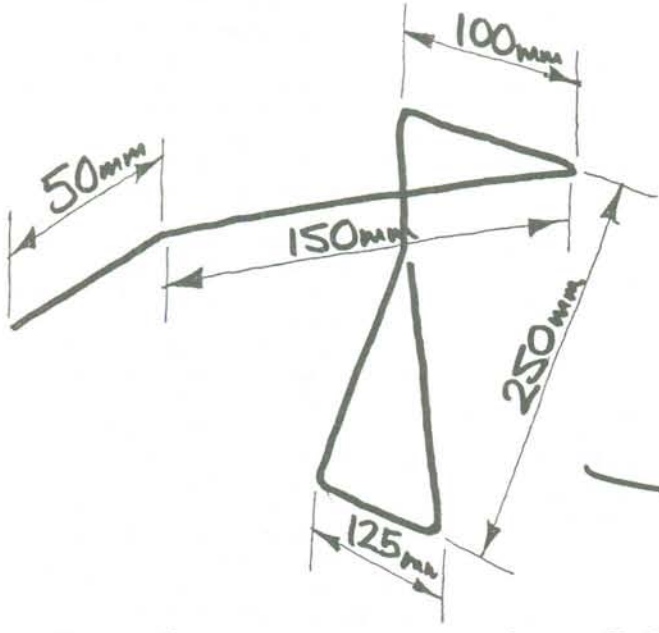


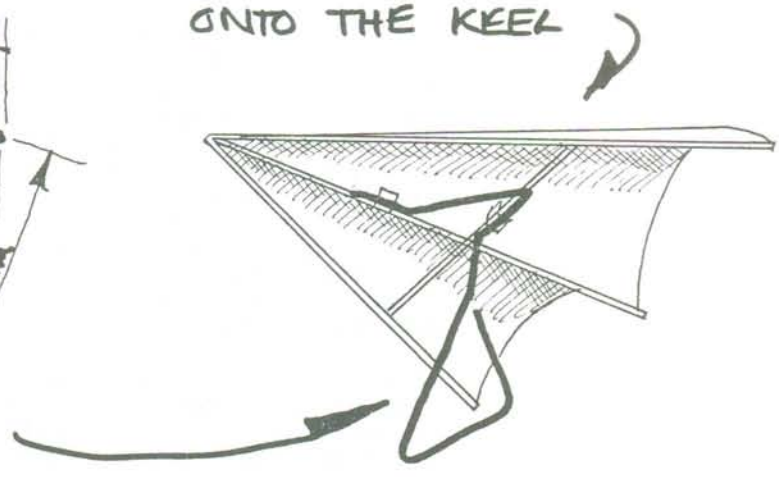

WITH THE SPARS LAID OUT ON THE PLASTIC, THEY ARE PLACED AT 90° WITH THE KEEL IN THE MIDDLE (MAKE SURE THIS IS RIGHT!). THE PLASTIC SHEET IS NOW FOLDED ROUND THE WING SPARS AND TAPED IN PLACE, NOW THE KEEL IS TAPE IN THE MIDDLE.

THE WING IS FINISHED!!

90°

NOW WE NEED A CONTROL BAR.
THIS CAN BE MADE FROM A WIRE COATHANGER.
IT IS THEN EASILY TAPED ONTO THE KEEL



YOUR GLIDER IS NOW READY FOR ITS MAIDEN FLIGHT! ADD A $\frac{1}{2}$LB WEIGHT OR DOLL TO THE CROSS BAR.

FLYING NOTES

IT IS BEST TO LAUNCH THE MODEL FROM A HILL, FACING THE WIND. LET THE WIND FILL THE SAIL AND LAUNCH YOUR MODEL WITH A SMOOTH HORIZONTAL ACTION.

IF IT DIVES INTO THE GROUND BEND THE CONTROL BAR TOWARDS THE REAR OF THE MODEL:

IF IT REARS UP AND STALLS PUSH THE BAR TOWARDS THE NOSE.

IF IT TENDS TO FLY TO ONE SIDE BEND THE WIRE TOWARDS THE OTHER SIDE.

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NOW TRY MAKING ADJUSTMENTS USING THE HOLES IN THE SPARS, SEE WHAT EFFECTS THESE HAVE.

MAKE NOTES ON YOUR RESULTS.