


THE KLUTZ BOOK OF PAPER AIRPLANES


















scanned by
VAKA66



 by Doug Stillinger

the planes

	TYPE	TIME ALOFT seconds	DISTANCE feet (meters)	FLIGHT SPEED	LAUNCH SPEED	FOLDS	FLY ZONE	DIFFICULTY 1= easy, 5= hard
Nakamura Lock	 Dart/ Glider	9.4	80 (24.5)	Slow	Soft	10	 Indoor	1
Spy Plane	 Glider	10.8	28 (8.5)	Medium	Hard	11	 outdoor	1
Swashbuckler	 Stunt	12.5	50 (15)	Medium	Normal	10	Indoor or outdoor	2
Headhunter	 Dart	3.3	68 (20.5)	Fast	Normal	15	 Indoor	3
The Hammer	 Dart	4.8	102 (31)	Very Fast	Very Hard	15	Indoor or outdoor	5
Pteroplane	 Stunt	5.6	35 (10.5)	Medium	Hard	14	 outdoor	4
The Professional	 Dart/ Stunt/ Glider	6.5	71 (21.5)	Fast	Hard	11	Indoor or outdoor	2
Flying Ninja	 Stunt	10.2	33 (10)	Medium	Normal	12	Indoor or outdoor	4
Space Cruiser	 Glider	6.1	48 (14.5)	Very Slow	Very Soft	13	 Indoor	4
The Hurricane	 Toy	3.5	28 (8.5)	Slow	Soft	4	Indoor or outdoor	3

THE KLUTZ BOOK OF PAPER AIRPLANES

Three white paper airplanes are shown in flight against a deep blue background. The largest airplane is in the foreground, angled towards the bottom left. Two smaller airplanes are positioned higher and further back, one towards the top right and another slightly below it. White dashed lines, resembling flight paths or orbital trajectories, curve across the scene. A small white circle with a crosshair is visible on the right side of the image.

 by Doug Stillinger
KLUTZ.

KLUTZ creates activity books and other great stuff for kids ages 3 to 103. We began our corporate life in 1977 in a garage we shared with a Chevrolet Impala. Although we've outgrown that first office, Klutz galactic headquarters remains in Palo Alto, California, and we're still staffed entirely by real human beings. For those of you who collect mission statements, here's ours:



WRITE US

We would love to hear your comments regarding this or any of our books. We have many!

KLUTZ

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www.klutz.com



the planes



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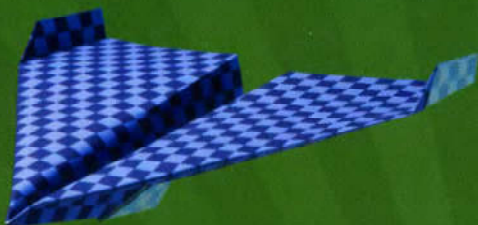
26 HEADHUNTER



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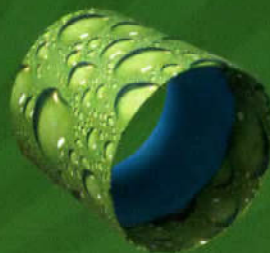
40 THE PROFESSIONAL



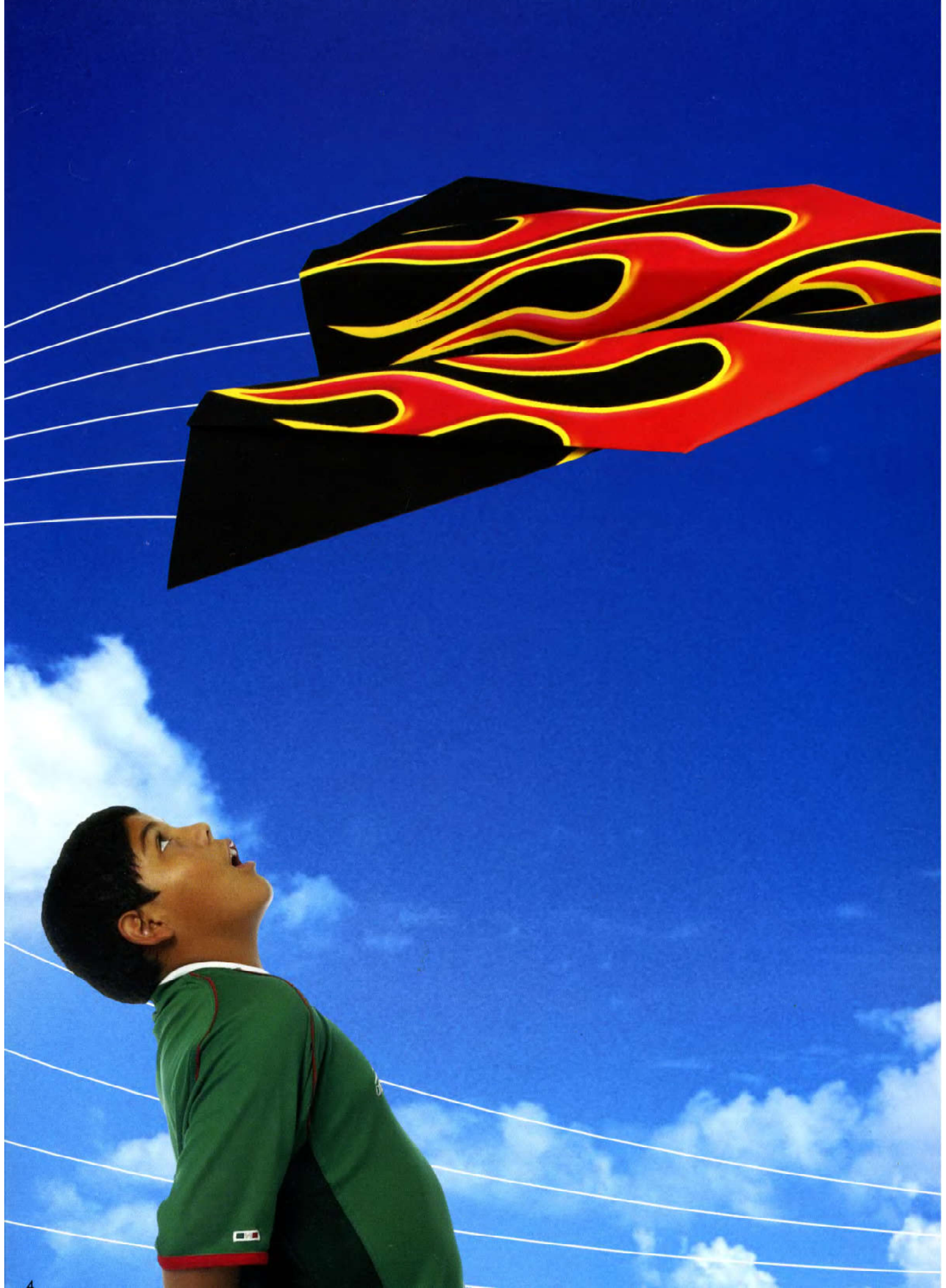
46 FLYING NINJA



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54 THE HURRICANE





forget everything you know about paper airplanes!

These aren't paper toys. And they're only technically paper airplanes. These are high performance, blow-the-competition-away flying paper machines.

The ten planes in this book are for people who think they've seen a good paper plane or two. They're for the hard to impress, the playground veterans — the kid at the next desk who thinks he and his plane will get sent to the principal's office first. These are the planes that can prove him wrong.

MATERIALS

All you need to make every plane in this book is a pair of hands, a smooth surface and a piece of paper.

Use 8½ x 11-inch (21.6 x 27.9-cm) paper with no cuts, tears or holes in it. The pad in the back of this book is full of flight-tested, ready-to-fold paper. If you run out, both photocopy and printer paper make a fine plane. Regular binder paper, with lines and three holes, is not flightworthy. We don't recommend it.

read this page!

If you skip this page, your planes won't work. It's that simple.



1

MAKE GREAT FOLDS

Great planes start with great folding. Take your time and put the paper exactly where it needs to be. Perfect folding will save a bad throw, but no throw in the world will save sloppy folding.

EXACT FOLDS
WILL FLY



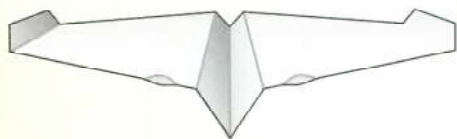
SLOPPY FOLDS
WON'T FLY



2

CHECK SYMMETRY

Every plane in this book is the same on both sides. The left wing is always a mirror image of the right wing. If you fold your plane so that one side is even the tiniest bit different from the other side, your plane won't fly straight, if it flies at all. The golden rule is this: *If you make a mistake, make the exact same mistake on the other side.*



THIS PLANE FLIES GREAT



The difference
is symmetry.
Look carefully.



THIS PLANE CRASHES GREAT



3

THROW IT EASY

Make your first few throws light and breezy. No matter how good your folding is, we guarantee that your plane's maiden flight will also be its maiden crash. Once you get it flying okay, then you can open up and haul off.

4

TOSS, CHECK & TWEAK

If you make your plane and it doesn't fly great right off (and it won't), you'll need to tweak the wings. **After every throw,** →

check:

1. Symmetry
2. The Dihedral (Wing Angle) (see page 9)
3. Elevators and Ailerons (see page 9)

A WELL-FOLDED AIRPLANE THAT HAS BEEN TESTED AND TWEAKED WILL FLY LIKE THIS...



A WELL-FOLDED PLANE THAT HASN'T BEEN TESTED AND TWEAKED WILL PROBABLY FLY LIKE THIS...

DOWN...DOWN...DOWN...



5

IF ALL ELSE FAILS, FOLD ANOTHER

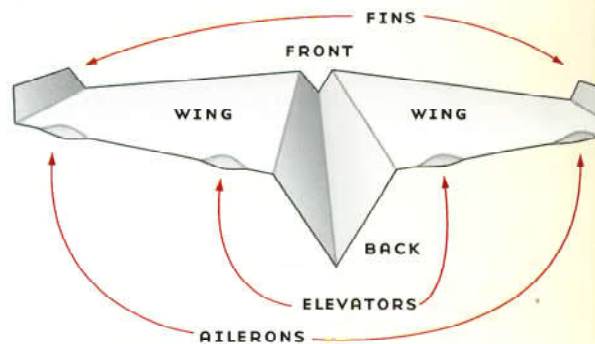
Some planes look perfect but, no matter how much you fuss, they just won't fly. Our advice? Grab another sheet and make a new one.

Stare at your plane, right down the middle. Make sure it looks the same on both sides and that the wings are angled upward.



folding and

Great folding makes a plane fly great. Sloppy folding makes a big, flightless mess. Take your time and fold carefully and exactly.



tweaking

1

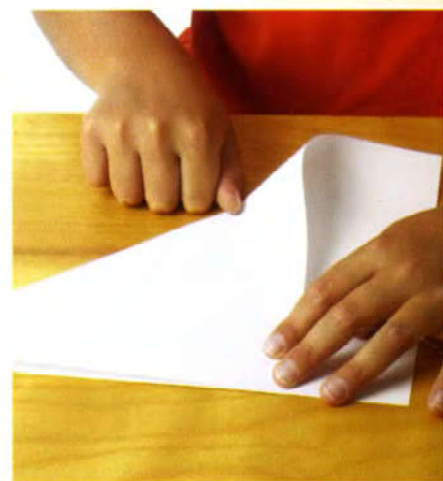
EDGE-TO-EDGE, CORNER-TO-CORNER

Almost every fold in this book is an edge-to-edge, corner-to-corner or edge-to-crease fold. When you're making these folds, put each edge or corner precisely where it's supposed to go. Even near-misses, if there are enough of them, will ruin a plane.

2

CREASE WELL

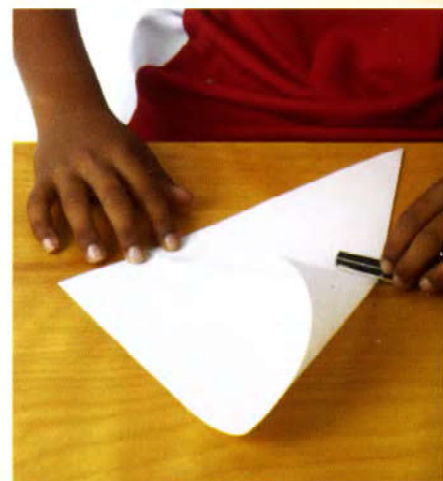
With every fold, make the crease as sharp and clean as you can get it. Run your fingernail along the crease to get it flat. The better the crease, the easier the following folds will be and the better the plane will fly.

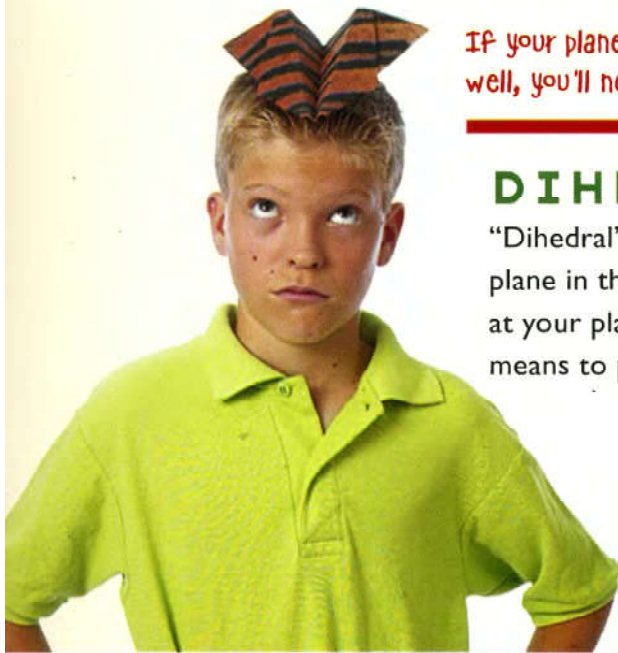


3

SMOOSH DOWN PAPER BUBBLES


A few folds into a plane, you may see some part of the paper bulging up. We recommend flattening these to make the rest of the folds easier. The best way is to use a pencil or pen cap and, pressing hard, sweep across the bubbled-up paper.





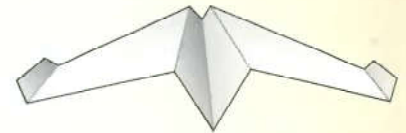
If your plane is folded correctly, but doesn't fly very well, you'll need to fuss with it a bit. Here's how.

DIHEDRAL

"Dihedral" is engineer-speak for the angle between a plane's wings. Every winged plane in this book flies best with a positive dihedral. That means that if you look at your plane from the back, the wings and body form a  shape. What this means to paper airplanes is this:



THIS PLANE FLIES



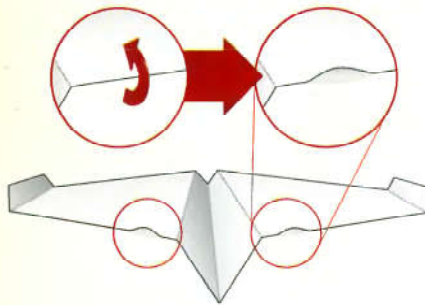
THIS PLANE CRASHES

ELEVATORS

Elevators are small flaps in a plane's wings that make the plane go up and down. If you want your plane to fly higher or longer, add up elevators. If it's flying too high and then diving, like it's on a rollercoaster, then it needs down elevators.

UP ELEVATOR

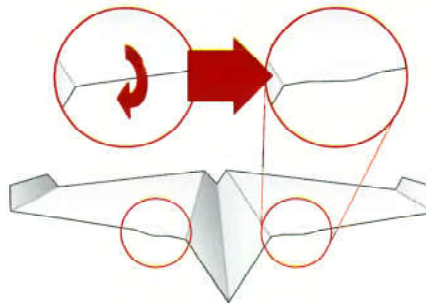
PINCH AND BEND UP. END UP LIKE THIS.



THESE FLAPS
MAKE THE PLANE RISE

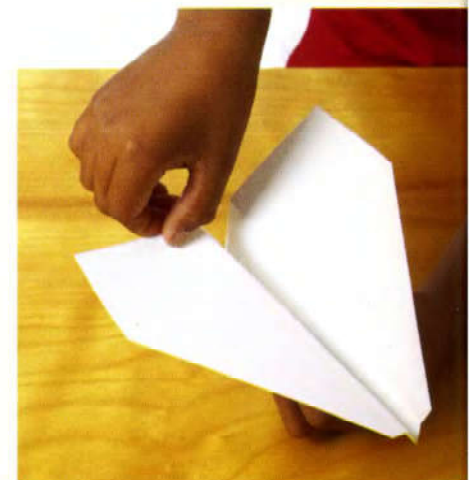
DOWN ELEVATOR

PINCH AND BEND DOWN. END UP LIKE THIS.



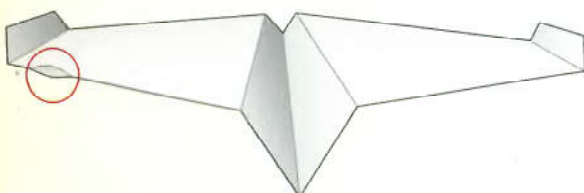
THESE FLAPS
MAKE THE PLANE FALL

TO MAKE AN ELEVATOR, PINCH THE BACK EDGE OF A WING, NEAR THE MIDDLE FOLD. THEN BEND THE PINCHED PAPER UP OR DOWN. MAKE ANOTHER ONE ON THE OPPOSITE WING.

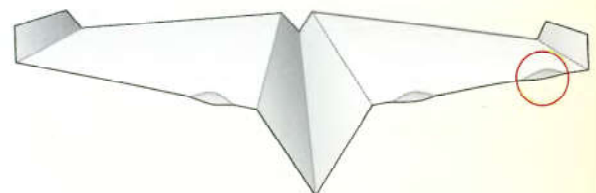


AILERONS

Ailerons look just like elevators, but make the plane bank or roll. An aileron in the right wing of a plane will make it bank (and turn) left, while an aileron in the left wing makes it bank (and turn) right. You make them just like you make elevators, but at the ends of the wings, not the middle.



THIS PLANE TURNS RIGHT



THIS PLANE TURNS LEFT



Nakamura Lock

TYPE: glider/dart

FOLDING DIFFICULTY:

1

FLY ZONE:



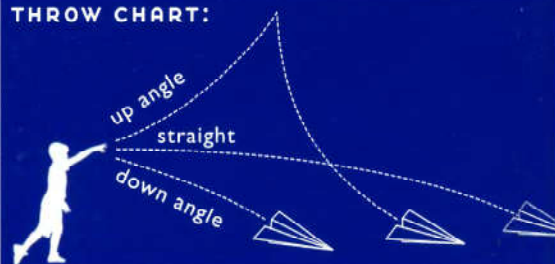
indoor



outdoor



THROW CHART:

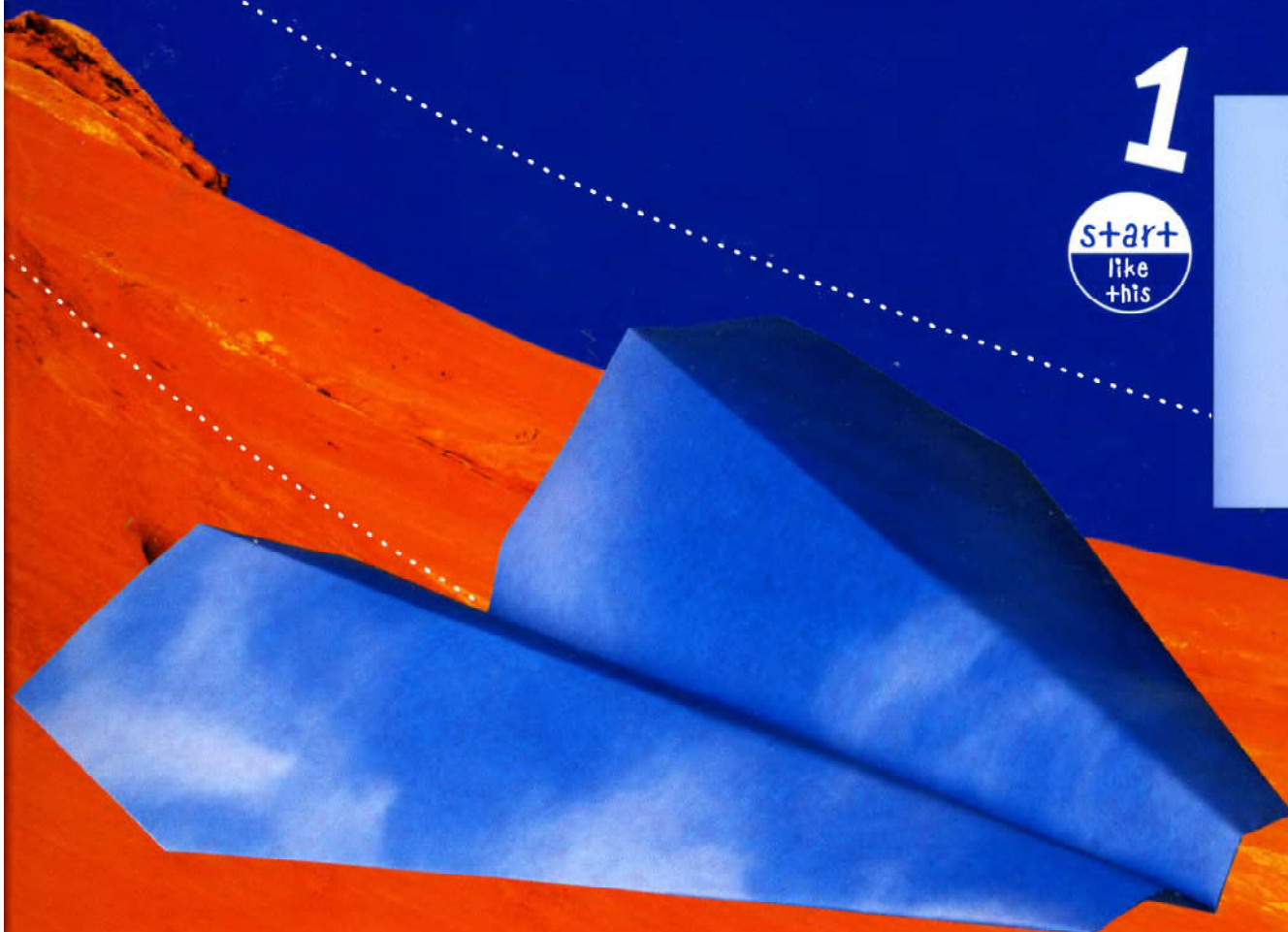


The Nakamura Lock

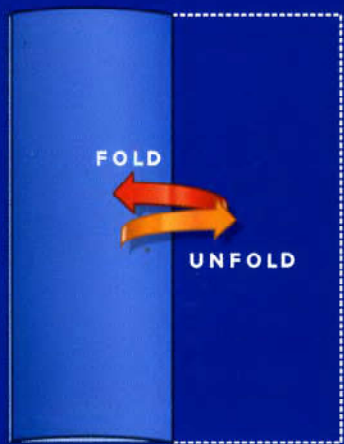
The Nakamura Lock is easy to fold and plenty forgiving. But the best part? Chances are, this will be the **best-flying** paper airplane you've ever made.

1

start
like
this

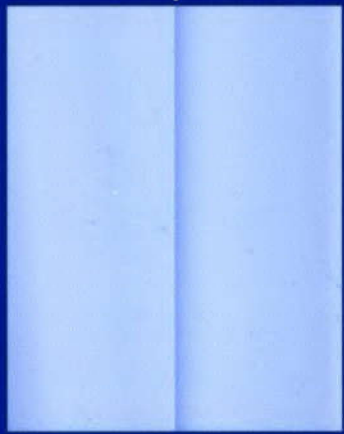


2



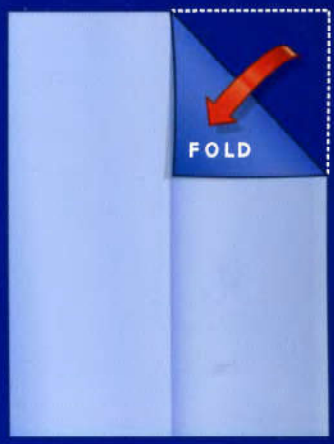
Fold in half lengthwise.
Unfold to make a
center crease.

CENTER CREASE

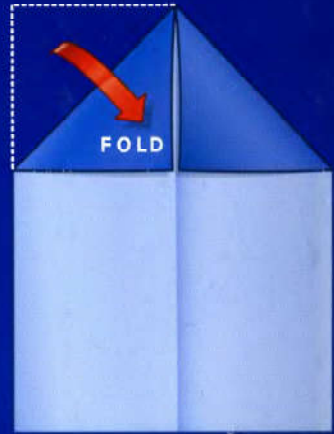


end up
like
this

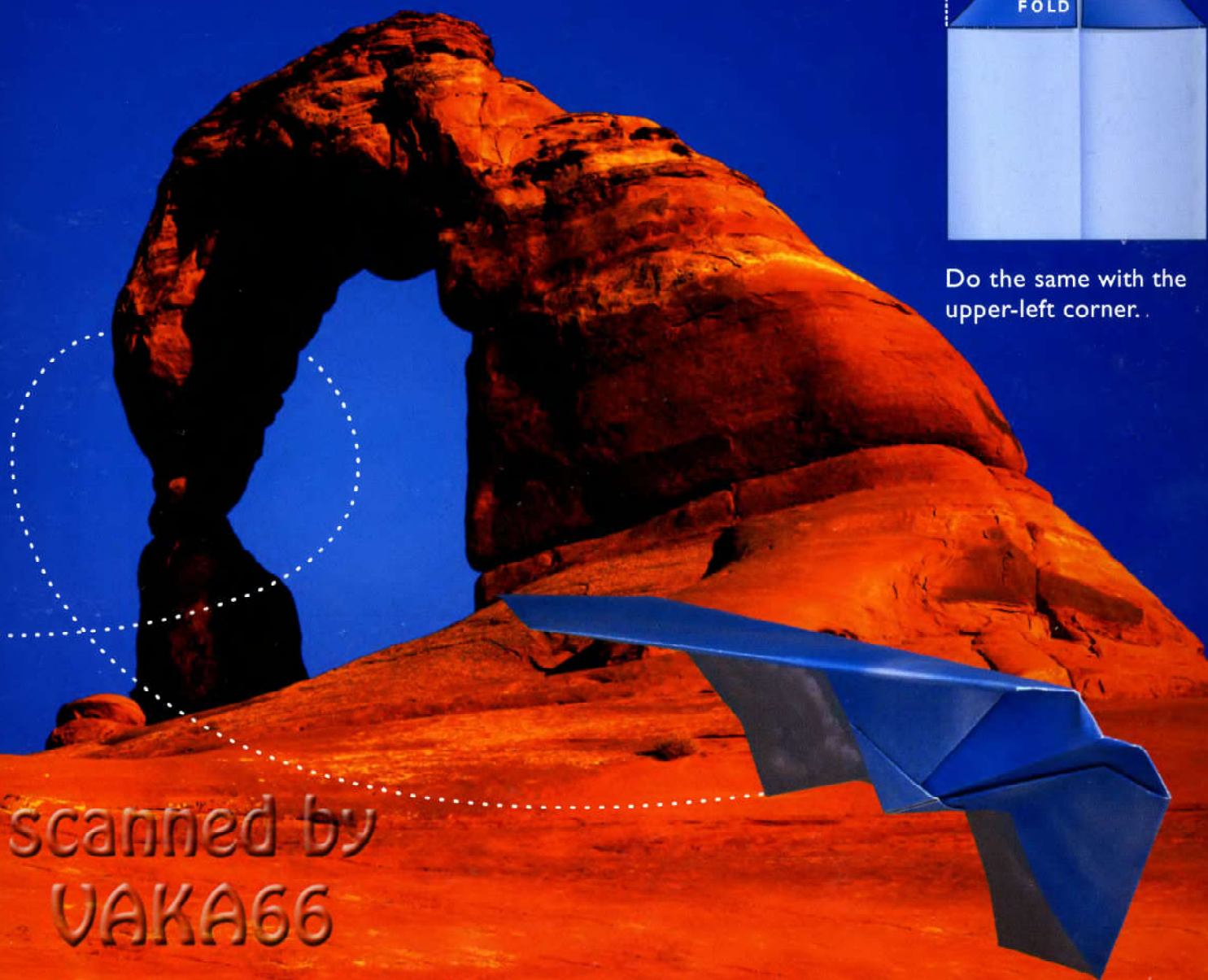
3



Fold the upper-right
corner down so the
top edge sits on the
center crease.

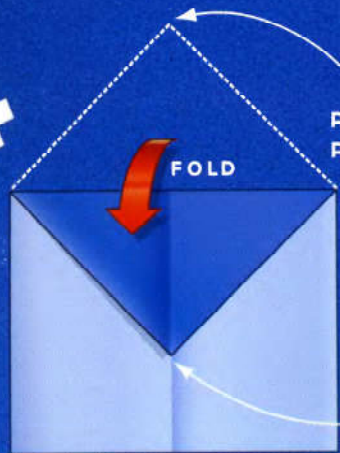


Do the same with the
upper-left corner.



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4

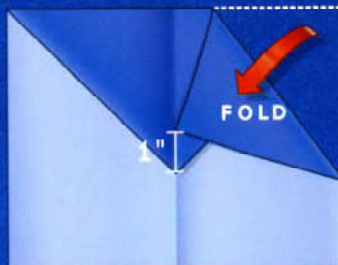


PUT THIS POINT...

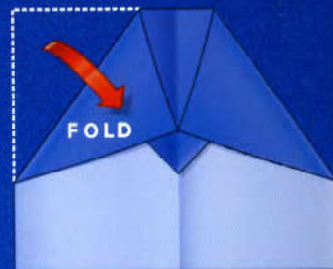
...RIGHT ON THIS CREASE

Fold the top point down, creasing right beneath the flaps you just made.

5



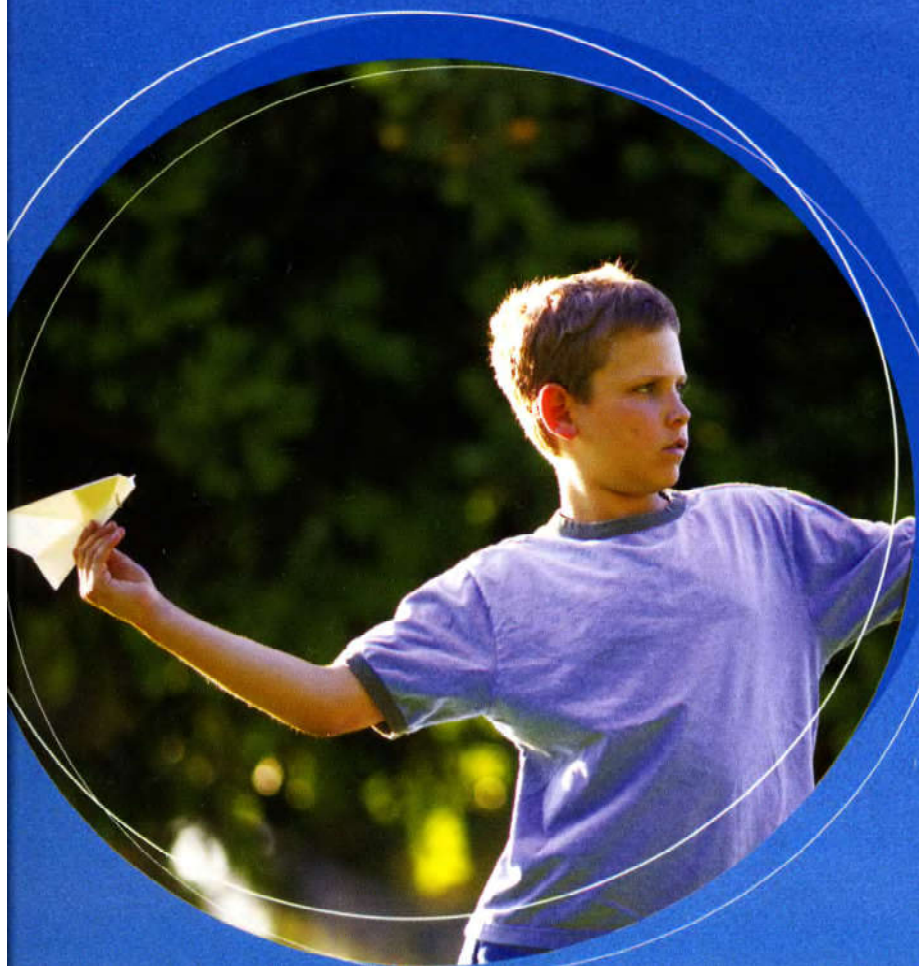
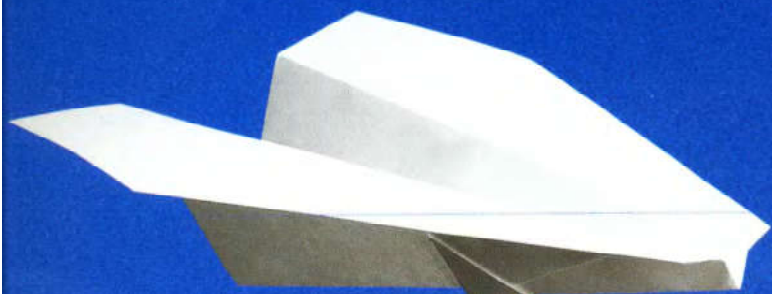
Put the upper-right corner on the center crease, about 1 inch (2.54 cm) above the point. Crease well.



Do the same with the upper-left corner.

this is an inch > 1" (2.54 cm)

folding tip Be precise!



6



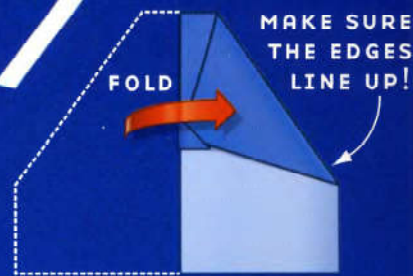
Flip the point up and fold so it's right on the center crease.

flip
over



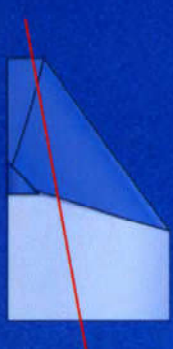
end up
like
this

7



Fold in half. Make sure the edges of the left side line up perfectly with the edges on the right.

8



end up
like
this

flip
over

Fold just the top flap so that the crease falls on the red line shown.

9



Fold the other wing so that it sits right on top of the first one.

LINE UP THE EDGES WITH
THE WING YOU JUST MADE

ALMOST
FINISHED

Unfold the wings part way, so that your plane looks like this from the back.



FLYING THE NAKAMURA LOCK

This classic paper plane flies best with a light, straight-ahead toss.




Spy Plane

TYPE: glider

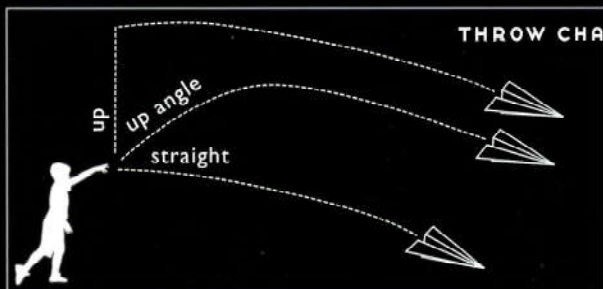
FOLDING DIFFICULTY:

1

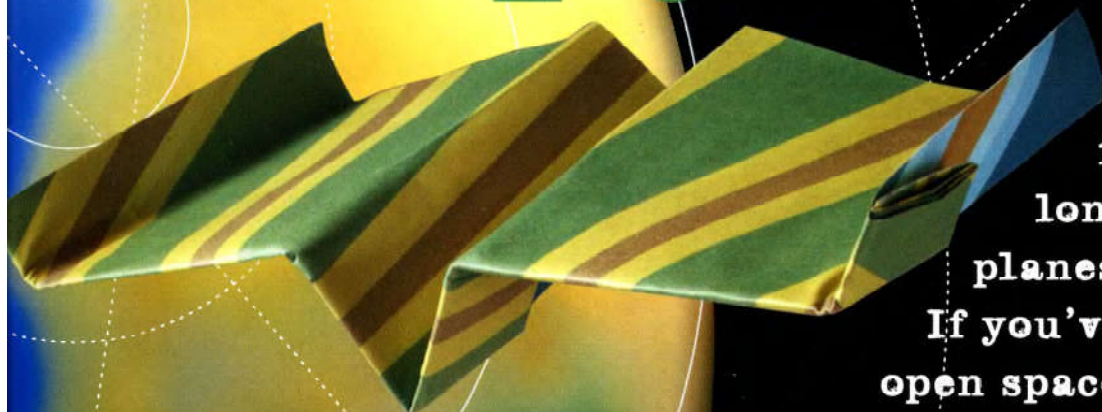
FLY ZONE:

indoor 

 outdoor 



Spy Plane

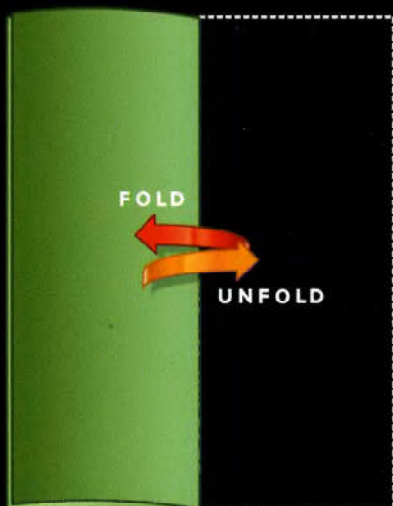


The Spy Plane flies higher and longer than most planes in this book. If you've got a big, open space and a healthy throwing arm, this is your plane.

1



2



Fold it in half lengthwise. Unfold to make a center crease.

CENTER CREASE



end up
like
this



this is
an inch >
(2.54 cm)



1"

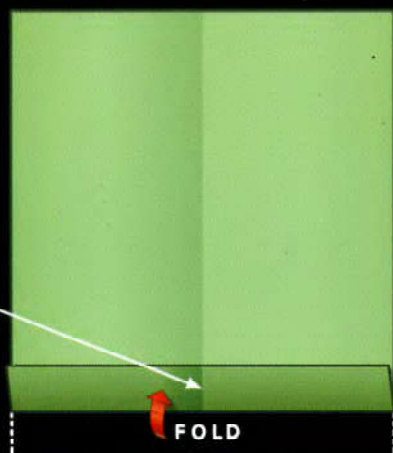
3



1"

Then, fold the bottom inch of the page up, putting the center crease right on top of itself.

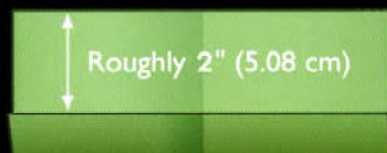
4



PUT THIS CREASE EXACTLY ON THE ONE UNDERNEATH IT. DO THIS FOR EACH FOLD.

Make the same fold six more times...

7 folds
total



Roughly 2" (5.08 cm)

end up
like
this

...until you get this.

TIP
good folding =
good flying!

5



rotate



flip
over



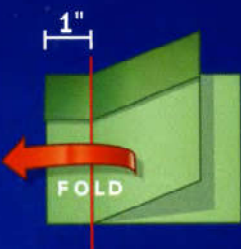
end up
like
this

6



Fold in half
from left
to right.

7



Fold the top flap
back along the red
line as shown.



end up
like
this



match the edges and press hard!

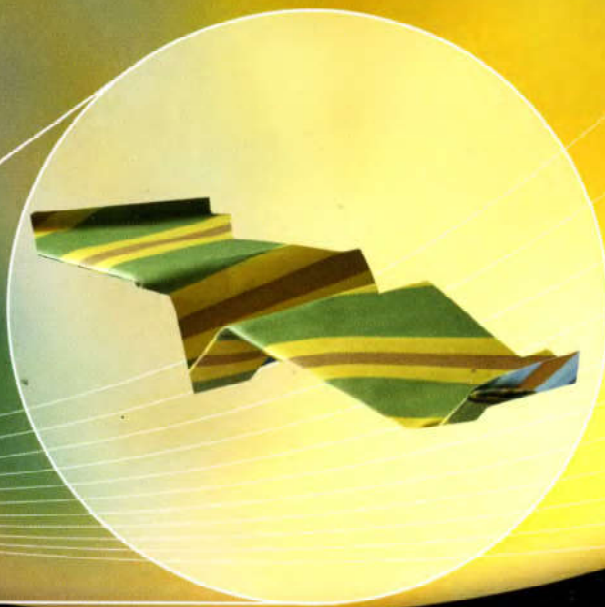
8

flip
over



end up
like
this

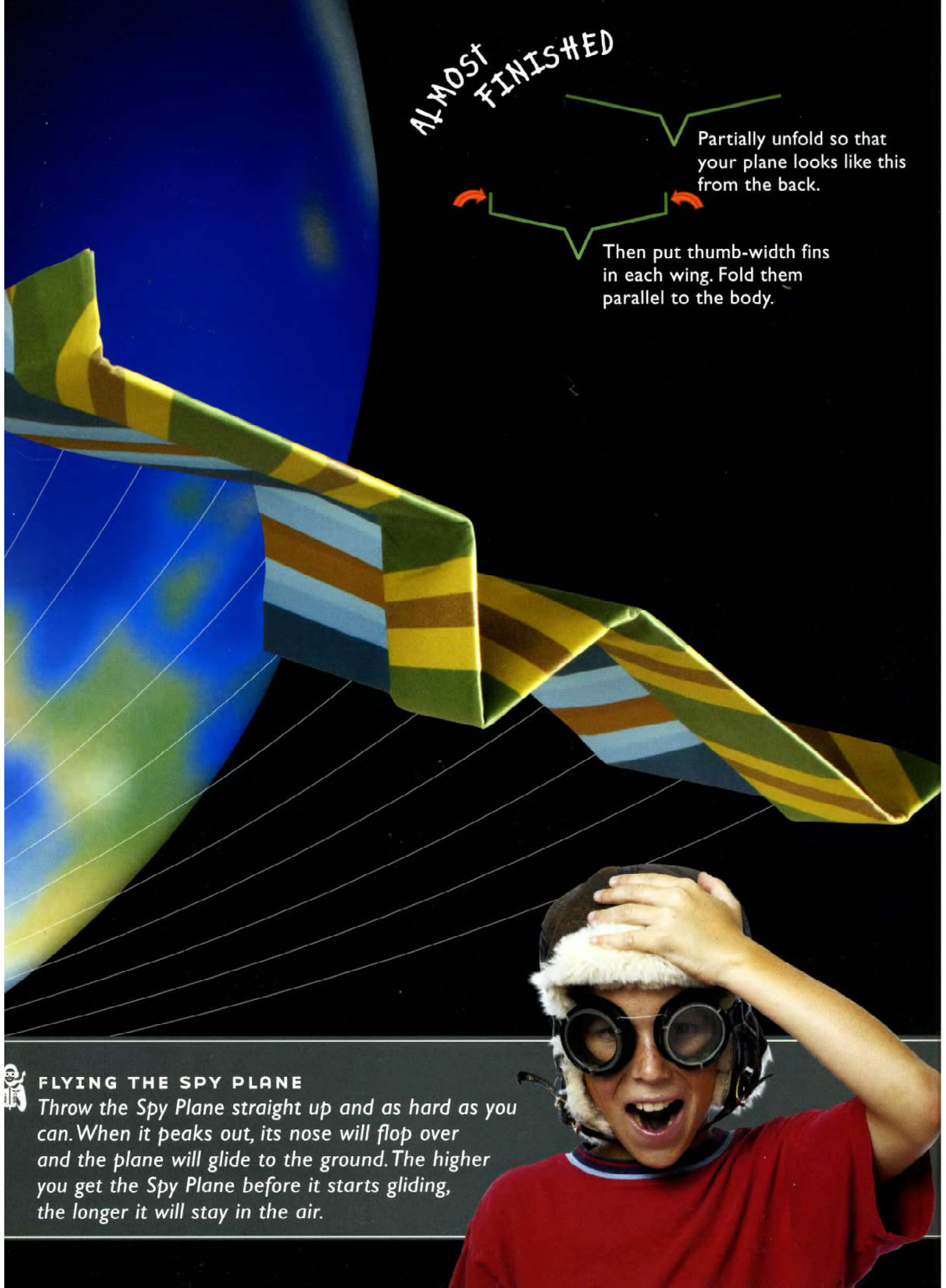
Fold the left side over
to make the other
wing. Line it up with
the wing underneath.



ALMOST
FINISHED

Partially unfold so that
your plane looks like this
from the back.

Then put thumb-width fins
in each wing. Fold them
parallel to the body.



FLYING THE SPY PLANE

Throw the Spy Plane straight up and as hard as you can. When it peaks out, its nose will flop over and the plane will glide to the ground. The higher you get the Spy Plane before it starts gliding, the longer it will stay in the air.



Swashbuckler

TYPE: **stunt**

FOLDING DIFFICULTY:

2

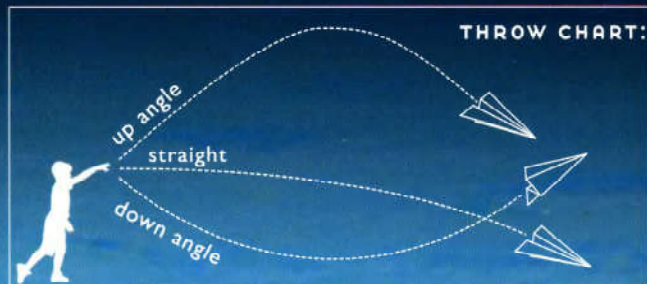
FLY ZONE:



indoor

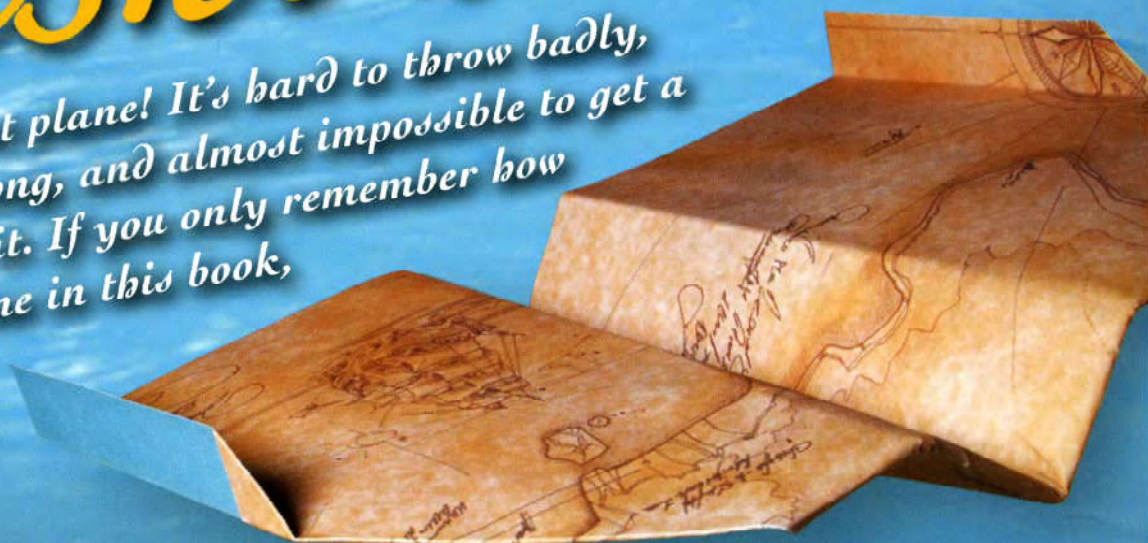


outdoor



THE Swashbuckler

The ultimate stunt plane! It's hard to throw badly, harder to fold wrong, and almost impossible to get a bad flight out of it. If you only remember how to make one plane in this book, make this it!



1

start
like
this

Pick up this corner and put it near the **X**.

X

2

LINE THESE EDGES UP!

FOLD

UNFOLD

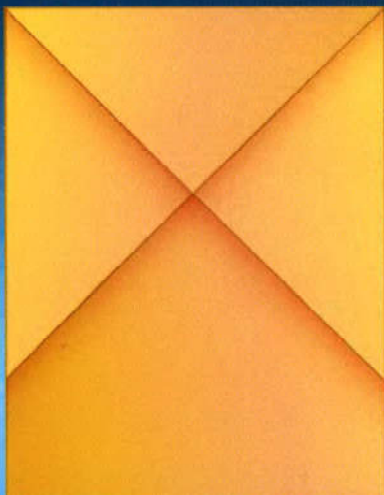
FOLD

UNFOLD

Make a perfect diagonal crease. Then unfold it.

Do the same thing with the other corner. Fold and unfold.

3

flip
overend up
like
this

You should now have a big creased X in your paper.

4



Fold the top of your paper down so that the corners line up precisely with the bottom of the creased X. Unfold.

5

flip
over

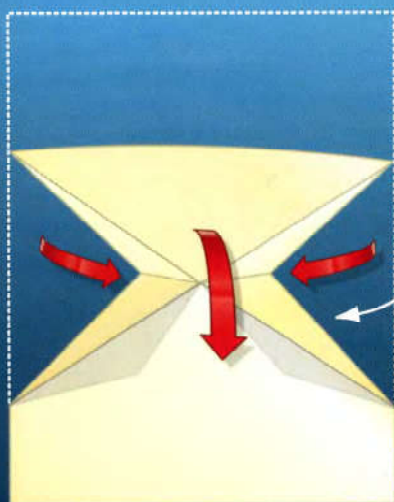
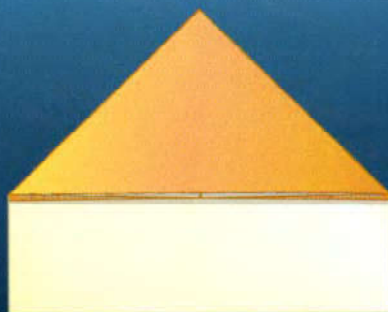
After you flip the paper over, lay it down on the table.

PRESS HERE... AND THE SIDES WILL POP UP



Then, press the middle of the creased X until the sides "jump" up.

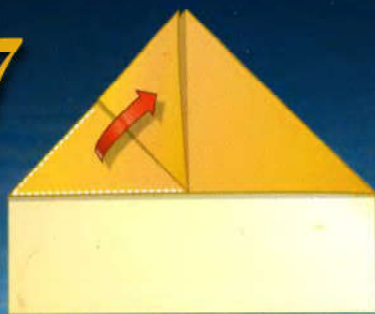
6

BRING THE SIDES
FORWARD AND TOGETHERend up
like
this

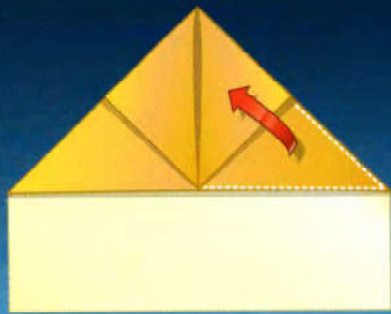
Pull the top edge of the paper downward. As you do, the sides of the paper should fold inward along the horizontal creases you already made.

good folding =
good flying!

7



Pick up just the top layer of the big triangle, folding the bottom-left corner to the top.



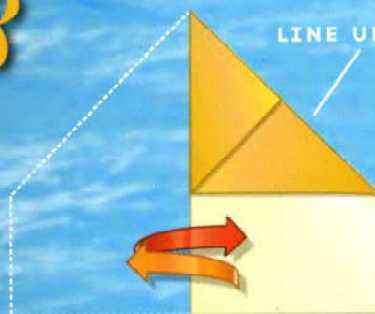
Do the same with the right side. If it doesn't look like this, you probably picked up both layers instead of just the top layer.

flip
over



end up
like
this

8



LINE UP ALL YOUR EDGES

flip
over

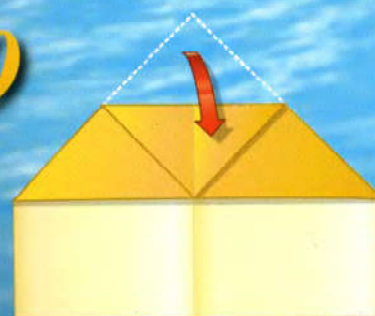


Fold the left side onto the right. Unfold.

end up
like
this



9



flip
over

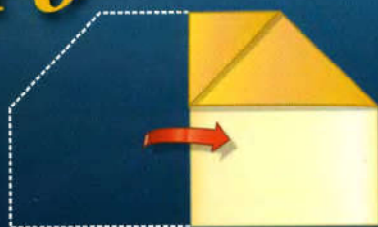


end up
like
this

Bring the very top of the plane down so that it sits right at the base of the triangle. Make sure it's lined up with the vertical crease, then fold.

KEEP
GOING!

10



Fold the left side on top of the right, lining up all the edges.

rotate

11

PUT THIS
CORNER...



...ON THIS
CORNER

Make the wing by folding the top of the nose down to the bottom.

end up
like
this



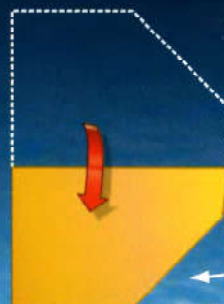
12

flip
over



end up
like
this

13



PUT ONE EDGE
RIGHT ON TOP
OF THE OTHER

Flip your plane over and do the same thing to the other wing. Line up the bottom edges of the wings.



Unfold so that your plane looks like this from the back.

ALMOST
FINISHED



Finally, add pinky-width fins to the ends of your wings. Make them straight up and down.



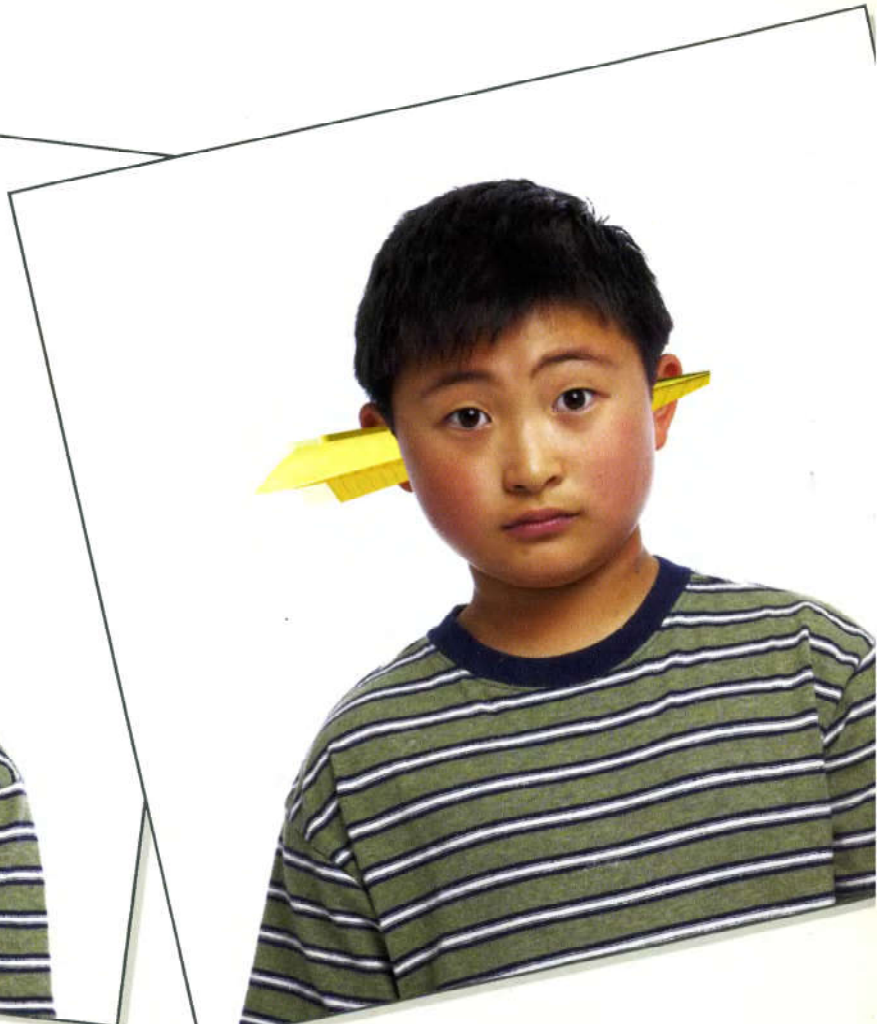
FLYING THE SWASHBUCKLER

Big, swooping loops and turns are no trouble at all for the Swashbuckler. Throw the plane upward at a diagonal and put a little weight behind it. If your folds are clean, you may get great flights right off. If not, put tiny elevators in the wings to help with the swooping and looping.

Learning to fly



Getting your plane into the air isn't hard, but getting great flights one after another can take a little practice. The trick is to figure out what type of plane you're throwing and how you want it to fly. Then, give it the launch it needs to get there.



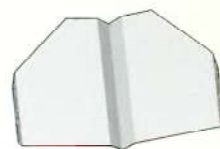
The only **2 things** that make one throw different from another are **speed and angle**.

And the way a plane is designed, it will naturally "like" certain angles and speeds, but not others. Dart-shaped planes, since they're thin and sleek, like fast throws. Gliders, with their wide, flat shape, prefer slow ones. In fact, for most planes, **all you need to know are these (big, important) rules:**

big, important throwing Speed Rules:



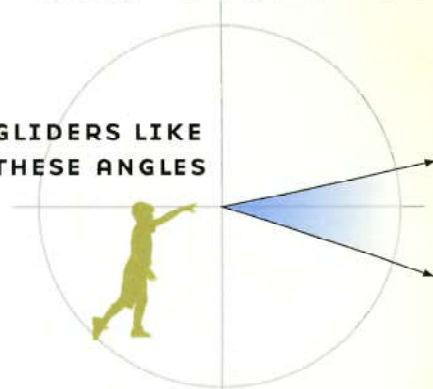
SMALL
WINGS = THROW
FASTER



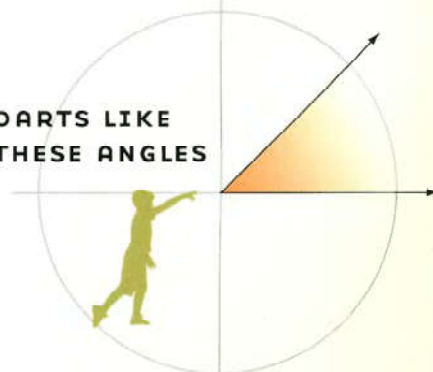
BIG
WINGS = THROW
SLOWER

big, important throwing Angle Rules:

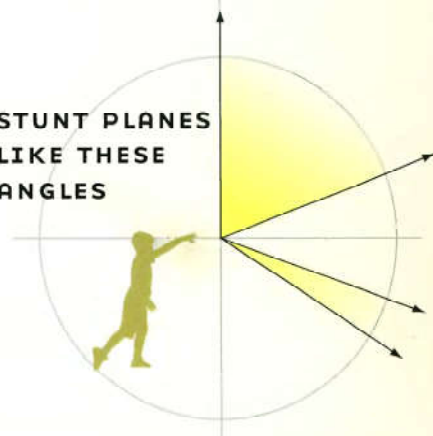
GLIDERS LIKE
THESE ANGLES



DARTS LIKE
THESE ANGLES



STUNT PLANES
LIKE THESE
ANGLES

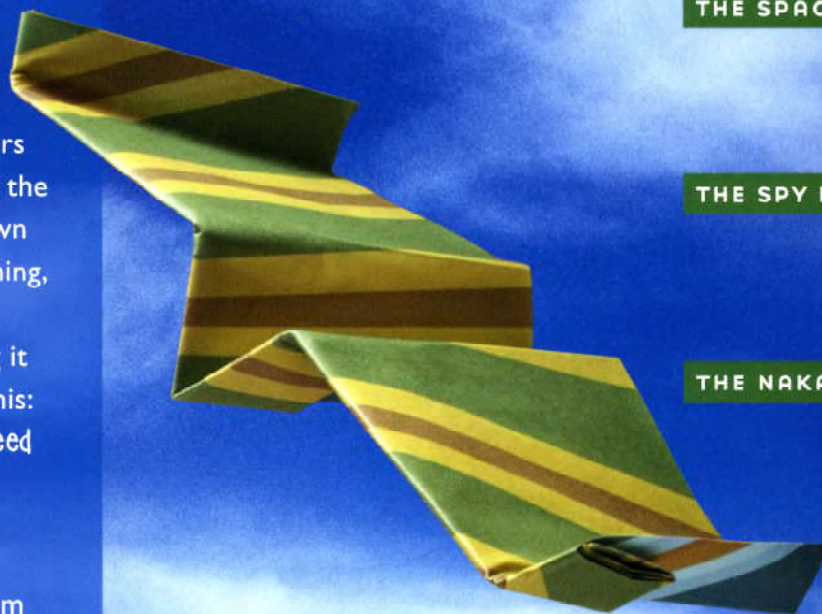


FLYING GLIDERS

Gliders glide. They're built for long, slow flights and big, lazy turns. A good glider, with a good launch, almost never lands without hitting something first.

There are two kinds of gliders: high fliers and room-crossers. Most gliders are of the room-crossing variety and are best flown with a smooth, even launch. You're pushing, not throwing, the plane so there's no wind-up and no such thing as launching it too slow. In fact, the rule of thumb is this: Launch a glider at the same angle and speed it would go if it were already flying.

High fliers begin with a rocket launch before gliding back to earth. Throw them straight up, like you're going to put a baseball on the moon.



THE PROFESSIONAL



THE SPACE CRUISER



THE SPY PLANE



THE NAKAMURA LOCK



FLYING DARTS

Darts are built to fly far, fast and straight as an arrow. They don't spend much time in the air but, while they're airborne, they don't mess around.

Throw a dart dead-straight or at an upward angle, and throw it hard. If you're going for distance, aim upward at about a 45-degree angle and haul off. If you're trying to hit a target (one that isn't too far away), launch straight ahead and throw only as hard as you need to to get the plane there.



THE HAMMER



THE HEADHUNTER



THE NAKAMURA LOCK



FLYING STUNT PLANES

Stunt planes are the dogfighters of the paper airplane world. They loop, circle, dive and roll better than any other plane. They also spend a lot of time on roofs and in trees.

Stunt planes are designed to be thrown in all kinds of ways. Most do well with a medium-sized throw, up and away from you. Throw hard enough to get them to do a trick or two before they land, but not so hard that the wings bend or collapse.

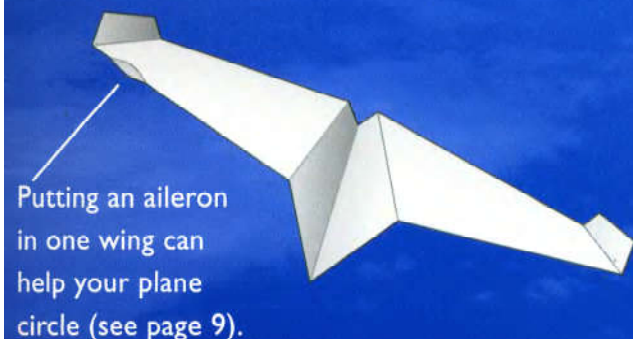
How to get loops

To get your stunt plane to loop, first give it big up elevators (see page 9). Then give it a good throw either at an angle toward the ground or directly upward.



How to get Circles

Circles are sideways loops. To get your plane to circle, launch it so that its wings are banked to the right, like so:



THE FLYING NINJA



THE PROFESSIONAL



THE PTEROPLANE



THE SWASHBUCKLER



INDOOR VERSUS OUTDOOR FLIGHT

INDOOR

If you're flying indoors, you're best off with planes that need calm air but don't need much space. Darts and slow gliders work best.



OUTDOOR

Outside, you'll get the best flights from heavier, more rugged planes. Stunt planes, small darts and high-flying gliders should make up your fleet.



The Headhunter

TYPE: **dart**

FOLDING DIFFICULTY:

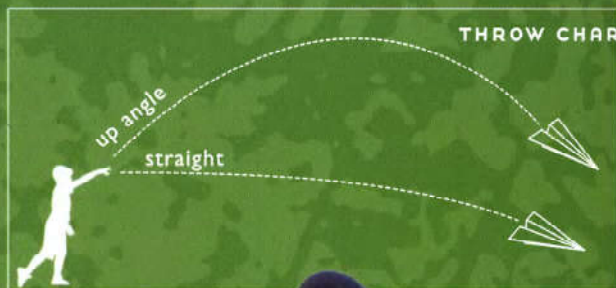
3

✓ indoor



FLY ZONE:

outdoor



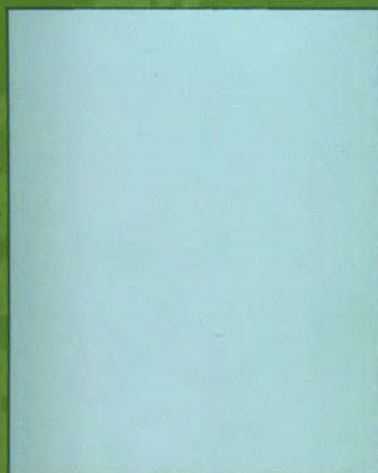
the HEAD- HUNTER



The Headhunter is sleek, fast and deadly accurate. Guaranteed to hit the chalkboard from the back of the classroom, or smack the center of the theatre screen. If any plane in this book is going to land you in trouble, this is probably it.

1

start
like
this

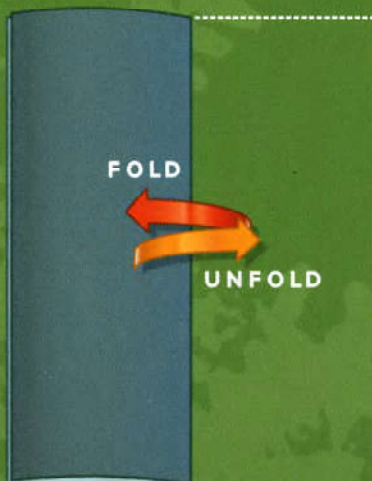


2

FOLD



UNFOLD

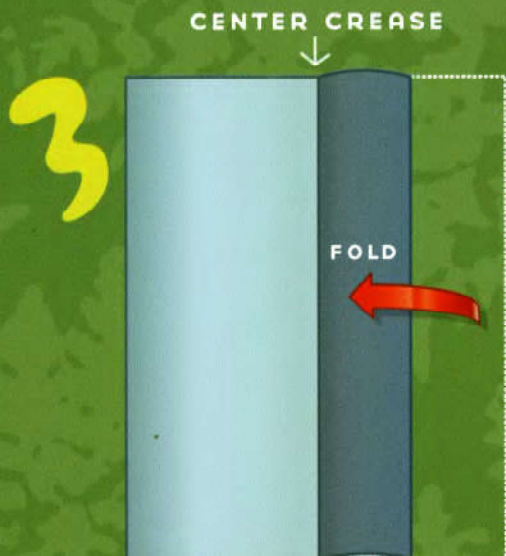


CENTER CREASE

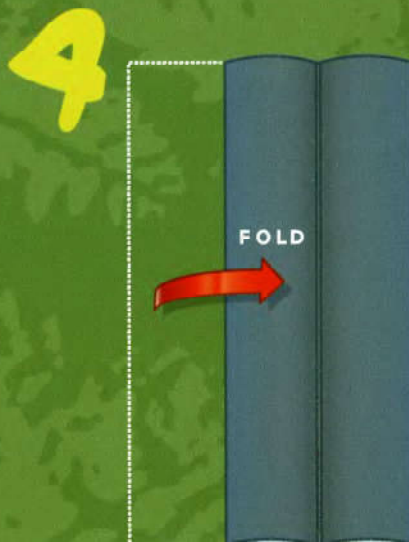


end
like
this

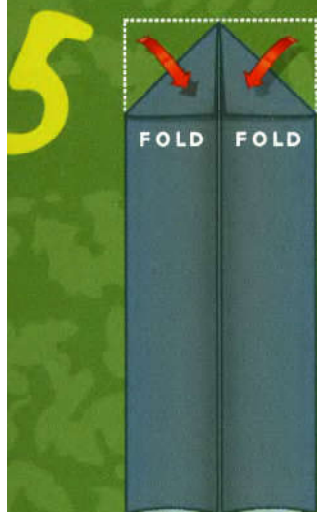
Fold in half lengthwise. Unfold.



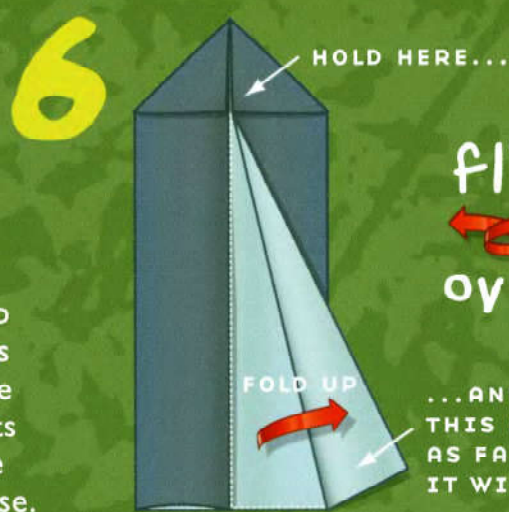
Fold the right edge to the center crease...



...and do the same with the left.



Fold the top two corners down so the top edge sits right on the center crease.

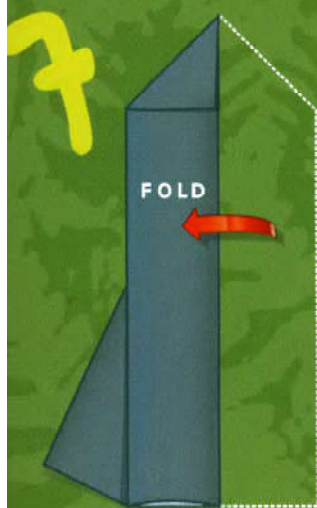


flip
over

...AND PULL
THIS FLAP
AS FAR AS
IT WILL GO



Hold down the flaps you just made with your finger. Then pull the big flap on the right side up from the inside corner.

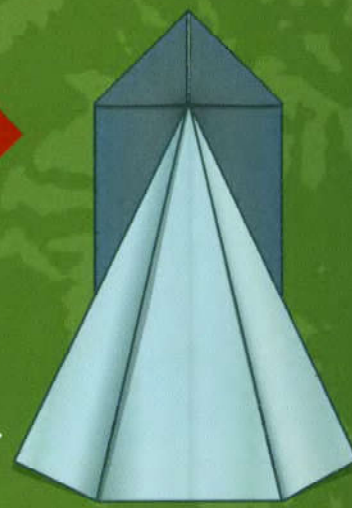


Fold the right half over onto the left side.



open up

Fold just the top big flap over, so it's right on top of the other one. Match up all edges perfectly.



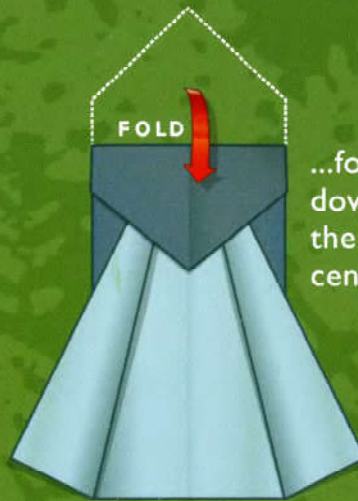
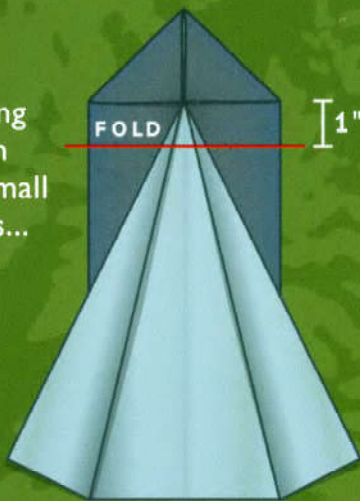
Open up the whole thing and lay it flat.

9

Then, starting about 1 inch below the small triangle flaps...



this is an inch > (2.54 cm)



...fold the top down, putting the tip on the center crease.

10

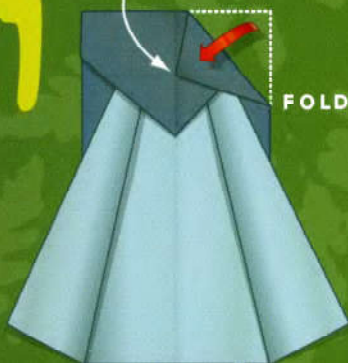
POINT TOUCHES TOP



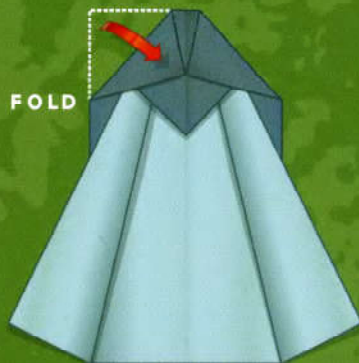
Fold the point up to the crease you just made, then unfold.

11

NEW CREASE MEETS CENTER CREASE

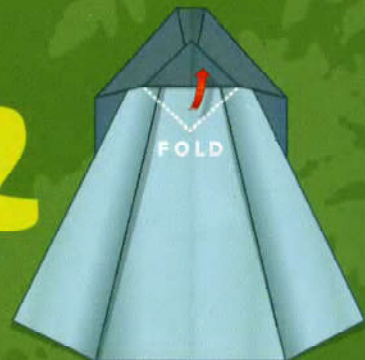


Put the top-right corner on the new crease, right in the middle.



Do the same with the left corner.

12



Flip the point up, putting it on the center crease.



flying tip!

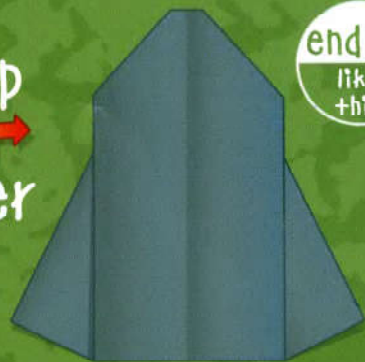
to get longer flights, put elevators on the headhunter's wings (see page 9).



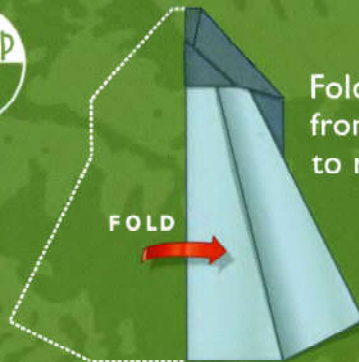


13

flip
over



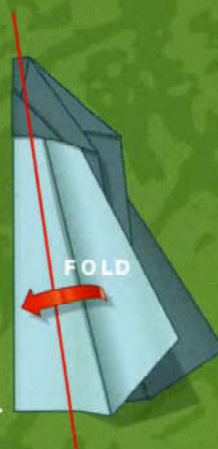
end up
like
this



Fold in half,
from left
to right.

14

Fold the
wing along
the red line.



FOLD



end up
like
this

15

flip
over

LINE UP
THIS EDGE...

...WITH
THIS EDGE



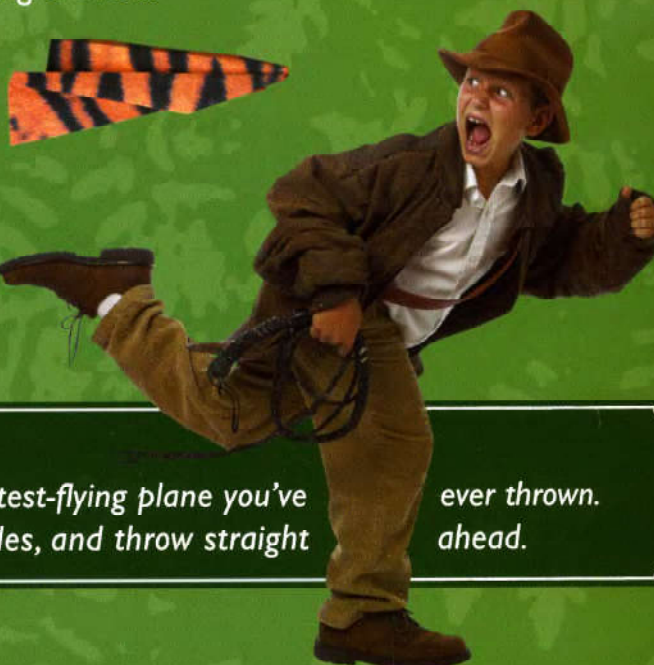
...fold the second
wing by lining the
edges up with the
wing below it.

After flipping it over...

ALMOST
FINISHED



Unfold the wings so your plane looks like
this from the back. Now test, fly and trim!



FLYING THE HEADHUNTER

With a little trimming, the Headhunter will be the straightest-flying plane you've
Make sure your Headhunter looks the same on both sides, and throw straight

ever thrown.
ahead.



The Hammer

TYPE: **dart**

5

FOLDING DIFFICULTY:

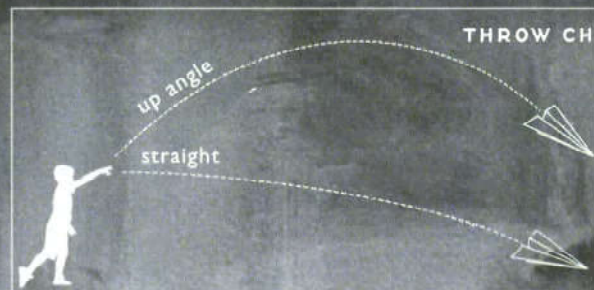
FLY ZONE:



indoor



outdoor



THE HAMMER IS EQUAL PARTS

PAPER AIRPLANE AND ROCKET JET

THE HAMMER

SMALL, TOUGH AND UNFAIRLY FAST, THIS IS THE RIDE OF CHOICE FOR PAPER FIGHTER PILOTS. THERE SIMPLY ISN'T A BETTER WAY TO HIT TOP SPEED WITH A SHEET OF PAPER.

1

Pick up this corner and put it near the **X**.

start
like
this

X

2

LINE THESE EDGES UP!

FOLD

UNFOLD

Make a perfect diagonal crease. Then unfold it.

FOLD

UNFOLD

Do the same thing with other corner. Fold and u

3



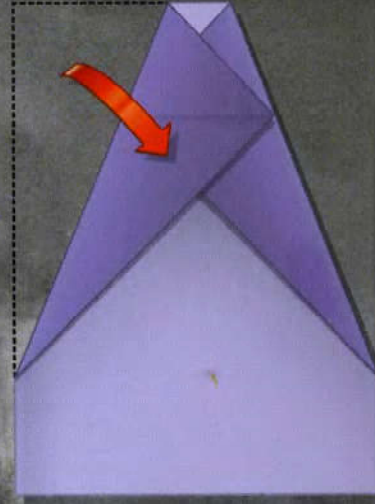
You should now have a big creased X in your paper.

4



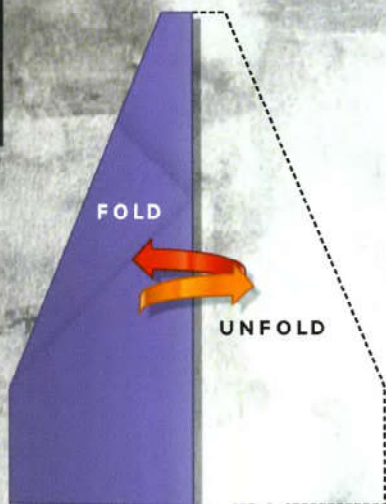
end up
like
this

Fold the upper-right corner down, putting the long edge on the crease you just made.

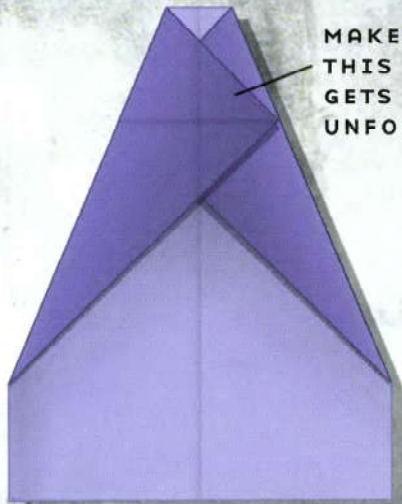


Make the same fold with the upper-left corner.

5

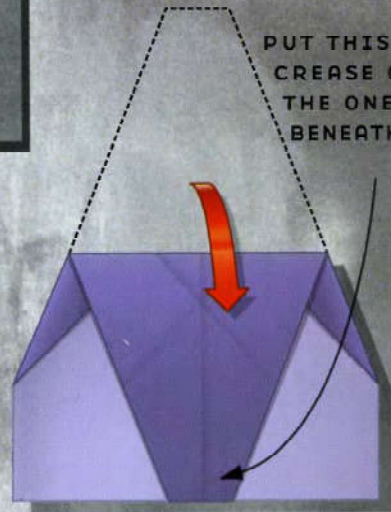


Fold in half, then unfold.



MAKE SURE
THIS FLAP
GETS
UNFOLDED

6

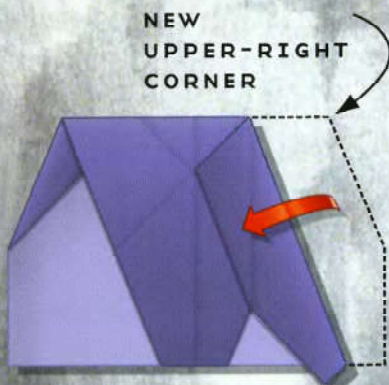


PUT THIS
CREASE ON
THE ONE
BENEATH

end up

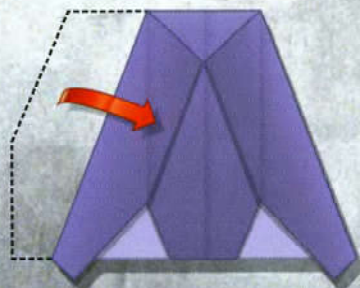
Fold the top edge to the bottom, lining up the crease

7



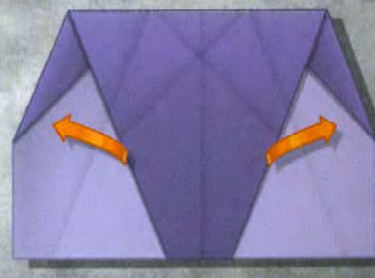
NEW
UPPER-RIGHT
CORNER

Fold the new upper-right corner to the center of the creased X.



Do the same on the other side.

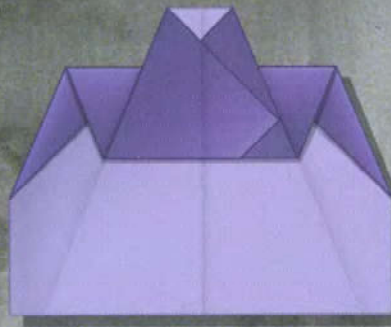
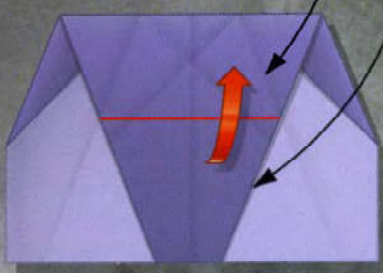
8



UNFOLD THE LAST TWO
FOLDS. IT SHOULD
LOOK LIKE THIS:

9

PUT THIS EDGE...
...ON THIS CREASE

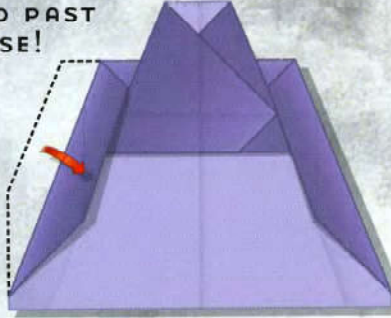
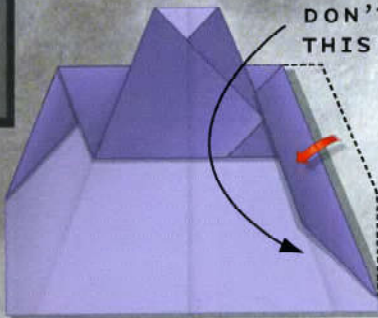


end up
like
this

Fold up on the red line as shown.

10

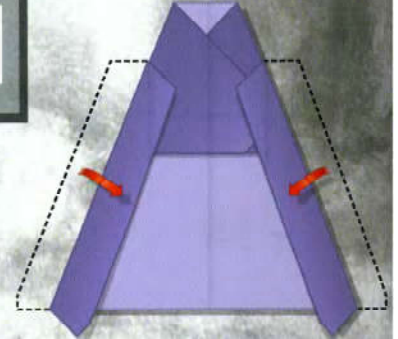
DON'T FOLD PAST
THIS CREASE!



Fold the diagonal edge on
the right side to the crease
you made in step 8.

Repeat on the left side.

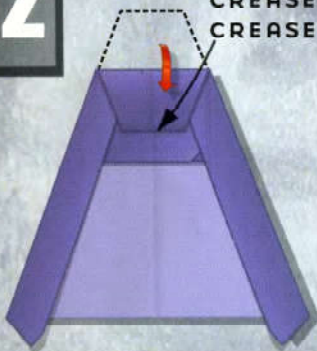
11



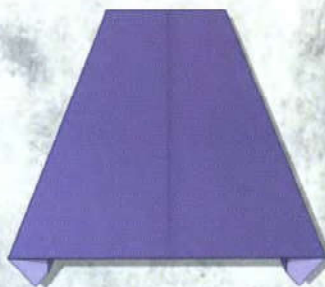
Fold both sides in along
the creases you made in
steps 8 and 9.

12

LINE UP THE CENTER
CREASE WITH THE
CREASE BELOW IT



flip
over

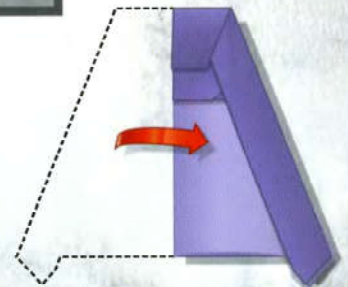


end up

Fold the top flap down
as far as it will go.

13

MAKE SURE TO LINE
UP ALL EDGES



Fold in half.

14

FOLD WING
EDGE TO THIS
POINT




Fold the wing
down so that the
edge sits on the
bottom corner.

flip
over



Fold the other
wing so it's right
on top of the first.

ALMOST
FINISHED

Unfold the wings so that your plane has a  shape from behind.



FLYING THE HAMMER

Aim at an upward angle if you're going for distance. Throw at eye-level if you're aiming for something on the other side of the room. For everything else, chuck it as hard as you want in any direction.

OBSTACLE GOLF

OBSTACLE GOLF

Grab a friend or two and arm yourselves with a few airplanes each. Make sure each person has a good mix of darts, gliders and stunt planes. These are your golf clubs. Then, pick a "hole" anywhere from 1 to 1,000 feet away. Good holes are things you can hit, land on, go through or pass by. Then take turns throwing a plane toward the hole, keeping track of the number of throws it takes to get there. You can switch to a different plane whenever you want, as long as you throw it from the same spot. Choosing the right plane for each throw will really help your game. And, just like in golf, low score wins.

GOOD OBSTACLE GOLF HOLES:

- Through a basketball hoop
- On a shelf
- Caught in a tree
- Through monkey-bars
- In a clean trash can
- Through a window
- Stuck in a chain-link fence
- Hit a street sign

game 1

a crash course in flight

or, Why a Plane Flies and a Brick Does Not



LIFT



GRAVITY



FORCE



THRUST



DRAG

LIFT VERSUS GRAVITY

Without a throw, a dropped piece of paper — even one that looks like an airplane — falls right to the ground. But throw it and something holds it in the air a little longer. That something is “lift” and it’s a force, just like gravity. In flight, lift and gravity play tug-of-war with your poor plane. And so long as lift is winning, the plane goes up. But when gravity takes the lead — and it always does — your plane has a date with the ground that it just won’t miss.

MORE LIFT
THAN GRAVITY...



...PLANE GOES UP

LIFT EQUAL
TO GRAVITY...



...PLANE
FLIES
STRAIGHT

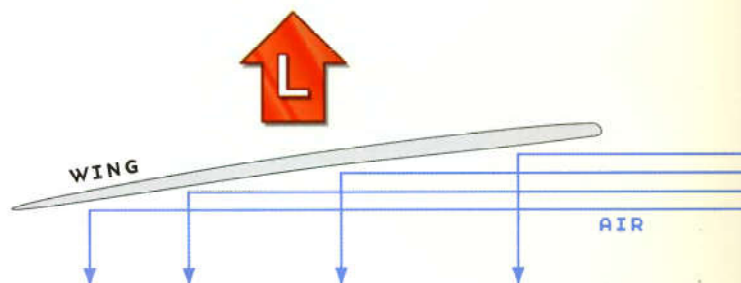
LESS LIFT
THAN GRAVITY...



...PLANE GOES
DOWN

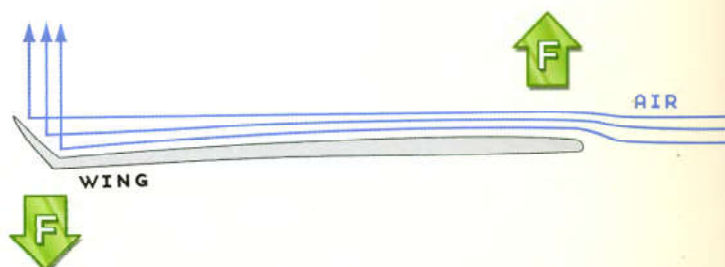
ANGLE OF ATTACK

The incline a plane’s wings make with the oncoming air is called the “angle of attack.” For most planes, the front of the wings is higher than the back. So, when you throw the plane, the rush of air hits the bottom of the wing and bounces off. The bouncing-off air pushes the wing upward, giving the plane lift.





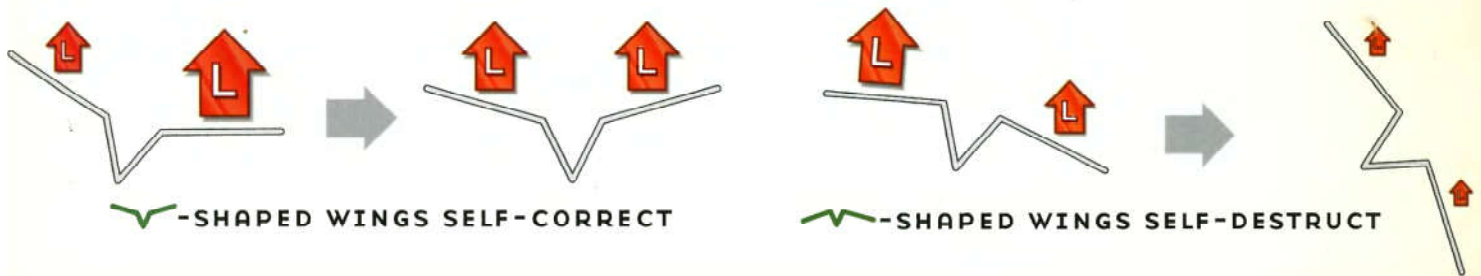
ELEVATORS & AILERONS

The flaps on the back edge of a wing change the angle of oncoming air and move the plane. If the flaps go up, air hits them and goes shooting skyward. This makes the back edge of the wing drop. The angle of attack gets bigger, so more air hits the bottom of the wings. The result? The plane gets more lift and flies higher.



SO WHY THE -SHAPED WINGS?

If your plane is flying straight, then the lift created by each wing is about the same. But if one wing is flatter than the other, that wing creates more lift and makes the plane barrel-roll. The reason most paper planes fly best with -shaped wings is that as soon as the plane starts to roll, the now-flatter wing makes more lift than the angled one. The extra lift forces the wing back up, straightening out the plane. With -shaped wings, a small roll causes a bigger roll and the plane spirals to the ground.



THRUST VERSUS DRAG

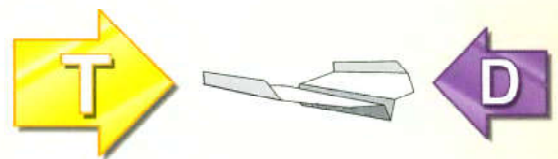
While gravity and lift control a plane's altitude, stuff engineers call "thrust" and "drag" change its speed.

Thrust is any force that makes an airplane go forward. In metal planes, propellers and jets create thrust. The only thrust a paper plane gets, though, comes from your own arm. Once the plane leaves your hand, it's gotten all the thrust it's going to get, which is why paper planes always end up on the ground.

Drag, on the other hand, is what air does to a plane to slow it down. The faster a plane goes, the more air hits it and the more the air pushes it backwards. And the bigger the wings are, the more air hits the plane, causing more drag. That's why glider-type paper planes go slower than darts. If a plane kept getting enough thrust to overcome both gravity and drag, it would simply keep going and going and going and going and going and



Small Wings = Less Drag = Faster



Big Wings = More Drag = Slower



The Pteroplane

TYPE: **stunt**

FOLDING DIFFICULTY:

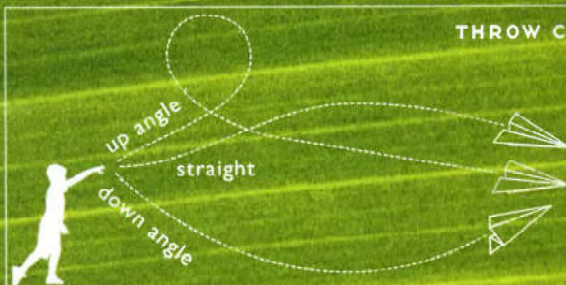
4

FLY ZONE:

indoor 

 outdoor 

THROW CHART



Pteroplane

The Pteroplane should have been born a dart. Instead, it's just about the quickest stunt plane anywhere. With a rocket-fuel throw, you can get it to loop, circle, even corkscrew before settling into a long, cool glide.



end
like
this

CENTER CREASE

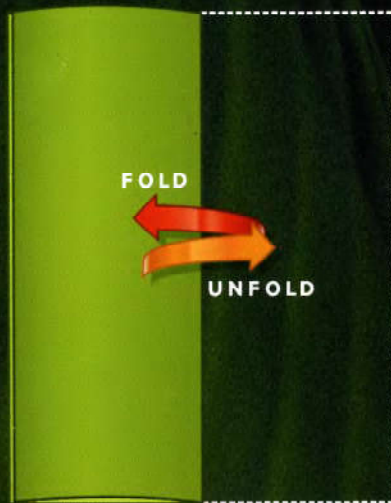
1

start
like
this

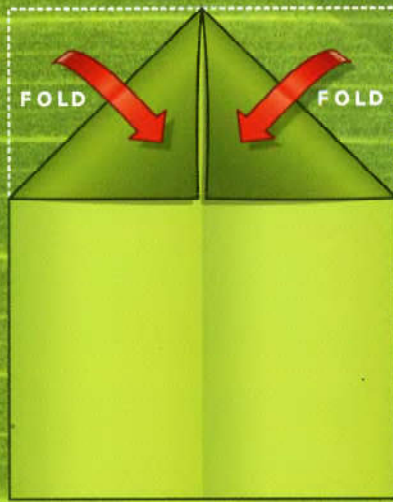


2

Fold and unfold lengthwise to make a center crease.

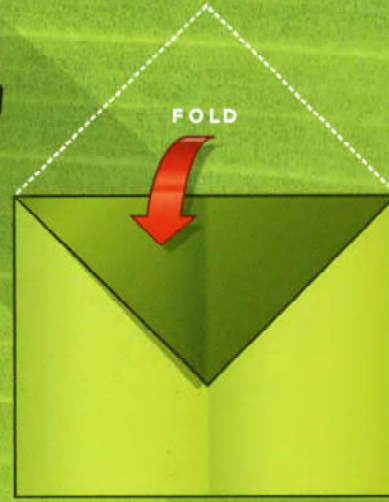


3



Fold the top two corners down so the top edge sits exactly on the center crease.

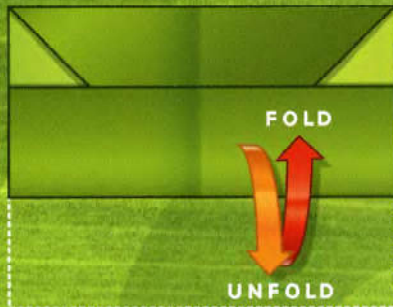
4



FOLD THIS CREASE AS CLOSE AS YOU CAN TO THE FLAPS YOU JUST MADE

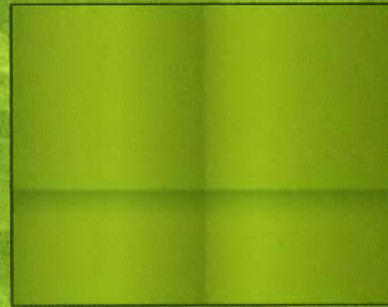
Fold the top point down on the center crease.

5



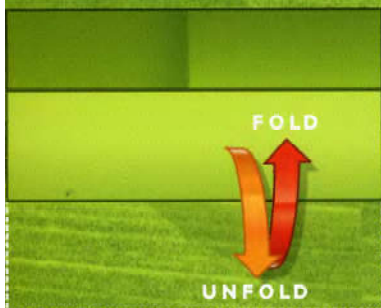
Fold the bottom of the paper up, making a crease right at the tip of the upside-down triangle. Unfold.

flip
over



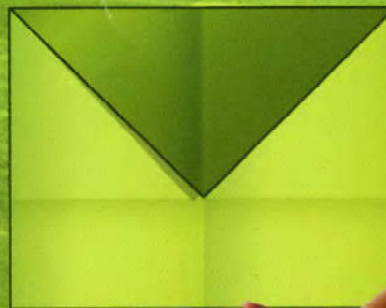
end up
like
this

6



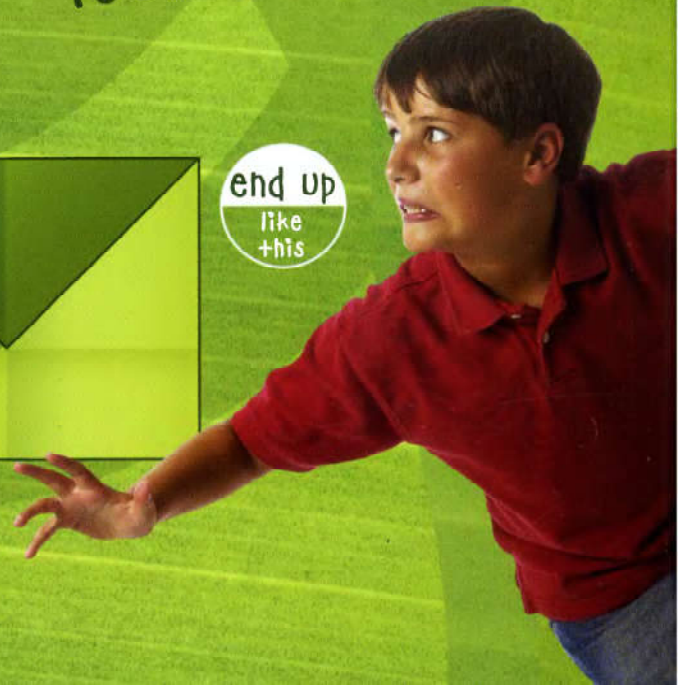
Fold the bottom up along the same crease. Unfold again.

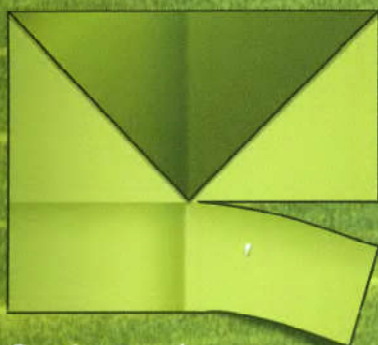
flip
over



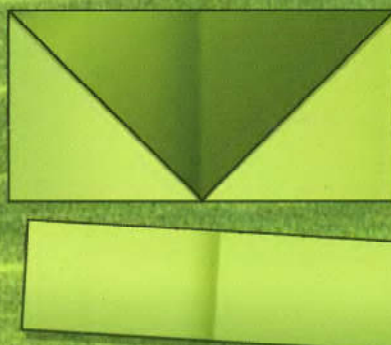
end up
like
this

look out, a dino-soa





USE
SCISSORS
IF YOU HAVE
TROUBLE
TEARING
THE PAPER



end up
like
this

SMALL RIPS
ARE OKAY

BIG ONES
AREN'T

Gently tear the paper
along the crease.

Tear slowly until the bottom of
the paper is completely removed.
Don't throw it away!



POINT TOUCHES TOP



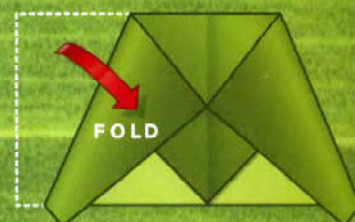
end up
like
this

Fold the point to the top
edge, right on the center
crease. Unfold.

9



FOLD

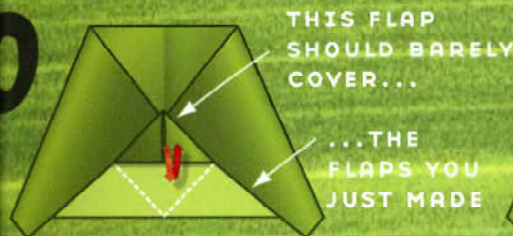


FOLD

pay attention.
this is tricky!

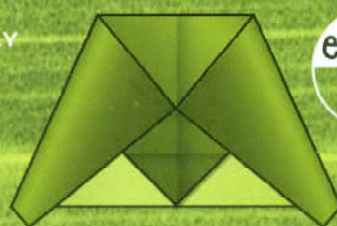
Fold the top right corner
to the + formed by the
creases in the middle.

Do the same with the
top-left corner.



THIS FLAP
SHOULD BARELY
COVER...

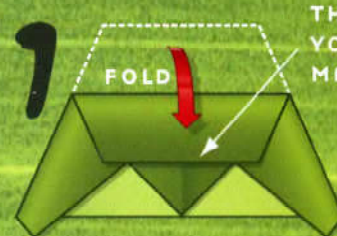
...THE
FLAPS YOU
JUST MADE



end up
like
this

Fold the point in the middle
up as far as it will go. Crease
well and unfold.

11



THE CREASE
YOU JUST
MADE

Put the top edge of your plane
on the crease you just made.
Line it up and crease carefully.



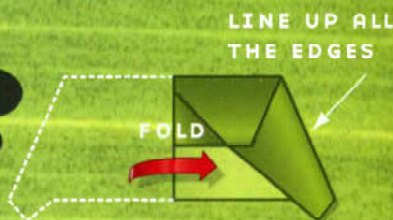
Flip the tip back up
along the same crease.

flip
over



end up
like
this

13



LINE UP ALL
THE EDGES

FOLD

Fold in half, left to right.

14



Grab the piece of paper you tore off in step 7. Fold it in half lengthwise.

15



Carefully tear the strip in half along the up-and-down center crease.

16

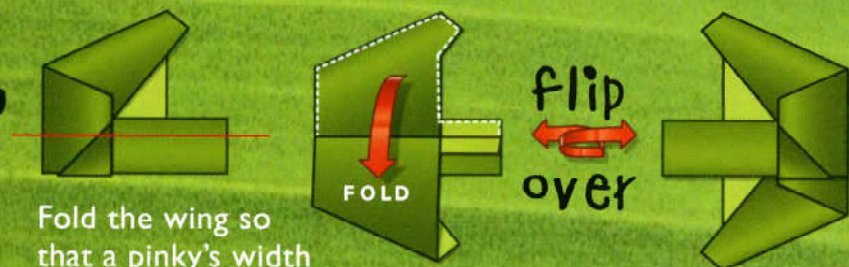


Tuck one of the pieces into the top flap of the plane's body. (Throw the other piece away.)

end up
like
this



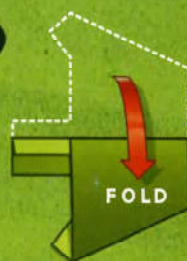
17



Fold the wing so that a pinky's width of the tail gets folded over. Make the crease parallel to the body.

end up
like
this

18



Fold the other wing down so it matches the one below it.

ALMOST
FINISHED



Unfold so your Pteroplane looks like this from the back.



FLYING THE PTEROPLANE

Your best flights will be hard throws up and away from you. Put an elevator in one wing for circles and corkscrews, and in both wings for loops.



The Professional

TYPE: glider/dart/
stunt

FOLDING DIFFICULTY:

2

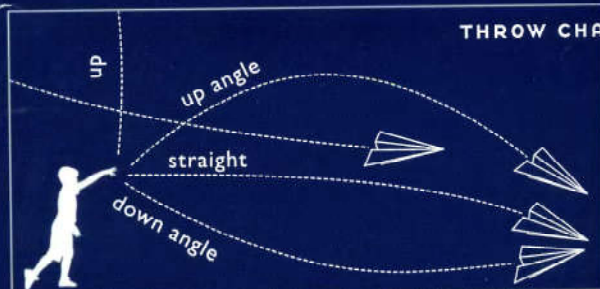
FLY ZONE:



indoor

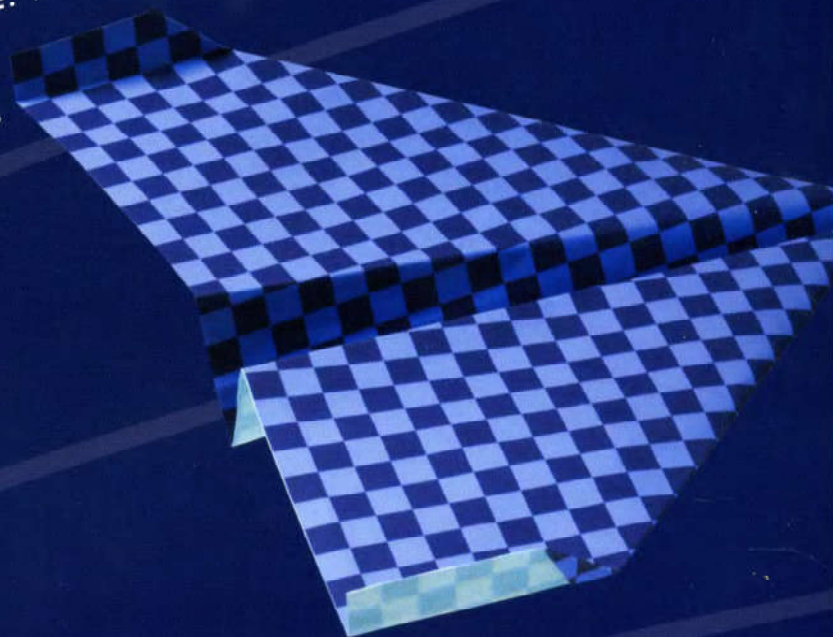


outdoor



THE PROFESSIONAL

THIS IS THE BEST ALL-AROUND PAPER AIRPLANE WE'VE EVER SEEN. IT'S EASY TO FOLD, DURABLE AND FLIES LIKE A PRO. WITH A LITTLE FUSSING, **THE PROFESSIONAL** WILL FLY LIKE A GLIDER, A DART, EVEN A STUNT PLANE. WHEN YOU NEED A PAPER PLANE THAT ABSOLUTELY, NO-QUESTIONS-ASKED ENDS THE COMPETITION — YOU NEED **THE PROFESSIONAL**.



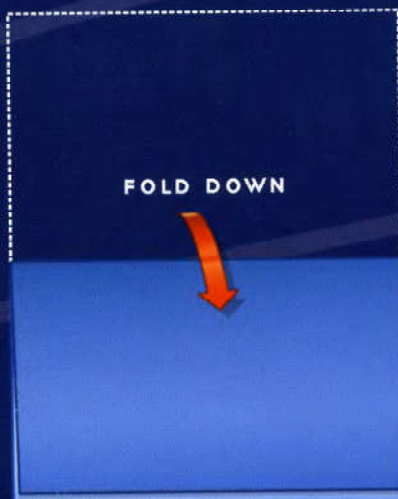
1

start
like
this

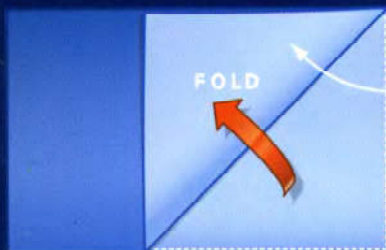


2

FOLD DOWN



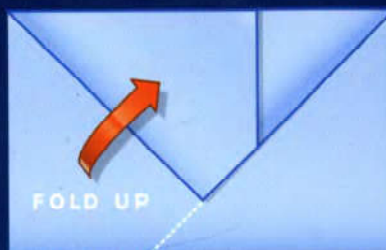
Fold in half,
top to bottom.
Be exact.



FOLD JUST
THE TOP
LAYER

Fold the right edge of the
top flap up so it sits on the
crease you just made.

4



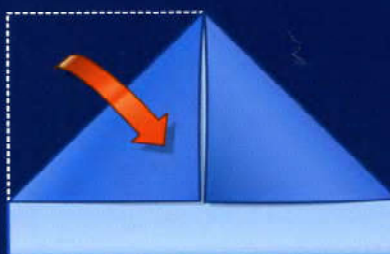
Make the same fold with the left
edge. The top half of the paper
should look like an upside-down
triangle.

5

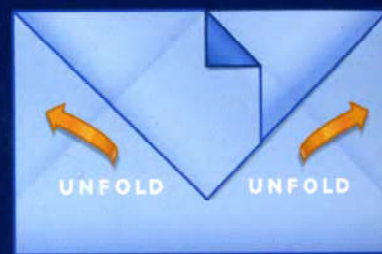


Fold the upper-right corner
down to the tip of the
upside-down triangle.

FOLD DOWN



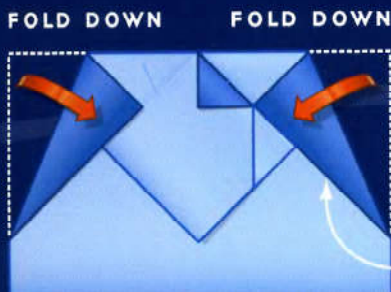
Do the same with the
upper-left corner.



Unfold the last two folds
you made.



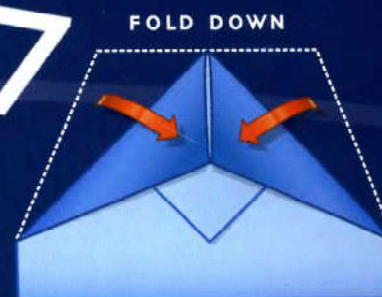
*this is tricky,
follow the
drawings carefully!*



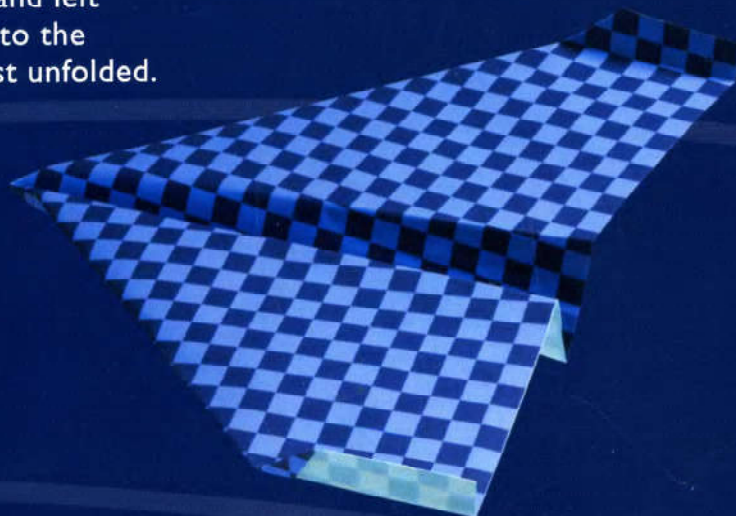
Fold the right and left
corners down to the
creases you just unfolded.

BRING THE EDGES
ALMOST, BUT NOT QUITE,
TO THE CREASES

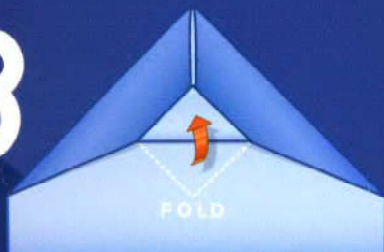
7



Refold along the same creases



8



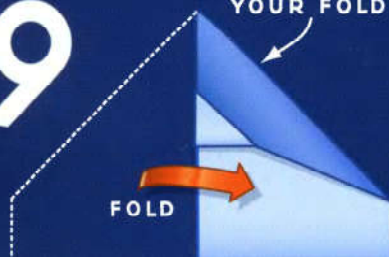
Fold the point in the middle up.

flip
over



end up
like
this

9



Fold in half, from left to right.

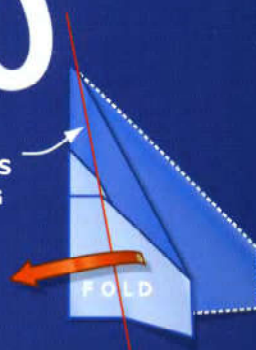
LINE UP ALL
THE EDGES
BEFORE YOU
CREASE
YOUR FOLD



You'll need to put
elevators in the
back wings.
See page 9 to
learn how.

10

FOLD THE WINGS
ROUGHLY ALONG
THIS LINE



Fold the top
wing down as
shown.

11

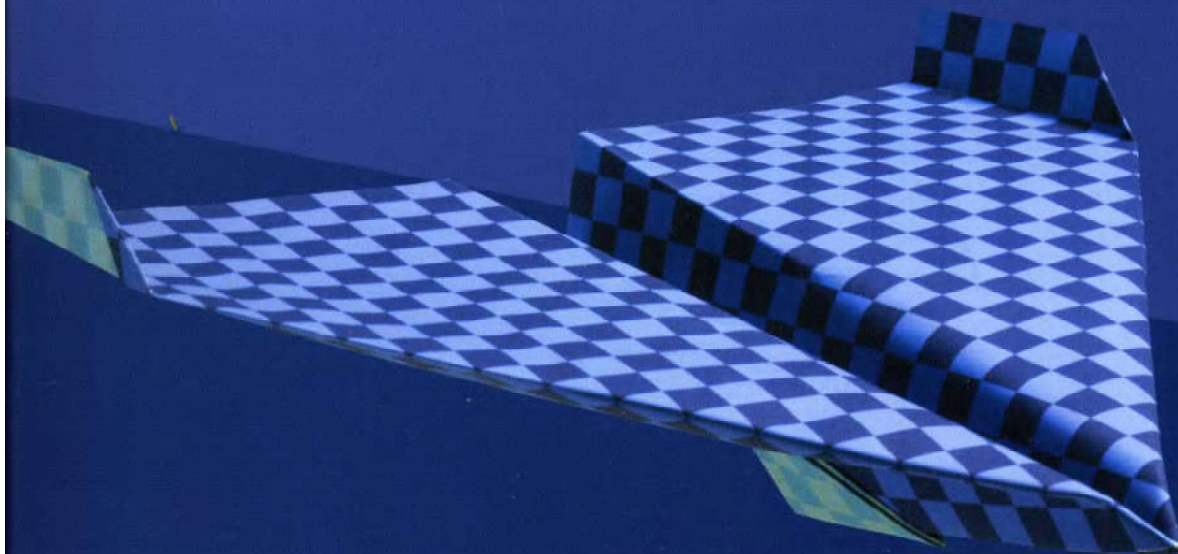


end up
like
this

flip
over



end up
like
this



FLYING THE PROFESSIONAL

Good, solid straight-ahead throws are the Professional's fuel of choice. But increase the elevators on the back edge and aim for the sky and you'll get big, arcing loops and corkscrews. If you want a slower glide, flatten out the fins. For dart-like flights, flatten the elevators and make sure the fins stick straight up.

ALMOST FINISHED



Fold the other wing right on top of the first. Line up all the edges carefully.

Unfold the wings so your plane looks like this from the back.

Make fins by folding a pinky-width of paper up on each side.

CHASE RACE

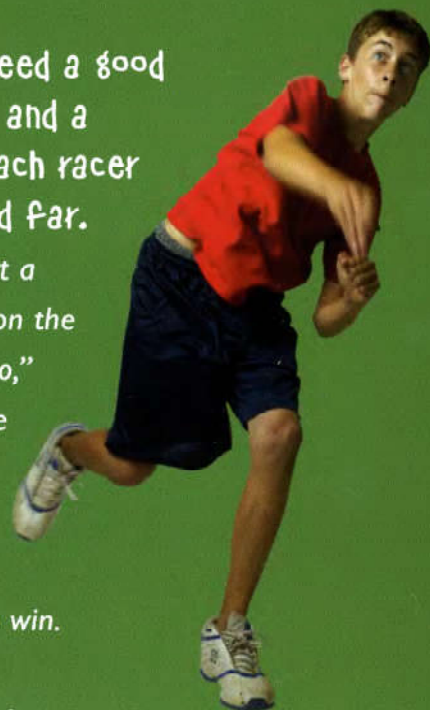
For this game, you'll need a good arm, a straight-flying plane and a couple ready-to-run legs. Have each racer make a plane that flies straight and far.

Then, pick a starting line and a finish line at least a soccer field's length apart. Get everyone to line up on the starting line, planes in hand. When somebody yells "go," each racer throws his plane as far as he can toward the finish line, then runs after it.

The only two rules are:

1. No running with your plane.
2. Both you and your plane have to cross the finish line to win.

So throw your plane, tear off after it, throw it again, tear after it, throw it again, tear after it... until somebody wins.



game 2

Troubleshooting better flying through fiddling)

✈ HOW TO TWEAK YOUR PLANE'S LITTLER BITS

Even a perfectly folded plane needs a bit of fiddling to fly its best. The good news is that careful tweaking can get almost any plane in the air, perfect or not.



PROBLEM

I get a
"rollercoaster"
flight path

Lower elevators or add
down elevators

SOLUTION

PROBLEM

my plane
barrel-rolls
to the ground

1. Make sure you have a
✓-shaped dihedral
2. Check your plane for symmetry
3. Add or change ailerons

SOLUTION

PROBLEM

My plane is
dive-bombing

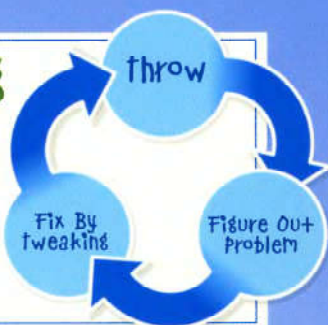
1. Ease up on your throw
2. Add up elevators

SOLUTION




The trick to tweaking your plane correctly

is to identify, then fix, one problem at a time. For the first few throws of a newborn plane, go through a cycle of checking and fixing that looks something like this:



PROBLEM

My plane's flight is unstable


1. Make sure your plane has a -shaped dihedral
2. Add vertical fins to your plane's wings (see page 17, Spy Plane)

SOLUTION

More about
dihedrals,
elevators
and ailerons
on page 9

PROBLEM

My plane rolls over and flies upside-down

Lift the wings to get a -shaped dihedral

SOLUTION

PROBLEM

It always turns in the same direction

1. Make sure your plane is symmetrical and fix any differences
2. Raise the aileron on the wing opposite the direction you want your plane to turn

SOLUTION



The Flying Ninja

TYPE: **stunt**

FOLDING DIFFICULTY:

4

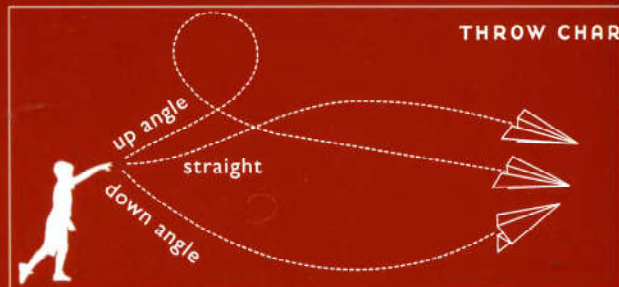
FLY ZONE:



indoor



outdoor



THE FLYING

NINJA

The Flying Ninja is a fast, sharp-looking, tight-cornering stunt plane. It's as quick and unpredictable indoors as outdoors and guaranteed to turn heads — or slice them off.

start

like
this

Pick up this corner and put it near the **X**.

2

LINE THESE EDGES UP!

FOLD

UNFOLD

FOLD

UNFOLD

LINE THESE EDGES UP!

Make a diagonal crease. Then unfold it.

Do the same thing with the other corner. Fold and unfold.

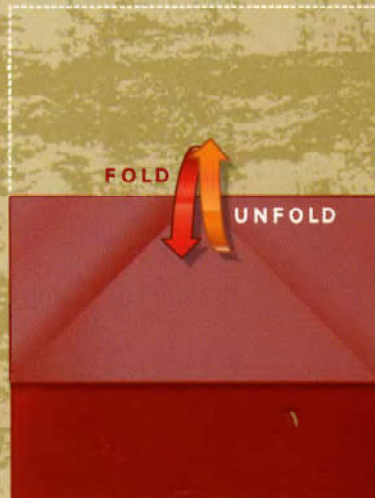
3

flip
over



end up
like
this

4

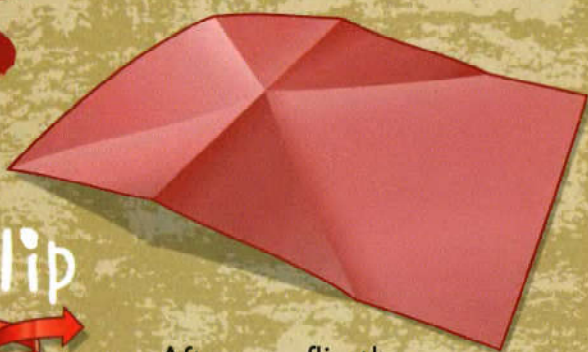


You should now have a big creased X in your paper.

Fold the top of your paper down so that the corners line up precisely with the bottom of the creased X. Unfold.

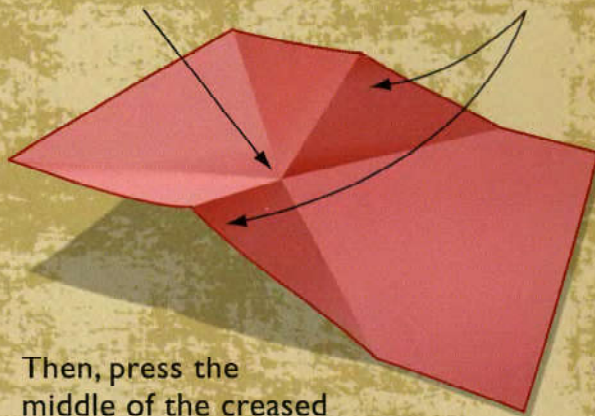
5

flip
over



After you flip the paper over, lay it down on the table.

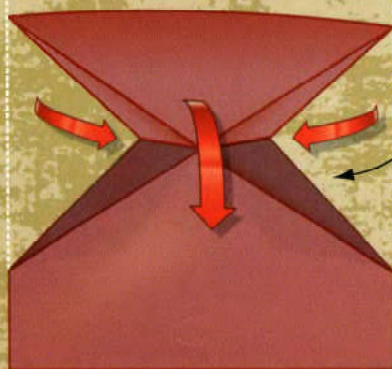
PRESS HERE... AND THE SIDES WILL POP UP



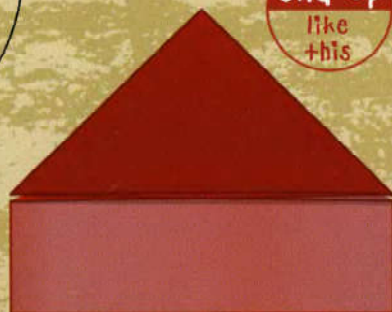
Then, press the middle of the creased X until the sides "jump" up.

6

BRING THE
SIDES FORWARD
AND TOGETHER

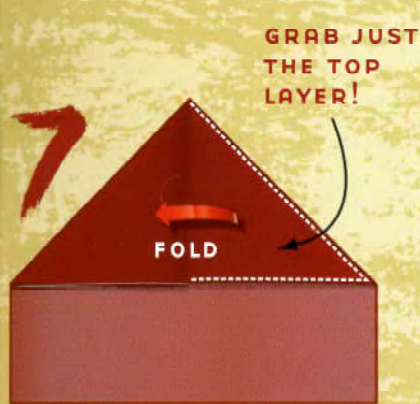


end up
like
this

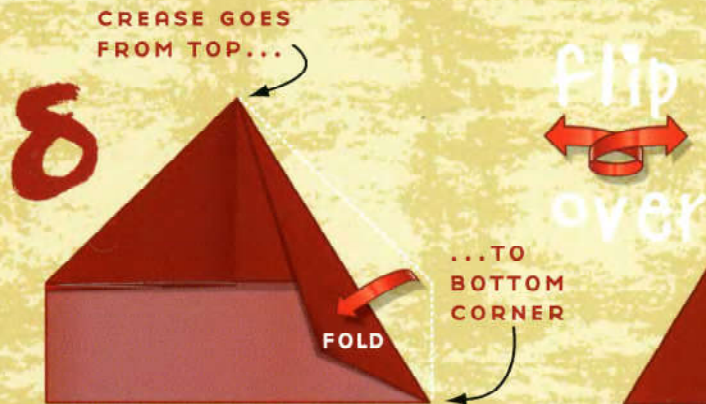


Pull the top edge of the paper downward. As you do, the sides of the paper should fold inward along the horizontal crease you already made.



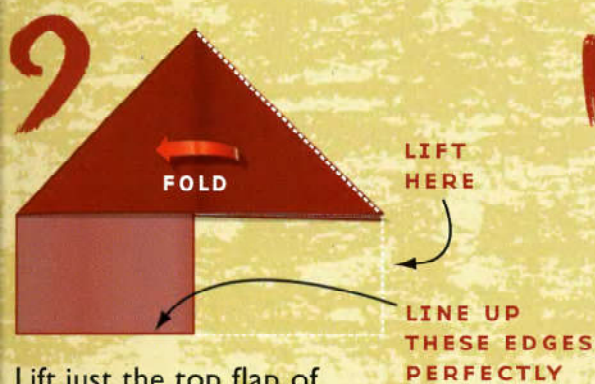


Bring the bottom-right corner of the triangle over to the bottom-left corner and crease.

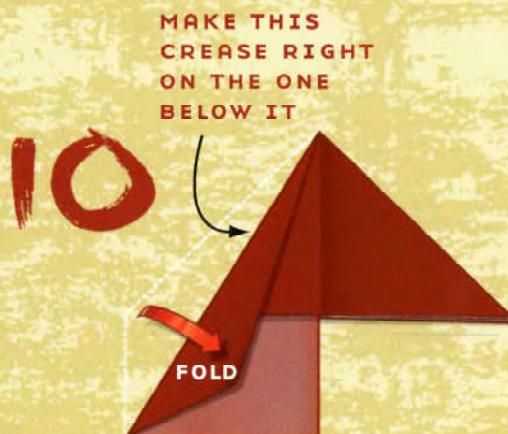


Fold the the new bottom-right corner of the triangle in so that the crease runs from the top of the triangle to the lower-right corner of the paper.

end up like this

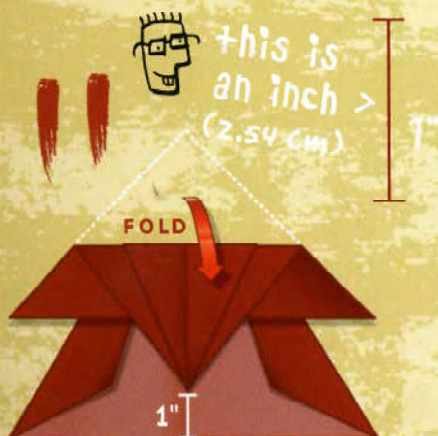


Lift just the top flap of paper on the right side of the plane. Fold it to the left side, lining up the bottom edges of the paper.

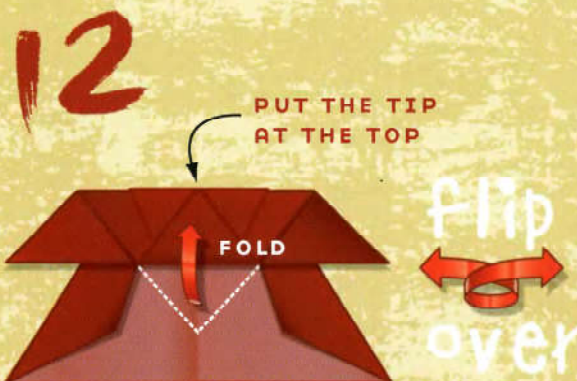


Fold the left corner of the triangle in, just like you did in step 8. Make sure it's right on top of the first one.

end up like this



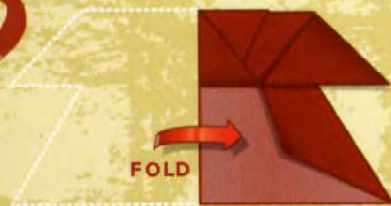
Fold the top of the triangle down so that it sits on the center crease, about an inch from the bottom.



Flip the same flap up so that the point sits on the crease at the top.

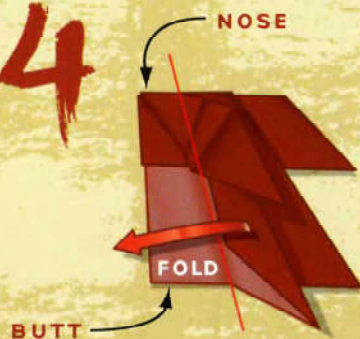
end up like this

13



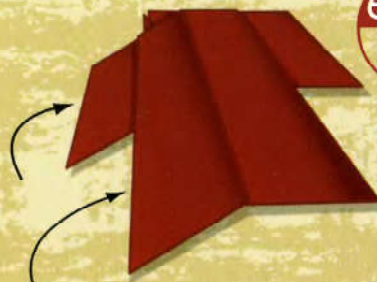
Fold the plane in half from left to right. Line up all edges perfectly.

14



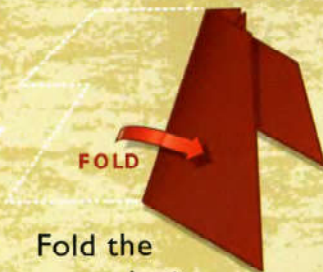
Fold the wing at a sharp angle, as shown. (The butt should be about twice the size of the nose.)

end up
like
this



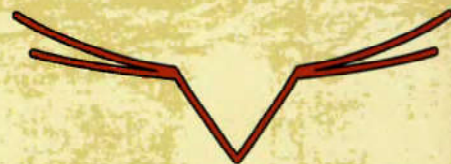
The edge of the wing and the body of the plane should be roughly parallel.

15 flip
over

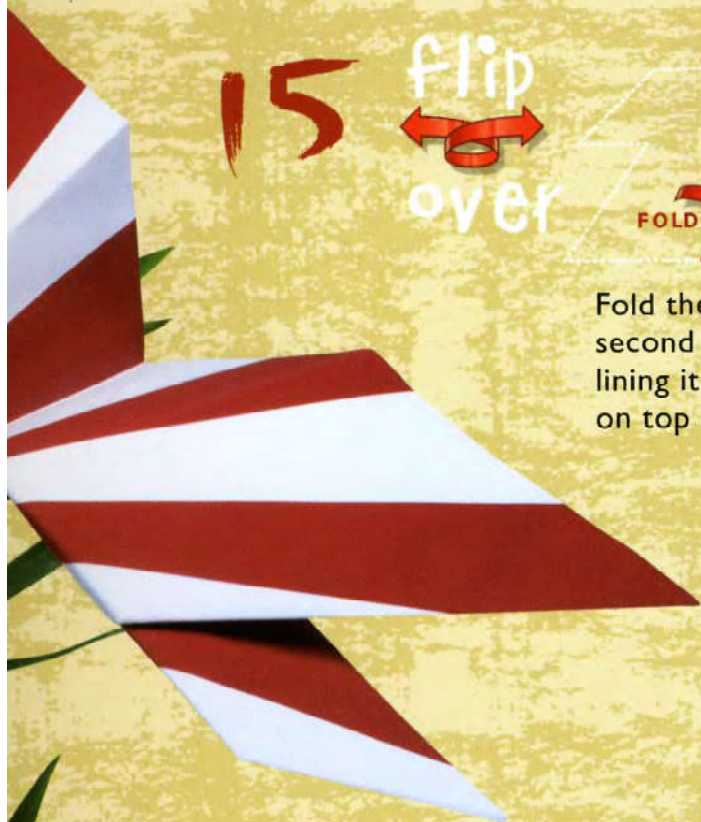


Fold the second wing, lining it up exactly on top of the first.

ALMOST
FINISHED



Unfold the wings so it looks like this from the back.



FLYING THE FLYING NINJA

Just aim anywhere between eye level and straight-to-the-heavens, then haul off. Put some elevators on the back edge of the wings if

you want small, tight loops.



The Space Cruiser

TYPE: glider

FOLDING DIFFICULTY:

4

FLY ZONE:



indoor



outdoor



THE SPACE CRUISER

THE SPACE CRUISER IS A LAZY, GRACEFUL GLIDER WITH FAR-OUT STYLING. GOOD FOR LONG, SLOW CIRCLES AROUND THE ROOM AND LOTS OF "OOH"S AND "AH"S.



1

start
like
this

Pick up this corner and put it near the X.

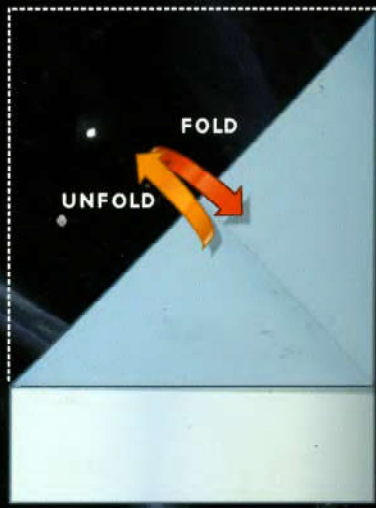
X

2

LINE THESE EDGES UP!



Make a diagonal crease, putting the top edge on the left. Unfold.



Do the same thing with the other corner. Fold and unfold.



 **TIP**
good folding =
good flying!

3
flip
over



THIS HAS BEEN
FLIPPED OVER

You should now have a big
creased X in your paper.

4



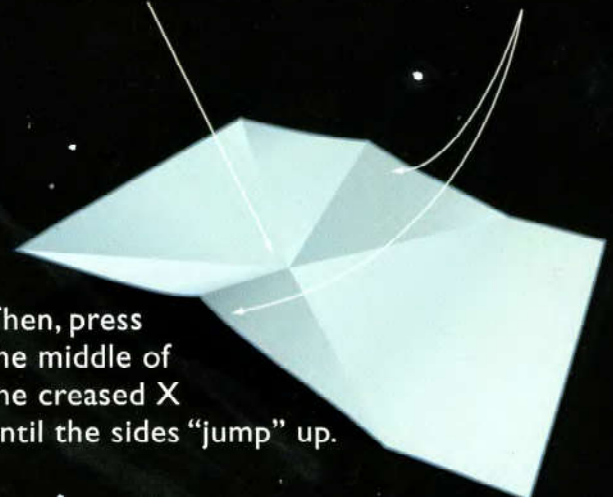
Fold the top of your paper
down so that the corners
line up precisely with the
bottom of the creased X.
Unfold.

5
flip
er



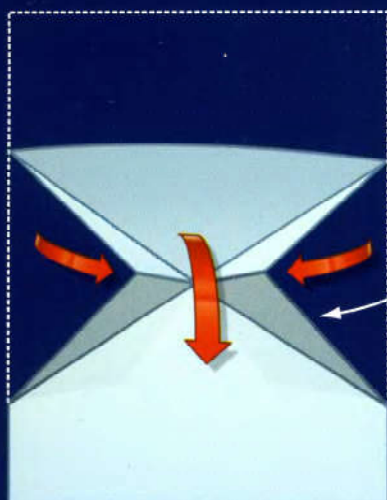
After you
flip the paper over,
lay it down on the table.

PRESS HERE... AND THE SIDES WILL POP UP



Then, press
the middle of
the creased X
until the sides "jump" up.

6



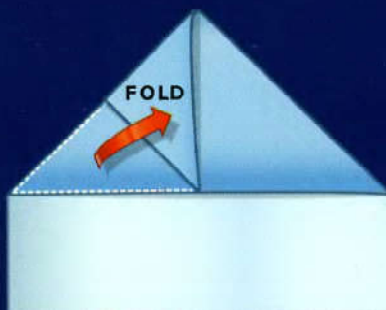
BRING
THE SIDES
FORWARD AND
TOGETHER

end up
like
this

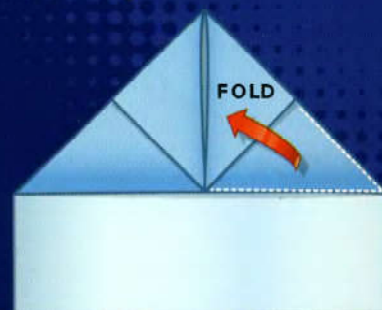


Pull the top edge of the paper downward. As you do, the sides of the paper should fold inward along the horizontal crease you already made.

7

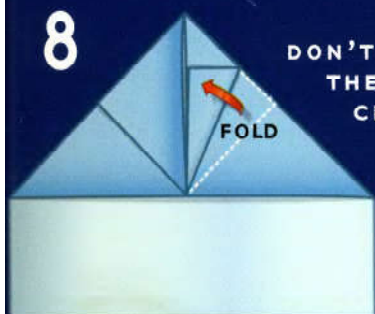


Pick up just the top layer of the big triangle, folding the bottom-left corner to the top.



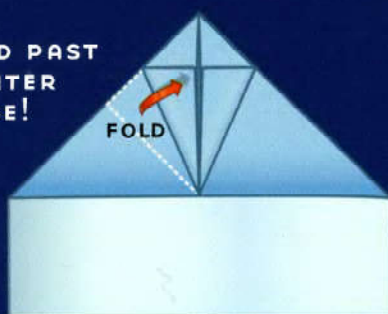
Do the same with the other side. Make sure to pick up just the top layer.

8



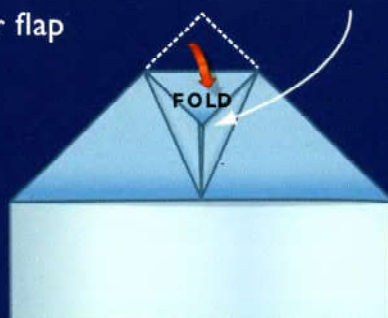
DON'T FOLD PAST
THE CENTER
CREASE!

Fold the flap up again, putting the bottom edge on the center crease.



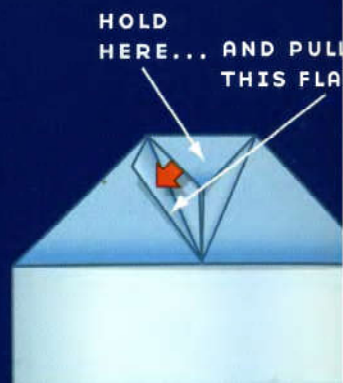
Then fold the other flap the same way.

PUT THE POINT
EXACTLY ON THE
CENTER CREASE



9

Fold the point down along the top of the flaps you just made.



While holding the triangle flat, hook your finger under the left flap. Pull just the top flap out from under the triangle.

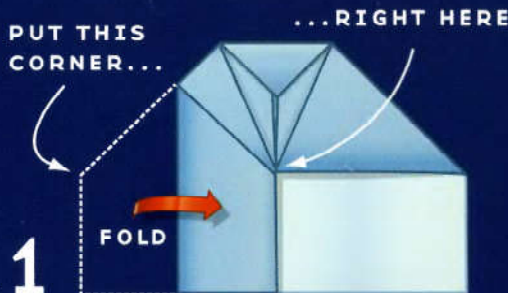
10



end up
like
this

Tuck the same flap into the left "pocket" of the triangle. Push it in until everything stays flat.

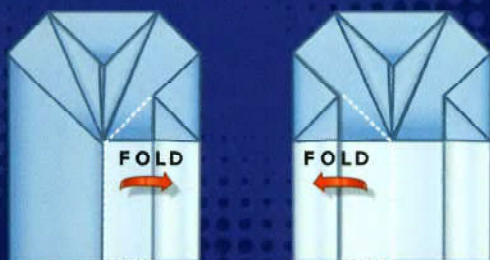
11



Fold the left edge to the center of the plane. Make sure all your edges line up.

Do the same with the right side of the plane.

2



Fold the same edge back to the crease you just made.

Repeat on the left side.

ALMOST
FINISHED



Straighten the wings so that your Cruiser looks like this from behind.



FLYING THE SPACE CRUISER

To fly the Space Cruiser, chomp on the back half with your hand, just like it's getting eaten by a giant sock-puppet alien. Then, instead of throwing it, give it a good push and let go. If all goes well, it should escape your hungry alien hand and glide gently to earth.





The Hurricane

TYPE: *foyer*

FOLDING DIFFICULTY:

3

FLY ZONE:



indoor



outdoor



THROW CHART



the hurricane

This is the world's only gotta-barrel-roll-to-fly paper airplane. Not only can it turn over and over and still fly, but it won't do it any other way. It's a great plane for a game of catch, a bit of flying or when you just have to have the weirdest plane in the sky.

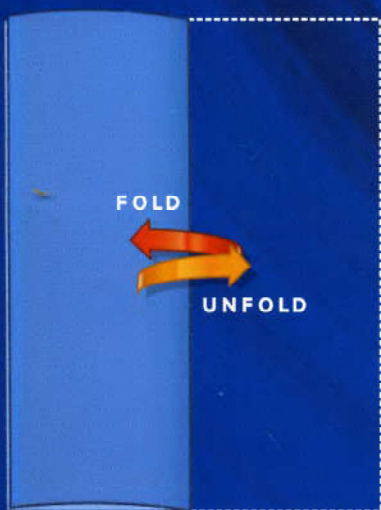


1

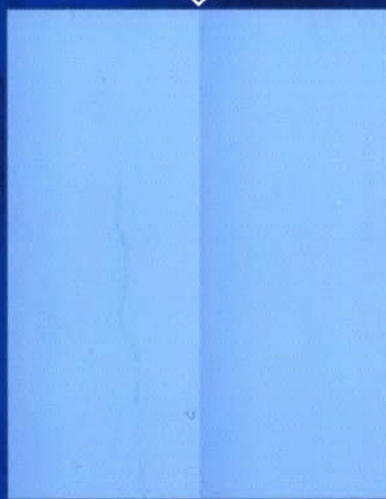
start
like
this



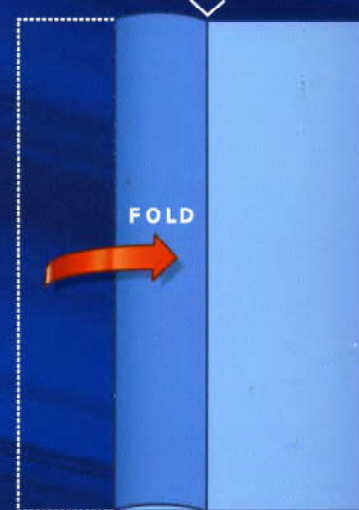
2



CENTER CREASE



3



end up
like
this

Fold in half lengthwise. Unfold to make a center crease.

Bring the left edge to the center crease and fold.

4

CENTER CREASE

CENTER CREASE



Fold the new left edge to the same crease and flatten well.

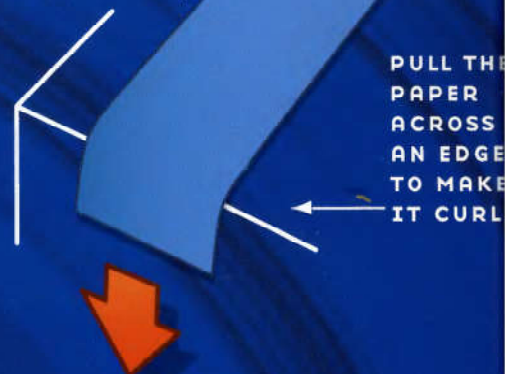


Then refold the center crease.



Fold the same bundle one more time.

5



PULL THE PAPER ACROSS AN EDGE TO MAKE IT CURL

ALMOST FINISHED

A BIT OF TAPE CAN KEEP IT FROM UNWRAPPING!



Following the direction of the curl, form the paper into a tube. Tuck the corner of the right-hand end under the lip of the other end. Overlap the ends by a thumb-width.



flying tip



put your index finger on the back edge of the tube and give it a push at the end of your throw.



FLYING THE HURRICANE

If you can throw a football, you can fly the Hurricane. Palm the outside, with the folded end facing away from you. Then throw it at medium speed with a little spin. The trick to getting spin is to flick your fingers toward the ground while you release the throw. If it's got enough forward movement and enough spin, it should corkscrew up and away.



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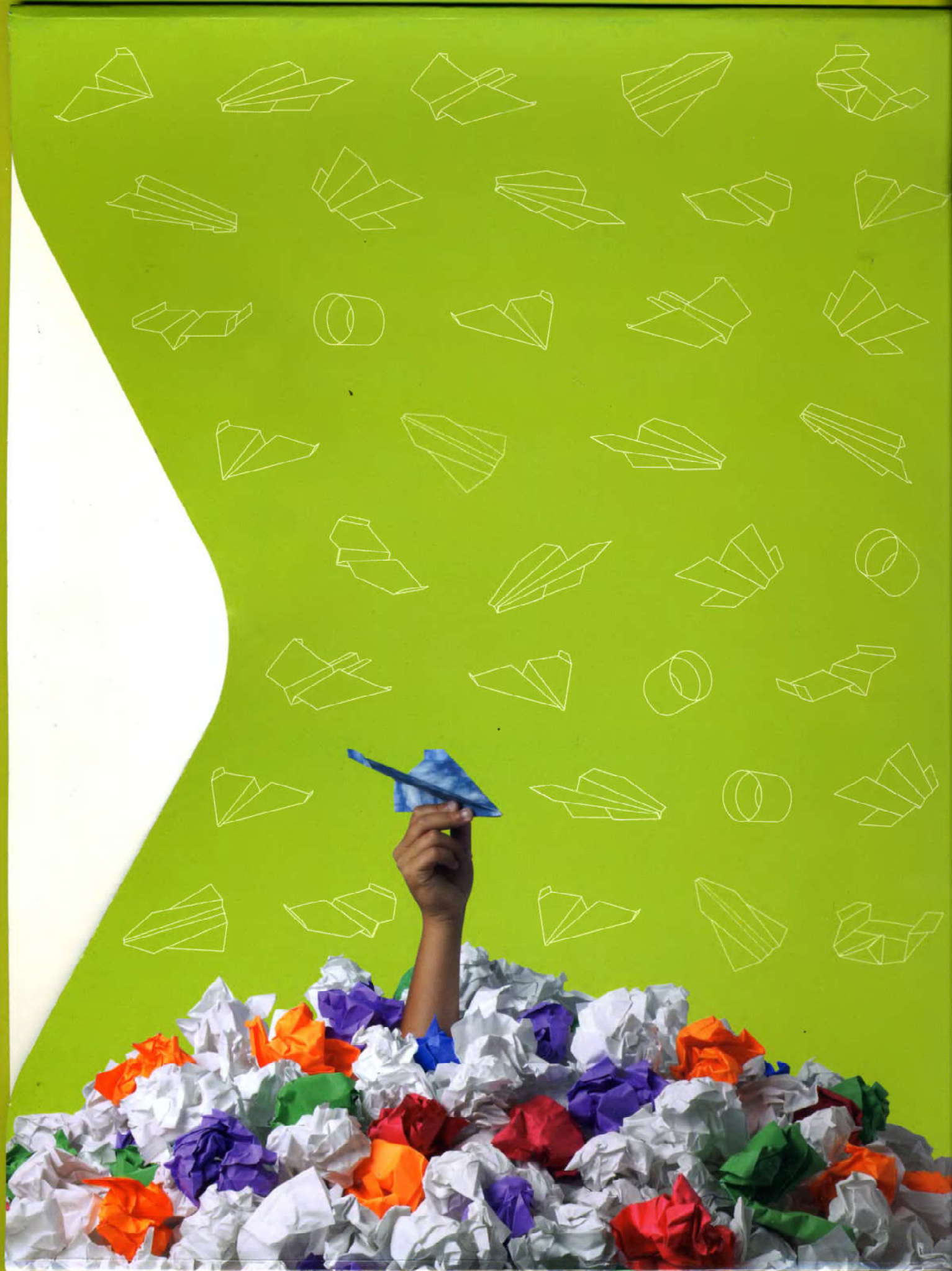
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