Flying Fighters

(15-19 years of age)

Are you ready to make and fly a fighter kite? The Nagasaki Hata is a popular Japanese fighter kite. By understanding where the *center of gravity* is and how to control its *yaw*, *roll* and *pitch*, you can make your kite execute a variety of acrobatic tricks. See what you can make your kite do as you perform several experiments and organize a kite-flying contest.

Activity: Build a Nagasaki Hata Fighter Kite and organize a kite flying contest.

Aerospace Skills: Building a fighter kite; experimenting with roll, pitch and yaw

Science Skills: Experimenting; building models

Materials: One 18" x 18" plastic sheet (kitchen garbage bag); one 21 ½" x 1/8" dowel; one 27 ½" x 1/8" dowel (match stick bamboo can be substituted); 43" kite line (10#-20# test); nylon reinforced tape; scissors; ruler

Blast Off

Making a fighter kite with a friend or your helper is a way to double the fun. This kite requires a long tail because it is so unstable, but it's also highly maneuverable. Basic directions are included. After you build your fighter experiment flying it by using different size tails.

Nagasaki Hata Fighter Kite

Specifications Rating:
With tail: novice
Without tail: expert

Wind:
Light to moderate

Line:
6-10 lb test (2.7-4.5 kg)

Kite Flying Tips

- When flying, a quick loosening of the tow line will cause the kite to become unstable and change its direction of flight. When the nose is pointed in the desired direction, placing tension on the kite will cause the kite to stabilize and continue on that flight path.
- If at any time the kite feels out of control as it dives toward the ground, do not pull on the tow line. If you do, the kite will increase speed and crash. To change direction, simply loosen the tow line from your hand until the kite changes direction. To maintain this new direction, just pull on the tow line once again. See for yourself!

	Action	Result
1. Quick loosening of the tow line		
2. Nose pointed in the desired direction, placing tension on the kite.		
3. Loosen the kite tow line from your hand		
4. Pull on the tow line after loosening it		

Material taken from ***Aerospace Adventures: Reaching New Heights Stage 3*** (BU-06844) by the National 4-H Council, page 24.

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Nagasaki Hata Fighter

Directions:

1. Fold 18” x 18” plastic sheet in half. (Figure 1) Measure 4” down from top (Y) along the fold and draw a line to corner (X). Cut on line Y to X.

2. Open plastic and lay shortest dowel (called a “spine” in kite terms) on fold. Tape to plastic at top and bottom (Figure 1) at points (W and Z).

3. Lay the longest dowel (called “strut” by kite flyers) on corner A and place toward tope of kite. Tape in place as shown. Bend strut and tape at point B. (Figure 2)

4. Where both dowels cross (Figure 2, point C); punch holes on both sides and tie “bridle line” (kite string) around both dowels. Measure 4” up from the bottom of the spine – point D. (What is a spine? Look back to #2.) Repeat on other dowel end.

5. Tie kite string in a loop ½” above center. (Figure 3)

A tail can be added by tying a narrow strip of plastic to the dowel below point D.

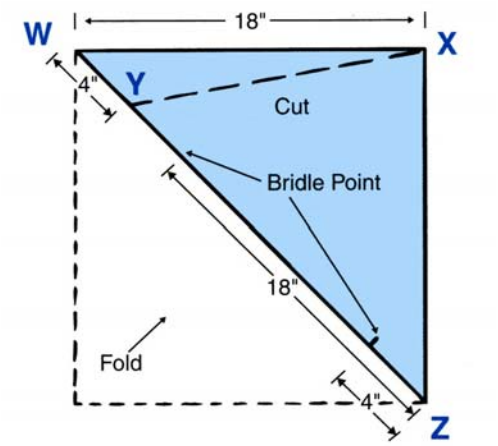

Figure 1

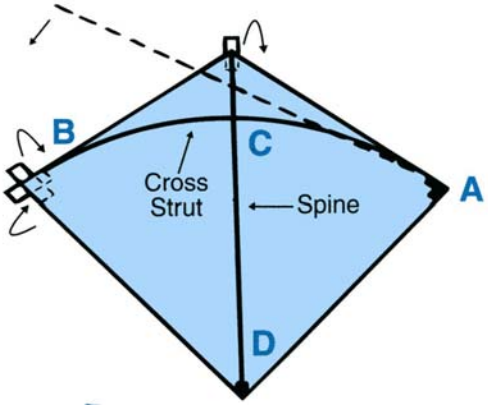

Figure 2

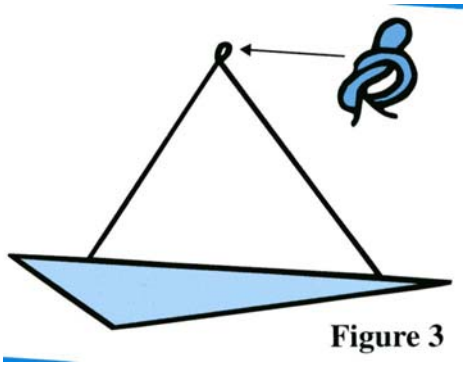

Figure 3

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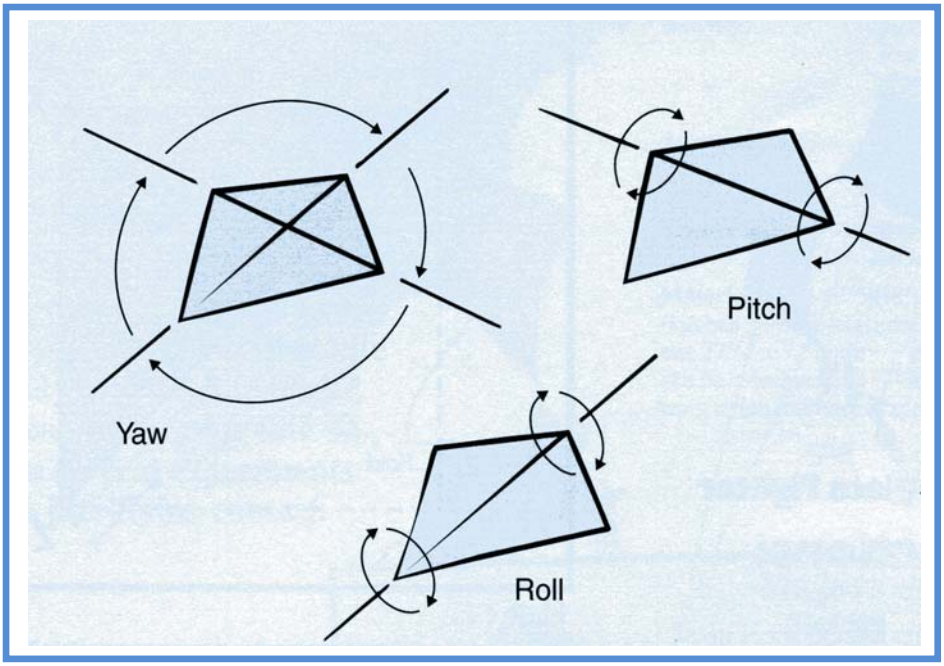

Use your kite to experiment with yaw, roll, pitch and center of gravity by doing the following:

1. Hold your kite away from you and balance it on one finger. What did you discover?

2. Use the diagram to try to roll your kite. How did you maneuver your kite?

3. Use the diagram to try to yaw your kite. How did you maneuver your kite?

4. Use the diagram to try to pitch your kite. How did you maneuver your kite?

Once your kite performs as you wish it to, organize a kite flying contest. Recognize the best roll, pitch and yaw as well as the most colorful, fastest launched, highest flying, most acrobatic and any other categories you choose.

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Debriefing

Ground to Ground (Share)

- How did you make your kite?
- How did your kite fly?

Climb Out (Process)

- How does a kite's center of gravity affect the way it flies?
- What are the benefits of a tail on a kite? How did your kite's tail help control yaw, pitch and roll?

Level Off (Generalize)

- How can making a model and making adjustments to it help you learn new things?
- What are some things you learned through the kite flying contest?

Cross Country (Apply)

- Describe ways that you learn through experimenting, and through contests.

Aerospace FACTS

Japanese Kite Flying

Kite flying, as practiced by the Japanese, is a highly competitive and often dangerous sport. Before a battle, kite warriors coat their flying lines with glue and bits of powdered glass. Sometimes curved steel blades are fastened to the tails. The object of the flight is to entangle an opponent's line and cut it down. Once a kite has fallen, the victor claims it as his own.

Solo Flight

1. The traditional colors of the Nagasaki Hata are red, white and blue. The designs are usually very simple, sometimes nothing more than three bold diagonal stripes. Decorate your kite to look like a traditional fighting kite or create a design of your own.

2. Find the center of gravity on a model rocket, airplane or kite. Demonstrate the design elements that stabilize a kite, airplane or rocket when they are affected by air turbulence.

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