Preparation is a Breeze!

Getting to the Wild Blue Yonder

If we're going to follow Professor Sherman Up and Away, we have a lot to do to be ready!

A fun way to start this section might be reading a funny short hot air balloon based picture book adventure like Alfie Small: Ug and the Dinosaurs by Alfie Small. Alfie's hot air balloon is swept inside the grinning mouth of an ogre-shaped cloud that propels him into another, crazy world. You never know where the wind might take you!

Have students think of everything that the Professor brought. What might you need to bring with you on a hot air balloon adventure?

Have students create their list of supplies and equipment needed for the trip and will calculate the weight of their total cargo. Using this calculation they will determine what size their balloon will need to be. Finally, they will make a drawing of their balloon and what they want it to look like with the dimensions they have calculated they will need.

There are several sites you/students can go to for lists on what you must have for survival in the wilderness or if disaster strikes, and this trip fits well into those categories because they will not be able to go to a store or call for help. They will be on their own and they must have all of the supplies and equipment they need for survival.

If possible, have students go to the following sites and make a list of at least 25 items they will need for the trip. They may add more than 25 items, if they feel you need them, but have them keep in mind that the more they add, the larger their balloon will need to be and the more space will be taken.

http://www.all-things-emergency-prepared.com/survival-list.html

http://www.thesurvivalistblog.net/preppers-supply-list-for-economic-collapse/

http://www.the-top-tens.com/lists/most-needed-2012-survival-supplies.asp http://www.greatdreams.com/basic.htm

Older students can also do their own supervised Google search for needed survival gear. All students can also use some of the ideas from the book such as a fishing pole for washing dishes and clothes.

Students will now need to figure out how much their supplies, equipment and passengers will weigh. Use the following statistics to help calculate your total weight:

Water Weight: Go to http://www.onlineconversion.com/waterweight.htm to calculate how much the water you are bringing will weigh.

Basket Weight: Rattan wicker weighs about 50 lbs per 550 square feet (remember to include any wicker furniture you may have in your gondola)

Burner Weight: 50 lbs

Fuel Tank Weight: 135 lbs per 20 gallon tank

100,000 cubic feet envelope: 250 lbs

Food and other equipment weights: Make your best estimates for food and equipment. You may be able to find the weight of a lot of equipment on shopping sites because they generally list the weight of items for shipping. Food is often listed by weight as well, such as 2 lbs of beef or 10 grams of granola. Students can use the following website to convert grams to pounds: http://www.metric-conversions.org/weight/grams-to-pounds.htm Just make your best estimate of the weight of your food and equipment.

Have students write down the total weight with a break-down of how they calculated their total in their journal. They will then use the formula to calculate the size of your balloon. **Do they need to change their original designs?**

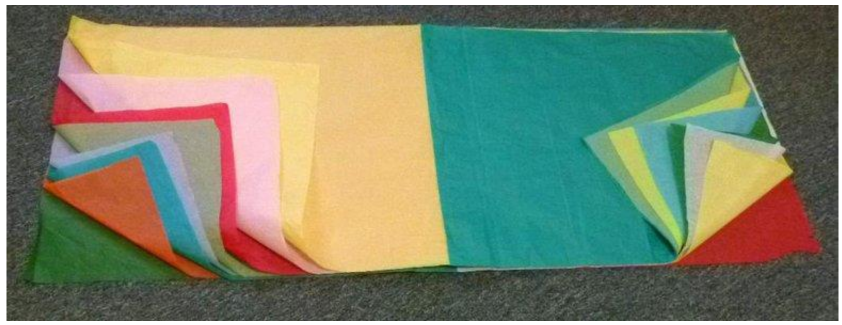
Formula: A cubic foot of air weighs roughly 28 grams (about an ounce). If you heat that air by 100 degrees F, it weighs about 7 grams less. Therefore, each cubic foot of air contained in a hot air balloon can lift about 7 grams. That's not much, and this is why hot air balloons are so huge -- to lift 1,000 pounds, you need about 65,000 cubic feet of hot air. Formula found at http://www.howstuffworks.com/transport/flight/modern/hot-air-balloon.htm.

They are now ready to go!! They will need to give your basket and balloon plans to the balloon manufacturer so they can create your balloon.

Building a prototype: YOUR first Balloon!

What does it take for each balloon?

- Tissue paper – 18-21 sheets, 20" x 30" or use whatever size you have available. Start with rolls of tissue paper 24 inches wide if available.
- Glue- Although almost any paste, glue, glue stick, or mucilage can be used, according to some their best results have been obtained using a quick setting, white glue, such as "Elmer's" or "Ross' School Glue", etc. and applied best through a narrow, tapered tip to control the flow. Others declare stick glue is best and liquid glue is not recommended.



  Experiment to find out which works best for your group! Do NOT use model airplane type glue, as it tends to soak through the tissue paper and cause the folds to stick together.
- 9 feet of drywall tape
- a 12" piece of string, ex. kite string (Note-you may want more string available to put a leash on your hot air balloons, in order to more easily retrieve them, and feel the power of buoyancy).
- and... a way to heat the air!

The 6-foot aerostat is made of 8 tapered gores each containing three panels of #1 grade tissue paper 20" by 30" in size or20 by 26 inches. You can use whatever size you have available. Each gore is assembled as follows:

1. Select three panels and place them end to end lengthwise with a ½" to 1" overlap. Carefully glue the panels together along the overlaps to form a single long sheet 20" by 90". Two and one half sheets of tissue paper will make one gore. Each gore can be unique using different colors of tissue paper, or make gores all one color. Use your imagination! Gores can be decorated with scraps of tissue, but be very careful not to add too much weight or the balloon will not fly well. By alternating colors you can form checkerboard and other patterns. Place this gore aside.

2. Repeat until you have a stack of 8 of these gores.

Shaping the gores

Once your stack of gores is complete, place them on top of one another, being careful to make them as aligned and straight as possible. If you wish, staple the 8 layers together 3 or 4 places along the long edges. It will make the marking and cutting steps that follow a lot easier. Look ahead at the following steps so you will know where to put the staples so they will be in the part that is cut away. If one ends up in the wrong place just remove it after you cut out the gores (those are the shapes that you will use to make the balloon).

You are now ready to cut the gores into the shape that will form the envelope. There are two methods for shaping the gores, using a pattern or cutting them freehand.

Using a pre-cut gore pattern

1. If mass-producing the tissue balloons it is advisable to build a gore pattern, ex. out of pressboard or hardboard, available at any hardware store in 4’ by 8’ sheets. A single sheet should allow you to create 4 gore patterns. The pattern should be no more than 88" in length, and 20" wide at the widest point, see figure 1.

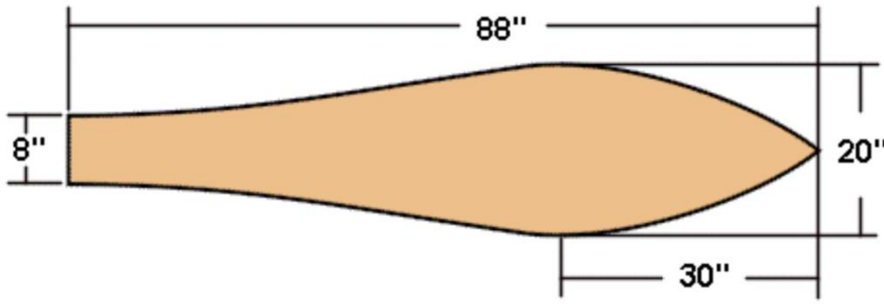


Figure 1.

2. Place the gore pattern on the stack of tissue "gores".

Mark the shape of the gores on the top of the stack of tissue paper panels. The exact dimensions depend on the width and length of the paper you are using, but aren't too important. The point will be at the top of the balloon. The long slanted parts will be glued together and will form the sides of the balloon envelope (the technical name for the outside of the balloon).

Have one person hold down the pattern while another cuts the stack of tissue "gores" with a pair of scissors, all layers at the same time.

Leaving everything flat on the floor helps a lot with this and following steps.

Cutting the pattern free hand

1. With all the tissue "gores" stacked on one another, carefully fold them in half lengthwise, making it 10" by 90" in size.

2. Carefully apply several spring clips (clips to hold paper) along the folded edge of the tissue "gores" to keep the sheets from moving.

3. Draw a half of a leaf shape on the top sheet (figure 2) and cut it out through all the sheets. It is possible to stack all of the rectangles and cut all at one time.

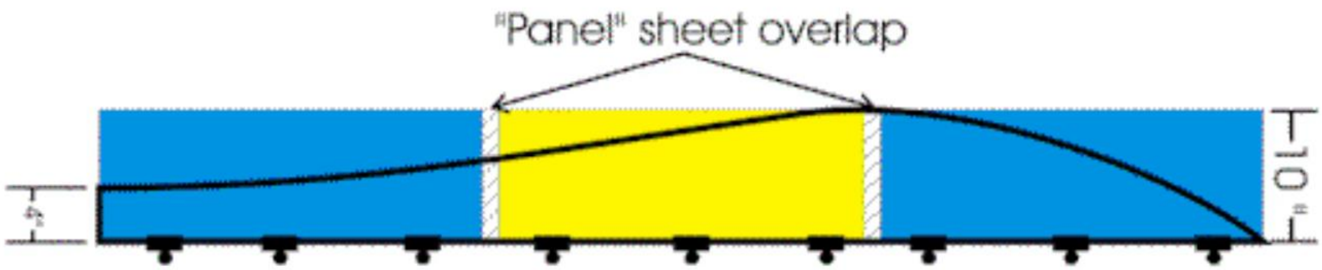
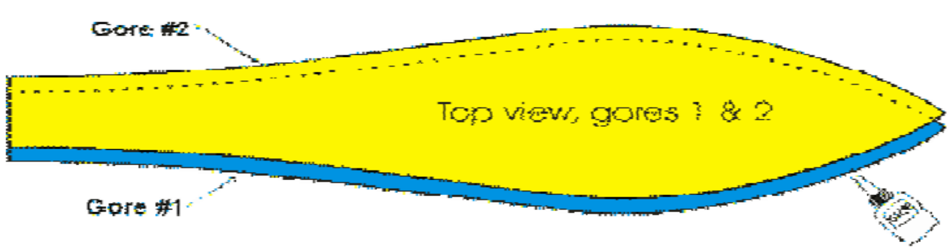


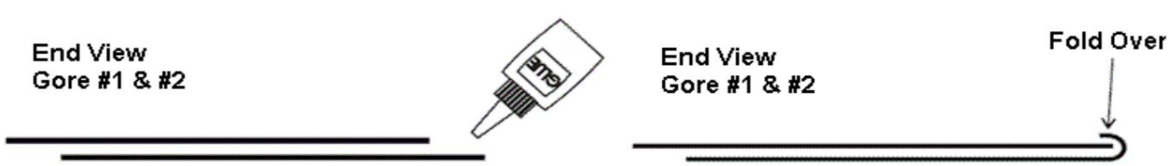
Figure 2.

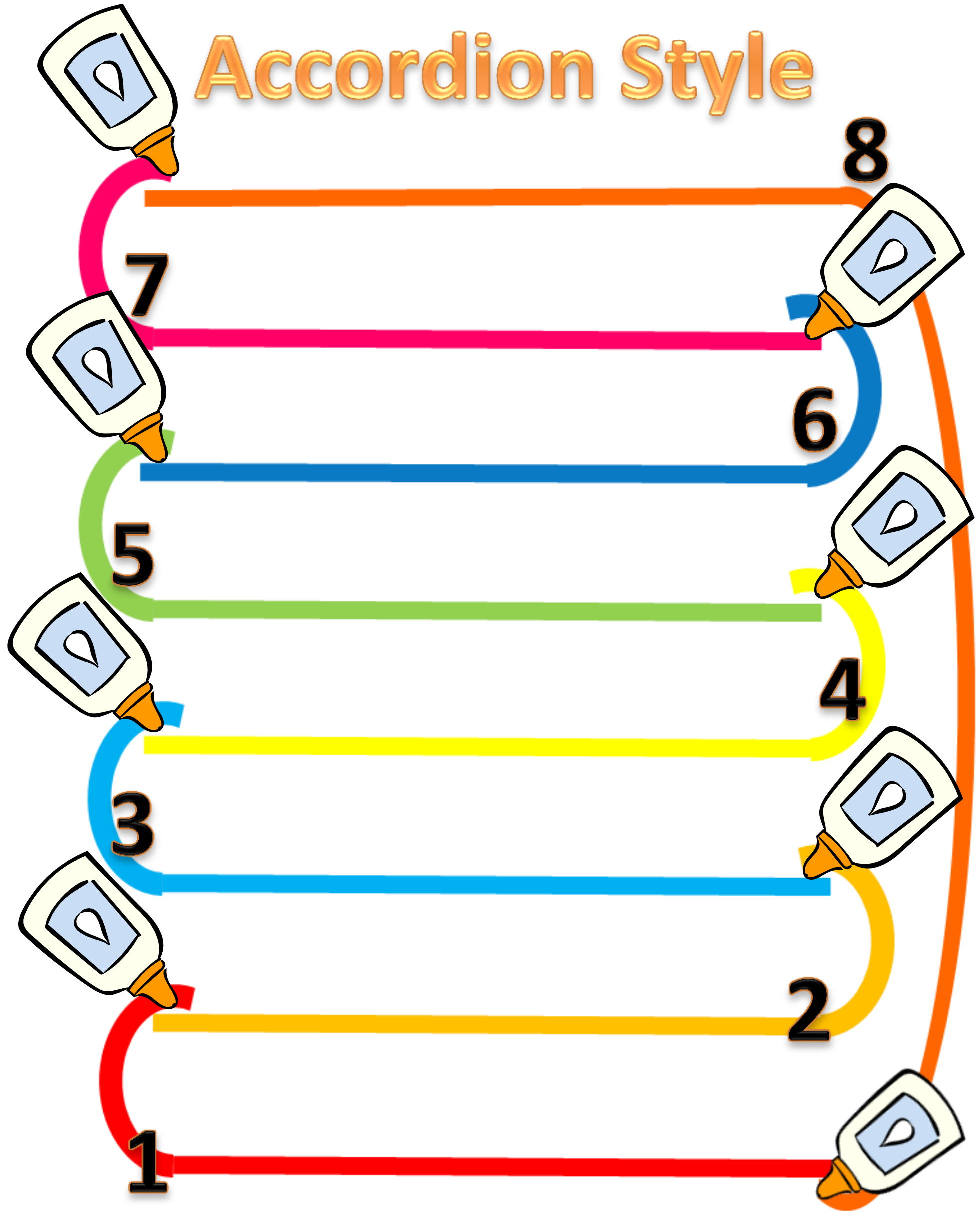
Option: Students can, if desired, very carefully embellish their gores with rubber stamps, rub-on letters, markers and drawings. Remember, these need to stay light in order to fly.

Next join the gores

Any glue stick will work; some say carefully applied quick drying liquid Elmer's with a narrow top works well, others say never use liquid, always use stick! Whatever type of glue you choose, it works well to slide the top layer over about a half inch and then put the glue on the second layer. It is also best to start joining at the point, because good alignment there will make it easier when they are finishing the balloon. Fold the lower layer over to make the joint along that edge. Neatness greatly helps but isn't critical, so if it's a tiny bit messy, they can still use it.







Place a third gore on top of gore #2, again allowing a ½" to 1" margin to show on **unglued side** of gore #2, starting at the point again.

Repeat the gluing like you did with the first two. Glue from the tip to the bottom. *During and after gluing, carefully separate all folds to keep them from sticking together. It is important to the final shape of the balloon that these folds do not stick together.*

Glue up the remaining 5 gores using the above procedure. Take your time, be careful. Don't rush.

You should now have a stack of 8 gores (folded accordion style) with two edges that have not been glued –one on the top and one on the bottom.

Now all we need to do to complete the envelope is to join the edge of gore 1 to the edge of gore 8. To do that, after making sure that there are no folds stuck together, lift gore 1 and push everything except gore 8 back out of the way. Line up the 2 free edges and glue them together just like you have done before (you must be getting good at it by now). The envelope is complete.

Check Your Joints: This is a good time to check for any places that the joints need to be re glued. Fix any big holes. Holes near the top are more important than ones near the mouth. **Why might that be?**

Figure 5.

Tie off the top of the balloon with string, about 1" back from the top to close hole in top of balloon. Leave a loop in string for holding balloon up while inflating (figure 5).

Next we will need to reinforce the mouth. Glue the

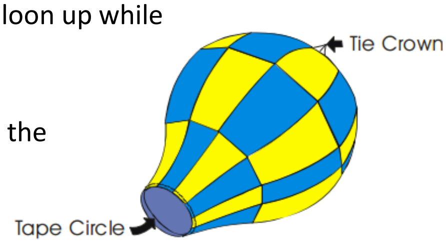
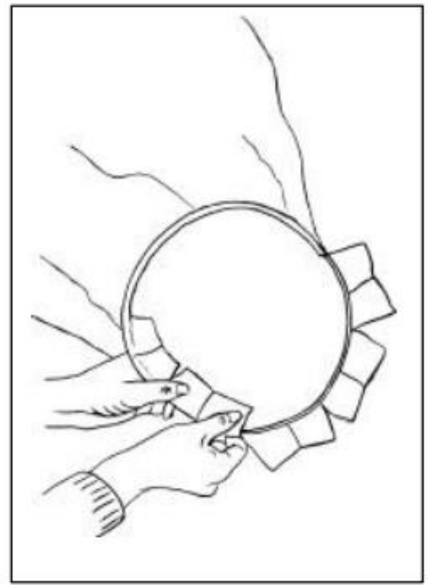


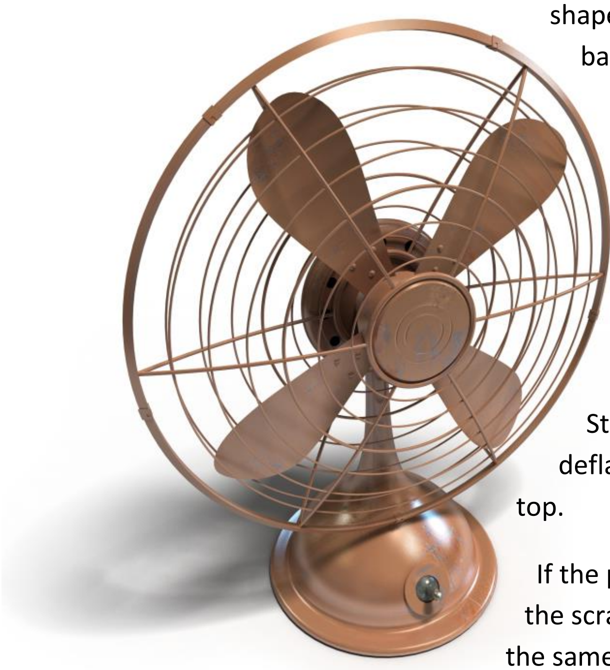
Figure 6.

pieces of drywall tape on top of each other. Form into a circle approximately 12” in diameter.

Open hole in bottom of balloon and shape balloon panels to fit by making tucks and gluing together. Place ring inside opening and fold paper over it about 1", gluing into place (figure 6). RING MUST BE A MINIMUM OF 12" FOR PROPER INFLATION!



Do not attempt to inflate the balloon without the throat ring installed. The ring acts to hold open the bottom of the balloon during inflation, to give shape to the balloon and to stabilize the balloon during flight.



Checking for Holes:

Let balloon dry thoroughly. You can inflate with a fan or hair dryer to check for holes, loose edges, etc. Make necessary repairs with glue and paper or tape. A fan or hair dryer is not sufficient to launch the balloon. Stand the inflated balloon upright and deflate it by slowly pushing down on the top.

If the points didn't come together perfectly cut a patch out of some of the scrap and glue it over the hole. Other holes and rips can be repaired the same way. Remember the balloon will fly best if it is as light as possible so make the patches as small as will get the job done.

What's in a Name?

Unlike most airplanes, but rather like ships of the sea, balloons are almost always named by their aeronaut owners. **What was the Professor's balloon's name? Why did he choose it? p. 40 in the novel.** Sometimes the names are merely a reflection of a company name, like Rocky Aoki's "Benihana" balloons, or in the age of the Internet, "America Online" advertising balloons. Sometimes a commercial balloon will reflect an advertising campaign, like the Pontiac balloon being named "Excitement". The name of the balloon often will reflect a characteristic of the balloon. A beautiful black-topped balloon with rainbow scallops resembles the NBC peacock logo, and is appropriately named "Peacock". Sometimes the names will reflect the balloon's characteristics with an especially inventive twist. One described one owner's view of his sport: "Hot Fun". Balloons flown by a commercial operator in Colorado are all purple with yellow flags.

Image Credit: Balloon Sketch done by the very talented Suhita. Find her and her art at http://sketchaway.wordpress.com/2013/05/19/hot-air-balloons-and-vintage-cars/. Copyright 2013. All Rights Reserved.

Classical titles with a slight twist become a fun names for big purple balloons... "Grape Expectations"... "Grape Adventure"... Not a totally unique way of thinking, apparently... Ed Lappies of Hillsboro, New Hampshire dubbed his mostly purple balloon "Edmund The Grape". Irish pride led Ted O'Hara of Schenectady, N.Y., to name his green-and-yellow balloon with shamrocks "Irish Rover". A balloon flown by Connecticut balloonist Jim Clark that keeps alive the memory of POWs and MIAs is appropriately named "Forget Me Not".

Often, the names reflect more romantic or mystical thought on the part of the owner. Looking through the rally program for a major rally like the 100-balloon Adirondack Balloon Festival held in Glens Falls, N.Y., shows the variety of names reflecting the very beauty and romance of the sport of ballooning. "Diamond Fire"... "Buoyant Breeze"... "Placidity"... "Rainbow's End"... "Windsong"... "Foxfire"... "Misty Horizons"... Tom Stodolski, of Westford, Massachusetts had fascinating and mystical names for a pair of balloons he had flown for over 10 years. The first was "Atlantis Seeker"... The second, as if in answer, "Atlantis Found". At the other end of the spectrum, New Hampshire balloonist Gary Morgan obviously wasn't feeling very imaginative... He simply calls his "Gary's Balloon".

Hot Air Buffoon: The Pun Also Rises

Many of the best names of balloons are those based on something about the owner -name, location, occupation - that sort of thing. Puns are, of course, the best option of all (for example, a balloon with a bunch of grapes on it: "Cluster's Last Stand" - examples abound). Some names to avoid might the clichés based on color (e.g. "Mellow Yellow," "Banana Split," "Big Bird," etc.)

Memorable. Distinctive. And clever. How many times have we read or heard that puns are the lowest form of humor? That’s not true! While bad puns abound, we can think of those as cheap, rather than bad; puns too easily made. Puns are a special form of humor based on double meanings. Puns are sometimes nicknamed “the lowest form of humor” and often greeted with groans, but in fact, the language knowledge needed to understand a pun is very sophisticated (Pollack 2011).

A brief definition, so we're all on the same track: A pun is the deliberate confusion of similar words, phrases or sounds for humorous — and sometimes serious — effect. Another word for pun is paronomasia, deriving from an ancient Greek word that means "to alter slightly in naming." It's rarely used except to say that it's another word for a pun. Because they require processing the sound and meaning of words twice, puns demand considerable language agility. Puns — quality puns, at least — are not the lowest form of humor, but among the highest, involving imagination, creativity and wit. Puns have contributed to the development of thought, language and creativity throughout time.

Introduce the concept that words can have multiple related meanings that are sometimes very divergent and these multiple meanings can lead to misunderstandings and point out that some of the misunderstandings can be quite funny. Puns are a playful way to confuse words that sound similar but have totally different meanings. Puns that create visual pictures between two words force the learner to think simultaneously about to things thus creating meaning and connections between everything along the way and increasing mental agility. Unlike humor based on sight gags, funny facial expressions, or amusing visual arrangements, the humor of puns is based on language play.

We see puns all over from long ago history to classic literature to gourmet ice cream flavors. Sir Francis Drake messaged a single Spanish word to Queen Elizabeth after defeating the Spanish Armada - 'Cantharides'. It means 'the Spanish fly'. Samuel Johnson did not like puns much. In fact, he actively advocated against the word play type. Still, hearing a Mr. Vowell was to be hanged he could not help uttering 'It is very clear it is neither U or I' to his companion. Sometimes a pun is on a different sense of the same word, as when in *Romeo and Juliet* the dying Mercutio (who can't resist a pun even in his last moments) says, "Look for me tomorrow and you will find me a grave man."

Puns are on our Popsicle sticks or in jokes like, “He wears glasses during math because it improves division,” or, “That girl said she met me at a Vegetarian restaurant, but I never met herbivore.” In titles like after a school's math team's winning meet the school paper had an article titled: "Divide and Conquer. Or in in shop names: Pollen Nation (a flower shop), a therapeutic massage shop called Nice to be Kneaded, a dress shop called Damsel in Dis Dress, a haircutter named the Mane Event and another called Curl up & Dye. Laundries named Spin City and All Washed Up. A coffee shop named Acute Café. A shoe repair shop, Sole Brothers. And,of course, the king of all restaurant-name puns, The Dew Drop Inn. Every state in America has at least one. **If you asked your students to bring in punning shop names in their town, could they find some?** From ancient culture, politics, language development for kids, build mnemonic, articulate dissent in a totalitarian regime, to advertising and product placement-- puns are an integral part of every language.

Puns are also language-specific. Every language has its own puns and wordplay, including languages that do not use alphabetic writing systems. There were puns in hieroglyphs and cuneiform! Among the ancient Greeks, the guy who could come up with the most clever pun earned the most respect. There was an ancient Athenian comedy club called the Group of Sixty and a prevalence of double meanings in Polynesian chants. Mandarin, for example, has puns based on the sounds and appearance of Chinese logograms. For example, the Mandarin word for “fish” creates a pun based on a close pronunciation with the word for “abundance,” and for that reason, the fish occurs in many Chinese illustrations as a symbol of wealth. The similarity of the sounds creates the pun, and fluent Mandarin speakers understand it effortlessly.

Expose your students to some puns, there are many possible reference sources such as **Dear Deer: A Book of Homophones, Eight Ate: A Feast of Homonym Riddles, a**nalyze good and bad ones with them, have them keep on the lookout for them, and encouraging them to pun themselves, aloud and in their writing. Puns are a wonderful aspect of language to promote, by exposing your students to good puns, they will learn to pun with class. And in class.

I'm Sorry I Haven't a Clue' Game

One ‘game’ is the rewriting of well-known book titles for specific audiences. Ask pupils to rewrite book titles so that they might appeal to hot air balloonists. Be sure to also show students how not to be corny, distasteful or to go for the easy pun.

Homonyms generally include two categories of word types: homophones and homographs.

- Homographs are words that are spelled the same but have different meanings.
- Homophones are words that sound the same when you pronounce them, but have different meanings.

At the following you can find a definition for almost every homonym you could think of from Alan Cooper! http://www.cooper.com/alan/homonym_list.html

Dressing for High Flying Success

The clothing balloonists and their crews wear sometimes will be as inventive and as fascinating as the names of the balloons. Pilots and regular crew members are often outfitted in "uniforms". These can be as modest as identical T-shirts, often printed with a picture of the balloon, or they may be as sophisticated as matching uniforms with unique jumpsuits and hats matching the colors of the balloon. Balloon names and attire will often match. A black balloon with a white skull-and-crossbones based in Albuquerque was flown and crewed by ballooning enthusiasts dressed in 18th century maritime garb. The Albuquerque International Balloon Fiesta, the world's largest balloon rally, is also a good place to see the extremes to which true fanatics can go! A red-and-purple striped balloon flown a woman pilot with an all-woman ground crew was a good example. Ground crew members were dressed in purple jackets, red tights, purple leg warmers, and had purple-and-red dyed hair!

The clothing worn isn't always so inventive. Commercial balloonists who will be landing with their paying passengers regularly on other people's property know that a clean, professional appearance is less likely to rile up a landowner than something bizarre or extravagant. Safety seminars recommend that balloonists wear long-sleeve natural fiber shirts and long pants to give themselves an extra measure of protection and time to react to rare emergencies like propane fires or the stinging, burning cold of raw propane from a burst propane line. Sadly, all too many balloon pilots today dress more appropriately for the summer heat than for safety and fly wearing T-shirts and even shorts.

Up! Up! and Away!

Hot air balloons fly best on still, cool mornings. You must have a large space to launch your balloon because, like the real thing, it is at the mercy of the wind, except that there is no one controlling it.

When you're ready for your balloon launch, grab your youngsters and a generous supply of old newspapers ... and head for the nearest open area that's free of trees, utility wires, rooftops, and winds over 5 MPH. (A large field or a big parking lot should do.)

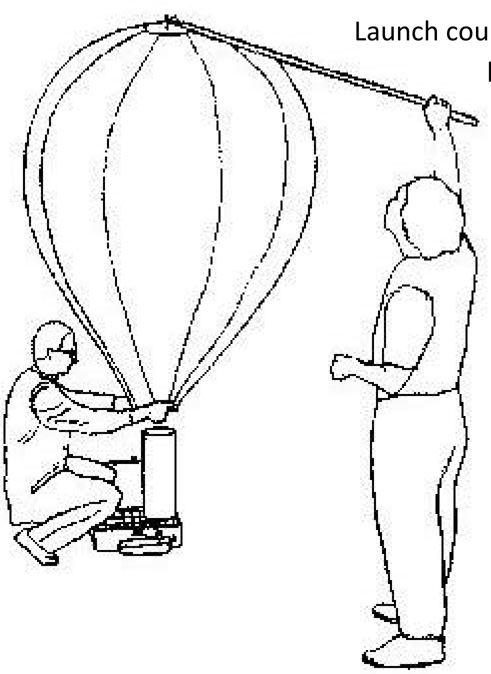
Practice ALL launch procedures of any kind with adults and become comfortable with all aspects before ever involving children.

Variation A Launching Device: the Stove & Pipe method

There are a wide variety of setups used to launch balloons. Wear a pair of leather gloves when using the camp stove.

Materials:

- 2 burner Coleman camping stove,
- Propane
- Stiff piece of dryer venting pipe
- Screen material
- Launching stick



Launch couldn't be simpler. Place the balloon loop on the nail of your launching stick*. Hold the balloon up using the stick.

A launching stick can be made from the two larger diameter sections of a jointed cane fishing pole. Wrap the shank of a nail with masking tape until it fits snugly in the top ferrel.

Any wind will make this operation less than simple though. You may need a helper or two to keep the balloon from catching fire from exposure to direct heat/flame.

Option: Use two sheet metal stove pipes (6 and 8 inch diameter) direct the heat to the balloons. This arrangement is slightly safer than a single pipe since the outer one won't instantly sear the skin if someone touches it. It is still hot enough to cause a burn though so please be careful. *Put screen over the top to prevent sparks and wear* *a pair of leather gloves when using the camp stove.*

If one does catch fire just keep everyone out of the way and let it burn, *don't try to put out the blaze with your hands!* Under no circumstances should fire be allowed to be carried aloft with the balloon near any trees and listen to the crowd cheer (they always do).

Variation B on Launching Device:: A Lot of Hot Air

Once you've put the simple flyer together, you'll need to create a source of heat to send it aloft. That, too, is a quick-and-easy process.

Materials:

- 6-46oz cans
- Triangle can opener
- Wire
- Tinsnips
- Pliers
- Screen material
- Leather gloves
- newspaper

Collect six *large* juice cans (the 46-ounce size works fine) and cut out both ends from five of them. The sixth can will serve as the base of the "smokestack," so you should remove only its top. You should also cut a wedge-shaped opening In one side of that "bottom" can. (You can start the hole with a triangle can opener, use a pair of tinsnips to enlarge it, and bend the sharp edges inward with pliers.)

Next, make three small holes (evenly spaced) around the top and bottom of each can, and thread short lengths of wire through those openings to fasten the cylinders together in a vertical stack. Finally — to prevent cinders from flying up into the balloon — wire a section of screen on top of the burner.

Using crumpled newspaper, build a slow fire in the bottom of the burner while two people hold the balloon over the top of the stack. When the tissue walls begin to feel warm and the ship starts lifting, let it go and watch your homemade balloon float lazily skyward! The craft will probably soar to 200 feet or more, and then in a few minutes (the duration of the flight will depend on the outside air temperature) it'll begin to descend. Chase the "ship" down, and it's ready to launch again.

Too much heat will ignite the balloons even if they don't contact actual fire. They will usually give a little warning by turning brown and starting to smoke before they burst into flame.
Best launching conditions are usually during periods of calm or with a very slight breeze of less than 3 m.p.h., usually in the morning or evening and in cool weather, which allows the hot air to dramatically rise in the cool air surrounding it.

Dead calm conditions are ideal. Breezy conditions rob the balloon of its heat and increase chances of fire. When the tissue walls feel warm and the balloon starts tugging let it go. The height the aerostat rises depends on the heat of the air inside the balloon. An ascent of several hundred feet is not uncommon. The balloon will stay aloft and drift until the hot air cools. The larger the balloon, the higher the rise and longer the flight.

Notes:

- See if students can use their math skills to improve on the balloon shape.
- They will need to figure out how wide the gores should be at each distance from the top.
- The right gore shape will have smoothly curving sides from the point to the mouth.
- The shape when inflated will have a nearly spherical top and the lower portion will be roughly conical.

Piloting a Real Balloon

Piloting a balloon takes skill, but the controls are actually very simple. To lift the balloon, the pilot moves a control that opens up the propane valve. This lever works just like the knobs on a gas grill or stove: As you turn it, the flow of gas increases, so the flame grows in size. The pilot can increase the vertical speed by blasting a larger flame to heat the air more rapidly.

Additionally, many hot air balloons have a control that opens a second propane valve. This valve sends propane through a hose that bypasses the heating coils. This lets the pilot burn liquid propane, instead of propane in gas form. Burning liquid propane produces a less efficient, weaker flame, but is much quieter than burning gas. Pilots often use this second valve over livestock farms, to keep from scaring the animals.

Hot air balloons also have a cord to open the parachute valve at the top of the envelope. When the pilot pulls the attached cord, some hot air can escape

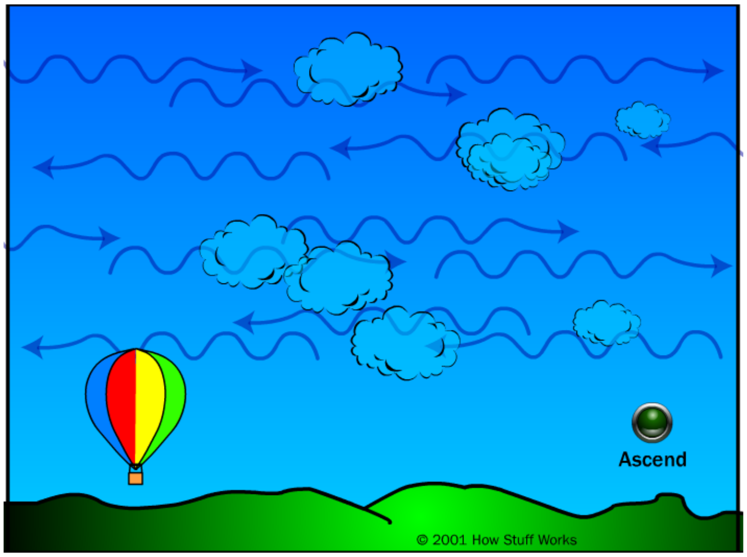
The parachute valve, from the inside of the balloon. A Kevlar cord runs from the valve at the top of the balloon, down to the basket, through the center of the envelope.

from the envelope, decreasing the inner air temperature. This causes the balloon to slow its ascent. If the pilot keeps the valve open long enough, the balloon will sink.

Essentially, these are the only controls -- heat to make the balloon rise and venting to make it sink. **This raises an interesting question: If pilots can only move hot air balloons up and down, how do they get the balloon from place to place?** As it turns out, pilots can maneuver horizontally by changing their vertical position, because wind blows in different directions at different altitudes. To move in a particular direction, a pilot ascends and descends to the appropriate level, and rides with the wind. Since wind speed generally increases as you get higher in the atmosphere, pilots can also control horizontal speed by changing altitude.

To maneuver the balloon horizontally, the pilot ascends or descends in altitude, catching different wind currents.

Of course, even the most experienced pilot doesn't have complete control over the balloon's flight path. Usually, wind conditions give the pilot very few options. Consequently, you can't really pilot a hot air balloon along an exact course. And it's very rare that you would be able to pilot the balloon back to your starting point. So, unlike flying an airplane, hot air balloon piloting is largely improvised, moment to moment. For this reason, some members of a hot air balloon crew have to stay on the ground, following the balloon by car to see where it lands. Then, they can be there to collect the passengers and equipment.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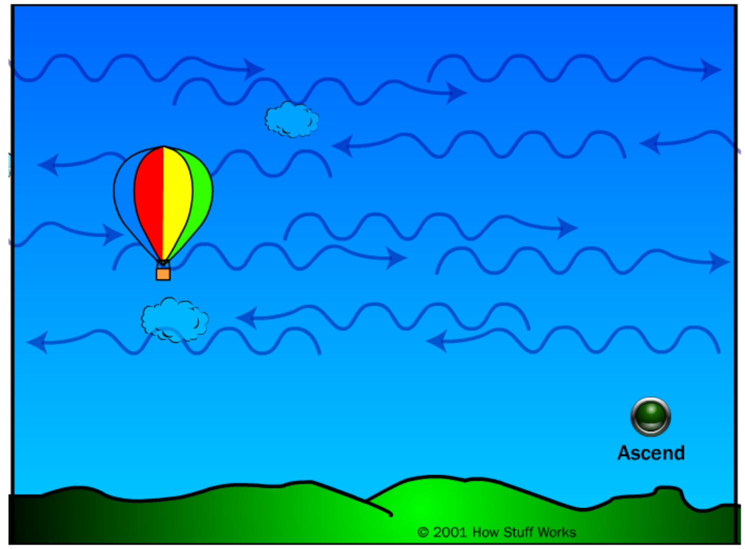
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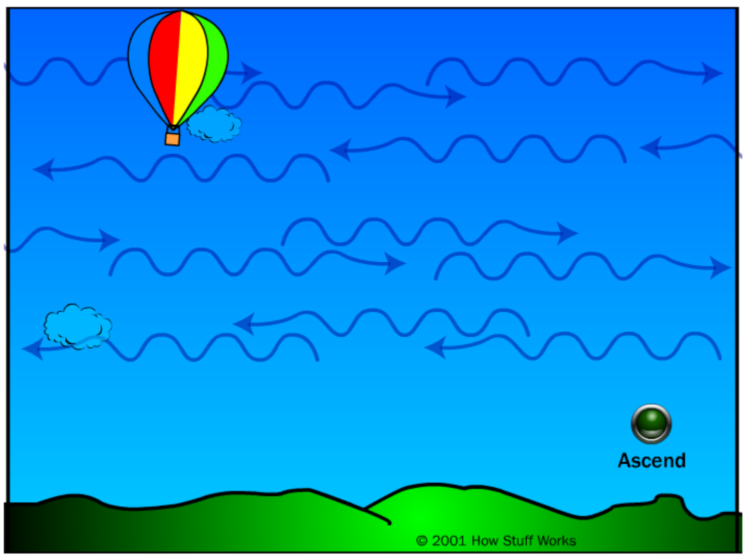
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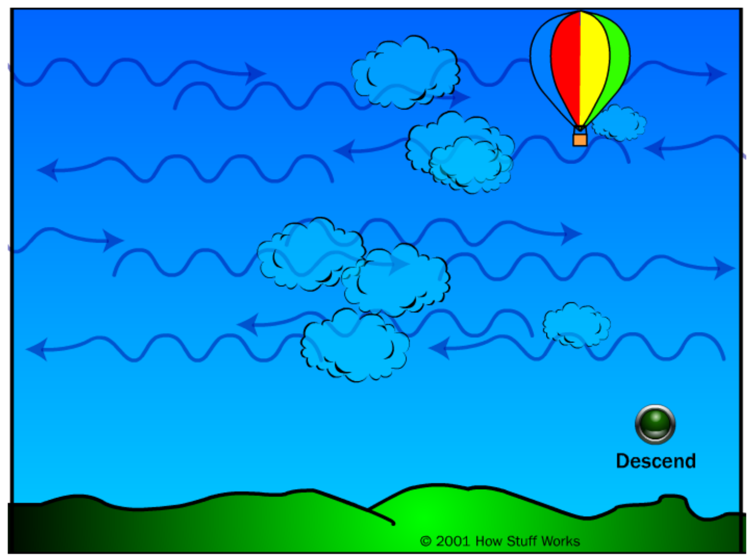
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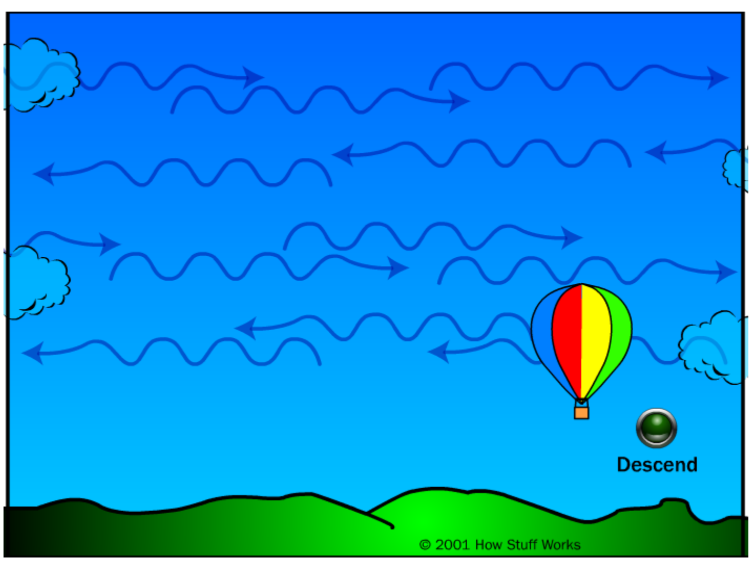
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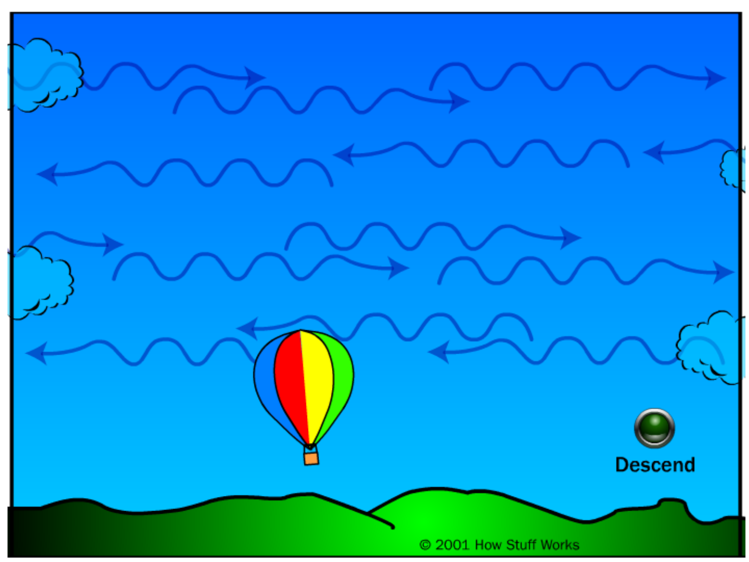
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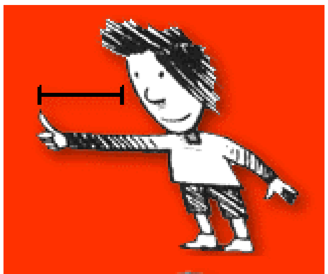
Up, Up, and How Far Away?

There's a hot air balloon approaching your island in the distance. The balloon will land in a matter of minutes, and you want to be the first to greet it and find out their purpose when it touches ground. But how far away is it? You better figure it out fast so you can decide if you should run, bike or drive to the landing spot.

Luckily, with your thumb, your arm, and a little know-how, you can estimate how far away the balloon is and be there with it lands. We're going to use visual perspective to estimate distance.

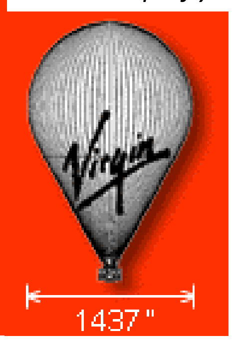


First, get a ruler. Second, hold your arm straight out in front of you and measure the length of your arm. Write down how long your arm is.

Got that? Cool.

Now you need to know how many times your thumb width would fit into the balloon if you are standing an arm's length away from it.

It helps if you know how many inches are in the width of the balloon.



Measure the width of your thumb and pop that number into the formula. Width of Balloon divided by Width of Thumb

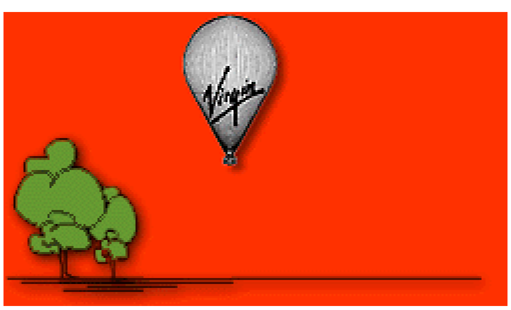
Example:

Width of Balloon: 48 inches = 96

Width of Thumb: .5 inches

How many of your thumb widths would fit into the balloon? 96? Whoa! That's a whole lot of thumbs! Now that you know how many times your thumb fits into the balloon when it's only one arm length away, you can estimate how far away the balloon is at any number of arm lengths away.

OK. This is what the balloon looks like from where you're standing.



Hold your arm straight out so that your thumb touches the paper. Compare the width of your thumb to the width of the balloon.

Does your thumb look OK. This is what the balloon looks like from where you're standing.

Hold your arm straight out so that your thumb touches the paper (or drawing on the whiteboard). Compare the width of your thumb to the width of the balloon.

- Does your thumb look bigger than the balloon?
- Does your thumb look smaller than the balloon?
- Does your thumb look about the same size as the balloon?

Your thumb looks bigger, eh? How much bigger? Hold your thumb up to the paper with your arm straight. Count the number of times the balloon fits into your thumb width. Drop that number in the formula to figure out how far the balloon is from you.

Formula: The number of times the balloon fits into your thumb width now **x** your arm's length **x** the number of times your thumb fits into the balloon at arm's length **=** how far away the balloon is

$$1 \times 20 \times 96 = 1920$$

The balloon is 1,920 inches away! That's 160 feet. What will you do? Jump into your sneakers and run, hop on your bike and pedal like mad, or grab the car keys and put the pedal to the metal? (If you don't have a driver's license, better ask your older friend to give you a lift!)

OK. This is what the balloon looks like from where you're standing.

OK. This is what the balloon looks like from where you're standing.

Hold your arm straight out so that your thumb touches the paper or the image that's draw on the board. Compare the width of your thumb to the width of the balloon.

- Does your thumb look bigger than the balloon?
- Does your thumb look smaller than the balloon?
- Does your thumb look about the same size as the balloon?

So your thumb looks smaller than the balloon, huh? How much smaller? Hold your thumb up to the paper or board with your arm straight. Count the number of times your thumb width fits into the balloon. Pop that number in the formula below to figure out how far the balloon is from you.

(Your arm's length **x** the number of times your thumb fits into the balloon at arm's length**)** **÷** the number of time's your thumb fits into the balloon now **=** how far away the balloon is now.

Tip: Remember order of operations! PEDMAS = Parentheses, Exponents, Division, Multiplication, Addition, Subtraction. Do them in the order they come on the list.
(20 x 96) ÷ 2 = 960 inches (or 80 feet if you divide 960 by 12)
What will you do? Jump into your sneakers and run, hop on your bike and pedal like mad, or grab the car keys and put the pedal to the metal? (If you don't have a driver's license, better ask your older friend to give you a lift!)

Teacher Tip: The key to this and the following activity (At Arm's Length) is to find the number of thumbs at arm's length that equal the width of a target in the distance. The distance between the student and the target is inversely proportional to the number of thumb widths: the fewer thumbs that appear to equal the width of the target, the farther away the student is. The more thumbs that seem to fit into the target, the closer the student is.

If student measurements seem dramatically different than expected, check to make sure that they used consistent units of measure for the entire calculation and that they are consistent about comparing the same width and portion of their thumbs and the same width and portion of their targets.

General equations to satisfy all cases are as follows:

If thumb and target appear to be the same width,

d = N x A.

If thumb appears to be wider than target,

d = N x A x number of times thumb is wider.

If target appears to be wider than thumb,

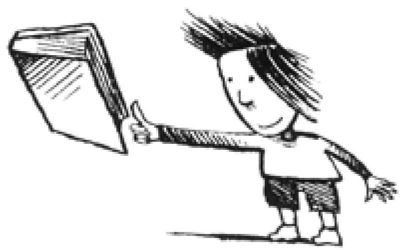
d = (N x A) / number of times object is wider.

Students can also estimate distances by using other objects besides their thumbs at arm's length, such as a coin, a pencil, or a book. All they need to do is calculate new values for B, C, and N.

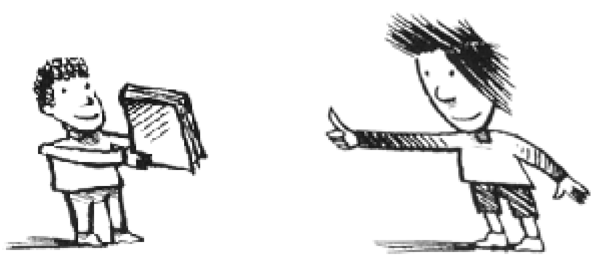
At Arm's Length: Student Handout

While they are in the air, balloonists often need to determine how far they are from a specific location or object in the distance. To do this, they can rely on high-tech equipment for exact measurements, like the balloonists in the program, or they can estimate distances using their arm lengths, as some amateur balloonists do. Try it and see.

Part I



1. Choose a target that is about four to five inches wide. At arm's length, hold your thumb up next to the target. What do you notice about the width of your thumb compared to the width of the target?



2. Now, have your partner hold the target up while you move away from it. Hold your thumb up at arm's length, close one eye, and align your thumb with the target. Move closer or farther until the width of your thumb appears to be the same size as the width of the target. Notice how far away you are from the target, and mark your position. Measure the distance you are from the target and record that number on the chart.
3. Next, change positions until it takes two thumbs to equal the width of the target. Again, notice the distance you are from the target, and mark your position. Measure and record the distance.
4. Finally, move until one-half thumb equals the target. Mark your position. Measure and record the distance.
5. Continue this process until you have filled in the chart.
6. Now have your partner do steps 1-5. Then answer these questions together before going on to Part II:

   How does the relationship between the width of your thumb and the width of the target change as you get closer to the target? How about as you get farther away?

Number of thumbs widths across target	3	2	1	$^1/_2$	$^1/_3$

Distance from target					

Part II

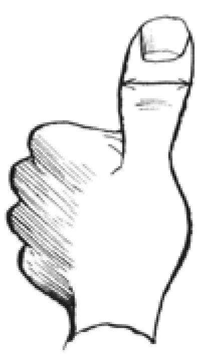
A simple formula can be used to estimate your distance from a target when your thumb appears to be the same width:

d (estimated distance) = N (number of thumbs per target) x A (arm length)

To use this formula, you and your partner will need to make the following measurements and calculations. Take turns doing each measurement.

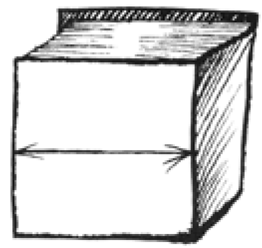
1. **Measurement A:**
   Your Arm's Length
   Hold your arm out as shown, and have your partner use a length of string to measure the distance from your eye to the top of your thumb. Measure the string and record the result.

   A = ______



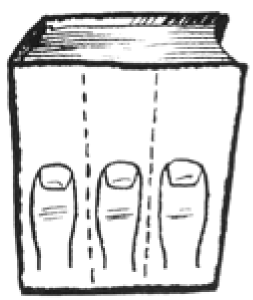
2. **Measurement B:**
   Your Thumb's Width
   Measure the width of your thumb, just below your fingernail.

   B =______



3. **Measurement C:**
   Your Target's Width
   Use string to measure the widest part of your original target. Measure the string and record the result.

   C = ______



4. **Calculate N:**
   Relationship Between Your Thumb and the Target
   Calculate how many times your thumb fits into the target if you are standing arm's length from it (N = C / B). Record the result.

   N = ______

5. When all of the measurements have been taken, use the formula to estimate the distance you would be from the target if your thumb and the target appear to be the same width. Compare this estimate to the distance you recorded in the chart.

   Estimated distance: ______

   Actual distance: ______

6. This formula is useful when you are at a distance where your thumb appears to be the same width as the target. How can you estimate distances when more than one thumb or less than one thumb appears to fit into the target? (Think about how the distance to the target changed when your thumb appeared to be twice as wide or half as wide as the target.) Use the data on your chart to help you change the formula so that it can be used to estimate any distance.

Balloonatics: Modern Day Real-life Race for Glory

"Dream big by setting yourself seemingly impossible challenges. You then have to catch up with them."- Richard Branson

If you don't dream, nothing happens. 'Swashbuckling billionaires and absent-minded dreamers, all chasing one of the last great adventures: 25,000 miles around the globe by jet stream and Icarian wing (inferring wings made of wax and feathers from Greek legend of the boy who flew too close to the sun and fell). No stopping, no sploshing (v: to scatter (liquid) vigorously about). On a moonlit night in January of 1996 people were gathering. Imagine you were there and word has gone out: It's time. The great balloon! The magic sail! Half inflated, it sprawls across the snowy meadow like a reclining brontosaurus, its surface glittering with hoarfrost, a sparkling, heaving acre of reflective Mylar. At the balloon's midsection, veinlike, flexible plastic tubes supply helium from truck-borne tanks, emitting a loud, breathy hiss that takes on the rhythm of a heartbeat. Whooshing and crackling, its longitudinal seams tensing like the fibrils of a giant muscle, the 150-foot-tall behemoth begins to assume its shape--"standing up," it's called.

At the balloon's base, eclipsed by the majesty of its envelope, stands a squarish, one-person gondola with a top-entry porthole. The yellow exterior is girdled by 17 tanks of propane, which will be burned to help keep the balloon aloft. By ascending a stepladder next to the gondola, it's possible to look inside, where dozens of dials and switches, two propane heaters, a sleeping bag and toilet, two notebook computers, three weeks' worth of rations, several radios, and dozens of other devices are cunningly nooked and crannied for optimal usability. The cockpit, so modest and efficient, is reminiscent of nothing so much as the interior of a tiny Winnebago, an RV of the firmament. Peering into the cavity, one is struck by a slow-dawning awe: Here is where it will happen. Here, on a thinly padded bench, multimillionaire options trader Steve Fossett will sit as he flies over three oceans and four continents on aviation's last and most daring journey: circumnavigation of the globe by balloon.

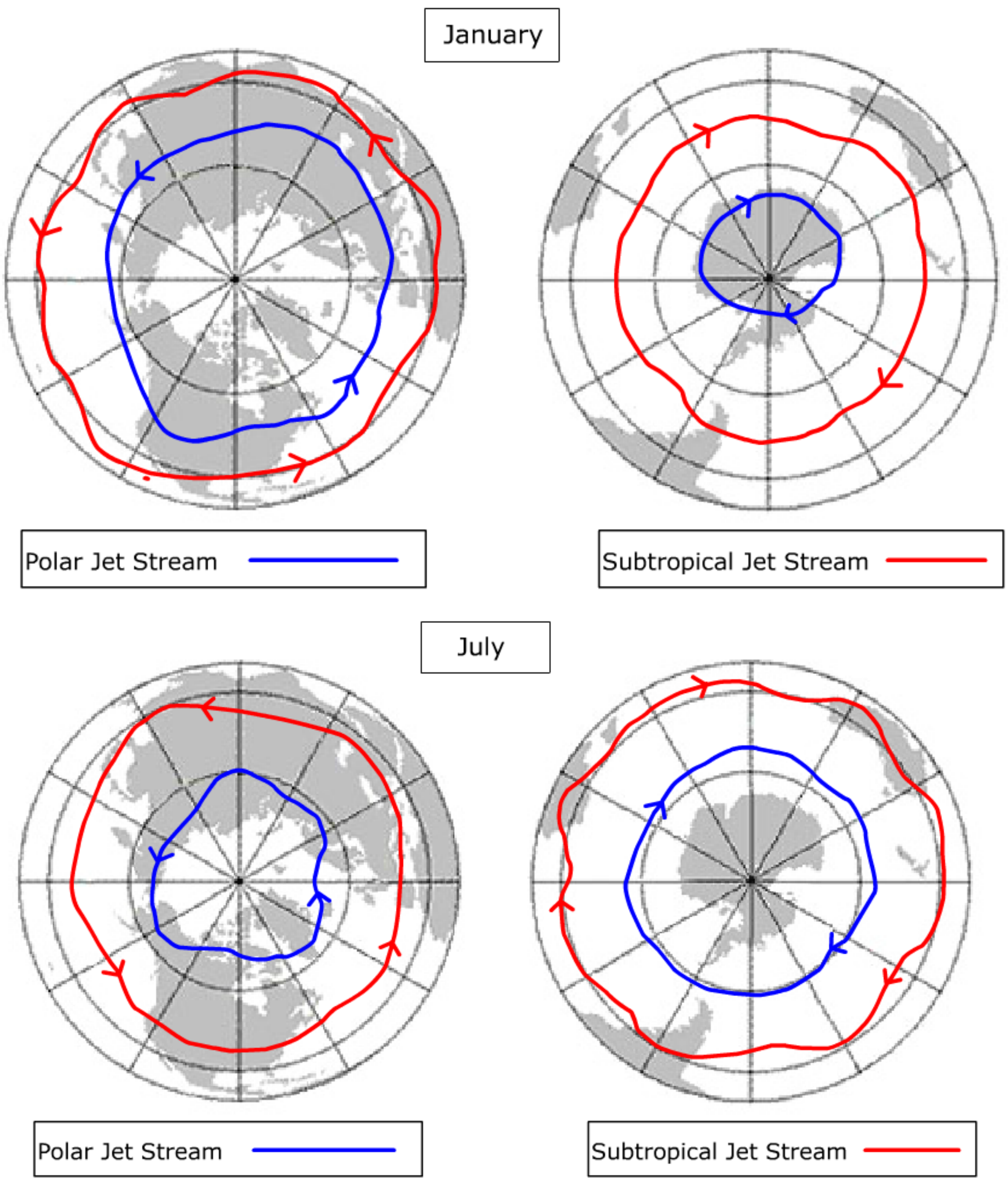
But even now, a troop of competing balloonists is making preparations to defy extremely long odds and 25,000 miles in search of the very same goal. This night, at a small factory in western England, another whirring little Winnebago is being assembled by the formidable British team of Richard Branson and Per Lindstrand, who together have navigated the Atlantic and Pacific. In the Netherlands, veteran balloonist Henk Brink is waiting with his copilot for good weather to launch his Unicef Flyer. In New Mexico, Bob Martin and his Odyssey group plan to top them all with a summer stratospheric flight at a record 120,000 feet.

Around-the-world ballooning is a sophisticated enterprise. It uses specially designed balloons that are nearly ten stories tall, high-tech gondolas for the crew and flight equipment, and numerous experts on the ground at mission control.

What did it take to accomplish this amazing feat? First, a balloon carefully designed to meet the rigors of the environment in which it would travel. The Breitling Orbiter 3 was a huge balloon, weighing as much as a fighter plane and holding an amount of air equal to the volume needed to fill seven Olympic-sized swimming pools. Experienced pilots, knowledge gained from the trial and error of previous, unsuccessful attempts, and a keen understanding of the atmosphere were additional crucial components of the monumental flight. For speed, Piccard and Jones caught a ride on the jet stream, a ribbon of fast-moving air in the upper troposphere. But without the assistance of skilled meteorologists to guide the pilots around storms and help them navigate the jet stream, the journey would not have been possible.

As we know, balloons are carried by the wind, so pilots have no direct control over their speed and direction. To steer, the pilot moves the balloon up or down in altitude to catch winds with the desired speed and direction. An understanding of global wind patterns, particularly the jet stream, is critical for around-the-world balloon flight. Mission control monitors meteorological data, which it relays to the pilots so they can choose the most favorable winds.

The maps below are polar views of the Northern and Southern Hemispheres. They show the general position of jet streams during January and July. Remember that the seasons in the Northern Hemisphere are the opposite of those in the Southern Hemisphere.



Generalized locations of the polar and subtropical jet streams. Northern Hemisphere (left) and Southern Hemisphere (right).

To set an official record, an around-the-world flight must meet certain requirements.

- The balloon has to fly at least 25,000 KM
- Crossings all meridians

- Within an area bounded by two caps superimposed on the pole

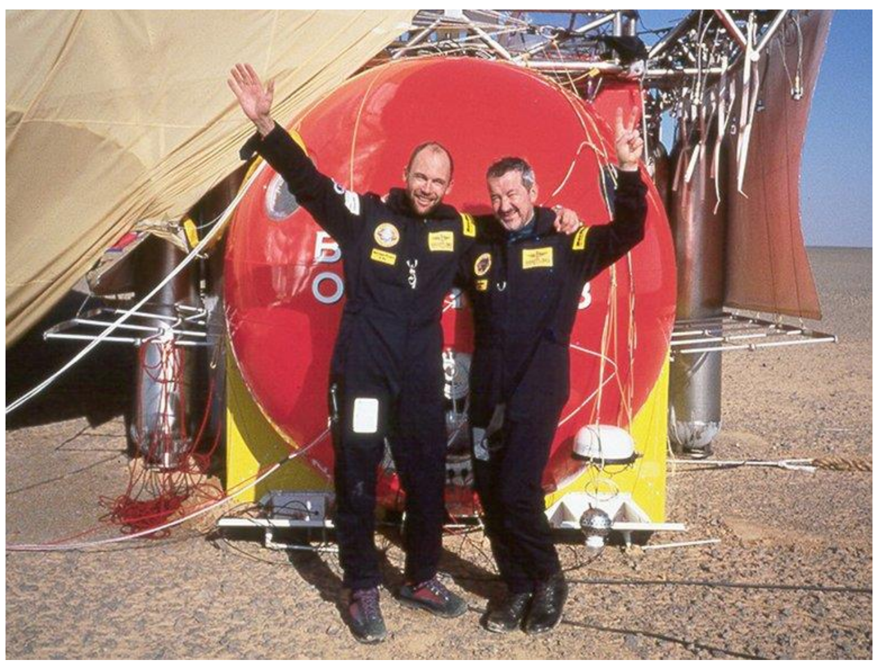
1. 2. Which jet stream(s) offer the best path that meets the rules for an around-the-world flight?
2. During which season do jet streams appear to offer optimal conditions for around-the-world balloon flight attempts?
3. Suggest two reasons why you might not want to use the northern polar jet stream for an around-the-world attempt.

Of course, flying "round the world" is not so much a race as a stab at immortality. There is no starting line; no standard set of equipment, and no monetary prize--even the sainted Lindbergh was gunning for a prize.

Every person who comes within sight of the balloon--millions, perhaps—will be drawn into the drama: Will they make it? Will they crash in the Himalayas? Will they be devoured by sharks? And that interest brings greater opportunities for sponsors to make money.

All the Way around the World?

Finally, on Saturday, March 20, 1999the first around the world flight was completed by Bertrand Piccard and Brian Jones in the the Breitling Orbiter 3 balloon. Leaving from Switzerland and landing in Africa, they smashed all previous distance records, flying for 19 days, 21 hours and 55 minutes.

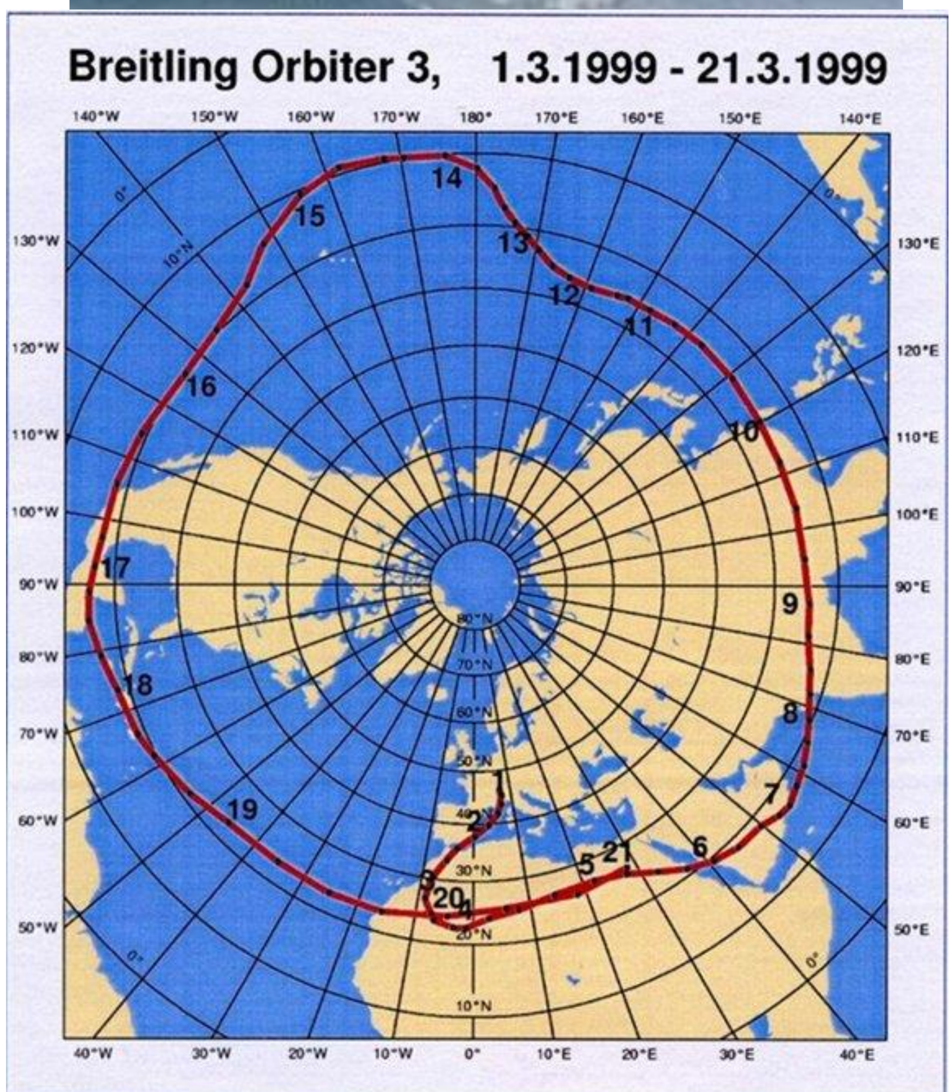


Before Bertrand and Jones there were a number of others who tried this great challenge but never managed to complete it. Among them were: Max Anderson, in his **'Jules Verne'** balloon, Larry Newman with **'Earthwind'**, Richard Branson and Per Lindstrand's **'Virgin Global Challenger'**, Bertrand Piccard's **'Breitling Orbiter'**, Steve Fossett and his **'Solo Spirit'** and Andy Elson's **'Cable and Wireless'**. It was becoming the most sought after title in the ballooning world, with more and more people trying year after year.

While many factors contributed to this record-breaking flight, the key to its success was a detailed knowledge of Earth's weather and weather patterns, particularly jet streams.

The specialized balloon that was created for the challenge was named the Breitling Orbiter 3. It took off from Chateaux D'Oex in the Swiss Alps on 1st March 1999.

One of the pilots' first major problems was having to fly far enough south to be able to conform with the restrictions of flying over China as China had always imposed laws about aviation crafts of any type flying over their country. They successfully managed to fly the right path and within 11 days they had reached the pacific.



As they approached the Caribbean the pilots started to lose speed rather rapidly. They had only one option which was to use a huge amount of Propane fuel to project them back up into the air, gaining as much altitude as possible. This of course was not their safest option as they did not want to run out of fuel but the situation left them no choice. At 10,500 meters, the air currents blew them back on course and with this strengthened wind, their speed increased a great deal.

The fastest speed recorded was over the Sahara desert in the final days of the flight at 123 knots (142 mph). Quite fast for a balloon!

On 20th March 1999, the **Breitling Orbiter 3** crossed the last meridian and landed in Mauritania, North Africa the following day, becoming the first hot air balloon to circumnavigate the earth. Both pilots had made history, covering a ground breaking distance of 42,810 KM - the greatest hot air balloon challenge in the world had been achieved!

Round-the-World in 19 & ¾ days!

- Distance: 42,810 km (26,600 mi)
- Time: 19 days, 1 hour, 49 minutes
- Total Flight
- Distance: 45,755 km (28,431 mi)
- Duration: 19 days, 21 hours, 55 minutes

The successful circumnavigation, which started from the Swiss Alpine village of Chateau d'Oex on 1 March, won the two pilots the $1m prize put forward by brewers Anheuser-Busch.

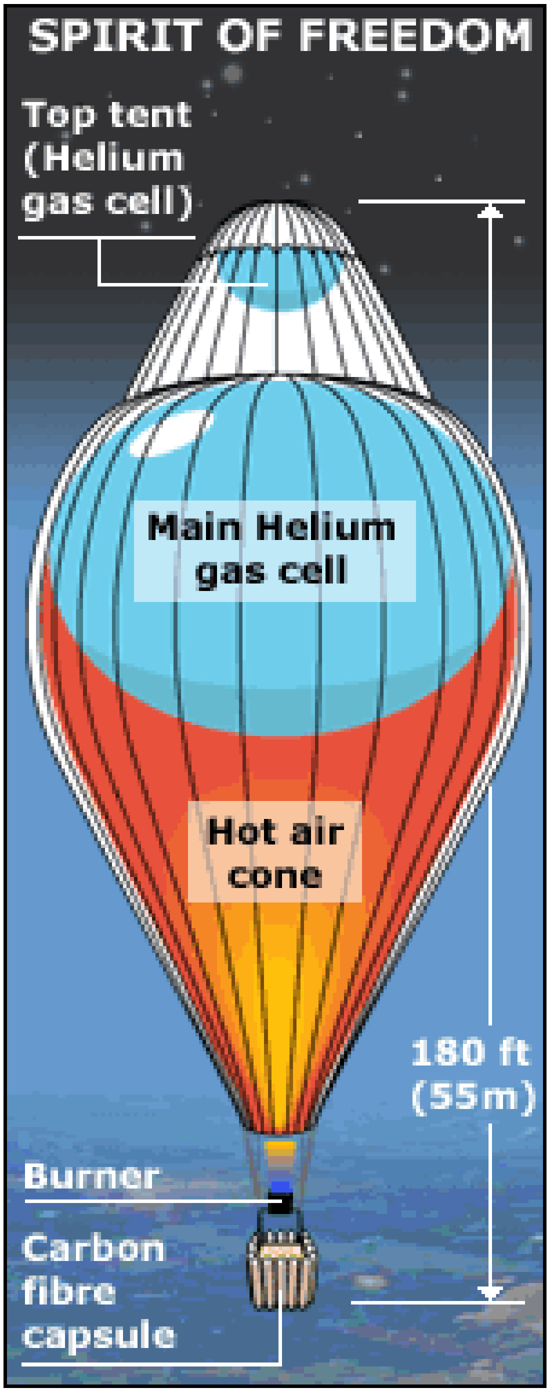
Going Solo?

Later, Steve Fossett became the first person in the world to complete a circumnavigation of the globe in a hot air balloon, completed in just under 15 days. Steve Fossett's attempted the RTW (round the world) challenge, a total of 5 times starting in 1996 before he finally completed the task on his 6th attempt in 2002.

The balloon, **The Spirit Of Freedom** used a combination of hot air and helium, known in the industry as a 'Roziere' balloon. The balloon envelope was 140 ft tall and 60 ft wide. The balloon used a special onboard autopilot system called 'Comstock Autopilot' which can maintain the balloon at a constant altitude by using a computer to control the burners.

The balloon was launched from Northam, Western Australia and the projected flight was to cross the Pacific first and then to travel across Chile, down round Argentina and the Southern Atlantic Ocean. From here would then fly towards South Africa, over the Indian Ocean and would finally end up back in Australia at a longitudinal equal to or farther east than where the journey had begun.

The conditions onboard the basket (or gondola as it is referred to in this case) were far from luxurious! The actual gondola itself was no larger than a normal sized closet. Fossett would on



average, manage about 4 hours of sleep each day, in broken down segments of 45 minutes naps. It would have been extremely cramped living in such a confined space. On top of all this, the temperature outside the balloon would have been well below zero and Fossett would have had to regularly climb outside the gondola to change fuel or to check on the burners.

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