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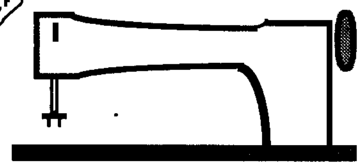
Dedicated to the Sport Balloon Home-Builder



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THE BALLOON BUILDERS' JOURNAL

May-June 1995

In This Issue

Up and Coming

We consider the design of an ultralight balloon with a 2.25 hour duration carrying a 225+ pound pilot. Details about Bill Arras' little lightweight basket will be presented.

Notices To Readers

The Second Annual Amateur Built Balloon Meet to be Held in Vermont

Brian Boland reports the second annual Balloon event is scheduled for May 26, 27, 28 and 29, 1995 in Post Mills, Vermont. This event should be even bigger than last year with new balloons and new attendees. If you are interested in more information contact Brian at P.O. Box 51, Post Mills, VT 05058 or call him or Fax him at 802-333-9254.

Subscription Renewals Are Coming Due for Many Readers

Sixty-one readers renewed with our last mailing. If your membership has come due, please take a moment to renew.

Current Readership

Currently, we have 172 subscribers to *The Balloon Builders Journal*

The Stages in Envelope Construction

By Bob LeDoux, Editor,

2895 Brandi Lane, Jefferson, OR 97352 CompuServe 73474,76

Your editor recently completed construction of a new envelope. We use this opportunity to itemize the costs and time required to complete such a project.

My wife, Marianne, and I recently completed a new envelope project. I thought a discussion of this project would be a good way to explain the various stages of balloon building. As part of our discussion we will relate the different building stages to articles that have been published in *The Balloon Builders Journal (BBJ).* Hopefully, this discussion will make the design and building process clearer for many prospective builders.

The envelope is shown in *Figure 1.* We have named it *Sewlight.* It weighs 60 pounds and contains 42,700 cubic feet. Construction is of 1.1 ounce parachute-type fabric and lightweight load tapes. Throughout construction we attempted to keep it as light as possible without sacrificing integrity or longevity. The envelope flies over our 30 inch square, rattan basket, which in turn, carries 2-ten gallon Worthington fuel tanks. The envelope fits into a packcloth bag of 18 inches diameter and about 30 inches tall. The envelope packs neatly inside the basket with tanks, and other equipment–a very compact system!

Figure 1. This 42,700 cubic foot envelope weighs 60 pounds, cost $1,261 and required 228 hours to design and build.

Figure 3, (page 4), itemizes the construction costs. We've spent $1,261 to build the envelope. These costs include leftovers, like 90 yards of extra fabric and part of a roll of load tape. The costs also include a 600 foot roll of 5 foot wide Kraft paper used to make fabric cutting patterns. We used about 100 feet of the paper on this project. Almost 80% of the project cost was for fabric with most of the remaining expense for the load tape and cable goods.

For those of you interested in building a larger envelope, the cost to build a full size AX-7 envelope of 77,500 cubic feet should be about $1,850. Using similar materials its weight should be about 90 to 100 pounds, depending upon a number of variables such as number of gores, and type of fittings to attach the envelope to the basket.

Figure 2, (page 3), lists the different stages of construction, the finish date for each stage, and the hours spent on each stage. During much of the construction two of us were working on the project. In those cases we have counted our time as two hours for each hour we were working together. Total construction time, at a relaxed pace, was about 228 hours spent over most of a year. Under normal circumstances the envelope could have been built over a three month period. But other commitments, in particular, editing and publishing *BBJ* expanded the time frame.

We discussed the reasons for undertaking this envelope project in Issue No. 6 of *BBJ* (May-June 1994, pages 2-5). Simply put, we wanted a lighter, and larger envelope to replace our aging, heavy (104 pounds) *Castaway* envelope of 38,000 cubic feet. With the redesign we were hoping to increase the balloon system duration from

Figure 2: Envelope Construction Stages	Hours	Completion Date
Develop and finalize envelope design	16.0	3/23/94
Prepare shop and work table	7.0	4/17/94
Prepare envelope cutting pattern	6.0	4/21/94
Cut fabric pieces for envelope construction	33.0	5/22/94
Complete sewing panels into half gores	60.5	8/1/94
Complete sewing half gores into gores	24.5	8/31/94
Sew together top	5.0	9/7/94
Sew gores into enclosed envelope	25.0	10/7/94
Sew circumferential load tapes	10.0	10/17/94
Complete top work and sew together envelope bag	23.0	11/28/94
Attach cables and parachute operating lines	18.0	1/23/95
Total of construction times in hours	**228.0**	

its current 1.75 hours to about 2.25 hours, by reducing the envelope temperature.

Referring now to *figure 2,* I would like to take the reader through each step of design and construction:

Develop and Finalize Envelope Design; 16 hours: Mari and I spent considerable time thinking about an envelope design. Our personality differences really show up in construction projects. She is an artist and a painter, and demands style in our balloon projects. As an example of her influence, our second homebuilt envelope *Sewhappy*, incorporated a fairly complex Southwest American Indian pattern. (See Issue 9, page 2 for a picture of this envelope.)

Compared to Mari, I am a functionalist, and prefer simple patterns and simple construction. (I generally lose out.) We agreed on the design seen in *Figure 1.* This design was taken from a Mike Adams balloon advertisement from the early 1980's.

During this first design stage my primary task was to determine the envelope volume required to meet our lift requirements. I used the *Lift Force Spreadsheet* which was published in *BBJ,* Issue No. 8 (September-October 1994, pages 2-8) The actual lifting force graph used for this envelope project was printed on page 3 of that issue.

While I was performing the design work, Mari was researching the color pattern for the envelope. We discussed the selection of fabric, and its purchase, in the article in *BBJ,* Issue No. 6 (May-June 1994, pages 2-5). We chose to build using second grade 1.1 ounce per square yard uncoated fabric. This fabric is often known as 'zero porosity' parachute cloth.

Looking at the photograph of the envelope you can see our design required one primary color and two accent colors (3 colors in all). The accent colors were used on the equator and mouth. I estimated the minimum yardage required of each color. We then referred to the factory color charts. Comparing the different colors, we created a list of all the 3-color combinations which were acceptable.

We then called the fabric broker and asked about available colors. We required a minimum of 330 yards for our primary color. He, Kenny, had two rolls of fluorescent cantaloupe color which totaled 338 yards–so far so good. We looked at our list to see what colors were acceptable with cantaloupe. We had to have a minimum of 85 yards of the other two colors. He had 121 yards of fluorescent lime and 126 yards of black. Thus our minimum fabric need, with some allowance, was about 500 yards and we actually bought 585 yards.

Prepare Shop and Work Table; 7 Hours: Many young builders would be content to work on the floor of a gym or other clean, large surface. But I am getting too old for stoop or back-bending labor. Construction of a builder's table was covered in Issue 9 (November-December 1994, pages 1-6). Using a variable speed electric drill as a screwdriver, the table was screwed together in an afternoon. All envelope cutting and sewing took place in our two-car garage.

Prepare Envelope Cutting Pattern; 6 Hours: The first part of this task was to prepare *The Gore Pattern Spreadsheet* for the envelope as discussed in Issue 1, (July-August 1993). From this spreadsheet, patterns were constructed using materials and techniques presented in Issue 4, (January-February 1994, pages 5-8). Our envelope was built around a 'vertical half gore' style, like the *Aerostar* 'S' series envelopes. The odd volume (42,726 cubic feet) resulted from 'tweaking' the volume until the vertical stations in the spreadsheet were distanced for easy measurement. In this case each station is 16 and $^3/_4$ inches apart. Odd distances like 1.349872 feet between stations can be a real pain to lay out.

I spent $55 to buy the 5 foot wide roll of Kraft paper for patterns. One full length pattern was constructed running from the deflation port to the mouth. a distance of 56 feet and 'no' inches. I adjusted the mouth and deflation port slightly to get this even gore pattern length. Smaller, individual patterns were constructed for the equator and mouth color-change areas.

Cut Fabric Pieces for Envelope Construction; 33 Hours: Here is where the more complex patterns take more time. Had we chosen to use a simple vertical pattern, without color changes, I estimate we could have taken about 60 hours off the total construction time. The cutting techniques were discussed in the 'Work Table' article mentioned above. The basic tools were a straightedge, sharp scissors, razor knife and patterns.

Complete Sewing of Panels into Half Gores; 60 Hours: In this process all the many (112) little pieces are sewn together into 32 long pieces (half gores), each of which is 56 feet long. When I first started building balloons in 1986, I did all the sewing. But Mari, who has sewn since she was in her teens, tried the double needle machine one day and it was clear to me she could produce a better product. (While my sewing is adequate her work is faster and more consistent.) So now she sews while I cut and inspect each completed seam.

Complete Sewing Half Gores into Gores; 24.5 Hours: This was the first stage of the long seam construction. Sixteen, 56 feet long seams turned 32 half gores into 16 gores. The seams were made on the curved or bias cut edges of the half gores. The time includes both sewing and inspection. After each seam was sewn, I inspected each inch of seam construction on both sides.

Sew Together Top; 5.3 hours: Our parachute top consists of an 18 foot diameter circle made from 4 widths of fabric sewn side by side. We chose this time to rough cut and sew up the top because this finished all the cutting of fabric. Once this task was completed, the table could be disassembled which gave us more working space.

Sew Gores into Enclosed Envelope; 25.4 hours. The 16 gores were sewn together into a complete envelope. As each seam was being sewn, a vertical load tape was also attached. Our vertical load tape was $^3/_4$ inch wide Mil-Spec 5038-III tape. More than one reader has asked about making the last seam. We discussed one technique for closing up the envelope as a *Homebuilder's Tip* in Issue 3, (November-December 1993, page 5).

Sew on Circumferential Load Tapes; 10 Hours: Our envelope has six circumferential load tapes. There are the heavy, one inch tapes (5038-IV) in the deflation port and in the mouth. All the rest of the tapes are the $^3/_4$ inch wide Mil-Spec 5038-III type tape. A tape is sewn around the mouth, about 7 feet up from the opening, *a la* Aerostar. This makes for invisible mouth area repair work and helps avoid a long rip if the mouth tape were to be burned through. Tapes also run around the circumference of the envelope about ten feet each side of the equator. Finally, there is a tape about 8 feet down from the deflation port which also acts as a mounting point for the parachute attachment points. The placement of these tapes, as well as sizing of the mouth and deflation port were discussed in Issue 2, (September-October 1993, pages 5-8).

Applying the equator circumferential tapes was the most tedious part of the whole building process. About 25 feet of fabric

Figure 3: Balloon Construction Costs

585 yards of fabric	$978.25
645 yards of load tape	93.52
Aircraft steel cable goods	48.91
Crown line: 75 feet 1/4 inch rope	9.00
Parachute line: 55 feet 3/8 rope	23.10
Steel ring and other minor items	18.47
1 LB thread, sewing machine needles	34.87
Kraft paper for patterns	54.95
Total Costs	$1,261.07

must pass under the arm of the sewing machine. This is best done as a two person task. Twisting the fabric into a long roll as it runs under the sewing machine arm simplified the task. One person sewed and the other pulled and rearranged fabric as necessary.

Complete the Top Work; Construct Envelope Bag; 23 hours: The top work included sewing the load tapes to the load ring. This is the combination which makes up the deflation port 'spider web'. A tape was also sewn around the circumference of the parachute top and attachment loops were constructed in the envelope and on the parachute edge. These loops were attachment points for the cords which attach the parachute top to the envelope.

Attach Cables and Parachute Operating Lines; 18 Hours: Builders typically connect their envelopes to their baskets using steel cables. Cables are generally constructed by cutting the wire cable to length and creating an eye in the end using a swaged fitting. The swaged fitting is nothing more than a precisely sized piece of copper which is squeezed into the cable with a special pliers which looks like a bolt cutter. The Nicopress™ company makes the components for the system commonly used in aviation. The swaging pliers are quite expensive–currently about $180. Many airport repair shops and Experimental Aircraft Association (EAA) groups have the swaging pliers available for rent or loan.

While many balloon manufacturers have used $^1/_8$ inch cable, I prefer the smaller $^3/_{32}$ inch diameter cable. The smaller cable is more than strong enough and it saves a pound or two in the overall balloon weight. The Balloon Works, before moving to Kevlar™-based lines, used this diameter of cable with good success.

We discussed methods to determine cable lengths in Issue 5 of *BBJ* (March-April 1994, pages 2-6.)

With the addition of the cables, the envelope was almost complete except for mounting the registration ('N') numbers and the builder's plate. The preparation of the paperwork for the Airworthiness Certificate was covered in our last issue (January-February 1995).

The parachute centering lines, which run from the side of the envelope to the parachute top, as well as the parachute suspension lines were made from a number 4 polyester woven line. This is the same line that Paul Brockman used in his project (*BBJ* Number 3. November-December 1993, pages 2-5.) This line is commonly available in marine supply shops at reasonable cost.

Fellow builder, Rod Purdum, chose to heat his line for an hour in a 250°F. oven. He reported that the line shrank about 10%. We didn't pre-shrink our line, but left the centering lines quite loose. When I first inflated the balloon, there were gaps in the fit of the parachute top. But after about an hour of tethering the line shrank and the parachute took on a proper fit.

The first inflation of the new envelope was performed in the Tillamook Blimp hanger on January 28th, as part of the mass indoor liftoff reported in our last issue.

The inflation proceeded normally and all went well. The lighter weight fabric required much less fan power to achieve a good cold pack.

Summary

The cost estimate is complete except for the parachute cord, the number 4 polyester line that attaches the parachute to the envelope. We received this as a gift from Rod Purdum.

From an overall design standpoint, the envelope weight of 60 pounds was about as light as I would want to go. While we chose 1.1 ounce fabric, we could have used the heavier, coated 1.3 ounce material. There would have been a weight penalty. The envelope weight would have climbed up to about 68 pounds, depending on the amount of coated fabric that was used. But the envelope would have been less porous, and more flammable. The fabric is more flammable due to the silicone which is applied as an anti-porosity coating.

It would be possible to build this envelope even lighter, but with some sacrifices. We used size 24 thread in our construction. The Balloon Works uses the smaller size 30 thread in their chain stitch seam construction. The smaller thread in a lock stitch would be slightly less resistant to abrasion but at a savings of perhaps half a pound in the whole envelope.

The Federal Regulations Regarding Ultralight Balloons

By Bob LeDoux, Editor,

2895 Brandi Lane, Jefferson, OR 97352 CompuServe 73474,76

Many pilots have mistakenly underestimated the potential for Part 103 (Ultralight) balloons. This is the first in a series of articles in which we encourage pilots to design and build these systems.

Introduction

The Balloon Builders Journal has received a number of inquiries regarding the limits for balloons operated as ultralight vehicles under FAR Part 103. The most common questions are concerned with the maximum allowable weight for the balloon and the limit on the amount of fuel that can be carried.

Many readers are confused because they limit their study to only FAR Part 103. In particular, because an ultralight hot-air balloon carries propane fuel, readers mistakenly consider it a 'powered' rather than an 'unpowered' vehicle.

For a clearer picture as to the FAA interpretation of Part 103, the reader must review an additional document. This document is Advisory Circular 103-7 which is titled *The Ultralight Vehicle.* While this Advisory Circular is no available through the Government Printing Office, it can be found at most Federal Depository Libraries, and is available for review at your local FAA office.

The Hot-Air Balloon as Ultralight

FAR 103.1 deals with the applicability of vehicles covered under the ultralight rules. Other sections of FAR Part 103 discuss the operational rules. This article will center its discussion on the vehicles.

As seen in the FAR extract, all ultralight vehicles must first meet three conditions: The vehicle must be designed for and operated by a single occupant (§103.1(a)); it must be used for sport and recreational purposes only (§103.1(b)); and it must not have a foreign or domestic airworthiness certificate (§103.1(c)).

These three conditions cause the balloon pilot little concern. It's the next sections, § 103.1(d) and §103.1(e), that cause confusion. These rules differentiate between 'unpowered' and 'powered' ultralights.

A very clear position on this subject is presented in the Advisory Circular 103-7. Review the following excerpts. Clearly a balloon is treated as 'unpowered':

Excerpt from FAR Part 103

§103.1 Applicability

This Part prescribes rules governing the operation of ultralight vehicles in the United States. For the purposes of this Part, an ultralight vehicle is a vehicle that:

(a) Is used or intended to be used for manned operation in the air by a single occupant;

(b) Is used or intended to be used for recreation or sport purposes only;

(c) Does not have any U.S. or foreign airworthiness certificate, and,

(d) If unpowered, weights less than 155 pounds, or

(e) If powered:

(1) Weighs less than 254 pounds empty weight, excluding floats and safety devices which are intended for deployment in a potentially catastrophic situation;

(2) Has a fuel capacity not exceeding 5 U.S. gallons;

(3) Is not capable of more than 55 knots calibrated airspeed at full power in level flight; and

(4) Has a power-off stall speed which does not exceed 24 knots calibrated airspeed.

"12.d: Unpowered Vehicles. An unpowered ultralight cannot be operated under Part 103 if it weighs 155 pounds or more. Balloons and gliders are unpowered vehicles."

"16.d: Free Balloons are Considered 'Unpowered.' A balloon, for Part 103 eligibility, is considered an unpowered ultralight, regardless of whether it drops ballast to ascend or uses heated air. The burner on a hot-air balloon is used to raise the temperature of the air in the envelope allowing the balloon to rise. This can be

compared to the glider's use of lifting air as a means of ascending. In both cases, no method of horizontal propulsion is employed."

The Weight Limit

Section 16.c(2) states the following with regard to the items included in the weight limit:

16.c(2): Free Balloons. The envelope, lines, harnesses, gondola, burner and fuel tanks are included in this determination. Parachutes and all personal operating equipment and harnesses associated with their use are not included. The weight of the fuel, in the case of a hot-air balloon, or any logical amount of removable ballast, when intended for control of buoyancy of a gas balloon, is not included in the weight specified in §103.1(d).

Based on these excerpts the following conclusion may be drawn:

To be classified as an ultralight hot-air balloon the vehicle must have an empty weight of less than 155 pounds, excluding fuel and certain specified equipment such as a parachute.

Let's now look at the question of a fuel limitation. Note that the rules define 'powered' and 'unpowered' ultralights as two separate and distinct types of vehicles. Because of the use of the word 'or' at the end of §103.1(d), the '5 U.S. gallon' fuel limit contained in §103.1(e)(2) pertains only to powered ultralights. This interpretation is further supported by the wording in Section 16.c(2) of AC 103-7, as stated above.

We conclude that an ultralight hot-air balloon may carry any amount of fuel, so long as the empty fuel tanks, are included in a total vehicle empty weight of less than 155 pounds.

What about hot-air airships?

Advisory Circular 103-7 provides the following definition of a 'powered' ultralight:

"17a 'Powered' Ultralights Eligible For Operation Under Part 103. All ultralights with a means of horizontal propulsion which also meet the provision of §103.1 are eligible; this includes ultralight airships, helicopters, gyrocopters, and airplanes."

Comparing this to excerpt 16.d, above, the FAA's intent becomes clear:

1. If fuel is used to create only lift, and not used to create horizontal propulsion, then that fuel is not included within the '5 U.S. gallon' limit.

2. If the vehicle has a means of horizontal propulsion, then the fuel which generates the propulsion is limited to '5 U.S. gallons'.

From this the following limits to an ultralight airship can be determined:

Like the ultralight balloon, the ultralight airship must be designed for and operated by a single occupant, it must be used for sport and recreational purposes only, and it must not have a foreign or domestic airworthiness certificate.

An ultralight airship must weigh less than 254 pounds empty weight, except for floats and safety devices like a parachute. It also cannot exceed a maximum level flight speed of 55 knots, (which is unlikely to be a limiting factor in a hot air blimp). The stall speed limit of 24 knots should provide no problem as a lighter-than-air craft should be able to sustain flight at 0 knots.

The airship fuel source that provides propulsive power cannot exceed 5 U.S. gallons. If more than 5 gallons of fuel is carried then the fuel used to propel the vehicle in the horizontal direction should be separate from the fuel providing lift.

The ultralight airship may carry any amount of fuel to power the burner that creates lift. However, the empty fuel tanks must be included in the total empty vehicle weight of less than 254 pounds.

FAA Sanction

I sent a copy of this article to my good friend, balloon builder/pilot, and FAA nice guy Scott Gardiner. I asked Scott to informally review this interpretation and report back to me. Scott chose to review my conclusions with FAA operations staff in Washington D.C. As a result of that review there exists an 'oral agreement' as to the interpretation of Part 103.1, with respect to ultralight balloons and blimps.

That understanding supports the text written above with the following caution:

The FAA places special emphasis on the 'pleasure and sport' aspects of the ultralight rules. They are very sensitive to activities which are commercial in nature or may be perceived as commercial. From that perspective, ultralight balloons or blimps which display advertising banners may be subject to special scrutiny.

Builders who choose to fly ultralights using the interpretation contained in this article are encouraged to keep a copy of this article for reference. If your local FAA official disagrees with this interpretation, ask him or her to contact either of the following for clarification:

Scott Gardiner,
Aviation Safety Program Manager
Seattle Flight Standards District Office
Phone 206-227-2880

John Wentzell, AFS-820
The General Aviation and Commercial Division
Phone 202-267-8212

Letters to the Editor and Other Bits of Information

Bill Arras Is Working on an Extensive Special Balloon Design Program

As many readers are aware, Bill Arras recently broke the existing world duration record for an AX-5 hot air balloon. Shortly after accomplishing this task, Bill hosted his traditional Easter weekend fly-in from his home in Redmond, Oregon. For a number of years Mari and I have chosen to enjoy the desert flying and Bill's noted hospitality. On Easter Sunday afternoon, with the events over, we had the opportunity to sit down with Bill, to talk, and to view a couple of video tapes showing his projects.

Bill has been involved in an extensive research and development program, often running up telephone bills of over $400 per month in his search for materials and technical information. During this past winter he constructed five special purpose envelopes, including three AX-1's, two AX-2's and one AX-5. One of these envelopes was constructed of fabric, while the others were made from nylon and other plastic films. A double hull AX-2 is shown in the photo accompanying this article.

The AX-5 record flight took place on March 7, 1995. The flight of 12 hours and 5 minutes, covered 100 miles and beat the previous record, set by Coy Foster for AX-4's and AX-5's, of 8 hours and 39 minutes. Bill took off from the Heisler, Alberta, Canada, high school, which is about 150 miles from Edmonton. The flight was terminated, with almost an hour of fuel remaining on board, because Bill was about to leave tilled farm land and enter forest with limited landing options. During the course of the flight Bill realized he had more than sufficient fuel. He thus had the freedom to climb to over 9,000 feet on two occasions and descend down to 10 feet to drop empty fuel tanks. Takeoff was at 8:20 AM with landing at 8:26 PM. Surface altitude at takeoff was about 2,400 feet. At takeoff the outside temperature was -4˚F and envelope temperature reached a maximum of 205˚F. Bill pressurized his fuel with nitrogen.

The flight equipment included a home built envelope, *Awunda*, which he had constructed in 80 hours from George Harris, F-111™ parachute fabric. At the time of the record

Bill Arras recently constructed this AX-2 double shell envelope. The outer shell is made from clear nylon film. The inner shell is Dupont Kapton™. The skirt is constructed from aluminized nylon film.

attempt, the envelope had logged 46 hours, most of which was a result of Bill competing in the U.S. Nationals and World Championships.

The basket was of Bill's own construction. It was a 24 inch by 36 inch structure of a takedown design, utilizing welded chrome-moly aircraft tubing, with crossed steel cables for rigidity. Empty basket weight was 38 pounds. At takeoff, Bill was carrying a total of 105 gallons of fuel in 11 ten gallon Worthington tanks. One tank was carried in the basket and the remainder were hung on the basket exterior.

He chose to fly in Canada for a number of reasons. He wanted to attempt records for a number of AX sizes. The small envelopes required very cold conditions, of at least -30˚F. Because temperatures were mild, only the AX-5 flight was attempted. The record flights also required wide open spaces and access to persons with a technical ballooning background. The area around Edmonton, Alberta, met these conditions, with its open farm land, and the technical support of the local ballooning community.

Bill is currently awaiting homologation of the record attempt by the NAA.

Joe Seawright Reports on His Envelope Project

February 8, 1995

Dear Bob:

As for an update on my homebuilt, I have finally gotten started on the construction phase. About three weeks ago I finally scrounged up enough cash to order all of the fabric. I needed about 780 yards of black, 100 yards of white, and 10 yards each of six rainbow colors for the accent panels. I bought the black through Kenny Santos, (see *BBJ* issue 6) and the remainder from Westmark, as I could not find small amounts of seconds in those colors. The black was purchased for $1.75, the white for $2.90, and the colors at $4.00. I would highly recommend Kenny as a broker, for I have found virtually no flaws in the black.

My cutting table is a 60" X 240" MDF (medium density fiberboard) topped table that I constructed from two pieces of 5' X 10' MDF. I got the two pieces from one of our production suppliers for about $35, and the homemade saw horses and support spars cost another $40, so the whole setup ran about $75, plus labor to assemble.

Joe Seawright's computer rendition of his balloon project 'Baby Grand'.

My Kraft paper patterns are made by overlaying 36" X 48" E sized sheets from my plotter. I can then cut the CAD drawing gore line to generate each section.

I have cut about 400 yards so far, and I am very pleased with the yield–probably better than 95% usable. I have completed cutting 80 of the 240 panels required in the pattern. My pattern is a 40 half-gore similar to an Aerostar S, but only 20 gores, not 24. I am laying out 40 pieces at a time.

I smooth out each piece and clamp it down with 1" spring steel binder clamps similar to that depicted in a recent *BBJ* (thanks for the tip). After all 40 pieces are in place, aluminum head push pins are nailed through the paper and the 40 layers of fabric to hold everything in place during cutting. Cutting is accomplished with a steel straight edge and an Exacto™ knife. I get about 36 to 48" out of a blade before changing, so blade usage is high, but the cut is exceptionally smooth and easy–about 3 passes and you're cleanly through all 40 layers. It actually takes much longer to get the fabric rolled out and clamped than the actual cutting, but the labor saving in cutting only one time per pattern is worth the extra time to index all 40 pieces.

I hope to be through with all cutting by next weekend, and then the sewing will start! I have had a couple of extensive sewing lessons from Guy Gauthier, who runs the shop at Thunder & Colt in Longview, Texas, so I feel like it will proceed smoothly. We have a good Juki double needle in very good working order, and I hope to have an envelope by late April or May, time permitting....

Joe Seawright

and Joe Follows up...

April 11, 1995

Bob:

As to the progress on the envelope, I completed all fabric cutting about three weeks ago, and my work schedule at Baldwin [Piano and Organ Company] has been so heavy in the last three weeks that I have had little time to sew, but I have gotten about eight or nine panels joined together. My pattern calls for six sections vertically to make up a half gore, and my plan is to make up all the individual half gores first, and then begin joining these together at the vertical seams.

The Juki sewing machine is quite a fearsome beast, with a top end output of what seems like several million stitches per minute, although about 4,000 per minute is probably correct. It will sew all the way up your arm and over your shoulder if you don't watch it! I am finding it quite difficult to achieve a moderate pace with the foot pedal. I have even rigged up a very long lever arm extension to try and give more control at slower speeds, but the Juki seems to be born to run - FAST. It sews like a million dollars when it is behaving, but it does have a mind of its own, at times a quite demented mind, so one's level of concentration must remain high. So far I have been fortunate that its periods of dementia have been during practice sessions, and I think I have it pretty well tweaked for the moment. I expect my workload at Baldwin to lessen somewhat by the end of April, and I plan on a big push at that time to complete the sewing, hopefully by June 1.

I plan to rig the envelope to an existing Thunder & Colt bottom end, with a single C-3 burner (actually the burner that Bill Bussey used to set his recent records from Missouri to Savannah, Ga) to meet certification. After the airworthiness certificate is obtained, then I'll start looking at alternative ideas. We are considering building a two seat chariot like the T & C Sky Chariot design, with a sofa type seat and 20 gallon horizontal tank, but that remains for future consideration.

Joe Seawright
218 East Harding St.
Greenwood MS 38930

If the sewing machine speed is really too fast, replace the pulley on the clutch motor with a smaller pulley. This will slow the stitch speed down. 'Slipping the clutch' promotes rapid wear in the clutch motor.

The clutch motor will typically have a 'J' bolt which can be adjusted to tighten up the belt with the smaller pulley. In some cases, it may be necessary to buy a new, shorter belt.

Notes from BRMA news

The Balloon Repair and Maintenance Association (BRMA) Newsletter for April noted Service Letters (SL) and Service Bulletins (SB) with the following topics:

For Aerostar:

SB 133: Cable redundancy for most 4-point aluminum superstructures;

SB 134: Reinforcement of large basket suspension;

SL 106: Basket poly skid guard protectors;

SL 107: Classic X basket floor plate;

SL 108: Deflation panels on S-52A envelopes;

SL 109: Cable redundancy systems on TW baskets.

If you think any of these service notifications may pertain to you contact Aerostar at 605-331-3500

For The Balloon Works:

SB B-30: Replacement of Mirage burner suspension springs;

SB B-32: Replacement of Mirage burner brass fuel fitting with stainless steel fitting.

For more information contact The Balloon Works at 704-878-9501

Possible Hose Problems

BBJ has received conflicting reports of possible problems with Parker model 801 hose. This hose was used as propane fuel line for a short period of time in Balloon Works systems.

In one reported case a pilot of a large ride balloon was laid out for cold inflation. On pressurizing the liquid fuel lines, the hose separated from its end fitting. It is reported that the pilot cut the end off the damaged hose, pushed the hose, by hand, back onto the barbed fitting and flew a 'large' number of passengers.

While we have been unable to substantiate the accuracy of this report, if your balloon system has Parker 801 hose, you should contact The Balloon Works at 704-878-9501 for more information. *BBJ* and the BRMA would also be interested in further information on this issue.

Possibilities for a Low Cost Envelope Temperature Gauge

For some time now I have been looking for a low cost envelope temperature gauge. I'm considering the following:

The Balloon Works (TBW) has started marketing a new liquid crystal display (LCD) temperature gauge. Utilizing low power technology, like that found in wrist watches, this gauge is mounted in the envelope skirt. Because of the low power draw, the unit can be allowed to run continuously with only annual battery replacement.

TBW has priced the new unit at $440 with a $50 trade in for the old display and sensor. My plan is to buy a couple of the old units, along with their sensors from local owners who are upgrading. Combined with appropriate wire these should make nice envelope gauges for my balloons.

As TBW has used several different temperature gauge systems, it is important to match the sensor with the appropriate reporting unit. According to recent mailings, the price of a sensor is $20. The wire 'gauge' should not be critical between the sensor and the gauge.

Locating sensor wire, capable of taking high envelope temperatures. has always been a ($) problem. I recently bought 400 feet of Teflon™ coated wire at an amateur radio 'hamfest' for $10; there are other options.

PVC insulated wire is being eliminated from aircraft use because it puts off dangerous fumes when heated. One of the replacements for PVC insulation is a material called Tefzel™. The Aircraft Spruce and Specialty Company, (Box 424, Fullerton, CA, 92632) sells wire with this insulation for $9.00 per 100 feet in 22 gauge wire. It is rated to 150°C or about 300°F, making it suitable for many balloon applications. It is a stranded wire which is preferred when wire is subject to vibration or repeated bending, as in packing away an envelope.

As an experiment, I would also consider using copper motor rewinding wire. Though it is not stranded, it is available locally at motor rewinding shops. The Formvar™ varnish used on this wire is good to at least 300°F, and the cost is reasonable, though service lift may be limited. (Over a period of time the varnish may harden and eventually crack, shorting out the sensor.)

Typically, two wires must run from the envelope sensor to the reporting gauge. I use the following technique to create a length of double wire:

Starting with a length of single wire about 2.1 times the distance from sensor to unit, I double the wire in half, creating a loop in the middle. I chuck an 'eye bolt' in an electric hand drill and put the wire loop in the bolt eye. With an assistant holding the two wire ends stretched out parallel to the ground, I run the drill until the length of wire is twisted every 4 to 8 inches. Cutting off the loop at the drill creates a 'twisted pair' of wires which is mechanically stable and fairly immune to electrical interference.

Brian Mehosky Offers Cable Length Calculations

Issue Number 5 of *BBJ*, (March-April 1994), contained an article on calculating envelope to basket cable lengths. Since that time, reader Brian Mehosky has generated a cable length calculation system using AutoCad™. Last November, he wrote to me discussing the stages of calculation. He also included a set of 12 computer drawings showing the process. In March, I put his system to the test. I asked him to calculate cable lengths for my new balloon. Brian responded in a couple of days with very clear and accurate results. Unfortunately, The large number of drawings and specialized data has not lended itself to an article in BBJ.

Brian has a valuable product for our readers. He has offered to help builders calculate the cable lengths on their own balloon projects. If you can use his services, contact Brian at:

Brian Mehosky
17100 Andras Drive
Walton Hills, OH 44146

Addendum: The following material was not part of the original publication.

This is a color picture of the Sewlight balloon seen on page 2. The balloon is inflating in front of our balloon barn outside our rural Oregon home.

There are advantages to inflating on one's back yard. For example, we can fly on a moment's notice. Mari and I can inflate and chase the Sewlight balloon without any additional crew. It's nice having drive-through balloon storage.

With power so close I'm developing a five horsepower electrically powered inflator fan.

There are also disadvantages. I have six acres to maintain using a farm tractor. The drive is long for our crew. Occasionally, we choose to sleep in and are awakened by the sound of a balloon trailer pulling up outside.