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November-December 1994

In This Issue

Up and Coming

In part 2 of his article, Adrian Brookes will follow up on Tracy Barnes' philosophy of envelope construction. Bill Bassett is preparing an article on building his own burner.

Notices To Readers

ITS THE BUILDING SEASON

With the onset of fall weather, many pilots are preparing to store their equipment until the return of flying season, next spring, But other lucky individuals know that winter is the season for balloon construction projects.

Even the first time builder should consider it realistic to design and build a new envelope over the course of the winter. If you start now, you could be flying a new envelope next May.

If you have been considering the possibility of building a new envelope, but need some encouragement, read the article which begins on page 2.

Reporting on Reader Projects

We encourage readers to send us a note about current building projects. We will publish details and address for the convenience of the readership. *The Readers are Building...* column begins this month on page 11.

Current Readership

As a result of the Vermont Homebuilding Meet last May, a number of magazines have carried feature articles on balloon building. This publicity has resulted in a recent increase is subscribers. Currently 134 individuals are receiving *The Balloon Builders Journal.*

Balloon Design and a Builder's Table

By Bob LeDoux,

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

Through a proper match of building space and balloon design, this simple, temporary table makes envelope construction a comfortable endeavor

Introduction

Translating rolls of fabric into envelope panels is not a trivial matter. The typical balloon contains somewhere between 400 and 1,600 lineal yards of fabric. Some first time builders are content to perform their fabric cutting on a school gym floor. But even young bodies find crawling across the floor while cutting up to a mile of fabric to be very uncomfortable. I built a balloon that way–once. Since then I've learned that the whole process is much easier when performed at the comfort of table height.

Few builders have unlimited space in which to build a balloon-building table. But many of us have access to a single or two car garage. Through an appropriate match of envelope design and available space, cutting out all those envelope panels can be a joy instead of a chore. Cutting can take place at the builder's leisure and not with the press of time because the school gym is needed for basketball in four hours. In keeping with these ends, this article will touch on balloon design, and the construction of a low cost, temporary table for envelope construction.

Table Size Considerations

As we've noted in past issues, there are two major families of envelopes. The Aerostar style of construction involves sewing together a few, very long fabric panels. In a typical AX-7 (77,500 cubic foot) balloon these can be as long as 72 feet each. The other family of envelopes uses multi-panel style of construction. These envelopes are made from many, but smaller panels, panels which are generally no more than 12 to 16 feet long. Typical of this style of construction are Cameron, Balloon Works and Avian envelopes.

Few of us have the space, much less a justification to build a 72 foot long table on which to build Aerostar-type envelopes. So if your Aerostar-type design is quite simple, with few color changes within half gores, it may be reasonable to cut out 32 to 48 half gores on a gym floor. While the cutout work is 'back breaking', the overall construction time for this type of envelope is shorter than multi-panel construction. (It is our experience that cutting and sewing many panels together into gores can consume as much as half the total envelope construction time.)

On the other hand, by designing a pattern into the envelope it may be possible to build an Aerostar-type envelope on a much shorter surface. If you are willing to create a more complex pattern, with no piece longer than 16 to 24 feet long then your 'cutting out' could be performed on a table in a one or two car garage. *Figure 1* shows our *Sewhappy* balloon, a replica of an Aerostar S-55, which was constructed on a 24 foot long table.

Another advantage of the Aerostar-type construction is that the table can often be more narrow. For example, as the S-55 envelope has a maximum panel width of 45 inches, the table could be built 48 inches wide which is the standard width of the wood

Figure 1: The author's replica of an Aerostar S-55, called *Sewhappy*. By incorporating this envelope pattern, construction was possible on a 24 foot table

panels used to construct a table top.

The multi-panel style of construction generally requires a table of less length but more width. These envelopes are typically constructed of a series of horizontal panels, each the width of the fabric, less the selvage edge. This width is generally about 5 feet. The panel length varies by placement in the gore pattern, but rarely exceeds 16 feet. This panel size invites construction of a work table that fits even in a single car garage.

One factor in table size is builders reach. Most average size women have difficulty working to the center of a table much wider than about 5 feet. So don't build a table that requires a footstool to reach the center. Most people will find a height of 35 to 37 inches a comfortable working level.

To summarize, let the envelope design direct the table size. Don't make the table any wider than necessary. For multi-panel construction, make it as long as your longest panel length. For Aerostar-type gore construction, design your balloon pattern to be consistent with the available space for your table. Since any table top will be built from standard 'sheet goods' which come in 4 foot by 8 foot dimensions, use multiples, or fractions of that measure for your table design.

As many of our readers are building multi-panel type balloons, some of which are Boland kits, we will layout a table appropriate for this style of construction. Our table will be 64 inches wide by 16 feet long.

Table Layout

To be most practical, we want a temporary table, built simply from common materials. On completion of the balloon building project the table can be taken apart and stored or its materials used for other purposes.

Figure 2: Here is the author's table in use. This table is 64 inches wide and 24 feet long. Note the fabric reel in the background. Binder clips are used to clamp the fabric to the left table edge with the pattern on top. The table top is exposed on the right side of the photograph where a previous panel was cut from the fabric. Simple, inexpensive, convenient.

The table we will describe consists of lengths of 'two by four' lumber to create a simple framework. This framework is assembled using 3 inch long hardened steel screws, sometimes called 'deck screws'. Then a table top of $^5/_8$ inch thick pressed board, often sold as floor underlayment, is screwed on top of this frame using shorter, drywall screws. The entire structure can be built in an afternoon. Once the balloon is finished, the screws can be removed and the whole structure disassembled. Costs, depending on your scrounging ability, and table size, will run from about $20 to as much as $80.

The following components are required: (See *figure 3*, page 5 for details).

Longerons: These are two long boards, of 'two by four' stock, each of which are about 6 inches shorter than the total length of the table. For a long table, these can be pieced up from shorter lengths. In other words, 24 foot long 'two by fours' are hard to find so a couple of 12 foot boards can be used to create a 24 foot length.

Cross members: These are 'two by four' stock which are cut about one foot shorter than the finished width of the table. These members connect the longerons and create a framework on which the table surface is mounted.

Legs: These are 'two by four' stock each about 34 to 36 inches long.

Table surface: The final surface is a $^5/_8$ inch thick pressed board. Its heavy, but cheap, about $9 per 4 foot by 8 foot sheet.

Fasteners: The 'two by four' pieces are assembled using 3 inch long hardened screws. These are commonly called 'deck screws' as they are used to assemble back-yard decking. The table surface is fastened using shorter hardened screws called 'drywall screws'. These are commonly used to attach plasterboard panels to wall studs and ceiling joists. All of these screws generally come with a Phillips head and can be driven using a variable speed drill with a screwdriver tip.

Tools: We will assume that your lumber supplier is willing to cut your material to size for a small charge. Therefore, the tools required are an electric variable speed drill to use as a screwdriver, and a sander to finish the working surface.

We begin construction of our table by acquiring materials. Take two 16 foot long 'two by fours' and cut 6 inches off the end of each. The other board stock can be cut from standard 'stud length two by fours' which are about 92.5 inches long. Take each stud and cut off a 34 to 36 inch length for a table leg. The remaining piece, 56.5 to 58.5 inches long, is the right length for a cross member. Cut up six studs in this manner.

The table top requires three pieces of $^5/_8$ inch thick pressed board. One piece is ripped to create three even-width pieces, each almost 16 inches wide. Two of these pieces become part of the table top and the third piece is not needed unless a longer, 24 foot long table is built.

Table Assembly

Again, refer to *Figure 3*, on page 5. Lay the two longerons out, on edge, on the floor, and place the cross members between them. Assemble the framework using an electric drill with screw bit and your 3 inch long screws. If you are constructing your frame from soft wood, like pine, you should have no trouble driving the screws. With harder wood like fir it might be easier to first drill a pilot hole in the longerons.

Now is a good time to check the overall dimensions. Measure the outside width of the framework. It should be at least 2 inches less than overall table top width. It also shouldn't be more than 10 inches less than the overall width. Check the length of the framework against these same standards.

After the framework is complete, the legs can be attached. Have an assistant raise up one side of the table and set each leg in place. Set the leg end even with the top longeron edge, and screw in place. For the end legs, run screws into the leg from the cross member and the longeron. I recommend a minimum of 4 to 6 screws in each leg.

Raise the other side, setting the top of the frame level, and screw on the other set of legs. At this time the whole structure will seem a bit flimsy, but will stiffen up when the top is put on.

Make certain the frame is square and start applying the table top. Set the top panels in place. There will be a crosswise joint in the middle of the table. Center this crosswise joint over the center cross member so top panels, on each side of table center, can be screwed to this cross member. This detail is displayed in *figure 3*. If the table is square the overhang should be even. Once all the table top pieces are aligned, screw the top to the frame. I used drywall screws for this purpose which are generally a bit more than 1 inch in length. The screws must be driven deep enough so their heads do not protrude above the table surface.

There may be unevenness where the table top panels butt up against each other. This can be corrected by bridging the panels with scraps of wood across the bottom of the surface. Screws through each top panel and into the scrap will hold the blocks in place, smoothing out the table top surface.

The table can be finished with a sander using 100 to 150 grit sandpaper. Be particularly careful around the table top edges and screw holes to eliminate splinters that can catch on the fabric. I don't recommend any finish like varnish. I completed my table by taping the ends with 2 inch wide plastic tape, the kind of tape used for wrapping packages. This provides a smooth surface over which the fabric can slide. I tend to let fabric run over the edge.

Of course, I drag it across the surface rather than picking it up and placing it on the table.

Using the Table

Figure 2, page 3, shows the table at work. Also seen In the background is a simple reel which holds the bolt of fabric. This reel is optional. The fabric is pulled out the length of the table and clamped in place. The table overhang, mentioned in the building instructions above, is intentional. It permits the table edge to be used as a clamping surface. I use 2 inch spring binder clamps, like the *Swingline Model No. 10,* which can be purchased at a stationary store for $3 to $4 per dozen. The light colored Kraft paper pattern has been lined up with, and clamped over the top of the fabric on the left hand edge of the table. The right edge of the pattern has been aligned with the cut fabric edge. This cut fabric edge was made when cutting out the previous fabric panel.

You'll note my straight edge lying across the table on the near-end of the pattern. For straight cuts, a straight edge is lined up on top of the pattern and the fabric is cut using a

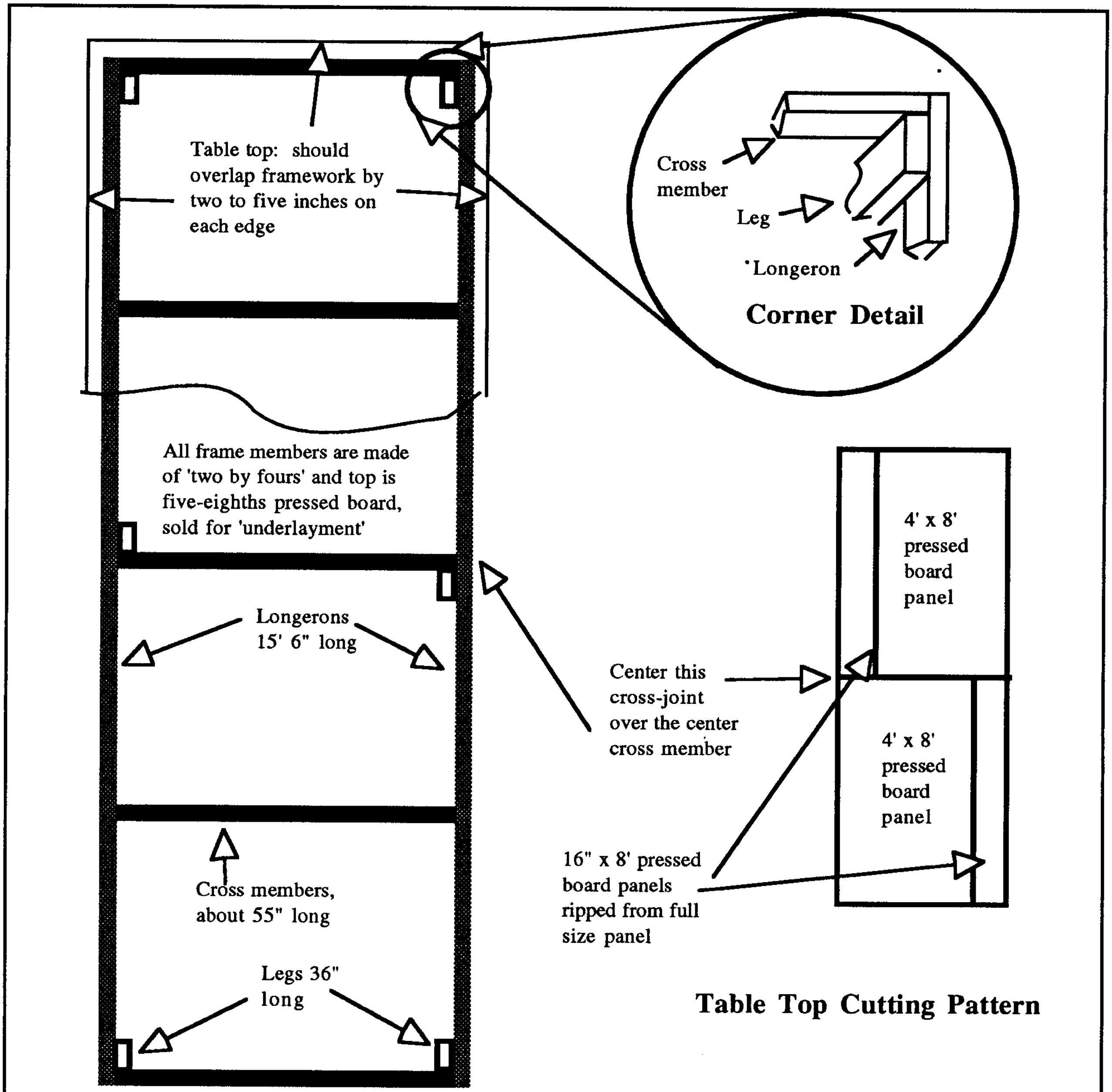


Figure 3: Here are the construction details for the 16 foot version of the builders table.

razor blade knife. My straightedge is 6 feet long. This allows me to clamp each end to the table surface, using binder clamps, when making a cross-the-table cut. If I need to 'clamp' the fabric at some point in the middle of the table, I simply take a piece of masking tape and tape the fabric to the table surface. When cutting multi-panel type panels, the builder can clamp a number of oversize fabric pieces, one on top of another and cut them all with a straightedge and a sharp razor knife.

When cutting long, curved edges like that found in Aerostar-type construction a different cutting technique works well. Many builders retain the selvage edge when building these long half gores. The selvage edge is clamped to the edge of the table with the pattern on top. Then a pair of scissors follows the curved pattern edge cutting the fabric. Cutting balloon fabric does not require opening and closing the scissors. Your scissors must be sharp enough to 'cut like a knife' when running down the fabric.

I purchased my razor knife at a commercial paint store. The knife consists of a wood handle into which is slipped a singled-edge razor blade. The entire blade edge is exposed, without guards. This is a dangerous tool, deserving of great respect.

Cutting fabric with the razor knife and straightedge involves scoring the table surface. Move the cuts around on the surface. Otherwise the heavy scoring in a small area results in rough and unclean cuts. Also try to keep away from the screws which attach the table top. Each screw head you hit will dull a razor blade edge. After considerable cutting the table surface will take on a rough surface. A light sanding will restore a smooth top.

During the development of this article I talked to Brian Boland. In that conversation we discussed his building table. Brian covers his table with thin sheets of masonite. This provides a replaceable surface. He can cut out about 5 balloon kits before the surface is so damaged its no longer usable.

Masonite could be placed over the table described in this article. Even $^1/_8$ inch thick material is adequate. It would eliminate dulling the knife on the screws that attach the table top to the frame. The spring clamps described in the article will open to about 1 inch. So the clamps could still be used with a masonite cover. However, the finger force required to operate the clamps is quite high at the wider openings.

If you are building a permanent table, or plan on building a number of balloons, consider the masonite cover. But attach it so it can be easily replaced.

Brian also prefers a slightly wider table, 66 inches wide. Builders working to this width can follow the framework instructions above. The extra piece of particle board would be ripped to 18 inch widths instead of the 16 inches called for in the plans. With this cutting schedule one 4 foot by 8 foot panel will produce two 18 inch wide panels and one panel about 12 inches. wide, less the rip saw kerfs.

Extending the Table Length

The table length can be extended to any convenient dimension. As noted in *figure 2*, I chose to build my table 24 feet long. (My two car garage is 35 feet long.) My desire to build Aerostar-type envelopes is consistent with the longer table length.

Building a longer length is a simple matter of extending the longerons and adding additional table top surface panels. It may be difficult to find 'two by fours' any longer than about 22 feet in length. Thus for longer tables, the longerons would have to be constructed from two shorter lengths. The shorter lengths can be placed end-for-end and a short 3 foot length of 'two by four' doubled over the joint and screwed to both pieces.

If building a 24 foot table, there is efficiency in making the table top 64 inches wide. Four of the 4 foot by 8 foot panels will be needed. One panel is ripped into three equal size 16 inch by 8 foot long pieces. This layout results in no scrap material for the table top.

A final note. To keep the confusion quotient low, we based our table design on 4 foot by 8 foot panels. In fact, other size panels are available. For example, 5 foot by 9 foot panels are often sold for table tennis table tops. It might be worth your effort to 'call around' to see if 5 foot wide panels can be purchased. Expect to pay a premium for these specially sized materials. But the end result may be a smoother table with a bit less work. If you really want to go exotic you might find marine grade plywood in 12 foot or even 16 foot lengths. But the cost is horrendous.

Builders Tips

Compiled by Bob LeDoux

Order your "N" Number Early!!

On July 14th, I sent the required paperwork to the FAA in Oklahoma City to reserve and register a new "N" number for my current balloon project. The response arrived on October 3rd–two and a half months later. As the FAA will not issue an Airworthiness Certificate until the number is assigned and mounted on your envelope, this delay could really put your project on hold. The message? Contact your FSDO office as soon as you contemplate a balloon building project. Ask for their technical information packet. Get the Notarized Statement, Registration Application form and the $5 fee in the mail as soon as possible.

One Source of Load Tape

I just purchased **load tape** for my light weight balloon project. I chose 3/4 inch Mil-T-5038 Type III for my vertical tapes. Its light in weight and inexpensive, though the tight weave is a bit more difficult to sew. One inch Type IV was chosen for the mouth and deflation port. It has a more open weave, and is easy to sew, but is over twice the price per yard. This is the same tape Aerostar uses in their envelopes. I decided to purchase my tape from **Bally Ribbon Mills** in Bally, PA. I purchased 576 yards of the Type III tape for $0.11 per yard. The Type IV tape cost me $0.275 cents per yard. Service was prompt and they treated my phone order as UPS COD without any problems. Both products were excellent quality. The 1 inch tape had one break in a 69 yard roll, while I found one break in each of 2 of the 8 Type III rolls.

Bally Ribbon Mills can be reached at 23 N. 7th. St, Bally, PA 19503-1004. Their phone number is (215)-845-2211

Light and Its Effect on Fabric

The following items come from Dan Poynter's *The Parachute Manual.* This manual, which comes in two volumes, is recommended for the advanced builder. Each volume costs about $50.

Tests were conducted at the U.S. Naval Weapons Center in China Lake, CA, on joining parachute fabrics with hot melt and solvent based adhesives. The resulting seams were tested for seam flexibility, peel strength and shear strength. One adhesive produced 100% seam efficiency and peel strength of 17.5 pounds per inch. (The *Miss Champagne*, worlds largest hot air balloon constructed a few years ago used adhesives in its construction.)

Dan Poynter reports that one week of summer sun exposure will result in nylon losing 52% of its breaking strength. After two weeks the loss is 71% and after three weeks 94%. If the fabric is exposed to sunlight behind glass, the rate of strength loss runs 75% to 90% of the rates above. After reading this I put 1.1 ounce scrap fabric over my workshop window to keep sunlight off of my balloon fabric. For most of the summer, this fabric has faced the summer sun with a Southeast exposure. It still has sufficient strength to pass an annual inspection.

Dan also reports that *fluorescent lights, in close proximity to the fabric result in about half the rate of damage as natural sunlight. Incandescent lights are fairly safe.*

Wills Wings, a company manufacturing paragliders expects their products to last 300-400 hours in sunlight exposure.

Basic thoughts about bobbins.

Changing bobbins is a basic headache of balloon construction. To make your bobbin thread last longer set the needle thread tension so the stitch knot is near the bottom of your stitch.

Most builders replace both bobbins at the same time. That is, when one bobbin runs out of thread both bobbins are replaced. But also, its no fun changing bobbins in the middle of a long seam. Consider installing new bobbins before each vertical seam. Wind the bobbins with enough thread to finish the entire seam. I can hand-wind my bobbins with about 65 feet of thread, which isn't enough for a large envelope. Pre-wound paper bobbins can be purchased. In size 24 thread, each comes wound with 29 to 35 yards of thread, depending on sewing machine model. This is enough for sewing most vertical envelope gore seams. Because of the paper bobbins, the leftovers can be saved for other smaller tasks. There are two disadvantages, one of which is cost. The other is some unevenness of thread tension caused by the bonding agent in the thread.

Letters to the Editor and Other Bits of Information

More on the Peregrine Project, NH_3 Flying, and Cameron's new *Concept Lite* Balloon

We discussed the Peregrine Trans-Atlantic balloon flight in our last issue. This letter from Bruce Comstock provides some additional information-Editor.

08-30-94

Bob,

I was in St. John's for the Peregrine launch. I flew to Newfoundland on July 31st and stayed until several days after the August 17th launch to do last minute errands.

This flight was a completely non-commercial, sporting adventure. There was virtually no publicity before or after the launch. The scene at the Fielding Grounds soccer club in St. John's on the night of the launch could just as well have been at the Kugler fertilizer plant in Culbertson, Nebraska, for the launch of an ammonia balloon. In fact, the inflation and launch was done primarily by a small group of fertilizer flyer friends of Tim Cole's. These included Dennis and Nancy Brown, Vikki Cole, Ruth Ludwig, and me, all of whom are among those doing NH_3 ballooning. If we had cared about titles, Dennis would have been called the Launch Director. I spent most of the inflation on or in the capsule, tending to control lines (seven!) and carabiners, and firing up some of the avionics, the electronic barograph and some of the onboard computer equipment.

The reason I have been so slow in responding to this message is that, after returning home from St. John's, I departed again a day and a half later for Albuquerque (to give a talk for AAAA on the Long Jump flight), through Colorado to visit friends, and to McCook, Nebraska to visit with John and Kathy Kugler. On Monday, after 20 years of flying in gas balloons as a passenger/ student pilot, I made my first pilot-in-command gas balloon flight. This was a five and half hour flight from Culbertson to about ten miles NNW of North Platte, Nebraska. A total of four of us inflated the two balloons in light winds. John Kugler and Linas Mastis took off first in John's Padelt-built "Big Dog" 46,000 cubic foot balloon, followed by me in John's "Little Stinky" 32,000 cubic foot envelope and my hot air balloon basket, which I had designed and built myself. The landings were a quarter mile apart at 1:30 in the afternoon in surface wind of more than 15 knots after

Joe Lapuski of Boyertown, New York built this elegant basket seen at last May's Experimental meet in Vermont.

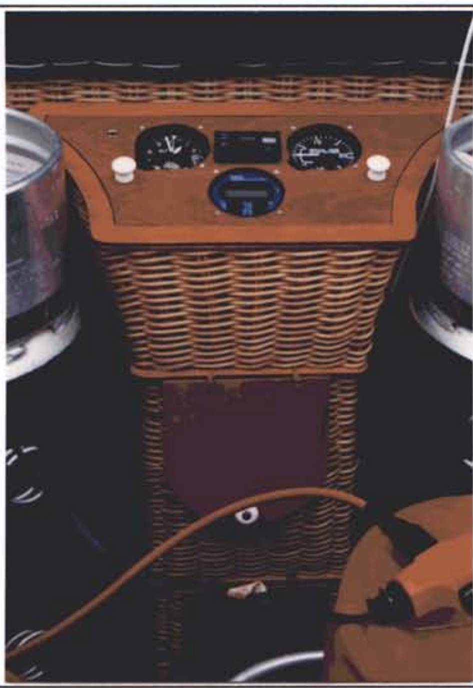
trailing for two miles across the sand hills NNW of North Platte.

My landing was the first landing I had ever made in a gas balloon, although I had once done a complete gas balloon approach to the point of having the trail rope out and just touching the ground.

After twenty years and ten gas flights using three different lifting gases, to finally be able to be pilot in command of a gas balloon made this a big day for me. To be able to fly for five and half hours under clear skies and bright sun made it even better.

Those of us fortunate enough to be doing NH_3 ballooning owe a lot to Tim Cole and Dennis Brown, who doggedly pioneered this form of gas ballooning despite much nay-saying, and to John Kugler, who has persistently and repeatedly demonstrated how feasible NH_3 ballooning really is despite continued criticism from some quarters. Heck, it's so straight forward with a little help even I can do it.

All of us need to remember that NH_3 is not hot air and not helium, and that NH_3 ballooning cannot and should not be done in many of the locales where these other forms of ballooning are often done. This said, though, it IS true that NH_3 ballooning is well adapted to the vast, wide-open spaces of the great plains. As long as we fly NH_3 only where it is safe and reasonable to fly it, many will continue to enjoy this beautiful and inexpensive way to fly gas balloons.



The rattan instrument panel in the Lapuski Basket.

Incidentally, after a number of ammonia flights and crewing experiences, I've noticed that the aroma of ammonia now elicits in me anticipation of ballooning excitement in the same way that the aroma of mercaptan elicits these feelings in many hot air balloonists.

Incidentally, Cameron Balloons U.S. is offering the 60,000 cubic foot Concept envelope built out of Soar-Coat™. When this is coupled to the tanks-on-the-outside basket this is called the *Concept Lite*. The *Concept Lite* is the balloon system I created for myself and I now carry mine IN the back of my van, always ready to pull out and fly.

Time to go. Lots of ballooning excitement followed by too much driving.

Best regards. More later. 73.

Bruce Comstock
CompuServe 73112,1104

An Electronics Instrumentation Project

Bob,

I hope to be able to contribute an article sometime so that you won't have to write most of them.

Got my basket built and plan to start envelope construction this winter. Basket is generally like a Boland basket, or actually more like Mike Emich's.

Electronics is my thing, so I've been playing some with a digital temperature-altitude-variometer system of my own design. Hope to have it done by the time my balloon is done.

The variometer I propose will be derived from just a computer calculation of the rate of change in the altimeter readings. The altimeter will be based upon a barometric pressure sensor which produces different output voltage for different pressures. It actually has a bridge circuit in it. It will be connected to an A/D converter. Of course, the whole thing is controlled by a microprocessor and the appropriate software which I am writing. The display will be via LCD.

Best regards,

Bob Hanway,
Charlotte, NC
CompuServe 71613,313

Jon Kugler spent a week in the hospital due to a blood clot in his leg. He was released on September 15th, and we are happy to have him back among the healthy.

Kitplanes magazine, for October 1994, ran an excellent eight page feature article on the May Experimental Balloon Meet in Vermont. If you missed that event this article has lots of good pictures.

Ron Borovec publishes a very interesting journal called **Roadable Aircraft Magazine** (P.O. Box 38, Edmonds, WA 98020-0038.) As its name implies, the magazine is focused on aircraft that are also at home on the highway. The July/August 1994 issue featured an in-depth discussion of Ron Parigoris' balloon-*Screwball*. This balloon uses an all terrain vehicle of Ron's design for self-retrieves. The vehicle was welded up from aircraft chrome-moly steel tubing and employs an engine and drive train from a commercial ATV. The basic vehicle weighs 146 pounds before adding the ballooning components.

Building Amateur Built Aircraft for Others

The following is taken from a communiqué from the Experimental Aircraft Association to various aircraft groups. "Balloon" is an appropriate replacement word for "airplane" in the following.

"....You are probably aware that there are quite a few people building airplanes for others. The proper category for these aircraft to be placed in is Experimental Exhibition. if the "sponsor" of an aircraft has a "hired gun" build an airplane for him and he signs the major portion eligibility statement, he then must sign a notarized statement saying that if he falsifies the above statement, he understands that he is liable for up to 5 years in prison and a $10,000 fine. Fortunately, this has not been enforced....."

Ben Owen,
Executive Director
Information Services, EAA

If you have another person build an aircraft for you under amateur-built rules, you are placing yourself in potential criminal liability. FAA offices have intensified their monitoring of aircraft builders. It is common for them to check on a builder's history. When the FAA conducted the Airworthiness Inspection on my last balloon, the inspector displayed a list of all my aircraft projects going back to 1974. The list wasn't limited just to balloons, it included my sailplane projects. In particular they are looking for evidence that a builder is 'manufacturing aircraft for sale'. In some Fight Standard District Offices (FSDO's) this concern is reflected in increased documentation requirements, that serve to show that the person receiving the certificate actually performed the building.

When you begin your building project, make certain you understand your local FAA expectations for documentation. At the very least, keep a written log of work performed and time spent. Keep all receipts, and take pictures displaying construction. -Editor.

Concerning Design and Airworthy Standards for Home-Built Balloons

This is a CompuServe exchange of letters between your Editor and Bruce Comstock.

6/12/94
Bob,

I do think most balloon manufacturers are more capable than most amateur builders of designing safe light-weight balloons. That it is possible to design safe balloons lighter in weight than the manufactured ones does not imply that this is easy to do. The price of a design error in weight-reducing a balloon could easily be someone's life. I think anyone designing balloons weaker than the manufactured balloons has a great responsibility to assure that the design is safely strong. This should be done through competent stress analysis backed up by strength testing. To me, actual strength testing of assemblies is more reliable proof than analysis, because analysis allows too much possibility of undetected error.

I have been machine "weathering" and tensile and tear testing samples of a batch of fabric I am considering purchasing for use in a pseudo-solar balloon I am thinking of building. I loaded the new little basket described in my earlier letter to more than 1200 pounds and suspended it to demonstrate its strength before I flew it. Doing these exercises has made me wonder how much testing most amateur builders are able to do.

When I flew the little basket with the tanks on the outside I ended up flying straight to Hell -- Hell, Michigan, that is. Hell is a pleasant little lake community about ten miles away with only lakes and trees for miles around. At sunset in a bit of a breeze I landed in the only place available -- a large fenced yard with no access. We walked the balloon back right to the upwind fence before deflating and packing it. It was really easy to set the tanks, envelope and basket across the fence, saving us what would have been back-breaking work in a standard balloon. I definitely would have passed up this spot had I been flying a normal balloon.

Best regards.

Bruce Comstock

06/13/94
Bruce,

I appreciate your comments about aircraft testing. I discourage the average reader from designing baskets. All the loads concentrate to that structure and I consider it the most critical part of the aircraft in terms of keeping body and soul together.

Carefully constructed envelopes made from proven materials, using proven designs give me less concern. The flight loads are broadly distributed so that stress concentrations are minimal, thus deterioration tends to be progressive in nature. This allows for reasonable monitoring of strength loss.

Those are my viewpoints, would you care to offer an opinion on these thoughts?

I am also curious about your thoughts regarding minimal strength standards for envelopes built from the 1.1 ounce parachute-type fabrics. It seems ridiculous to apply a Federal Test 191 tensile test standard, pull test of 40 pounds or so to a fabric rated at 45 pounds, new. I consider about 2.0 pounds on a 1 inch tensile tear test as minimum for safety. I note that parachute fabrics run from about 5 to 12 pounds on this test when new.

Whatever the case, we have builders using lightweight fabrics and they don't yet have factory standards to turn to for minimum standards. What minimal strength standards must your Soar-Coat envelope maintain for you to consider it airworthy?

Good luck,

Bob

6/14/94
Bob

I agree with your comments regarding basket and envelope strengths.

I want the Soar-Coat in my balloons to meet the same minimum strength requirements as any other type of fabric used in balloons I fly. In the case of Cameron's this would be, annually, a 1" grab test to 30 pounds. There is no tear test requirement, but Soar-Coat which passes the 30 pound grab test would surely have plenty of tear strength due to the silicone coating.

-Bruce

Editor's comment: We offer a couple of basic comments which don't even begin to cover the issue of prototype testing. While the opinions of experts should be sought when contemplating any new design, remember that 'one structural test is worth a thousand expert opinions.'

A very basic strength test of a new system is to load the inflated balloon to gross weight, tether a few feet above the ground and then jump up and down in the basket to create shock loads.

Basket builders should be especially sensitive to inspections after a hard landing. Such landings can place potentially destructive loads on a basket that result in significant damage visible only under close inspection.

We would like to publish articles on balloon strength testing. Readers with background on this topic are encouraged to submit their ideas.

Readers are Building...

Bill Hawkins, currently with the U.S. Army in Germany, (SFTS Det Unit 20101, APO, AE 09165) completed a Boland 73-12 balloon at Brian's Balloon Camp during January and February of 1994. He is currently flying not far from the Ronneburg Castle and finding German farmers very friendly.

Phillip MacNutt of 4909 Great Divide Drive, Austin Texas 78736, is building an AX-4 of 41,000 cubic feet from Brian Boland's plans.

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

This is an interior view of the Sewhappy balloon seen on page 2. This Aerostar S-55 copy had 24 gores with 48 vertical half gores. The top was a para-vent. One third of the top operated like a parachute for venting. The other two-thirds was a traditional hook-and-pile rip top. This top has poor venting power, with excellent ripout capabilities with low operating loads.

The envelope contained more than a thousand panels. It was constructed from mill end pieces. Unfortunately, the violet fabric failed after about 250 hours of flight time. As the balloon contained 96 distinct violet panels the decision was made to retire the envelope rather than replace all the panels.

The failure was surprising. It occurred during a 40-hour period of flying. At the beginning of the season the violet passed pull tests. Forty flight hours later it separated with minimal effort.

BBJ readers are reminded that untested fabric may be subject to rapid deterioration. Be on the lookout for the sudden appearance of small tears. If there is any question as to the fabric integrity attempt to continue the tear with light hand force. If less than three pounds of force is required to extend an existing tear, the fabric integrity is suspect.

This is a view of the builders' table seen on page 3 of this issue. This is the same view, from a slightly different angle, after the fabric pattern had been removed. The countersunk drywall screws are evident in the tabletop seams.

Seen here is fluorescent cantaloupe dyed parachute fabric used to construct the Sewlight balloon described in issue 12. A photo of that balloon is seen on page 2 of issue 12. A picture of Sewlight inflating in our back yard can be seen on page 12 of issue 12.