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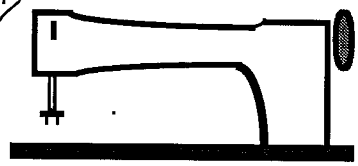
Dedicated to the Sport Balloon Home-Builder



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THE BALLOON BUILDERS' JOURNAL

May-June 1996

In This Issue

Up and Coming

In our second article on *Design Considerations for the Amateur Builder* we consider basket design and testing. This article is part of our ongoing effort to help ensure the aircraft we build are safe to fly.

Don't Forget the Experimental Balloon Meet in Vermont

Brian Boland again is hosting this, his third experimental balloon and airship meet. Only experimental aircraft are invited to this weekend event.

The event is schedule for Friday, May 17th, through Sunday, May 19th, at the Post Mills Airport in Post Mills, Vermont.

Weather is historically good with temperatures down to about 52° at night and 78° during the day.

Camping on the airport is free, propane is $1.00 per gallon. Brian will be happy to provide a list of local motels.

There are no scheduled races or competition. Pilot briefings will be on a personal basis.

Contact Brian for more information at P.O. Box 51, Post Mills, VT, or call him at 802-333-9254

Design Considerations for a Small Rattan Basket: Part 2

By Bob LeDoux, Editor,

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

In this, our second article, we discuss the construction of a small rattan basket.

Introduction

In the last issue of *Balloon Builders Journal*, I discussed the concept and design to my *Castaway* single person rattan basket. In this article I will present the basket layout and construction in further detail.

This article discusses the basket construction with one major omission. I will not discuss the design and construction of the burner load ring. There are two reasons for this intentional omission. First of all, the load ring design is dependent upon the choice of burner. A single load ring design is not going to fit the wide variety of burners which are available. Secondly, as noted in my last article, I am not completely happy with my current burner ring design. I do not want to encourage readers to build a design which has the shortcomings mentioned.

I would encourage readers to look over the burner load rings employed on factory basket systems. Give consideration to the lightweight suspension system used by Brian Boland. If you create a good, self-supporting load ring system, please submit it for publication.

Construction Summary

The basket construction revolves around two major building sequences. The basket base is constructed using traditional wood working tools and skills. The rattan sides require basic weaving techniques which involve a couple of special tools. Additionally, a bit of sewing is required to construct the basket top edge cover.

The design was developed to emphasize simplicity. The construction sequence can be summarized as follows:

• The plywood basket floor is laid out and drilled for the rattan reed vertical stakes and other rattan poles.

• The wood skids are cut and fitted to the basket floor bottom.

• The reed stakes are then inserted into the floor after which the skids are bolted and glued to the basket bottom.

• The basket sides are woven and the top of the basket is finished.

• Final completion involves varnishing the basket, attaching the steel cables and lacing on the fabric cover.

Weaving a basket of this size requires some jigging if an even and consistent shape is to be produced. I actually made two simple jigs. The first of these is a template of the basket floor. A scrap piece of plywood was clamped to my basket floor blank. Then, as the holes were drilled in the basket floor, the template was also drilled with a matching set of holes. The vertical rattan stakes were run through the holes in the template and the actual weaving was performed between the

Figure 1: Note the use of the plywood template to keep the vertical stakes in position for weaving. Also note how the reed was wrapped around the 1 inch diameter poles.

template and the floor. This template can be seen in *Figure 1*. Using this technique even a beginner can create a consistently shaped basket.

To further ensure symmetry, I created another simple jig which kept each of the basket corner poles in proper relationship to each other. This jig is a simple 'H' shaped frame with pieces of dowel that fit into the 1 inch diameter corner pole holders.

To simplify the weaving I chose a particular sequence of construction. After inserting the vertical stakes through the holes in the basket floor, I glued the skids on the basket bottom. This locked the stakes in place. The skids also added weight to the bottom of the basket, providing stability during the weaving process. The smooth surface of the skids also allowed easy rotation of the basket while weaving.

The downside to this assembly sequence is that the fitting and gluing of the skids takes place after the floppy stakes are inserted. Thus, the stakes are at risk of damage. There are a couple of ways to solve this problem One option is to mount the basket floor, like a table top, bottom side up, about 4 feet above the ground. The stakes can be inserted and the skids glued to the floor using this secure mount. Another option is to set the assembly, on its side, on a table top and attach the skid plates using considerable care to avoid breaking the stakes.

Tools

Most of the wood working can be performed with familiar hand tools or hand power tools. A jig or coping saw, drill and small sander are essential. A skill saw is useful. The builder must have a method of cutting grooves in lengths of wood. These cuts can be made using a skill saw, dado head in a table saw, a router, or even with a molding plane for the traditionalists.

Working the rattan reed requires two tools. There must be some means to cut the ends of the reed. This can be a double edged cutter, like the basket reed cutters sold by rattan suppliers. A sharp diagonal cutting pliers, sometimes called 'dykes' can also be used. A sharp gardener's snips might also perform this task.

The second rattan working tool is a *reed squeezer*. These pliers are used to squeeze the water-soaked reed so a right angle bend can be made without breaking the reed. I constructed my squeezer by taking a large

Figure 2: Here is my homebuilt reed squeezer at work. Squeezing the water-soaked reed allows it to be bent without breaking. I built my squeezer by grinding the jaws of a common pair of pliers to a rounded shape.

pair of common pliers and grinding the jaws to a half round shape, removing the teeth in the process. See *Figure 2*.

Layout

The first step of the project was layout of the design. On page 8 is shown a detail drawing of the basket floor. The drawing assumes the reader is looking down on the floor from above. The assemblies below the floor are shown in dotted lines. A study of this drawing will make many of the construction details clear. As this basket is a close copy of the Raven Rally flat top basket, an examination of that basket design is also useful.

Looking at the drawing, on page 8, we see a set of $^{13}/_{32}$ inch diameter 'donut' holes which are the holes for the vertical stakes. These holes are about 2 inch centers. My vertical stakes were made from #11 reed which is about $^{11}/_{32}$ inch in diameter. As already noted, my stakes were constructed by bending the water soaked rattan reed into a 'U' shape, and inserting each end of the 'U' into adjacent holes in the plywood floor. Thus I attempted to lay out my floor with 'pairs' (even numbers) of holes for the stakes.

But I chose to put in an odd number of stakes. On one of the sides, (the bottom side on the page 8 drawing) I spaced the holes to allow an extra hole to be added. By doing so I ensured that each layer of weaving crossed over the previous layer. Otherwise, two stakes must be skipped to alternate the weave.

In each corner is found a 1 inch diameter hole for the rattan burner support pole. Each of these poles is topped with a 1 inch inside diameter aluminum tube into which the burner support upright fits. Around the corner from each burner support pole is found a $^5/_8$ inch diameter rattan stiffener. The purpose of the stiffener is to act as a support for the tank straps. The tank straps run on the outside of the basket and around the 1 inch and $^5/_8$ inch poles. If I were building a flexible support system, I would eliminate the 1 inch support pole and replace it with another $^5/_8$ inch diameter pole.

Next to each of the 1 inch diameter poles I drilled a $^1/_4$ inch diameter hole, through the floor, for the $^5/_{32}$ inch basket support cable. These are the cables which run from the metal plate in the basket bottom up to the burner support ring. These cable paths are shown as the gray lines on the drawing. These cables run horizontally, through the glue joint between the two skid plate layers and then turn to go vertical up through the floor. Construction of the cable path is the only tricky part of the basket construction. These details can be seen in *Figure 3*.

Preparation of the Basket Floor and Template

After drawing a rough sketch of the basket floor, on paper, I cut out the plywood for the basket floor to its finished size and transferred the essential lines and drill points to it. Before drilling the holes, I clamped an extra scrap of plywood to the floor. This scrap, which became my weaving template, was slightly larger than the floor, and was drilled at the same time as was the plywood floor.

I proceeded to drill all the holes for the stakes, the corner poles and the stiffeners through both layers of plywood. Once drilling was completed, I separated the two pieces of plywood, marking each so I could stack them, one on top of another, at a future time.

Skid Plates

First a terminology note: The skid assembly consisted of two layers of hardwood. Trying to call these layers 'top' and 'bottom' is confusing because work typically took place with the floor upside down. I will call the layer of wood in direct contact with the plywood basket floor the 'first skid layer'. The second layer of wood, the layer which makes contact with the ground, will be the 'second skid layer'.

Based on my basket size I constructed my outside edge skid plates from $^3/_4$ inch by 3-

Figure 3: I constructed this model to display details of the basket base construction. You are looking down on the bottom of the basket. The plywood is the basket floor and the two skid plate layers are cross-sectioned to show details.

- At the bottom of the photo we see a pair of stakes inserted into the plywood floor. The stakes were made by bending a piece of reed into a 'U' shape and inserting the ends through holes in the plywood floor.
- The first skid layer is slotted to allow it to clear the 'U' shaped loops in the stakes. This skid plate must fit tightly against the plywood floor.
- The top of the first skid layer is slotted across its width to allow passage of the basket support cable between it and the second skid layer. The curve in the cable occurs where the cable turns to go through the skid plate and plywood floor.
- The right hand bolt, in the second skid layer, shows typical construction of the edge reinforcement bolts. The bolt head is inserted upside down and is held in place with a washer and nut on the top surface of the floor. The bolt head is countersunk to allow wear of the second skid plate without abrading the bolt head.
- The left hand bolt, an AN509 tapered head bolt fitted to a tinnerman washer, is not actually found in the bottom skid plate. It is shown here only for detail. This bolt assembly creates a head which is flush with the floor surface. This assembly is used to mount the steel plate and cables. See *Figure 4* for more detail.

$^1/_2$ inch clear wood. After the skids were fitted for size on the basket floor, the lengthwise groove was cut to clear the stakes. I cut a $^3/_4$ inch wide by $^3/_8$ inch deep groove in the first layer of skids. The groove runs the length of the skid and was centered over the holes for the stakes. The groove had to be cut in a curve to allow clearance for the stakes in the corners of the floor. This groove can be seen in the model on page 4.

The center skid consists of two layers of $^3/_4$ inch by 2-$^1/_2$ inch wide clear wood. The first layer skid has a notch cut into it so the steel attachment plate sits flush with the top surface of the that skid plate.

The steel plate was constructed from .065 thick chrome-moly aircraft steel plate. The plate was 6 inches square. A $^1/_4$ inch diameter hole in each corner served to attach the basket cables to the plate. Two holes in the center of the plate were used to bolt the plate through the basket floor and through both skid layers. I fabricated this plate and then painted it for protection from rust.

The top of the first edge skid layer has a groove for the cable path. If you look at the photo in our last issue, page 5, you will see the cables run through the joint between the skid plate layers. When each cable reaches the vertical $^1/_4$ inch hole through the floor, the cable then follows this hole up through the floor and up to the burner support ring. This groove can be seen in *Figure 3.* I completed the cable path in the following manner:

With the first layer of skid plates clamped to the basket floor I located the $^1/_4$ inch diameter holes, the cable holes, in the plywood floor next to the 1 inch poles. With a drill, I extended these holes through the floor and through the first layer skid plates. The steel plate was set in position on the center skid. Taking a straight edge, I lined up the corner hole in the steel plate with the hole I had just drilled through the skid plate This straightedge laid out the path of the cable which is shown as the gray line in the drawing on page 8. A pencil line was drawn all the way across the width of the skid plate. This was repeated in each corner.

On each line I cut a groove $^1/_4$ inch wide and $^1/_4$ inch deep all the way across the skid. This groove was the path of the cable through the skid. Where this groove ran into the hole through the skid, I filed the corner to give about a 1 inch radius. Of course, as the cable turns to go vertical, it runs into the groove we have cut on he other side of the skid to clear the stakes. It may be necessary to glue a small bit of wood in the groove at this point to allow creating the 1 inch radius.

Stake Insertion

To determine the length of each stake, I estimated the sidewall height. To this I added the 10 inches of stake required to form the top edge border, the border under the foam cover. My basket was 38 inches tall, above the floor, so each stake length needed to be 48 inches. I water soaked my stakes, starting about 45 inches from one end of the reed, soaking about a foot of the reed length. The stakes are thick enough that overnight soaking was required to make them pliable. I then crimped the reed with my squeezer pliers, at 48 inches and 50 inches from one end. I bent the reed at these two points to make a 'U' which fit the spacing of the holes in the basket floor. See *Figure 3.*

The ends of the reed were now shoved through the holes in the plywood floor. I proceeded to insert stakes until all my $^{13}/_{32}$ inch diameter holes were filled with reed. With the odd number of holes there was one stake which fit a solo hole.

To reach all the way to the basket top, the stakes had to be about 8 feet long. Some of the stake material was shorter than this. For these cases I made one side full length and left the other side short. The extra length was made up with a 'doubler' during weaving. I spaced these short lengths around the basket perimeter, between the full length pieces.

Now it was time to check the fit of the skid plates. The first layer of skid plates were placed in position and checked to be certain they cleared the stake loops on the basket bottom. I drilled and chiseled out any interference areas until the skid plates rested firmly against the plywood floor.

Gluing the Skids in place

The skids could now be glued to the floor. A waterproof or at least water resistant glue should be used. Weldwood™ glue is acceptable, low cost, and generally available. The builder may also chose to use one of the more exotic epoxys which are now common in the aircraft and marine industry.

I chose to glue both layers of the edge skids together to the basket floor in one session. I drilled the holes for the reinforcement bolts shown on the drawing on page 8. Using these bolts reduced the need for clamps. Before gluing on the second skid layer, I placed short lengths of cable in the groove and down the cable hole in the basket floor. While the glue was drying I slid these cables back and forth to make certain the cable path remained clear. Any glue found on the cables was wiped off.

Figure 4: Here we see the steel plate, mounted between the center skids. A basket support cable is attached to each corner using an AN509 aircraft bolt. The bolt attaching the left hand cable has been taken apart to show its assembly. The right hand cable shows the normal assembled appearance.

The AN509 bolt is lying next to the cable eye. The sequence of parts is discussed left to right: The tinnerman washer fits over the head of the bolt. The pilot would actually walk on this washer and the bolt head. Next is the AN970 aircraft wood washer. This washer can be seen under the right hand cable assembly. The spacer actually fits in the cable thimble. When seated on top of the AN970 washer, the spacer should fit snugly between the steel plate and the basket floor. An AN960 washer and AN365 lock nut complete the assembly.

My reinforcement bolts on the edge skids were mounted like those on the Raven Rally basket. Washers were slipped over the bolts. The bolts were then fitted into flat bottomed, countersunk holes in the skids. See *Figure 3*. I drilled my countersunk holes about $^{1}/_{2}$ inch deep using a $^{3}/_{4}$ inch diameter spade bit. An auger or Forstner bit could also be used . A washer and nut, screwed on the bolt on top of the basket floor completed the assembly. Because these bolts are all at the floor edge, the exposed nuts caused no problems.

The bolts for the center skid required a different technique, as these were situated in the area of the basket where the pilot stands. These are the type of bolt seen in *Figure 4*. The countersunk head AN 509 aircraft bolt was fitted through a tinnerman washer and down through the basket floor. The nut was screwed on in a flat bottom countersunk hole in the bottom of the skid plates. This technique resulted in bolt heads which were flush with the interior floor. Details of this bolt technique can also be seen in *Figure 3*.

Other stakes and poles

The 1 inch diameter corner poles were topped with aluminum tubes into which the rattan burner support upright poles fit. I calculated the distance from the basket floor to the top of the basket sidewall. From this length, I subtracted 4 inches. The 1 inch diameter pole was cut to this dimension. Over the top of the pole I slid an 11 inch long piece of 1.125 outside diameter 6061-T6 aluminum tube with a .065 inch wall thickness. The tube was slipped over the pole so that the tube extended 4 inches above the top of the pole. About 1 inch up from the bottom of the tube, I drilled a hole for a 10-32 screw ($^{3}/_{16}$ inch diameter hole). The hole penetrated both sides of the aluminum tube and the pole. I locked the tube in place with a 10-32 screw with a nylon locking nut. An AN-364 aircraft nut was perfect due to its small size. The 1 inch poles were then slipped into the holes in the basket floor.

Four of the $^{5}/_{8}$ inch diameter poles were prepared. I left these a little long, about 40 inches long, to be trimmed later when the basket was being finished. These were slipped into their holes in the basket floor.

Weaving

A rustproof nail was driven through the edge of the floor and into each of these poles to hold them in place during weaving.

With the basket resting upright on it skids, I fitted the template over the stakes and all the poles. It was necessary to cut some relief into the 1 inch diameter holes, in the template, so the template would clear the aluminum tubes with their machine screws and nuts. I used spring clamps around the $^5/_8$ inch diameter stiffeners to keep the template in place, about 10 inches above the plywood floor. The "H" jig was placed on top of the aluminum poles to help keep everything 'square'.

Most all of the basket was woven using a single weaver. I used the Aerostar technique of ending each weaver on the inside surface with a diagonal cut and beginning the next weaver with a right angle bend. The right angle bend is made about 2 inches from the beginning of the reed using the reed squeezer pliers.

The actual weaving process was straightforward. As each weaver was finished, the next was begun. When the space between the completed weaving and the template became too narrow, the template was repositioned up and clamped in place. This process was continued until the top of the basket was reached.

With every other pass, the weaver made a complete wrap around the 1 inch diameter poles. This locked the pole in position. See *Figure 1.*

When I reached the end of a short stake, I simply took a short length of reed, a doubler, and shoved it down into the weave beside the 'shorty' and continued to weave on the 'doubler'.

I did not want to run the uprights through the fabric cover on the top of the basket edge. Thus, I had to move the weaving to the outside of the aluminum tube. I accomplished this by weaving in a doubler on the outside edge of the 1 inch poles. A length of reed was taped to the outside of the pole, starting about 7 inches below the top of the aluminum tube. This reed was woven in as the weaving continued. Starting about four inches below the top of the aluminum tube the weaving was made around the reed and not around the pole.

I chose to weave holes in the basket for the passage of the tanks straps through the basket side. This area was woven using a $^1/_8$ inch diameter reed in contrasting color. It wasn't the best of ideas. This thin reed has not fared well from the pressure and abrasion of the straps. In future designs I will eliminate the holes and pass the straps through the weave.

The top edge was finished using a 'three rod plain border', a technique commonly found in beginning text books. The ends of the stakes were soaked, at the point where they exit the top of the weaving. The squeezer pliers were used to create a bend and each stake was woven into the next three stakes.

Finish up

Once this was completed, the basket was ready to be finished. The reed surface had many fine hairs. I burned these off by flashing a propane torch over the surface of the weave. Care must be taken not to burn the reed or catch it on fire. A little scorch maybe viewed by some as adding character.

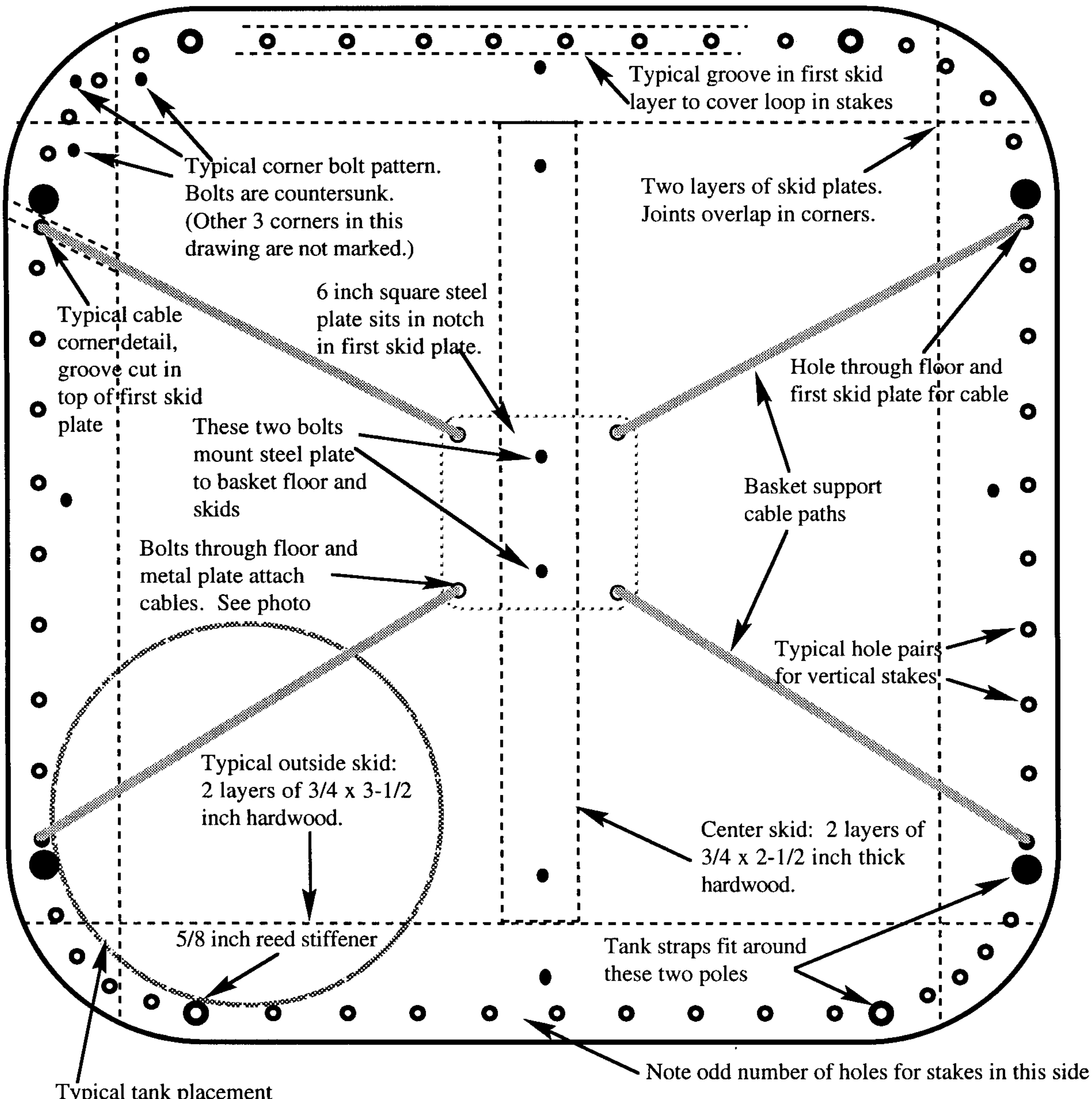
I protected the weave by spraying it with a coat of Varathane™ varnish.

The top edge was finished by covering it with refrigeration insulation. My insulation was intended for 1-$^1/_2$ inch diameter refrigerant pipe. On top of this I placed a cover which was sewn up from Cordura™. The cover was held in place with short lengths of leather thong. I took a hot wire and penetrated both edges of the cover. A knot was placed in the end of the leather thong, The thong was threaded through the holes, through the weave and a needle nose pliers was used to hold the thong tightly in place while a knot was placed on the far side. The excess length was cut off beyond the knot.

Cable installation was simple as a result of the groove between the skids. I threaded each cable down the open weave next to the 1 inch pole and into the $^1/_4$ inch hole in the basket floor. The cable was shoved sideways and into the interior of the basket bottom by using a small rod shoved into the slot between the skid layers from the basket exterior.

Figure 4 shows the details for the cable-to-steel-plate arrangement. My technique creates a double shear attachment dividing the loads between the basket floor and the steel plate. There has been no elongation of the holes in either the plywood floor or steel plate. The spacer assembly also reduces the possibility of bending the steel plate on a hard surface like a rock. To bend the plate, the spacer and AN 970 wood washer would have to be driven through the plywood floor.

The drawing of the basket floor is on the following page, page 8.



Legend

- 1 inch diameter burner support poles
- 5/8 inch diameter stiffeners added to provide additional tank strap support.
- 13/32 inch diameter holes for stakes
- 1/4 inch diameter bolts which provide additional support to the skid-floor assembly. Two bolts also mount the steel plate in the center skid.

Castaway Basket Floor Layout Pattern

Letters to the Editor and Other Bits of Information

Tom Rogers Offers Balloon Computer Programs

Tom Rogers, a retired Ford Motor Company engineer with a long history in computer program development, has created a series of programs which are of significant value to the balloon builder.

Each of the eight programs runs in GWBASIC (Basic). Each program invites various user inputs and allows output to be sent to the screen or to a printer. Tom was kind enough to allow your editor to review the programs. I was impressed by the amount of work he has put into them. The programs are well thought out and typically provide multiple output options.

Your editor, who is an Apple Mac maniac, had no trouble going back to the DOS machine to get these packages running.

If you are interested in experimenting with this material, order the diskette from Tom at the address shown below. What follows is a listing of the different programs:

BASKET: Is a weight estimation program, based on the Boland and Arras basket designs. The user enters various parameters such as the dimensions of the desired basket. The program takes these parameters, the 'per unit weight' for the different materials, calculates the amount of material required, and creates a table of materials and total weight.

BURNER: Creates an inventory of burners which are currently in use. A listing of used burner prices, as taken from Balloon Clearinghouse, is also included. The listing can be expanded by the program user.

CABLE: Generates the set of cable lengths required between the envelope mouth and the burner load ring. The user inputs either 3 or 4 equally spaced load ring attachment points, the number of gores, mouth diameter, and the balloon type. The 'balloon type' allows calculations for envelopes which use varying mouth angles. The output includes an extensive table layout with considerable data.

I am impressed with this cable length program. The *beta* version of my program had one limitation. If four attachment points are chosen for the basket layout, the program assumes these points represent a square. Some balloon basket attachment points create a rectangle, that is the distance between the points have different lengths and widths. Hopefully, Tom will be able to modify the program to solve this shortcoming.

GORENAT: This is a Basic version of the Gore Pattern Spreadsheet contained in the first issue of *Balloon Builders Journal*. This program generates fabric cutting patterns for any desired size of envelope.

LIFT: Generates the lift provided for an envelope under various conditions. The program provides five different outputs. including an FAI table of balloon class limits. Tables for lifting gases such as helium are also included.

NG: Given a vertical gore construction, this program calculates the maximum volume that can be created with a 1 or 2 or 3 fabric panel wide gore system. This program also calculates the distance between gore stations similar to the calculation found in program GORENAT.

SONC: Calculates the 'half-sphere-on-cone' envelopes like those used in Brian Boland designs. This program creates 7 different envelope tables including comparisons between designs. The program includes tables of values which are an expansion of the envelope tables contained in the Brian Boland information package.

TANK: Generates a listing of commonly used balloon fuel tanks and their parameters. This program will also calculate the weight of an unknown tank given various parameters such as diameter, height and tank wall thickness.

Some of these programs employ tables of values. For example, the BASKET program relies on a table of different weights to allow the user to generate a custom basket design. Tom would appreciate reader feedback, including additional contributions for his program lists. Your efforts will make the software more effective for all concerned.

If you are interested in these programs contact Tom. Any one program is $5 plus $2 for shipping and handling. All eight programs are $20 which includes shipping and handling. For more information send a self addressed stamped envelope. Specify 5-1/4 inch 360K floppy diskette or 3-1/2 inch 1.44m diskette. Contact Tom Rogers at 16529 MacArthur, Redford, MI 48240. His telephone is 313-535-8000.

The following comments were taken from subscription renewals.

03-12-96

-Wish you would go back to **publishing a picture of new balloons** that members have built.

Ken Kennedy
Rt 2, Box 73
Broken Bow, NE 68822

I make it a point to publish all the photos of reader projects that I receive. Readers-send in your project pictures. -Editor.

03-12-96

I've got most of the stuff together to **start my 66K silcoat envelope**. I hope to have it done before the Boland [experimental] meet.

Ron Cassidy
25 Maple Farm Road
Auburn, NH 03032

03-11-96

What happened to the **articles on homebuilders and testing?** I know there must be other builders who conducted their own component testing like I did. I'd like to know how they did?

Mike Gross
P.O. Box 590302
Orlando, FL 32856

The Gross family sent me a well executed notebook of photos and documentation describing the construction of their Boland basket. They performed a number of strength tests on the basket and its components. I will be incorporating their material into an upcoming article on basket testing.

I feel that basket testing is an appropriate topic after the current 'Castaway basket construction' articles. Up to this point the Gross family are the only readers to make a contribution regarding balloon testing.

I remind all readers that BBJ is sent to less than 200 subscribers. I believe this readership represents the bulk of active balloon builders in the U.S. That's not a very large group!

I recently performed a search of the FAA aircraft registry and located about 300 amateur built balloons. Many of these are old, some of them go back into the early 1970's and it is unlikely they are still flying. Thus the number of currently flying homebuilt balloons is quite small. I find it a little perplexing to think I have personally constructed about 1% of all the amateur built balloons in the U.S.

Professional balloon designers and engineers, persons who would conduct strength tests on aircraft, represent a very small population. You can probably count all the engineers in the U.S. working on hot air balloons on the fingers of one and not more than two hands. Thus very few people are performing a testing program.

To Mike Gross I offer this thought: You are probably one very few amateur builders who have recently attempted strength testing of your balloon. Hopefully, we can encourage other builders to take up this charge. –Editor.

03-12

I have enjoyed your newsletter and especially want to thank you for putting me onto Brian Mehosky. **Brian and his computer were able to give me the correct cable lengths for my homebuilt.** My basket now hangs perfectly under the envelope. The mouth used to bunch up on two sides, before re-cabling.

Steve Hunter
880 W. Barberry Circle
Louisville, CO 80027

Brian Mehosky recently sent me a computer spreadsheet version of his Cad-Cam cable computation program. I am studying it for possible publication in the future. If you wish to make use of Brian's services, contact him at 17100 Andras Drive, Walton Hills, OH 44146. Good going, Brian!!

03-13

I really am working on the **article on the construction of the Zia gas balloon.** I read Paul Clinton's letter. Are you still interested in a full article?

Have you seen any homebuilt balloons with turning vents?

Peter Cuneo
1209 Florida St. NE
Albuquerque, NM 87110

I think the readers would like to see an article on your gas balloon project. Are readers aware of amateur balloons with turning vents?-Editor.

03-11

I'm working on envelope number 2, a 56,000 cubic foot Aurora copy built from 1.1 ounce coated fabric. **I recently purchased 1800 yards of 60 inch first grade fabric for $1.60 a yard,** all in hot pink, unfortunately. Its been 100% usable so for.

Paul Tavenier
1624 Hazelaar Way
Los Altos, CA 94024

Paul, our readers might be interested in knowing more about the availability of this fabric for their projects. Can you offer more information?

03-14-96

Please have a 2 or 3 year [subscription renewal] rate--its saves renewing.

David Woods
Rt 1, Box 232
Chandler, NC 28715

I would like to have a multi-year rate. At issue is continued publication of BBJ. Each April I make a conscious decision whether or not to budget the hundreds of hours it takes to produce this newsletter for the coming year. One of these Aprils I'll probably concede that its time to get back to other family obligations. A single year subscription rate reduces the number of refund checks I'd have to write.

For the record, I'm committed to publishing BBJ at least through June 1997.

Airbags for Balloons?!

The Buyer's Guide in *Balloon Life* magazine, April 1996, had the following interesting paragraph on page 47:

"B-C Products, Inc. is pleased to announce a joint venture with Coyote Balloons, Inc. in developing and distributing the first 'pilot activated air bag' for gas and hot air balloons. The "OPD" occupant protective device (patent pending) is a gas 'CO2' inflated fabric bag to protect the passengers and pilot in high winds landings. OPD's range in size from four feet by three feet to four inches for collar rings for upright tanks. Marketing and distribution will begin in early spring 1995. Prices vary from $65-145. For more information please fax or call Ken Tadolini, Distribution Director. FAX (303) 730-1142 or Phone (303) 936-8389."

Coyote Balloons happens to be *BBJ* reader and ammonia balloon enthusiast John Kulger's registered business name. Of course B-C Products is Dennis Brown and Tim Cole's ammonia kit balloon business. This product clearly represents a new approach to improving balloon occupant safety.

Balloon Life Report on New Aircraft Sales

Also, as part of the *Balloon Life* Buyer's Guide, that publication reported the historic balloon registrations in the United States. The numbers do not bode well for our sport.

The highest number of new registrations occurred in 1989 when 363 new balloons were registered with the FAA. The next highest registration occurred in 1992 with 345 registrations.

Since 1992 we have seen a continuous reduction in the number of balloon registrations. The following shows the registrations by year with the percentage reduction since the high point in 1992:

1993	309	-10.4%
1994	270	-21.7%
1995	238	-31.0%

Some may attempt to put a positive spin on these reductions suggesting they are the result of improvements to design and materials technology. We certainly agree that today's products are ergonomically better designed and with a longer envelope life than balloons of the past.

But the bottom line is that the market for new aircraft is diminishing.

Should this trend continue, we certainly foresee increasingly difficult times for balloon manufacturers. A reduction in the market by 31% in three years shows that the factories are having to work harder to keep a smaller number of prospective buyers.

For homebuilding, this may mean upward pressures on used equipment prices, with an increasing interest in building by those looking for more economical flying opportunities. This may result in modest market growth for vendors of amateur balloon building products.