



10...9...8...

the voice of **UKRA**

Winter 2003

Volume 7, Issue 4

Xavien XCET-1 Timer
by Graham Platt

Airfix Saturn V PMC
by Darren J. Longhorn

Model Achievement Programme
by Paul Lavin

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by Tim Van Milligan

The Road to Serbia.
by Genni Lavin

Construction Techniques
by Leon Kemp



Editorial

I have recently discovered within myself a great deal of sympathy for the character of Gregor Samsa in the novella “Metamorphosis“. In this story Gregor awakens one morning to discover that during the night he has been transformed into some species of monstrous vermin – a bug to you and I...

The sympathy stems from the similarities in our situations, only instead of trying to work out how to control six legs or where best to obtain rotten foodstuffs, I find myself plunged into the far scarier world of trying to publish a newsletter for a few hundred dedicated rocketry types!

It seemed like such a good idea at the time. I distinctly remember thinking “Cool – I get to edit the newsletter”, but recently that has been replaced with various versions of Alan Shepherd’s “Please God, don’t let me screw this up...”

To this end I need your help; if you have any thoughts or comments on this issue of 10... 9... 8... then please send them to me. If you have any ideas for future articles (or even better, actual articles!) then please send them to me. If you have any interesting photographs of anything rocket related... I don’t really need to finish that, do I? Such submissions should be roughly aimed towards newsletter@ukra.org.uk.

And finally from this disjointed, caffeine fuelled ramble I would like to thank Darren for his sterling work over the last twelve issues (and a fair chunk of this one if truth be told). I only had five or six of them land on my mat, but they always brightened my day and got me a fair few odd looks as I perused them in work! With luck (and with the support of all UKRA members – hint) I hope that my efforts will be half as well received.

Richard Parkin
richard@my-rockets.com

A Message From The Council – A Man Of Many Talents

Webmaster, Newsletter Editor, Council Member, Secretary and much, much more. Who are we talking about? Mr Darren Longhorn of course!

After many years of excellent service for UKRA, Darren has had to relinquish his many responsibilities to concentrate on other things.

I'd like to offer a big 'Thank You' to Darren for all his hard work in helping to get UKRA to where it is today.

Cheers Darren!

Mike Crewe
UKRA Chairman

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Xavien XCET-1 Timer

by Graham Platt

I'd been looking at building a timer to trigger cameras in my rockets for a while, prototyping several different designs, none of which really did everything I wanted them to. Not being an electronics wizard didn't help much either.

Then I saw the ROL advert for the XCET-1, and had a look at Xavien's page. This was exactly what I'd been looking for.

The timer itself is small (6.3cm X 2.4cm X 1.4cm high), and runs off a 9v battery, although the working voltage range is 7 – 15 volts and the current draw is 15mA. The unit can handle 2A output at up to 15V continuously, or a peak of 3A at up to 15V for 10 seconds without damaging the board. If the timer is to be used to trigger an ematch, Xavien have tested several varieties, including OXRAL and Daveyfire.

The XCET-1 is programmable by way of a bank of DIP switches to give a delay variable between 1 and 31 seconds (off time) in 1 second increments, and a pulse period of 0.5 or 1 seconds (on

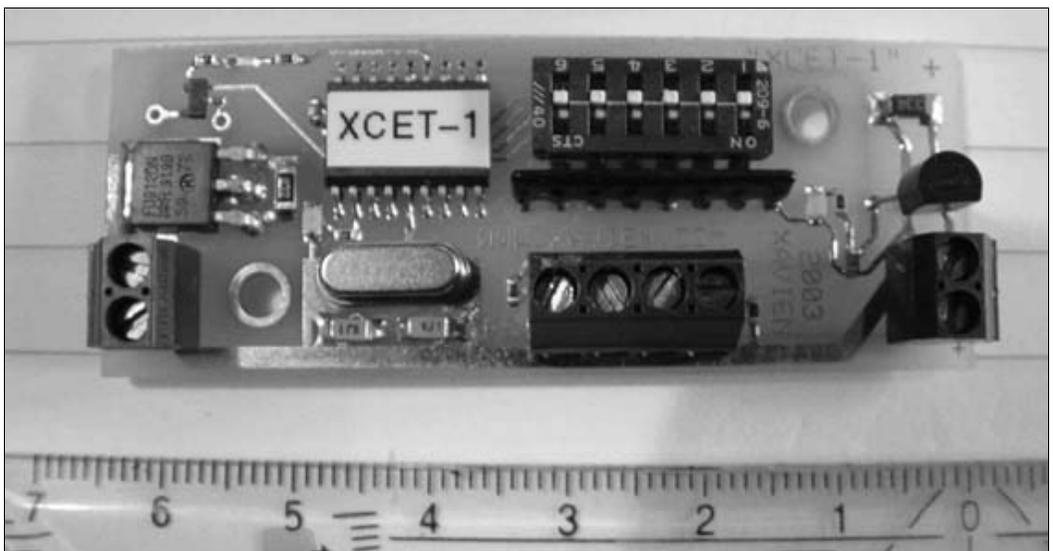
time). The unit is armed by way of two failsafes – Xavien recommend an arming switch be connected to one failsafe and a breakwire to the other. Both failsafes must be disabled for the unit to work.

There is a green power LED on the board to indicate good supply and a red one to indicate both failsafes have been disabled and the unit is working.

Why is it called a continuous event timer? Once the delay and pulse period have been set by DIP switches, and both failsafes have been disabled, the unit will continue to function using its settings until the power has been switched off. This makes it ideal to trigger the shutter of a camera from liftoff to landing via a relay.

The unit is supplied with a PP3 battery connector and a mounting kit (4 screws and 2 standoffs).

The timer cost \$30.00 plus shipping (\$9.00 by Global Priority Mail) and arrived within 5 days of my order being placed.





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Airfix Saturn V PMC

by Darren J Longhorn

So what made me break my building fast? Several things. Mainly, I wanted to make something to fly in the scale contest at the IRW 2003, and I only had a week to do it in. Secondly, I was very intrigued by the recent 10...9...8... article detailing a Plastic Model Conversion (PMC) by Steven Rogers. Lastly, there were two Airfix 1/144th scale Saturn V kits peering out of a bag in the corner of the "spare" room. These had been bought several years ago when Woolworth's were selling them off for less than a tenner each.



Hmmm, the theme for the IRW scale contest changes every year, and this year

it was "manned boosters", so the Saturn V would fit, but it also suggested the Cosmodrome Vostok kit peering at me from another corner of the room. However, that particular kit is rather more than a week's worth of building! For me, anyway. So, unless I built something from scratch, that made the Saturn V favourite again.

Design Compromises

I had originally bought the two Saturn V kits with the intention of building one for display, with the possibility of converting one for flight. Of course, once I started to think about how I might go about it, my imagination ran wild. What motors should it be built for? Naturally, my first inclination was to power all three stages: 5 x 18mm in the S-IC (first stage), 5 x 13mm in the S-II (second stage) and a 13mm motor in the S-IVB (third stage). Just as naturally, I discarded this idea when I considered what I would do for fins on the upper stages. A bit of googling revealed that this had been done before, but the folding fins mechanisms were beyond me in the time available.

I googled widely and consulted various email lists including pmc-rockets@yahoogroups.com where I found some good advice. Eventually I decided to keep it simple and go with a single motor mount. That made the motor mount size a no-brainer too. Rocksim was telling me that an 18mm motor wouldn't be enough (even a composite D would be borderline) and so it had to be 24mm. Rocksim also had some interesting things to say about the first stage fins. It was quite simple to develop a model in Rocksim, and it showed that with a little nose weight the model would be stable even with scale sized fins. However that additional nose weight would also increase the motor power required. At this point I still thought there

was a chance of being able to fly on an Estes D, so I wanted to minimise the weight.

Recovery was another issue that need some careful thought. I suppose the obvious thing to do would have been to run a stuffer tube the full length of the stack and use the Command & Service Module as the nose cone. However this would have meant putting quite a lot of work into centring the stuffer tube, so I opted to split the model at the stage 1 / 2 join. Given that basic design, I thought it best to recover the two halves separately on independent parachutes. I'll go into the detailed arrangement later, suffice to say that the main work in this conversion is running a motor mount / stuffer tube through the first stage.

Construction

These construction notes should ideally be read in conjunction with the instructions that come with the kit. I submitted a scan of those instructions to Sven Ninfinger's web site <http://www.ninfinger.org/> some time ago, so they may have been uploaded and available by now. For those unfamiliar with the Ninfinger site, it's a huge resource covering both model rocketry and scale space modelling. In the following paragraphs the numbers in parenthesis are the actual part numbers.

Step 1

Add the conduits to the fin can, but omit the fins. The fins from the kit are not used, but one is needed to be used as a template. I used clear 1mm thick Lexan to make larger replacement fins. Using one of the original fins I scribed the outline and painted on the pattern of the original fin. The new fins had tab matching the original fins. I found them to be a tight fit, so simply push fit rather than glued them into place. After trying

them out, I removed them until after final painting.

Step 2

Cut off the mounting studs from the booster fin can (5) and the engine mounting plate (18).

The stud can be cut from the plate with an x-act knife. The stud on the fin can may be broken off manually.

Cut a hole to suit a BT-50 motor mount tube in both the fin can and the plate. This is for the motor mount/stuffer tube. Assemble the outer nozzles as shown and fit to the baseplate, omitting the centre nozzle. Spray the nozzle base plate assembly, and the inside of the fin can silver.

Glue a small wooden block to the back of the nozzle plate and allow to dry. Drill a



small pilot hole through the nozzle plate and into the wooden block. Run some thin CA into the hole and then screw in a small eye hook. This is the parachute attachment point for recovery of the first stage. Don't glue the nozzle plate assembly to the fin can yet.

Step 3

Spray the inside of the first stage halves silver. I used some metallic silver paint from B&Q.

At this point I should admit that I didn't

really pay attention to the colour of the innards of the stages, or even the aft ends and engine bells. If I had, I would have noticed that silver isn't really appropriate! You can see what I mean by taking a look at these photos of the Saturn V at KSC - <http://www.nsrq.org.uk/outings/ksc/saturn/>. I took these pictures when I went to see the last Columbia launch in January 2003 - <http://www.nsrq.org.uk/outings/ksc/columbia/>.

Open up a hole in the first stage forward tank bulkhead (19) for the BT50 motor mount. Cut a length of BT50 310mm long, this is used for the motor mount / stuffer tube. Use a short piece of coupler tube, or a slice of a spent Estes D motor as a thrust ring. At this point I should also have added a motor retaining hook, but I forgot. More of this later!

Although I chose to use the forward tank bulkhead as the centring ring, I didn't glue it into the place directed by the instructions. I put it about mid-way up the first stage. This leaves much more room for parachutes. The two halves of the first stage (20,21) are then assembled and glued to the fin can. Next slide in the motor mount / stuffer tube, but don't glue it in place yet. I chose to paint this before assembly, as it's much easier. Dry fit the engine mounting plate and nozzle assembly from step 2. This allows accurate positioning of the stuffer tube. The end should be level with the ends of the four nozzles. Carefully remove the assembly, glue the stuffer tube in place and replace and fix the nozzle assembly. Having the motor mount level with the end of the rocket nozzles means that they can be left on for flight. Just arrange for the exhaust of the real motor to be deflected away from the base of the rocket!

Glue on two short lengths of launch lug, one at the top of the body, one at the

base.

Step 4

Assemble the interstage as directed and spray the inside silver. Although it's designed to be removable, I glued the interstage to the first stage because, as with the location of the forward tank bulkhead, it leaves more room for the parachutes.

Step 5

Open up a hole in the second stage aft bulkhead (27) to take a length of BT50 coupler. Cut a length of BT50 coupler 45mm long. Cut a thick card or balsa centring ring 60mm in diameter to centre the BT50 coupler. I used card. It doesn't really have to be very strong, it's more of a guide than anything.

Cut two small blocks of wood and glue one to the back of the back of the aft bulkhead, and one to the inside of one of



the body halves. Drill two small pilot holes and screw in eye hooks using CA as before. It is important to make sure these hooks will be in line when all the parts are assembled.

Push fit the engine nozzles onto the aft bulkhead, but don't glue yet. Stand the part on the nozzles, and insert the length

of BT50 coupler into the hole in the bulkhead, but don't glue it in place yet. Slip the centring ring over the coupler and The within the forward part of The bulkhead, making sure that the end of the coupler is square with the ends of the motor nozzles. Glue the centring ring into part 27. Let it dry.

Cut a small bulkhead from balsa or thick card and use it to plug the end of the coupler. The protruding length of coupler will fit into the BT50 stuffer tube on the first stage.

Assemble the rest of the second stage as directed, but omitting the centre motor nozzle and it's mounting (26,30,31). With a sharp knife, Remove the small studs in the inside of the base of the second stage body. These are meant to "twist lock" the second stage to the first stage, but as this is where the rocket will split at ejection, this would now be a Bad Thing

(TM).

Step 6

Assemble the third stage as directed, but omit the engine nozzle as it won't be visible. Glue this stage to the second stage after painting.

Step 7

Skipped assembly of the Lunar Module as it won't be visible in the completed model.

Step 8

Omit the Lunar Module from step 7 and glue the adapter ring (61) and LM shrouds (62, 63) in place. I didn't bother to paint the interiors, as they are not visible when glued in place.

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Step 9

Build the Service Module as indicated, but you can omit the nozzle (68) as it isn't visible when the model is completed. Although it is designed to be removed, I glued the service module to the LM housing, after final painting to avoid losing it.

Step 10

Stage 10 is the assembly of the command module. Since the command module isn't visible when assembled, this stage can be omitted entirely.

Step 11

Complete stage 11 as directed, apart from the command module that wasn't built in stage 10, paint the assembly white and glue the boost protective cover to the service module.

Step 12

Omit the nozzle adapter (79), instead glue a spent 24mm motor to the stand. This will fit into the BT50 tube of the motor mount and allow display of the completed model.

Painting

Some of the painting I did as I went along, but I left the final painting until most stuff was assembled. I masked off the insides of the first, second and third stages, using rolled up paper. I painted them all over using a couple of coats of Halford Diamond White. The plastic seemed like a good surface, so I skipped applying a coat of primer.

I did consider masking around the black roll patterns and spraying them on too, but I always find masking to be a little tricky, and fitting the tape to the surface corrugations was a bit daunting.

In the end I used a paintbrush and Humbrol Satin Black enamel. OK, so up close you can tell I applied the paint by

hand, but from a distance I reckon it looks acceptable.

Of course I discarded the Airfix painting directions, as they are for a test article rather than any of the manned boosters. Everyone knows that, right? So I took my painting directions from Peter Alway's excellent "Rockets of the World" (ISBN 0-9627876-7-1 - a must for every Space Modeler's book shelf). Having said that, I did cheat a little. Because I was applying the paint by hand, I decided to take liberties with the positioning of some of the black/white painted edges to places more convenient for my aging Mk1 eyeballs. I leave determination of the location of these liberties as an exercise for the reader.

Decals

The Airfix decals are OK, in the main, with a couple of exceptions. The red decals, "USA" & "UNITED STATES" are fine, as are the black & white fin letters and targets, but the Stars & Stripes are terrible. The blue and white star field is out of register with the red and white stripes. I fixed this by cutting out the star fields and applying them separately. The same problem occurs on the much smaller Stars and Stripes for the Service module. Having got this gripe over, I have to admit that the decals were nice and thin and conformed well when applied to raised detail.

Recovery Rigging

Parachutes. I love hemispherical parachutes and loved the idea of my rocket dropping from the sky on proper red & white parachutes. There are several tool on the internet for generating templates for the gores. I used the one on Richard Nakka's experimental rocketry web site. This generates pattern to produces a semi-ellipsoid shape, which looks like a slightly flattened

hemisphere. It's meant to be more efficient, but I would guess it's hard to tell at these dimensions. I made both parachute with gores 250mm across the bottom, with six gores per parachute. The gores were cut from nylon, and my ever support full wife, Karen, stitched them together for me.

The parachutes are both housed inside the first stage. The first stage parachute within The stuffer tube, and the parachute for the second/third stage assemble around the outside of the stuffer tube.

My original idea was to have separate parachutes for the first stage, and the rest of the rocket, rigged to bring them down horizontally. That is exactly what I did for the second/third stage/CSM assembly. I attached a length of Kevlar approximately 600mm long to the previously installed eye hooks. Holding the model up by the Kevlar I arranged for the rocket half to be suspended horizontally, and tied a loop where I was holding the Kevlar. This is there the parachute shroud lines were attached to.

For the first stage, I started having second thoughts. I only had one solid parachute attachment point, at the base for the stage. The intention had been to have another attachment point inside the stuffer tube. However the stuffer tube is unsupported for 110mm of it's length, and it seemed likely that this would crimp when hanging from the parachute. I tried to rectify this by fitting a "fillet" of balsa between The body wall and stuffer tube, changing the surrounding space from an "O" shape to a "C" shape, but I still wasn't satisfied. In the end I reasoned that this stage needn't be recovered horizontally as all of the fragile detail was at the rear end. So, I used a single parachute attachment point, running a length of Kevlar up the side of the rocket and into

the parachute bay via a small notch in the stage body.

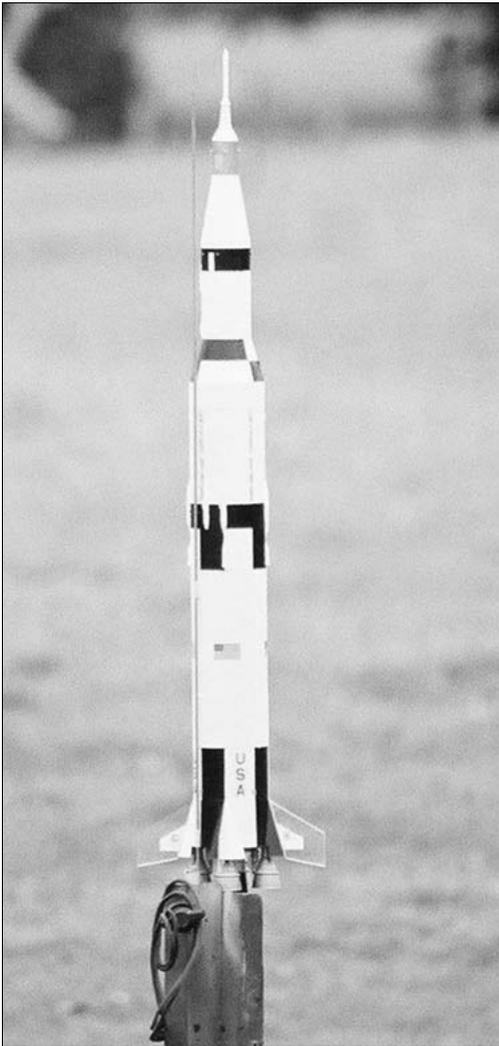
Flight

It was when prepping The rocket for flight that I realised I had left off any method of



motor retention. I could have sworn that I had fitted an engine hook, but alas, no. As launch fever gripped me, I casually applied some tape around the end of the RMS. It's hard to believe that I really thought this would be sufficient. It wasn't.

The launch was excellent, with a reasonably straight boost, but there was no ejection at apogee. It looked like we were going to see a classic lawn dart, but the rocket became horizontal and began



helped with the search.

The rocket itself was in surprisingly good condition. All four fins had come off, as had the Escape Tower and the third stage, but it was all repairable. I just need to retrofit some positive motor retention and I'll be ready to fly again.

As for the contest, well, despite the damage, I won joint first prize, shared with Mike Crewe and his Estes Mercury Redstone. We both won Estes Big Bertha rocket kits, which we're going to drag race at next year's event.

to spin. I've seen rockets recover like this before, notably the Estes Phoenix. Upon examination, it was seen that the motor had not been retained and had in fact been kicked out at ejection. Lots of people helped search for the RMS casing, randomly at first, but then I think it was Mike Crewe who suggested forming a line and walking the area methodically. I think John Bonsor was the one to find the casing. Many thanks to Mike, John and everyone else that



UKRA Model Achievement Programme

by Paul Lavin

The UKRA Model Achievement Programme (MAP) is under new management and the process has been overhauled to the benefit of UKRA and participants. All the pieces will be in place for the 2004 flying season, if not before. An added bonus for MAPers next year: £100 in prizes will be awarded at the end of the year, courtesy of Deepsky Rocket Supplies (www.modelrockets.co.uk).

New MAP certificates will be issued to current participants and they can take up right where they left off in their programme from last year. "Flyers that complete Level 1, 2 or 3 of MAP in 2004 will all get a chance to win a share of the prize pot that includes model kits, building supplies and rocket components," said Deepsky's Andy. "We also plan to set up a special raffle draw just for MAPers at UKRA 2004 and at KLOB next autumn."

MAP is open to everyone - from a first time novice to HPR flyers. You always learn something when you push the red button and MAP acknowledges that achievement. Blast Off for Britain is holding a series of rocket building workshops throughout 2004. Rockets built during the workshop will automatically attain Level 1 and Level 2.0 and 2.1 if the flights are successful... which they usually are! For more info see www.blastoff4britain.org.uk

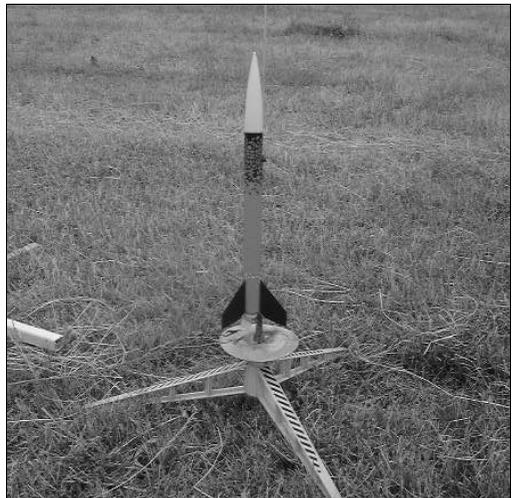
"Flying models with new MAP scheme is far more fun," explained Paul Lavin, MAP's new czar. Registration is EZPZ and you will get a handsome certificate to show that you have enrolled in the programme. For each task you will get a

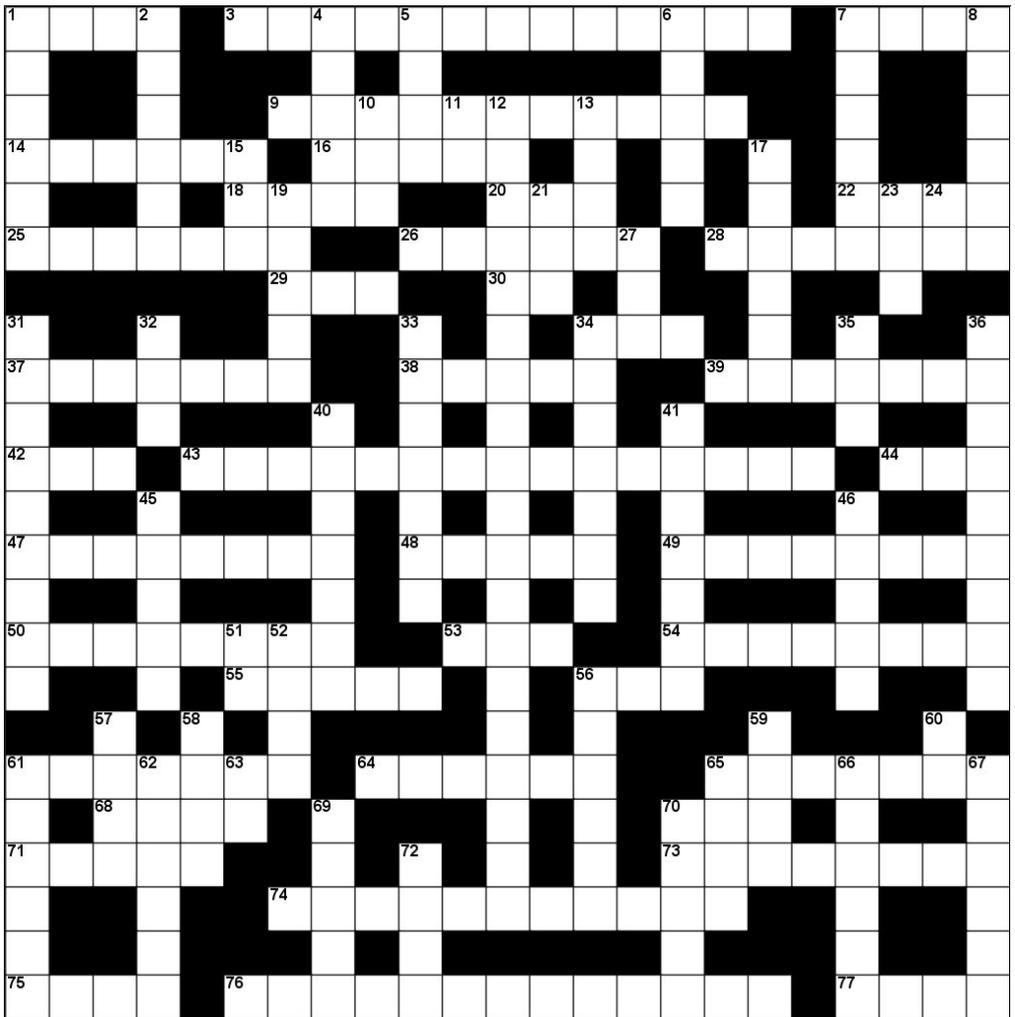
sticker for your certificate to show that you have completed a task or a level. You can get your sticker right after recovering your rocket so there is maximum fun and instant bragging rights for a successful flight on the very day."

The skills learned in following MAP are important to all rocket flyers. As you can work through the challenges of building and flying different configurations, you quickly and inexpensively and learn how to fly and recover rockets safely. MAP can save you money! If you get your homework done using MAP, you can spare yourself embarrassing moments and expensive spacks when you move to complex, medium and high power rocketry.

The tasks and levels of the previous MAP scheme haven't been changed for 2004... but they are under review so if you have any great ideas or grinding issues, email map@ukra.org.uk

The last few t's are being crossed and the i's dotted as we go to press. The full details of the scheme will be found on the UKRA web site (www.ukra.org.uk) in the next few weeks. Get building - the wind and rain's gotta stop sometime!





Many thanks to Felix Lennie for creating this rocket related crossword, and to the Muppet (aka as Sal Davis) for donating an “Unstable Rocketeer” t shirt in either black or yellow, XL sized (although that’s not how she described it!) to the first correctly completed copy of the crossword that I open some time in the new year – call it the first of February!

Rules;

UKRA Council types, Felix and myself aren't allowed to enter; nor is Darren, who unfortunately for him has already seen the answers!

The Editors decision is final. Hmm – always wanted to say that...

ACROSS

- 1 Nasty launch event
- 3 Not a basic vehicle
- 7 Up to pressure ?
- 9 Much better than average
- 14 Hope this doesn't happen when your chute opens !
- 16 A launch day requirement ?
- 18 Speed ?
- 20 OS
- 22 It has gone wrong !
- 25 Watch out for rural traps !
- 26 Maximum Altitude ?
- 28 Weight in addition ?
- 29 Guide
- 30 Negative
- 34 Danger colour ?
- 37 Do you need to keep this !?
- 38 On the way ?
- 39 The First ?
- 42 Tubular guide that needs listening too !
- 43 A welcome sight at Apogee !
- 44 Imperial measurement
- 47 Not enough lift ?
- 48 Not a straight flight
- 49 Unpredictable ?
- 50 Blast-Off !
- 53 Resistance is Futile !!
- 54 Not as one ?
- 55 Got one of these in your tank ?
- 56 Junior SWARM Logo
- 61 Sixth sense ?
- 64 Fill that tank !
- 65 Falling over ?
- 68 Nice weather for a launch ?
- 70 Down in the dumps ?
- 71 A rocket's propelling force
- 73 Sending out ?
- 74 Building up nicely
- 75 Holding back ?
- 76 Opens your fuel line !
- 77 Sniffer !

DOWN

- 1 In the middle
- 2 Vital gas
- 4 A place to put a motor in
- 5 MIA
- 6 What you don't want in your recovery harness
- 7 You can see this !
- 8 Lift ?

10... 9... 8...

- 10 Digit
- 11 Thanks !
- 12 Solid Fuel ?
- 13 A Silly Fixer !
- 15 Got it wrong ?
- 17 What happens to Quantum tubing when it gets hot
- 19 Where you may find your rocket at LARGS !
- 21 Once upon a time !
- 23 The rules
- 24 Preposition
- 27 Share out
- 31 Out of control speed freak ?
- 32 Rocket Boys first Rocket
- 33 The sum of
- 34 What you hope to do after that launch !
- 35 Control Centre ?
- 36 Measurement device
- 40 More than one motor ?
- 41 Motor whim !
- 45 Not Solid Fuel
- 46 The industry most SWARM members belong to
- 51 New technology or somebody's cousin !
- 52 Lubricates ?
- 56 Removes air from Hybrids fuel line ?
- 57 An essential read
- 58 Note
- 59 New Zealander ?
- 60 Not out !
- 61 Nitrous flyer ?
- 62 Where the grains go ?
- 63 Hope you don't end up here !
- 65 Big Rocketry Book ?
- 66 A thing that pushes your chute out !
- 67 Another lubricant used on John Travoltas hair !
- 69 Circular motion
- 70 Boundary ?
- 72 A competition ?

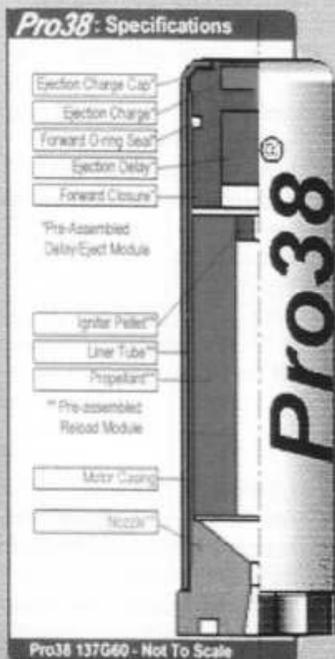
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Rocketeer Fuel?

by Joan

Cornish Star-Gazy Pie

This famous Cornish traditional pie looks odd because the fish-heads stick up through the pastry to look skywards (hence the name!) Originally made with pilchards, now more often made with small herrings.

Method

Split, bone and clean 8 pilchards (small herrings) but leave the heads on. Remove the shells from 3 hardboiled eggs and slice thinly. Finely chop 2 peeled onions and 4oz bacon. Mix 3oz breadcrumbs with 3 tablespoons milk in a bowl then add half chopped onions, chopped mixed herbs, salt and pepper to taste and 1 tablespoon lemon juice. Mix well. Stuff the fish with half this mixture and arrange the fish in a deep 9" pie plate with tails to the centre and heads over the plate edge looking up. Fill the gaps between the fish with the other half of the mixture plus sliced eggs, chopped bacon and remaining onions. Spoon over 4 tablespoons of dry local cider. Roll out shortcrust pastry (made using 8oz flour to 4oz fat plus water) and cover pie so the fish-heads peer out. Glaze top of pastry with a beaten egg. Bake 20 minutes @ 200 degrees C (400 degrees F or Gas 6) then turn down to 180 degrees C (350 degrees F or Gas 4) and bake for another 25 minutes. Serve hot with Cornish new potatoes and a Rocket (the herb) salad.

Rocket-Ship Dessert

Make up a lime jelly, chop and put on individual plates (grass). Halve arctic rolls and stand in the middle with a generous helping of devon clotted cream on top. Stick a chocolate flake in the centre so it is rigid and put an upside-down cone on top to resemble rocket shape. Blast-off !!

More Cocktails

by Sarah Packham

Bee-sting! (one for the kids)

- 3oz Orange Juice
- 1 Banana
- Strawberries

Blend together with some ice until smooth and add some fruit to garnish! healthy too!

G-wiz!

Add equal parts of:

- Kahlua or Ameretto
- Baileys
- Vodka

Layer them into a shot glass and top with whipped cream, drink it down in one go! (try it with no hands!)

Swarm Sizzler!

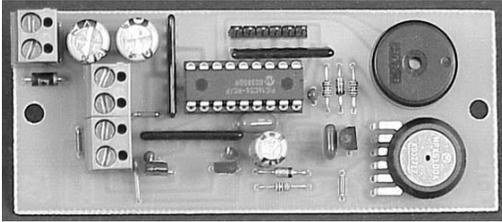
- 1 part Brandy
- 1 part White Rum
- 1 part Triple Sec
- a dash of lemon juice

Simply mix together and wait to get sizzled!

Transolve P6K - Altimeter Kit

Review

by Damian Burrin



HPR can be an expensive hobby and buying the electronics for dual deployment is no cheap part. It was while I was looking for a backup altimeter to go along side my Rdas and Perfectflite WD that I came across the P6K from Transolve.

The P6K is a kit version of their mainstay P6 Peak recording altimeter with dual event and at a cost of only \$53 is pretty inexpensive.

If you were to buy a P6K, what would you get? Well, basically everything you need, from good detailed instructions and circuit diagrams, to all the components (plus a couple of spares) right down to the solder. Don't worry about the surface mount parts because the circuit board has all surface mounts pre-soldered.

Actually putting this kit together was a bit daunting for me, my soldering skills have been likened to a blind monkey welding, so I have to admit to asking for a little help on this score. My brother John is no professional when it comes to soldering, but I would call him a competent amateur and between him and myself it took about an hour to actually put the whole thing together. I would have thought that anyone who is capable of wielding an iron should be able to put it together quite easily.

Specification

- Range - 25,000 ft. (6350 m.)
- Altitude resolution - 100 ft. (25.4 m.)
- Output apogee/main devices 1A @9V
- 5, 10, 15 second selectable SID
- Selectable main parachute opening at 400 or 800 feet (600/1200 foot chip available).
- Optional Airstart Board for air-started motors, multi-staging or special effects
- Size - 1.4 x 4 x 1.2 in.
- Weight - 1.1 oz. (31.2 g.)
- Power - 9-volt alkaline battery
- Auto-ground elevation subtract
- Flashbulbs or Daveyfire low-current electric matches for initiation
- On-board beeper signals continuity, altimeter status, and peak readout in feet

Accuracy

As with all altimeter kits, questions can be asked about how valid or accurate the given altitude actually is. I asked John at Transolve and this was his response.

"My calibration was done at an FAA facility, on the master unit. All units are within 3% accuracy" - John Fleischer

The P6K has a 100' resolution and does not pretend otherwise. When beeping out the altitude two or three beeps are given indicating the altitude e.g. 2 short beeps followed by 5 short beeps =2500', 2 short beeps followed by one long beep and 3 short beeps = 20500'.

I knew when I bought and built the kit that there would be flyers who were still concerned as to whether the readouts were valid and could be used in UKRA results and records, it was for that reason mainly that I decided with the help of Graham Platt (UKRA #1264) to ground test the P6K against other commercial

products. We fashioned a vacuum vessel out of a plastic carton and started testing.

The results may not show that any of the altimeters are accurate but what they do show is that all the altimeters tested were as good as each other.

I showed the results of my tests to John Fleischer at Transolve and this was his response.

"After looking at your cal test data, I have the following comments;

"The P6 should be within 100' in accuracy at all times.

"Because it samples 3 times per second, and apogee is immediately fired when the samples stop increasing, during a casual vacuum test against a logging altm that samples at 10HZ or faster, it may appear that the P6 is reading low. In an actual rocket flight, this generally will not occur. The way that the vacuum is decreased and the rate may make comparing altimeters a difficult problem." - John Fleischer

Costing

Ordering directly from John Fleischer at Transolve (<http://www.transolve.com>) couldn't be simpler, he responds quickly to emails and accepts paypal. Orders can also be placed through Ross at Magnum

- P6K Kit \$53
(John will build it for you for an extra \$10)
- Shipping \$14
- Total \$67
- UKP £40.90

I did have to pay £8 import duty and the post office charged me £8 'handling fee' which is a bit of a liberty since they never actually delivered it I had to go fetch it from my local sorting office.

On the whole I think that the P6K is a good altimeter especially as an introduction into flying with electronics and dual deployment (it's not gonna hurt that much if you spack it!!) It's well-packaged kit and relatively simple to construct and test.

Altimeter #1	Altimeter #2	Altitude #1	Altitude #2	+/-	
GP Perfectflite WD 2002ed	DB Perfectflite WD 2003ed	1940	1946	-6'	W
DB RDAS fw 3.1	DB Perfectflite WD 2003ed	2130	2126	4'	
P6K	GP Perfectflite WD 2002ed	2400	2647	-247'	W
P6K	GP Perfectflite WD 2002ed	1800	1781	19'	W
P6K	GP Perfectflite WD 2002ed	3200	3016	184'	W
P6K	DB Perfectflite WD 2003ed	1800	1806	-6'	W
P6K	DB Perfectflite WD 2003ed	2900	3201	-301'	W
P6K	DB RDAS fw 3.1	1500	1469	31	
P6K	DB RDAS fw 3.2	2200	2178	22	
W = Witnessed by Graham Platt					
WD 2002ed	MPX4115a				
WD 2003ed	MPX6115A				
P6K	MPX5100A				
RDAS fw 3.1	MPX4100A				

A Vertical Empire – The History of the UK Rocket and Space Programme 1950 ~ 1971

review by Mark Perman

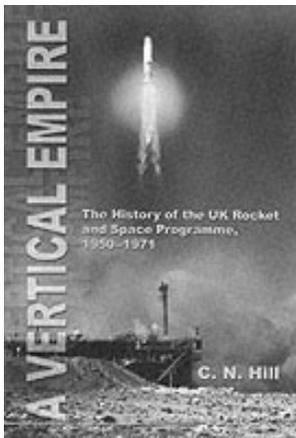
A Vertical Empire by C. N. "Nick" Hill describes the UK rocketry programmes of the 1950's and 1960's. The book describes British work in the fields of Rocket Engines, Rocket Powered Interceptors, The Blue Steel Stand off Missile (or cruise missile as we would now refer to it), Blue Streak, ELDO and Europa, Black Knight and Black Arrow.

Much of the information in the book has not been available before, due of course to the 30-year rule covering UK government documents. Nick has also provided much analysis of the reasons why various projects were cancelled.

Anyone with an interest in the UK's past Rocketry programmes will find this book a fascinating read.

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*Includes 98
Black and White
Illustrations*

Power Line Safety

by Mario Perdue

I'm sure that by now every member of ROCI is aware that the Academy of Model Aeronautics (AMA) has agreed to allow us to begin flying HPR at the Aeromodeling Centre. The word is also out in the general rocketry community which has, inevitably, led to many questions. One of the more frequently asked questions is, "How did you get around the power line issue?" The short answer to this question is, "We didn't." What that means is that we have to keep the rockets out of the High Power lines or we will lose the use of the field. In a nutshell, that means that we will have to shut down the range whenever the conditions exist that could easily cause our rockets to land in the wires.

But the high power lines at the AMA are not the only power lines that we, as rocketeers, have to worry about. There are other power lines that surround the AMA field too. In fact, almost every place you can launch rockets in Indiana is close to some sort of power lines. We need to be careful around all of these lines. While we're on the subject...

It's true that model rocketry is a safe hobby when compared to other outdoor activities such as little league baseball, football, basketball and soccer. We don't have anywhere near the number of injuries and deaths associated with those sports, however, you might be surprised to learn that over the last five years there have been at least three deaths resulting from rocketry activities. All of these deaths resulted from violating rule #11 of the NAR safety code:

Rule 11 - I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places.

As you have probably guessed, all three

of these fatalities involved power lines, but you might not have guessed that all the victims were adults who should have known better.

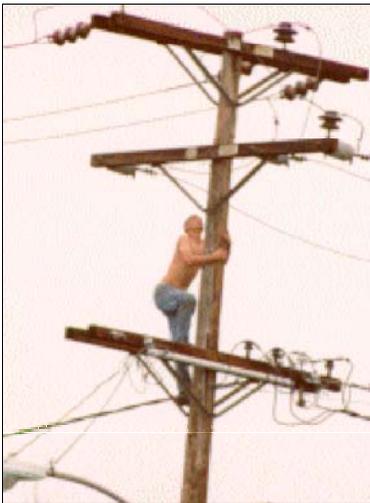
Most residential power lines carry at least 7.2 kV not 120 volts. Never assume that a wire is a ground or guy wire. Never assume that a wire is safe to touch. Never assume that you will be OK if you use insulated tools; at least one accident occurred when a person attempted to retrieve a model rocket with a fiberglass pole. The pole was not a good enough insulator and that person died.

Ted Cochran, a member of the Minnesota Amateur Spacemodeler Association (MASA) - Section 576 of the NAR and former firefighter says, "In 1984, while I was a firefighter, I watched a 7.2 kV power line melt a ten foot section of sidewalk, complete with gutter and curb, into green glass. I still have a piece of it in my office." If 7.2 kV can melt

a sidewalk, what do you think the 730 kV running through the power lines at the AMA could do to your body?

If you should happen to land a rocket on a power line, any power line, leave it alone. This is not a request, it's an absolute rule when flying rockets with ROCI. No matter how much it cost you, or how easy it looks to retrieve it, leave it alone. No rocket is worth your life, ever. No rocket is worth months in a burn center. If the rocket looks like it may tempt others to try to recover it, call the power company so they can take care of it. Don't leave it to cause injury to someone else.

I think I can safely say that every member of ROCI would rather lose our flying field than lose a club member to an electrical accident.



This is NOT trick photography. In 1996, this person reached out his hand and grabbed the power line conductor! At that instant 16,600 volts shot through his body and engulfed him in the ball of fire that you see in the lower photo. The air surrounding him became ionised and began to conduct and burn. The smaller fireball near the street lamp is where the arc went to ground. This person somehow lived through his encounter with high voltage. Most people are not so lucky.

The Road to Serbia... and beyond for the UK Rocketry Team Juniors (Part One)

by Genni Lavin

It's a long way from Yatesbury in Wiltshire to Sremska Mitrovika in Serbia and Montenegro where the British Rocketry Team juniors travelled to the 9th European Space Modelling Championships (??? miles to be pedantic, one of my specialities).

Our team did pretty well in the competition considering it was our first international competition. It was more work than anybody knew it would be but it was still really cool. The team wants to go on, no matter what, to the next big international competition.

FAI competition rocketry is way harder than model rocketry and is a lot more precise than HPR. The rockets may be small (350mm x 30mm minimum for juniors in parachute and streamer classes) but they are very high tech. We left the UK prepared to enter four classes but we managed to actually compete in five. You can find the rules on www.fai.org.



We chose S3A parachute duration, S4A rocket glider duration, S6A streamer duration and S9A helicopter duration and put all our efforts in those four classes. Once we got there we assembled a small fleet of S1A altitude rockets from left over bits that we had with us. Nothing lost for trying!

Juniors in international events compete with 2.5 Ns A impulse motors while the grownups get to play with Bs. If you think that those little motors are a pretty small, the winning S1A rockets went to over 1000 feet on that power. My sister Gaby, my friend Trevor and I all scored maximum points with two of our S3A parachute duration models with flights of over 5 minutes. Not bad for an A.

The rockets we used were mostly made out of Kapton, a super strong and melt proof plastic that my dad loves to death for some reason. It's dark orange and transparent - making it very difficult to colour coordinate with our red, white and blue team uniforms. A real fashion disaster!

To do well in FAI competitions you need to be able to build a lot of rockets that are exactly the same because you don't get some of them back! You fly one and modify the next one and then fly it and modify and fly and blah blah blah. You have to keep track of the flights with stop watches and binoculars and even have to have dig into trigonometry tables to handle altitude rockets. Every time you fly you need to know if you are making improvements or screwing up. There is a lot more stuff you need to know in competition rockets than flying Estes models or even HPR.

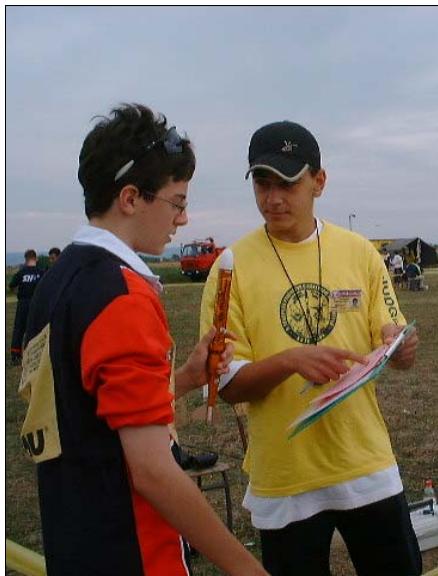
A properly made S3A rocket without its parachute or motor weighs less than five grams. By the time you bung in a mid-sized 600mm chute and those pokey motors, you're way, way up to 15 grams in no time. But they are not toys.

Do the maths and discover that the diddy rockets have more to them than meets the eye. If you multiplied the weight by 100 and got one and a half kilos and multiplied the impulse by the same factor to get 250 Ns, you are talking about a fairly light and high performance Level 1 rocket with a mere 30mm cross section. These are small but very high performance rockets!

I made the parachutes for the team, it's my other speciality. Blast Off for Britain bought a big roll of extremely thin Mylar and I made a bunch of 600mm chutes with Kevlar thread for everybody. When deployed they open up to a lovely mushroom shape and glide a hell of a long way.

These chutes were good enough to score maximums points (my sister, Trevor and I all got maxes) but if we had had better preparation and understanding of the winning competition strategy, we might have taken a medal our first time out. Darn! I set a UK junior record for S3A parachute duration but I want to do better next time.

Our journey to the European Championship started with team qualifications held in suitably appalling weather in May at the SERFs flying site in the Vale of the White Horse. The wind was blowing a gale as we launched our parachute S3As and streamer S6As. The conditions turned out to be good practice for the wind in Serbia. S4A gliders were storm tossed but we managed to get everything in the air and record times good enough to impress the BMFA's Free Flight Technical Committee. I guess that they thought that we wouldn't be an embarrassment to Britain if they let us go to the European Championships.



Despite scouting all of the UK rocket clubs and bribing and blackmailing assorted friends from our schools, we only just got a team of four together. This was really, really, really the smallest team possible. Even with the help of my mum and dad and Geoff and June Seabrook we were really stretched and not up with the other countries. We really gotta have a bigger team next year for the World Championships to be in with a chance for medals!!!

The team consisted of me, my sister Gaby, who is really into gliders more than she is into rockets, Trevor Seabrook, a mate of mine and my dad's, and Robin Seabrook, the kid on the team who was pretty much into everything equally. We hope to have a bigger team of ten juniors or so next year - so come on! Its fun and don't believe for a minute that this is just model rocketry with three meals of ethnic food served daily.

Since this was the 9th European Championships there were lots of teams that have had eight years to get their acts together whereas, thanks to some messing about with the BMFA, we actually had less than six months to get sorted. Some European teams didn't even show up so I guess we were alright. We had to do without the Swiss, all of Scandinavia, the Germans and the French. They missed a great event.

The rugged rockets we flew at Yatesbury were good enough to qualify but were no way good enough to take to Serbia. My dad and Geoff scoured the internet, sponged hints off the UK senior team members and applied their knowledge of rocket science to come up with state of the art S3A, S6A and S9A rocket designs for us to build - only the all-conquering Poles might have had a technical edge on us in Serbia. Most of teams were far more experienced with strategy and tactics, had more man (and woman) power and made better use of the conditions than we could. We learned a LOT but they got the medals ;-)

For our S4A gliders and S9A helicopter rotors we used tried and proven designs from the senior UK team members. Brung up the rear, our S1A rockets were built the night before. They were born out of leftover Kapton tubes and a couple of special bits (like nose cones and fins) that my dad took along "just in case".

We had plans to enter the scale model competition with a fun and unique model but there really wasn't time and besides Gaby didn't get the support she needed from officialdom. Still, we went out there to Serbia and flew most of the classes that were taking juniors... and with the smallest possible team. That was a lot of work with very few hands to do it all.

We got to Serbia a day early and had a great time bombing around the shops in Belgrade. It is a bit horrifying that just a few years ago NATO was not having a great time bombing in and around Belgrade. I don't know what all that was about but we saw the Chinese embassy that got hit "by accident" according to my dad (the inverted commas are his). All the people seem keen to get on with foreign visitors and most spoke English. Knowing a bit of Russian helps ;-)

The flying field was about 60km out of Belgrade by motorway but the hotel was about a 30 minute coach ride away by country lanes. The Hotel Termal in Vrdnik was past its prime and mum sez it was a real relic of the Soviet era (whatever that is). We called it the Hotel Terminal.

There were huge swimming pools that were heated by thermal springs. The rooms



were OK but a bit dirty. The food was surprisingly good. The promised spa treatments were non-existent. My dad was impressed with the price of the local beer (half a Euro for a pint) but not its name (Lav Pivo). He said the wine wasn't very good but at least it was cheap. The slivovitz was my mum's favourite. There was something for everyone ;-)

Monday started out as just a day to hang. We were in a parade through the town, the mayor welcomed us, the choir sang for us, children in ethnic costume danced for us and we had a nice lunch at a different hotel in the big town of Sremska Mitrovika. In the afternoon we got to go out to the field and practice. It was almost a total disaster.

We couldn't practice much in the UK because the necessary 10.5mm Serbian, Polish or Slovakian motors aren't allowed in. This is a major problem for the UK team - if we can't practice at home or do lots of R&D, we show up at these meets totally in the dark. It's kinda a nice surprise when stuff works the way you planned... and sometimes it is not a nice surprise when they don't. And don't mention the igniter problems to my dad unless you want to see the veins in his forehead start to pulse...

Because you can't take motors or BP on airplanes, we had to get our motors in the country. There is a whole big song and dance about the motors being tested before the competition. They actually fired motors on a test stand on the hotel balcony - what a stink. They had an E motor CATO during testing and that was a bit scary.

After the motors are tested, they are all impounded. Nobody told us! So there we were with a shed load of cute little motors all tested and paid for but totally unavailable before the competition started. We scraped up a few motors by flirting with the cute Russian and Polish guys so we had a few to see if our rockets worked.

We were told by the senior team that we had to use a piston launcher with our launch tower to be competitive. But we didn't have any BP despite "arrangements being made" and had to make do with some mysterious chunky pink stuff in our igniters (which were hand made igniters with a little bit of drinking straw epoxied on top to hold a pinch of

BP).

Instead of just burning fiercely and lighting our motors, the pink stuff mostly just exploded. My dad was not pleased as the piston launcher worked fine at home but we had to abandon it because we had no practice using it. Piston launchers need just the right snugness to work and without experience, we couldn't rely on it.

Somehow a small supply of BP was found otherwise I don't know how we could have got the rockets off at all. Those little APCP A motors aren't easy to light. Without the piston launcher, we had to sacrifice altitude with every single flight because the promised BP didn't materialise until after practice closed. Piston launchers are supposed to give you 10 to 20 per cent better performance.

The hours we had to keep during the competition were a major drag. Up at 0630. Breakfast at 0700. Into the buses at 0730. Set up the pad and prep the rockets at 0800. Start flying at 0830. And then it was recovering, prepping and flying more rockets until the mid day break. Lunch was quite yummy Yugoslavian Airline business class box lunches from 1200 to 1300.

Then it was flying and prepping in the day's other class until 1800. Then there was the prize giving that went on 4ever (especially since we didn't get any) and then the buses took us back to the hotel at 1900 and dinner was at 2000. Whew!

We were beat but we still had a bit of energy for swimming, watching some of the grown ups get silly and helping my dad and Geoff put last minute touches on the next day's rockets. We had to register our rockets for the next day by 2200 (or so we were told but that turned out to not be true) so it was often a scramble to get everything ready for the deadline.

Repeat that schedule Tuesday thru Friday. Aarrggggghhhh.

On Tuesday morning my sister Gaby, Trevor and I flew S3A parachute duration rockets. Big stomach butterflies! Our first real blast off for Britain! Recovery was bare hard with the chutes because our rockets flew well and the parachutes went way away on a 15 knot wind.

My dad was so far out in the recovery area he was worried about finding his way back. He said that he was about 2 miles out and right at the limit of our walkie talkie range. Even so, the massive Polish team equipped with dirt bikes and vans were even farther out.

Competition rocket flying is a team sport unlike the individual efforts in model rocket contests and HPR. You have to use two rockets to make three flights so you have to have a good recovery team in the field to get at least one rocket back for each flyer to make their third flight if you want to win.

We never managed that necessary trick except for one of Trevor's that the nose wasn't on tight enough and landed close to the pad. The nice Polish guys eventually found our rockets but we got them back too late to get a third flight in the final round.

We came in 8th (out of 12) as a team but it could have been second place ;-(I had the highest team placing at 18th (out of 36) No embarrassment there. I felt sorry for my mate Estefano on the Spanish team that came last. Of course, we beat the French - the cheese eating surrender monkeys didn't even turn up [NOTE - The

views of the author are not *necessarily* the views of UKRA or the Editor – Ed].

The Serbian team won S3A but the best individual flyer was a Pole. You can see all the official results at www.eurospace2003.org.yu These eastern European kids have the advantages of state support for their rocketry. They have special teachers that go around the country teaching rocketry skills and lots of model clubs in countries that fewer people than London! They even have competition rocket factories where they can go and build stuff. Blast Off for Britain is setting about levelling that playing field but we have a ways to go.

The contests are run in rounds, three for each category. Each round is set for an hour so each of the three contestants has a 20 minute slot (theoretically) to pick their best launch time in each round. Except nobody told us any of that and we were pretty disorganised. We managed to get all our rockets off in the allotted hour but sometimes it got a bit tense. We could have done better and next time we will.

Part 2 of Genni's article can be read in the next issue of 10... 9... 8...

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Construction Techniques

by Leon Kemp – CAR S561

A Revised Method for Mounting Through-the-wall Fins

A frequent dilemma faced when assembling a rocket with through-the-wall fins is how to get a good bond between the fins and the inside tube (usually the motor mount). Generally we attach and gusset the 2 (or more) bulkheads prior to mounting the motor mount assembly in the outer tube. Consequentially, it becomes difficult to get a known-good adhesion of the fins to the inside tube, and impossible to build a gusset. We ran into this problem with Peggy's LOC NORAD, with one fin coming loose during its first flight. I have always been concerned with this as I built my various rockets.

As I was overseeing Bethany in the construction of the rocket for her L1 Junior Certification, I got an idea. If I built the gussets while the motor mount was outside of the outer tube, I could insert the fins later, and the small amount of epoxy that adheres on the edge of a fin would be able to provide a very strong bond.

Here is what we did - first we attached the two bulkheads and engine retainer, and applied the gussets. Then we positioned this assembly temporarily inside the main body tube. We used a long knife blade to scribe a line marking one side of each of the fins. We were careful to get the knife perpendicular to the motor mount. If we made a mistake here, we could correct it later, so an absolute exact marking was not critical.

We then applied masking tape along the scribed line, so that we would not get epoxy where it was not wanted (yet). A strip of 1/16" square balsa was then

epoxied in place for the length of each of the fin lines and allowed to set up. These strips would prevent epoxy from setting up at the sharp edges of the fins while we formed the gussets. Meanwhile, we taped a 2" wide strip of wax paper along the edge of the fin that would ultimately bond to the body tube. This would prevent premature bonding of the fin to the motor mount.

After the fin positioning strips were set, we re-inserted the motor mount, and checked the fin alignment. By trimming the balsa or adding masking tape, we were able to get perfect alignment.

After removing the motor mount, we applied a second strip of balsa on the other side of the fin. We were careful to minimise the amount of epoxy that came into contact with the wax paper, as we did not want to epoxy the sharp corners in place, as this would make removing the wax paper difficult.

Once all of the fin positioning strips were in place, we could apply normal gussets from the motor mount to the fins. After the epoxy was fully cured (best left overnight), we removed the fins and the wax paper, leaving a preformed gusset.

The next step was to re-insert the motor mount and do a final check of fin alignment. With that done, we positioned the motor mount for the correct amount of protrusion of the retainer. This allowed us to scribe some lines marking the front and rear of the fin position on the motor mount. We removed the motor mount, and glued some small balsa blocks at each end of the fin, and verified their position. These blocks would stop the epoxy (when we glued in the fins) from squeezing out the ends, and force it up the sides of the fins.

The motor mount was then epoxied in place, with the fins located through the outer wall and into the gussets, but not epoxied yet. This allowed us to build good gussets on the forward edge of both bulkheads, by rotating the assembly. Once the motor mount was in place, the fins were removed, a small amount of epoxy applied to the edge, and the fins were re-inserted, and immediately removed again. By checking the amount of epoxy that had squeezed up the side of the fin, we determined that we wanted a bit more epoxy. A second (or sometimes third) application was judged to be sufficient. Normal fillets were applied between the outer body and the fins. We now had some fins that would be nearly impossible to break off.

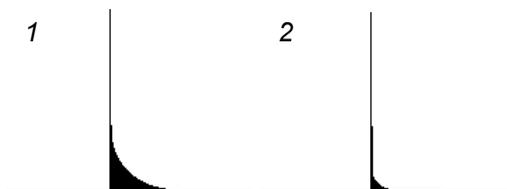
Glue Fillets Revisited

I recognise that many of us have been building rockets for years, and that filleting fins is a process we all take for granted as being a simple process. However, I have seen some poor procedures based on a misunderstanding of the nature of the glues most commonly used. For purposes of this discussion I have chosen to separate the glues into two categories, which are those with volatile solvents, and those without. The emphasis of this article will be solvent-based glues.

Glues with volatile solvents include cyanoacrylates, water or urethane based wood glues, and silicone adhesives. These are the glues of primary interest here, because all solvent-based adhesives contract during curing. Improper application of the glue can result in minimal strengthening of the joint. It is a common practice to apply a glue fillet, and then run your finger along the joint to form a concave bead (see figure 1). As the glue dries, it shrinks down, and results in a very small area of

reinforcement (see figure 2). It appears to still be a reasonable reinforcement, as we can see the layer of glue, and can see the curvature of the fillet. Because we only see the top surface, we do not recognise the actual weakness. Most of the fillet actually provides no reinforcement, with only a small amount of glue in the corner actually strengthening the joint, which is then more likely to fail.

The correct procedure is to leave the full convex bead in place (see figure 3), and allow the glue to cure down into a concave fillet (see figure 4). This can



result in a bit of a lip (see figure 4), which can be removed or reduced with a small diameter round file. This technique ends up with a strong layer of glue along the full span of the fillet, and it will have a better chance of standing up under launch / recovery stresses.



Some experimenting will be necessary to determine how much a specific volatile glue will shrink while curing.. My personal favorite wood glue is Lee Valley Tool's GF202. This is a fibre-filled gap-filling glue with very high shear strength

(over 4200 psi). It shrinks down approximately 60%, which means that a full rounded glue bead will shrink down to a nice convex fillet.

Figure 5 is a photo of a finished fillet on a rocket. I have rarely had a fillet done in this matter fail.

As an aside, this technique for volatile



adhesives can also be applied to other areas where a strong fillet is required, such as caulking bathtubs or windows.

With a non-volatile adhesive (epoxy), the fillet is formed to the desired final shape. These materials do not shrink during curing, so what you form is what you get.

Perspectives of a Rocketeer's Wife, Or "An 'M' Motor costs HOW much?"

by Peggy Kemp – CAR S562

One day my husband brought home the great movie "October Sky". The whole family enjoyed the rocket shots, and the movie seemed to re-light a passion for rocketry that Leon had not enjoyed for 15 or 20 years. Together we decided that rocketry would be a great hobby for our family. That was before I realised a lot of things about the hobby.

First of all, rocketry cannot be limited to \$12.00 kits anymore. Leon attended his first mid-power launch, and heard the

guys talking about flying "J's". "Js?" he exclaimed. "When I was a kid, "D"s were considered big." That was the advent of a family trek into the mysteries of high power rocketry. We started off small, with one of Blackhawk R&D's great Black Brant X mid-power kits. That was launched to an altitude of a mere 1,500 feet, and the hunger for "MORE POWER" only increased.

Secondly, I did not realise just how much the paraphernalia of rocketry can take over your life. This comes from the woman whose bedroom has been decorated in early American rocketry for the past year. Honestly, for a while a 9-foot section of a future model of a V-2 stood in my bedroom. Hmmmmmm. This doesn't even begin to take into account various wonderful tools, cans of pretty paint, and smaller rockets that creep into fill all available space. Before one launch I swear that I almost could not walk into the bedroom for fear of disrupting a herd of rockets in various states of repair and disrepair. Oh, Wait! The disrepair part comes after the launch, when all the little rockets are being put to bed.

Thirdly, I did not realise that rocketry is contagious. Our 13 year old, Bethany, asked for and received her first mid-power rocketry kit last year for Christmas. Her rocket, named "Gwahair" after the eagle king in "Lord of the Rings", made its maiden flight at this year's Roc Lake meet. She also looked with gleaming eyes at her Dad's "J" project, and started talking with rockets in her eyes about being 14 next year. I think I know what she wants for Christmas this year, although she hasn't realised just how difficult passing the test might be. Even the two little ones want "bigger rockets, MORE POWER."

Lastly, I was a bit amazed at just how

much the sport can cost if you get really into it. When I speak of cost, I do not only mean money, although high-power motors could cause a slight heart attack ...as I said in the title, an “M” motor costs HOW much??? There are also costs in time. Ask anyone with a shiny rocket just how much time they put in sanding the thing. I also discovered that sanding is (hack cough) a better thing done outside the house, even if it is the middle of winter. And painting is something best done far away from the house (ah, the aroma of freshly sprayed paint).

High-power kits, or even “scratch-built” rockets will add up in cost before the work is finally completed, especially as you enter the high-power rocketry stage and need to think about various electronic devices to ensure getting your rocket back in one piece, or to find out just how far up you went. The end result can be pretty spectacular, though.... and hopefully the “rocket gods” allow it to come back in one piece, or you start the whole process again. And you do want the rocket back, especially when all that time has been wasted....I mean spent working on the thing.

On the plus size, rocketry has made buying Christmas and birthday presents for Leon a whole lot easier. I think most of his presents for the past two years have had something to do with rocketry, be it combination birthday/Christmas gift of a new altimeter (cough cough hack cough...how much does that thing cost????), a set of binoculars, or a cute little table so he doesn't have to prepare the rockets on the ground.

It is also great fun to go to the rocket launches, be they model, mid-power or high-power launches. Where else can you spend \$20.00 (I'm talking model rocket motors here) and have a full family

afternoon of fun? We have also met a diverse, but very nice group of people from all areas of life who are eagerly sharing everything about the hobby with one another. If anyone has a problem, there is no lack of expertise, help, and advice on how to fix it.

In closing, although there were parts of the hobby that were a bit unnerving (I swear at one time I had 50 rocket parts as the decorative theme to the bedroom), as a whole rocketry is a great hobby for our family. We have had a lot of fun building and launching the rockets, and with the people involved in the sport. It truly is contagious. In fact, I enjoyed building my own kit, and successfully obtained my level one certification at Roc Lake this year. And yes, I am going to go for level 2.

Build or Buy?

by *Paul Lavin*

Build or Buy? Or a recovery device deployment kit lament and modification rant...

I've built lots of kits in my chequered career as a rocket person but my predisposition lately has been toward scratch building. It's not because I revel in the hair shirt mentality that afflicts some scratch builders or, happily, not from lack of 'resource'. It's just a lack of perceived value in many of the brand named boxes and bags holding gaily festooned tubes, cones and balsa bits. Learning how to drive SpaceCAD sets you free ;-)

Recently I had to build a rocket for the British Rocketry Team that could take a payload of streamers up to 1000 feet and barf them all out in the same piece of air for comparative testing. This sort of thing, if it has ever been done before, isn't documented anywhere... probably because of the cloak of competitive pressure.

To get the rocket's own linen on the line as well as dispatching a flotilla of streamers with 10g weights pendant, an ejection piston was required. Pistons are one of the best ways to ensure routine deployment. When the BP charge goes off, everything in the tube goes out the open end with authority. No exceptions.

Pistons are also useful for near fool proof recovery device scorch prevention. The hot gasses and flaming chunks never get a look at what's on the other side of the bulkhead. Another plus for my inner green self is that I wouldn't be leaving wedges of fireproofed toilet roll strewn across the countryside with a piston.

Pistons aren't really a new feature to the Lavin build practice though I am far from

an expert. My daughter Genni's Barbie Space Programme's recovery was piston driven as our S3 and S6 competition rockets are, too.

Getting a half a meter of parachute out of a 30mm diameter body reliably needs a piston! FAI competition rockets ALL use pistons though the 30mm diameter foam cookies that ride on top of teeny A motors aren't a lot like the 75mm one sitting above a Pro 38 G/H in the BO4B Bazooka. Heck, the PML piston alone weighs as much as a half dozen competitive rockets!

I bought a 3 inch PML Piston System Kit for less than a tenner to fit the whacking great PML tube destined to become our streamer testing beast. It was a convenient way to buy the coupler tube and the plywood disk all sorted and sized in a tidy bag with hardware and instructions. However, when I got home and examined my purchase, there was no way I would ever build an unmodified PML piston into one of my rockets.

The piston, assembled according to instructions, is an accident waiting to happen. The piston in the kit is designed to be permanently fixed in the airframe tube. You cannot easily or effectively clear the tube of ejection residue. Eventually, when sufficiently coked up, it >>will<< jam and the anticipated deployment won't happen. A jammed piston could also cause overpressure in the tube leading to motor ejection and failed deployment by another route unless you use Rowe Retainers (as I do religiously).

What's worse, being permanently fixed in place with epoxy top and bottom, you can't easily replace the nylon webbing when it gets fried. The crucial bit destined to be bien cuit is glued to the top of your motor tube deep in the bowels of

your rocket. And fried it most assuredly will be in a rocket that is used again and again.

Aarrgggghhhhh... the nylon webbing PML provides is black. Even if you did get your eyeballs down the tube to divine if the next flight was going to become a core sampling mission followed by a protracted game of hunt-the-nosecone-and-chute in yonder county, the colour of the webbing would do a great job of concealing the surprise ending of its next flight. Cooked black webbing buried a couple of feet down inside a long, badly lit tube could look almost like new. It won't work like new, though.

And if all this isn't enough to make me feel like I paid dearly for a coupler and plywood disk, the prospect of a zipper with the current design cooled my now dissipated ardour to a few degrees Kelvin. As a middle aged bloke, and consequently not being a 501 fan, I feel that zippers belong in trousers.

Building rockets is like advising a legal client. You eliminate all the weaknesses in a case one by one and try to get insurance or hedge the ones you can't ;-) Putting an impossible to maintain and difficult to inspect critical component with a built in a pair of Achilles heels in a rocket is not a great idea.

My redesign is simple. Replace the nylon webbing with a bit of utterly singe-resistant 2mm steel cable from that national chain of rocketry component suppliers, B&Q. An unexpected bonus was that the cable actually weighed less than the nylon webbing it replaced. Quel mirable!

I brought the aft end of the cable out through a washer-reinforced hole under my Rows retainer.

A yellow and red plastic guide tube was installed between the motor centring rings, purloined from a handy dispenser at McDonalds. The fore end of the cable was looped around and shoved through a 4mm hole drilled in a homemade plywood disk (having shelved PML's generously slotted one). The piston hole was also reinforced with a washer and backed up with a dab of RTV silicone to reduce the ingress of errant cinders.

The plywood bulkhead was epoxied into



the coupler tube as per PML's instructions - that's about the only thing they advised that was an unalloyed great idea. A quick connect retains the loop in the top of the piston and provides secure and easy attachment of our SkyAngle chute

Holding the whole thing together securely yet allowing for dismantling, inspection and timely decarbonising are still more B&Q-sourced rocket goodies. Trundle along to the electrical department and get a strip of terminal connectors. You get a

dozen or so for a quid. Inside each is a brass fitting that can take a 2mm cable doubled over with two screws to lock it in position.

Enjoy! Cheap rocket fixings are a delight.

So far this is more or less a straight replacement of the accident prone PML webbing with a lighter, stronger, heat impervious cable. However if you also want to forestall any chanced of zippering your airframe, size the cable length so that the piston never actually leaves the tube.

I set mine (easily adjustable courtesy of the aft end fixing) so that the piston coupler protrudes only 2/3 of the way from the tube. Despite this limitation, the entire contents of the payload bay should be flapping merrily in the breeze when the piston reaches its endpoint in the flight profile.



Around the circumference of the coupler wall I drilled a number of holes... a few small ones at the top and more and bigger ones further down. This allows the ejection gasses to vent progressively, decelerating the piston and taking a bit of strain off the cable as it extends. There's no over pressure, ever, and nary a tendency to kick out the motor should your motor retention budget be more towards masking tape than a Rowes Retainer.

Steel cable has a lot less elasticity than webbing (and thankfully a whole heck of a lot less give than frazzled webbing). If you have a very short rocket with a very large diameter piston, you might consider incorporating some kind of strain relief. With the 900mm or so in BO4B Bazooka body, it is apparently not an issue. The maiden flight of the anti-zipper retained baffle piston ejection mechanism went without a hitch. On a Pro38 G60, the rocket was simmed at 333 meters and achieved 1048 feet, an excellent departure point for an S6 streamer in a competition. The BO4B streamer bus is now taking passengers and it will hopefully have a long and fruitful life ferrying streamers reliably up to 1000 feet.

I have a length of black webbing and a slotted PML 75mm plywood disk going spare. Any takers?

UKRA NEWS!

by UKRA for the most part...

UKRA Safety Code Update

The new version (4.2) of the Safety code is now available for download in PDF format at http://www.ukra.org.uk/docs/Safetycode_4_2.pdf.

Council Position Vacant

Following Darren's resignation from the Council after many years of good work, we now have a vacancy for a co-optee to serve on the Council, bringing us up to a full complement of 8. This position is unelected, and the successful candidate will have the opportunity to serve on the Council from the start of January 2004 until the Council election at the AGM in June 2004.

The successful applicant will need to be able to attend a Council meeting roughly once every 6 weeks, normally at Heckington, Lincs., but locations may vary from time to time. Being a co-optee to the Council is a different way of being able to put something back into the hobby, and gives you a chance to be a part of the decision making process that shapes UKRA. New ideas and a fresh view on UK Rocketry are always welcome on the Council. The position also serves as an excellent "L-plate" period for anyone thinking of standing for election to Council at the AGM.

If you are interested, please send a brief personal biography and a short covering note explaining why you think you should be selected, and what qualities you can bring to the Council by snailmail to UKRA, PO Box 1561, Sheffield, S11 7XA or by email to enquiries@ukra.org.uk. The closing date for applications is January 10th 2004 with the successful candidate being notified soon thereafter.

2004 Launch Dates

Big EARS, as usual, is taking place over the first May Bank Holiday weekend at the EARS site in Elsworth, near Cambridge.

The dates for the ever popular UKRA annual launch have been set for June 4th - 6th 2004. The venue, as in previous years, is to be Pete's Farm at Heckington in Lincolnshire.

International Rocket Week (IRW) 2004 will be held between Monday 23rd and Monday 30th of August.

KLOB 2004 is to be held on the 25th and 26th September, also at Pete's Farm.

BROHP Conference

The dates for the British Rocketry Oral History Project 2004 conference have been fixed for April 14-16th 2004. For more information visit <http://www.spaceuk.org>

UKRA Marquee for hire

The UKRA marquee is now available for hire to UK Rocketry groups or UKRA members for use at events. The Marquee is 8m x 4m (24ft x 12ft in real money), has windows along its length both sides, with opening panels on the front and at both ends.

The hire rate will be £10.00 per day of use, with the group / individual hiring it responsible for arranging transport to and from the event site. The marquee must be returned clean and complete within 7 days of completion of hire, with the contents list countersigned as intact against the pre-hire check.

If you wish to hire the marquee, please email enquiries@ukra.org.uk

Action stations!

An appeal from BO4B

28 December set for 2004 Junior Trials for British World Space Modelling Championship Team.

Despite the efforts of the Blast Off for Britain executive committee, there has been a communications/organisation problem somewhere between the British Model Flyers Association, their Free Flight Technical Committee and the British Space Modelling Association.

The nominations for the 2004 junior members of the British team to compete at the World Championship must be submitted by the end of December. From those nominations the BMFA will certify the official teams in mid January. This timetable was set with NO official notice or publication, according to Paul Lavin, Chairman of BO4B.

"This is not what has happened last year as BO4B did our trials in May and were sorting ourselves out to carry on in that fashion until this morning. The BMFA Competition Secretary has supposedly said that this year there will be no exceptions," he said.

Given the extremely short notice, Blast Off for Britain will host the qualifying trials on Sunday the 28th of December at either their Kinsbourne Green field or at their field in Hampshire near Preston Candover. The choice and timing will be announced shortly.

The rockets used must be UK legal which means that 13mm "Estes" A motors must be used as the 10mm competition motors used in European competitions are not allowed in the UK. In addition, the 10mm motors are not available equally to all competitors and are therefore inequitable for UK competitions.

Construction and event rules follow the

FAI rules (see links section). As a minimum, competitors should be ready to fly S3A (parachute duration) and S6A (streamer duration) that employ a 13mm A motor. Two rockets and three rounds will be flown for each class.

Other classes will be flown based on the participant turn out. BO4B will provide a 30mm tower launcher and launch controller system. Paul Lavin, UKRA RSO will officiate. Bring friends for recovery! Hot chocolate will be served! A workshop for rocket building is tentatively scheduled for 14 December in Kinsbourne Green. For more information send us an email 2004team@blastoff4britain.org.uk



UKRA Council Meeting Minutes

Date: 25/10/2003 (12:30pm)

Location: UKRA Hut, Heckington, Lincolnshire

Present

Cath Bashford (CB), Mike Crewe (MC - Chair), Darren J Longhorn (DL - Outgoing Secretary), Graham Platt (GP - Secretary), Damian Burrin (DB) Pete Davy (PD - Invited guest).

Apologies

Richard Osborne (RO), Jim Macfarlane (JM), Ziggi Kklynossikki (ZK).

Agenda

- Minutes of previous meeting
- Matters arising from minutes of last meeting
- Election of Secretary
- Secretary's Report
- Membership Report
- Finance Report
- Motor legality (UN 0471)
- Home Insurance
- BO4B & MAP proposal / Education Committee
- Help during certs due to disability
- Youth / School group scheme insurance
- Marquee
- BMFA Tech Committee
- Guinness records
- UKRA 2004
- Council co-option
- Newsletter editor
- UKRA Cert Badges
- AOB
- DVNM

Minutes of previous meeting

The meetings of the previous meeting were approved.

Matters arising from the minutes of the previous meeting

The outstanding action points were updated.

Election of Secretary

In light of DL's resignation from the Council, it was felt necessary to appoint a replacement for the role of Secretary at this point, in order that DL not be required to minute this meeting. GP volunteered for this role, and was unanimously accepted.

Secretary's Report

DL circulated items received from the BMFA since the last meeting. There was nothing which required a response. Council attendance at the BMFA AGM was discussed, and although not compulsory, it was noted that it may be beneficial to UKRA as an opportunity to renew contacts within BMFA hierarchy.

Membership Report

MC reported that we had 194 members, which is down by 5 members on this time last year. He stated that the number of new members was down substantially on last year, but that the percentage of members renewing was up.

Membership fees for 2004 were discussed, and it was agreed to leave them at the same level as for 2003.

Finance Report

CB gave a brief rundown of finances for the period since last meeting.

CB suggested that UKRA change it's banker from Barclays to an online Abbey National account, as service was better, the account accrues interest on the balance and it was not geographically constrained by being tied to a particular branch of the bank.

Motor legality (UN 0471)

Following an enquiry regarding UN0471 from a firearms officer, clarification was given regarding why 0471 was not necessary on the COER3 for fliers, only importing vendors. Aerotech had certain motors classified as UN0471 by the DOT. In the UK, the HSE classified the same motors as UN0351, the change occurring once the motors were in the possession of the dealer at the point of entry into the UK

Home Insurance

An enquiry has been received from a member asking if UKRA could recommend an insurer for home insurance for rocket fliers. This was discussed in some depth, the outcome being that UKRA should not recommend specific companies for insurance to members, as there was no guarantee that any two members would receive the same response from the same company. As there is no company at present that will give a consistent answer to members, it was deemed unfair to nominate a company.

BO4B & MAP proposal / Education Committee

Further to Paul Lavin's offer to run MAP for UKRA, GP has been working with Bob Arnott and Paul Lavin to arrange the handover of MAP to Paul. A vote was taken on MC's proposal to set up a UKRA Education Committee with GP as Chair - this was passed unanimously.

Help during certs due to disability

A member has enquired regarding assistance during certification flights in light of his disability. It was unanimously agreed that a third party should be allowed to perform tasks at the direction of the flier, under observation of the RSO. It was emphasised that the third party was to only perform tasks as directed by the certifying flier.

Youth / School group scheme insurance

Clarification was sought by a member regarding the level of insurance cover offered by the Schools / Youth Groups scheme. It was stated that the group is covered by insurance for flights up to the certification level of the lead member. In the event that the lead member does not hold a UKRA certification, the group is insured up to G. Flights of H and above should be conducted in line with UKRA flight procedures. Lead members should be encouraged to attain UKRA RSO status although this is not essential.

Marquees

Following on from the successful procurement of a marquee to replace the one loaned by Aspire at UKRA 2003, Aspire (Rick Newlands) has stated that the replacement marquee should be for UKRA use, with Aspire having first preference on it for use. This was agreed to be a generous gesture on the part of Aspire. It was also agreed that UKRA should hire out the marquee to UK rocketry groups for their events at a small cost per day. It was agreed that hiring groups should organise the transport of the marquee to their event, and also its return in a timely manner after the event. PD noted that the hirers should also be made aware of the need to return the marquee complete and clean.

PD suggested that a box be made up to hold the marquee parts to keep it safe during storage and transit. PD quoted £25.00 for the materials for the box and has volunteered his labour at no cost to make it. This was unanimously accepted and PD was thanked for his kind gesture.

BMFA Tech Committee

A member has raised the issue of rocketry potentially no longer being encompassed by the BMFA Free Flight Technical Committee. This would entail a separate Rocketry Technical Committee being set up within BMFA to oversee competition rocketry activities. Further investigation has made clear that the BMFA meeting at which this item will be discussed will not take place until the first quarter of 2004. It was agreed to adopt a "wait and watch" stance until the meeting outcome was known.

Guinness records

Frank Sharman has contacted UKRA to advise that his application to Guinness for ratification of his bid for smallest model rocket had been turned down. He enquired whether UKRA was able to intervene on his behalf to assist. It was agreed that RO was best placed to assist with this, given his involvement with UKRA records.

UKRA 2004

Dates for UKRA 2004 were discussed, and the weekend 4th - 6th June 2004 was selected based on crop state and closeness to other flying events. It was felt that a date in mid May would not be feasible, as the crops were at a critical stage at that point and also that the event would be too close to "Big EARS", which would adversely affect both events.

The dates for KLOB04 were also discussed and set for 25th / 26th September 2004.

Pricing for UKRA04 and KLOB04 was discussed, and it was agreed that the current pricing levels should remain for the events in 2004.

The possibility of a UKRA events calendar on the website was discussed, and it was agreed that the idea merits further investigation.

PD raised the issue of more robust signage for UKRA events, as the existing flimsy signs were showing excessive wear and tear, and were also not particularly visible. It was agreed that PD should investigate the costs of more permanent signage.

Council Co-option

Due to the resignation of DL from the Council, his place requires filling for the remainder of the year. It was agreed that instead of nominating people for the role, an article should appear on the website and in the magazine requesting volunteers for the place. Applicants should send a brief bio and reasons why they feel that they should be selected for the role, along with a brief summary of what qualities they feel that they would bring to Council. Volunteer applications should be received no later than the end of December, with the appointment being notified by mid-January.

Newsletter Editor / Webmaster

Following the resignation of DL from the Council, and also his duties as magazine editor and webmaster, DL has been contacted by Richard Parkin regarding the magazine Editor job. Richard has volunteered to take on the role of Editor for the next 12 months, with a view to taking the role on permanently after that time. This was unanimously approved.

CB nominated Martin Sweeney as editor for the website, as he is currently looking after 2 other sites hosted on the same server. It was noted that he would be given strict guidelines to work to regarding content, and also the need to have content approved by Council before posting.

UKRA Cert badges

It was agreed that due in order to have the badges ready in a reasonable timescale, no competition would be run for the design. All agreed that the HPR cert badges should be the UKRA logo on copper, silver & gold metal bases, representing L1, L2 and L3 respectively, using the metal colour to replace the white elements in the logo. Size of badge and quantities for each level were agreed. CB undertook to contact the manufacturers for a firm quote based on our exact requirements and report back to Council via email for a decision.

AOB

RSO Email List

CB raised the matter of the RSO list, and stated that the mailing permissions had been changed such that only Council could mail the list direct - all other mails to the list would be moderated by CB / MC.

RF transmission equipment use at launches

DB complained that he had lost a rocket at KLOB as his tracker signal was swamped by another member who refused to switch off his tracker when it was not on the pad. It was agreed that this problem may be more prevalent in the future due to the wider availability of affordable trackers all working on the same frequency. It was agreed that outwith a brief test away from the flightline to check that the transmitter and receiver equipment were working, the only time an RF tracker should be switched on was on the pad immediately prior to launch. In the event of multiple rockets using trackers in the same launch cycle, trackers should only be armed after the preceding rocket had landed. MC suggested that the best solution would be to add a section on acceptable tracker use and etiquette into the Member's Handbook magazine, and the event guide, with a reminder on the website. It was also stated that this should be made clear in the daily flier's briefing at events.

Event Organisation Committee

GP suggested that he, DB & PD should continue to be the event organisers for UKRA04 and KLOB04 given the success of UKRA04. This was agreed unanimously.

GP asked for opinions on the revised range layout he tested at KLOB03, and it was agreed that this was better than the layout used at UKRA03, as it allowed a single RSO to run both model and HPR ranges in addition to acting as announcer if necessary.

Discussion of rangehead manning followed, with agreement being reached on an ideal of one HPR RSO, one Model RSO and an announcer.

Event Vendor's Fees

MC asked for opinions on whether the vendor's fees at events should be continued in light of the improvement in event finances over the last couple of years. It was agreed that not charging vendors for their attendance would increase the range of products available at the events from the smaller suppliers. Voting was unanimously in favour of not charging vendor's fees at UKRA events in 2004, to be reviewed later in the year.

Thanks from Darren Longhorn

Darren thanked the UKRA Council for the pleasure he has had whilst serving as Secretary.

Vote of thanks - Darren Longhorn

MC proposed a vote of thanks to DL for his long and untiring service to UKRA, agreed by all. It was agreed that formal thanks should be expressed to Darren from the Chair via the magazine and website.

DVNM

Proposed date is Saturday 6th December at UKRA HQ, Heckington, 12:30 start.

Building Rockets for Safety

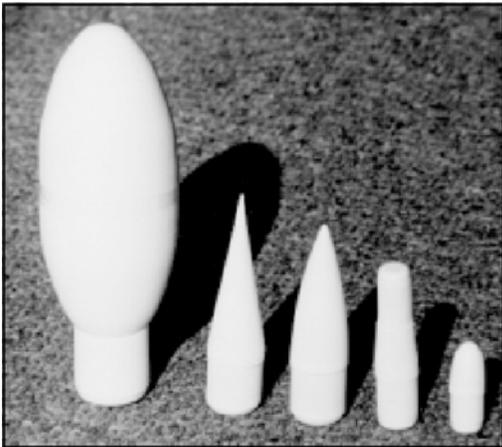
If Your Rockets Are Built To Survive A Ballistic Crash, It May Be Time To Rethink Your Design Philosophy For Safety.

By Tim Van Milligan

Over the past five or six years, I've noticed a disturbing trend among rocket builders. It seems to be popular to build rockets to survive ballistic crashes. While this sounds like something great, the result of these types of ruggedly built rockets is that they forsake safety.

What does this mean? One important thing that contributed to the excellent safety record established during the 1960's and 70's was that models were designed out of lightweight materials. More importantly, they were made out of "frangible" materials. That is, they could crumple in on themselves if they were to strike an object.

This ability to be frangible is important. Think of an automobile for an example. Since the 1950's, all cars have been built with a "crumple zone" at the front and rear of the vehicle. This crumple zone is designed to absorb the impact energy of a crash. It transfers the energy by deforming the materials; keeping it away from the occupants inside the car, nor the object which the car strikes.



Lightweight vacuum formed cones are good to use when designing for safety.

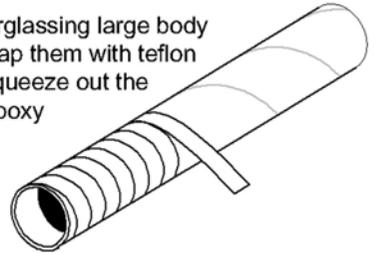
Our rockets are missing this important crumple zone. There is no way to dissipate the energy of a crash. The sturdily built rocket survives, but whatever it hits — like a building, car, or "person" — receives all the damage. I worry that someone is going to get really hurt by one of these indestructible rockets.

It this concerns you too, what should you do?

First, stay away from thick-walled tubes; and those made from exotic materials like high-impact strength plastics and phenolics. What are good are thin-walled tubes made out of paper. Also, the safer nose cones are the light-weight balsa varieties, or thin-walled vacuum form plastic ones. Nose cones that have a blunt nose shape are also safer than ones with a pointy shape.

For bigger rockets, I still like the thin-wall paper tubes, which can be strengthened just enough fiber-

After fiberglassing large body tubes, wrap them with teflon tape to squeeze out the excess epoxy resin.

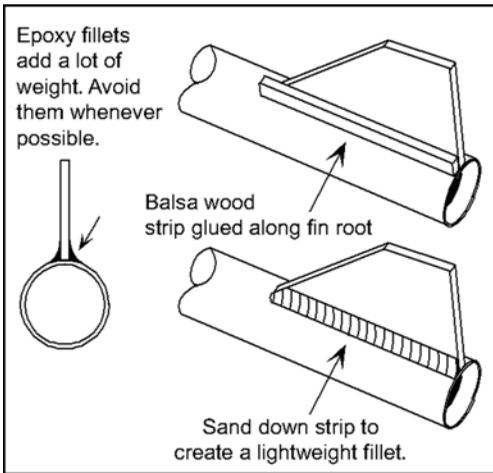


glass to give sufficient rigidity. Use epoxy sparingly. Epoxy doesn't add strength; only weight. I highly recommend the vacuum bagging technique to squeeze out excess epoxy resin from fiberglass cloths.

If you don't have that, excess epoxy can be squeezed out by using Teflon tape (like used on water pipe threads). Just wrap the tube tightly with the tape, and the epoxy is squeezed out between the wraps. When it hardens, it will leave ridges. But these are easily sanded down.

Similarly, watch that your fin fillets remain low mass. Epoxy fillets really add a lot of weight. Try another technique instead. Balsa strips can be glued along the root edge of the fins, and sanded down like a normal fillet (see the illustration on the next page).

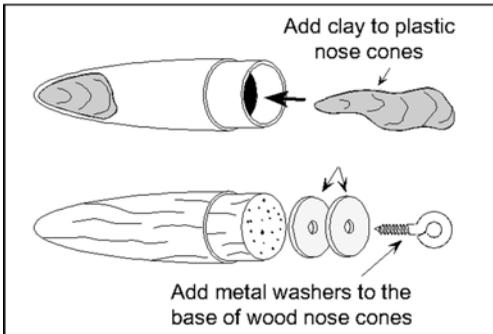
Remember, keep the mass of the rocket as low as



possible. A lightweight rocket doesn't have the damage potential of a heavy one.

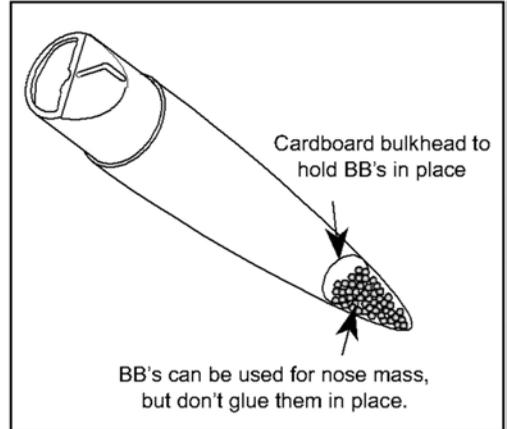
If you must add weight to the rocket (such as getting it up to its optimum mass), try to put it in the payload of the rocket. If there is no payload, use clay or sand in the nose cone. If you have to use metal, try to use washers attached to the base of the shoulder. That allows the forward part of the nose to deform to use up the energy of a crash.

To move the CG forward, use BB's in the nose,



but don't epoxy them in place. Instead, use a cardboard disk behind them as a bulkhead to prevent them from shifting aft. As a last option, use lead shot BB's (not the most environmentally friendly) for maximum CG shift.

In reality, building lightweight frangible rockets will mean that the model will take some pretty seri-



ous damage if it should crash. To avoid this, you'll need to relearn the basic flying skills. They are: choosing the correct motor for your rocket, selecting the proper recovery device, aiming the rocket to match the given wind and recovery area constraints — and most important of all — whether or not to fly the rocket at all on that day (or range). As I've said hundreds of times before, I recommend a software simulation program like RockSim. It will aid you in learning proper launch skills. It is a much inexpensive way, compared to crashing rockets, to learn launch skills.

In conclusion, remember model rocketry mimics real-world aeronautics. In that sense, by building heavy and indestructible rockets, we are getting away from the principles that modelers should be using to guide our endeavors. Please, build lightweight and frangible rockets.

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