



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

the voice of UKRA

Autumn 2003

volume 7 issue 3

Ozark Aerospace Altimeter

by Graham Platt

Body Tubes to Boat Tails

by Leon Kemp

Super Roc Rocket Gliders

by Robert Alway & Peter Alway

Two stage Monocopters

by Dave Russell

David & Goliath

by Ross Finlay

Rocket Photography

by Bob Arnott

Project Orion

by Paul Lavin

UKRA 2003

by Ray Hancox & Mark Robinson

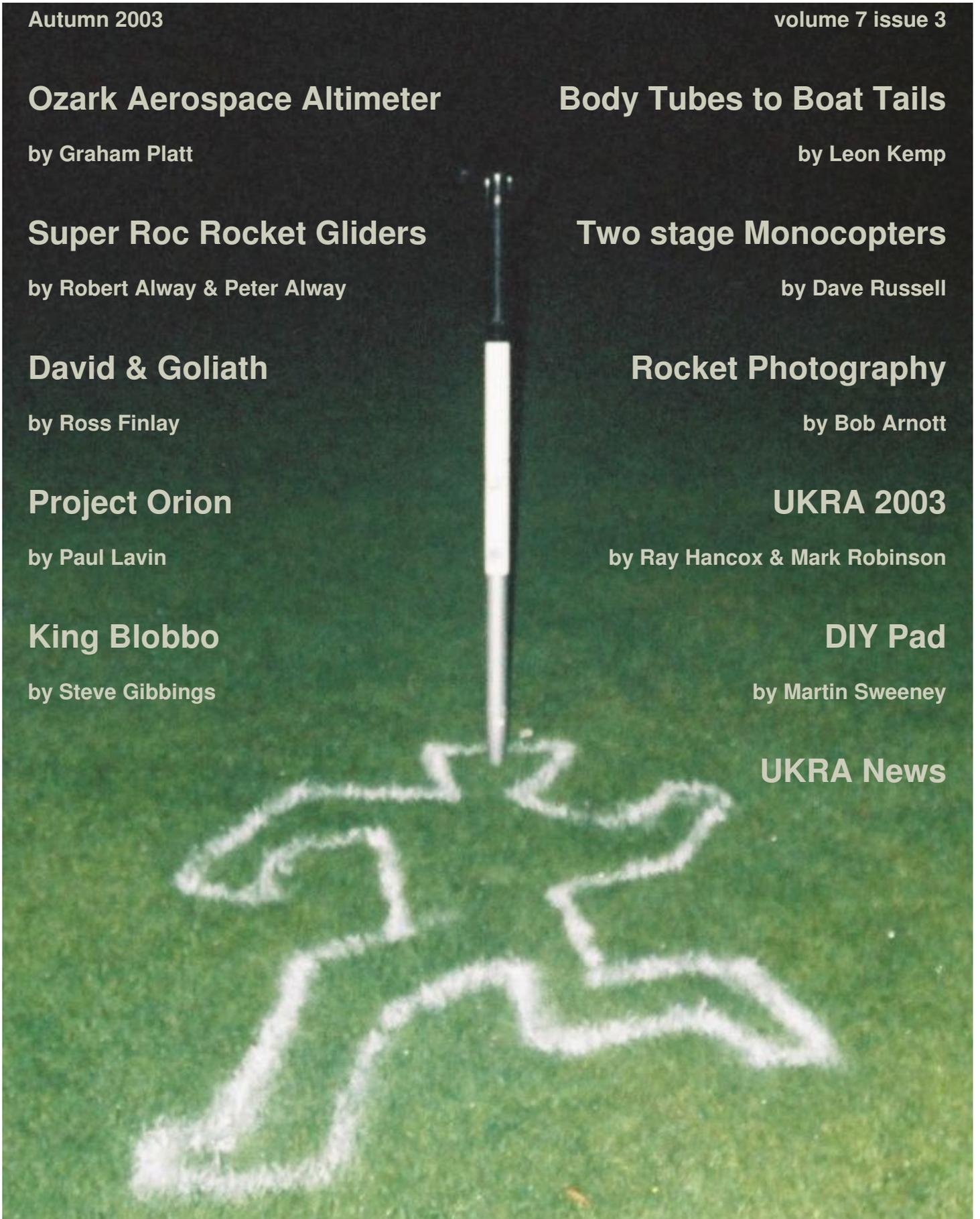
King Blobbo

by Steve Gibbings

DIY Pad

by Martin Sweeney

UKRA News



Editorial

Motor availability

Is there finally some light at the end of the tunnel? Rumour has it that both Cesaroni & Congreve are close to sorting out the CE marking issues (perhaps even by the time you read this) that have plagued us since the start of the year. Aerotech however, seem to be some way behind, but hope to have motors sometime next year. How they intend to address the CE marking issue is another question.

Strength to Strength

The hobby that is. Despite the shortages of some types of motors, it seems that the hobby in the UK continues to grow. With Black Knights, CROCK, EARS, SWARM and WRS now holding monthly (at least in the summer) flying events, it sometimes feels as though there is a launch event every weekend that I don't manage to attend! Add to that other clubs' less frequent launches such as NSRG, SARA, SERFS etc, and the big multi day national events such as UKRA, IRW, K-Lob, BigEARS, Canterbury Cup, and it appears that we really have become spoilt for choice. And, rumour has it that next year there may be even more events. Watch this space.

And finally...

As promised, this issue is super-sized to make up for the skimpy summer issue. This is the 12th issue I've been involved with and, sadly, my last. Though I've thoroughly enjoyed producing the newsletter over the last three years, since leaving my previous company for pastures new, I no longer have the time to do the job properly. In fact I'm taking the opportunity to stand down from the UKRA council completely. So, many thanks to all of you who have taken the time to write and submit articles for publication, or in any way assisted me in the various jobs I've undertaken for UKRA over the last few years, it's much appreciated. See you on the flying field...

The Editor

Editorial Team

Editor | Darren J Longhorn

Newsletter Contacts

Submissions | newsletter @ ukra.org.uk

Advertising | advertising @ ukra.org.uk

UKRA Contacts

Membership enquiries | membership @ ukra.org.uk

General enquiries | enquiries @ ukra.org.uk

Safety & Technical | sat @ ukra.org.uk

Postal address | P.O. Box 1561, Sheffield, S11 7XA

Cover Photo: Late night scene from IRW 2003 (*Photo courtesy of Darren J Longhorn*)

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King Blobbo Part Deux

by Steve Gibbings

At the end of the last article I had my King Blobbo covered in what looked like blue snot. It was actually lightweight filler used for kit aircraft but it's the lightest filler I've come across. It's a wee bit difficult to spread on a tube without getting the odd low spot and plenty of ridges caused by the edges of the spreading tool. On my level 3 rocket I'm using the same stuff but applying it differently. More heat and following the instructions! It's recommended to force a very thin key layer into the weave first then apply more as required. My composite techniques have improved too, which made it an easier job.

Following what felt like months of sanding I applied six coats of UV Smooth Prime rolled on. Then loads more sanding. The remaining few areas that needed more work before painting were fixed using an acrylic putty. This is neat stuff; it's very fine and soft making it easy to get a good surface. It only sticks to primed surfaces so don't try to use it for filling spirals on tubes before painting!

After a good few coats of trusty old Halford's grey primer it was ready for painting. Helen Green kindly sprayed the rocket in Orange Pearl and applied the graphics (See photo opposite). I was worried about the 1/2lb of fishing weights and epoxy coming loose from the tip of the nose cone so Helen also riveted through the nose cone so I don't think it's going anywhere.

The rocket was nicknamed "Oranje Boven" which means Orange Above in Dutch, seems appropriate for an orange rocket.

When I got the rocket back I reran the simulations on the Pro 38 J400 Smoky Sam. It looked like getting to 2,500ft or so, which I was happy with for a first flight. The rocket weighs 7lb without motor but still gets quite a kick from the J400. Big EARS was a week



Oranje Boven

away so a flight was planned for that. I ran a test of the electronics, ARRD and the recovery system. After blowing a hole in the 48" PML chute I rigged a 29mm tube with the apogee charge inside. This tube is 8" long and is mounted on the upper bulkhead alongside the ARRD. The chutes are packed around the tube so the charge never comes into contact with the chutes. A layer of Nomex covers the chutes at the top. I tested this system again and it works great. The charge hits the bulkhead in the nose cone from point blank range and there was no evidence of damage to any of the recovery system. I was able to halve the amount of black powder I used in the apogee charge as a result.

At Big Ears I met up with Gary Sinclair, a fellow EARS member, and we agreed to have a drag race with his similarly adapted King Blobbo on J400s. We used Gary's dual button launch controller with both igniters connected to the same system. Neither will ignite until both buttons are pressed, a very fair drag race.



Drag race with Gary Sinclair

As is usual with Pro 38 motors they lit up and were off immediately. Loads of smoke and in a nice V formation (See above photo). Gary's rocket got off clearly before mine but as mine was slightly taller and heavier it got a bit more altitude on that motor. At apogee (RDAS 2,202ft) both chutes came out which was a bit of a disappointment but it recovered safely.



Oranje Boven launch

When I checked the charges, both had fired. Not sure what happened but I'll try again before I fly it on a K550.

At EARS in June I flew Oranje Boven again on a J400. This time on motor ejection only, single deployment. I'd had my car stolen with the ARRD in the glove box (don't ask!) so I had no choice if I still wanted to fly. Another great flight (See above photo) but it was lost in a tree for most of the day. Thanks to Bob Arnott and Dave Wren for braving the thorns in the trees with me to find it.

This project was a lot of hard work for me. I wanted to use techniques I knew I would use on my level three project. I learnt a lot and I know it has made things more straightforward on Tinnitus. Hopefully I will be able to fly on a K550 at K-lob, should be a good flight.

Thanks to Helen Green and Gary Sinclair for their assistance during this project, it's very much appreciated.

Ed's note: read more about Steve's projects at: <http://liftoffrocketry.co.uk/>

Deepsky Rocket Supplies

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New items now in stock: Art Applewhite Flying Saucer kits for motors up to 38mm!! Art Applewhite Cone Rocket kits up to 29mm. Orbital Engineering VMX-2 Spaceplane kits. Estes E power V-2, Saturn V, Screamin' Mimi and Guardian kits. Giant Leap "Fireball" airframe anti-zipper protection. Giant Leap "Slider" - soft deployment for parachutes. BSD 3" THOR kits, large range of Fliskits.

New stuff in transit: Estes "Operation Enduring Freedom" range

And of course all the usual stuff: Huge range of rocket kits from Estes, Quest, Art Applewhite, Sunward Model Aerospace, Das Modell, BSD High Power, Yank Enterprises, Cosmodrome and Public Enemy. Parachutes from Top Flight Recovery, Acme conformal launch lugs and fin cans, Magnetic Apogee Detector kits, Micro Beacon location devices, ammo boxes, stainless steel launch rods, Night Launch Systems, Sure Fire II launch control systems, CA and epoxy adhesives, fillers, microspheres, and much more!

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UKRA 2003 Reports

by Mark Robinson

Seems like I've been tasked with trying to write the NWR report, according to Sean anyway!

OK. Andy Issott and I decided to travel down to Heckington early Friday morning. "I'll meet you at 0600", which meant we were actually leaving bleak and dismal Chipping by about 0700. Eventually got to the farm mid- to late-morning, but at least the campsite wasn't full and we managed to get a table in Hangar 18. Pitched the tents in the dry, and the weather got better from then on. When Sean turned up he asked if Richard (Parkin) was here yet. "He said he was getting to Pete's farm early". No sign of Richard until about teatime - a long story involving much chain smoking!

We didn't do any flying on the Friday, but just took stock of things and went to meet & greet a few people. It was hoped that I might do my Level 1 with the AMRAAM, but we found out that 29mm motors were thin on the ground (and in the air for that matter). Sean decided to set up his (Dave's?) launch rail at the HPR site. What a long trek that was! 4x4 vehicles next time please!

Saturday dawned and turned out to be a scorcher of a day, despite the heavy rain in the night. At least my tent didn't leak. I forget the exact timetable of our flights, but seeing as it's my report I'll detail my flights first (so ner!). Due to the lack of appropriate motors for my AMRAAM, I flew 3 of my model rockets for the first time:- Rogue Aerospace Standard ARM on a D12-5, nice performer, but the recommended 18 inch 'chute meant a long walk into the wheat field behind the HPR range. At least the 'chute stayed on top of the crop. In addition we recovered another rocket (HPR) which came to earth in two separate parts (REAL dual recovery!) and got a lift back to the launch site in the guy's 4x4. He was that chuffed about getting his rocket back that he wasn't bothered over my profuse apologies for getting muck on his nice clean car mats! I then flew my Estes "Delta Crapper" (Longshot with



In the Hangar

a Delta Clipper paint job) two stage, D to C6-7. Great flight, which thanks to streamer recovery landed in the field behind the marquees. The last model I flew was my Estes Fireflash. It's a great looking sounding rocket design, but single stage with a hell of a lot of weight in the nosecone and forward body tube. Despite all the clay it launched and flew well on a C6-5, reefed its 'chute all by itself! (snapped a shroud line) and then impaled the heavy nose into the HPR range with thankfully no damage.

In between these proceedings, Andy, Sean and Richard all flew rockets on the HPR range. Sean's upscale Thunderhawk ripped the sky apart and flew beautifully to a dual recovery on a J400 Smokey Sam to an altitude of 3315 feet. Later that afternoon, his modified upscale Optima now with die-bond fins and cluster motor mount took to the pad. "See lads, these scratch built rockets are designed to be stripped down and modded". The Optima sported 4 motors up its backside - the main being a J570 airstarting a G80, G40 and F25, "just to tickle it" was Sean's wonderful explanation! What a final HPR flight of the day. If the thunderhawk ripped the sky apart, then the Optima tore the remaining pieces asunder and spat them out of it's exhaust flame - SCORCHIO! Then, whilst it was rapidly gaining height, another roar was heard - the airstart. In the event it was only the G40 which lit up, but it brought a cheer. Now what goes up must come down, unless it has achieved the escape velocity of whichever planet the vehicle was launched from. The Optima hadn't quite managed this so it decided to return under its drogue 'chute. Unfortunately, the main 'chute didn't deploy thanks to the G-Wizz not working and the heavy landing bashed the



CROCKS

base of the nosecone and bent one of the fins
- easily repairable.

Andy flew his freshly finished PML Explorer, modified for dual recovery, which seared off the pad on a Pro 38 I212 smokey sam. You know, those smokey sams remind me of a corporation bus setting off from its stop, although a damn sight quicker! Nice recovery in the next field without its beeper. It seems the ejection charge burned through the kite string holding the beeper on. At least it was still working after it hit the floor!

Richard flew his Canadian Sprint from BSD - his kit review was in the last issue of 10..9..8.. The motor was a Pro38 H143 Smoky Sam. He used altimeter deployment but with the motor as backup at 13 seconds. Top flight to 2k feet ;-). The beeper detached itself on deployment, but it was recovered OK; a little bit of mud but no damage. Hmm... Seems to me that beeper attachment deficiency is contagious!

Many other great flights, both HPR and model, were made. Yes a few flights ended not quite according to plan, but I doubt there will ever be a rocketry meet with 100% perfect flights. Tripoli NL were here in force too, putting on a good show of big, bad, lock-and-lose type launches. One of our european visitors (apologies for not knowing which nationality he was) managed a flight of 7200 feet approx. altitude with a small, beautiful, metalflake

silver rocket using a 6-grain Pro 38 motor. It had some of the most gorgeous looking carbon fibre fins I have seen to date. The finish seemed to be 10 feet deep! Initially he couldn't grab the data off his altacc, but with Richard and Andy's help it was soon downloaded.

I believe George made a great comeback flight with his Enterprise 2 hybrid model, although it was doing a bit of tail wagging on the way up. It had a wonderful new chrome paint job with orange fins - a big change from the original which energetically disassembled itself on the pad at Largs last year. Colin Rowe presented an unusual 2 stage design in which the second stage had conformal flip fins which should have deployed after it left the booster; unfortunately it never did leave the booster on the flight which I witnessed. However, it was beautifully engineered as usual though Colin!

With the flying over with we retired back to Hangar 18, initially for the AGM. One of the points raised was that of financial contributions towards the fireworks display, both at UKRA and K-LOB. My worry was that if we rocketeers provide money, thus letting the creative juices of the firework people flow, then the display might escalate into battlefield tactical nuke territory! Now, where's my wallet :) When darkness fell, we were treated



No, I'm just very pleased to see you...

Davy family. God, sounds like an Oscar award ceremony doesn't it?

by Ray Hancox

Well I promised Jane (that's the wife by the way) that she could have a few days Holiday in June so I packed my bag's and off to Pete's Farm where I think the Rocket Gods live. Anyway I Arrived there on Thursday, first job was to unload the Rockets and all that goes with it. Next thing to get done was the tent, that done I was ready for cup of tea and a bite to eat. Had a few words with the lads who was there, and by this time it was time to get things put in the right order so out came the beer and with finger into the pull ring the can was armed and primed for use (there's not much in them cans when you had a busy day). So went the rest of the night placing the empty cans in an orderly manner on the table if you can find room on there. I'm sure the amount I take multiplies ten fold in such a sort time from the car to the bench. Regards the weather, it was low cloud and a bit of a chill in the air, any way time went by and 12-30am was soon on top of us, I said good night and off to bed only to be awoken at four o'clock by rain belting down making the tent sound like a drum but managed to get some kip in before dawn. I'm sure some of the Choir (night entertainment) was all mostly in tune with the rain.



White Knights?



Chewing the fat

to a great display with plenty of loud explosions although we didn't quite feel them in our chests (K-LOB last year!). Any chance we can have a simulated B-52 saturation bombing run next time lads? It was disappointing that the catherine wheel of DOOM turned into the catherine wheel of partial defeat & uncertain destiny after it refused to spin up properly. Another point to note that UKRA read backwards doesn't have the same childish appeal as K-LOB :) Speaking of childish appeal, Mr. Davey managed to sell me some Astrojax after an impromptu display from him and Mike Crewe. Pete, check out their website and get some tune-up kits in for next time!

Well, that's basically the end of my report of UKRA 2K3. As usual a great time was had being in the company of like-minded nutters..erm sorry, individuals. More of the same at Largs and K-LOB please. What about Sunday you ask? Well, Andy and I needed to set off early afternoon so no visit to the range was made. That decision was quite fortuitous because a tropical storm decided to blow in. We just managed to manhandle Andy's tent into Hangar 18 as the rain hit. The noise was incredible. Unfortunately more than a few people were at the range frantically hanging on to the marquee and presumably trying to shelter. Perhaps an eyewitness report will turn up in 10..9..8..? The storm soon blew over and we said our goodbyes and left in pleasant sunshine.

My thanks go to everyone attending and making the meet what it was, UKRA council members for their organisation, the Burger man, Rockets & Things and of course the

With the start of a new day (Friday) this time I remembered to take an elec/kettle so we could have a cup of tea / coffee in these trying times after breakfast the hut was starting to fill with more rockets of all sizes and shapes with a lot more Hyperteks about this year, also there were men (well I think they were men) walking about what I can only describe as in a trance.

But I have got to write this down, as it really started the weekend off to a good start. Mel S opened his big box, you know the one I mean, that one he has the kitchen sink in. Well, it was clean and very tidy - mind you, he did have great difficulty trying to find things from within it but, it didn't take too long for his tables to be filled up with all sorts of goods, and it was still full when he but the top back on.

Then came the Briefing. That over, it was time for some pre/flight checking, as time went by the weather was getting better by the minute it turned out to be a very nice day so the range was declared open be it rather muddy.

As I was doing my level two (2) Mel Sharp was the L2 RSO watching every move I made with all the prep/work done it was time to set out Launch Pad & Rail, went back to get my AMRAAM 4 we walk all the way out to the Pad only to find some one had there Rocket on it, so Sean who was helping me had to go back to the Safety line and wait for his Rocket to go unfortunately he had a misfired, next time he got a broken wire so he stood down so I could get my L2 off and running. Sean A helped with loading the AMRAAM 4 onto the rail, igniter was put in place and the RSO was satisfied all was well we walk back for my turn. The RSO gave me the go ahead as the young lady over the P/A system gives the 54321. The key turned, the button pressed, a short delay and with a roar the Pro 38 5g J300 left the pad on a straight flight. Deployment of the parachute was spot on, recovery of the AMRAAM 4 was good and easy. A really good clean flight she landed approximately 40m from the old barn 15m from the track with no damage at all, just a smear of dirt on the nose cone. Isn't it a good feeling? All the butterflies are gone and I'm a real happy man (-:-) So it's a big thank you to the RSO, UKRA council members, and of course the members of my own club the



At the rangehead

Black Knights for all the help given, I must also give special thanks to Malcolm Ingram for the loan of his 54mm motor retainer ring, also Pete Davy for the loan of a Parachute which was also missing. Sean and I retired to Hanger 18 for a well needed cuppa.

After a cool down and a chat it was getting close to dinner time so a wash & brush up dinner was ordered at Burger Bill's plus two bottles of Red Wine supplied by Mel S. And so we got down eating and drinking, Mel insisted we drink the good bottle first and the not so good last assuming we don't taste the second bottle (This is a top tip - Ed), after dinner we all got settled into Hanger 18.

After the AGM meeting was over we had a bit of a clean up so we could settle down to talk over the day's events wash down with tea, coffee, beer and more red wine until the early hours. As for me I went to bed around 01-30hrs and they were still at it.

Sunday morning raining again but it did stop for a short time, a full breakfast ordered as we sat down to eat, down came the rain again. So a dash to the hanger. After breakfast I decided to pack up and head for home paid Pete D said my goodbyes and away off home.

Almost forgot the fireworks - nice one lads. To the Black Knights and to all who was there we had a really great time with lots and lots of laughs, it must be one of the best weekends for all rocketeers there.

Ed's note: Photos courtesy of Kevin Timmins.



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Mobile: 07973 545475

Email: malcolm@jennings99.fsnet.co.uk

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Super Roc Rocket Gliders

*by Robert Alway
& Peter Alway*

Research and Development Project presented at NARAM 42 by the Bumbling Brothers Flying Circus, NAR Team 011.

Summary

For decades, rocketeers have observed that some rockets, particularly long, slender models, will glide backwards if they fail to deploy their parachutes. Modelers usually dismiss such recoveries as "dumb luck," but we investigated how to turn this phenomenon into a deliberate recovery system. We explain super roc rocket glide recovery with the relationships of the Barrowman center of pressure (BCP), center of lateral area (CLA-an approximation of the high angle-of-incidence center of pressure), and the center of gravity (CG). We predicted that any model whose GC falls ahead of the BCP and behind the CLA can glide backwards. We concluded that by forcing the model to experience a high angle of attack, we could trigger the transition to a backwards glide.

We devised a model that uses a novel method of inducing this high angle of attack-an ejection port that causes a pitch maneuver--and tested the model with a variety of BCP-CG-CLA relationships.

We found that an ejection port was a reliable method for transitioning to glide. We found that the range of BCP-CG-CLA relationships that results in a successful rear glide recovery is narrower than expected for models that do not spin on recovery. We found that models that spin on recovery can fall sideways or glide over a larger part of the predicted range BCP-CG-CLA relationships.

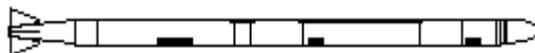
We have found that a small-finned, long slender model rocket with a single ejection

port at the front of the tube, whose CG is midway between the BCP and CLA, can function predictably as a no-moving-parts rocket glider.

Introduction

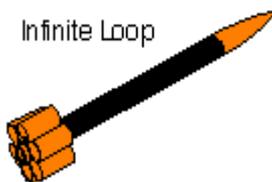
On July 28, 1938, Robert H. Goddard observed a peculiar phenomenon. His model L-16, a tall, slender, fin-stabilized rocket, boosted vertically with the aid of his guidance system. At apogee, the guidance system became ineffective, and the rocket fell without guidance. Instead of descending nose first from its apogee, the rocket fell horizontally. Because of this slow, sideways descent, the parachute was able to deploy before impact, saving the rocket for another flight (1).

Goddard's L-16



In 1969, model rocketeers observed that the tube-finned "Infinite Loop" rocket would glide backwards when it suffered a separation (2).

Infinite Loop

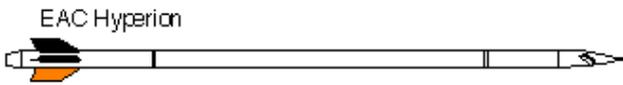


In the early 1970's, one manufacturer, AVI, in Mineral Point, Wisconsin, produced a kit, the Linnaeus Gigantus, specifically designed to glide backwards after ejecting its nose. AVI described this kit as over 6 feet long and 2 cm in diameter and using "float recovery" (3).

Linnaeus Gigantus



Casual observation has shown that long, slender models are most prone to this flight-typically in the NAR Super Roc competition. One of us has even resorted to exploiting the phenomenon to fly the NAR Rocket Glider Duration event with a long, slender scale model (EAC Hyperion) (4), resulting in qualified Rocket Glider flights (5) in at least one NARAM.



We will call conventionally configured tall, slender rockets flown with the intention of recovering in a glide under the lift of the body tube, nose cone, and fins only "super roc rocket gliders."

Objectives

The goal of this project was to understand the reasons for the two stable modes, boost and glide, of super roc rocket gliders, to determine if the transition to glide could be made reliably, and to optimize the design of the super roc rocket gliders.

Understanding Super Roc Rocket Gliders

Our hypothesis is that two modes of stability are possible because the center of pressure of a model rocket varies with angle of attack. We have at our disposal two means of calculating center of pressure-The Barrowman equations, for near-zero angles of attack (6) and the "cardboard cutout" or lateral area approach for high angles of attack (7). One significant difference between these two methods is that the body tube has no effect on the low angle-of-incidence calculations while the body tube area has a significant effect to the high angle-of-attack calculations. The results of the two calculations can differ significantly, especially for long, small-finned models. Typically the center of lateral area (CLA) is ahead of the Barrowman center of pressure (BCP).

The difference between the two CP calculations allows for one particularly interesting case. If the center of gravity is ahead of the BCP but behind the CLA, the model will be stable in some orientations and unstable in others. At low angles of attack, the CG is ahead of the CP, and the model will be stable moving forward, but unstable moving backwards. At high angles of attack, the CP is ahead of the CG and the model will be unstable moving forward, but stable moving backwards.

Such a model will be arrow-stable at launch,

but moving backwards, it will be stable at a high angle of attack and unstable at a low angle of attack. It will settle into an equilibrium angle of attack and glide.

Figure 1: CG-CP Relationship Throughout Flight

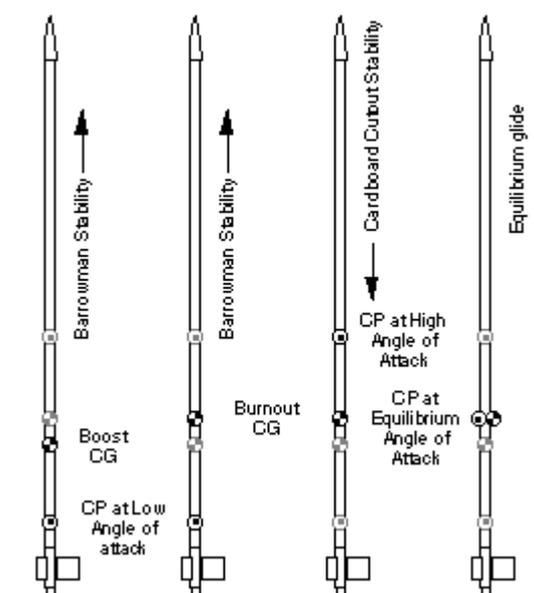


Figure 1 shows the CG-CP relationship of such a model at four phases of flight. 1: At launch, the relevant CP is the Barrowman Center of Pressure, and the relevant CG is with a full-weight engine. The model is stable moving straight forward. 2: At burnout, the CG has moved forward, as the weight of propellant is gone. It is still stable moving straight forward. 3: At ejection or apogee, the model transitions to a high angle of attack, no longer pointing in the direction of motion. Now the CLA is the functional CP, located ahead of the CG. The relative wind blows the nose back, and the model starts moving tail first. If the model points directly backward, the Barrowman CP again becomes important, and the tail is pushed away from the direction of motion. 4: After the transition to glide, the model settles into an angle of attack where the CP matches the CG.

Some models can be weighted to reach the condition where the CG lies between the BCP and the CLA, but this condition is natural for long slender model rockets with small fins-typical Super Roc contest rockets.

Transition to Glide

For a super roc rocket glider to fly

successfully, it must experience a low angle of attack from launch to apogee or ejection. Adherence to the NAR safety code's launcher and wind speed requirements has proven to be adequate to insure a low angle-of-attack boost.

Transition to glide requires that the model encounter a high angle of attack during flight, preferably near apogee. This need only be a momentary encounter. Once the model leaves the realm of low angle-of-attack arrow stability, it will tend toward the rearward equilibrium angle of attack.

There are three methods of increasing angle of attack. First, if the model is ascending perfectly vertically, the model may begin to slide backwards at the apex of its flight. This is a rare phenomenon, but we have witnessed this occasionally.

Second, ejection of the nose cone can induce a high angle of attack. This requires the ejection to drive the model into reverse, or at least to a speed comparable to any relative crosswind at the time of ejection. This method usually works (it was employed by the AVI Linnaeus Gigantus kit, and one of our previous Rocket Glide entries), at least in low winds and vertical boosts. If the model is descending rapidly at ejection, the model may maintain its low angle-of-attack arrow stability directly into the ground. One of us has deliberately used a nose-blowing scale model for qualified NAR Rocket Glider Duration competition flights.

Third, the ejection charge can be directed to increase the angle of attack. Simply by punching a hole in the body tube as far as possible from the center of gravity of the model, we can harness the ejection charge to produce a torque around the pitch axis of the model. While we are not aware of any previous use of an ejection port for a pitch maneuver with super roc rocket gliders (observation of an old Astron Sprite tumble recovery model suggests that the ejection port pitch maneuver played an important part in the tumble recovery system), it was an attractive approach for flying models with fixed geometry in our tests.

It is our intention to design super roc rocket

gliders for maximum flight duration, in the hopes that they might be competitive in the Rocket Glide event, especially at high impulse levels where it is difficult to build a successful model without radio control. In our actual work, we found it challenging to map out regions where these models work; we performed limited optimization trials.

Approach

We began by writing an Excel spreadsheet that can calculate the center of pressure of a model according to the Barrowman equations and according to the lateral area method. This gave us a feel for how the two CP's differed. Each row of the spreadsheet represents a different model, so that we could produce plots of high- and low- angle of attack centers of pressure for a range of designs.

There are several obvious variables in performance: body length, fin size, fin shape, weight, and center of gravity. We felt that minimizing weight was an obvious asset, so we did not study that variable. We expect fin planform to be of minor importance. The significant parameters defining if a model will glide would be body aspect ratio (length), fin size, and center of gravity. For practical purposes, we experimented with a model 55 diameters long. To explore the CG-CP relationships, we varied fin size and center of gravity.

For test models, we settled on a no-moving-parts, three-fins-and-a-nose-cone design with ejection port for transition to glide. We varied the fin size with interchangeable tail sections. For each flight, we noted if there was a glide, and the quality of the glide. We also timed most flights.

Equipment

We used a Macintosh computer running the Excel spreadsheet (any PC running Microsoft office would do as well), a stopwatch, a conventional launch system, several Estes B6-4 engines, basic modeling supplies, and the models themselves.

Description of the Models

We built the models in three interchangeable sections. The nose cones were 4:1 ogives, 0.736" (19 mm) in diameter and 2.944" (75 mm) long, with 0.5" shoulders, produced by Balsa Machining Service. We cut off the shoulders at an angle of about 20 degrees from the original bases and sealed the bases with cyanoacrylate glue to protect them from ejection heat.

The body tubes were Totally Tubular T-20's (equivalent to Estes BT-20), 34" (86.4 cm) long and 0.736" (19 mm) in diameter. We punched a hole about 0.25" (6 mm) in diameter about 1/2" from the upper end of the tube.

The tail sections were 2.75" (7 cm) long Red Arrow Hobbies 18 mm motor tubes (equivalent to Estes BT-20) with 3" (7.6 cm) long totally tubular T-20 couplers glued about 1/2" (13 mm) into the tube to double as engine blocks and tube couplers. This caused the engines to protrude 1/2" (13 mm) from the rear of the tube, allowing for taping. We glued three square fins to the tube, spaced equally around the tube, and centered along the length of the tube. The fin size varies from 3/4" (19 mm) to 3" (76 mm) inches on a side in 1/2" (12.7 mm) increments from 1" to 3". We made fins from 1/16" balsa.

We present a model construction plan for the version with 1.5" x 1.5" fins, the "Backslider 1.5" in Figure 2.

We taped tail sections, body tubes, and nose cones together with 1/2" electrical tape on the field. We then inserted an Estes B6-4 or A8-3, secured it with tape, inserted an igniter and mounted it in an Apogee components tower launcher or on a conventional launch rod.

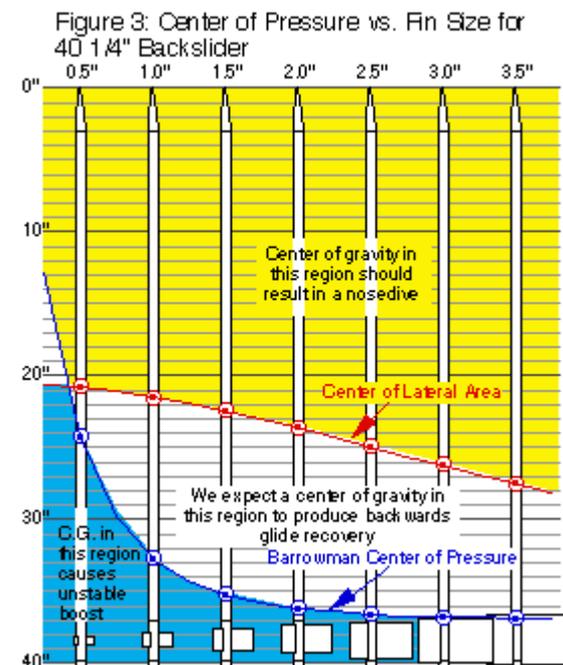
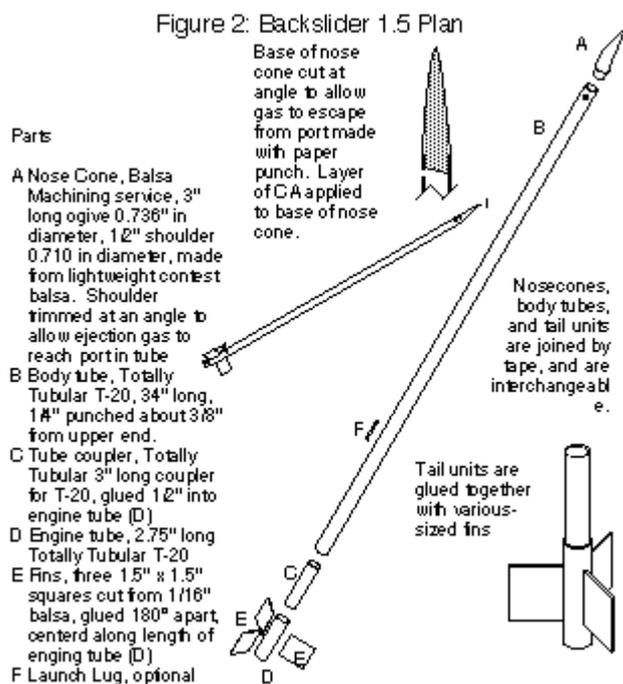
Data

We produced four types of data:

1. We calculated Barrowman and lateral area center of pressure locations. Both sets of equations were entered into an Excel spreadsheet. We calculated and plotted results for a range of theoretical models.
2. We measured center of gravity in the burnout mode by placing an expended B6-4 engine in each version of the test model. We also measured a couple launch CG's, but we considered this only for purposes of launch safety.
3. We made qualitative notes on the stability of each test flight on ascent and descent, including transitions to and from glide. We paid particular attention to the effects of the ejection port pitch maneuver.
4. We timed our flights according to NAR conventions, from launch to landing.

Results

Calculated Barrowman and Lateral Area Centers of Pressure



We calculated Barrowman centers of pressure (BCP, for low angle-of-attack) and centers of

lateral area (CLA, for high angles of attack) for models covering a range of fin sizes and tube lengths. Figure 3 is a plot of the results for our 40 1/4"-long Backslider model with various fins. Figure 4 is a plot of the results with an 18" tube replacing the 34" tube giving a total length of 24 1/4". Figure 5 is a plot of the results with a 6" tube giving a total length of 12 1/4".

we concentrated our efforts on the longest model of the backslider.

Ejection Port Pitch Maneuver

Our most pleasing qualitative observation was that the ejection port pitch maneuver worked in every case. The pitch at ejection maneuver was conspicuous, and successfully triggered the transition to a high angle of attack. In many cases we could clearly see the model tumble end-over-end at ejection. This proves that a novel class of model rocket, the no-moving-parts super roc rocket glider-the Backslider-can fly successfully and reliably once the proper CG-CP relationship is established.

Spinning vs. Non-Spinning Recoveries

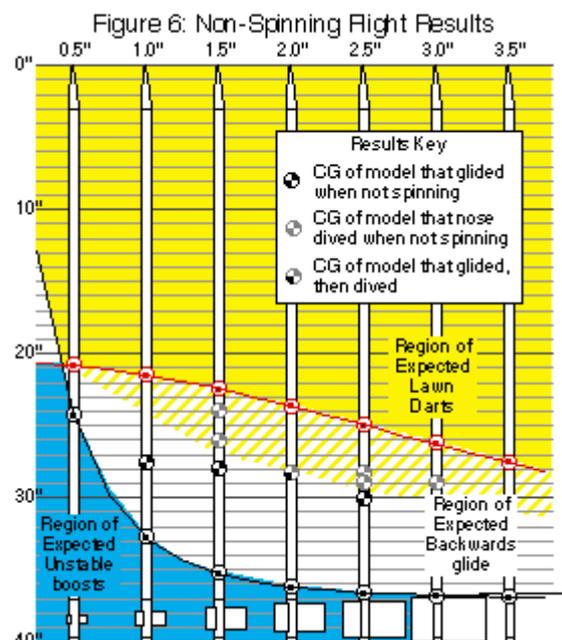
A second qualitative observation was that a model that spun rapidly around the roll axis on descent could fall horizontally or in a glide with a CG-CP relationship that would result in a nose dive when the model wasn't spinning. Spin or lack of spin on recovery was not easy to control. We made no effort to induce a spin on boost, yet some flights ended up with a spin after recovering from the pitch maneuver. Because a spinning rocket was more likely to glide, we chose to examine the CG-CP relationships in the cases of non-spinning recoveries to define the region of reliable glide recovery.

Effects of the CG-CP Relationship

We predicted that we would see glide recovery when the center of gravity (CG) fell in the region between the center of pressure (CP) curves.

Note that as the models get shorter, the envelope between the BCP and CLA curves shrinks, not just in absolute terms but also as a fraction of body length. In the case of the 40 1/4" model, the distance between CP's is as much as 12.8", or 32% of total length. For the 24 1/4" model, the distance between CP's is at most 6.2", or 26% of the model length. For the 12 1/4" model, the distance is just 1.7" at most, or about 14% of the model length. In this case, the need for one-caliber stability at launch, and the forward shift of CG during burn practically eliminates the chance for a backwards glide recovery.

This is consistent with the general observation that long, slender rockets are more likely to recover by a backwards glide accidentally. With both theory and experience suggesting a longer model would be more likely to perform,



The table below shows calculated Barrowman center of pressure, calculated center of lateral area, measured burnout center of gravity, qualitative flight results, and times. For safety reasons, we only flew models whose CG fell in the range likely to glide.

Table 1: Flights without spin

(presented graphically in figure 6)

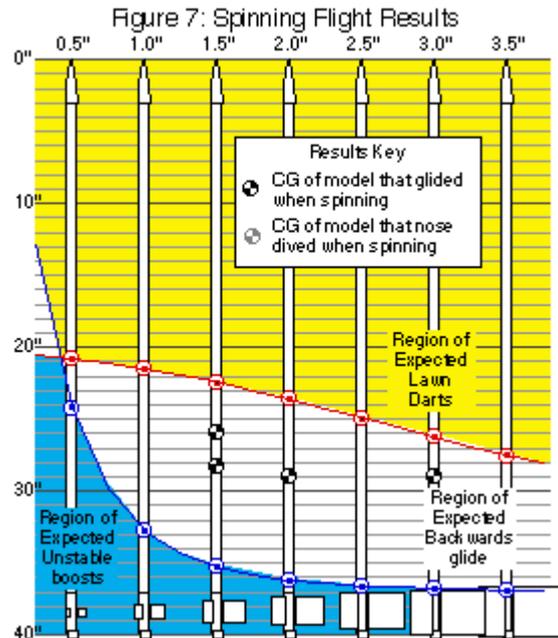
<i>Fin Dimensions</i>	<i>BCP from nose tip</i>	<i>CLA from nose tip</i>	<i>Burnout CG nose tip</i>	<i>Flight results</i>
0.75" x 0.75"	29.8"	21.0"	~27"	Unstable
1.0" x 1.0"	32.7"	21.5"	27.5"	Backwards glide, 25 and 27 sec.
1.5" x 1.5"	35.2"	22.4"	28"	Backwards glide, 40 and 37 sec.
1.5" x 1.5"	35.2"	22.4"	26"	Nose dive (one of five trials w/nose weight)
1.5" x 1.5"	35.2"	22.4"	23.9"	Nose dive (two trials w/nose weight)
2.0" x 2.0"	36.2"	23.6"	28.25"	Brief glide, transition to nose dive, 11 sec.
2.5" x 2.5"	36.6"	24.9"	28.5"	No glide, nose dive.
2.5" x 2.5"	36.6"	24.9"	29"	No glide, nose dive. (w/tail weight)
2.5" x 2.5"	36.6"	24.9"	30"	Backwards glide (slow roll) 29 sec. (w/tail weight)
3.0" x 3.0"*	36.8"	26.2"	~29"	Spinning glide, nose dive when spin stopped

Table 2: Flights with Spin

(presented graphically in figure 7)

<i>Fin Dimensions</i>	<i>BCP from nose tip</i>	<i>CLA from nose tip</i>	<i>Burnout CG nose tip</i>	<i>Flight results</i>
1.5" x 1.5"	35.2"	22.4"	28.2"	Spinning glide
1.5" x 1.5"	35.2"	22.4"	25.9"	Spinning glide (four of five trials)
2.0" x 2.0"	36.2"	23.6"	29	Spinning glide
3.0" x 3.0"*	36.8"	26.2"	~29"	Spinning glide, nose dive when spin stopped

* a single flight of the 3"-fin model displayed both flight modes



Because our understanding of the super roc rocket glide phenomenon depends on the relationship of the burnout center of gravity, the Barrowman center of pressure, and the center of lateral area, it is useful to present this data in a way that describes this relationship. We will define the relative CG position as the distance the CG is in front of the BCP in units of the distance between the BCP and the CLA.

$$\text{Relative CG} = (\text{BCP} - \text{CG}) / (\text{BCP} - \text{CLA})$$

If the CG is at the BCP, the relative CG is zero; if the CG is at the CLA, the relative CG is one; if the CG is halfway between the BCP and the CLA, the relative CG is one half.

In the regime where the CLA is forward of the BCP (true for all models we studied), a negative relative CG represents a model that is unstable at any angle of attack. A relative CG between zero and one indicates a model that is Barrowman stable (for low angles of attack) but cardboard-cutout unstable (for large angles of attack). In this realm, we expect to see the super roc rocket glide phenomenon. A relative CG of greater than one indicates a model that is stable at any angle of attack.

Here are the non-spinning results organized by relative CG.

Fin Dimensions	Relative CG	Flight results
0.75" x 0.75"	0.32	Unstable
1.0" x 1.0"	0.46	Backwards glide, 25 and 27 sec.
1.5" x 1.5"	0.56	Backwards glide, 40 and 37 sec.
2.5" x 2.5"	0.56	Backwards glide 29 sec.
2.0" x 2.0"	0.63	Brief backwards glide, transition to nose dive, 11 sec.
2.5" x 2.5"	0.65	Nose dive
2.5" x 2.5"	0.69	Nose dive.
1.5" x 1.5"	0.72	Nose dive
3.0" x 3.0"	0.74	Nose dive after spin stopped
1.5" x 1.5"	0.88	Nose dive

What we see is that non-spinning models attained successful super roc rocket glider flight in only part of the predicted regime. Models only reliably glided when the relative CG was less than about 0.6 (x0.04). If the center of gravity was located in the forward 40% of the gap between the Barrowman CP and the center of lateral area, the models nose dived.

One possible explanation is that the center of pressure at 90x is not the center of lateral area. We suspect that a more accurate method of calculating the 90x CP would weight the body tube and nose cone less than the fins.

Conclusions and Further Work

We have begun to assemble the design tools for designing reliable super roc rocket gliders. The super roc glide phenomenon no longer need be an accidental quirk, but a deliberate design feature. We have demonstrated a novel method for reliably pitching super roc rocket gliders into their high angle-of-attack glide modes. This could mark the beginning of an essentially new recovery system and a new class of model rocket-the zero

moving parts super roc rocket glider, or what we informally call the "backslider."

In the future, we would like to collect more data across the parameters of length, fin size, and CG to better define the limits of the tail glide envelope, and to optimize duration.

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4. [Scale Bash](#), Peter Alway, Saturn Press EAC Hyperion plan for BT-50.
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6. Centuri technical report by James Barrowman.
7. Estes technical report TR-9.

Abbreviations

BCP:Barrowman center of pressure
 CLA: Center of lateral area
 CG: Center of gravity
 CP: Center of pressure

Ed's note: Peter Alway is the author of several books about rocketry and scale model rocket building. *Rockets of the World* and *Scale Bash* are perhaps the most well known of these.

Rockets of the World is a huge book containing potted histories and, importantly, scale drawings of a wide range of rockets from around the world. Every scale model rocket builder should have a copy! *Scale Bash* is an excellent introduction to scale building, describing many conversions from readily available rocket kits. Available from Saturn Press:

members.aol.com/Satrnpress/saturn.htm

Project Orion

by Paul Lavin

We could have been to Mars in 1965!

Some of America's top scientists were planning to visit Mars by 1965 and touring the satellites of Saturn by 1970. The best laid plans of Project Orion were to use nuclear power in its most brutal form to provide the impulse (literally!) to tour the solar system while von Braun tinkered with kerosene and liquid oxygen in Alabama.

Sadly, Project Orion, resulted in only a meticulously planned but unbuilt atomic spaceship. Aside from a conventionally powered scale model, it never got off the ground. The theory was solid. Experiments showed that it could work and stay in one piece (and not kill the crew). Implementation budgets were sought but the project just limped along until it was killed off in 1965.

Orion was the victim of the NASA v US Air Force turf war, von Braun's rocket boosterism, international political manoeuvring and, perhaps in no small measure, the sheer outlandishness of using several thousand atomic bombs to blast a 4000 ton space ship to Mars and back.

The unlikely story of early Atomic Age scientific daring-go is told by George Dyson in his book *Project Orion: The true story of the atomic spaceship* (Owl Books, 2002) Author Dyson is the son of the famous physicist Freeman Dyson who was an enthusiastic participant in the plot to build the space ship for a journey to Mars nearly 40 years ago.



Orion Test Vehicle

The all-star research team assembled to create Project Orion included Richard Feynman, Stanislaw Ulam, Edward Teller, Dyson senior, Ted Taylor, Cornelius Everett, Francisco de Hoffman and other glitterati of the 1950s atomic research establishment from Los Alamos, Princeton and the US Air Force. They believed they could do it and set about their task.

Tests showed that an atom blast didn't annihilate everything. There is a 900 kilo plug of reinforced concrete that took off at an estimated 150,000 miles per hour from a bomb test instrumentation bore that is probably now on its way into interstellar space! You could actually conduct live tests back in the old days when there were no computer simulations and a more relaxed attitude to nuclear power.

Pusher plate ablation was found to not be a factor – the big problems occurred not when a bomb went off but when there was a misfire and the shock absorbers had to deal with the rebound. The mechanical engineering was daunting but no technical magic or unobtainium alloys were required. And the scale model flew!

The book recounts in detail the trials and tribulations of how a dedicated and inspired group of visionaries from our parents' generation tried to get to Mars. Every scientist and technician involved with Orion was intending to go along for the ride... a ride that would have taken half the time of the Zubrin's Mars Express flight plan thanks to the luxury of plenty delta V on tap.

Nukes became very unfashionable in the early 60s and no one was listening when the Orion team spoke of their highly evolved small, clean, propulsive charges that were fantastically efficient at directing their energy at the vehicle's pusher plate. It was calculated that an Orion lift off from the surface would have produced only a small even infinitesimal fraction of the fallout that was already in the environment from above ground testing. In the climate of the day (and indeed today), any at all was too much.

However, instead of a reusable interplanetary space ship that could have provided an effective way to deplete the growing super power nuclear arsenals, we got the use-once-and-throw-away Saturn/Apollo dead end flags and footprints production followed by the white elephants of the Shuttle and the International Space Station. Bad choice?

Orion was outlandish in the extreme. However, the greatest atom scientists of the time not only thought it could work but wanted to be the first to ride it to Mars. Building and testing Orion would have cost less than the whole Saturn/Apollo boondoggle and created a meaningful step to the planets and beyond.

Orion played a part in Jerry Pournelle's and Larry Niven's fictional work, *Footfall*, in the 1980s. But aside from that little else has been heard about it due to the classified nature of the underlying atomic research. That is, until Dyson's book brought interviews with the pioneers and freshly released film and files into the open.

Orion may not be completely dead as NASA as rediscovered atom power and may be about to revitalize its commission to explore beyond earth orbit. Certainly we aren't going to see a 4000 ton version of Orion lift off from the surface but we may see impulse powered craft heading for the outer solar system some day. We'll be able to watch its two pulse per second flare for a long while... delayed by a mere half century. Feynman would just shake his head.

Coda: I plan to help the UK junior rocketry team to build a scale model of the Project Orion test vehicle for FAI competition in Class. A scale model of a scale model? Why not?

The 1 m diameter test vehicle was powered by a succession of C4 explosive charges... I think we will probably manage to light a small cluster of conventional motors under it. I think we might be able to get away with a 1/5th scale.

FAI scale model competitions are rather daunting and the fledgling UK junior team will be up against competitors that spend hundreds of hours detailing rivets on Ariane IVs that actually peel of parallel staging and do all manner of tricks for extra points.

The Orion model is pretty simple and easy to do (we hope) and perhaps we will get points for being the first to model this interesting vehicle. It would be interesting to make an impulse powered version, perhaps with active stabilization... but not this year!!!

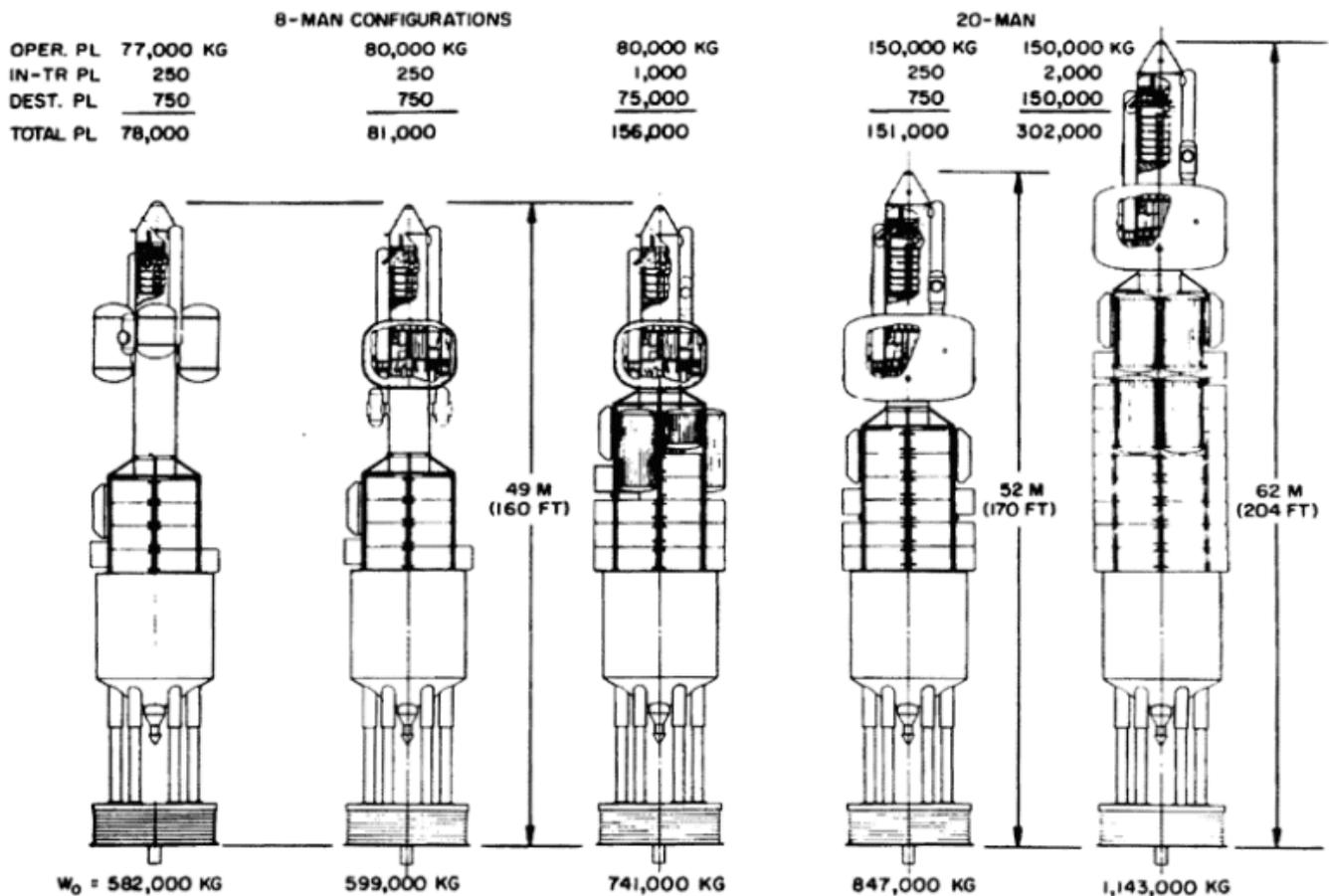


Fig. 3. 12--Various payload configurations on basic 10-m propulsion module (with departure weights for 72, 850 fps Mars mission)

Ozark Aerospace ARTS Altimeter

by Graham Platt

I'd been looking for a new altimeter for a while, something to act as a halfway between my PerfectFlite MAWD and the RDAS that I haven't got round to buying yet. I was quite taken with the BlackSky Altacc, but for one reason or another actually buying one got put to one side. At the start of July, I saw an advertorial piece on ROL for the Ozark Aerospace ARTS. I'd previously seen discussion of the test item, and how impressed testers were with the pre-release versions, so I had a closer look. And bought one.

The altimeter arrived very well packaged by US Postal Service Global Priority mail within 7 days of me ordering it - 2 of those were a weekend. Inside the box, alongside the receipt, were the altimeter, data cable, software CDrom and instruction booklet.

The altimeter itself is the same size as an Altacc, and has 2 mounting holes to fit either a standard Altacc mount, and also has a mount hole at each corner to fit normal mounting posts. The board has connector blocks for 9V in (it'll take 9 - 12V dc), an arming / power switch, and 2 pyro channels. There are connectors for the data cable, for a GPS unit (connects to a standard NMEA 2.0 GPS unit, with selectable comms speed of 4800, 9600 and 19200 baud) and an auxiliary unit - currently Ozark are producing an igniter expansion board and a telemetry module to work with the ARTS - the telemetry board should hit the street soon, as people are currently beta-testing it in the USA, with the igniter board to follow as demand dictates - it's already designed, but not built yet.

The altimeter works on both accelerometer and barometric sensors, so it should be suitable for use with hybrids (although it hasn't been tested on a hybrid flight yet, as none of the beta testers flew them), and is also

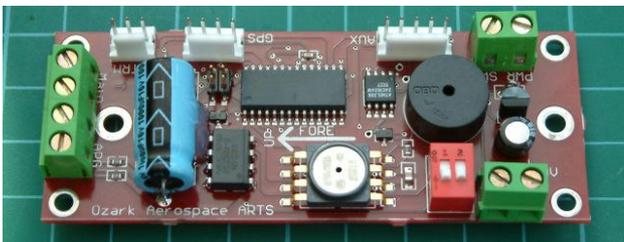
immune to the effects of transonic flight. The launch detect condition is 2.15G for 0.04 seconds. At apogee, the barometric sensor comes into play, and looks for the user-specified main chute altitude if it is set in the flight profile.

There is sufficient memory on the board to hold two full flights - the sampling rate is selectable between 10 samples / second (about 26 minutes of data is recorded), 20, 50, 100 and 200 samples / second (82 seconds of data is recorded at this rate). There are also 2 preprogrammable flight profiles that you can download to the altimeter, which are selectable using dip switch 1 on the board. Profile #1 is a basic one, with channel 1 firing at apogee, and channel 2 firing at a user-configured altitude, with adjustable sampling rate. Profile 2 is much more configurable - useful for staging, airstarting or just as a backup altimeter, offering firing of channel 1 and 2 at, or at an interval of up to 2 seconds after, launch, main engine cut off (MECO), apogee, or given altitude. In this profile, both channels are configurable for the same range of events, and again, the sample rate can be set from the dropdown list of options in the software. The pyro channels give 1.2A for 0.25 seconds - recommended e-matches are the Daveyfire white ones.

The altimeter connects to a PC using a supplied cable that connects into a 9 pin D socket on the PC. The software provided (Data Analyzer) is easy to install, and I've tested it so far on Windows 98 & XP. One caveat is that the cd may not be readable on older, slower CDrom drives.



Altimeter, cables, manual and CD



Close up of altimeter

The user interface is smooth and very easy to use, with both menus and shortcut buttons to the most frequently used operations. Features of the software include a data viewing screen that will show either a summary, interpreted data, or just the raw datapoints from uploaded from the sensors, as well as a graphing option. A diagnostics screen is available, allowing the user to test the beeper on the board and upload firmware to the altimeter. This screen shows the settings of both dip switches and also of the pyro channels, as well as allowing radio telemetry testing and ground firing of both pyro channels.

A nice touch is the availability of a flight information screen, where you can save data about the location, air temperature etc. of the launch site, and your rocket, along with comments, which is then saved as part of the flight data for future reference.

After purchase, you'll also be added to the ARTS users email list, run by Loki Research, where you can ask all manner of silly questions about the unit, share flight experiences & reports etc. with other users, as well as providing feedback and 'what about adding...?' requests. One of the main users of this forum is Erik Hall, the main designer of the ARTS, so tech questions get answered straight from the source. I can vouch for the usefulness of this forum, as some of the facts used in here came from Erik's response to my questions posed on there.

Overall, I'm extremely impressed with what is a lot of altimeter in a neat package, for not much money. I ordered it from www.lokiresearch.com for 150 US Dollars - shipping was an extra 8 dollars, so at the time of writing, that's around £100 all up. I was hit for import duty etc. by customs, which added just under £20 to the cost, but it's still extremely good value at that price. Loki have a limited number of these units at \$150 as an

introductory offer - once they're gone, the price will be \$200.

Addendum: I flew the Ozark ARTS altimeter on a Hypertek J317 - it worked perfectly. Very heavy rocket (c. 14lbs loaded) and hit 1265 feet, dual deployment with drogue at apogee and main at 800 feet. I got some unusual data recorded for the first 1.25 seconds, which, I assume, would be ignition etc. phase of the hybrid. The data file is out with Erik of Ozark Aerospace & Jeff of Loki Research for analysis at the moment, so I'm not sure what caused the anomalies, but this level of manufacturer interest is excellent.

I'm a Housewife - get me out of here!

by Felix Lennie

I wonder how many of you would start up a 'sewing-circle'; 'a flower-arranging group'; 'a belly-dancing class' or even an 'under 5-s reading club' or a 'pensioner's tea-dance or 'sequence dancing' club? I know you will say that 'presumption is a dangerous thing' and the inevitable percentage of rocketry-fans particularly male who actually would (perhaps have), please get in touch! I really want to hear from you!!

Perhaps, however, you others may be able to grasp a notion of who I am, what I am about and why I continue to work so hard establishing the South-West Rocketry Club known as SWARM. Believe me, it is and always has been very hard work not just for me but for Jim and Roy (also Phil in his own area) who, at least have been 'bitten by the rocketry bug' and are now very enthusiastic!!

After eighteen months of letter-writing, poster-distribution, e-mailing and campaigning, gradually we are seeing signs of success. We have built up a great relationship with local

people, the local media, Chivenor and the local police. To the prestigious supporters of the club since its inception, the 'Rocket Boys' Homer and Jimmie; 'Starchaser' Steve and Adrienne and Stephen Hawking have been added Lord Sainsbury of the D.T.I and John Burnett our local M.P. The opportunity for doing 'talks' in schools and colleges has encouraged us to put together presentational material which could be used as a basis by any member of the club invited to do a talk or display.

If all goes to plan with the important Mayflower Project, I hope to approach the N.F.U via club contacts to see if we can at least get some low- medium power rocketry sites organised nearer our scattered members particularly those down the 'toe' of Cornwall. Phil in particular has had some success already in South Wales. Of course, I realise any new sites would be subject to UKRA scrutiny but at any rate it will be helpful to set a precedent for the rocketry calibre of Mayflower at our local site to enable Level 3 and other flights to be locally acceptable. The BBC documenting the Project will also be hopefully helpful. I keep saying it but once more round the swings won't hurt—we are glad of ANY advice or input from any UKRA members who feel they can support Mayflower. It is more about establishing high-power rocketry here than about the altitude attempt and getting it right is more important than 'looking good' !! (the men of course wouldn't agree !!)

Don't be misguided into thinking that because 'rocketry' isn't a 'chosen' hobby or interest of mine that I won't give it 100% (which is actually what I scored in Paper A of the written Level Two exam !). James and I, whatever 'life' throws at us tend to regard it as a personal challenge, are super-competitive and will maximise every opportunity to the nth degree.

A 29 mm Aerotech reload H 97 J has been donated to encourage me to do a Level One Flight with my 'Alpha-Omega' warthog which I intend to do at the Open Weekend of 26th/27th July hopefully under the eagle-eye of Pete Davy and anyone else who wants to see the 'little housewife' in action !! The hospice where I was a patient for so long desperately needs an extension with respite

beds so perhaps I should sell tickets !! James had a very hard time because there were no respite beds when I was ill so it is a big deal to all cancer sufferers and their families in the area. The building of the warthog is well-documented on the SWARM Data & Design website at :- <http://www.swarmrocketry.co.uk/rocketbuilding.htm>

For those who have not seen it, I followed the instructions except that I discarded the motor adaptor and centring rings as not needed with the 29 mm motor tube. I also discarded the thrust ring and thrust ring flange then used a pair of pliers to cut the tab off the motor hook so the mount will accommodate a longer motor casing which hopefully Nigel Woolcock is lending me. The warthog on an H 97 J motor, sims to 2600 feet and should look spectacular as it climbs into the sky on a black pillar of smoke. I will need to balance it with 3-5 ounces of ballast in the nose-cone to keep the CG ahead of the CP.

I remember the thrill I got the first time I launched 'Alpha-Omega' knowing that I had built it myself and that I had 'got it right' !! I'm sure that as SWARM progresses, I will get time to get more fun out of rocketry again especially when the caravan becomes the Club Base instead of my home, Mike's eye operations enable him to return as the Club Photographer and the administration gets less. I do however get a lot of satisfaction and fun out of watching others of all ages getting a 'buzz' out of launching. My mother in particular, the 'Goldstrike Granny' who is such an inspiration to everyone who meets her, loves launching and with her 90th birthday coming up next year, I will be hard put-to-it, to think of an appropriate 'birthday' experience !! Any suggestions ?

Felix Lennie
SWARM Founder & Secretary & Web Mistress

Editors note: Since writing this article Felix has successfully gained her Level 1 certification, but has stepped down as Secretary and Web Mistress for SWARM. She deserves the well earned rest and, hopefully, will be able to fly more rockets.

David & Goliath A Tall Tail

by Ross Finlay

If you can't beat world record holders you might as well join them by creating a new record. This is the story of how I claim to have made & successfully flown the world's tallest model rocket at IRW 2002. The current status of my claim from the Guinness World Records is that they do not have a record for this but they will abide by the UKRA definitions of a model rocket.

Two years ago a very good family friend, Liza Downie, spotted an advert in the Glasgow Herald for John Bonsor's Model Rocket Workshop at IRW 2000. She suggested we take our families over to Kelburn Country park for the afternoon, spend our £5 per rocket and learn how to make a model rocket. (A ridiculously small sum when compared with the cost of a family trip to the cinema).

Most kids lasted about 20 minutes before giving in to the magnet in the play area, but they came back from time to time to see how we were doing. They need not have worried, the Dads & some Mums saw out a very pleasant few hours crafting away; making our nose cones & streamers, cutting and sanding our fins and putting it all together under John's expert tuition. Finally we were issued with a C6-3 motor. Petal 4 was weighted, swing tested and taken to the launch pad. The name Petal 4 by the way came to me after ex-friend Bob Downie mentioned that my carefully curved streamlined fins looked rather "girlie". She flew straight as a die to 1000 ft.

At this stage I was warned by a passing high power rocketeer about the addictive nature of model rocketry, but it was too late the virus had entered my system.

The first thing the virus does is to back itself up, so I had to find a mate who would also be interested in the new hobby. It did not take long. My first port of call was the Cathcart



Goliath on the pad

Chess Club, a place where competitive eccentrics of all ages and types can meet and feel perfectly at home. My young chess mentor had previously told me the Campbell Dougan was the most weird person in the Club. Of course I had to meet him and have an eccentricity show down ASAP. We found that the rest of the world was equally out of step with both of us and discovered a shared interest in armchair cosmology. Rockets were of course right up his street and we were soon directing our creativity into an easy competition designing & scratch building our rockets mostly from found or cheap materials.

As this stage I thought the proper way to have fun with rockets was to gain as much height & speed as possible. One theme was to do the minimum necessary to stabilise the motor. The result of course was quite a few lost rockets.

A year passed and we went to IRW 2001 (Campbell knocked a few socks off with a rocket made from drinking straws). I saw high power rockets fly for my first time and was duly impressed, not least with their ability of their owners to get them back. It was a lovely day with a fine view, Arran's sleeping warrior mountains in the background, the ferry dotting

back and forth from Largs to Millport over a very glassy firth of Clyde. There was plenty of time between launch windows to chew the fat with other model rocketeers who enjoyed watching the big ones but did not have the premises, budget or whatever to try high power rockets for themselves. During one of these conversations a rocketeer said, "of course the purpose of model rocketry is to show off". I disagreed, I thought the purpose was to have fun. He has now forgotten our conversation and wishes to remain nameless rather than having any of the discredit for inspiring my project.

He had started me thinking though, maybe I should try out this idea of showing off. After all I wasn't having so much fun when I lost rockets. Hmm well showing off ... , big is good, the rocket won't go so high and so far, and it will be easy to see in the sky and the long grass, Ye gods, I'll get it back! It might even be fun.

OK, I'll try it, the new protocol is tall, broad, lightweight, big "fluffy" rockets (BFRs) which make people go WOW! when they see them and probably Ha Ha! when/if they fly.

I'm an engineer with equal respect for theory and practice, now I have an objective to optimise my design and materials towards. I made a spreadsheet on my PC with formulae to mathematically express the WOW! FACTOR of potential fuselage materials. For a long time I was a "fuselage man" looking for the nearest thing to my ideal which would be an infinitely rigid, zero weight force field which could be painted (if you don't see it, it doesn't make you go WOW!). It is interesting to note that the purpose of the fuselage is now to carry the maximum area of paint into the air. Everything went into the spreadsheet from cling film tubes, beer cans, doweling, drink bottles but polystyrene coving won by a long shot.

When the time came to turn a fuselage into a rocket a few of my previous rockets influenced me. There was Five-sat-on, a fun rocket from my earlier days. It is a cluster of five C motors sat on top of a bamboo cane with a string tied to the bottom trailing strips of bin liners, crepe paper & Christmas decorations. It comes with a built in poor man's altimeter and recovery

system. It took some stick from Campbell "not a proper rocket" but it went down well (up too) at IRW 2001 despite his sabotage slipknots allowing some strips to slide along the string.

Then there was the flying poster tube, not a successful flight (the only rocket I have seen takeoff twice in the one flight) but very helpful in refining my ideas. I changed too many things at once (four) – no nose cone, let the air through the rocket, motors towards the front, no fins. It was also the first time I had tried four stages.

My job had me teaching a fibre optics course for a mechanical engineering company in Sydney. During the course, I would say – "Fibre optics is not "rocket science", anyone can understand it, in fact even rocket science is now easy. If anyone is interested in rockets we can have a go after the course." Well guess what the virus had spread again, in fact it was already lying dormant in several people and rapidly became active. The balcony of my hotel room became a paint shop, and on some swampy land with Chinook mozzies, we let fly some good and some not so good rockets.

After returning to the UK the thing that really made me decide to try a 25ft rocket was when my wife called me from her favourite coffee shop. She said I had to join her urgently and look at "Hello!" magazine. Now this seemed a little strange since we are really quite different characters, for example she is NOT a rocketeer and I DON'T read "Hello!", but I know better than to disobey, so off I trotted. When I joined her, there it was, the Aug 21 2001 edition, open on the table at a picture of Frank Sharman with his 23ft rocket "Yellow Peril" the fuselage bending through about 20° in the breeze. Yes this is the downside of BFRs, they like calm conditions. The caption said he did not get into the record books since the launch had to be aborted. ...so he would have if it had gone OK? ...hmmm, I wonder how tall my BFR "technology" would go? Amazing! it should do it, even more amazing, a rocketeer got into "Hello!", I could finally win the respect, nay adulation of my wife, ...hmmmmmm.

The logic of my BFR series is this. Most scratch build rocketeers start with a tube, put

a heavy motor at the back, then add fins, nose weight or both to ensure stability. The centre of gravity COG ends up one or two diameters ahead of the centre of pressure COP and like an arrow or a shuttle cock or weathercock it will point nose into the wind.

I thought why not put the heavy motor at the front where we want the weight, as per stick rockets like a firework rocket or Five-sat-on (see above). Now we won't need fins or ballast weight (and the whole thing can be bigger), so much the better if we then let the air through by making the fuselage open at each end, a ventilated rocket, like the flying poster tube (see above). It is worth noting that my reason for putting the motor at the front is for weight distribution, not the Goddards's folly notion that pulling is better than pushing to make the rocket go straight. Of course it also helps that a lightweight and flexible fuselage is in tension rather than compression if you want it to stay straight (no buckling).

I told John Bonsor of my intentions and we had some lengthy telephone discussions between mentor and student. He must have met a few loose cannons in his time and does not really like finless rockets (they are blown in the wind too much). I had a bit of an uphill struggle to convince him that I was in fact a creative, talented (& modest?) amateur rather than the loose cannon I must have sounded like. Anyway he must have been persuaded eventually since he was range safety officer when David & Goliath flew at IRW 2002.

Rocket no. 1 in the BFR series was Tom Thumb – WOW factor 1. Eight feet long, powered by a single D12-3. A 4ft tripod of doweling rods connected the motor mount and chute container to 4 x 4 ft of coving held together to make a circular hole in the inside and an octagon on the outside.

The first "flight" went 3 inches up the launch rail (a wooden stake through the middle). I attached the igniter wires to crocodile clips either side of one of the doweling rods, cleverly making sure they would not short circuit but stupidly ensuring that the rocket would be lassoed by the spent igniter and launch leads. After this potentially embarrassing experience I was glad that I had checked that the top tripod structure passed a

swing test and would make a stable rocket on its own right in the unlikely event that it separated from the coving tube. This leads to the point in the title of this article ie the coving tube can be regarded as a (very) long circular tail fin rather than as a fuselage with the motor at the front. My response to the question, Is it a fuselage?, is it a fin?, is it a launch lug?? is, it is all of these & none, it is a structural element of the rocket and like any other it has weight and air resistance, contributing to COG, COP, drag etc.

Two days later Tom Thumb flew successfully, landed in a loch and I got soaked for 30 minutes in torrential rain waiting for it to blow to the shore. Campbell would have stayed to share this experience with me, but I told him to go back to the car knowing it would be torture for him to watch me getting soaked without having a flask of tea to hand.



David on the pad

WOW factor 2 was David at IRW on 23/8/02. Sixteen feet long. Just like Tom Thumb but with more coving and this time with a cluster of 3 D12-0s plus a D12-3. The purpose of David was to work out solutions to the problems of erecting a large flexible structure with so much weight at the nose as well as sorting out how to hang launch leads high in the air without the weight of the wires

detaching from or pulling out the igniter. David went from horizontal to vertical about six times as different problems appeared. One time the wire pulled out of the back crocodile clip (sorry Adrian). Another time the rocket bent so much on its way to vertical that it looked like the curve of the Sydney Harbour bridge ie nearly doing a U turn and considerably straining the fuselage.



Goliath's Traction unit and chute holder

Next up two days later was Goliath – Wow factor 3. 25 feet long powered by 8 Ds in two stages, each one a cluster of four. This required another trip to the hardware store for coving and a 2.5 metre extension to the launch rail. Perhaps my record attempt should be for the biggest rocket and launch pad to fit in a small hatchback. The bend in the fuselage was straightened with taught optical fibres as tension elements and pieces of doweling as compressive elements. Goliath also had a longer tripod and the three outrigger boosters angled outwards to avoid cooking the polystyrene quite so much.

A launch controller with a very long lead was borrowed thanks to Claire Hunt for seeing what we needed and sniffing it out in time. All the previous launch problems had been sorted by David though we had a hacksaw on hot standby and were ready to cut off 2ft lengths from the tail if necessary. Goliath went from horizontal to vertical nicely first time with a skilled effort from the Warp Factor team (Niall Fairbairn & Campbell Dougan) on the fuselage and me on a long tent pole (see picture).



David taking off, note the exhaust coming out the base of the ventilated rocket

David's fuselage remained a bit curved and so flew more like a bird than a rocket. It went in a low arc going maybe 200 feet up and 600 feet along. The parachute deployed about 50 feet above the ground, suddenly arresting David's sidelong downward cruise. Amazingly neither the strings nor the 1.3 m chute was ripped by the shock, in fact the flexibility of David's body and the fact it was cruising almost horizontally acted as a shock absorber, the front of the rocket was stopped by the chute while the middle wobbled and the tail fell to the vertical, then the rocket slowly descended to earth (one day I will get the movie or stills on a web site).



Ross, Niall & Campbell putting Goliath on the pad, Andrew Bevan checks our work!

On recovery I could see that while the one D motor as per Tom Thumb had little affect on the heat shield (to stop the exhaust destroying the polystyrene) the four Ds powering David was a different matter. At the top David's inside was blackened for 2 feet by the hot gas and even at the tail end 12ft down the tube the wall thickness was reduced

The sun was just going down and Goliath lifted on the first countdown (thank God) to become the last rocket of IRW 2002. The fire at the back of the four Ds looked great in the dim light (see picture) plus we were seeing and hearing them from quite close as Goliath went straight up to a John Bonsor estimate of 600±100 ft and then ... straight down.

I always wanted to have a D12-1 or a D12-2 to pop out the chute (but they don't exist) so Goliath was already hurtling down tail first when the D12-3 pushed the chute out, the shock was too much for some of the chute strings and Goliath effectively descended on a big streamer. He almost landed back on the launch pad. The initial landing was on the weakened part that had been cooked by David's motors, and while it made an excellent 2ft crumple zone (see photo) I can't help wondering, if it had not been weakened would Goliath have bounced pogo stick style? Next Goliath slowly started to fall over, and as noticed by John Bonsor only then did people step back as a new (and minor) hazard of model rocketry became apparent – the rocket might fall over on you after it lands. All this is visible in the wonderful (to me) video taken on my camcorder - thanks to Mark Dunn.



WOW!

3x30cm tube and the strengthening of the attachment points must have been the last straw. The chute only came 1/2 out and did not deploy. It was however pleasing to see that "Goliath with a spin" did turn in the air as well as spinning. It takes a while for a 23ft long rocket to do a 180° turn but it did manage it before crashing nose first into the ground. The doweling shattered but the rest is still useable so I only have about 19ft of the remains standing by my stairs. My next plan (before Colossus) is to fly "Goliath with attitude" launch him at an angle and hope to achieve the same shock absorbing effect that David had when the chute opened. Another idea to avoid breaking the chute strings is to use a single D12-0 as a third stage to provide a "boosted cruise" phase and deploy the chute nearer the top of the flight, it might make Goliath appear to hover at about 700 feet WOW!



Goliath's crumpled Zone

With the amount of stress relieved I could have fallen over myself. John came over, shook my hand and said "Well done Ross, you've really proved your point." I wondered if there was a silent plea "Now please stop!" Well when God was handing out the genes for embarrassment I obviously missed out so hopefully sometime there will be a Colossus – WOW! factor 4 and even an Atlas - WOW! factor 5.

The next day was experimental day so I wanted to fly Goliath again. This time it would be two feet shorter (after cutting off the crumpled zone), the outriggers were angled to make him spin and the chute attachments reinforced. Most people had gone including the kind but anonymous person who had previously loaned their long wired launch controller. John B. kindly came to the rescue with a 23ft length of quickmatch and a couple of inches of slow match. The result was a spectacular launch, slowed down on the video you can see the effect where black powder has collected at the folds in the quickmatch and the tube is weaker, it goes fizz boom fizz boom every 50cm.

It is quite difficult to pack a 1.3m chute into a

Remember my thesis is if you are not worried about cooking a payload and if you are not after the benefit of staging by dropping off the odd fuel tank, the engine is best at the front of a rocket both from the weight distribution point of view and because the BFRs are flexible structures which will behave better in tension than compression (imagine trying to push a water-skier with something the same weight as a rope).

Perhaps someone from the world of high power rocketry have the guts to put an engine at the right (top) end of a rocket at IRW 2003 (Aug 18 – 25 at Kelburn, Largs) or elsewhere, if so please let me know about it (email above). Could BFRs be part of the future for model rocketry? Well I agree with Bob Dylan, the answer is - "blowing in the wind".

Thanks to:

- John Bonsor for introducing me to model rockets and helpful discussions.
- Bob & Lisa Downie for finding John's workshop.
- Campbell Dougan for the healthy competition.
- The Lightspeed (now Warp Factor) team (Niall & Campbell) for carrying & erecting Goliath.
- Anonymous rocketeer for revealing the true purpose of model rocketry (showing off).
- Frank Sharman & Hello! magazine for further inspiration from the picture of the bent 23ft rocket.
- Adrian Hurt for loan of launch controller.
- Mark Dunn for the excellent camcording.
- Claire Hunt for timely borrowing all the things needed at the launch.
- Andrew & Jonathan Cross for lending the long tent pole used to push Goliath to the vertical.
- Andrew Bevan for construction (not constructive) criticism, I always listened anyway.

...when rocketeers first saw a BFR:

- "WOW!" – This is the desired effect of a BFR (big fluffy/flexible/...rocket)
- Q - "This is a wind up in't it?" A – "Yes, but it is also going to fly"
- "I think we have an article for the newsletter here" – sorry it took so long.
- "It won't work because a... b... c..." It worked & we are not finished yet.
- A few cold reactions were apparent, this is to be expected, after all who likes a show off and when you are working on a 25ft rocket you don't have to say, "mine is bigger than yours"
- Q - "it will work, but why would anyone do it?" A - "a very good point, I thought it could be done, no one else was going to do it and I don't fancy sitting on a pole for ages to get into the record books!

Technicalities:

a) The Walk Test

While BFRs with motors at the front are obviously very stable (I estimate 13 calibers for Goliath instead of the usual 1-2) some BFRs can have motors at the back and fins. As per any large rocket the usual swing test is not practical and much debated in any case. The approach is to use software like VCP but it is nice to have a real experimental result also. The usual criticism of the swing test is that centre of pressure varies with speed and the swing test is too slow and conservative

especially if the string is short. To test BFRs in a similar way I developed the walk test. As per the swing test the rocket is supported at its centre of gravity by a string, you then walk forward with the rocket suspended at the centre of gravity, the hope is that it will start to turn nose forward. If outdoors just see if it points into the wind (weathercock test). Obviously this is very low air speed, but BFR's don't go all that fast, especially off the launch rail when it matters most, so it is kind of like a low speed swing test on a long string. This will be conservative but not as conservative as a short string swing test.

b) The Centre of Pressure Test

The walk test principle can be taken farther to find the low speed centre of pressure. Just add weight to move the COG till the rocket goes neither head nor tail into the wind.

c) Safety

BFRs are in many ways safer than conventional rockets. They are big, easy to see and avoid if necessary. They accelerate, travel and turn relatively slowly. Goliath was on the limit for the safe take off weight per D motor (the worry is the rocket could leave the launch rail too slowly for it to be stable, ie a lazy launch) but even without conventional fins to stabilise them David & Goliath took off well. They had the benefit of an unusually long rail and of course and that walk test would apply well at low speeds. Calm weather of course was also very helpful. I feel there is a case for revisiting some of the usual rules for range safety officers in the case of BFRs. especially max launch weight per motor.

Update: Colossus - WOW factor 4, flown at the IRW this year. The bare bones are Colossus was 35 feet, launched successfully and flew OK for about a second, did some very interesting aerobatics for some very simple reasons, then what turned out to be the first & third stage of a rocket intended to be 1½ stages made very nice landings. Even I would not claim a successful flight however, though I learned a lot and it was a pretty good achievement to get him to the vertical.

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Monocopters and Staging

by D. Russell

The Monocopter

After seeing a J90 powered monocopter at a Maryland Delaware Rocketry Assoc launch two years ago I decided to build my own monocopter, a search of the internet produced little in the way of instruction and so the project was shelved. Roll on IRW 2002 where I was given basic instructions on how to build a monocopter, four iterations of the monocopter later and I finally had a version that flies. The following instructions should allow one to construct a 24mm monocopter that will fly on motors ranging from a D12 to an F12J.



Figure 1. The monocopter

Parts

1. Balsa sheet (12x2x0.5 inch)
2. Wooden dowel (9 inch, 1/8 inch diameter)
3. 24mm motor tube (2 inch long)
4. Fiber glass and epoxy
5. 1/4 inch drill bit (launch rod)

Construction

1. Sand about 10 inches of the balsa into a wing profile, Figure 2.
2. Epoxy the motor tube onto the non shaped end of the balsa at 11 degrees.
3. Apply 3 layers of glass and epoxy to motor mount-wing join.
4. Drill a hole with the drill bit 1 3/8 inches from the non shaped end of the balsa. Currently I've flown my monocopter on a D12, D11, E18W, E11J and an F12J without problems.

5. Epoxy the dowel across the wing next to the hole drilled in 4.

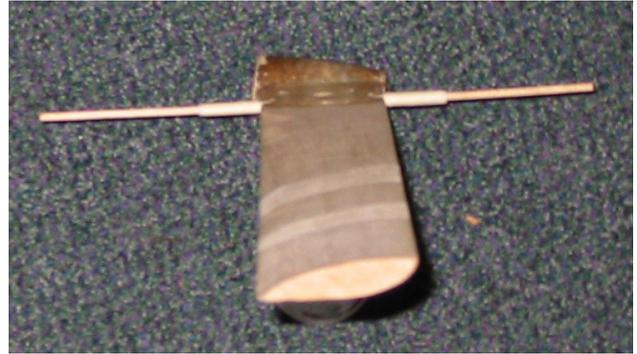


Figure 2.

Flight

A launch controller with longer leads than the standard Estes controller is recommended as a failure of the monocopter can be quite dangerous. A sturdy pad is also recommended (Figure 3.) as a monocopter will easily break an Estes pad. Be sure to clear the launch area of tall grass etc and pin the pad down using the pegs then test the fit the loaded monocopter on the launch rod (should be about 2 inch long, I use a drill bit) and spin the monocopter a couple of times to check it won't catch on the pad. eg Figure 4. Finally install the igniter as per the Estes/Aerotech instructions, retire to a safe distance and launch.

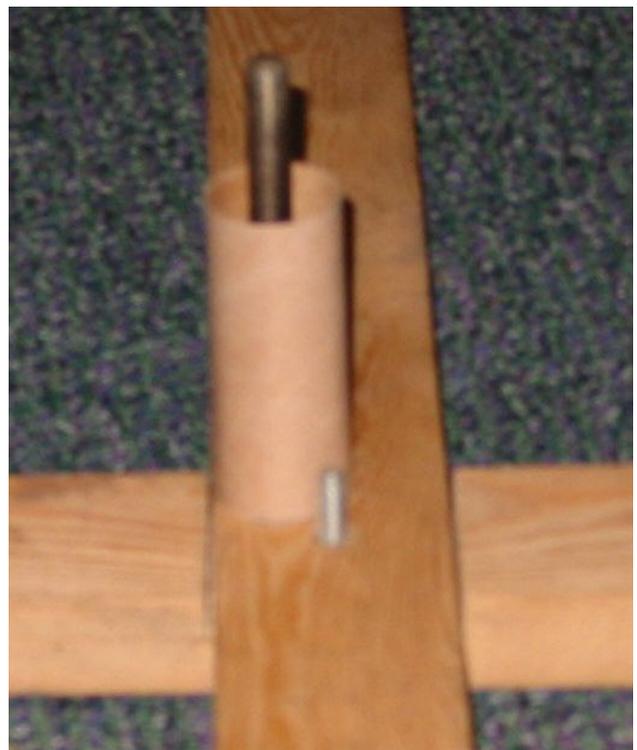


Figure 3.

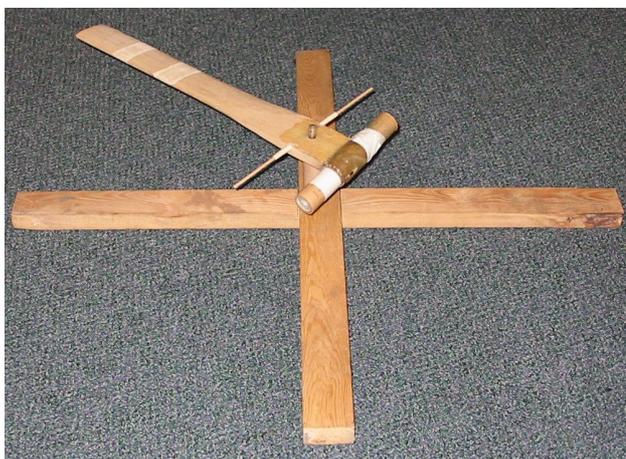


Figure 4.



Figure 6.



Figure 7.

Staging the monocopter

After flying my monocopter at bigEARS 2003 someone suggested I try staging it using a pair of Estes D12s. Having flown a 9 stage micro cammanche I felt this wouldn't present a problem. The first flight showed this confidence to be misplaced as the second stage failed to light, below is the method I've used to ensure reliable staging.....

1. Cut a small length of quickmatch and insert this into the sustainer nozzle and use a small piece of tape to hold it in place, Figure 5.
2. Place the two motors together and join using masking tape, one or two wraps are all that's needed, Figure 6.
3. Wrap masking tape around the booster motor to create a thrust ring, Figure 7.
4. Place the motors into the motor mount and use more masking tape to hold the sustainer motor in place, Figure 8.
5. Fly.....

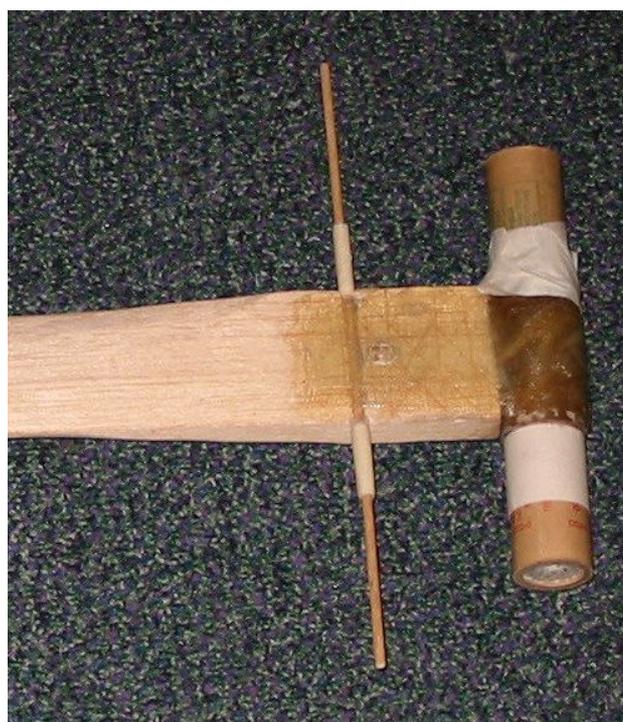


Figure 8.



Figure 5.

Ed's note: Dave says to look out for his 38mm monocopter soon!

You can read more about Dave's monocopters at the web site of the Wirral Rocketry Society: www.rokits.org

Alternatively, if you have any questions about this article, you can contact Dave directly: d_a_russell@yahoo.co.uk

PHYSICS OF FLIGHT



ALARM (UK)
(Air-Launched Anti-Radar Missile)
Length: 658mm (27.5")
Engine: D

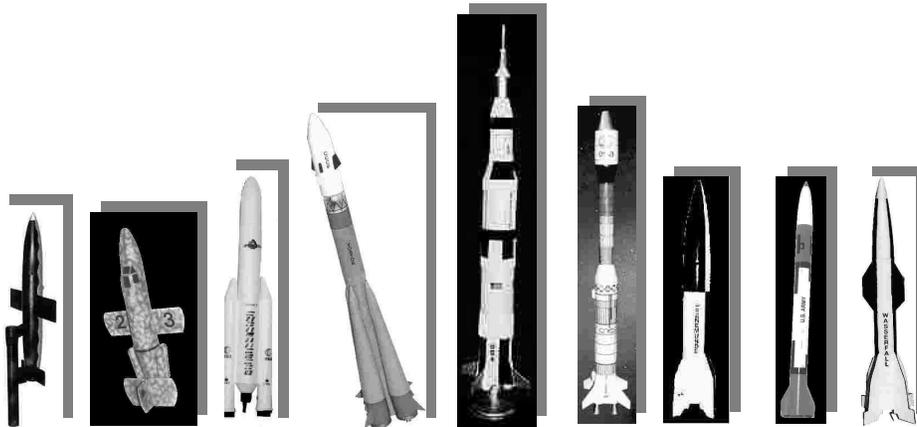


NOMEX
No more recovery wadding
needed! Hobby pack contains:
Three 3"x 3"
Two 9"x 9"
One 12"x 12"



ADDER
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Length: 610mm (24.5")
Engine: 3xB or 3xC cluster

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Video Moments, Micro Javelins and a Soggy Launch Crew

by Frank Sharman

The Rocket Season began for me in March 2003, with the start of a month long exhibition of my Javelin display rockets at Mansfield Museum, All the flying was done on video film, thanks mostly to Carlton Television, who produced some past moments of Javelin newsreel footage that looked back on with some amusing nostalgia. The exhibition was a great success and resulted in some new flying dates being booked in 2003.

However, all the rockets were cold and silent until the 1st of May when I conducted the first live fire launch of the year which was another Javelin milestone. This time it was no giant missile on the launch pad, but the first public demonstration of a Micro Javelin, smaller than a pencil and powered by two short strands of quick-match. It was also a launch conducted indoors. Yes I did say indoors, from a tiny Javelin launch site set up on a small plywood base.

It was all part of a special demonstration of my rocket activity for the local school, and was The last bit of fun planned to take place in the school hall. Of course, in classic Javelin farce, the first attempts were foiled by a blocked vent tube on The launch pad which refused to be unblocked. In the end, a by-pass ignition was rigged and a perfect blast off was rewarded by a big cheer. The tiny rocket pleased all the children by leaving a sooty imprint on the hall ceiling, which was then shown as unquestionable truth that a rocket really had been launched inside the school.

The first conventional rocket launch came on the 11th of May at Morvan Park carnival. This involved six mini class Javelins, taking off and landing from a central arena. The only thing being, this year, the arena had shrunk to half its size. Not surprisingly, I didn't get one rocket back in the cordoned compound, but this was

not really a problem because of the new display rockets' soft airframe.

This launch nearly didn't come off at all though, because of one of those strange viruses that make you head feel like a bucket with a brick in it. On the morning of the 11th I felt as if I were dying, and 'phoned up the



Exhibition Stand

organiser to explain that I was too ill to put my rocket trailer in the parade that morning. However by dinner time a sleep in the arm chair had taken away the headache and just left me with a bad cough. So being as the launch was set for 1610 hours, I phoned again and said I was still going to put on the actual rocket display. A little fresh air seemed to revive me further and I was soon on site assembling mission control.

Time flew by and I just managed to get six rockets ready for the introduction on the P.A. system for the Rocket Man at which point, on perfect cue, the heavens opened up with a heavy shower of rain. In less time than you can count from 10 to 0 everything was wet and everyone was expecting the rain to make things a damp squib. With a soggy launch crew suit dripping H₂O onto my finger tips, I did my best to be quick fitting clips to igniters. Then the signal was given and countdown began.

The first count ended in a miss-fire. It was as we had first feared, but no, wait. A clip had come off. We tried again. 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, zero! Whoosh! The rocket was away to a heartwarming cheer. And so too did all the other five Javelins. When the last rocket blasted off and the spectators were still cheering, I gave a satisfied smile and, despite the distant drums in my head and aching limbs, I was nevertheless pleased that I had made it after all.

Building Boattails

by Leon Kemp

One of the most effective methods of increasing the performance of a rocket is to add a boat tail. Essentially, a boat tail changes the rear of a rocket from a large flat surface with high drag, to smaller (although still flat) surface with lower drag.

There are several methods of constructing a boat tail, including modifying a nosecone, creation of a simple shroud (which gives most, but not all of the benefits), and fiberglassing over a mould. This article will deal only with building a boat tail by modifying a body tube.

To start out, draw a full-size side view of a transition that includes the desired dimensions. This should allow for the dimension of the base of the rocket (as it exists), the length of the transition, and the desired final dimension (usually just enough to clear motor installation). (Fig.1)

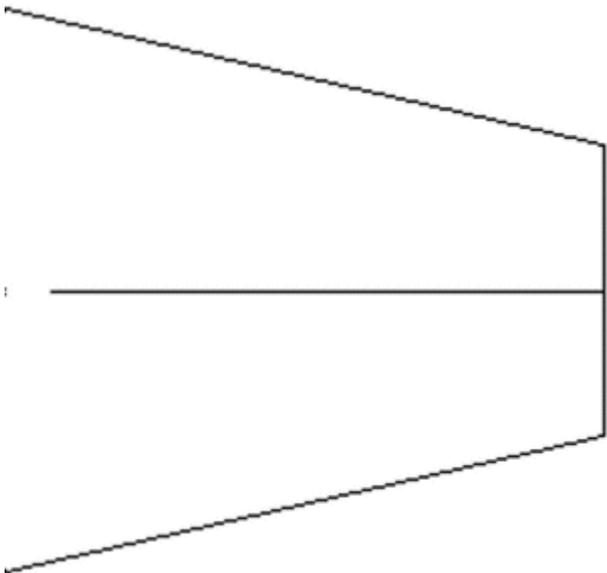


Fig. 1

Now, extend the two sides to form a point. (Fig.2)

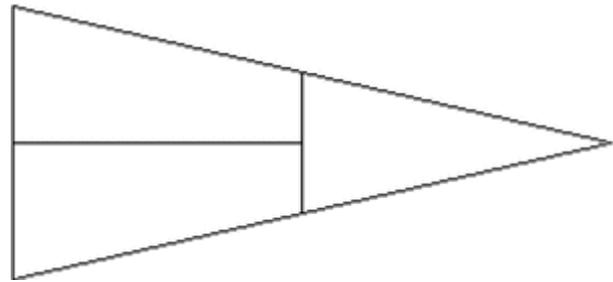


Fig. 2

Using a compass, draw two arcs, one from each end of the transition. The length of the arcs must equal the circumference of the tubes. This forms the shroud. (Alternatively, you can use a shroud generator like the one in VCP and extend the edge lines to a point to get to this result). (Fig.3)

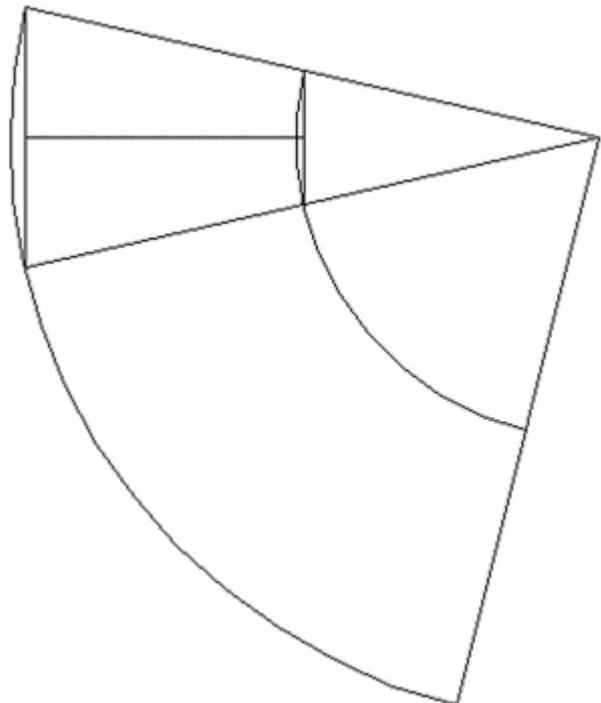


Fig. 3

Determine the number of cuts that you want to make in the tube to be modified. There are a couple of factors to be considered. If you are modifying a body tube, this number should be a multiple of the number of fins. This will allow a cut to be made at each fin, which eliminates having thin strips of body tube beside the fins. On the other hand, if you are using some coupler tube, you may use any number of cuts. There is also a trade-off between smoothness of circumference and final strength. As an example, I have had good success on a 3" tube with 16 cuts.

Use a ruler to locate a point along the length of the triangle that be easily divided by the number of cuts that you are planning to make. Draw a line at this point.

Sub-divide the line you drew in the last step into the number of smaller arcs that you want. Extend lines from the point, to the outer arc. (Fig.4)

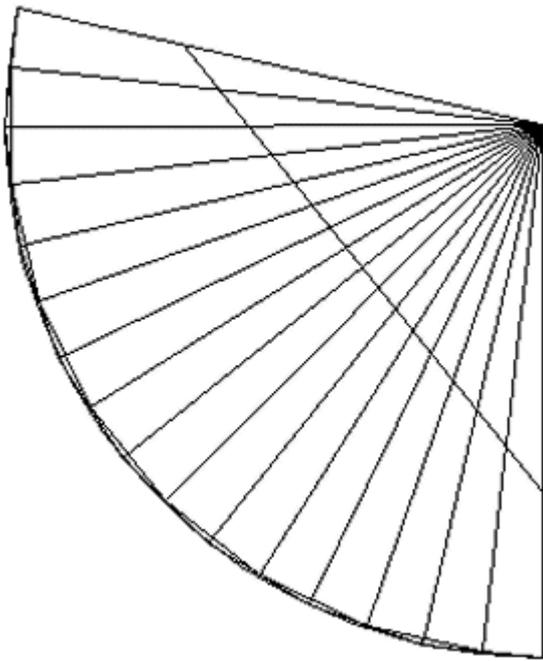


Fig. 4

Cut out the shroud. Then carefully cut from the small end to just short of the outer edge. Straighten the shroud out, and lightly tack the edge on another piece of paper. Draw lines to represent the intact tube prior to modification.

Space the open arc ends evenly. Remember that the spaces at the side of the shroud are each only $\frac{1}{2}$ of the space between arc segments. When you are satisfied, tape the arc segments down securely with clear tape (you will need to be able to see through to cut). (Fig.5)

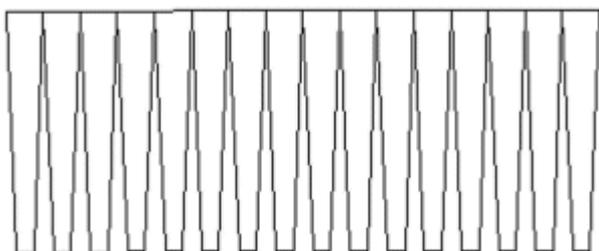


Fig. 5

Cut out the backing piece of paper, and tape the whole assembly onto the tube to be modified. Remember to account for the material being removed when taping down. Also, if desired, line up the wedges that will be removed with existing fin slots.

This is the single trickiest part of the operation. Take your time, cut slowly, and don't try to cut through in 1 pass. It is actually preferable to go slowly, using more than 5 or 6 passes. Cut out the wedges of material that are to be removed. Remove the template. (Fig.6)



Fig. 6

Tape several lengths of string (number will be determined by tube diameter and rigidity) above the wedges. These will be used to draw in the ends. If you are modifying a connector, insert it appropriately in the body tube. Position the motor mount. Ensure that it is securely centred, so that it cannot move if knocked during glue-up. You may want to protect the motor mount by wrapping it in wax paper.

Apply a small amount of slow-curing epoxy (NOT 5 minute) to the end of each wedge. Make sure you apply it ONLY to the end.

Draw the ends together by tensioning the strings. Allow the boat tail to form a curve. When you are satisfied with the appearance of the boat tail, secure the tape, and let all set up thoroughly. (Fig.7)



Fig. 7

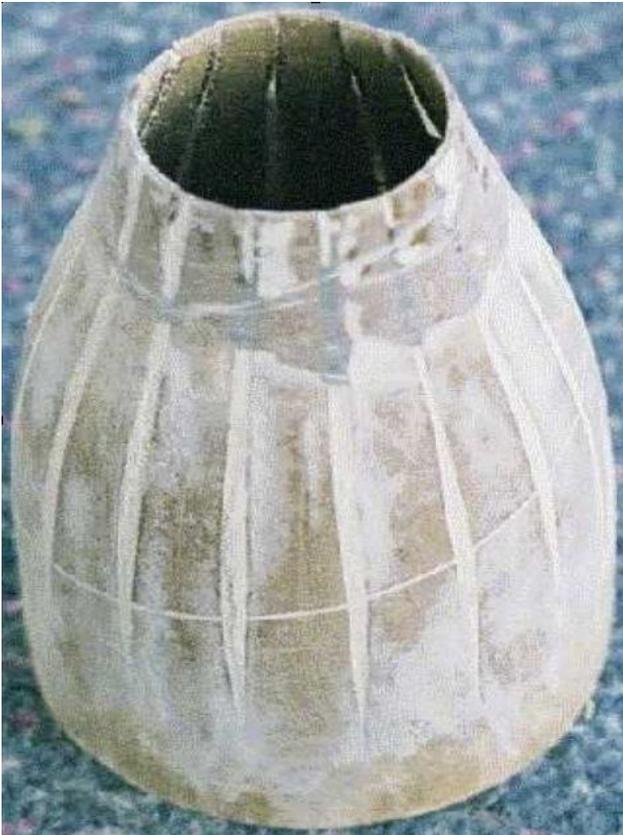


Fig. 8

Once the epoxy is cured, remove the strings. If desired, you can lightly sand any epoxy that has formed ridges on the strings. You may also remove the motor mount, and remove the connector (if used) for easier access.

Inflate a small balloon inside the formed boat tail. The balloon should be inflated only enough to seal the cracks, but not press outward heavily on the boat tail. This will act as a backer when filling in the cracks. Fill the cracks with epoxy and a filler material. Set aside to cure up. (Fig.8)

Once cured remove the balloon, sand and fill to shape. Extend fin slots if required. If you were using a connector to create the boat tail, you will want to taper the connection from the body tube to the boat tail. Mount and finish in normal manner. (Fig.9)



Fig. 9

Editors note: Leon Kemp is a level three certified member of CAR, the Canadian Association of Rocketry. This is just one of a number of articles that Leon and his wife, Peggy, were kind enough to submit for publication in 10...9...8... Many thanks to them both for doing so. The other articles will be published in future editions.

Find out more about CAR and rocketry in Canada, here:
<http://www.canadianrocketry.org/>

DIY Pad

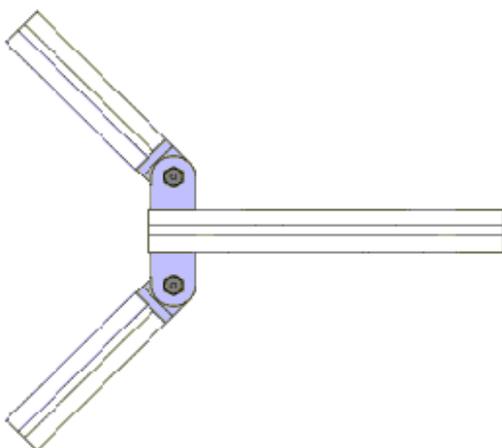
by Martin Sweeney

There comes a time in a rocketeer's life when the borrowing of pads has to stop, and a suitable pad must be found to post haste! [So why were you were borrowing at Largs? - Ed]

As in common with many other people in the community, I plan to move away from traditional launch rods (for reasons of stability) and towards the launch rail. For those not in the know, the launch rail (in this case anyway) is an extruded section which has slots running down the sides, in which 'buttons' can be inserted. These buttons take the place of a launch lug on the airframe, and so the rocket slides nicely up and out of the rail.

At a MARS meeting at Pete's Farm, I was very interested in some new rail which he had in stock – anodised and very very cool. A little out of my price range at that time (mainly due to loss of avionics and motor case in a certain rocket), I decided to leave it. Since then, Sean Arrowsmith of Black Knights found a supplier of these rails, and lots of associated bits and bobs. His article for a rail can be found at www.blackknights.org.uk/articlerrail.htm.

This company was called Machine Building Systems, and they have a fantastic range of products – hours of reading and scheming time here! Their website is at www.mbsitem.co.uk, which can be used to order a catalogue. They have excellent service and fast delivery.



Pad Schematic

Upon inspection of their excellent catalogue, I noticed that they stocked some rather natty hinges, and plans began to form in my head <evil laugh>. I did the honourable thing and contacted MBS, with lists of what I wanted, but was shocked and dismayed when I got the price list - £11 each for the hinges! But then I thought – id only need three and other stuff would be minimal, so why not.

Anyway, what with 2m of rail for the actual rail, and another 2m for the legs, a few hinges and brackets the price stood at £84 ex vat and delivery. Then came delivery, which was £12, justifiable with that weight but VAT was on top of that, so the grand total came to £119.73. Quite expensive – yes it was but you do get a pad (around £90 for equivalent) and the 2m of rail (the equivalent of \$140 for an equivalent heavy Extreme Launch Rail from Giant Leap) for that price.



The completed pad

Assembly

The parts all come in nice little boxes, and are all clearly marked and identifiable. Lots of nicely anodised aluminium parts – lovely. You'll need a good set of Allen keys, as all nuts are hex. Some of the rail will need to be cut in half (this saved £6 ex vat) to make the legs. Then, the hinges are disassembled and screwed onto the base leg. The only problem I had with assembly was trying to get the screw into the end hole of the rail – so I had to cut a thread into it (with my trusty tap and tap wrench) to get the screw into it. Otherwise it was plain sailing.

Stability

The pad, with only the 1.5 m of rail is very stable, but with the full 2.5m it is a little unstable. A few weights on the legs and a brace from the back leg to the rail, it'll be very stable.



Hinge detail



Hinge detail



Folded away

Parts List

<i>Item</i>	<i>Description</i>	<i>Qty.</i>	<i>Cost</i>
0.0.419.06	Profile 6 30x30 (1.000m) [m]	4	21.36
0.0.417.28a	Button-head screw M6x14 [ea]	6	0.72
0.0.419.40	T-slot Nut 6 St. M6 [ea]	6	3.90
0.0.419.43	T-slot Nut 6 St. M5 [ea]	2	1.30
0.0.419.43	T-slot Nut 6 St. M5 [ea]	2	1.30
0.0.419.85	Hinge 6 30x30 Heavy Duty with Clamp Lever	3	35.43
0.0.441.58	Hinge 6 30 Zn 6/6 [ea]	1	3.99
0.0.459.11	Bracket 6 30 Flat [ea]	3	4.02
0.0.459.26	Fast. Set for bracket 30 (M6x10 + M6 nut)	6	6.24
Total Cut Charges		1	6.32
Packing		1	5.00
Carriage		1	12.32
Goods and Services Total			101.90
VAT Total			17.83
Invoice Total			119.73



Top hinge

UKRA News

- Recent Events
- RSO renewal
- Advertising Rates
- HSE Consultation Document
- Council Meeting 24/05/03
- UKRA AGM 07/06/03
- Council Meeting 07/06/03
- Council Meeting 19/07/03
- Educational Conference
- Waddington Airshow

Recent Events

In the light of recent events, and at the request of UKRA members, the UKRA Council would like to issue the following statement:

Any threats against, victimisation, or harassment of UKRA members or Associated Clubs will be taken very seriously. Wherever possible, full UKRA Disciplinary Procedure will be taken against any members found to be doing this.

UKRA will always welcome the introduction of any new rocketry product to the UK, and if requested, will provide help in ensuring that any items meet all the legal requirements.

Mike Crewe
UKRA Chairman.

RSO Renewal

A recent enquiry asked if it was reasonable for a lapsed member, who was previously an RSO to be able to rejoin UKRA and immediately take up RSO duties again. It is a responsibility of an RSO to try and keep up to date with current practice when carrying out their duties, and it is hard to how this can be done if not regularly RSOing. Therefore it has been decided by the council that a members RSO status lapses on lapse of membership. As and when a lapsed member rejoins*, they

may keep their most recent certification status, but may not function as an RSO until they have been interviewed again.

* Obviously this does not apply to normal annual renewal.

Advertising Rates

Advertising rates for 10...9...8... were recently reviewed. Costs have remained the same, but the qualifying criteria for advertising on the back page have been removed. Current rates are:

- B/W half page £5
- B/W full page £10
- Colour full page £30

Event adverts are still free. To place an advert contact newsletter @ ukra.org.uk

HSE Consultation Document

UKRA have recently been invited to comment on proposed legislation regarding the carriage of dangerous goods, to be introduced by the HSE. We have examined the supplied documentation and there appears to be nothing of concern for rocket fliers. UKRA will continue to monitor the progress of this proposed legislation.

Council Meeting 24/05/03

Location

UKRA Hut, Southview Farm, Heckington, Lincolnshire

Attendance

Cath Bashford (CB), Mike Crewe (MC - Chair), Pete Davy (PD), Darren J Longhorn (DL - Secretary), Jim Macfarlane (JM), Richard Osborne (RO), Zigi Kklynoski (ZK), Stuart Lodge (SL - invited guest).

Agenda

- Apologies
- Minutes of previous meeting
- BMFA Technical Committee
- Secretary's Report
- Finance Report
- Membership Report
- Tripoli Europe
- Certification level lapse & renewal
- Cross recognition of HPR certification with IMR
- Members' access to RSO list
- Banner & other promotional materials
- Safety code rev 4.01
- UKRA 2003
- Family Membership
- Action Point reporting
- AOB
- DVNM

Apologies

Apologies were received from Bob Arnott (BA).

Minutes of previous meeting

The minutes from previous meeting were read and approved. The list of action points was worked through, and progress noted.

BMFA Technical Committee

MC introduced SL. SL represents BSMA who, like UKRA are also a BMFA specialist body. SL discussed BSMA & UKRA joining forces to create a BMFA Technical Committee for rocketry. SL began by admitting that he had not yet received full details of what The full duties of a Technical Committee were, but gave us a brief overview as he understood it. For each discipline in the BMFA, Power, Control Line, Helicopter, Free Flight etc. there is a Technical Committee. The Technical Committee has a seat on the BMFA council and reports directly too it. Currently rocketry is represented by the Free Flight Technical Committee. Generally this has served is well, but they are focussed on contests. SL want on to say that there was a valid "if it ain't broke don't fix it" view, but went on to suggest that world events - new legislation triggered by antiterrorist initiatives could mean that we needed more influence. He summed up by suggesting the following benefits:

- it would promote cooperation between our organisations
- we are already seen as a key source of information within the BMFA
- we would have easier access to legal representation via the BMFA
- it would consolidate our position within a changing BMFA; we've been looked after very well by Grahame Lynn, who is retiring
- it would give us more influence with other external bodies

The discussion was opened up. DL was worried that it would place additional obligations upon us. JM wondered if it would really give us additional influence outside of the BMFA? SL said that he thought it would - we were happy being a specialist body and this would be the next logical step. ZK stated that we were probably on the fringe of the BMFA and a lot of BMFA operations seemed irrelevant.

It was agreed that it was potentially a good idea, but that we needed more information. It was also pointed out the at we didn't want to step on anyone's toes. MC thanked SL for coming and agreed that we would cooperate to further the investigation.

Secretary's Report

There was no Secretary's report.

Finance Report

CB gave a brief financial report. The full accounts are to be presented at the AGM.

Membership Report

MC reported that membership stands at 165, 35 of which are new members. DL noted that this meant there were still a lot of people who had not renewed although almost half the year had gone.

Tripoli Europe

We discussed a letter received by MC and his proposed response. The letter outlined a proposal that a new European rocketry group be formed from various Tripoli prefectures in the continent and UKRA. This group would be a part of the US organisation. DL asked what

the perceived benefits of this would be as we already had our own organisation that in many ways provided better benefits than Tripoli. ZK stated that 'Tripoli' was a bad choice of words, that the new group would be organised like Tripoli, but not part of the US organisation. This was contrary to most people's reading of the documentation received. DL said that we should be forming links with other groups, but not be absorbed by another organisation. ZK said that rumours of a requirement in the proposed organisation before purchase of Aerotech motors was not true. A proposal was made to send MC's letter of response (which basically says thanks, but no thanks, but were willing to cooperate in such areas as cross recognition of certifications etc.). This was unanimously agreed.

Certification level lapse & renewal

MC queried if it was a good idea to be able to rejoin UKRA with the same certification and RSO status after a lapsed membership. It was proposed that certification level should be maintained but that RSO status would be subject to an interview. This was unanimously agreed.

Cross recognition of HPR certification with IMR

Interessengemeinschaft Modellraketen e.V. (IMR) had requested cross recognition of certification levels with UKRA. The accompanying text was reviewed and it was agreed to do so in principle, but that several apparently typographical errors should be queried.

Members' access to RSO list

DL had been asked by a member if there was some way in which members could get access to a list of current RSOs. It was agreed that we would have a form on the web site which would allow queries to be sent to the new RSO email list.

Banner & other promotional materials

This was partly discussed while processing outstanding actions. We agreed that we would purchase stickers and a vinyl banner.

PD stated that lottery funding was available up to £5000 for "properly constituted" groups. MC thought that these grants had to be "of benefit to the community". PD suggested that we could do that by running rocketry workshops.

Safety code rev 4.01

Changes were discussed and it was agreed that the final draft would be ratified via email.

UKRA 2003

PD reported that toilets had been ordered. 35 tables were on order in addition to the 10 that we already had. 27 had already been prebooked. PD requested that he get cheques made payable to the farmers. This was agreed. It was also agreed that we would provide £50 for fireworks.

Family Membership

MC queried what family members should get? It was agreed that there was little point in sending duplicate copies of paper work to family members.

Action Point reporting

MC asked that everyone try and report action point completion/progress to the secretary before council meetings.

AOB

Should members have to pay for failed certification attempts? It was agreed that we need to be able to record failures and that the new paperwork would allow for this while not require payment.

MOD land. ZK reported that the new Brigadier had not been as positive as had been hoped. Perhaps it's time to bring in the BMFA?

JM asked if the direct email links on the web site could be removed as an antispaam measure. This was agreed.

PD asked if UKRA wanted to rent the hut for a further year at the same rent. This was agreed.

Guinness have been in touch regarding 'model' rocketry records. It was agreed that we should wherever possible.

There was some discrepancy in the documentation about multiple RSO requirements for L3 Certification.

DVNM

To be agreed after AGM.

UKRA 2003 AGM 07/06/03

Location

UKRA Hut, Southview farm, Heckington

Attendance (council members)

Bob Arnott (BA), Cath Bashford (CB), Mike Crewe (MC - Chair), Pete Davy (PD), Darren J Longhorn (DL - Secretary), Jim Macfarlane (JM), Richard Osborne (RO).

Agenda

- Chairman's Remarks
- Minutes of previous AGM
- Annual report of the council
- Financial report
- Result of elections to council
- Appoint Auditors
- Appoint Solicitors
- AOB
- Date & Venue for 2004 AGM

Chairman's Remarks

MC opened the meeting by saying that he hoped everyone was enjoying the UKRA 2003 launch event and had been having fun since the previous AGM.

Minutes of previous AGM

Due to an oversight the minutes of the previous AGM were not available and were therefore not read. However they had been previously published in the newsletter and DL asked if there was any objection to them being

approved. There was not and therefore the minutes were approved as a true record.

Annual report of the council

MC asked the members of the council present to report on their areas of activity.

DL stated that the web site had been kept up to date with about 33-40 updates so far this year, including about 60 separate news items. He also stated that there had been three issues of the newsletter since the last AGM, the last issue of 2002 and the first two issues of 2003. These were 36, 36 and 28 pages in length respectively. He said that we had changed to a new printers and felt that this has improved the quality. This had meant an increase in postage for some issues due to paper weight. To mitigate this additional cost we will use second class postage for the larger issues.

BA said that he thought we were now up to date with MAP awards and certificates, but that if anyone knew different, to let him know.

RO said that it had been a slow year for altitude records, and to please let him know of any flights with recorded altitudes, even if they weren't actual records.

JM reported that it had been an easier year for S&T then last year and that a new revision of the UKRA Safety Code had been submitted to the BMFA and that it would be released soon.

PD reported that the CE marking process for motors had been very slow, and was proving difficult due to expense and lack of agreement within the EU of what the CE marking meant with respect to rocket motors.

CB said she would present the accounts under the relevant agenda item.

MC said that membership stood at 183.

Financial report

CB presented the accounts for the period 18/11/02 - 24/05/03. See appendix i.

Result of elections to council

DL read the results of the election of members to the council. A total of 29 ballots were cast each containing up to 5 votes:

Mike Crewe	26
Cath Bashford	23
Richard Osborne	24
Jim Macfarlane	23
Darren J Longhorn	27
Zigi Kklynoski	14

As there are eight places on the council and six candidates, all candidates were elected.

Appoint Auditors & Appoint Solicitors

MC described the reasoning behind these annual agenda items, and said that he thought it was still not warranted to pay for the services of either a solicitor or auditor. DL pointed out that we had asked for volunteers from the membership to audit the accounts, but that none had come forward. The question of whether UKRA needed to appoint auditors or solicitors was put to a vote and was carried with no votes against and one abstention.

Any other business

Damian Burrin asked if anyone had seen his 'five grain' Pro38 Reload.

Mike Roberts said that there was an opportunity for promotion at UKRA at a show at Donnington Park on 18-25th October, and asked anyone interested in running a stand to contact him. Mike also asked if may open a can of worms. There was no objection and so the can was opened and the (chocolate) worms were handed around.

Graham Platt reminded everyone of UKRA's coming attendance at Waddington on 28th & 29th June and asked for one more volunteer to help run the stand.

CB suggested that in future it might be a good idea to set up a group separate to the UKRA council to plan and run the annual events. This was positively received and Cath suggested those members contact her after the AGM.

Date & Venue for 2004 AGM

It was generally agreed that this was one of

the better attended AGMs and that holding at the UKRA launch event was a good idea. JM proposed that the 2004 AGM should be held at UKRA 2004 launch event. This was seconded by Rick Newlands and approved by a show of hands.

Appendix i

UKRA Accounts 18/11/02-24/05/03

INCOME

Bank Interest	£0.80
Certification Fees	£25.00
Donation (M.E.Show)	£50.00
Income from UKRA2003	£222.00
Raffle (M.E.Show)	£47.20
T-shirt	£30.00
UKRA HQ hire fees	£215.00
UKRA Membership	£4,529.00
TOTAL INCOME	£5,119.00

EXPENSES

BMFA Membership	£2,647.00
Misc	£115.00
New member rockets	£117.46
Printing & Photocopying	£478.00
Stamps & Stationary	£441.72
UKRA Building	£660.00
TOTAL EXPENSES	£4,459.18

TOTAL INCOME - EXPENSES £659.82

TOTAL Balance Forward (18/11/02)	£3,191.29
CURRENT Total (24/05/03)	£3,851.11

Council Meeting 07/06/03

Location

UKRA Hut, Southview farm, Heckington

N.B. This was a short meeting with one purpose, to elect executive and non executive council position. As such the minutes of the previous meeting were not read and action points will be addressed at the next meeting.

Attendance

Cath Bashford (CB), Mike Crewe (MC - Chair), Darren J Longhorn (DL - Secretary), Jim Macfarlane (JM), Richard Osborne (RO).

Agenda

- Apologies
- Election of council positions
- DVNM

Apologies

No apologies were received.

Election of council positions

Executive positions:

- DL proposed MC for Chair, seconded by RO. MC elected by unanimous vote.
- MC proposed RO for Vice Chair, seconded by CB. RO elected by unanimous vote.
- MC proposed CB for Treasurer, seconded by RO. CB elected by unanimous vote.
- CB proposed DL for Secretary, seconded by JM. DL elected by unanimous vote.

Nonexecutive positions:

- RO proposed JM for Safety & Technical Chair, seconded by DL. JM elected by unanimous vote. JM to appoint others within and without of the council.
- CB proposed MC for Membership Secretary, seconded by JM. MC elected by unanimous vote.
- It was agreed to ask Bob Arnott if he would continue to administer the Model Achievement Programme, at least in the short term.
- Possible cooption of various members was discussed. It was noted that Graham Platt had indicated he would be happy to be considered and it was agreed to ask him. It was agreed that we should consider other candidates to be approached before the next meeting.

DVNM

Provisionally agreed for 19th July.

Council Meeting 19/07/03

Location

UKRA Hut, Southview farm, Heckington

Attendance

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

Agenda

- Apologies
- Minutes of previous meeting
- Secretary's Report
- Membership Report
- Finance Report
- Support for the Junior National FAI team
- HSE consultation document
- Newsletter advertising rates
- Marquees
- AOB
- DVNM

Apologies

Apologies were received from Richard Osborne (RO), Jim Macfarlane (JM), Ziggi Kklynossikki (ZK).

Minutes of previous meeting

The minutes from previous meeting were read and approved. The list of action points was worked through, and progress noted.

Secretary's Report

DL circulated items received from the BMFA since the last meeting. There was nothing which required a response.

Membership Report

MC reported that we had 186 members, 25 of which were new this year. He also stated that we had reduced our membership fees for the remainder of the year in line with the reduced BMFA portion of the fee.

Finance Report

There was no detailed report, CB promised a report on UKRA 2003 for the next meeting.

Support for the Junior National FAI team

A request for support had been received from the Blast Off For Britain group. It was assumed that a cash donation was required, but it wasn't felt we could do that without knowing more about the requirements. Alternatives were discussed and the idea of helping to host hosting a fund-raising and /or workshop type event at the UKRA building was suggested. This was unanimously approved.

HSE consultation document

MC reported that we had been invited to comment on proposed legislation regarding the transport of dangerous goods by the HSE. Both MC and PD had studied the supplied documentation and saw nothing that should concern us. It was agreed that we would acknowledge receipt of the material and monitor developments. It was agreed that we should issue a statement regarding the proposals both immediately and when it came into effect.

Newsletter advertising rates

DL reported that since the requirement to take a whole year's worth of advertising before an ad could be placed on the back page was introduced that there had been no interest in advertising on the back page. It was agreed that this requirement be removed and that the rates should stay the same.

Marquees

Aspire's marquee that we had used at UKRA 2003 had been damaged by the windy conditions. It was agreed that we should repair or replace this.

AOB

Altitude Contest - GP suggested that we might run another event at Heckington dedicated to altitude attempts. It was agreed that we

should investigate this for next year.

Renewal Incentives - It was agreed that we would hold a draw for renewals before a certain date (TBD), the prizes being free passes for the UKRA and K-Lob flying events.

Fire Equipment - It was agreed that we should investigate The procurement of fire extinguishers as a priority.

Request for Statement - A member had requested that UKRA clarify its position with regard to recent posts on uk.tech.rocketry and an abusive email received by another member. It was agree that we would make a statement and publish it on uk.tech.rocketry, the web site and newsletter.

Co-option - Since there was a shortfall in candidates at the election it had been agreed to attempt to co-opt two members. Graham Platt had already agreed to be co-opted after the AGM, leaving us just one short. Various members who could be approached were discussed and a short list was drawn up. It was agreed that MC would approach the candidate on the top of the list.

Anemometer - MC queried the location of the UKRA anemometer. It is believed to be in possession of a member.

Canterbury Cup / Radios - PD reported that the organisers had requested use of the UKRA radio gear for The event. It was agreed that they could do so.

Burger Bill's Kitchen - PD reported that he had had a proposal from the food vendor at UKRA 2003 (Burger Bill) that we could purchase from him a portable kitchen unit. There was much discussion about costs, refurbishment, maintenance, and operation. Ultimately it was decided not to pursue this matter.

CAA - PD advised that the David Cockburn of the CAA (General Aviation Department, Safety Promotion & Education Officer) had been in touch with a request for information. He wants to write an article advising about rocket flying and safety for publication in a GA magazine. It was felt that this was a very positive development and we should add Mr Cockburn to our Newsletter circulation list.

Education - As a result of recent promotional events, requests had been received for educational materials. It was agreed that we should produce some. GP reported that he and a member (Damian Burrin) had already been looking onto this. It was agreed that they should continue. It was also suggested that other parties interested in rocketry (BO4B, UKAC, various members who are teachers) and education be consulted.

DVNM

Proposed date is Saturday 6th September at the offices of Fusion Digital Technology in Harrogate (since cancelled).

Educational Conference

Recently several groups and individuals have become interested in attracting more people to

the hobby by way of educational out-reach programmes. Teachers have approached UKRA members running promotional stands at various events and asked what educational materials are available for use within the classroom. As a result UKRA would like to produce such material, indeed some members have begun work.

At the same time groups such as Blast Off For Britain have begin out-each programmes of their own. Clearly, as we are all resource poor, it makes sense to coordinate our efforts and avoid duplication. Perhaps something could be done in coordination with UK-SEDS?

As a first step, UKRA has agreed to host a conference at the UKRA hut, where ideas can be presented and discussed. If anyone wishes to attend, or has any ideas they would like to put forward, please get in touch at education @ ukra.org.uk, or via the P.O. box number. The time and date will be determined when we get an idea of who wants to attend and when they are available.

		<h1>ROCKETRY SUPPLIES</h1>		<p>Importers of the highest quality fuse and ignition materials, including Green fuse, ICI PIC, Quick Match, Delay fuse and Electric Igniters. Manufacturers of firing control systems.</p>	
<h2>GREEN FUSE</h2>	<p>Water resistant, highest quality lacquered fuse. 50 metre rolls</p>	<h2>PIPED NATCH</h2>	<p>5 ply Standard or water proof, highest quality 50 metre rolls</p>		
	<p>10mm/second 2.2mm - £3.00 3.0mm - £6.00</p>		<p>Waterproof £8.50 per 50mtr</p>		<p>Longer burning soldered igniters with protective removable caps</p>
	<p>24mm/second available</p>		<p>Standard £4.50 per 50mtr</p>		
<p>*Manufacturers and developers of FIRE BY WIRE(tm) , manual and computer firing systems *High energy computer fired pyro-musical firework displays for any event worldwide.</p> <p>MLE Pyrotechnics Limited, Unit 6, Austin Way, Royal Oak Industrial Estate, Daventry, Northants, NN11 5QY, England phone +44 (0) 1788 899188 fax +44 (0) 8701 335798 web www.category4.co.uk/rocketry</p>					

Waddington Airshow

by Graham Platt

The RAF Waddington International Airshow, held on June 27th & 28th, is the largest military-run airshow in the UK. It attracts on average 120,000 + spectators, and a wide variety of aircraft, both military and civilian, from all over the world. This year was no exception, with unusually favourable weather for once - blazing sunshine for both days, and what seemed to be a higher than usual number of visitors.

After bouncing the idea off Pete Davy for a sanity check, I applied for a stand in the exhibition hangar on the offchance that one would be available as a cancellation, as I thought that I'd missed the deadline for applying. One phone call and a confirmatory email from me later, and I was the proud stallholder of a 5 metre square stand in 3 hangar. Asking round for volunteers provided a core of 6 people, including myself - Pete Davy & Damian Burrin (both local to the show) volunteered their services in advance of my securing the stand. Mike Roberts of EARS also volunteered his time and exhibition experience, as well as an entire small carload of display material - you'd be very surprised at how much he managed to fit into a Polo! Sal Davis & Chris Eilbeck of MARS offered their time & help as well, to make a nicely rounded team.

MARS loaned us the use of their extremely neat and professional folding display and what is known as the Tardis. It's essentially a freestanding kiosk that has been very professionally built by Tim Grimston for the group to use at exhibitions they attend. It has space inside for a monitor, and shelving for a laptop or PC, and sufficient storage space for ready-use items like spare leaflets etc. We were also loaned MARS' fullsize mockup of Deimos Odyssey - all 24 feet of it! Cath Bashford also arranged the donation of over 1000 MARS stickers, but more of those later.

Pete & I arrived at Waddington on the Friday morning with both of our vehicles full of rocket



Sal & Damian before the action begins

stuff. We'd had a dry-run at setting out the stand in the UKRA hut a couple of days before, and had drawn up a rough layout of how we wanted the stand, to save us time on the day. We set to work, and by 11am, what had been several stacks of stuff had miraculously transformed itself into the makings of a very respectable stand. We put together the Deimos Odyssey mockup, and cautiously raised it into position. Work on several other stands came to a halt as everyone gawped at our centrepiece. Around lunchtime, we decided that we did need the spare launchpads that Pete had at his shop, so we did a mad dash to and from Heckington, and returned in time to be able to finish as much of the stand as we could by the 4.30 hangar closure.

Mike, Sal & Chris made their way up to Lincoln on the Friday evening, and we got a relatively early night. Saturday started at 6am, and we were in the hangar just after it opened at 7am. The airfield was already awake and buzzing with activity - last minute arrivals were being marshalled into place, foodstalls began to waft the smells of hot food around, and we put together the finishing touches to the stand, with Mike's model rocket display, his EARS & educational posters, and not least his collection of all the world's spent reloads! If Mike asks you for your spent single-use or Pro38 rounds, please donate them, as they're incredibly useful for explaining the hobby to the public.



Visitors appear

The airfield opened to the public at 8am, and from then until 9am, we saw a steady increase in the number of people walking through the hangar. At about 10am, it seemed to really step up a gear, and from then on, it was a whirl of activity. The most frequently asked questions we had were "Do you get them back, then?", "Does it use a parachute?", and "What motors do you use?". It was very gratifying to speak to a large number of people who were already into flying Estes models they'd bought from toyshops, and to find that a lot of them were interested in taking the next steps in the hobby. The mini-cdrom that I created with more information on it was invaluable, and I gave out over 80 of these over the weekend.

Chris & I took our laptops along, and used both to continuously play rocketry video, from the UK & the USA. The crowds loved these - there's nothing like the footage of the MARS B4 static test firing to turn heads of passers-by towards the stand!

Damian found a new vocation - running around putting stickers on every small child in sight. At one point every child I passed was adorned with a MARS sticker. I had a batch of trifold UKRA leaflets and some MARS leaflets printed up before the show. Pete contacted Ripmax, the UK distributor for Estes, and at very short notice, they sent across a box of the Estes 'introduction to model rocketry' brochure, which went down a storm.

Over the course of the two days, we met and gave contact details to a number of teachers, scout leaders, and Air Cadet officers, who were interested in using rocketry as an activity in their groups. To this end, Pete, Damian and I are working on an educator's pack, and possibly a couple of teach-ins at the UKRA hut.

Anyone interested in assisting with this can contact me via enquiries@ukra.org.uk.

Flt. Lt. Scott Jennings was the officer responsible for the exhibition hangar, and he spent a fair amount of time in the stand talking with us about the hobby and watching the videos. Pete donated a couple of model kits to the Station raffle, which donates all of its proceeds to charity. We made, and left, a good impression with the RAF, and speaking to Scott before I left, it would appear that we'll be invited back for next year's show.

By Sunday evening, we were all shattered. Three long days and a whole lot of talking had taken their toll, as had a bug that we'd all picked up. After we'd taken the stand down, and loaded Pete's van & my car, we headed off to our homes. Damian and I sat down at my place with a coffee, and the tiredness just washed over us. Both of us sat there, with a silly grin on our faces, realising that we'd just taken the promotion of UK Rocketry to it's largest live audience yet, and the fruits of our work would start to show over the coming months. We're all looking forward to seeing a lot of the people we spoke to as spectators at future EARS and UKRA launches, and hopefully flying alongside them as members of UKRA.



Rockets on the stand

Rocket Photography

by Bob Arnott

Ever wondered how to get consistently good photos of rockets as they launch...? In this series of articles I'll attempt to show you how to do it, then it's up to you. We'll start off with camera kit and what should work and what shouldn't work and then we'll move onto technique in a future article and finally how to set up great still life shots of your rockets.

Part 1: Equipment

At the end of the day, the equipment that you use will ultimately determine how good your shots come out, you can be the best photographer in the world, but if you only use disposable cameras, you're not going to get great rocket photos. However, you might have the latest whiz bang all singing all dancing £5,000 digital SLR, but unless you know how to use it you may as well have bought a £10 disposable.

First things first, generally speaking compact cameras won't get you great shots, some of them might be okay, but you'll never get the really jaw dropping ones. There are many reasons for this, the small lens, too slow auto focus, no motor drive, bad exposure calculation, the list could go on. If you're serious about taking really great shots, then I would recommend investing in some form of SLR system.

It doesn't really matter which manufacturer, they're all pretty much of a muchness these days, although try and get one that feels right in your hands. The only way to buy a camera is to go into shops and handle them, they're all different. You might have your heart set on a Nikon F80, but when you finally handle one, you may find it to be on the small side and a bit on the light side. Conversely, you might find that a camera from a manufacturer you wouldn't normally touch, feels perfect in your hands. You're going to have to like the camera you buy, as eventually you should be using it quite a lot and for long periods of time

at the bigger launches.

Camera Bodies

This is where it starts to get a bit on the complicated side, do you buy a modern auto focus model that comes with a couple of zoom lenses, or do you go second hand and buy a manual focus camera and some lenses for a similar price. Personally I'd be wary about buying a cheap auto focus model, there's a reason why they're cheap and it's all down to the quality of the lenses. As with most things, you get what you pay for, but when it comes to camera bodies and lenses that really only holds true for the lenses.

You can buy a budget body and stick a really expensive lens on it and get just as good a photo as with an expensive body. If you use a cheap body and a cheap lens, you won't get the same quality as with a cheap body and an expensive lens. The cheap lenses use either plastic or organic glass and generally don't have extra low dispersion glass elements which all leads to less resolution and softer images. Not really what you want when you want a razor sharp photo.

While I said that you could use pretty much any camera body, I was generalising slightly, the more expensive the body the more likely hood of it having a better exposure system or faster shutter speeds and a better auto focus system. Personally I'd avoid the really cheap cameras and go for one of the models in the middle ground. These days, most of the middle ground cameras have pretty good auto focus, fast shutter speeds and reliably exposure systems.

However, for the ultimate control in your photographs, nothing beats doing it manually. Auto focus takes a split second to work out which bit of the photo to make sharp, and on cheaper models can be confused by fast moving subjects. By manually focusing your lens, you can guarantee that the rocket will be in focus for the entire duration of the flight (we'll cover that in the technique section). Manual exposure also means that you can set up the camera for the effect you want, rather than the effect the camera thinks you want.

A lot of the older manual cameras were built like tanks, which also means they've got a lot less to go wrong and will generally out live their modern electronic counterparts. At the end of the day though, it comes down to what you can afford and what else you'll be using the camera for. Either way, you must handle a variety of different models and makes before you make a decision. You also need to take into account the range of lenses available for that particular camera system, as there's no point in buying into a system that only has a few lenses.

Camera Lenses

As I've said above, you really do get what you pay for with camera lenses. I'd rather pay for a cheaper body to enable me to buy better lenses than have the latest expensive body. But as with bodies, there's a vast variety of lenses to choose from, so how do you know which ones to go for? Is a couple of zoom lenses (28-80mm and 80-200mm) better than having a collection of prime lenses (28mm, 50mm, 85mm, 135mm, 200mm) for example.

Personally I think having a combination of both works best, I have prime lenses in 28mm, 50mm, 135mm and 300mm focal lengths and zoom in 28-80mm and 80-200mm. Which ones do I use most for rocket photos? Probably the 80-300mm for launch shots and the 28-80mm for general shots around the launch area and of people with their rockets. If it's a big Level 3 attempt and I'm a long way from the rocket, then I'll dig out the 300mm, or if the light's poor I'll get the 28mm or 50mm out.

The key here is flexibility, you need to decide on what sort of photograph you want to end up with. If you want close up shots of rockets just leaving the pad and that's it, then a 200mm or 300mm is what you are after. If however you wish to include more of the background to show the launch site, then a 80mm or 135mm is more what you're after. Personally I think it is all down to personal choice, it's harder to track a rocket with a bigger lens, but sometimes you lose the rocket in the landscape if you use a wider angle lens.

A prime lens will always give you a better

quality image than a zoom lens, the light has less lenses to pass through on its way to the film. Although with modern high quality lenses you'd be hard pushed to notice so a good set of zoom lenses would start you off in a good direction. A 28-80mm would be good for general shots around the launch area and of model launches, while a 80-200mm would be better for high power launches and close ups of rocket details.

The main thing to look out for though is the maximum aperture of the lenses you buy, as this determines how much light they can let through. This is important if the weather isn't at its best and you want to show at a long focal length. There are three things that influence the exposure of a photograph, shutter speed, aperture and film speed, by varying these three things you can achieve different effects. To get a sharp shot of a rocket in flight you need to use a fast shutter speed, 1/500th of a second or higher. If you are using ISO200 film and it's a bright sunny day then shooting with a 50mm lens set to f16 you can use a shutter speed of 1/250th and get a good result.

If however you want to shoot with a 200mm lens, then there will be less light getting to the film, so you may have to shoot at f8 to compensate. If the weather isn't so good then you might find that you need to drop a couple of stops to f4 to keep the 1/250th shutter speed. You might also be trying to shoot a very fast rocket that means you need to use 1/1000th of a second to guarantee getting the rocket without any motion blur, this would put your aperture down to f2.

There aren't many prime lenses that go down to f2, let alone zoom lenses, so as you can see you would have had to put in faster film or have shot at a slower shutter speed to get the correct exposure. This is where prime lenses have an advantage, as it's cheaper to build a fast prime lens than a fast zoom lens. A really good Nikon 80-200mm F2.8 D AFS lens will set you back £1,338.90, whereas a Nikon 85mm F1.8 D AF and 180mm f2.8 AF D will cost you £1,049.80. Generally you can buy a couple of really fast prime lenses for less than the cost of a zoom that covers their range.

Take the budget Nikon 28-200mm f3.5/5.6 G

IF-ED AF for £299.90, at the 28mm end it's got a maximum aperture of f3.5, which isn't bad. Although at the 200mm end it's maximum aperture is f5.6, which isn't very good at all and will probably leave you struggling with lower shutter speeds or faster grainier film on average launch days.

So I'd recommend trying to find yourself some fast primes lenses with maximum apertures of f2.8 or faster. You can then compliment these with a zoom, probably in the range of 80-200mm with a maximum aperture of f4 or faster. I've seen manual focus Tokin 80-200mm f2.8 lenses going for under one hundred pound second hand, a bargain for a fast lens like that.

Which also brings me onto the subject of manual focus versus auto focus. Because auto focus lenses have more electronic bits and bobs in them, they are generally more expensive. On the second hand market you can pick up fantastic deals on quality manual focus lenses that are in pristine condition. You can still use manual lenses on a variety of auto focus cameras, so you don't even need a manual body to take advantage of cheap lenses.

Film

The final bit of equipment that you need to take care in selecting is the film that you use, as this can have quite a large impact on the quality of the final result. Faster films are grainier, so an ISO200 film has more grain than an ISO100 film and an ISO1600 film has grain by the bag load. Even with our less than sunny weather there should be no need to shoot above ISO400 and you should be able to get away with shooting at ISO200.

Personally I've found that ISO400 has just a bit too much grain for my tastes, especially when the images have been scanned in for display on the Internet. I would avoid using ISO100 or anything lower as you will struggle to maintain a fast shutter speed in all but the brightest conditions. I have found ISO200 to be the best compromise between grain and keeping a fast shutter speed, although there are times I wish I used ISO400, but then I put a shorter lens on and go for different shots to compensate.

What brand of film you buy is really up to you, although I'd stick with one of the leading names and not trust any of the cheap budget films. Budget films are generally made by either one of the major manufacturers using an older emulsion, or are made by companies who've bought rights to older emulsions from the main manufacturers. If you want quality result, then invest a bit more in the quality of the film as this is the component that actually records the event.

Unless you already have a favourite manufacturer, mine if Fujifilm, then I'd try a few rolls of Fuji, Kodak, Konica and Agfa to see which you prefer. They're not all the same and will all give slightly different results, so it's really a matter of taste to which one you prefer. But what ever you do, don't buy out of date film as the chemicals in the emulsion will be past it and your end result will suffer.

Finally, don't buy you film on the high street where it will cost you £13-15 pound for five rolls. Buy mail order where you can get twice as many rolls for a similar price, I get mine from 7 Day Shop and have paid £11.70 plus shipping for a pack of ten in the past. Buy Amateur Photographer magazine and check out the adverts in the back for which company is supplying cheapest that week.

Recommendations

When it comes to choosing a camera system, make sure that you are comfortable holding it, make sure it has a wide variety of lenses. It's up to you if you go for manual over auto focus, but you'll be able to pick up a manual focus system for far less second hand than an equivalent auto focus system. Personally I'd go for something like a manual focus Nikon FM or equivalent and a couple of prime lenses 28mm, 35mm or 50mm, backed up by an 80-200mm f4 zoom. A set up like that wont cost the earth and as long as you've bought equipment of a decent condition, will last for quite a while.

Ed's note: See back page for some examples of Bob's excellent rocketry launch photographs.

