

SPARK

The Official Newsletter
of the
UK Pyrotechnics Society



Issue 10
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The **UK Pyrotechnics Society** is the only independent UK organisation that exists to represent the heritage, science, history and art of pyrotechnics in the United Kingdom.

The society was officially formed in 2006, and consists of industry professionals, academics, and enthusiasts of the general public.



We are not a trade association, but represent the interests of a very wide ranging, vibrant membership. If you are not already a member, we invite you to read the newsletter, visit our webpage:

<http://www.pyrosociety.org.uk>

and perhaps even consider joining our organisation?

Steve Miller MIEpE. UKPS Chairman

Some of the information published in Spark is of a technical nature. While the UKPS make every effort to ensure published information is correct, we cannot be held responsible for accidents or injuries occurring through use of any information published in the magazine.

Opinions expressed are those of the authors and not necessarily those of the UKPS.

The UKPS does not approve of or encourage any illegal activities connected with the construction or use of fireworks.

Front Cover - Sidney Alford at the AGM, inset, shaped charge demonstration.

Photographs by Bob Twells

AGM Photos By Chris & Phil Dunford

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From The Editor:

So here we are, finally in double figures – welcome to Spark 10! I'm delighted to say that you don't have to suffer any articles from me in this issue as everything is from our members! Please keep it up and Spark will continue to be a varied and vibrant publication.

As you read this, the Olympics will be underway or over, and I can only hope that the passing of this major event will make the authorities a little less jumpy with respect to the activities of legitimate experimenters.



Enthusiasm is still high from our very successful AGM and you will find a report about this in these pages from our new chairman Steve Miller MIEPE.

We extend a warm welcome to Steve. I'm sure that once he has got his feet under the table, the society can expect great things.

It would be unforgivable not to acknowledge the huge contribution made by Richard Harwood during the first 6 years of the society's existence. The presence of a reliable and consistent figure at the top has done much to get the society to where it is today. A truly representative body for the UK experimental firework community – thank you Richard.



Phil Dunford

Editor & Vice Chairman

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From the Chairman:

I trust that everyone who attended the AGM/Conference had as good a time as I did. For those who didn't make it to Woodstock, you missed out on a most excellent day – hope you can make the AGMs of the future. We want to have alternate North/South AGMs in the future – so tell us if you know of suitable venues – the AGM could be on your doorstep.

We quickly dealt with Society business in less than 30 minutes, as promised. Richard handed over the reins to me, so I can take the society forward and build upon the excellent work Richard and others have put in over the years. Richard was presented with a Life Membership of the Society in recognition of the hard work he has put in since the Society's inception.



Part of The Committee

Vic's demonstration of rocket motor pressing was very well received, Phil Dunford's retrospective of UKPS activities was excellent and really showed what the society has been doing, Wayne Robshaw's presentation on the work we've been doing on the Explosives Legislation Review (MSER) showed that the Society has the respect of the HSE and that they are taking our views seriously, plus my



Vic's Demonstration



Steve's Talk

presentation on firework forensics was none too shabby (even if I do say so myself)!

Of course none of us could hold a light to the hugely entertaining anecdotes, and sometimes contentious views of Dr Sidney Alford. The demonstrations of his Vulcan (copper lined) shaped charge and the larger (magnesium lined) brother were something a little different for the UKPS.



Wayne

Unfortunately, these two bangs did generate one complaint from a local resident, we did our best to placate him, but he was insistent that he was going to write to the school and complain. However, no such letter appears to have been sent. Dr Alford had requested a copy of the letter of complaint as he likes to display such documents at his business premises - I'll leave it to your imagination to decide upon exactly which room he wallpapers in this fashion!

We talked about what we wanted to do as a Society - one of my pet projects is what's been coined 'Big Science' doing explosive demonstrations with the emphasis on the science involved, for schools or at appropriate locations where families can visit. The aim being to get kids interested in



Setting up the display

pyrotechnics and explosives as a means of countering the non-practical chemistry lessons in the schools and try and undo the anti-fireworks thoughts that seem to be installed in most young people today.

At the end of the day, the Society is here for the members; we will do whatever the majority of the membership wants us to do. To this end we've set up a poll on the forum, so please vote on your preferred options. If what you want isn't on the list let us know and we'll see if there is enough interest to pursue it.

Be Safe and Have Fun.

Steve Miller
UKPS - Chairman
Steve@LiveActionFX.Com



Part of the display



Simple Bengal Matches

by Paul Dack

For those unfamiliar with Bengal Matches, they consist of a stick and friction sensitive composition in the normal manner, with the addition of a colour composition coated for a reasonable length down the matchstick, so that when you strike them you have a few seconds of coloured illumination.

They were popular up until quite recently, but are now increasingly hard to find, so I decided to write a quick tutorial to help you use up those odds and ends of star composition on a quick and simple project.

The traditional variety used a shellac fuelled composition, which gave a fairly poor colour by modern standards. Such a composition was dissolved in boiling alcohol, then dipped as shown below. After drying, an additional dip of Antimony Trisulphide and Potassium Chlorate composition added the striker to the tip. I have tried the traditional variety but have come up with a new method which gives a much faster construction time and removes the need for boiling alcohol or chlorate striker compositions.

The advantages of the method I am using are as follows:

Uses excess colour/star compositions that would otherwise have to be burnt off and wasted.

Acetone based, dries in minutes.

Works with a wide variety of compositions.

Unlike most methods there is no need to contaminate your workshop with chlorates.

Materials:

Long safety matches – short ones also work but with reduced burn time and worrying proximity to fingertips!

Tin foil.

Acetone.

NC Lacquer (unless using stars high in parlon or red gum).

Around 20g of star composition, dependant on dipping container.

Small dipping container – I used a tiny jam jar from a variety pack.



Important note – do not attempt to make these with star composition which gives out sparks. It is best to stick to organic compositions with a small flame envelope, and if you must use metal fuelled compositions, ensure that the fuel consists of only very fine particles. You do not want stray titanium or magnalium sparks to be given out so close to your hands.

Step 1

If you already have a composition prepared, skip to the next step.

Select a suitable organic composition. Something along the lines of:

Potassium Perchlorate	60
Parlon	15
Strontium Carbonate	15
Red Gum	10

The parlon and red gum help to make it nice and sticky, so that it will adhere to the matchstick. Compositions lacking these ingredients will work, but may require the addition of some nitrocellulose lacquer.

Step 2

For the organic red above, I weighed out 20g of composition along with 2g of very thick NC lacquer (just to make sure, not really necessary) and 8g of acetone. I then stirred this thoroughly with a surplus wooden stick until the consistency resembles honey. If you dip the stick into the composition, you should get a nice even coating at least 1mm thick, with no solid clumps.



If you find that you have added too much acetone (viscosity too low) then simply leave it to stand and thicken up for a few minutes.

If your container is narrow, for instance a test tube, you can get away with using far less composition to give the required depth for dipping.

Step 3

This step will be a great test of your dexterity and eyesight! Rip a small strip of tin foil, approximately 20mm long and 5mm wide. Proceed to roll the foil over just the head of the match to form a little 'hat'. Roll the foil between your fingertips to crimp it onto the match head, then ensure that it is firmly fixed in place (so that it doesn't free itself when dipped). The intention is to shield only the match head, so that when the foil is removed the composition is coated right to the head and takes light easily. If your foil covers too far down the matchstick, there is a risk of the composition not taking fire when struck.



If you would like to make quite a few of these, it may be as well to cover your composition to ensure that it does not dry up whilst foiling the match heads. If you forget, a quick stir and some more acetone should rejuvenate it in any case.

Step 4

Stir the composition again to ensure that it has not settled out, then dip matches one by one, twisting them if droplets form at one side to even them out. It is inevitable that your first few will not be uniform, and at this stage you may feel the need to adjust the viscosity of your composition once more to get it perfect.





After dipping, you will see the composition has a glazed finish. By blowing gently on it whilst rotating between the fingertips, you can force the outer surface to stiffen and keep its shape.

Insert the match upright (handle end down of course) into a piece of expanded polystyrene to dry for a few minutes.



Step 5

Remove the foil caps after several minutes of drying by pulling them directly away from the stick with either gloved fingertips or an old pair of snipe nosed pliers. This works best whilst the composition is still slightly malleable; if you remove it when the composition is set solid you make them more prone to cracking/flaking of the exposed edges. Leave for an additional 30 minutes or so to ensure they are dry - thicker coatings will require longer drying times.



Step 6

To misquote an often used proverb – the proof is in the burning!



International Symposium on Fireworks 2012 – Malta

Richard Harwood

Malta will be well-known to UKPS members for the highly unique and unusual nature of its fireworks. Over the space of just 122 square miles, there are an incredible 33 firework factories, over 120 firework societies (band clubs), and in excess of 1000 licensed pyrotechnists.

Many UKPS members have visited Malta over the years to enjoy the remarkable firework displays. Some have even been lucky enough to be invited into the factories by the local firework societies or band clubs – and to participate in the Maltese festivities that accompany their extensive use of highly novel and evolved aerial and ground effect fireworks.

I have been fortunate enough to spend time in other parts of the world noted for their strong fireworks culture – namely Valencia, Spain, and Liuyang, China. Malta was one place I had yet to visit, and it was something I had promised to myself that I would do!



MALTA international
FIREWORKS
FESTIVAL 2012

Lily Fireworks, Mqabba
13th International Symposium on Fireworks - Malta
Wednesday 25th April 2012 8.30 PM
Mellieha

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Facebook

One day in late April, a good friend of mine who runs a leading firework company here in the UK, contacted me and asked if I would care to join him to attend the 13th International Symposium on Fireworks in Malta, held between April 23rd – 27th in Malta. How could I refuse!

A week later and we were on the tarmac at Malta International Airport. Our trip was only for the first few days of the Symposium, so we were determined to make the most of our visit.

Upon arrival at the host hotel (the rather grand Excelsior Hotel in Valletta), we checked in and then went to register. Within moments, we realised we were surrounded by almost every notable fireworks professional you could think of. Companies from Japan, Italy, Spain, France, Australia, and the USA to name but a few...

The Symposium is of course an opportunity to mix both business and leisure – it is a unique opportunity to network with friends and colleagues from around the world – and to make quite a few new contacts in the process. We spent the evening chatting to familiar faces over a glass of red wine – about fireworks, naturally!

The evening's welcome reception was brought to a conclusion with an eight minute close proximity pyromusical show by FireOne Malta in collaboration with St. Nicholas Fireworks Factory of Siggiewi.

After a good night's sleep, an early start for breakfast and then up to the conference floor where most of the talks and activities would be taking place each day. In the lift I bumped into Rev. Ron Lancaster of Kimbolton Fireworks, whom of course needs no introduction. It was nice to see that several of us had made up the British contingent!

The talks at the Symposium were extremely comprehensive and varied in subject matter. There were discussions ranging from the novel application of Blue Aluminium for the manufacture of 'safer' flash powders, through to the reduced sensitivity of black powder at elevated temperatures. It is fair to say everyone at the symposium learnt something new – and the copy of the proceedings (a very thick volume I might add!) contained within a goody bag given to all delegates came in very handy at digesting so much fresh information.

Your author was most pleased to be the first delegate to win a prize in the daily raffles (to encourage attendance of the lectures and talks!),

and was presented with a copy of Dr. Tom Smith's new book; 'Firework Displays: Explosive Entertainment'.

On Monday afternoon, we were fortunate to be given a private guided tour of St. Joseph's Firework Factory, Ghaxaq. A few of us went by car to the factory gates before being shown around. This is an experience I will always remember, and one I look forward to repeating when I next visit Malta. Each Maltese factory guards its techniques carefully, so if you wish to learn more, you will have to visit Malta in person!

The Monday evening of the Symposium was concluded with two excellent displays of fireworks in Mdina. The first was a comprehensive pyro-musical display by Scarpato / PyroDigiT of Italy, followed by Mount Carmel Fireworks Factory of Zurrieq, Malta.

The hot fallout from these displays set fire to a large part of the valley bottom, beneath the old railway bridge where the displays were fired. This didn't seem to trouble the Maltese! As the trees and bushes started to burn, they just fired more!

I will never forget the Mount Carmel display, being the first time I had witnessed Maltese fireworks being used in Malta. The multi-break shells were literally breath-taking; the concussions from the bottom shots (final, large flash report break) could really be felt in the bottom of your stomach. Their display even concluded with a 24" shell of shells.

On our final evening in Malta, with no fireworks displays planned, we went to explore Valletta, and were pleased to spend dinner with our Japanese friends. It goes to show, that despite the fact that we spoke English, and they spoke Japanese, we got along just fine - we spoke the international language of fireworks!

I look forward to returning to Malta, and to future symposia. The next ISF takes place in Changsha, China in October 2013. For more information, visit www.isfireworks.com.



UKPS Management Committee after 2012 AGM

Chair – Steve Miller

Vice-Chair – Phil Dunford

Treasurer – Joseph Matthews

Membership Secretary – Chris Dunford

Meeting Secretary – Paul Dack

Secretary – Phill Cooper

Safety Officer – Gareth Barnes

Website Development – Bob Twells

HSE Liaison – Wayne Robshaw

Life Member – Richard Harwood



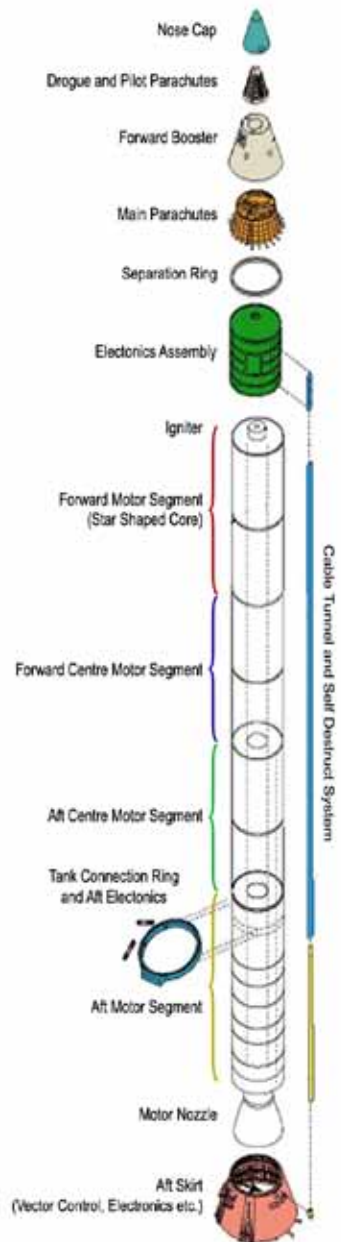
The World's Largest Core Burner

By Bob Twells

One year ago saw the final launch of the NASA's Space Transportation System, the Space Shuttle, which was retired after 30 years of service. The propulsion system of the Space Shuttles consisted of three main liquid fuel powered engines (liquid hydrogen and oxygen), and a pair of reusable solid rocket boosters (SRBs) which provide the additional thrust required at take-off to escape earth's gravitational force. These SRBs, despite their immense size and added features, use the same basic principles utilised in the firework rockets we are more familiar with.

The SRBs are a well recognised feature of a Shuttle before launch; the two white tubes straddling the huge external orange liquid fuel tank on which the Shuttle piggybacks during launch. They are manufactured primarily by ATK Launch Systems in Utah, with parts supplied from many other contractors.

Each SRB stands 149ft (45.5m) tall, and weighs 1.3m lbs (590,000kg) before launch, which drops to around 200,000 lb (91,000kg) when fully burnt. The actual motor section is 126ft (38.5m) long and 12ft (3.7m) in diameter. The outer steel casing is built in separate segments, which are assembled at the launch site and, as well as the motor itself, also house the electronics, recovery parachutes, separation gear, and a self-destruct system. They are the largest solid rocket motors ever flown, and were the first designed for reuse. Their modular and reusable nature also means that different configurations have been



planned for use in other NASA programs including the (now scrapped) Ares I and Ares V, and the Space Shuttle's upcoming replacement, the Space Launch System (SLS), due for launch in 2017.

The SRB fuel is a solid mixture referred to as Ammonium Perchlorate Composite Propellant (APCP), with the composition: Ammonium Perchlorate (oxidiser – 69.6%), Aluminium (fuel – 16%), Iron Oxide (catalyst – 0.4%), Polymer binder (PBAN or HTPB – 12.04%), and an Epoxy curing agent (1.96%). Each SRB contains 1m lbs (450,000 kg) of the composition, which is mixed in 600 gallon bowls before being cast into the required segments, just slightly more than is allowed under our 100g rule! The cured propellant has the consistency of the eraser on a pencil, and is a form of synthetic rubber.

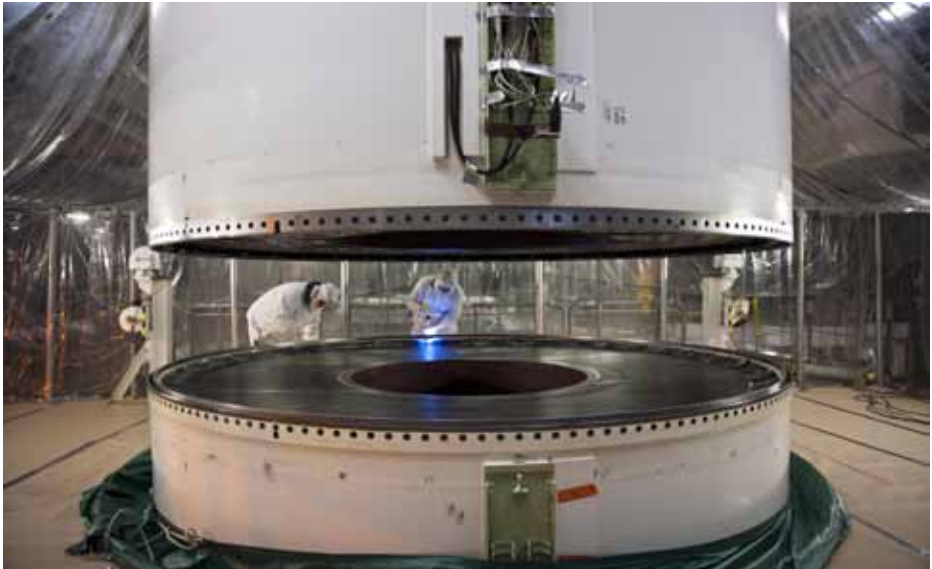
A hollow core is used in the rocket to increase the surface area of the burning fuel, exactly the same as in black powder core burner rockets. In this case however, the first segment of the motor has an 11-pointed star shaped core, giving a hugely increased surface area for the initial (launch) stage of the burn, with the remaining three



Shuttle Launch

segments being a traditional cone shape. As the rocket burns the star softens out to a more circular shape. This configuration gives maximum thrust during the initial launch stage, after which the thrust drops off to about two thirds to prevent over stress as the Shuttle experiences it's maximum aerodynamic stress ("Max Q").

As expected with solid fuel rockets, once ignited they cannot be extinguished, so the SRBs are only ignited as the final step of the launch sequence, as the countdown clock reaches zero. The other three main engines on the Shuttle are started around 6 seconds earlier, and must reach 90% thrust within 3 seconds (as well as some additional checks),



Solid rocket booster – segment stacking

otherwise a safety shutdown procedure will automatically end the launch and the SRBs will not be ignited. Ignition of the rockets begins with a PIC capacitive discharge system, charged to 40 volts, which must receive three simultaneous fire signals from the various computers controlling the launch. When initiated the charge starts the chain reaction of ignitions building up to the final ignition of the main composition. A series of NASA Standard Detonators (NSDs) are first to detonate, which ignite a booster charge, which then ignites an ignition initiator, which finally ignites the main propellant! At the same time the pyrotechnic bolts

fixing the boosters to the launch platform are also fired, leaving the shuttle completely detached and free to launch.

Each SRB generate around 3.1m lb (14 MN) of thrust at their maximum (a few seconds after launch), and together provide around 83% of the total lift off thrust for the Space Shuttle. Two minutes into the launch, at around 146,000ft (44.5km) and Mach 4.5 (3,425mph), the rockets are jettisoned from the Shuttle, but continue to rise for around another 75 seconds to their apogee of approx 220,000ft (67.1km). As they start to fall back to earth, parachutes are deployed and they will land in the ocean and around 140 miles from the launch point, and will float upright with around 30 ft sticking out of the water. They are recovered by ship and the major parts will be refurbished and refilled for reuse in another booster rocket.

The simple core burning principle helped launch a total of 135 Space Shuttle missions, which carried numerous satellites, probes and experiments into orbit, launched the Hubble Telescope, and enabled the construction and servicing of the International Space Station. In 1986 a failure of one of the SRBs during launch led to the disintegration of Space Shuttle Challenger, killing all seven crew on board. It was later found that an O-ring used where the segments of the SRB are joined had failed due to cold weather, allowing the exhaust gases of the motor to escape through the side of the casing, and subsequently burn through the casing of the main liquid fuel tank.



Book Review – Heaven Sent by Christina Jones

The Green Man

I thought I would include a brief mention of this excellent book, not least because it includes a passage pinched from my website. Far from being offended at the plagiarism, the Green Man is quite flattered. I did however mention this to the author, who was suitably sheepish. No legal action followed!

The novel concerns the adventures of Clemmie Coddle a young girl whose aim in life is to work with fireworks. I won't spoil the plot by telling you if she does...

Although far from being exclusively about fireworks (it's a romantic novel!), there is some lovely technical detail and speculation which should appeal to readers of Spark.

If you would like a change from your usual diet of Tenney Davis and the internet, I would certainly recommend this book.

ISBN 978-0-7499-3854-3

(By the way, the Green Man will soon be back in his workshop...)



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Please note the change of Company Registered address.

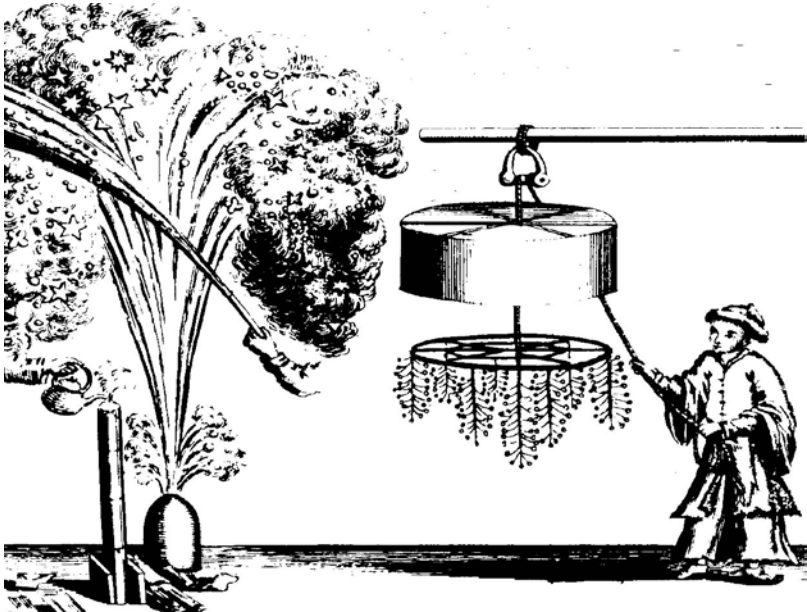
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Luigi travels to China for some industrial espionage



Firework Quote:

All architecture is great
architecture after sunset;
perhaps architecture is really
a nocturnal art, like the art of
fireworks.

Gilbert K. Chesterton



We welcome any firework related articles for publication.

Please send to:
editor@pyrosociety.org.uk

Remember to visit the Website and Forum for up
to date information

www.pyrosociety.org.uk
www.pyrosociety.org.uk/forum

We now also have a Youtube Channel at:

<http://www.youtube.com/ukpyrosociety>

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