



Aeronaut

The Newsletter for the Association of Experimental Rocketry of the Pacific

Tripoli Rocketry Association, Inc. Prefecture no. 23

May 2000: Volume 12, Number 2

First Commissioner's Corner

Well the first launch of the season is just around the corner and you should all be at the peak of your building cycle. First I'd like to tell you that we have all our permits and waivers in hand. We have blanket altitude waivers for all our launches to 50,000ft MSL. So we have a useable above ground level altitude of 46,000ft. We are also applying for additional high altitude windows of 90,000ft MSL for our Blackrock Experimental launch in September. I also have a verbal confirmation from Mike Bilbo of the BLM that our permits for this year have been approved and the final letter will be sent out in the next couple of weeks. So we are ready to go for the summer.

Equipment Party: We had an outstanding turnout for the equipment cleanup party this year. THANKS to all of you who came by Tom's new digs to help out. We got a great deal accomplished and we think the equipment is in great shape for the 2000 season. Special thanks to Tom and his family for putting up with all of us for the entire day!

Tripoli Insurance Issues: As most of you know we now have a new TRA insurance policy that offers more coverage and for the first time offers member-to-member liability coverage. This is good news but it does have a down side. The new insurance requires strict adherence to TRA safety codes and NFPA 1127, and the AERO-PAC Safety rules. Among other things this means that the RSO's will not give any leeway on allowing the use of non-certified motors at our launches. Please don't put the launch, RSO or yourself in an uncomfortable position by trying to pass off a non-certified motor as certified. Also on the new flight cards you will notice that we are asking for some new info and requiring you to sign the card stating that you are following TRA safety rules and the motor manufacturer's printed assembly instructions. PLEASE, PLEASE, fill out your flight cards completely before visiting the RSO table. Additionally, I'd like to remind you that

FIREWORKS of any kind are strictly prohibited at AERO-PAC launches. If you or anyone in your party is seen using fireworks at or near the rangehead, your launch privileges will be revoked and you will be asked to leave.

I'm really sorry to sound so much like the "police" but IF we have an accident of any type the insurance company will look for any reason to deny us coverage. This could lead to us losing our launch site and in the extreme, the loss of insurance for Tripoli as a whole. Enough of the sermon (I hate being the "bad cop!").

There was some initial confusion about members from other rocketry organizations being able to launch high power rockets at a TRA launch. Let's just say that everything has worked out and TRA insurance will recognize both NAR and CAR (Canadian Assoc. Rocketry) members and they needn't become TRA members to fly with us. Also anyone who wants to come to a TRA launch and fly a 2-G cluster or smaller may do so without becoming a member of any rocketry organization.

AERO-PAC Memberships: This is the last newsletter you will receive if you do not renew your membership. There was a membership form included in the last newsletter but if you've misplaced it you can download one from the AERO-PAC website. Or call Rich Amstadter our Treasurer and he'll send you one. IMPORTANT, the members@ email list will be purged later this month and only current members will be included on the new mail list. So Please don't procrastinate any longer and lose your mail list and newsletter benefits.

Launch Duty and Gold Cards: We will have on-line launch duty signups again this year. Please help us put on a great launch by signing up for a 2-hour stint. Remember Primary RSO's MUST be Level 2 or higher. Launch duty volunteers will receive one raffle ticket for each shift they work and those staying for clean up will receive an additional 2 tickets, instead of Gold Cards. These tickets will be held until the end of the season and we

will have a special raffle just for the volunteers. We are planning on having some really nice prizes for this special raffle (no \$5 gift certificates!). However, if the July launch has a large attendance we will issue Gold Cards in addition to the raffle tickets.

Porta-Potty Hauling: As per last year, potty transporters will receive \$50 each way. Pick-up is in Sparks so you only haul it from there to the launch site. Many thanks to those who did this service last year! Contact Tom Rouse if interested and/or sign up on-line.

New AERO-PAC T-shirts: Our illustrious Second Commissioner, Bob Fortune is putting the final touches of the new T-shirt design and should have it available for preview at the next members meeting on June 3rd. I think the new design is awesome! Nice job Bob.

Members Meeting: The next meeting will be at the new Portal building and will happen from 1-3pm. (see directions on page 2 of this newsletter). Bring your projects, videos, photo's, sale/trade items etc.

Well I think that's just about enough for now. See you on the Playa next month!

2000 Schedule

- June 3, Saturday** – Board and Member's meeting at Portal's new HQ in San Jose.
- June 24-25** – Mudroc 7.0
- July 28-31** – Aeronaut 2000
- August 19, Saturday** – Board and Member's meeting at Portal.
- September 9-10** – Black Rock XII
- September 11** – Black Rock EX3 (experimental launch)
- October 14-15** – Hayburner launch.
- December 2, Saturday** – Board meeting and end of season meeting and feast at Portal.

December Meeting Photos

By Steven Preston



The presentation by John Mouritsen, AeroJet General Solid Propulsion Division.



Stanford professor Bob Twigg's presentation on the ARLISS project.



Lunch after the meeting at the old Portal headquarters.

The New Portal Offices

By Al Frazier

Portal Has Moved!

Portal is now located at 10200 So. De Anza Blvd. in the city of Cupertino. It is a 4 story building near the intersection of De Anza Blvd. and Stevens Creek Blvd.

From Hwy. 280:

To get to Portal exit Hwy. 280 at De Anza blvd. You want to head south on De Anza. You will go through about 4 stop lights before you get to Stevens Creek Blvd. Portal is on the left side of the road so you will need to go one block past Stevens Creek Blvd. to the next light and make a U-turn and come back to Portal.

From Hwy 85:

Exit on De Anza Blvd. north. Go through about 7 lights. Portal is on the right side.

Parking:

Parking is under the building. You will see a drive just next to the building and just as you drive by the back of the building, you will see a smaller drive that will take you to the underground parking. *You can park any where you like.* Then take the elevator up to the lobby.

Many thanks to Al for the continuing use of the Portal offices for our AERO-PAC meetings. See you on Saturday, June 3rd at 1:00pm.

Launch Duty

Sign up for launch duty for the upcoming launches. We have the new on-line sign up forms available at

www.aeropac.org/duty.html

Thanks for your help in making our launches this year the best ever.

Don't forget to renew!

If you don't renew your membership soon, this will be your last newsletter! Use the membership form in your February newsletter or visit the web site at www.aeropac.org for another application.

We hope to see you for another glorious flying season at Black Rock!

Electrical Current Requirements of Rocket Igniters

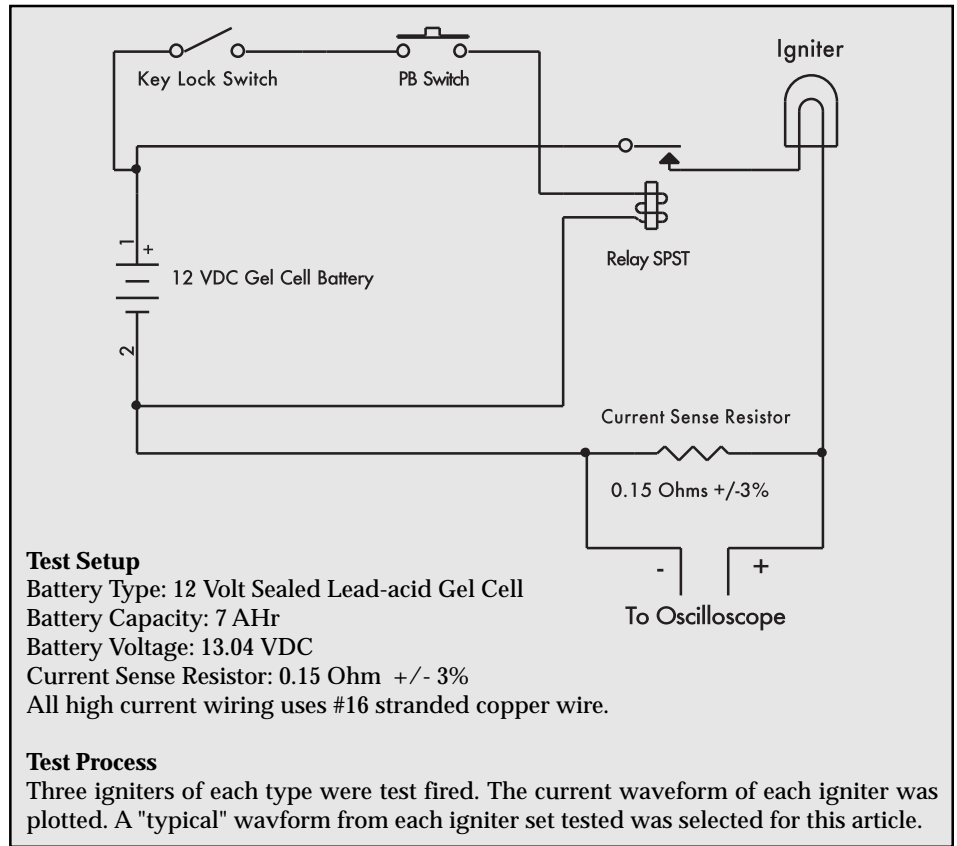
By Robert Briody

Overview

Every model or high power rocket flight is initiated by a single event. The igniter or electric match fires which in turn ignites the blackpowder or composite propellant. For such a critical role, little technical information is available regarding the electrical characteristics of these devices. This document will shed some much needed light on the electrical characteristics of electric matches.

Test Results

The first electric match tested was the DaveyFire N28F (black wire). The waveform shown in Figure 1, below represents the current consumed by the igniter. From Ohms law ($I=E/R$) we see the peak voltage to be 2.125 volts across a 0.15 ohm resistor or 14.16 amps! The manufacturer's data sheet specifies the current as 2 amps for 40 milliseconds. Depending on the application, the manufacturer's specification can be misleading and lead to less than desirable results for the unsuspecting rocketeer.



hp stopped

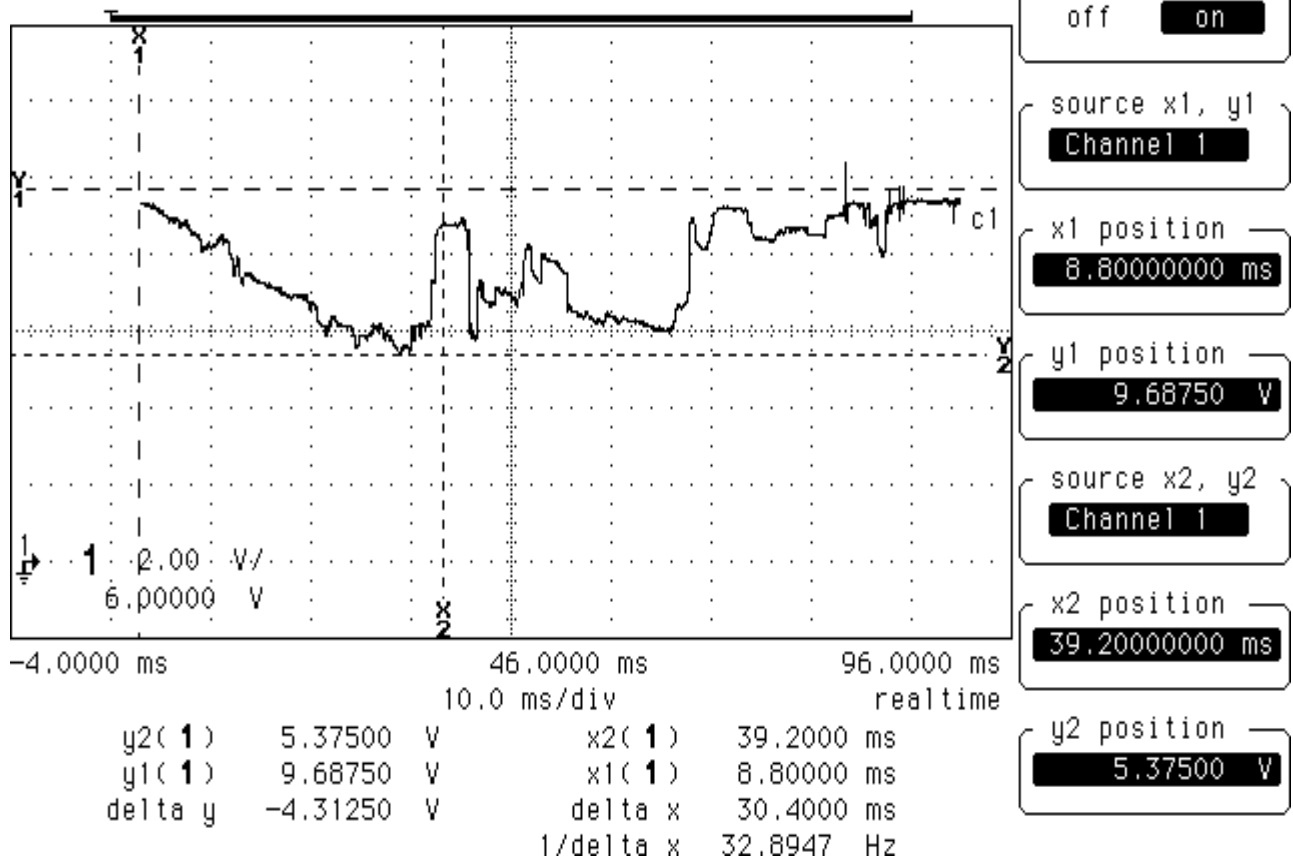


Figure 1. DaveyFire N28F Electric Match current waveform. The scale 3.33 amps/division. The peak current is 14.16 amps.

Figure 2 shows the relatively low current requirements of the DaveyFire N28B electric match. Peak current required is 5.79 amps. The manufacturer's literature says 1 amp for 2milliseconds.

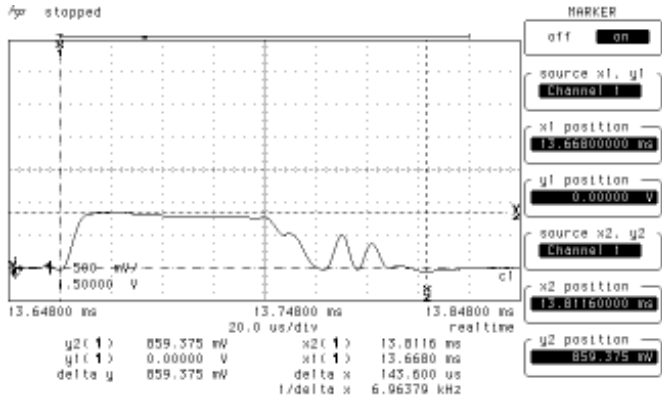


Figure 2. DaveyFire N28B Electric Match current waveform. The scale is 3.33 amps/division.

The next electric match tested was the Aerotech Copperhead from a G64 RMS motor. To make it reliable and compatible with alligator clips, I delaminated the entire length, except for the last 2 inches. Figure 3 shows the current demands of a Copperhead igniter.

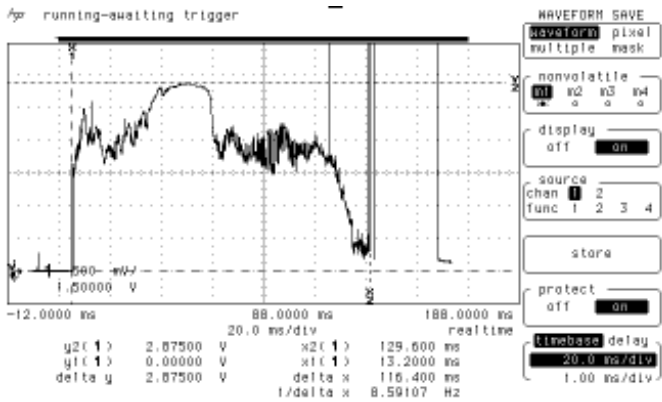


Figure 3. Copperhead current requirements. Peak current is 19.16 amps. The spikes going off the scale are the copper strip shorting as the match burns.

After the Copperhead, I tested the IgniterMan Igniter (#24 wire electric match). Figure 4 shows the current demands of an IgniterMan Igniter. Notice the ramp up in current to the peak of 11.98 amps. This ramp represents the conduction current of the gas plasma produced by the burning pyrogen.

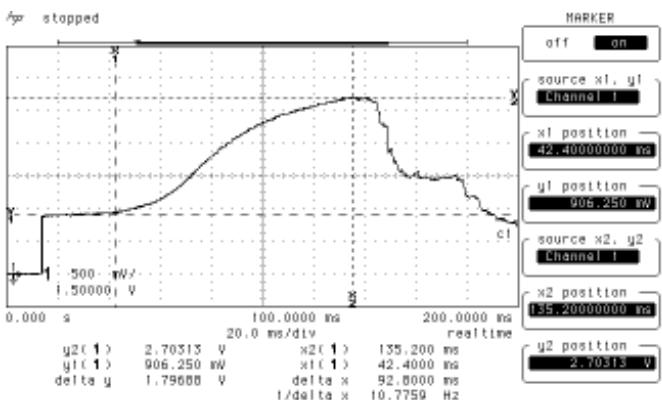


Figure 4. IgniterMan Igniter. Peak current is 11.98 amps. The vertical scale is 3.33 amp/division.

Figure 5 shows the electric current demands for an Oxral electric match. Note the extremely low current, compared to all of the other electric matches tested. With out a doubt, this is the best electric match to use for ejection charges when avionics are used. It's relatively low current and short duration are exceptional. The Oxral match does have one detractor when used as an ejection charge initiator. The protective plastic sheath consumes a large percentage of the internal volume of a microcentrifuge tube. This in turn limits the total amount of blackpowder that can be loaded into the tube. This is easily solved by purchasing larger containers or tubes. No manufacturers data sheet was available for this electric match.

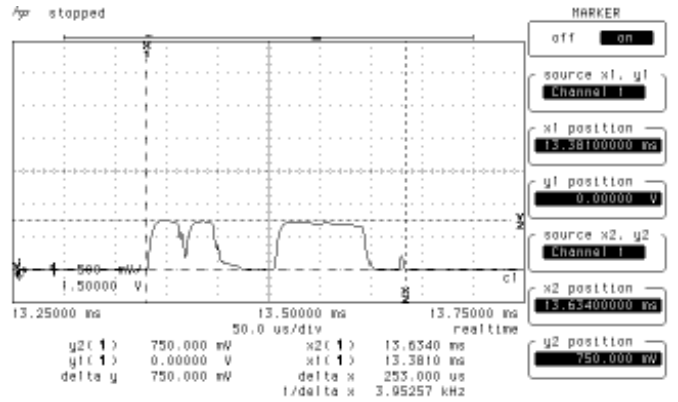


Figure 5. Oxral Electric Match. Peak current is only 5.00 amperes and the duration is only 253 microseconds. The scale is 3.33 amps/division.

Next, we'll take a look at the peak current requirements of an AG-1 Flashbulb. Figures 6 and 7 show the long term and short term current requirements respectively. These devices are perceived to be "low current" devices. The peak current here is 9.89 amps!

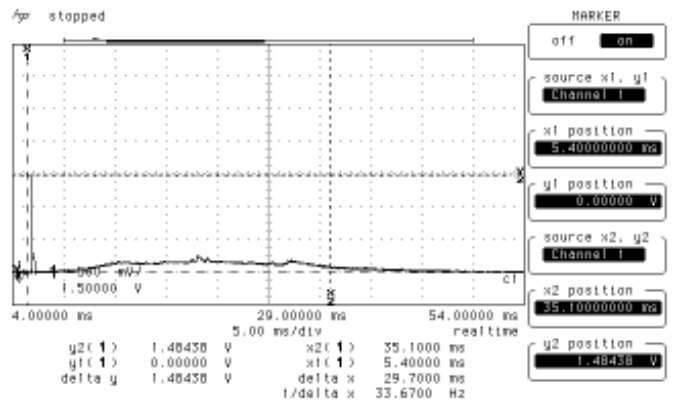


Figure 6. Long term current requirements of an AG-1 flashbulb. The scale is 3.33 amps/division.

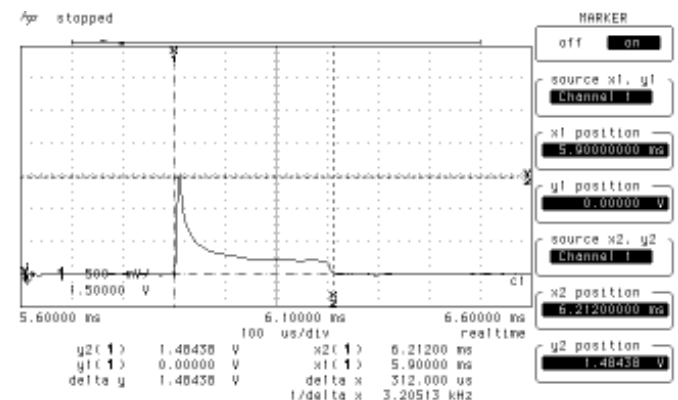


Figure 7. The short term peak current requirements (expanded view of the current spike on the left-hand side of Figure 6, above).

Electric Match Compatibility with 9 VDC Batteries

Most Altimeters and Accelerometers used for air-starting motors and recovery initiation use the standard 9VDC transistor battery. As you'll see from the following waveforms, you'll probably want to switch to using a dual battery system. In a dual battery system, one battery is used to power the computer or electronics and a second battery is used to power electric matches and the associated firing circuitry. The battery grounds are common but the Plus (+) terminal are separate and isolated. This configuration prevents power spikes or glitches, produced by firing electric matches, from causing erratic or erroneous flight computer or timer operation.

Figure 8 shows what happens when a DaveyFire N28F is placed directly across the terminals of a Standard Duracell Copper Top 9VDC alkaline battery. The battery is fresh with an open circuit voltage of 9.68 VDC. The current demands of the electric match are such the battery voltage dips to 2.56 VDC! This has serious potential for glitching or causing anomalous behavior for most ANY flight computers on the market.

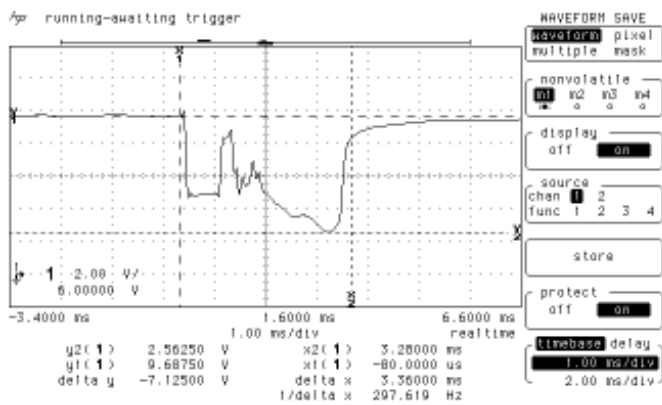


Figure 8. DaveyFire N28F across a Duracell 9VDC transistor battery.

Figure 9 shows a DaveyFire N28F across the terminal of a Duracell ULTRA 9VDC transistor battery. Though the results were improved, there is little to no room for electric match variance.

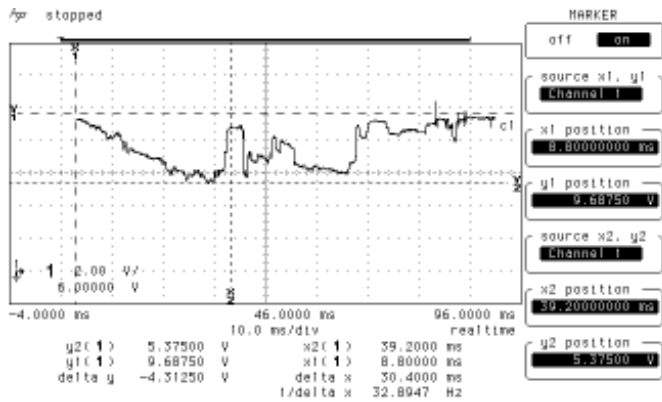


Figure 9. Battery voltage of a Duracell ULTRA with a DaveyFire N28F connected directly to it. The cell voltage drops to 5.37 VDC from 9.59 VDC.

In the next test I connect a DaveyFire N28B (white wire) directly across the terminals of a Duracell Copper Top 9VDC transistor battery. Figure 10 shows the superior electrical performance of the N28B over the N28F. This electric match requires the least amount of current and is excellent for recovery initiation. **WARNING:** The N28B is incapable of reliably firing composite propellant motors. It's burn temperature is too low and burn rate is too fast. Reliable motor ignition is best achieved through Firestar, IgniterMan, Magnelite or dipped/augmented Daveyfire N28F igniters.

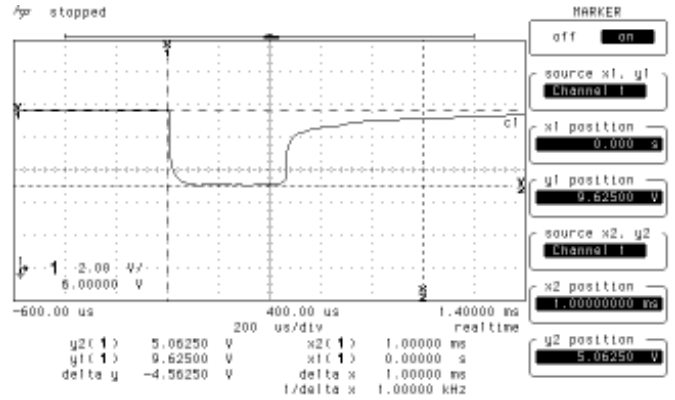


Figure 10. DaveyFire N28B across Duracell Copper Top or ULTRA battery. The battery voltage was within 0.2 VDC for both batteries in this test. The waveforms were also nearly identical.

Summary

Igniter/electric match electrical current demands vary widely, as can be seen from the above information. The "all fire/no fire" current ratings, though useful, don't adequately show the igniters true electrical characteristics. When choosing an electric match, you must understand the target application AND if connected to computer-controlled electronics, you must design the system to handle the PEAK current demand of the igniter/match. Failure to perform either one of these steps can cause serious malfunction or momentary failure of the electronics. This could cause your prized rocket to "lawn dart" or "core sample." Remember, this is rocket SCIENCE.

This document is work in progress. Firestar, Magnelite, and other igniters/matches will be added to the document. Updated versions of this document will soon be available on a web site to be announced. I'll e-mail all AERO-PAC members when the document is online in PDF format.

Acknowledgments

Thank you Doug Pratt of Pratt Hobbies for providing the DaveyFire N28B electric matches without charge for this test. Thank you Pius Morozumi for providing several varieties of electric matches and flashbulbs (soon be tested) and for convincing me to expand the scope of this document to include nearly all of the common igniters used in model and high power rocketry. Thanks also goes to my son, Scott Briody, for helping me perform the tests.

Would you like to see more technical articles such as Rob's excellent experiment?
Be sure to submit your articles to the newsletter so we all can learn.
Send photos and articles to john@jcs.com.

New Range Setup

By Tom Rouse

In order to relieve some of the long lines for high-power pads and to make the launch control system easier to use, we are changing the way we allocate pads for this year's launches. Our launch controller is organized into three banks of 10 pads each. Bank A is pads 1 through 10, bank B pads 11 through 20 and bank C pads 21 through 30. We want to support two banks of front row pads for model and mid-power rockets, a second row for high-power rockets (H-K) and a few away pads for larger rockets (L and above).

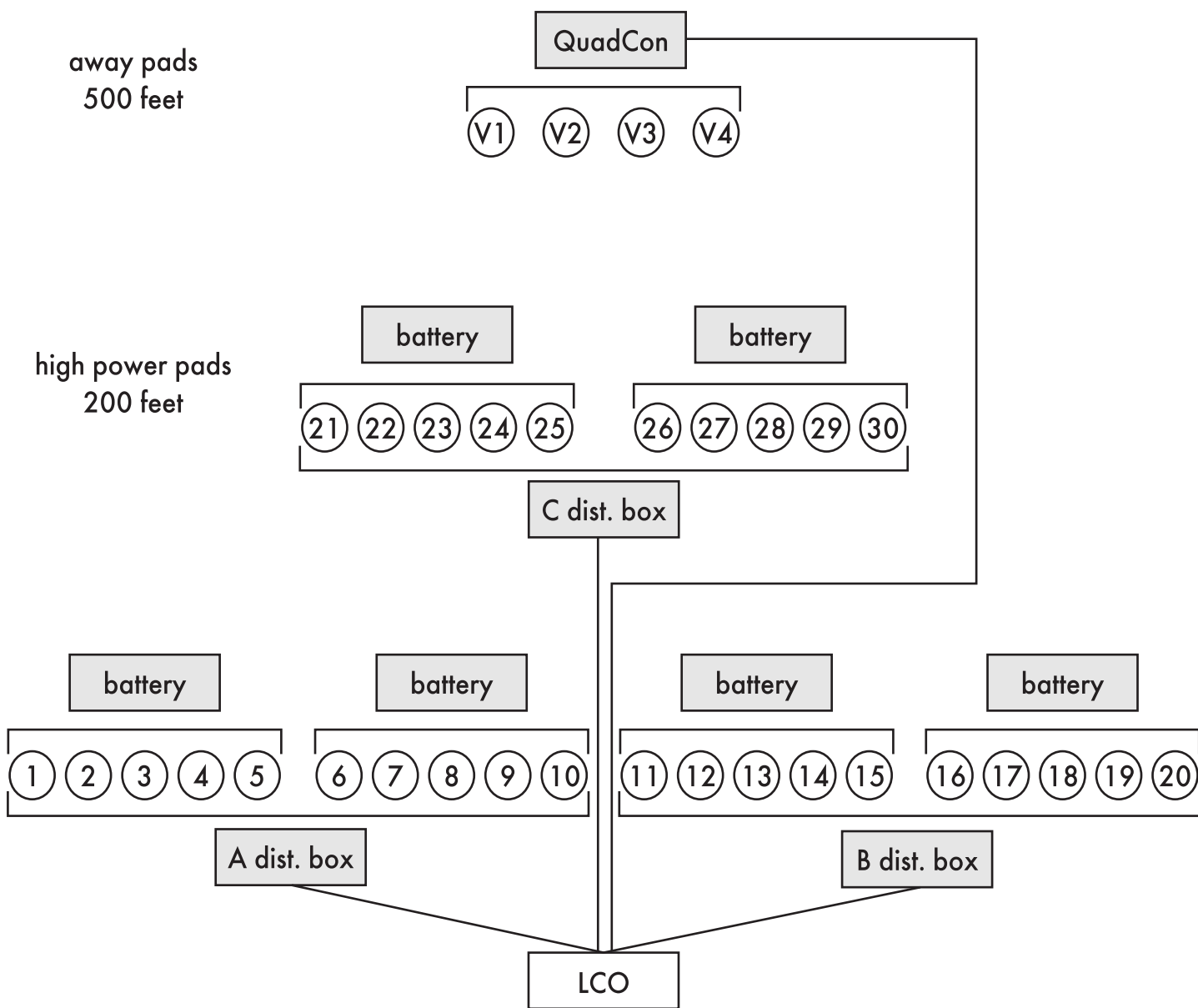
In the past, we used bank A for the left front row, bank B for the right front row and split bank C between the mid- and far-row pads. This caused three problems: 1) too few pads available for H-K motor rockets, 2) confusion because the same bank was used for

two rows and 3) the far pads were not far enough away.

For 2000, we are going to use all of bank C for the center row. This means more pads in the popular middle row which should help keep the lines short. Also, since the entire bank C is dedicated the same row, impromptu drag races should be reduced.

This brings up the question of the far pads. We are purchasing a QuadCon (four pad controller) which will be dedicated to the away cell and be able to run at a true 500 feet from the flight line. This will mean no more need to move one of the pads to get a little farther away.

Below is a diagram of the new range setup. A similar diagram has also been posted in the equipment trailer for reference during setup.



flight line (set up after A & B pads)

Minutes of the board meeting

Minutes of 4/22/00 Board Meeting

Present: William Walby, Bob Fortune,
John Coker, Tom Rouse,
Randolph Mitchell
Absent: Richard Amstadter

By consensus, the board agreed to purchase/upgrade a number of items or determine costs, grouped below by the person assigned to the task:

William:

- ÿ Launch rods: One, 1/2" x 8' and Ten 7/16" x 7'
- ÿ Take NASA launch rail to Rick Forbyrn for estimate.
- ÿ Convey condolences to Karl Baumann, ask if we can assist in any way.

Tom:

- ÿ Obtain price for surge brakes for club trailer to ensure more members can safely tow it.
- ÿ Post schematic of Pad Layout on trailer door.
- ÿ Price new Quadcon or equivalent to control 4 large projects, 1,000 feet of cable. (Check with Jerry Vaughn and Ed Hackett.)
- ÿ Weigh trailer.
- ÿ Buy 6-8 straight backed folding chairs for range use.
- ÿ Buy spray chalk (paint no longer allowed). Orange or Red only.
- ÿ Buy orange vest for Pad Manager.

Haul that Porta Potty!
AERO-PAC is paying
Porta Potty haulers
\$50 each way! Sign up for this
and other launch duty at
www.aeropac.org/duty.html

John:

- ÿ Design new Flight Cards.
- ÿ Build CGI for online launch duty signup.
- ÿ Publish schematic of pad layout in next issue of the Aeronaut.

Bob:

- ÿ Research insurance on club trailer and contents.
- ÿ Design this year's club T-shirt.
- ÿ Design Black Rock 2000 T-shirt.

Ranny:

- ÿ Contact Sue Weeks about secure storage in Gerlach area for our heavy equipment.

Respectfully submitted,
Randolph Mitchell

Contribute to the Newsletter

We need contributions to make this newsletter better and share useful information. If you have an article, a launch report or pictures to share, please send them to John Coker. My email address is john@jcsw.com. If you have a digital camera or a scanner, please send the pictures in as high a resolution as possible. If you have prints or slides and no scanner, I can scan them and even return the originals (please include SASE). Send pictures to:

John Coker
723 Chateau Drive
Hillsborough, CA 94010

Thanks!

Back to Black Rock

By John Coker



How to Contact the Board

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Newsletter Editor	John Coker	john@aeropac.org	(650) 685-1890

Other AERO-PAC email addresses: board@aeropac.org and members@aeropac.org

Don't Forget to Renew!
Many people have not yet renewed their membership for the 2000 season.

If you don't renew soon, this will be your last newsletter. A Regular membership is only \$20 this year