Heavy-Duty Model Rocket Launch Controller

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Figure 1 Launch Controller

GENERAL: This paper describes the design and wiring of a home-made launch controller for the ignition of model rocket motors. The controller will deliver enough electrical power to ignite 6 or 12 volt igniters, and has been tested to easily ignite an 8 cluster rocket. With the exception of the arming safety guards, all items can be purchased at Radio Shack or other electronics stores. The batteries can also be purchased at most hobby stores, and are standard batteries used in model RC cars. The aircraft-grade red safety guards (as shown in Figure 6) can be acquired through aviation supply channels.

DESIGN: The launch controller (Figure 1) is a completely self contained device housed in a Radio Shack project box and will meet all your launch power needs for all rockets from the ½A used by the Estes™ Mosquito® to high-power applications. The unit I built weighs 3 lbs. and its dimensions are 10" wide by 8" long by 4" high. External red (positive) and black (negative) female banana clips are located on the down-range side of the controller (Figure 2) to attach the required length of electrical wiring to the launch platform. A 35 foot (minimum safe distance for G motors) to 50 foot spool of Type CL2 18 AWG stranded speaker wire, left on the spool, with male banana clips on one end and spliced alligator and Aerotech™ Copperhead® igniter clips on the other, will provide connection to all available types of igniters. Add more clips if you routinely launch clustered rockets. All wiring throughout is 18 gauge stranded and all connections are soldered for continuity and reliability.

Figure 2 External Wiring

Figure 3 Battery Pack with Velcro

POWER: Two 7.2 volt **Heavy-Duty NiCad Batteries** (Figure 3), wired in series, when charged, will nominally provide 14.4+ volts of electrical power for igniters. The electrical connections have been replaced with quick release connectors to allow easy switching between the launch controller wiring harness and recharging adapter. Full recharging takes approximately 3 hours per battery. Velcro strips attached to the batteries and the case floor provide security.

AURAL WARNING: Dual **Piezoelectric Buzzers** have been installed in the system (Figure 4). The first is wired through a test button (spring loaded, momentary-on) mounted between the arming switches (as shown in Figure 6), and allows for a continuity check without arming the launch circuits. The second buzzer will automatically sound once the system has been armed, informing everyone that all circuits are energized, there is continuity through the igniter, and all that remains is to push the launch button. The draw of each buzzer should be no more than 150 mA to limit the current flowing through the igniters. Experience has shown when only one buzzer is used *to perform both functions*, the wiring was such that when the test but-

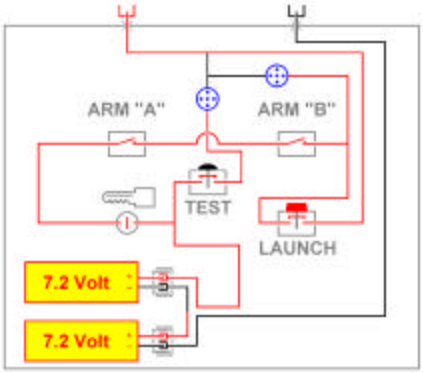

Figure 4 Wiring Diagram

ton and launch button were pushed simultaneously, electricity would bypass the arming circuits and send full voltage to the igniter, prematurely firing the rocket motor -- not an ideal situation.

Figure 5 Removable Key Lockset

SAFETY INTERLOCKS: The first safety feature is a **Removable Key Lock** (Figure 5) attached to a neck length chain. The lockset is a discarded computer keyboard lock, and the key does not remain locked into the keyhole once it is armed. I recommend one that does, but the price was right (free) and I made it work. Care must be taken to ensure the system is safe when removing the key.

The second safety feature is a dual, in-line set of **Arming Switches** (Figure 6). Although only one is needed to provide a positive break between key and launch button, two were used on this project to provide symmetry and increase its "cool" factor. Both are non-spring loaded single-post single-throw toggle switches, housed beneath aircraft-grade red safety guards. They are marked ARM "A" and ARM "B". Make sure the toggles are long enough so lowering the guards will force the switch to the safe position. Because of their high visibility, even at a distance, the position of the red guards can be seen to confirm a safe system, regardless of the key being removed with the lockset in the armed position.

The spring loaded **Launch Button** (Figure 7) is the last safety feature prior to sending full voltage to the rocket motor igniter. The 'you-can't-miss-it' red button is surrounded by a high-visibility chartreuse and black diagonally hashed square for easy identification. The button is spring loaded to the released position, and must be held in to provide power to the igniter. As electricity flows through the switch, it bypasses the Piezo buzzer, silencing it during the ignition sequence. Once the button is released, the buzzer will sound again as a reminder to safe the system, provided continuity remains in the igniter.

Figure 6 Arming Switches & Test Button


Figure 7 Launch Button

If the igniter is burned through, the buzzer will not sound. The system still requires at least one of the other safety features (red guard(s) down, key to 'safe') to be disarmed before the controller can be considered safe. If not, and the system is left armed, the buzzer will immediately sound a warning when a new igniter is attached to the clips as continuity is reacquired. As long as the launch button is not being pressed, the current through the leads will not be enough to light the igniter. Nothing gets the heart going faster than hearing the confirmatory continuity check as your hands attach the leads to an igniter just beneath the exhaust nozzle of the mother-of-all motors.

COST: Nothing is cheap (anymore) and this project used many components above and beyond that required for a basic launch controller. The idea was to design and build a system that would be durable, functional, attractive, and provide many years of high-abuse use. Since I love to get the young involved in the hobby, I designed the system to be easily used and understood by a 7 year old (which just happened to be the age of my son when I built it). When everything was tallied, the cost of the launch controller approached $100, with batteries being the most expensive. Yes, I could have used a holder filled with "D" cell batteries, but you can't beat the rate of current that NiCads are capable of delivering. With proper care, the batteries will still be providing top voltage with high-amp current for many years to come.

THE PAYOFF: I have never gone to a local school yard without collecting a small crowd of curious onlookers. Even the RC'ers land their planes to watch the rockets. I feel the best way to get others, young and old, interested and involved in the hobby, is to let them participate in the launch process. Safety comes first, followed closely by fun. As a military flight instructor, I love to teach and impart my wisdom on the young. I always love to see the wonder and excitement of both children and adults as they take control of the console and send a rocket skyward, filling the role of "launch control officer" as I act as "range safety officer". The experience is heightened by a realistic NASA looking launch controller, and most kids utter a "wow" as they step up to the console to take the reigns of the rocket.

This is a far cry from the Estes™ Electron-Beam® controller yet, because of its strait-forward design and safety features, I feel more comfortable letting a child sit down to operate my launch controller than the Estes. With a car brake lightbulb (Figure 8) soldered to clips and inserted in place of the launch wiring, I can explain the operation of the controller in a minute, showing the entire sequence of arming, countdown, and simulated launch (lightbulb a glowin'). This walks the "launch control officer" through the entire operation, so they know what to expect and won't be startled as the buzzer starts going off during the countdown. I am happy to say that, on more than one occasion, someone has enjoyed the thrill of launching one of my rockets so much they asked where the nearest hobby store was so they could immediately go purchase their own 'starter' kit, and begin enjoying the hobby themselves (usually to the chagrin of their female counterparts).

Figure 8 Light Continuity Tester

As an ambassador of a popular, yet not so often seen, hobby, I always try to conduct myself in a professional manner. I have a checklist that I show them, which includes the TRA/NAR safety rules, distances, etc., along with flight data for the rockets I fly and the various motors available. Many people enjoy seeing a hobby carried out safely and responsibly. It makes adults feel comfortable enough to let their kids get involved. Professionalism, safety, fun, and a "totally awesome" launch controller round out all the important things of a hobby made popular by NASA footage of Mercury, Gemini, Apollo and Space Shuttle launches. Besides, everybody loves to push a big, red button surrounded by danger signs and warning horns.