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NAPAS*News*

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August 2009 Orangeville Photos

Photos by Nick Cox

Colin Dow's Interceptor on a C6-3.

Rocket Photography Part 3: Electronics

By Len Lekx

Now that the camera is ready, it's time to assemble the electronic circuit that will control it. This is surprisingly simple…

Basically, the contacts on the shutter button are 'bridged' by a relay controlled by a timing system. The relay is an optical type, because there are no mechanical parts that can be affected by acceleration. Whether one chooses to use a film camera or a digital, it can be controlled in one of two ways:

- a dedicated timer circuit that uses an IC timer like a 555 or 556,
- a fully-programmable microchip

The dedicated-timer option is rather limited, because it restricts you to a set of options that can only be altered by rewiring the circuit. I will avoid describing this system, and concentrate on the programmable-chip option.

Depending on your level of skill, you can either choose a chip that's programmable in a low-level language, or a language such as BASIC. Since this article is geared to someone starting out, the focus will be on the BASIC-programmable chips.

The chips I choose to use are available from the UK – called a PICAxe, they are available in 8, 18, 28, and 40-pin versions. All are capable of being programmed after building the circuit, and can be reprogrammed as required. In this example, I'll describe a circuit using an 18-pin version – called the PICAxe 18X. Since it will be beneficial for you to read the online manuals before starting, I'm only going to go over the additional parts needed for a camera controlling circuit.

Parts are available from the following sources…

Resistors, LEDs, optical relays – Digi-Key www.digi-key.com

G-Switches – AeroCon Systems www.aeroconsystems.com

Experimenter-type circuit boards, batteries, etc. – Circuit City (The Source)

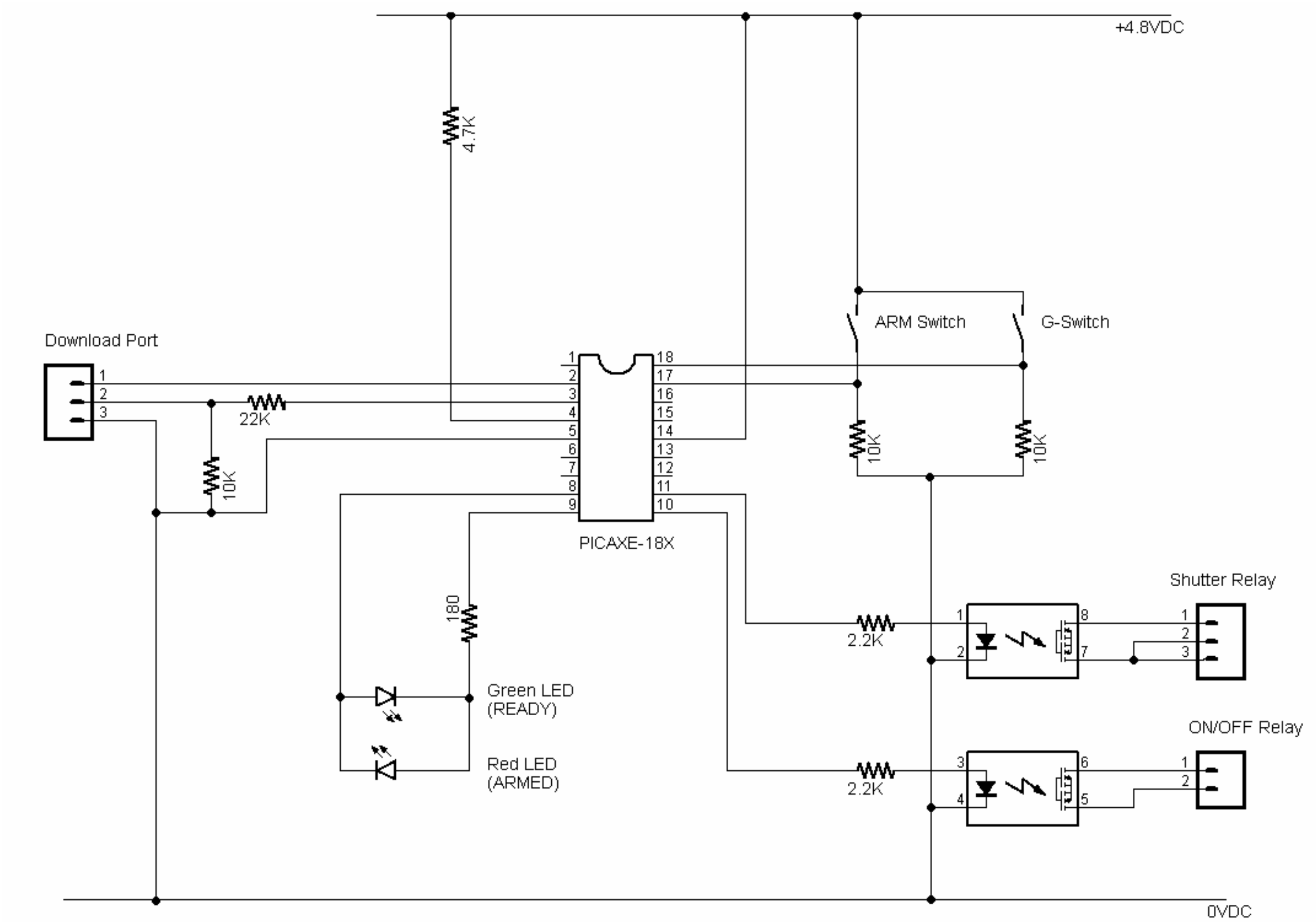
PICAxe chips, manuals, and software – www.picaxe.co.uk

The chip itself is designed to be powered by a supply that ranges from 4.5VDC to 5VDC. I chose to use a 4.8-volt battery pack common to R/C airplane use since they are rechargeable.

The red/green LED pair is simply a visual indication of the status of the system… green represents the controller being on, but not yet armed. Red means the controller is armed, and will start taking photos when it detects an input on the G-switch.

The G-switch itself is a self-contained device, available online, that closes when it is subjected to more than two gravities of acceleration. Since a typical rocket lifts off at four to five gravities, it will trigger immediately upon liftoff.

The relays are an optical-type device – which means that there are no moving parts or contacts that will be affected by the forces in flight. The device I use is called a NEC PS7141-2A, which is readily obtainable through most electronics stores. You should note that other devices might require a different size of resistor, because the current the internal LEDs draw may be different.



Once you have the circuit built, it's time to write the program. Since the chip is programmed in the BASIC programming language, this is fairly straightforward to do… so I won't discuss it here. Basically – once you have the camera turned on (manually for a film camera, or under program control for a digital), all you want to do is wait for the G-switch to close… and then either start triggering the shutter relay for as many pictures as you want to take on a film camera, or closing the shutter relay for as long as you want to 'burst' on a digital. This will obviously take some experimenting with time delays for whatever particular camera you're using, so be patient and don't worry if you have to re-write your program several times. (I did, too…)

To help you out, here's a program for a straightforward film-camera trigger. You can change this program to do more, but this is a starting point…

```
` Camera-trigger control program
`   Len Lekx
`
`  For one film-type cameras with an ON/OFF button connected to Output #4
`                                        and the Shutter button connected to Output #5
`
`  Definitions...
`
symbol green_led = 2
symbol red_led = 3
symbol shutter_button  = 5
symbol cam_power   = 4
`
symbol exposures = 30     ` Number of pictures to take per flight
symbol interval = 1700     ` Delay between exposure in milliseconds  (1/1000 sec)
```

```
symbol shutter  = 300       ` Close the shutter relay for this many milliseconds
`

start:
high green_led

for b0=1 to 5
low green_led
high red_led
wait 1
low red_led
high green_led
wait 1
next b0
`
` Turn the camera on by simulating an on/off button press
`       (If you don't have a camera that uses this, it will not harm anything…)
`
gosub camera_power_toggle

` wait for arm switch before starting recording
` NOTE - once arm switch is selected, the only way to disarm is to remove power.
`
check: if pin0=0 then goto check
high red_led
low green_led
`
` wait for G-switch before starting timers
`
ready: if pin1 = 0 then goto ready
pause 50  ` delay for debounce
if pin1 = 0 then goto ready
`
` close relay for number of exposures
`
for b0 = 1 to exposures
high red_led
high shutter_button
pause shutter
low shutter_button
low red_led
pause interval
next b0
`
` Delay a bit, so the camera can rewind if necessary.
`
wait 120        `  Two minutes…
`
` Turn the camera power off…
`
gosub camera_power_toggle
`
end
`
camera_power_toggle:
`
`  This subroutine simulates a press of the ON/OFF button on the camera…
`
high cam_power
pause 300
low cam_power
return
```

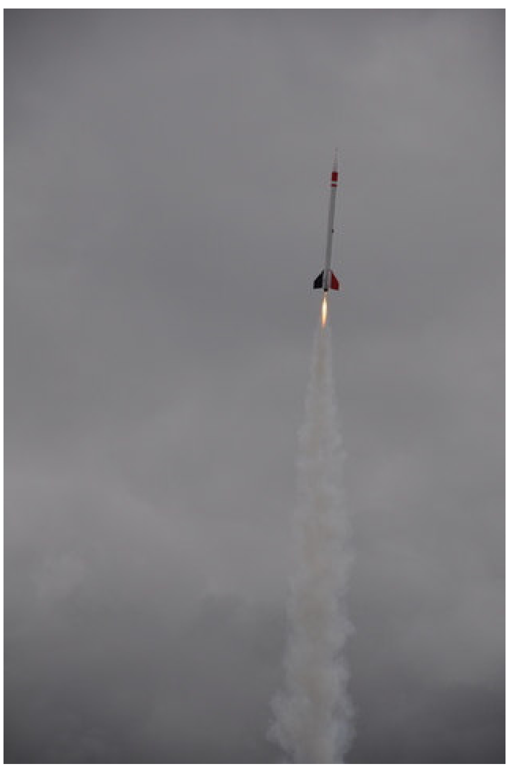
August Photos, con't

Photos by Nick Cox

Top: Nick Cox's Amraam 2 on a G69 Skid.

Below left: Josh Suskin's Estes D-Region Tomahawk on an E15-7.

Below right: Lawrence Engel's Strongarm on a G64-7.



How to Make Your Own Igniters

By Tony Haga, a guest article from the Jackson Model Rocketry Club

As everyone knows, the Copperhead igniters that come with the Aerotech motors can be a pain to get to work. My goal here was to come up with an igniter that can be made with more-or-less off the self materials that will light small composite motors more reliably than the Crapperheads.

You will need the following:

•"Wire wrap" wire (32 gauge). It looks like Radio Shack is discontinuing this item. You made have to order from an electronic supply house like Digikey

•Wire strippers

•Drill for making 'twisted pair" wire

•Dry graphite lubricant

•Yo-Yo sparklers (available at Commonwealth)

•Acetone

You'll first need to twist a length of wire into a twisted pair. Cut a length of wire, about 20 ft or so, and duple it over. Tie one end to a doorknob, or other convenient fixture, and place the other end into your drill. Start you drill and let the wire twist until you get 6-8 turns per inch. Next, cut the wire into sections about 12-18 inches long. Strip about ¼ inch of insulation off one end, this will be the hot side, and about 2 inches off the other end, this will be the clip side. Now for the hard part, you'll need to take the hot end and bend the bare wires parallel each other and about 1/5mm apart.

Mix up some of the graphite with some acetone until you get slurry. You'll have to experiment until you come up with the correct consistency. To thin and you won't get a good coat and too thick and you'll get to much. You want to make sure that when you make the dip you get a good bridge across the wires. Dip the hot end of the wires into the graphite. You may need to dip a couple of times to get a good coat.

While the graphite dip is drying, you'll need to prepare the pyrogen. The Yo-Yo sparklers seem to work well. When my kids lit an entire box at once, the resulting fireball was most impressive. Take a couple of the sparklers, putt them between a couple of pieces of heavy paper and carefully tap with a hammer to knock off the pyrogen. I then used a mortar and pestle to carefully grind the pyrogen into a fine powder. Prepare a slurry with acetone the same way as with the graphite. Now take the igniter that you just dipped in the graphite and dip in the pyrogen. Make sure you don't get too thick of a coat or the igniter won't fit into the small nozzles of the E and F motors.

Let the igniter dry and then dip into some clear finger nail polish. This will make a hard coat to protect the pyrogen layer.

Completed Igniter:

If you measure the resistance with an ohmmeter, you should see about 30 ohms. As a result of this fairly high resistance, you will need a good power source to fire these igniters and they will not be a good choice for air-starts. I have not tried this in a cluster so let me know how they work.

These igniters do make a goodly amount of fire:

Of course, firing an igniter in your basement should be done with caution!

Bob Pouliet's Video FX lifting off on 2 Pro29 H170 Blue Streaks, air-starting 2 H175 Smokey Sam's at the August 2009 Orangeville launch. Photos by Nick Cox.