

RE: Safety with Electric Powered Models

Dear CAM Members:

As promised at our last General Meeting, enclosed is the document “Safety with Electric Powered Models.” This hard-copy is being mailed to emphasize the importance of this topic, since electric-model accidents have caused several serious injuries in recent times.

Please study the document and keep it handy. It will also be posted on the CAM website.

A primary cause of electric-model accidents is an unintended motor start, sometimes with body parts in the prop arc. Prop blades are sharp and motors are powerful, so serious cut injuries and bleeding result, and THEY CAN DISABLE THE MODELER COMPLETELY. Some steps to avoid these:

- 1. Arm the model in a restrained condition and only just prior to flight.**
- 2. Keep hands, arms, face and tools out of the prop arc at all times.**
- 3. Hook your thumb around the throttle stick to keep it at the idle position while carrying your transmitter and model to the flightline.**

All modelers should study the document whether flying electric models or not. Almost all our new pilots will be flying electrics and they need guidance from our senior members. And all of us are using modern batteries in our transmitters, ignition systems and radio power-packs and the guidelines cover battery handling.

No one wants to be part of an accident. Some thoughtful precautions will prevent most of them.

Safe flying!

Your CAM Board of Directors

Safety with Electric Powered Models

By George Krueger, CAM Safety Officer

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The recent advent of very capable electric airplane motors, speed controllers and lithium batteries has presented new challenges to safe handling and operations. The last 3 years has seen some noteworthy accidents within Central Arizona Modelers, a few of which have required first-aid and then follow-up medical care. In the interest of preventing further accidents, these guidelines are presented. They will be updated as further experience is gained and as technology changes.

The safe employment of electric power systems goes beyond the flying field. It includes battery charging and storage, bench setup and testing, transportation, setup at the field, flight operations and fire prevention or containment. The following are some guidelines for all of these phases of operation.

A. Lithium Polymer Battery Storage and Charging

1. If possible, store and ship batteries in a discharged condition (below 3.5 volts/cell). Note that most retailers DO NOT want batteries shipped back to them. The major freight carriers also prefer that batteries not be shipped..

2. Store and carry batteries in a steel box of some sort. Realize that lithium batteries burn fiercely, like flares, with a shooting and very hot flame that cannot be extinguished by normal means, only by flooding with water or smothering with earth. Your plastic or fabric transport bag is no match for this flame. And the flame from one battery will ignite the others nearby for a real inferno, possibly in your shop or car trunk.

3. Charge your batteries at no more than 1C amperage, on a fireproof surface and preferably inside a fireproof bag. Do not leave a charging battery unattended. Utilize a smoke alarm in your shop, located near your charging station.

4. Neutralize a lithium polymer battery by completely immersing in salt water for several hours. Disposal is then safe.

B. Transporting Lithium Polymer Batteries

1. Transport in a steel box or ceramic container. Utilize only female connectors on batteries and be sure there are no bare wire elements which might short against each other or your metal box.

2. Batteries are heavy objects, especially a boxful. Place them against a seatback or bulkhead or on the floor in your vehicle so they cannot fly forward in a panic stop or collision and do damage to you or your models.

3. Be suspicious of any "puffed" or otherwise damaged battery. Transport those alone in a fireproof bag.

4. Keep batteries well separated from any gasoline or flammables you may also be transporting.

C. Setup and Shop Testing of Electric Power Systems

1. Realize that arming an electric power system on your workbench represents a real and silent danger. Be prepared for an unintended startup! If possible, do initial checkouts without a prop installed on the motor. In all cases be sure the model, batteries and power system are restrained and that the propeller area is clear.

2. For the medium and large models, utilize a "shorting plug" (actually a jumper connection) in the motor circuit, so the radio system can be armed without danger of the motor starting. Also suggest this approach on any model where the battery is inserted in the bottom of the model, armed and then the model turned upright on the bench.

3. It is a mistake to install an electric speed control (ESC) that is marginal for the amperage demands of the motor. An overloaded ESC is a fire hazard. Use a wattmeter of some sort to tell you of actual current demands. Always install an ESC with some excess capacity so it will run cool and safely. A somewhat oversize ESC costs very little in terms of dollars, weight or size.

4. Use a "double system" to restrain your batteries within your model (i.e. Velcro strips and a hold-down strap). Loose batteries will change the center of gravity of your model and may make it uncontrollable.

5. When working with an armed system on your bench, keep your hands, face and any tools you are using clear of the prop arc. Again, be prepared for an accidental motor start. Keep the transmitter somewhat away from the work area so you don't accidentally move a control stick.

6. Realize that the first startup of a new power system MAY HAVE THE THROTTLE CONTROL REVERSED, that is the motor may be at full throttle with the transmitter stick at idle. Be prepared for this situation. Have the prop off the motor until you are sure of motor rotation and of throttle response.

7. Start out with a recommended propeller size on your motor. The ESC will generate a specific RPM (or try to) regardless of prop size. The wrong size prop can generate current draw in excess of the ESC's capacity and cause a fire danger. Experiment with other prop sizes after you gain experience with your new system and have measured power draw.

8. Power system cooling provisions are inadequate on most models as-delivered. Make logical enhancements to cool the motor, batteries and ESC. Usually this means enlarging or creating vents. Be aware that ventilation exits must be larger than inlets to work effectively. Make sure there are unobstructed pathways for cooling air to flow to the right places within your model.

D. Field (Pit Station) Preparation and Flight

- 1. Current CAM policy does not permit the arming of electric models other than in the pit area (i e not on the picnic tables, ramada platforms, truck tailgates or other such places).**
- 2. Arm the model with appropriate restraints in place in case of accidental motor startup.**
- 3. Keep the propeller area clear of tools and parts, and keep your hands and face away.**
- 4. Be especially careful when arming the motor with the transmitter stick on "high" (to properly set the max power position in the ESC). We have seen motors start during this setup operation even though the ESC's are supposed to prevent it.**
- 5. Keep the transmitter somewhat removed from the pit table clutter so control sticks don't get accidentally moved or the transmitter tipped over.**
- 6. Be very sure that battery hold-downs and hatches are tight.**
- 7. Double-check model selection and control directions on your transmitter before every flight.**
- 8. Be very careful if carrying the model and transmitter together to the flight line. Carry the transmitter with your thumb around the throttle stick to ensure that the stick stays in the idle position.**
- 9. Choose a position on the flight line where the other pilots can hear your announcements for taxi, takeoff, low pass and landing. The other pilots do not have the benefit of noise from your motor to help them stay aware of your position.**
- 10. If you sense an impending or actual power loss in flight, immediately turn toward the center of the field and move the throttle to idle. The battery will recover slightly during the glide toward the field and may allow a last burst of power if needed**

E. Fire Prevention

- 1. Li-Po battery fires can only be extinguished by flooding with water or smothering with earth.**
- 2. In-flight fires will usually be caused by overheated ESC's. Land immediately and disconnect the battery if you can. Keep the airplane away from other planes and people. Use the fire extinguishers in the frequency box as appropriate.**
- 3. If an off-field crash causes a battery rupture and fire, it may spread to the nearby grass and weeds. Call 911 for fire service, then use the water extinguisher in the bunker to fight the grass fire.**