T-CRAFT MAINTENANCE

The following is probably quite elementary to many of you. However, in light of recent squawks/questions, I believe a review of the basics might help. Thanks to AOPA Flight Training, Marc E. Cook and others for their contributions to this article.

ELECTRICAL SYSTEM BASICS

Many pilots look down their noses at airplanes w/o at least two com/nav radios, an intercom, and GPS or other assorted ways to keep from getting lost. All these technologies are dependent upon the airplane's electrical system.

In the days of old many aircraft were not equipped with an electrical system. They were equipped with a magneto system, which supplied electrical energy to the engine ignition system only and thus had to be hand-propped. Airplanes still use an independent magneto system, but in addition are equipped with an electrical system

T-Craft aircraft are equipped with either a 14- or 28-volt direct current electrical system. This figure is the charging voltage, which is always a little more than the battery's standing voltage.

The airplane needs a basic source of power to get started. This source is the battery that is made up of separated, alternating metal plates coated with lead oxide and placed in a sulfuric acid electrolyte, which induces the chemical reaction that produces electricity. (Thank you Thomas Edison). A 12-volt battery will have six 2-volt cells, while a 24-volt battery has twice as many cells.

Airplanes have a charging system. Engine-driven alternators supply electric current to the electrical system and also maintain a sufficient electrical charge in the battery. If the battery loses its stored electrical energy there will only be a limited supply of electricity for use in the event the alternator fails. The alternator produces alternating current (AC) from the rotation of the engine's crankshaft, which must be converted to direct current (DC) by a rectifier assembly.

A voltage regulator controls the rate of charge to the battery by stabilizing the alternator electrical output. The alternator voltage output is usually slightly higher than the battery voltage. For example, a 12-volt battery would be fed by an alternator system of approximately 14 volts. The difference in voltage keeps the battery charged.

The Master Switch provides a means to turn the electrical system "ON" and "OFF". Turning the Master Switch "ON" provides electrical energy to all the electrical equipment circuits with the exception of the ignition system.

Electricity from the battery and charging system gets to the airplane and electrical equipment through a device called a bus, which is simply a way of connecting all the electrical devices to the source of power.

Usually there are two basic buses – the main airframe bus that carries such items as the strobes and electric instruments, and a separate avionics bus (so they can be on a Master Switch, allowing you to turn all the avionics on/off with one motion).

The bus bar – a strip of steel, copper or aluminum – connects the combined battery/charging system output to one side of a group of circuit breakers. Have you ever wondered why the circuit breakers are all lined up in row? Mainly to simplify the wiring behind the panel.

Circuit breakers are used in the electrical system to protect the circuits and equipment from electrical overload. They are a form of electrical relief valve, a device intended to break the circuit in the event of excess current demand. Markings indicate the amperage, usually 5, 7.5, 10, or 15 amps. Circuit breakers are there to protect the wiring rather than the device it's connected to. Most devices have internal breakers/fuses.

A good preflight should include checking all circuit breakers as being in place. If you see a circuit breaker that has popped out, what do you do? First, think about which circuit it serves and which device(s) is/are no longer working because of it. Sometimes unrelated devices are grouped on same breaker, e.g. nav lights and clock. Next see if there is a way to turn off the affected device(s). Then attempt to reset the breaker. If it pops out immediately, or will not accept being reset, leave it alone and alert your friendly maintenance staff (a chance to use the on-line Schedule Master Maintenance Squawk feature).

The ammeter shows if the alternator is producing an adequate supply of electrical power to the system by measuring the amperes of electricity. This instrument also indicates whether the battery is receiving an electrical charge. You should see a plus value to the right of center, a negative value to the left. If the needle indicates a plus value, it means that the battery is being charged. After power is drawn from the battery for starting, the needle will indicate a noticeable plus charge value for a short period of time, and then stabilize to a lower plus charge value.

If the needle indicates a minus value, it means that the alternator output is inadequate and energy is being drawn from the battery to supply the system. This could be caused by either a defective alternator or by an overload in the system, or both.

Full-scale ammeter discharge or rapid fluctuation of the needle usually means alternator malfunction. If this occurs, you should cut the alternator out of the system and conserve battery power by reducing the load on the electrical system. If in flight you should consider landing as soon as possible. The sooner you can shut the aircraft down, the better. Do not attempt to continue flight until the malfunction is resolved.

If you have an electrical failure while airborne, remain calm, fly the aircraft, and follow the checklist. The loss of the alternator – or any of its supporting hardware – will leave everything running on the battery, which is (if fully charged) capable of powering a minimum of systems for at least 30 minutes.

How do you know if the charging system is offline? Normally the ALT light will illuminate when the battery voltage is greater than alternator voltage suggesting that either the alternator is shot or the engine is turning too slowly to support the electrical load.

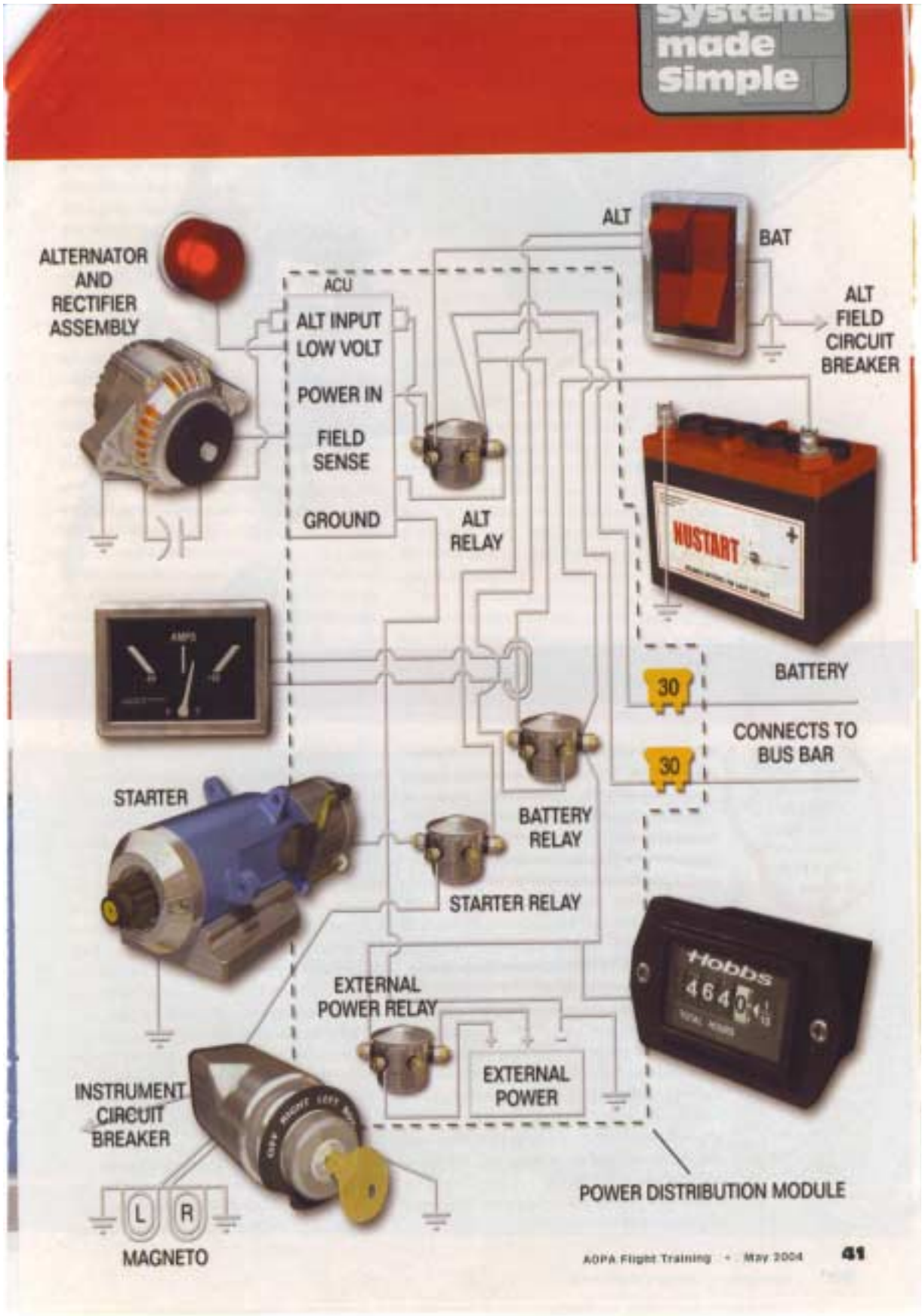
Look at the ammeter, which will be pointing in the direction of current flow. If it shows a negative indication it means the battery is supplying the juice. The greater the discharge indication the more current is being provided by the battery and the sooner it will become discharged.

If you note a charging system problem, follow the checklist steps for resetting the system but also keep in the back of your mind that you may have to do what you can to preserve battery power.

This is called load shedding and involves turning off all nonessential electrical equipment such as the #2 radio, ADF, strobe lights, etc.

If the battery dies in flight, will the engine stop? Not if the prop is still turning! You may lose the radios and some gauges inside, but the engine will continue blissfully, its ignition system powered by independent, self-powered magnetos (part of the **Ignition System** to be covered at another time). Unlike your car's, the aircraft engine, once started, will continue to run without battery or alternator.

Losing electrics is an inconvenience but not overtly dangerous.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LOW VOLT
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FIELD SENSE
GROUND
ALT RELAY
ALT
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ALT FIELD CIRCUIT BREAKER
NUSTART
BATTERY
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CONNECTS TO BUS BAR
BATTERY RELAY
STARTER
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