Today, virtually all GPUs have the standard NATO 3-pin plug that neatly inserts in a "conveniently" located receptacle on the airplane, all too often being directly behind a propeller or under the wing near the fuselage.

Ground power is typically used to start an engine for the first time on a cold day—conditions difficult for the battery to operate in. The GPU is also used by mechanics when they need electrical power for extended periods of time without the engine running. When using a GPU there are several areas of concern. First make sure all avionics are turned off.

Avionics are highly susceptible to damage from transient high voltage, or "spikes." Most GPUs have a variable voltage output so it is necessary to make sure the proper voltage has been selected on the power unit to match your aircraft electrical system. Similarly, the polarity of the GPU must match your aircraft system's polarity. Some aircraft incorporate polarity reversal protection in the aircraft receptacle, however the prudent pilot will always check it before utilizing the power source. For reasons that will become apparent later, GPUs should not be used to start an aircraft that has a dead battery.

THE LEAD ACID STORAGE BATTERY

The heart of the electrical system is the battery, and lead acid batteries are still standard equipment in light, general-aviation aircraft.

It's important to understand that the battery is not an electricity producer; it is a storer. The modern aircraft lead acid battery is an efficient, carefully designed piece of equipment that is significantly different from its automotive cousin. It must operate dependably under conditions unheard of for auto batteries. Its list of jobs includes engine starting, preflight of electrical equipment and accessories, and backup for the alternator. The conditions under which it must operate are extreme, to say the least. Aircraft go where even cars dare not tread: the arctic tundra, high up in the mountains, far into deserts, deep into rain forests, onto rivers and lakes, and into airports below sea level.

The battery must operate reliably in unusual attitudes, including inverted flight, at very high altitudes, and be capable of handling potential temperature changes in excess of 100 degrees during a single flight. Despite all of its capability, the aircraft battery, as seen in Figure 8-2, weighs less and is smaller in size than its automotive counterpart. There are trade-offs, though, and the aircraft battery tends to be a little more delicate and does not maintain itself as long. The aircraft battery is designed to provide a greater, short-term capacity such as the cold weather start. To understand what a battery can do for you, and what you must do for it, some theory is necessary.

Theory of Operation

Three important terms used when discussing the battery are volts, amps, and amp-hour. A *volt* is a measure of electrical pressure; it is potential. It is the motivating force that moves electrons through a conductor. A 12-volt battery has a potential of 12 volts of electrical pressure. *Amps* describe flow rate, or current—a measure of how many electrons flow through a conductor. *Amp-hour* is a rating given to a battery indicating potential