temperature extremes than do lead-acid batteries. Many operators use NiCd batteries routinely at temperatures ranging from –30 through 130 degrees F. Other advantages are reduced engine wear as a result of faster starts, low internal battery resistance, and an inherent ability to maintain high-power output longer than an equivalent lead-acid battery.

If all this sounds too ideal, understand that cost alone is a significant deterrent to owning an NiCd battery. NiCds are often four to five times as expensive as a lead-acid battery. In addition, servicing is more critical and the battery requires constant temperature monitoring when in use. The worst drawback, though not a common problem, is called thermal runaway.

Thermal runaway

More properly called overcharge runaway, thermal runaway results in the self-destruction of the battery. The causative factors are heat, reduced resistance and current flow. An overcharge runaway scenario goes something like this. The aircraft has been flying short trips all day in instrument conditions. There have been frequent battery-powered engine starts and the electrical load was continuously heavy during start and in flight. The battery has been getting a heck of a workout. This causes a constant, excessive charging of the battery, which generates excessive battery temperature. These factors, combined with as few as one bad plate in a cell, give you the beginning of the NiCd battery's equivalent of core meltdown.

When plates short, they overheat, causing the entire cell to overheat. It, in turn, overheats the surrounding cells and as internal battery heat increases, it eventually will begin to decrease the cell's internal resistance. Lower resistance permits higher current flow. The more current that flows, the more heat produced and the lower the resistance. Before long, the cellophane between the plates in the bad cell deteriorates, making the situation worse. With even less resistance, more current flows and this begins a vicious cycle of increasing temperature and decreasing resistance. Thus far, it is the generator that is feeding the battery. If the problem is caught in time, you merely isolate the battery from the generator and the problem should end. But there is a possible outcome that is significantly more serious.

At some point, the resistance of the bad cell will be low enough that the good cells will have sufficient power to feed it. When that happens, isolating the battery does not remedy the situation because the battery is feeding itself; it is literally self-destructing! At this point the pilot can only hope to land the airplane as quickly as possible. Such a condition has been known to cause a fire in the battery box and, in at least one case, the battery actually melted through the box and dropped out of the bottom of the aircraft. Fortunately it is not a common event, and good operational and preventive maintenance procedures are strong deterrents. To aid the pilot in heading off such a problem, a monitoring system is installed with NiCd battery systems. Depending on the manufacturer, it measures either rate of battery charge (a good indication of battery heat buildup) or actual battery temperature.

THE ALTERNATOR

As the demand for a reliable electrical source increased, the wind-driven generator gave way to an engine-driven version. Though it solved all the pressing problems of the time, it too