Chapter Four

The Spark Plug

The spark plug transfers high-voltage current into a cylinder and causes it to jump through the fuel/air mixture between the spark plug's center and ground electrodes, thereby igniting the mixture. If that sounds simple, then consider the conditions. The voltages are in excess of 18,000 V, there are wildly fluctuating gas temperatures as high as 3000 degrees F, and there are greatly varying pressures from partial vacuum up through 2000 psi. Come to think of it, it sounds like a drink I once had at a bar in the French Quarter of New Orleans. However, the pressure variations (in the cylinder, not the drink) are particularly significant because as compression pressure increases, the magneto voltage required to spark the gap also increases. As if these conditions were not bad enough, the plugs must not allow naturally emitted ignition radiation to interfere with sensitive navigation and communication equipment, and they must do all this reliably for long periods of time. Some time ago someone calculated that during a 100-hour operating period, any given spark plug is required to ignite approximately 7,000,000 combustion charges!

Types of Spark Plugs

Several variables are associated with choosing a spark plug. Particularly confusing is a plug's heat rating: hot and cold. The rating reflects the plug's ability to transfer combustion-chamber heat via the insulator core nose to the cylinder and engine cooling system, as shown in Figure 4-8. Hot plugs transfer heat relatively slowly, causing its insulator core to stay hotter. Cold plugs transfer heat quickly and tend to stay cooler. The correct heat rating assures the plug will operate cool enough to prevent *preignition*, which is a condition where the mixture is prematurely ignited because of some "hot spot" within the cylinder. Typical hot spots that might form in a cylinder might be a glowing hot portion of the spark plug or a bit of carbon that becomes lodged in the cylinder and glows. The correct heat rating also will assure that the plug operates warm enough to resist plug fouling by burning off unwanted contaminants.

Aircraft spark plugs use either fine-wire or massive-core electrodes. Fine-wire electrode spark plugs tend to be self-cleaning, which greatly reduces the chance for misfiring. The electrodes are actually made of precious metals, typically platinum or iridium, because these metals virtually prevent lead deposits from adhering. The plugs should be cleaned and gapped every 100 hours, and if properly maintained they can last 1700 to 1800 hours. Other benefits include easier starting, greatly reduced incidence of plug icing, and no high-altitude flashover.

A massive-core plug, as shown in Figure 4-9, should be cleaned and gapped twice as often as fine-wire electrode plugs, every 50 hours, and then the average life is in the range of 350–400 hours. It doesn't sound like much of a deal until you consider that for the typical light-duty recreational aircraft, these dependable plugs could easily last for several years and can be purchased for half the price of fine-wire plugs.

Resistor plugs reduce the heat energy of capacitance after-firing, which in turn reduces the severity of electrode erosion. Because the problem is associated primarily with high-tension magneto systems, resistor plugs will be of little use with a low-tension system. Properly used, they cut erosion in half.