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Turbocharger Systems

MOST PILOTS KNOW THAT A NORMALLY ASPIRATED ENGINE LOSES power as the aircraft climbs because air density (the number of oxygen molecules per cubic foot) decreases as altitude increases. Similarly, high ambient air temperatures cause an engine to produce less power, again due to decreased air density because warming the air causes the oxygen molecules to spread apart, lowering the density. So, if engine power is directly proportional to the mass of air and fuel burned in its combustion chambers, it should be a simple matter of increasing the flow of fuel/air to regain lost power.

In a way, it really is that simple. A larger fuel pump can increase the flow of fuel and an air pump (compressor) can pack more molecules into the cylinders. The complexity comes in constructing, attaching, and driving the compressor.

SYSTEM OVERVIEW

Mechanically driven compressors, called superchargers for their act of increasing the density within a specific volume, have been with us nearly as long as the airplane itself. At one time, the geared supercharger equipped virtually every transport or military aircraft. Most big radial engines have them, though they require a lot of power to drive. You still can find examples of mechanically driven compressors on diesel trucks and drag-racing cars. Aircraft, on the other hand, use exhaust-driven turbo-superchargers such as the Piper Malibu Mirage turbo-induction systems shown in Figure 7-1.