## Turboprop Engines

The turbopropeller (turboprop) engine is a combination of a gas turbine engine, reduction gear box, and a propeller. *[Figure 1-78]* Turboprops are basically gas turbine engines that have a compressor, combustion chamber(s), turbine, and an exhaust nozzle (gas generator), all of which operate in the same manner as any other gas engine. However, the difference is that the turbine in the turboprop engine usually has extra stages to extract energy to drive the propeller. In addition to operating the compressor and accessories, the turboprop turbine transmits increased power forward through a shaft and a gear train to drive the propeller. The increased power is generated by the exhaust gases passing through additional stages of the turbine.

Some engines use a multirotor turbine with coaxial shafts for independent driving of the compressor and propeller. Although there are three turbines utilized in this illustration, as many as five turbine stages have been used for driving the two rotor elements, propeller, and accessories.

The exhaust gases also contribute to engine power output through thrust production, although the amount of energy available for thrust is considerably reduced. Two basic types of turboprop engine are in use: fixed turbine and free turbine. The fixed turbine has a mechanical connection from the gas generator (gas-turbine engine) to the reduction gear box and propeller. The free turbine has only an air link from gas generator to the power turbines. There is no mechanical link from the propeller to the gas turbine engine (gas generator). There are advantages and disadvantages of each system, with the airframe generally dictating the system used.

Since the basic components of normal gas-turbine and turboprop engines differ slightly only in design features, it should be fairly simple to apply acquired knowledge of the basic gas turbine to the turboprop.

The typical turboprop engine can be broken down into assemblies as follows:

1. The power section assembly—contains the usual major components of a gas turbine engine (i.e., compressor, combustion chamber, turbine, and exhaust sections).
2. The reduction gear or gearbox assembly—contains those sections unique to turboprop configurations.
3. The torquemeter assembly—transmits the torque from the engine to the gearbox of the reduction section.
4. The accessory drive housing assembly—mounted on the bottom of the compressor air inlet housing. It includes the necessary gear trains for driving all power section driven accessories at their proper rpm in relation to engine rpm.

## Turboshaft Engines

A gas-turbine engine that delivers power through a shaft to operate something other than a propeller is referred to as a turboshaft engine. *[Figure 1-79]* The output shaft may be coupled directly to the engine turbine, or the shaft may be driven by a turbine of its own (free turbine) located in the exhaust stream. As mentioned with the turboprop, the

**Figure 1-78.** *PT6 turboprop engine.*