Extinguishing Engine Fires

In all cases, a fireguard should stand by with a CO_2 fire extinguisher while the aircraft engine is being started. This is a necessary precaution against fire during the starting procedure. The fireguard must be familiar with the induction system of the engine so that in case of fire, he or she can direct the CO_2 into the air intake of the engine to extinguish it. A fire could also occur in the exhaust system of the engine from liquid fuel being ignited in the cylinder and expelled during the normal rotation of the engine.

If an engine fire develops during the starting procedure, continue cranking to start the engine and blow out the fire. If the engine does not start and the fire continues to burn, discontinue the start attempt. The fireguard then extinguishes the fire using the available equipment. The fireguard must observe all safety practices at all times while standing by during the starting procedure.

Turboprop Engines

The starting of any turbine engine consists of three steps that must be carried out in the correct sequence. The starter turns the main compressor to provide airflow though the engine. At the correct speed that provides enough airflow, the igniters are turned on and provide a hot spark to light the fuel that is engaged next. As the engine accelerates, it reaches a self-sustaining speed and the starter is disengaged.

The various covers protecting the aircraft must be removed. Carefully inspect the engine exhaust areas for the presence of fuel or oil. Make a close visual inspection of all accessible parts of the engines and engine controls, followed by an inspection of all nacelle areas to determine that all inspection and access plates are secured. Check sumps for water. Inspect air inlet areas for general condition and foreign material. Check the compressor for free rotation, when the installation permits, by reaching in and turning the blades by hand.

The following procedures are typical of those used to start turboprop engines. There are, however, wide variations in the procedures applicable to the many turboprop engines. Therefore, do not attempt to use these procedures in the actual starting of a turboprop engine. These procedures are presented only as a general guide for familiarization with typical procedures and methods. For starting of all turboprop engines, refer to the detailed procedures contained in the applicable manufacturer's instructions or their approved equivalent.

Turboprop engines are usually fixed turbine or free turbine. The propeller is connected to the engine directly in a fixed turbine, resulting in the propeller being turned as the engine starts. This provides extra drag that must be overcome during starting. If the propeller is not at the "start" position, difficulty may be encountered in making a start due to high loads. The propeller is in flat pitch at shut down and subsequently in flat pitch during start because of this.

The free turbine engine has no mechanical connection between the gas generator and the power turbine that is connected to the propeller. In this type of engine, the propeller remains in the feather position during starting and only turns as the gas generator accelerates.

Instrumentation for turbine engines varies according to the type of turbine engine. Turboprop engines use the normal instruments—oil pressure, oil temperature, inter-turbine temperature (ITT), and fuel flow. They also use instruments to measure gas generator speed, propeller speed, and torque produced by the propeller. *[Figure 1-15]* A typical turboprop uses a set of engine controls, such as power levelers (throttle), propeller levers, and condition levers. *[Figure 1-16]*

The first step in starting a turbine engine is to provide an adequate source of power for the starter. On smaller turbine engines, the starter is an electric motor that turns the engine through electrical power. Larger engines need a much more powerful starter. Electric motors would be limited by current flow and weight. Air turbine starters were developed that were lighter and produced sufficient power to turn the engine at the correct speed for starting. When an air turbine starter is used, the starting air supply may be obtained from an APU onboard the aircraft, an external source (ground air cart), or an engine cross-bleed operation. In some limited cases, a low-pressure, large-volume tank can provide the air for starting an engine. Many smaller turboprop engines are started using the starter/generator, that is both the engine starter and the generator.

While starting an engine, always observe the following:

- Always observe the starter duty cycle. Otherwise, the starter can overheat and be damaged.
- Assure that there is enough air pressure or electrical capacity before attempting a start.
- Do not perform a ground start if turbine inlet temperature (residual temperature) is above that specified by the manufacturer.
- Provide fuel under low pressure to the engine's fuel pump.

Turboprop Starting Procedures

To start an engine on the ground, perform the following operations:

1. Turn the aircraft boost pumps on.