ENGINES, AND SYSTEMS (chapter 2)

ENGINE TEMPERATURE

1. Excessively high engine temperatures either in the air or on the ground will cause loss of power, excessive oil consumption, and excessive wear on the internal engine.

2. An engine is cooled, in part, by circulating oil through the system to reduce friction and absorb heat from internal engine parts.

3. Engine oil and cylinder head temperatures can exceed their normal operating range because of (among other causes)

    a. Operating with too much power
    b. Climbing too steeply (i.e., at too low an airspeed) in hot weather
    c. Using fuel that has a lower-than-specified octane rating
    d. Operating with too lean a mixture e. The oil level being too low

4. Excessively high engine temperatures can be reduced by reversing any of the above situations, i.e., reducing power, climbing less steeply (increasing airspeed), using higher octane fuel, enriching the mixture, etc.

CONSTANT -SPEED PROPELLER

1. The advantage of a constant-speed propeller (also known as controllable-pitch) is that it permits the pilot to select the blade angle for the most efficient performance.

2. Constant-speed propeller airplanes have both throttle and propeller controls.

    a. The throttle controls power output, which is registered on the manifold pressure gauge.

    b. The propeller control regulates engine revolutions per minute (RPM), which are registered on the tachometer.

3. To avoid overstressing cylinders, excessively high manifold pressure should not be used with low RPM settings.

ENGINE IGNITION SYSTEMS

1. One purpose of the dual-ignition system is to provide for improved engine performance. a. The other is increased safety.

CARBURETOR ICING

1. Carburetor-equipped engines are more susceptible to icing than fuel-injected engines.

    a. The operating principle of float-type carburetors is the difference in air pressure, between the venturi throat and the air inlet.

    b. Fuel-injected engines do not have a carburetor.

2. The first indication of carburetor ice on airplanes with fixed-pitch propellers and float-type carburetors is a loss of RPM.

3. Carburetor ice is likely to form when outside air temperature is between 20°F and 70°F and there is visible moisture or high humidity.

4. When carburetor heat is applied to eliminate carburetor ice in an airplane equipped with a fixed-pitch propeller, there will be a further decrease in RPM (due to the less dense hot air entering the engine) followed by a gradual increase in RPM as the ice melts.

CARBURETOR HEAT

1. Carburetor heat enriches the fuel/air mixture,
   a. Because warm air is less dense than cold air.
   b. When the air density decreases (because the air is warm), the fuel/air mixture (ratio) becomes richer since there is less air for the same amount of fuel.
2. Applying carburetor heat decreases engine output and increases operating temperature.

FUEL/AIR MIXTURE

1. At higher altitudes, the fuel/air mixture must be leaned to decrease the fuel flow in order to f compensate for the decreased air density, i.e., to keep the fuel/air mixture constant.
   a. If you descend from high altitudes to lower altitudes without enriching the mixture, the mixture will become leaner because the air is denser at lower altitudes.
2. If you are running up your engine at a high-altitude airport, you may eliminate engine, roughness by leaning the mixture,
   a. Particularly if the engine runs even worse with carburetor heat, since warm air further enriches the mixture.

ABNORMAL COMBUSTION

1. Detonation occurs when the fuel/air mixture explodes instead of burning evenly.
2. Detonation is usually caused by using a lower-than-specified grade (octane) of aviation fuel or by excessive engine temperature.
   a. This causes many engine problems including excessive wear and higher than normal operating temperatures.
3. Lower the nose slightly if you suspect that an engine (with a fixed-pitch propeller) is detonating during climbout after takeoff. This will increase cooling and decrease the engine's workload.
4. Pre-ignition is the uncontrolled firing of the fuel/air charge in advance of the normal spark, ignition.

AVIATION FUEL PRACTICES

1. Use of the next-higher-than-specified (octane) grade of fuel is better than using the next lower-than-specified grade of fuel. This will prevent the possibility of detonation, or running the engine too hot.
2. Filling the fuel tanks at the end of the day prevents moisture condensation by eliminating the airspace in the tanks.
3. In an airplane equipped with fuel pumps, the auxiliary electric fuel pump is used in the event the engine-driven fuel pump fails.

'**STARTING THE ENGINE**

1. After the engine starts, the throttle should be adjusted for proper RPM and the engine gauges, especially the oil pressure, checked.
2. When starting an airplane engine by hand, it is extremely important that a competent pilot be at the controls in the cockpit.