Oil Systems
for
Reciprocating and Turbine Engines
Objectives

• Define Oil Systems for specific engine types
• Explain purposes of Oil Systems
• Explain differences between Wet Sump and Dry Sump Systems?
Reciprocating Engine

- Name comes from back-and-forth (reciprocating) motion of pistons
- “Recip” Engines convert energy by combusting fuel and air in a tight space, which creates pressure to move pistons back-and-forth
- Back-and-forth motion converts to rotating motion by connecting pistons to Engine Crankshaft with Connecting rods
- By-product of combustion occurring due to back-and-forth movement and rotation movement is **Friction**
- Friction causes
  - Additional heating
  - Excessive wear
  - Loss of engine efficiency
Reciprocating Engine Oil System Functions

- Reduces friction between moving parts
- Transfers heat out of engine interior for exterior cooling
- Removes
  - carbon particles combustion process produces
  - Contaminants that enter the engine via air, fuel or other external sources
- Provides cylinder wall seal for greater engine efficiency
- Provides Shock Absorption to reduce engine vibration
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Two primary types of Oil Systems
Wet Sump and Dry Sump
Wet Sump

- Wet: Oil supply is internal-stored in a pool (called a sump) in engine bottom
  - Most common system in smaller General Aviation (GA) aircraft
  - Pump with direct gear connection to Engine Crankshaft provides oil pressure to Engine
  - Uses “Splash and Spray” method
Wet Sump Oil System Components

- Oil Sump
- Oil Pump
- Oil Filter
- Oil Pressure Gauge
- Oil Temp Gauge
Wet Sump System

- Wet sump system oil reservoir
- Sump Pump sucks oil from sump
- Oil Filter cleans oil
- Splash and Spray
- Gravity recovery/recapture
Oil Filters

- Resin saturated fiber surrounding a steel core

- Removes contaminants from the oil, such as:
  1. Water
  2. Dirt
  3. Metal Shavings
  4. Carbon
  5. Dust
Oil Pumps

Two different oil pump types
Dry Sump

- Dry Sump: Oil supply is external, in a reservoir outside the engine.
  - More complex than Sump Systems
  - Usually includes more than one oil pump, complex connection of tubes (called lines) to move oil to and from engine parts getting lubrication
  - Normal for very large engines and Turbine Engines
  - Variations of Pump arrangements
  - Often, more than one “point to point” oil line
Jet Engine Oil System

- Types of Jet Engines Oil System
  - oil circulation system
  - oil mist lubrication system
  - oil-air lubrication system
Dry Sump Oil System Components

- Oil Tank
- Oil Filter/Cooler
- Oil Pump
- Scavenge Pumps
- Oil Pressure Gauge
- Oil Temperature Gauge
Turbine Engine Overview

- Turbine engine is a **rotary** machine
  - Very high RPMs
- Converts energy from flow of compressed air and fuel burning into **thrust**
  - Compressing air creates heat
- Turbine engine rotating components (Engine Bearings) require high pressure lubrication (must flow at high pressure to and from each bearing)
- Loss of oil pressure is not immediately catastrophic
  - Limited engine operation with low or no oil pressure is possible in some turbine engines
  - Precautionary shutdown usually recommended
Dry Sump System

- Dry sump system - external oil tank
- Main pump sucks oil from tank to filter
- Oil under pressure to oil cooler
- In the case of jet engines, oil sprays onto bearings
- A secondary scavenger pump, sucks oil back out of lubrication areas then to external oil tank
- Dry sump (pressurized) systems function
  - Regardless of altitude
  - Even while inverted

Fig. 1. Double-row angular contact ball bearing with two (separable) inner rings
Additional Functions for Reciprocating Engine Oil System

• Provides important lubrication for:
  – Vacuum pump drive
  – Supercharger
  – Propeller reduction gears

• Actuation of hydraulic actuators for constant speed propeller
  – Oil pressure (under control of Prop Governor) varies Propeller Pitch in Constant Speed Prop Engines
  – Oil pressure balances against Spring pressure to hold propeller rpm constant regardless of changes in airs speed or engine RPM
Gauges and Indications

- Oil Pressure gauge provides direct reading indication of oil system pressure
  - Pressure changes occur more rapidly
  - Loss of oil pressure will lead to catastrophic engine failure

- Oil Temperature gauge provides direct indication of oil temperature
  - Temperature changes occur more slowly
  - High Oil Temps indicate several things
    - Engine lubrication not working
      - Blocked oil lines
    - Too much demand on Engine
      - Power setting too high for ambient conditions
    - Not enough cooling
    - Ineffective cooling (blocked cooling)
Turbine Engine Oil System Functions

- Lube and cool engine bearings
- Provide “hydraulic power” for some auxiliary systems
- Wash away particulates and contaminates that break away or shear off bearing surfaces
Turbine Engine Oil System Components

- Oil Tank (Dry Sump System)
- Pressure Pump
- Oil Filters
- Oil Coolers
- Scavenge Pumps
- Spray Oil Jets
Dry-sump Wet-sump differences
Summary

• While oil systems in reciprocating engines are true multi-taskers, turbine engine lubrication has a more singular focus

• Regardless of engine type, lubrication is critical to overall performance

• Oil is the lifeblood of the engine, and every pilot needs to pay special attention to, and must clearly understand how the oil system works in his or her aircraft

• Proper oil system function is vital to safe flight

• Pilots must know exactly how to handle each Oil Pressure problem
Questions?