Miltech Simulations Skyraider

Engine and Failures System

Engine

The A1 Skyraider is powered by the Wright R-3350, one of the most powerful piston engines ever fitted to a single-engine aircraft. This 18-cylinder, two-row radial engine produces approximately 2,700 horsepower, delivering the raw torque and reliability needed for the Skyraider's demanding combat and carrier-based operations.

In the A1 Skyraider (or any large piston-engine aircraft), climb performance is closely tied to the correct balance between throttle, propeller RPM, and mixture.



Engine Failure System

Caution

The Engine Failure System is enabled by default. To disable it, simply turn **off** the **↔ Beacon Audio switch, located on the front panel**, left of the Manifold Pressure Gauge.

- Engine instrument readings (CHT, Manifold Pressure, RPM) become frozen or unresponsive after catastrophic failure. Flaps, dive brakes, etc. will also fail.
- Sound effects and vibration cease gradually as the propeller slows.
- Restart of the engine is **not possible** once a mechanical failure has occurred. Flight must be restarted.

The A1H Skyraider’s radial engine requires careful management of manifold pressure, cylinder head temperature (CHT), and water-injection duration. Exceeding the limits below may result in partial or complete engine failure. The simulation models both cumulative and instantaneous stresses on the powerplant.

1. Cylinder Head Temperature (CHT)

- **Maximum Safe CHT:** 250 °C
- **Behavior:**
- When CHT exceeds 250 °C, the engine begins to experience thermal stress that may lead to detonation and failure.

Cooling Procedures:

- Open the cowl flaps to increase airflow and reduce CHT rise.
- You may use the "Auto" position on the Cowl Flaps switch as a "Set and forget" - the aircraft will automatically manage the cowl flaps based on the temperature.
- Engage water injection to temporarily assist cooling; water supply lasts approximately **30 seconds** of continuous use.
- Reduce manifold pressure and engine RPM to bring CHT back into safe range.

2. Manifold Pressure (MAN)

- **Normal Operation:** ≤ 50 inHg
- **Caution Range:** 50 - 54 inHg
- **Critical Range:** > 54 inHg

Notes:

- Operation above **54 inHg** automatically engages water cooling.
- If the water supply is exhausted, further operation above this limit will cause CHT to exceed safe levels and eventually result in engine failure.
- Continuous operation at **> 57 inHg** is time-limited to a **total of 1000 seconds cumulative** over the entire flight. Exceeding this cumulative duration may trigger permanent engine failure.

4. Fuel and Inverted Flight Limitations

- The engine fuel system is gravity-fed and not fully pressurized.
- **Negative-G flight or Inversions exceeding 5-10 seconds** can cause fuel starvation.
- Recover by re-establishing positive-G and applying mixture and throttle adjustments.

5. Propeller Collision

- The A1H Skyraider’s large, four-blade propeller sits low to the ground and is highly susceptible to damage if excessive pitch, roll, or sink rate is maintained during taxi, takeoff, or landing. Any contact between the propeller and the ground results in **immediate and catastrophic engine failure**.

Power Plant Controls

The throttle, mixture, propeller, and supercharger controls are mounted in a control unit \ installed on the left side of the cockpit. Each control moves through a quadrant in operation. For ease of handling, the engine control unit is plainly marked with the name and position of each control.



From Left to Right: Blower, Throttle, Propeller, Mixture

THROTTLE CONTROL

The throttle control is located on the engine control unit on the left side of the cockpit.

Primary control to monitor is manifold pressure (MAN), which determines how much air (and thus power) the engine is producing. On climb:

- Set full or nearly full throttle up to the maximum allowable manifold pressure.
- As you climb, manifold pressure will drop because air density decreases - you'll need to gradually advance throttle and/or mixture to maintain MAN until you reach full throttle and can't maintain pressure anymore.

MIXTURE CONTROL

Standard mixture controls are implemented. The Mixture Increment and Decrement commands adjust the setting through the entire operational range - from IDLE CUTOFF to FULL RICH (HIGH).

For normal flight operations, the mixture should typically remain within the NORMAL range. The HIGH setting is intended primarily for takeoff and landing, where maximum power is required.

As altitude increases, **air density decreases**, so the **mixture becomes too rich** if not adjusted. During climb:

- **Gradually lean the mixture** as you gain altitude to maintain peak engine performance and prevent fouling.
- Watch **MAP (Manifold Pressure)** or **RPM** - lean until you see a slight rise, then enrich slightly again.
- At cruise, lean more aggressively for efficiency.

The mixture control also plays a vital role in regulating Cylinder Head Temperature (CHT). A leaner mixture results in hotter cylinder temperatures, providing greater fuel efficiency but at increased thermal stress. Pilots should monitor CHT carefully to ensure temperatures remain within operational limits. If CHT becomes excessive, first attempt to open the cowl flaps or reduce throttle before adjusting the mixture. Avoid abrupt or unnecessary mixture changes unless operationally required.

PROPELLER CONTROL

The constant-speed propeller control is located directly to the left of the mixture control. Move the control up to increase RPM, and down to decrease RPM.

Note
Note: Maximum RPM should be used **for takeoff only**.

This control adjusts the constant-speed unit (governor). The control itself does not directly alter the blade angle. Rapid changes in either throttle or propeller control settings may cause the engine RPM to momentarily overshoot the selected value before stabilizing. Smooth and deliberate adjustments are recommended to maintain optimal performance and prevent unnecessary stress on the engine and propeller system.

↔ WATER INJECTION MASTER SWITCH

The Water Injection Switch is used to harness the additional power produced by reducing the fuel-air mixture temperature during high-power operations.

When activated, a mixture of water and methyl alcohol is injected into the engine induction system, lowering the charge temperature and allowing for higher manifold pressures without detonation.

SUPERCHARGER (BLOWER) CONTROL

The Skyraider’s engine is equipped with a two-stage supercharger induction system, consisting of a main stage impeller driven directly by the crankshaft and an auxiliary stage impeller that operates through oil-actuated clutches. These clutches allow the auxiliary impeller to engage in either of two fixed gear ratios-Low Blower or High Blower.

The High Blower setting should be used only when the desired manifold pressure can no longer be maintained in Low Blower, ensuring maximum available power at higher altitudes. Specifically, the shift to High Blower should not be made until it is impossible to obtain 50 inHg of manifold pressure at full throttle in Low Blower. To prevent unnecessary mechanical strain and maintain engine reliability, transitions between blower stages should not occur more frequently than once every five minutes.

COWL FLAP CONTROL

The cowl flap control switch is located directly below the mixture control. The cowl flaps are fully opened automatically whenever compression of the landing gear struts is detected, so manipulation of the control on the ground should be unnecessary.

The flaps should not be closed while on the ground, but can be adjusted to the pilot's preference in order to maintain and regulate CHT. Open about two-thirds for takeoff and climb and closed, or open slightly if required for high-speed and cruising level flight.

↔ CARB AIR SWITCH

The carb air switch is located directly above the flap control switch. This control has two positions: DIRECT and ALT. When in ALT, warm air from the engine accessory section is directed into the carburetor.

OIL COOLER DOOR CONTROL

The control for the oil cooler door is located to the left of the cowl flap control switch. The quantity of cooling air admitted to the oil coolers is regulated by the oil cooler door. In the AUTO mode, the door is thermostatically operated; however, it may also be manually positioned at the pilot’s discretion by moving the switch to either OPEN or CLOSE.