Volume 9 • Number 3 • Summer 2008

# AAOG

AFFILIATED AIRCRAFT OPERATOR GROUPS

Cheyenne • Conquest
King Air • MU-2

www.aaogmagazine.com

## MHI Recognizes Longtime MU-2 Owner, Jack Broome*

Shown with Jack Broome are: Ralph Sorrells, Deputy General Manager, MHIA APSD
Shinichiro Yokoi, Program Manager of MU-2, MHI, Nagoya Aerospace System Works
Noel Takayama, General Manager, MHIA APSD
Tom Berscheidt, President, Turbine Aircraft Services, Inc.

* Jack has owned and operated MU-2s for over 35 years.
The photos shown are Jack's MU-2s, both purchased new from the factory.



## Those Were the Days

Page 3

# NTS Operations

*How to Properly Conduct the Checks* | by Rick Wheldon

Honeywell Engines recently released Operating Information Letters **(OILs)** OI331-20R1 and OI331-21R1. Both documents deal with various safety checks that should be performed for TPE-331 engines. OI331-20R1 deals with "slow turn" engines, the TPE-331-5 and -10 engines found on MU-2 aircraft with 4 bladed propellers. OI331-21R1 deals with the "fast turn" engines found on the other MU-2 models. Because these safety checks primarily deal with the NTS system, and because I have occasionally heard mis-statements about how to properly conduct the checks, I would like to discuss the checks and what they accomplish.

First, a note about the OILs is appropriate. TPE-331 engines are installed in a number of different ways by the various manufacturers. For example, some aircraft use a separate annunciator light for the NTS test switch, while MU-2 aircraft and some others connect the NTS switch to the Beta light. Also, terminology can vary by installation (Condition Lever vs. Fuel Shutoff and Feather Lever), so the language in the OILs is generic. However, regardless of the terminology or installation, these NTS safety checks can be accomplished in all TPE-331 powered aircraft. In this discussion, I will use MU-2 specific terminology.

Honeywell first addresses the Feather Valve Check, and there are two procedures discussed. MU-2 operators should be aware that MU-2 aircraft use the first procedure, titled "For Aircraft Equipped with NTS Check Light." In all MU-2 aircraft (except B model MU-2s with TPE-331-25AA engines installed, which does not have an NTS check switch installed), the NTS Check Light is labeled the BETA light.

Let's look at the Starting Engines and Negative Torque Sensor Check, which Honeywell calls the NTS System Ground Checks. For as long as I have been flying MU-2s, I have performed the NTS start check on every start. Since no additional time or effort is required to perform the NTS start procedure, there is no reason to skip it. Honeywell states in their OILs that "The NTS system ground check verifies that the feathering valve actually opens when negative torque is sensed."

To perform this check, the pilot pressurizes the propeller control system with the unfeather pump. The Beta light illuminates, which indicates that the system is pressurized. Next, the pilot, while continuing to hold the unfeather button, engages the starter. Because the starter "drives" the engine much like a propeller would "drive" the engine after an engine failure, the torque sensor senses negative torque. Fig. 1 depicts the NTS start check immediately after the start button is depressed, and the fluid lines in blue represent unfeather pump pressure. The torque sensor, sensing negative torque, blocks the release of the oil at the torque sensor, causing a build-up of oil pressure on the back side of the feathering valve (in the direction of the red arrows). This repositions the feathering valve to the right in the Fig. 1, which in turn releases oil pressure from the prop dome (green, return pressure) and reduces the pressure at the NTS pressure switch, causing the Beta light to extinguish.

As the engine accelerates after lightoff, the power section begins to provide positive torque. This happens typically between 20% and 40% rpm. Once this occurs, the torque sensor releases pressure to the back side of the feathering valve

*Continued on Page 18*

**Rick Wheldon** has over twenty-four years of aviation experience. He was the former manager of the demo fleet for Mitsubishi and an airline pilot with international experience flying with Braniff and Pan American. Rick holds an ATP and has accumulated over 7500 hours of flying time.

Reprinted From the Summer 2008 Issue of AAOG Magazine

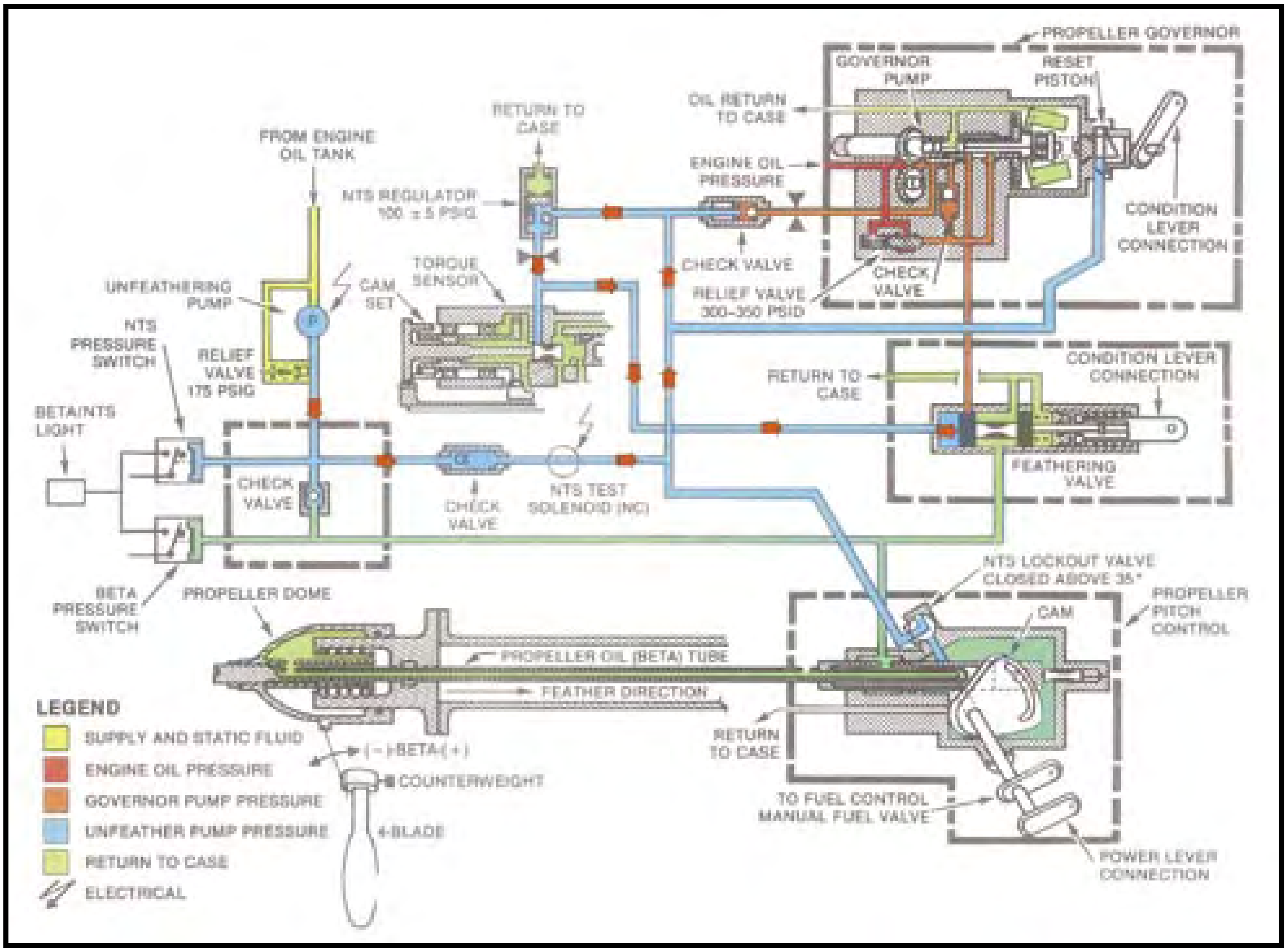


*Figure 1 – NTS Start Check Powered by Unfeather Pump*

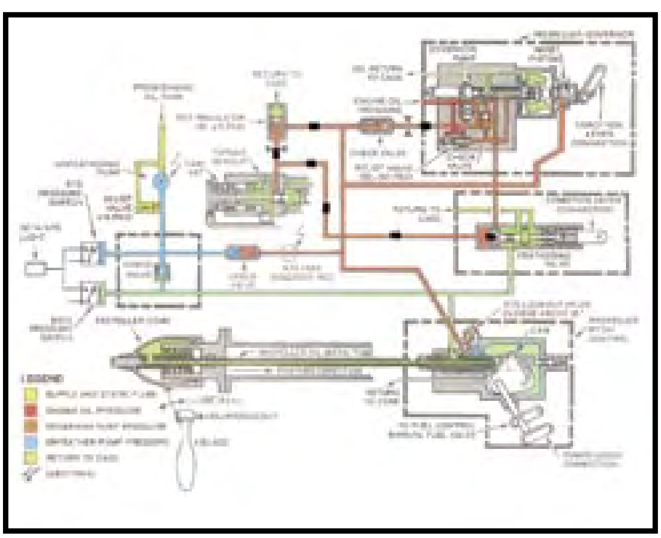

*Figure 2 – NTS In Flight Powered by Propeller Governor Pump*

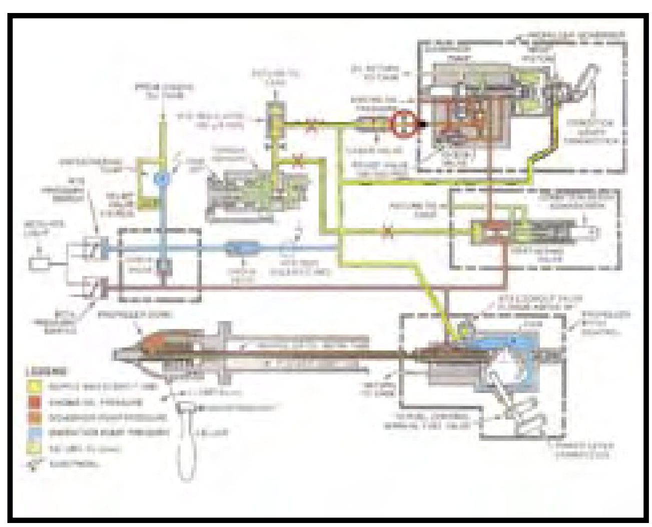

*Figure 3 – NTS Powered by Propeller Governor Pump with Blocked Oriface*

*Continued on Page 18*

## NTS Operations *Continued from Page 16*

and the feathering valve returns to the normal in-flight position. This allows pressure build up within the propeller dome and the NTS pressure switch closes, re-illuminating the Beta light. The pilot can now release the unfeather button. Both the applicable Honeywell OIL and the MU-2 Flight Manual contain provisions that re-illumination of the Beta light must occur by 40% rpm. This is based on continuing to depress the unfeather pump button to provide pressure to the propeller control system. Honeywell clearly states that "Premature release of the unfeathering pump switch will result in an unsatisfactory NTS system check. Successful completion of the NTS system ground check is predicated upon energizing the unfeathering pump throughout the check sequence."

The NTS system uses unfeather pump pressure during the start check but uses propeller governor pressure to reposition the feathering valve in flight. Fig. 2 depicts in-flight NTS actuation using propeller governor pressure, in orange with black arrows. As in the start check, the feathering valve has been repositioned to the right, in Fig. 2, to relieve pressure to the propeller dome (green oil lines) and allow the propeller springs to drive the propeller towards feather and reduce drag.

However, what happens if the propeller governor does not supply sufficient pressure? Again, from the Honeywell OIL, "If the oil passage between the propeller governor and the downstream NTS system (was) blocked, the ground check would not reveal the inoperative system." As seen in Fig. 3, the oil passage contains an orifice, circled in red, and a check valve." The yellow lines reflect static or no pressure downstream from the orifice to the feathering valve. Despite a negative torque signal from the torque sensor, the feathering valve does not reposition and an NTS failure results.

Slow turn engines (engines with four propeller blades) have a procedure to ensure that the orifice is not clogged. The oil line from the propeller governor that provides pressure to the feather valve also provides pressure to a hydraulic rpm reset piston on the governor. When pressurized, the rpm of the governor is set 5% to 8% lower than when un-pressurized. The Supplementary (or Supplemental) NTS requires that the pilot set the condition lever at taxi and advance the power lever until the rpm stabilizes. The Beta light should extinguish, the torque should increase, and most important, the rpm should stabilize at the propeller governor low setting, which is typically 95 to 96% in MU-2 aircraft. If oil pressure were not available, the rpm would stabilize 5% to 8% higher, at 100% to 104%. The pilot should ground the airplane if the rpm stabilizes in the higher range.

Fast turn engines do not have an rpm reset function, and there is no Supplemental NTS check procedure. However, I have been told by Honeywell representatives that the orifice is much larger in fast turn engines and therefore less likely to be clogged.

One fallacy regarding the Supplemental NTS which I once heard is that the check is also accomplished by advancing the power levers on a normal takeoff. When the Beta light extinguishes, according to this line of thought, the pressure is assured to the reset piston, torque sensor, and feathering valve. The problem is that at the propeller governor high position (99.5% to 101%, with some overshoot allowed during power addition) the reset piston function could be masked because the overspeed governor may limit rpm to as little as 103%. That leaves little or no margin to differentiate a low propeller governor pressure and an overspeed governor actuation. This check should be accomplished on the after start checklist!

For anyone interested, Honeywell has made all OILs available online at https://www.e-engines.honeywell.com/index.jsp, then click on communications, pilot information, and operating information letters. For pilots of TPE-331 powered aircraft, these OILs should be a must read! **AAOG**

Reprinted From the Summer 2008 Issue of AAOG Magazine