Miltech Simulations CH47D

AFCS System (Autopilot)

Caution

AFCS IS NOT NATIVELY SUPPORTED BY MSFS - IMPLEMENTATION IS EXPERIMENTAL

Due to the limitations of AP Systems on MSFS, the current implementation of autopilot relies on a series of custom PID Controllers to manage the helicopter controls.

Known issues that will be improved overtime include:

- Tendency for the aircraft to cruise in a "crab" position with HDG mode engaged at high speeds. A "crab angle compensation controller" is in the works, however this adds a significant amount of complexity to the system and further testing is required.
- Under some conditions, the controllers may overreact to small heading changes.
- Under some conditions, the system may generate oscillations.
- Conflicts with Collective hardware if not set to IDLE when altitude modes are engaged.

Caution
A minimum 2% Deadzone in Cyclic and Pedal (In some cases up to 5% on old or inaccurate hardware) is required for AFCS to function correctly. Not enough deadzone will result in the input controllers and the system inputs conflicting with each other, leading to erratic or unexpected behavior.

System Overview

Miltech Simulations CH47D Features a three-degree of freedom Advanced Flight Control System (AFCS), designed to alleviate the load on the pilot during cruising, long flights and terrain-following flights. The system controls the aircraft in the vertical, roll and yaw axes - three modes are available: HDG Select, Baro ALT Hold and RAD ALT Hold.



AFCS Panel

1. **HDG SELECT:** Click here for more information
2. **BARO ALT HOLD:** Click here for more information
3. **RAD ALT HOLD:** Click here for more information
4. **System Select:** Selects the AFCS System the aircraft will use. Under normal conditions, BOTH will be selected for redundancy. HDG/BARO/RAD won´t engage unless the selector is at any position other than OFF.
5. **Cyclic Trim FWD**
6. **Cyclic Trim AFT**
7. ◇ **Cyclic Trim AUTO/MANUAL Selector**

HDG Select

HDG Select Provides automatic control of the aircraft heading, following the Selected Heading on the Pilot Side HSI.

- To engage, make sure that the AFCS SYSTEM SELECT is ON (either in the 1 / 2 / BOTH position). Only then press the HDG button to engage system.

- Upon pressing, the aircraft will automatically take over cyclic and pedal controls in order to follow and maintain the selected heading. Important to note that any cyclic or pedal input when HDG Select is engaged will ultimately conflict with the AFCS Commands.
- At airspeeds under 25 Knots, the aircraft will make exclusive use of pedals to yaw in place. Cyclic input is minimal and used exclusively to maintain the aircraft leveled during the turn. The pilot maintains full control over pitch and cyclic trim.
- At airspeeds above 25 knots, the aircraft will make use of pedal and cyclic to perform coordinated turns at speed. The pilot maintains full control over pitch and cyclic trim.
- The only source of HDG navigation data is the HDG Bug on the Pilot's side HSI. The AFCS will not follow any flight plans inputted via GPS, nor will follow other navaids.

BARO ALT Hold

BARO ALT Hold Provides automatic control of the aircraft's barometric altitude, keeping altitude stable at the moment of engagement. CH47D Does not feature an altitude select mode. Instead, the aircraft will aim to maintain the current altitude and a V/S of zero by adjusting the collective.

- To engage, make sure that the AFCS SYSTEM SELECT is ON (either in the 1 / 2 / BOTH position). Only then press the BARO Alt button to engage system.
- Only engage BARO ALT when the vertical speed is close to zero (eg. aircraft is on stable flight). This avoids aggressive corrections by the aircraft upon engaging.
- After engaging, **move your HARDWARE COLLECTIVE AXIS TO THE MINIMUM** (eg. if using a throttle quadrant, move to IDLE position). This will avoid hardware conflicting with the controller script, leaving complete collective authority to the automatic system.
- To change altitude, disengage the system, manually fly to the desired altitude and then reengage.
- Engaging BARO ALT Hold mode will disengage Radio ALT Hold automatically, and viceversa.

RAD Alt Hold

RAD ALT Hold Provides automatic control of the aircraft's altitude, following the terrain to mantain a constant altitude above the ground following the radio altimeter. The aircraft will aim to maintain the Radio Altitude at the moment of engagement.

- To engage, make sure that the AFCS SYSTEM SELECT is ON (either in the 1 / 2 / BOTH position). Only then press the RAD Alt button to engage system.
- Only engage RAD ALT when the vertical speed is close to zero (eg. aircraft is on stable flight). This avoids aggressive corrections by the aircraft upon engaging.
- After engaging, **move your HARDWARE COLLECTIVE AXIS TO THE MINIMUM** (eg. if using a throttle quadrant, move to IDLE position). This will avoid hardware conflicting with the controller script, leaving complete collective authority to the automatic system.
- To change altitude, disengage the system, manually fly to the desired altitude and then reengage.
- Beware that Radio ALT Hold has a high sampling rate, and as such the system may perform aggressive corrections on unstable terrain. The aircraft will also react to ground obstacles, such as buildings and vegetation, as these are detected by the radio altimeter.
- Engaging Rad ALT Hold mode will disengage BARO ALT Hold automatically, and viceversa.

Controlling Airspeed

The CH47D lacks a mode for airspeed or pitch control. Instead, the pilot shall use the Rotor Longitudinal Pitch to adjust and control the aircraft's pitch. Doing so will also allow speed control when the altitude modes are engaged.

- Make sure your hardware is setup for helicopter control - assign two buttons to control the Rotor Longitudinal Pitch as explained in the Recommended Hardware Configuration
- With either ALT Mode engaged (BARO or RAD), applying rotor trim DOWN will decrease the pitch and accelerate the aircraft forward. The AP system will increase collective to compensate and keep the V/S constant. Increasing Pitch will decelerate the aircraft, and the aircraft will automatically react by decreasing collective to keep V/S constant.

Controlling Vertical Speed

The CH47D lacks a mode for vertical speed control. Therefore, pilots must manually fly any maneuvers that require changes in altitude and vertical speed control.

Control Matrix

Mode Selected	ROLL	PITCH	YAW	COLLECTIVE	SPEED
HDG HOLD					
BARO ALT		/			/
RAD ALT		/			/
HDG + BARO		/			/
HDG + RAD		/			/

:white_check_mark: = Controlled by AFCS System

:joystick: = Pilot Controlled

:level_slider: = Controllable by using Rotor Longitudinal Pitch

Control Bindings

All three modes (HDG HOLD, BARO ALT HOLD and RAD ALT HOLD) can be easily keybinded using default MSFS events (TOGGLE AUTOPILOT HEADING HOLD, TOGGLE AUTOPILOT ALTITUDE HOLD, TOGGLE AUTOPILOT RADIO ALTITUDE HOLD respectively).

AFCS System Selector can be keybinded using LVARs. Beware that the modes above will not engage unless an AFCS System is selected (1/2/Both)

More information: Keybinds Guide