

## Using an Autopilot

### Getting a helping hand

### What is an Autopilot?

An autopilot (from "automatic pilot"), is a device that can automatically control an aircraft's motion about one or more of its three axes (pitch, yaw, and roll), via input from a human pilot pushing buttons and turning knobs, or via navigational equipment sensing signals from navigation aids on the ground.

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### What Can an Autopilot Do?

In Flight Simulator, the Cessna aircraft and the Beechcraft Baron 58 are equipped with autopilots that can:

- Hold the wings level so that the airplane does not turn.
- Maintain the aircraft's current pitch attitude.
- Maintain a selected heading.
- Maintain a selected altitude.
- Maintain a selected rate of climb or descent.
- Follow a VOR radial.
- Track a localizer or localizer back course.
- Track the localizer and glide slope of an Instrument Landing System (ILS).
- Track a GPS course.

The GPS does not provide vertical guidance to the autopilot.

Additionally, the Beechcraft King Air 350, Bombardier Learjet 45, and all of the Boeing jets in Flight Simulator are equipped with automatic flight control systems that include an autopilot, an autothrottle (jets only), and a flight director. These systems can:

- Maintain a selected speed (indicated air speed or Mach number).
- Eliminate unwanted aircraft yaw.
- Help a pilot to manually fly the aircraft exactly as the autopilot would.

Some of the add-on aircraft and panels for Flight Simulator provide even more autopilot functionality, and model advanced features like:

- Flight management computers (FMCs).
- VNav (vertical navigation).
- LNav (lateral navigation).
- Flight Level Change.
- Control Wheel Steering.
- Autoland.

### Why Would I Want to Use an Autopilot?

There are some pilots who view using an autopilot as a crutch (as in, "Real pilots don't need autopilots!"), but they're missing out, because used properly an autopilot can substantially reduce your workload...especially when flying under Instrument Flight Rules (IFR). You can let the autopilot handle some of the grunt work (like maintaining heading and altitude) while you concentrate on more safety-oriented concerns (like navigating, looking for traffic, and communicating).

Reducing your workload by using an autopilot will also help you feel less tired at the end of a long flight. There's nothing more dangerous during the approach and landing phases of a flight (especially a bumpy IFR flight in the clouds) than a pilot who's mentally and physically exhausted from simply flying the airplane.



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#### DC-3 and Vega Autopilots

The autopilots on the Douglas DC-3 and Vega panels can:

- Maintain the aircraft's current pitch attitude.
- Maintain a selected heading.

These autopilots operate differently from the other autopilots in Flight Simulator. To learn more, see the [Douglas DC-3](#) and [Vega](#) Flight Notes.

## The Two Most Important Rules

When two pilots (for example, a flight instructor and a student) are taking turns controlling an airplane, they make it very clear who has control at any given moment. When one pilot hands over control to the other, he says, "You have the airplane." As the second pilot takes control, he may respond, "I have the airplane." In this way, they avoid a dangerous situation where both pilots are controlling the airplane (or no pilots are controlling the airplane).

Using an autopilot is no different. The two most important rules to remember when using a two- or three-axis autopilot like the ones modeled in the Flight Simulator aircraft are:

1. When the autopilot is off, you control the airplane.
2. When the autopilot is on, the autopilot controls the airplane, and you monitor and control the autopilot.

## Staying in the Loop

Never ask the autopilot to do something you can't (or wouldn't) do yourself. For example, no good pilot would be able to make a 120-degree turn and intercept a localizer while flying at 300 knots less than a mile from the localizer; neither would an autopilot. Keep your expectations realistic. If you make things easy for the autopilot, the autopilot will make things easy for you.

That said, just because the autopilot is on doesn't mean you should take a nap. The great thing about using an autopilot is that it frees up some of your attention to do other important tasks. So instead of staring blankly out the window, get to work:


- Maintain situational awareness. Even when the autopilot is controlling the aircraft, as the pilot in command, you're still ultimately responsible. Don't rely on the autopilot to take you to your destination. If you know where you are at all times and the autopilot fails, you can easily take over.
- Monitor which autopilot functions are engaged. Talk to yourself, if it helps. For example, you might say, "The autopilot is engaged. Altitude hold mode is engaged and we're climbing to 7,000 feet MSL. Heading hold is engaged and holding heading 260 degrees, which is our ATC-assigned heading to intercept the 290 degree course from the Seattle VOR."
- Make sure the autopilot is doing what you want it to. If something seems wrong, if the autopilot seems to be malfunctioning, don't hesitate to disengage it: click the autopilot master switch, or press **Z**. Note that doing so does not disengage the autothrottle (available on Flight Simulator jets), which is a separate system. To disengage the **autothrottle**, click the autothrottle switch (see below), or press **SHIFT+R**.
- Monitor the engine instruments. Use some of your extra attention to check on the engine. Confirm desired power settings, and check on fuel usage.

## Other Tips

There's a lot to remember about using autopilots. Here are some key points to keep in mind as you fly:

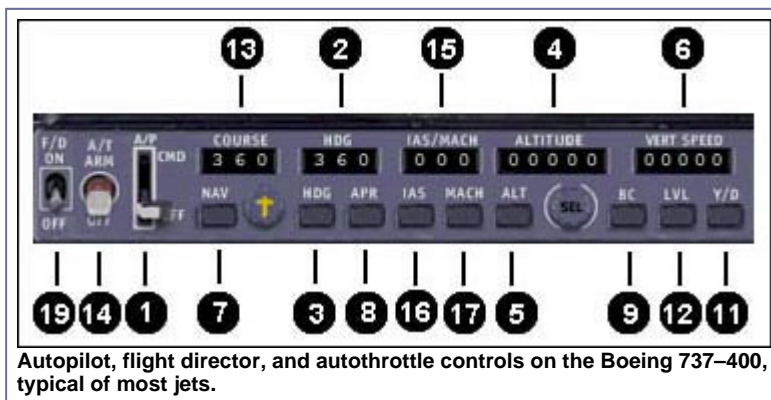
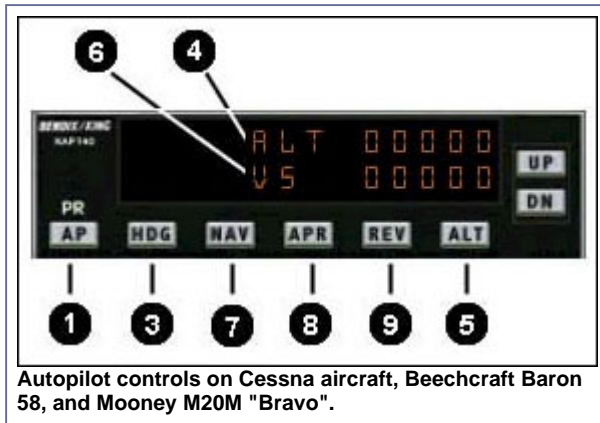
- Don't attempt to manually control the aircraft with the joystick while the autopilot is turned on. If, for example, you select Altitude Hold mode and then try to hand-fly the airplane, the autopilot will compensate by running the trim. This situation can lead to several problems in the real world, especially if you're flying in the clouds. For example, upon disengaging the autopilot, you could find that the autopilot had run the trim all the way nose up or nose down and have a very hard time maintaining control of the airplane, or the autopilot could disengage itself after hitting the trim limits. You might assume that the autopilot is still on, release the controls to unfold a chart, or tune the radios, and enter a spiral, stall, or other unpleasant condition before you figured out what was going on.
- Always disengage the autopilot before landing. None of the autopilots in Flight Simulator are equipped with autoland capabilities. Always disengage the autopilot and autothrottles during the final approach, at least by decision height (DH).
- Always "fly the airplane" first and foremost. If you're fiddling with the autopilot and something doesn't make sense, don't fixate on the problem. Fly the airplane (manually if necessary), and come back to the problem as your time and attention permit.
- Don't lose your manual flying skills. Autopilots make your job easier, but if you always use one, you may forget how to fly by hand. Hand-fly every now and then to keep your skills sharp.

## Autopilot Controls

The autopilot appears slightly different on each aircraft. On many aircraft, it's part of the radio stack. To display the radio stack, click the Radio icon  on the panel. On other Flight Simulator aircraft (typically jets), the autopilot is on part of the main instrument panel called the "Mode Control Panel."

You can change the autopilot's settings using the mouse: Just click a button to "press" it. You can also use the mouse to change the selected heading, course, altitude, and other settings. Hold the hand pointer over the numbers you want to change, wait until the hand shows a plus or minus sign, then click to make the change (or rotate the mouse wheel, if your mouse has one).

As you read the following sections, look at the accompanying screenshots to learn what each control does. The controls are slightly different on the various autopilots in Flight Simulator aircraft, but they all have the same effects in Flight Simulator.



## 1 - Autopilot master switch

The autopilot master switch turns on the autopilot, making the other settings and options available, holds the current pitch attitude, and holds the wings level. When the autopilot is engaged, you cannot control the aircraft using your joystick or the keyboard. This is consistent with the functionality of real-world autopilots. As noted above, either the autopilot is controlling the aircraft, or the pilot is.

When the autopilot is engaged, it controls both pitch and roll, and an associated flight director (not available on all airplanes) displays both pitch and roll commands. The autopilot cannot control just pitch or just roll, nor can the flight director display just pitch or just roll commands.

If any autopilot mode buttons (for example, Heading mode, Altitude mode, or Navigation mode) are engaged when the autopilot master switch is turned on, the autopilot immediately maneuvers the aircraft to turn to that heading, climb/descend to that altitude, or intercept that course. For this reason, it's good practice to verify that the heading bug, altitude select, and course select are properly set before engaging the autopilot.

### To turn the Autopilot Master switch on or off

- Click the **AP** button.
- or-
- Press the **Z** key.

## 2 - Heading selection window/bug

The heading selection window/bug enables the selection of the heading the aircraft will turn to and fly when Heading mode is engaged (see below).

### To set the desired heading

- Click and drag the heading bug on the Heading Indicator or on the Horizontal Situation Display.
- or-
- Click in the **Heading Selection** window.
- or-

1. Press **CTRL+SHIFT+H** to select the Heading bug.
2. Press the **EQUAL (=)** and **MINUS SIGN (-)** keys to move the bug.



In all non-jet Flight Simulator aircraft, you can set the heading for Heading mode using the heading bug.

### 3 - Heading mode selector button

The heading mode selector button engages the autopilot's heading mode, and commands the aircraft to turn to and maintain the heading indicated by the heading bug on the Heading Indicator or Horizontal Situation Indicator (HSI). Any change in the position of the heading bug results in the aircraft turning to and maintaining that heading.

#### To engage Heading mode

- Click the **HDG** button.
- or-
- Press **CTRL+ H**.

### 4 - Altitude selection window

The altitude selection window enables the selection of an altitude the aircraft will climb/descend to then maintain when Altitude hold mode is engaged (see below).

#### To set the desired altitude

- Click in the Altitude Selection window.
  - or-
1. Press **CTRL+SHIFT+Z** to select the Altitude selection window.
  2. Press the **EQUAL (=)** and **MINUS SIGN (-)** keys on the numeric keypad to move the bug.

### 5 - Altitude hold mode selector button

The altitude hold mode selector button engages the autopilot's altitude hold mode. When engaged, the aircraft climbs/descends to the altitude set in the altitude selector at the rate set in the vertical speed selector (see below).

#### To engage/disengage Altitude hold

- Click the **ALT** button.
- or-
- Press **CTRL+Z**.

### 6 - Vertical speed selection window

The vertical speed selection window enables the selection of a climb/descent rate for the aircraft to use when climbing or descending to the altitude set in Altitude mode (see above).

**To set the desired vertical speed**

- Click in the Vertical Speed window.

**7 - Navigation mode selector button**

The navigation mode selector button engages the autopilot's navigation mode, enabling automatic tracking of a VOR course, GPS course, or localizer for enroute navigation. When engaged:

- If the Nav/GPS switch on the panel is set to Nav, the aircraft captures and tracks the VOR course or localizer tuned on the Nav1 radio and set on the VOR1 indicator, HSI, or in the course window (jets only, see below).
- If the Nav/GPS switch on the panel is set to GPS, the aircraft captures and tracks the course to the next GPS waypoint.

**To engage/disengage Navigation mode**

- Click the **NAV** button.
- or-
- Press **CTRL+N**.

**Capturing a VOR course, Localizer, or GPS course**

Remember: never ask the autopilot to do something you can't (or wouldn't) do yourself. For example, no good pilot would be able to make a 120-degree turn and intercept a localizer while flying at 300 knots less than a mile from the localizer; neither would an autopilot. Keep your expectations realistic. If you make things easy for the autopilot, the autopilot will make things easy for you.

**8 - Approach mode selector button**

The approach mode selector button engages the autopilot's approach mode, enabling automatic tracking of a VOR course, GPS course, localizer, or localizer and glide slope for instrument approaches. When engaged:

- If the Nav/GPS switch on the panel is set to GPS, the aircraft captures and tracks the course to the next GPS waypoint.
- If the Nav/GPS switch on the panel is set to Nav, the aircraft captures and tracks the VOR course, localizer, or localizer and glide slope tuned on the Nav1 radio and set on the VOR1 indicator or HSI.

**To engage/disengage Approach mode**

- Click the **APR** button.
- or-
- Press **CTRL+A**.

**Intercepting the glide slope**

In order for the autopilot to capture a glide slope, you must intercept it from below. Although some real-world autopilots can capture a glide slope from above, standard operating procedure is to intercept and capture glide slopes from below. Thus, many real-world autopilots—and all Flight Simulator autopilots—can only capture a glide slope from below. If you want to intercept a glide slope from above, descend through it, level off, and push the APR button twice to disengage and reset approach mode. Then intercept and capture the glide slope from below.

**9 - Back Course approach mode selector button**

The back course approach mode selector button engages the autopilot's back course approach mode, enabling automatic tracking of a localizer back course for instrument approaches. When engaged, the button functions just like approach mode, except the glide slope is disabled, and the autopilot's response to a localizer signal is reversed. (For example, if the localizer needle is offset to the left, the autopilot will turn the aircraft to the right to intercept it).

**To engage Back Course approach mode**

- Click the **REV** or **BC** button (depending on aircraft type).
- or-
- Press **CTRL+B**.

**10 - Nav/GPS switch**

The Nav/GPS switch selects the navigation receiver (Nav 1 radio or GPS) that feeds the Nav 1 display and the autopilot.



When the Nav/GPS switch is in the GPS position and the autopilot's Navigation mode is enabled, the autopilot will follow the programmed GPS course to each lateral waypoint in sequence. The GPS does not provide vertical guidance to the autopilot.

**To toggle the Nav/GPS switch**

- Click the **Nav/GPS** switch.

## 11 - Yaw damper switch

The Yaw damper switch engages the yaw damper (on King Air 350, Learjet 45, and Boeing jets), which helps eliminate unwanted aircraft yaw and keeps turns coordinated.

**To engage the yaw damper**

- Click the **Y/D** button.
- or-
- Press **CTRL+D**.

## 12 - Wing Leveler switch

The Wing Leveler switch disengages heading mode and engages the wing leveler (on the Learjet 45, Boeing 737–400, and Boeing 777–400), which keeps the aircraft's wings level. The switch is on by default, unless the autopilot is in heading mode.

**To engage/disengage the Wing Leveler**

- Click the **LVL** switch.

## 13 - Course selection window/knob

The course selection window/knob designates the VOR radial or localizer course the autopilot will track.

**To set the desired course**

- Click the **Course indicator** knob.
  - or-
  - Click in the **Course Selection** window.
  - or-
1. Press **V** to select the **Course selector** knob.
  2. Press the **EQUAL(=)** and **MINUS SIGN (-)** keys to change the course.

## Using the Autothrottle

In addition to an autopilot, the Learjet 45 and Boeing jets in Flight Simulator are each equipped with an autothrottle that can control airspeed by automatically adjusting the throttles. The autothrottle works independently from the autopilot, although most autothrottle controls are presented on the MCP along with the autopilot controls:

## 14 - Autothrottle arm switch

The autothrottle arm switch arms the autothrottle. When armed, the autopilot controls the aircraft's throttles to hold a specific airspeed or Mach number (see below).

**To arm/disarm the Autothrottle**

- Click the **AT/ARM** switch.
- or-
- Press **SHIFT+R**.

## 15 - Airspeed/Mach selection window

The airspeed/Mach selection window enables the selection of the airspeed/Mach number the aircraft will turn to and fly when airspeed hold mode is engaged (see below).

**To set the desired airspeed/Mach**

- Click in the **Airspeed/Mach Selection** window.  
-or-
- 1. Press **CTRL+SHIFT+R** to select the **Airspeed/Mach Selection** window.
- 2. Press the **EQUAL (=)** and **MINUS SIGN (-)** keys on the numeric keypad to change the airspeed/Mach setting.

## 16 - Airspeed Hold mode selector button

The airspeed hold mode selector button holds the aircraft at a constant airspeed you specify. The autothrottles must be engaged for airspeed hold to work.

### To engage/disengage Airspeed Hold mode

- Click the **IAS/SPD** button.  
-or-
- Press **CTRL+R**.

## 17 - Mach Hold mode selector button

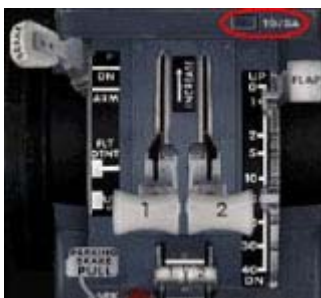
The Mach hold mode selector button holds the aircraft at a constant Mach speed (% of speed of sound) you specify. The autothrottles must be armed for Mach hold to work.

### To engage or disengage Mach Hold mode

- Click the **MACH/SPD** button.  
-or-
- Press **CTRL+M**.

## 18 - Takeoff/go-around mode selector button

The Takeoff/go-around mode selector button engages TO/GA mode. Throttles automatically advance to takeoff power, and the Flight Director (see below) indicates takeoff pitch. TO/GA mode can be used for takeoff, or for a go-around on landing. The autothrottles must be armed for TO/GA mode to work. On the panels of aircraft equipped with TO/GA mode (Boeing 737–400, 747–400, and 777–300), the TO/GA button is located on the throttle quadrant. To display the throttle quadrant, press **SHIFT+4** or click the **Engines** icon



The Takeoff/go-around (TO/GA) mode selector button on the Boeing 737–400 throttle quadrant.

### To engage or disengage Takeoff/go-around mode

- Click the **TO/GA** button.  
-or-
- Press **CTRL+SHIFT+G**.

## Using the Flight Director

A flight director helps you manually do what the autopilot would do if it were engaged: hold altitude, hold heading, track a VOR

course, complete an ILS approach, and so forth. In Flight Simulator, a flight director is only available on the King Air 350, the Learjet 45, and the Boeing jets.

The flight director consists of either:

- A pink chevron (on the King Air 350 and Learjet 45) that displays on the Primary Flight Display. The chevron indicates deviation from the suggested heading and pitch attitude. Move the yoke to keep the yellow chevron (which indicates the aircraft) nestled just under the pink chevron (the flight director).



- Two command bars (on the Boeing jets) that display on the Primary Flight Display. The vertical bar shows horizontal deviation from the suggested heading, the horizontal bar shows vertical deviation from the suggested pitch attitude. Move the yoke to keep the command bars centered.



Whereas an altimeter or a VOR display shows raw data (you need to figure out what to do with the information), a flight director displays computed data (it tells you what to do). This makes your job much easier.

With the flight director turned on and autopilot modes selected—but the autopilot master switch turned off—the flight director shows what the autopilot would do were it engaged, based on the setting of its modes. When both the flight director switch and the autopilot master switch are turned on, the flight director shows what the autopilot is doing.

The flight director has just one control:

## 19 - Flight director switch

The flight director switch turns the flight director on and off. Manipulate the yoke to follow the pink chevron, or to keep the command bars centered.

### To turn the Flight Director on or off

- Click the **F/D** switch.  
-or-
- Press **CTRL+F**.

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