Cessna 172SP Update Description

This is a MOD for the excellent X-Plane 11 Default Cessna 172SP aircraft. While this default X-Plane 11 aircraft is an amazingly complete and accurate simulation of the real airplane, there were some minor changes needed to correct some small discrepencies in the aircraft configuration and flight dynamics. This X-Plane 11 aircraft is all about realism and real world flight training, and this update makes flying it come even closer to flying the actual aircraft.

The following changes are made in this update:

1. The engine exhaust has been moved to the correct location to make it visible in X-Plane 11.50+

2. The full flaps deflection angle has been reduced from 40 to 30 degrees, to match the actual 172SP aircraft specifications. The 172N was the last model that used 40 degrees for full flaps.

3. The elevator trim sensitivity has been reduced to allow easier and more precise trim control, especially when using an external trim wheel, like the Saitek Trim Wheel.

4. Damping parameters have been added to all of the control surfaces to improve stability and reduce over controlling. This reduces the control surface response to sudden movements, making them react more like the actual aircraft controls.

5. The fuel tanks have been moved slightly aft to more closely match the actual aircraft weight and balance specifications found in the C172S POH.

6. The CG forward and aft limits have been changed to more closely match the actual aircraft specifications.

7. The Basic Empty Weight of the aircraft has been reduced slightly to 1,700 lbs, and the default CG location has been changed to match the actual weight and CG of a similarly equipped real world C172SP (N567JW), and to simplify weight and balance calculations. While these changes are minor, they do affect the stability and flight dynamics of the aircraft, and they provide more realisitic weight and balance with different aircraft loading configurations.

   The Basic Empty Weight of the C172SP Seaplane version has been increased to 2,030 lbs., which includes the actual 330 lb. weight increase of replacing the landing gear with floats on the real aircraft.

8. A simple, easy to use Weight and Balance Guideline has been included in the

README file for quickly estimating and setting the Payload and CG sliders in X-Plane for different aircraft payload configurations. This provides a much more realistic simulation of safely loading and flying the actual aircraft with different payloads.

9. Complete Installation Instructions, and some comprehensive real-world Flying Tips are also included in the README file.

10. Updated ACF files for the G1000 and Seaplane versions of the aircraft are also included.

11. A copy of the C172S POH (Pilot Operating Handbook), and a handy FAA Handbook on Airport Traffic Patterns are also included with this update.

Note: The change to the default CG location will affect any "Quick Looks" you may have previously defined and saved, requiring them to be redefined.

Cessna 172SP Update 1.0.1 Description

I made a minor change to the Flying Tips in the README file.

Cessna 172SP Update 1.0.2 Description

The following additional changes are included in version 1.0.2 of this update:

1. The new XP-11.36 bungee connected nosewheel castor parameter has been configured for 30 degrees maximum deflection, to match the actual aircraft specifications. Applying differential braking during taxi now allows the nosewheel to swivel an additional 20 degrees to a maximum angle of 30 degrees. This greatly improves taxi and ground handling performance.

2. The Low Speed nosewheel deflection angle has been reduced to 10 degrees maximum to match the High Speed deflection angle, and the actual aircraft specifications.

3. The nosewheel steering max deflection time has been reduced from .7 seconds to .2 seconds to more closely match the actual aircraft. This improves steering response during both the takeoff and landing roll, and further improves taxi and ground handling.

4. The engine exhaust has been moved slightly to more closely match the actual aircraft location.

Cessna 172SP Update 1.0.3 Description

The following additional changes are included in version 1.0.3 of this update:

1. The engine side cant angle has been increased to 2 degrees to eliminate excess yaw during cruise.

2. The aileron and rudder trim have been adjusted to improve straight and level cruise flight.

Cessna 172SP Update 1.0.4 Description

This update is a complete overhaul of the flight model for the C172SP... It has been optimized for the new "Experimental Flight Model" in XP11 and configured to use it by default. It now more closely matches the actual aircraft performance specs for cruise speeds, stall speeds, and approach and landing speeds. The overall stability and handling have also been improved.

The following additional changes are included in version 1.0.4 of this update:

1. The flight model geometry for the wings, horizontal and vertical stabilizers and fuselage have all been updated to more closely match the actual aircraft.

2. The main wing incidence has been reduced from 3.0 degrees to 1.5 degrees to match the aircraft specs.

3. The main wing dihedral has been increased slightly to match the aircraft specs.

4. The main wing and stabilizer airfoils have been updated to match the aircraft specs.

5. The prop diameter and pitch have been reduced slightly, and the max RPM increased to match the aircraft specs.

6. The flaps geometry and the lift/drag/pitch coefficients have all been adjusted to more closely match the actual aircraft.

7. The rudder and elevator max deflections have been increased to match the aircraft specs.

8. The default CG has been moved aft by 2.4 inches.

9. The aircraft has been re-trimmed for hands off straight and level cruise flight.

10. The landing gear vertical height has been adjusted.

Weight and Balance Guideline

The default CG location has been set for the aircraft in the default configuration when loaded in X-Plane (empty aircraft + oil and unusable fuel + Pilot) .

X-Plane automatically adjusts the aircraft weight and CG for any changes in fuel load, based on the aircraft fuel tank locations, but any changes in weight and CG as a result of different Payloads must be made manually using the sliders on the X-Plane Weight and Balance configuration screen.

Use the following guideline to calculate and adjust the Payload and CG sliders in X-Plane for different loading configurations of this aircraft. This is based on actual aircraft weight and balance calculations using the C172S POH :

Payload	Payload Weight	CG Change
Pilot	170 lbs.	-0.25 inches
Front Passenger 1	+170 lbs.	-0.25 inches
Rear Passenger 2	+170 lbs.	+2.5 inches
Rear Passenger 3	+170 lbs.	+2.5 inches
Baggage Area 1	+30 lbs. (120 lbs. max)	+1 inches
Baggage Area 2	+20 lbs. (50 lbs. max)	+1 inches
Total Payload & CG Change	730 lbs.	+6.5 inches

Set the Payload and CG sliders to the Total Payload values calculated above.

Note 1: The CG Change for each Payload item listed above is proportional to the weight, so if you use more or less weight for any Payload item, adjust the CG Change for that item by the same amount.

Note 2: The total combined weight for both bagagage areas must not exceed 120 pounds.

The Total Payload weight and CG Change can now be added to the aircraft Basic Empty Weight and CG and the Fuel Weight , and the resulting Loaded Airplane Total weight and CG can be checked against the Center of Gravity Limits envelope on page 6-16 of the POH to insure that they are within the allowable limits.

	Weight	CG
Basic Empty Weight	1,700 lbs.	40 inches aft of Datum
1/2 Fuel (26.5 usable gallons)	+160 lbs.	+1 inches
Total Payload	+730 lbs.	+6.5 inches
Loaded Airplane Total	2,590 lbs.	47.5 inches aft of Datum
Floats (Seaplane version)	+330 pounds	+0 inches

Note 3: The above loading example is 40 pounds over the maximum takeoff weight of 2,550 lbs., and the CG is +0.2 inches beyond the allowable aft limit of 47.3 inches for Normal Category operation (+7 inches beyond the aft limit of 40.5 inches for Utility Category operation). So, the Payload must be reduced and redistributed, and/or the Fuel load must be reduced to bring the total weight and CG within the allowable limits.

Note 4: The aircraft has the most forward CG, and is more stable, if you fly it with just yourself and a front seat passenger. Also, with this loading all flight maneuvers in both the Normal Category and Utility Category are permitted.

Flying Tips

Takeoff and Climbout:

1. Set the Fuel Tank selector to BOTH (check the fuel guages for adequate levels).

2. Set the elevator trim to TAKEOFF.

3. Set the Mixture to RICH (full forward), or to max RPM if the field elevation is above 3000 ft.

4. Set the Flaps to full UP, or to 10 degrees for a short field takeoff.

5. Set the Altimeter to the airport field elevation, or to the current altimeter setting announced on the ATIS, or given to you by ATC.

6. For visual reference, set the Heading Bug to the runway heading. Adjust the DG heading indicator to match the current Magnetic Compass heading.

7. Begin the takeoff roll by smoothly advancing the throttle to full power, while applying right rudder as needed to maintain runway alignment. Ease back on the yoke at 50 - 55 knots to raise the nose slightly. Maintain the yoke back pressure until liftoff, which should occur at 55 - 60 knots depending on the aircrafts total takeoff weight.

After liftoff, continue holding yoke back pressure to maintain the best angle-of-climb speed of 60 -65 knots until all obstacles have been cleared. Continue to apply right rudder as needed to maintain the runway heading by keeping the Heading Bug at the top of the DG Heading indicator. Apply ailerons as needed to keep the wings level.

8. After clearing all obstacles, raise the flaps if they were used for takeoff. Ease off the yoke back pressure a little to increase the airspeed and continue the climbout at the best rate-of-climb speed of 70 - 75 knots.

9. If you are departing the airport, continue climbing on the runway heading until you are at least 500 ft. above Pattern Altitude (1000 ft. AGL). Re-set the Heading Bug to your departure heading for visual reference, and for engaging the HDG mode of the autopilot later on. Now, turn to your departure heading, unless instructed otherwise by ATC.

To improve forward visibility so that you can see and avoid other traffic at the same altitude, Ease off the yoke back pressure and reduce power to 2400 RPM, then adjust the trim to lower the nose until you can see the horizon. This should result in a normal enroute climb rate of +500 to +700 fpm, at about 90 - 100 knots. Now you can engage the HDG and V/S modes of the autopilot, if desired.

(See the Climb Performance chart on page 5-18 of the POH for more information)

Above 3000 ft., adjust the Mixture for maximum RPM, while keeping the EGT exhaust temperature at about mid-range. Monitor the EGT temperature, and the OIL temperature indicators and re-adjust the Mixture as needed to keep them below redline.

10. After reaching your desired cruising altitude, Level off and re-adjust the power and trim for level cruise flight at an indicated airspeed of 100 - 110 knots. Re-adjust the Mixture for max RPM and fuel economy.

If the autopilot V/S mode was engaged during your climbout, start incrementally reducing the vertical speed setting when you are 500 feet below your desired cruising altitude. When you reach cruising altitude, either set the vertical speed to 0, or engage the ALT mode of the autopilot.

(See the Cruise Performance charts beginning on page 5-19 of the POH for more information)

11. If you are going to stay in the airport traffic pattern after takeoff, continue to climbout on the runway heading until you are about 100 ft. below Pattern Altitude (1000 ft. AGL), then ease off the yoke to lower the nose and reduce power to 2100 RPM to level off at Pattern Altitude. Then, make a shallow (15 - 20 degree bank) 90 degree turn onto the Crosswind leg of the pattern. When the Heading Bug is at the far right, or far left, side of the DG heading indicator, roll out onto the Crosswind heading. Adjust the power and trim to maintain Pattern Altitude at about 90 knots.

When the airport is behind you at an angle of about 30 - 45 degrees (1/2 - 1 mile away), make another shallow 90 degree turn onto the Downwind leg of the pattern. Roll out on the Downwind heading when the Heading Bug is at the bottom of the DG heading indicator.

Approach and Landing:

1. Set the Fuel Tank selector to BOTH.

2. Set the COM 1 radio to the airport Tower frequency, or at smaller uncontrolled airports to the airport Traffic Advisory Frequency (CTAF / UNICOM / FSS). Continuously monitor the COM 1 frequency throughout your approach and landing to stay aware of the location of all other aircraft arriving or departing from the airport, and to receive clearance and instructions from the Tower if needed. Set the COM 1 standby frequency to the airport Ground Control frequency.

(Press "M" to open the map in VFR Sectional mode, then zoom in and click on the airport to see the field elevation, and all of the airport COM radio frequencies listed under "Details)

(Pressing the ENTER key at any time during flight will open the ATC window and list the currently appropriate ATC radio frequencies, and allow you to auto tune the COM radios)

3. Set the COM 2 radio to the airport ATIS frequency (or AWOS / ASOS at smaller airports) and then listen to the current airport weather conditions, altimeter setting and active runway information.   Set the Altimeter to the current barometric pressure announced on the ATIS (or AWOS / ASOS), or given to you by ATC.

Set the COM 2 standby frequency to the airport Approach Control or Center frequency so you can request Flight Following or a current altimeter setting if needed, as you get closer to the airport.

4. For visual reference, set the Heading Bug to the active runway heading. The DG will gradually drift over time during flight, so correct for this by re-adjusting the DG heading to match the current Magnetic Compass heading.

5. Set the NAV 1 radio to the active runway ILS frequency, to aid in more precise runway and glideslope alignment on Final approach. Using the ILS as a reference for maintaining runway alignment also automatically corrects for any crosswinds.

(Press "M" to open the map, then change the mode to "IFR low enroute". Zoom in and click on the active runway ILS approach feather to see the ILS frequency, and auto tune the NAV 1 radio)

6. Set the NAV 2 radio to the frequency of the VOR station on, or nearest to, the airport, to aid in establishing your location and maintaining your Approach course.

(Press "M" to open the map in VFR Sectional mode, then zoom in and click on any VOR or NDB station to see its frequency, and auto tune the NAV or ADF radios)

7. Set the ADF radio to the frequency of the NDB station on, or nearest to, the airport for an additional navigation aid, which can be cross referenced with the VOR 2 for more accurately determining your location, or the bearing to the station. At larger airports, a NDB is often located at the runway Outer Marker (4 - 7 miles from the runway threshold).

8. Unless otherwise directed by ATC, set the Transponder squawk code to 1200 (VFR) and set it to ON.

9. Slow the aircraft down by reducing the power to 2000 RPM (Bottom of the green arc) while applying yoke back pressure to maintain altitude until the airplane slows to about 90 knots. Ease off the yoke pressure and increase the power to 2100 RPM, then trim for level flight at about 90 knots.

10. Unless instructed otherwise by ATC, descend to the airport Pattern Altitude (1000 to 1500 ft above field elevation) by reducing power to 1500 RPM, and then adjusting the power as needed to establish and maintain a descent rate of about -500 to -700 fpm. At Pattern Altitude, increase the power back to 2100 RPM and trim for level flight at about 90 knots again.

11. Set the Mixture to RICH (full forward), or to max RPM if the field elevation is above 3000 ft.

12. Approach the airport so that you can enter the Downwind leg of the traffic pattern at mid-field, at a 45 degree angle, unless you are making a straight in approach, or you are instructed otherwise by ATC.

(See the included FAA Airport Traffic Pattern handbook for more information)

Approach the runway toward mid-field at a 45 degree angle to the Downwind leg of the pattern, with the Heading Bug in the lower left, or lower right, corner of the DG heading indicator. Check for other traffic already in the pattern, and when you are about 1/2 - 1 mile from the runway make a shallow 45 degree turn onto the Downwind leg of the pattern. Roll out onto the Downwind heading when the Heading Bug is at the bottom of the DG heading indicator. Adjust the power and trim to maintain Pattern Altitude at about 90 knots.

13. After passing the runway threshold on the Downwind leg, reduce the power to 1900 RPM, and then lower the flaps one notch to 10 degrees while applying forward pressure on the yoke to keep the nose from rising. After the aircraft has slowed to 75 knots, ease off the yoke pressure and increase the power to 2000 RPM. Then, adjust power and trim as needed to maintain Pattern Altitude at about 75 knots.

14. When the runway threshold is behind you at an angle of about 45 degrees, make a shallow (15 - 20 degree bank) 90 degree turn onto the Base leg of the traffic pattern.

Roll out onto the Base heading when the Heading Bug is at the far right, or far left, side of the DG heading indicator. Reduce power to 1900 RPM, then lower the flaps another notch to 20 degrees while applying forward pressure on the yoke to keep the nose from rising. After the aircraft has slowed to 65 knots, ease off the yoke pressure and increase the power back to 1900 RPM. Adjust the power and trim as needed to maintain a Base leg descent rate of about -200 fpm. at about 65 knots.

15. Check for any traffic already on Final approach, especially aircraft making a straight-in approach, then when the runway threshold just passes behind the wing strut, make another shallow 90 degree turn onto Final. When the Heading Bug is at the top of the DG heading indicator, roll out onto the Final approach heading. Reduce power to 1700 RPM to begin your descent on the glideslope.   Adjust the power and trim as needed to establish and maintain a descent on the glideslope of -400 to -500 fpm at about 65 knots.

Line up on the runway and maintain your final approach heading by either keeping the Heading Bug at the top of the DG heading indicator, or by centering the VOR 1 vertical needle on the ILS localizer. Maintain your descent on the glideslope by making small power changes only, while observing the runway VASI / PAPI lights (red and white lights should both be visible) or by centering the VOR 1 horizontal needle on the ILS glideslope.

16. At about 500 ft. AGL you can choose to either continue making a normal landing with 20 degrees of flaps, or to minimize your landing speed and distance for a short field landing you can lower the flaps one more notch to Full Down (30 degrees), while applying forward pressure on the yoke to keep the nose from rising. When your airspeed has slowed to 60 knots, ease off the yoke pressure and increase the power as needed to maintain a -300 to -400 fpm descent on the glideslope at about 60 knots. Maintain your descent on the glideslope with small power changes only.

17. To execute a Missed Approach (Go Around), ease back on the yoke to stop your descent, while smoothly advancing the throttle to full power to begin climbing again, then if needed raise the flaps back up to 20 degrees. After climbing to 500 ft. AGL or more, raise the flaps to 10 degrees and re-adjust the trim to continue climbing at about 75 knots.

At about 100 ft. below Pattern Altitude, lower the nose and reduce power to 2000 RPM to level off. Adjust the power and trim to maintain Pattern Altitude at about 75 knots, Then, when you are past the far end of the runway make a shallow 90 degree turn onto the Crosswind leg of the pattern, as described above. Then, make another shallow 90 degree turn onto the Downwind leg again.

18. To complete the landing, after crossing the runway threshold ease back on the yoke

to level off, then slowly reduce power while raising the nose to keep the airplane just above the runway. Smoothly reduce the power all the way to idle while applying yoke back pressure as needed to allow the airplane to gently settle down onto the runway. After touchdown, ease off the yoke back pressure and allow the nosewheel to settle down onto the runway.

19. While maintaining runway alignment with the rudder, apply the brakes evenly to slow the aircraft to a complete stop. Raise the flaps and then exit the runway at the next taxiway, or as instructed by ATC. The easiest way to evenly apply both brakes in X-Plane is by pressing the "b" key, or assigning a joystick button to the command "Hold brakes regular".

Note: All of the airspeeds in these recommended procedures may need to be increased 5 - 10 knots for operation at higher altitudes, or with maximum takeoff weight.