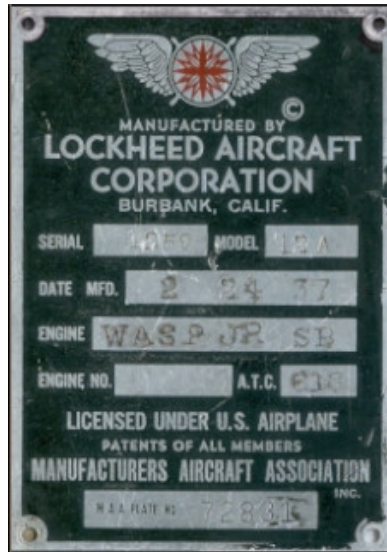


Lockheed L-12A Electra Junior
For X-Plane 11
By Steve Baugh (a.k.a. Humbug01)
FMOD sounds by Dan Hopgood



Introduction

The Lockheed Model L-12A (USAAF designation, C-40) was developed in 1936 as a smaller version of the L-10 Electra in order to meet the needs of regional “feeder” airlines for a fast passenger aircraft. Designed by the well-known Lockheed engineer, C. L. “Kelly” Johnson, it has the distinctive twin v-stab tail like its older sibling and the Lockheed P-38 Lightning fighter with some innovative features for the time. I recommend that you search the internet for the history of this fascinating aircraft, and a few PDF documents are included in the \documents folder.

Be sure to watch the several y**tube videos which have been the exclusive source for some of the technical aspects of this model. Nevertheless, due to the unavailability of full information there are some features of this aircraft that required reasonable guesswork in making the model. And in a few cases (like the landing gear lock pin or control lock lever) working with an X-Plane model required creative inaccuracy. Hopefully these can be overlooked in light of the desire to provide an enjoyable simulation of flying this truly wonderful, historic aircraft.

Quick Start

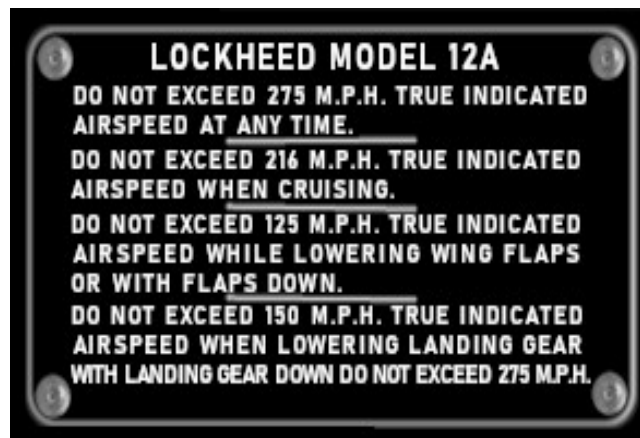
Please be sure to read the information below carefully. But if you want to start quickly, there are only a few things to know to get going. Be sure to locate the various controls such as the elevator trim and oil cooler knobs (see below).

Take off:

- No flaps used during normal takeoffs
- Prop controls and mixture full forward
- Throttle to about 35 inches manifold pressure (“mp”) (maximum is 36.5 inches)
- Lift off is at about 80 mph
- Raise gear after lift off
- Climb is conducted with props at 2000 rpm and throttle at 30 inches mp (“20/30”)
- Cruise is with props at 1900 rpm and throttle at 27 inches mp at 8,000 ft.

Landing:

The landing gear should be deployed when the speed is between 140 and 120 mph. Here is the panel speed plaque:



- Lower throttle to about 22-23 inches mp to reduce speed
- Props and mixture full forward
- Speed should be between 140 and 120 mph for lowering gear
- Lower flaps one notch (10 deg.) at 100 mph
- Circuit speed is 90 mph, lower flaps to second notch (20 deg.)
- Hold 80 mph for landing with full flaps (45 deg.)
- Flair just before touchdown on front wheels then push nose slightly forward
- Throttle down and let tail wheel touch tarmac gently, raise flaps
- Brakes are not generally needed during landing

The Flight Manual

The original flight manuals were distributed for the C-40 by the U.S. Government and for the Model 12A by Lockheed. Today these documents are not available freely but only for purchase at:

www.flight-manuals-online.com

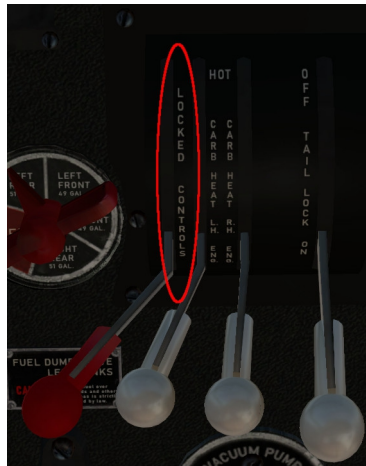
which is why I cannot distribute the flight manuals. Some of the information that follows is loosely derived from these manuals as well as from video and various pilot reports.

Today, there are fewer than a dozen Model 12A aircraft in existence. When you study the pictures of the panels of these aircraft and compare them with the few grainy photos of originals, there are quite a variety of components in the modern 12A instrument panels and differ considerably from each other and from the original. Most of the current instrument panels include some sort of GPS, glass instrument elements, phone apps, etc.

This X-Plane model does not reproduce any one modern or historic Lockheed Model 12A or C-40 but is a reasonable composite from many of them. What follows is a brief description of the distinctive controls and flight characteristics of the aircraft in X-Plane 11.

Unique Controls

1) The lower left lever on the center stand houses a control locking lever on the real-world (“RW”) plane which simply hides or shows the yokes in X-Plane. For convenience, you can also show/hide the yokes by pressing the large screw on the yoke arm. Hiding the yoke helps with using the left panel table switches.



2) The two big switches on the front of the left table house and deploy the landing lights which takes about 4 seconds. The landing light on/off switch itself will not work until the light housings

are deployed so you have to wait to switch the lights themselves on. The blue LED lights on the ends of the big housing/deploy switches turn on when activated. If you have the lights on and raise one light housing, both lights switch off automatically.

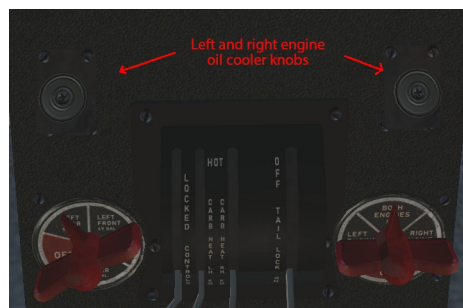


The RW exemplar:



3) The nose “warning light” must be OFF before opening the nose baggage door. Otherwise the side baggage door will open, but not the nose door. You can open the baggage doors with various switches: a) the handles on the inside or outside of the side baggage door; b) either of the two lock pins on the nose baggage doors; c) or a switch on the right panel table next to the main door switch.

4) The center stand has two pull knobs above the fuel and engine fuel knobs which open the “oil cooler” gateways for each engine in real life. (X-Plane knows nothing of an oil cooler, so they open cowl flaps even though the Model 12A’s Pratt & Whitney R-985-SB engines have no moving cowl flaps.) The oil on this aircraft is known to run hot so keep an eye on the temperatures and use the oil cooler knobs to help cool the oil.





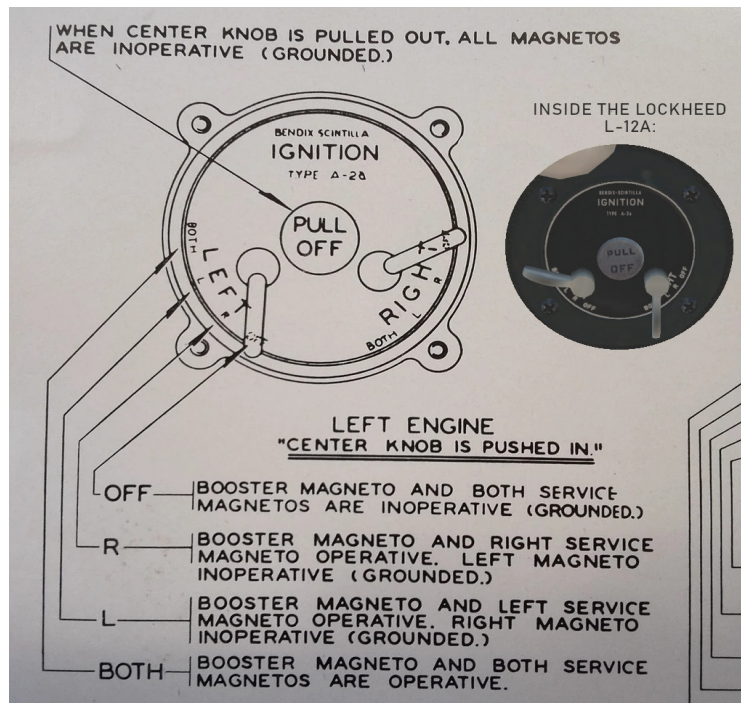
5) The “vacuum pump” switch at the bottom of the center stand is supposed to be on the “right engine” by default and switch to left only if the right engine stops. This is to divide the load on the left engine which runs the generator. There are prominent engine feather switches on the top of the front panel in case one engine fails.

6) I believe that to raise the gear in the RW plane you have to press the locking pin while pushing or pulling the gear knob on the center stand. This is not modeled due to X-Plane controller limitations. The pin simply moves when the knob is moved.

The picture below shows the pin and other nearby knobs and controls that match RW controls.



7) The ignition system is based on the following RW controls which is used on at least one RW Model 12A:



8) The parking brake lever is the wooden pull handle on the upper left of the panel.

9) The lighting knobs on the left table are not marked. The front one controls instrument brightness and the back two control left and right panel lights. The panel lights should be off when you start up the aircraft in X-Plane during the day local time.



10) The tail wheel lock system on this model does not reflect the RW system. In the RW the pilot has differential brakes and easy access to engine both controls with one hand. In X-Plane, both brakes and both throttle controls are often assigned respectively to a single keypress or joystick button making steering with a free castoring tail wheel impossible. Accordingly the tail wheel lock here locks the tail wheel straight ahead as in the RW plane (the knob toward the bottom of the center stand goes down), while turning OFF the lock allows the tail wheel to be steered with the rudder controls. See the checklist below for how to use this control.

The Fuel System

The Model 12A fuel system models the original system as much as can be gleaned from grainy pictures and sparse description in the FM (thanks to Troopie and others on the x-plane.org forum for help in figuring this out). The Model 12A has four fuel tanks: two forward left and right tanks of 49 U.S. gallons each and two left and right rear tanks of 51 U.S. gallons each. (See graphic below.) Here are the main controls.

The fuel control valves are located toward the bottom of the center stand. The left knob controls the fuel tanks (left rear, left front, right front, and right rear) and the right knob controls the engine assignments. Obviously you will want to keep the right engine selector on “both engines” unless one engine stops running.

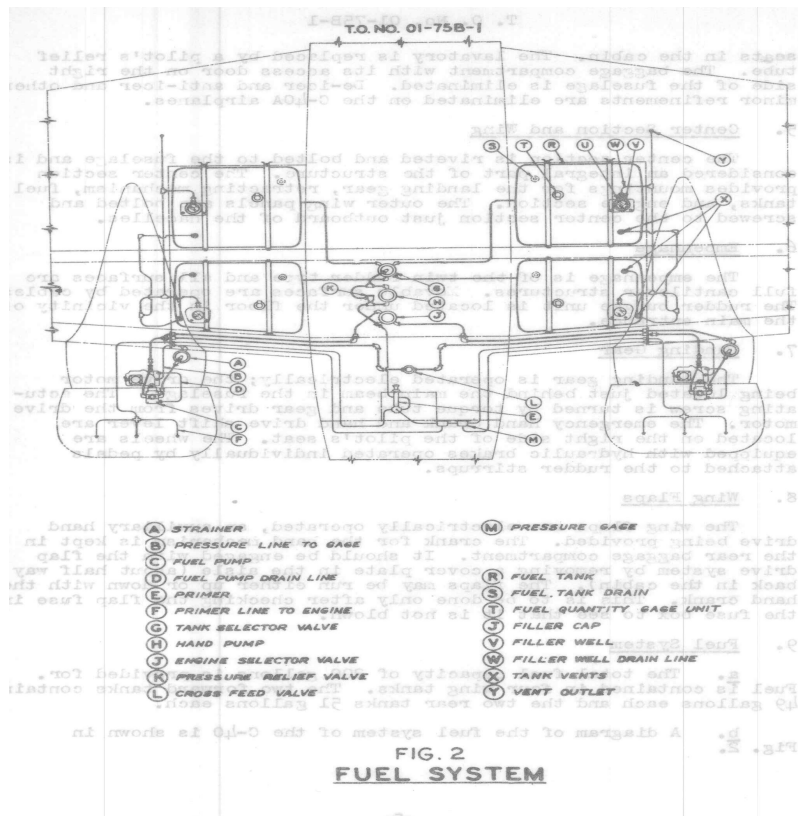


The Lockheed FM notes that the electric fuel gauges are designed to show fuel levels in flight but will not be accurate when the aircraft is on the ground in a three point stance (which is modeled in X-Plane also). Furthermore the FM specifies that the pilot should turn OFF the fuel gauges for most of the flight and only use them to check fuel levels periodically in flight and especially before landing. Select the tank with the most fuel for take-off and landing.

The next picture below shows the fuel level gauges (left and right) and the gauge switches on the bottom. The gauges are switched off in the picture.



Finally, the fuel pressure should be at least between 3-5 psi and the fuel warning light on the upper left of the front panel comes on if it drops below 1 psi.



The following shows the main panel warning lights and other components:



In the picture above, the aircraft is configured according to passing remarks from Glen Hancock, a Model 12A owner, and matches the performance he mentions (about 155 knots true airspeed at 8,000 feet, props at 1900 r.p.m., 27 inches manifold pressure, 18 g.p.h. fuel flow when mixture leaned out; he gives 24 g.p.h. and about 165 knots with richer mixture).

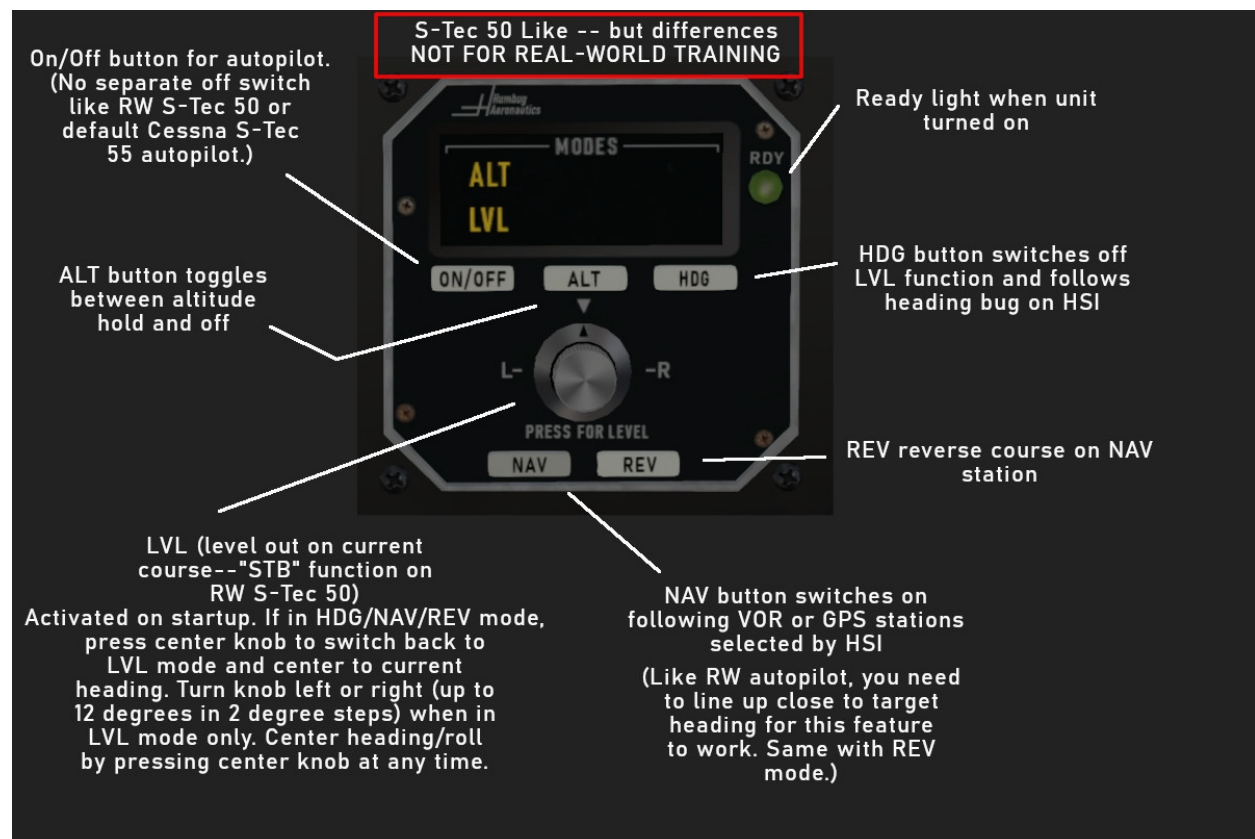
Starters

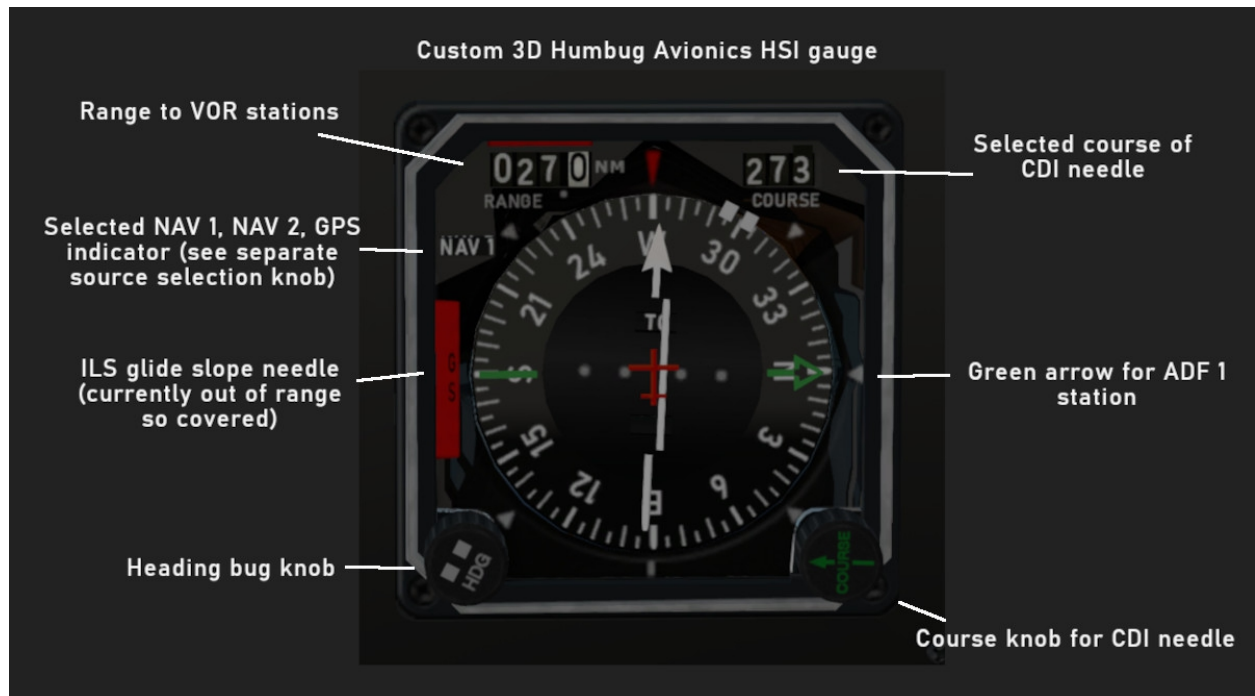
The engine starter buttons are hidden behind a protective plate on the front of the left table. Press the plate to open it. Each engine in the RW plane is started by pressing both the starter and boost buttons together. In the X-Plane model, press either button to start the engines.



Electronics

This aircraft is equipped with the Laminar Research default version of the Garmin 530 GPS, audio panel, and transponder. In addition it has two main custom instruments, a custom built S-Tec 50-like autopilot and an HSI gauge (with HSI source selector switch). Here are key features of these two gauges:





Checklists

PREPARATION FOR FLIGHT

- | | |
|----------------------------|--------------|
| 1. All doors . . . | Closed |
| 2. Fuel level gauges . . . | Check |
| 3. Compass . . . | Check |
| 4. Altimeter . . . | Set |
| 5. Vacuum pump valve . . . | Right Engine |
| 6. Tail wheel lock . . . | Off |

STARTING ENGINES

- | | |
|---|------------------------------------|
| 1. Brakes . . . | Locked |
| 2. Wing flaps . . . | Up |
| 3. Carburetor heat . . . | Cold |
| 4. Mixture . . . | Full Rich |
| 5. Propeller pitch . . . | Low Pitch |
| 6. Engine fuel valve . . . | Both Engines On |
| 7. Master switch . . . | On |
| 8. Ignition knob | In |
| 9. Ignition switches | Both |
| 10. Control lock lever . . . | Off |
| 11. Prime engine . . . | One to Five Shots |
| 12. Fuel pump switch . . . | On |
| 13. Open throttles . . . | One inch |
| 14. Open cover and push starter and boost buttons | |
| 15. Repeat operation for second engine | |
| 16. Idle engines 800 to 1000 r.p.m. | |
| 17. Set tail wheel lock lever | Off (to taxi to take off position) |

TAKE-OFF

- | | |
|---|-----------|
| 1. Mixture . . . | Full Rich |
| 2. Propellers pitch . . . | Low Pitch |
| 3. Adjust elevator and rudder tabs to proper position | |
| 4. Brakes . . . | Locked |
| 5. Tail wheel lock | On |
| 6. Rev up engines to 30" manifold pressure, checking r.p.m., ignition, cylinder head temperature (not less than 250 degrees), oil temperature (not less than 40 degrees Centigrade), oil pressure, fuel pressure (not less than 3 lbs.), and carburetor temperature (about 80 degrees F. to avoid icing). | |
| 7. Standard climb: 30" manifold pressure, 2000 r.p.m, 125 m.p.h. | |

8. Check oil temperatures and open oil cooler gateways as needed

LANDING

1. Check fuel levels and switch to tank with the most fuel
2. Tail wheel lock to OFF until ready to taxi
3. Lower landing gear between 140 and 120 m.p.h.
4. After gear fully extended change propeller to low pitch. It is imperative that propellers be in low pitch at all time the landing gear is in down position.
5. Recheck carburetor heat and mixture controls to see they are in the proper position
6. Lower wing flaps at 90 m.p.h.
7. Make approach at 80 to 85 m.p.h.
8. When the field is long, very nice landings can be made by coming in with the engines turning about 1300 r.p.m. and cutting the throttles at the instant of making the actual landing.
9. Do not use over 20 degrees of wing flap if there is an appreciable cross-wind.
10. Raise flaps after ship has stopped rolling and release tail wheel lock.
11. Park and set brakes and tail wheel lock.
12. Shut down engines using reverse of engine start checklist

Aircraft Specifications

Lockheed L-12a Notes gleaned from various sources

Crew 2 / 6 passengers

Length: 36' 4" (36.33 feet; 11.07 m)

Wingspan: 49' 6" (49.5 feet; 594 in.; 15.09 m)

Wing chord datum: 11' 2" (11.17 feet; 3.40 m) back from tip of nose

Dihedral: 6 degrees

Height: 9' 9" (9.75 feet; 2.97 m)

Empty weight: 5,765 lbs. (2,615 kg)

Gross weight: 8,400 lbs. (3,810 kg)

Max t/o weight: 8,650 lbs. (3,924 kg)

From the Lockheed L-12A Flight Manual

Power table for recommended power output

between 235 and 260 BHP per engine:

<u>ALTITUDE</u>	<u>RPM</u>	<u>MP</u>
MSL	1900	27.3"
2000 feet	1900	26.7"
4000 feet	1900	26.2"
6000 feet	1900	25.6"
8000 feet	1900	25.1"
10,000 feet	1900	24.5"
12,000 feet	1900	24.0"

Performance according to one pilot report:

<u>ALTITUDE</u>	<u>RPM</u>	<u>MP</u>	<u>SPEED</u>	<u>FUEL FLOW</u>
8,000 feet	1900	27"	155 knots (178 mph)	18 gph
8,000 feet	1900	27"	165 knots (190 mph)	24 gph

(The model is close on these numbers.)