# FDE 1.2 Upgrade for the
# Lockheed L-1049G/H Super Constellation

Content:



## 1. Introduction

This package is intended as an upgrade to the Lockheed L-1049G/H Super Constellation released by Manfred Jahn and Team 1049 in May 2009. It will offer a number of changes that will simulate the operation of the Super Constellation more closely than before.

Changes included in the FDE upgrade
- New manifold pressure model:
  - Ram air effect
  - Air intake heat
  - New supercharger effect
  - Revised supercharger lever settings
- New manifold pressure gauge faces with matching power limits for EA-3 series engines, FE gauge faces with blue arc showing 10% lean mixture limits.
- Working fuel crossfeed system
- New anti-ice fluid level gauge and system
- New hydraulic system:
  - 2 separate hydraulic circuits and crossover switch
  - Hydraulic pumps pressure warning lights
  - Emergency brake system
- New electric system:
  - Modified DC voltmeter
  - Modified AC voltmeter
  - New DC voltmeter selector switch
  - New load transfer switch
- Modified radio stack with second ADF receiver
- Modified RMI with second ADF needle
- Modified FE IAS gauge
- Vacuum gauge on main panel
- Elimination of fuel low level warning lights and OxyFlow gauge.
- Grey replacement textures for 2D panel and VC
- Three new wing views (Ctrl+Shift+2, 4 and 6)
- New fuel dump system with more realistic fuel dump rates (optional, available for FS9 only)
- Orientation of emergency shutoff levers corrected (as part of the optional fuel dump system)
- Revised automatic engine start for more realistic start sequence (optional, available for FS9 only)

Most of the changes are similar to the FDE upgrade for Lockheed L-749 by our team. However, compared to previous versions, there is a considerable difference how Flight Simulator handles power settings internally. The throttles will need much closer attention. Please follow the detailed notes below.

In the original uploads, the L-1049G simulates engines of the DA-3 series with 3,250 HP maximum power each, while the L-1049H has EA-3 engines of 3,400 HP. The L-1049H is configured for the later H/06 variant, allowing higher operating weights than the original version, which was identical to the L-1049G in that respect. If you wish to simulate different types of aircraft, you can limit weight and power settings according to this table:

| | MTOW | MLW | MZFW | TOGA | METO |
|---|---|---|---|---|---|
| L-1049C/D/E | 133,000 | 110,000 | 103,500 | 3250HP/56.5"/2900 RPM | 2600HP/47.5"/ 2600 RPM |
| L-1049G[1] | 137,500 | 113,500 | 103,500 | 3250HP/56.5"/2900 RPM | 2700HP/49"/ 2600 RPM |
| L-1049H[2] | 142,100 | 114,500 | 104,200 | 3400HP/58.5"/2900 RPM | 2860HP/51"/ 2650 RPM |

Note:
[1]: with DA-3 engines, original L-1049H with DA-3 identical
[2]: L-1049H/06 with EA-3 engines; MLW 5% overweight (120,225 lbs.) permissible in pure cargo configuration, max. descent speed limited to -420 fpm when overweight

For further details about the different Super Constellation versions, please refer to the historical note below.

To install, please follow the instructions in the Readme file closely, particularly if you have installed add-on repaints or changed anything else about the default folder structure. For any further questions regarding this upgrade, support is available at Tom Gibson's California Classic Propliner Forum:

http://calclassic.proboards.com/index.cgi?board=general

But most of all – enjoy flying the Lockheed Super Constellation!

## 2. Historical Note: The Lockheed Super Constellation

The basic Lockheed Constellation had been successful in commercial service since 1946, but by the late 1940’s, it experienced increasing competition by the Boeing B-377 Stratocruiser and the Douglas DC-6B. The Stratocruiser had very complex engines and required a lot of maintenance which did not endear it with the airlines. However, the DC-6B had a MTOW to match the L-749A and could seat more passengers on shorter flights, along with very favourable operating costs.

Lockheed decided to offer a stretched version of the Constellation. To speed up development, it acquired the original prototype from Howard Hughes. An 18’4” plug was inserted forward of the wing forward and another one of 10’8” aft. Eventual production version would also have a revised cockpit window layout with 7 higher windows instead of the previous 9 as well as a changed cockpit roof, rectangular cabin windows, taller vertical stabilizers and new engines of the CA-1 series of 2700 HP at take-off power, allowing a MTOW was 120,000 lbs. A fuel cell in the center wing section was added as well. However, the wing remained basically unchanged without any substantial strengthening of the structure. This stretched version received the name “Super Constellation”.
Basically, the aircraft was optimized to carry many passengers on short to medium length flights. This original Lockheed L-1049 (without any designation letters) found only 2 customers; between November 1951 and October 1952, 10 airframes were delivered to TWA and 14 to EAL, the latter did not have the center fuel cells installed to save weight. It was relatively underpowered, and an engine upgrade to 2,800 HP CB-1 series engines did not help much.

When the Turbo Compound variant of the R-3350 became available for the military, it was first used by Lockheed for the P2V-4 Neptune. The Turbo Compound ducts exhaust gas from the cylinders through 3 turbines connected to the crankshaft, allowing a considerable increase of power, initially to 3,250 HP on take-off, which in turn allowed an increase of operating weights. Along with the more powerful engines, Lockheed upgraded the wing structure. Instead of riveting stiffeners to the wing panels, the new wing panels were milled out of solid slabs of aluminium with the stiffeners already in place. About 90% of the slab was removed in this process, but it allowed a much stronger structure for a comparable weight. However, the shape of the wing remained identical.
The first version designed was the L-1049A airborne early warning (AEW) version, nicknamed the ‘Warning Star’. A similar concept had previously been evaluated by Navy based on the 749A fuselage. The longer fuselage of the Super Constellation would allow more radar operators, and additional wing tip tanks increased patrol time. The production version had large AN/APS-20 radar with a range of up to 200 nm in a large random below the fuselage and an additional AN/APS-45 heightfinder radar on top of the fuselage. An APS-42 weather radar was fitted in the nose. Unlike the previous L-1049, it had round windows. The major production version was the WV-2 for Navy with 142 aircraft delivered, plus 8 more WV-3 weather reconnaissance aircraft with additional meteorological equipment. 72 more were delivered as RC-121D to the USAF; these had an additional 1000 gall fuel tank in rear cargo bay. Production of the L1049A ran from October 1593 to October 1958.
The L-1049B was a cargo variant with strengthened floor and two large cargo doors on the port side. Like the L-1049A, it had round windows and weather ra-

dar, but early versions had no integral stiffening of outer wing panels and therefore could not carry tip tanks. MTOW was 133,000 lbs. and 50 were delivered to the USN and one was converted to a presidential transport. The 1049B were actually delivered before the 1049A, because they lacked the sophisticated electronic gear of the Warning Stars. 10 more 1049A were designated as Air Force transports but the order was changed to Warning Stars with the designation RC-121C. Externally very similar to the WV-2, they had simpler scopes and lacked wing tip tanks. All further Air Force Warning Stars were 1049A/RC-121D and the RC-121C was retired from AEW duty and converted to transport/trainer versions once 1049As became available in sufficient numbers.

The Turbo Compound Engine became available for civil use in 1953, 3 months before the competing DC-7. MTOW was increased to 133,000 lbs, allowing true long-range operations with a much higher payload than the basic Constellation over long distances, but still transatlantic flights usually required a refuelling stop. The first version was the 1049C, followed by the 1049D dedicated freighter version, while the 1049E offered some minor improvements over the 1049C, but was otherwise essentially identical. 49 Cs, 4 Ds and 25 Es were delivered, most of them to non-US customers. The L-1049F was a transport version for the USAF, which acquired 33 airframes. Unlike the Navy's L-1049A/R7V-1, it had square windows. Eventually 322 of a total of 579 Super Constellations built were delivered to US military, while Douglas did not sell any military DC-7.

At the same time, the L-1249A was developed for turboprop installation. 4 aircraft were built, which offered a substantial increase in operating weight but not in cruise speed. 2 of them underwent a short evaluation by Navy of around 100 hrs each, while the USAF used another pair of them for 2,000 hours each. The L-1049E was in fact designed with conversion to turboprop engines in mind; these would have been designated 1249B. Lockheed would eventually offer a completely new design of a turbo-prop, but 1249 would give considerable experience.

In 1955, with the L1049G another significant upgrade was introduced, nicknamed the "Super G" by TWA. It had new engines of the DA-3 series with the same take-off power of 3'250 HP, but an increased max. continuous power (by 100 to 2'700 hp) allow higher operating weights. Optional tip tanks and weather radar were available. Externally, there were only minor changes, particularly a slight revision of the engine cowl with ram air intake and a wider spinner afterbody. 104 were built and earlier Super Connies were frequently upgraded to higher standards. The L-1049G was mainly competing against the Douglas DC-7B. While usually neither plane could make non-stop westbound transatlantic crossings, the Super Constellation could carry more payload over long distances.

Based on the "Super G", the L-1049H was a quick-change version for both cargo and passenger configuration, and 53 were built. Beginning with this type, more powerful EA-3 series engines of 3,400 hp take-off power became available, even though they initially suffered from reliability problems. These were frequently fitted to the 1049H at some time in their career, some 46 planes in total, and were also made available for the "Super G", even though only 13 were so equipped.

The introduction of DC-7C again put strong pressure to upgrade Constellation to give it more range. This eventually led to a complete redesign of the wing, the resulting aircraft being named the L-649A Starliner. But production of the 1049G/H and the RC-121C/WV-2 Warning Stars production continued, parallel to Starliner production. In fact, a WV-2, serial number 5522, was the last plane of the Constellation series. Production ended in 1958, when the jets arrived. Lockheed tried more evolutionary approach than Boeing and Douglas with the turboprop driven Electra but was not successful on the commercial market.

Weather radar became mandatory for airliners in North America from the early '60s, and many aircraft were retrofitted. With the arrival of the jets, some aircraft were fitted with cargo doors. The Super Constellation continued in service with major carriers into the second half of the 1960s, but was being rapidly replaced by jets then.

The Warning Stars were initially employed for "barrier" patrol as an extension of the land-based early warning radar systems until 1965. By then, the main threat had shifted from bombers to intercontinental missiles and the barrier became redundant. Most AEW units were disbanded and a number of aircraft subsequently modified for testing and research purposes. However, airspace surveillance became important again occasionally during times of international crisis like the Cuban Missile Crisis or the Quemoy incident, while Navy planes continued weather patrol. The Warning Stars then saw extensive use in Vietnam, where gradually a shift from Early Warning to Control and Coordination took place. However, in spite of the continuous upgrades of the electronic gear, the radar system suffered from limitations when used over land, but patrols over the North Atlantic from Iceland-based planes continued until 1978, while weather patrol phased out by 1976. Transport versions were transferred to Air National Guard units during the early 60s, and were eventually disposed of by the late 1970s as well. The last Super Constellation in US military service was retired in 1982.

In 1968, 40 civil and 190 military Super Constellations were still flying, but by 1974, only 56 were left. The last operators were based in the Dominican Republic, but a ban on prop-driven freighters from that country in 1993 meant the end of commercial use of the Super Constellation. Today, 31 Super Constellations remain, 3 of them airworthy, on each in the United States, Australia and Switzerland.

Sources:

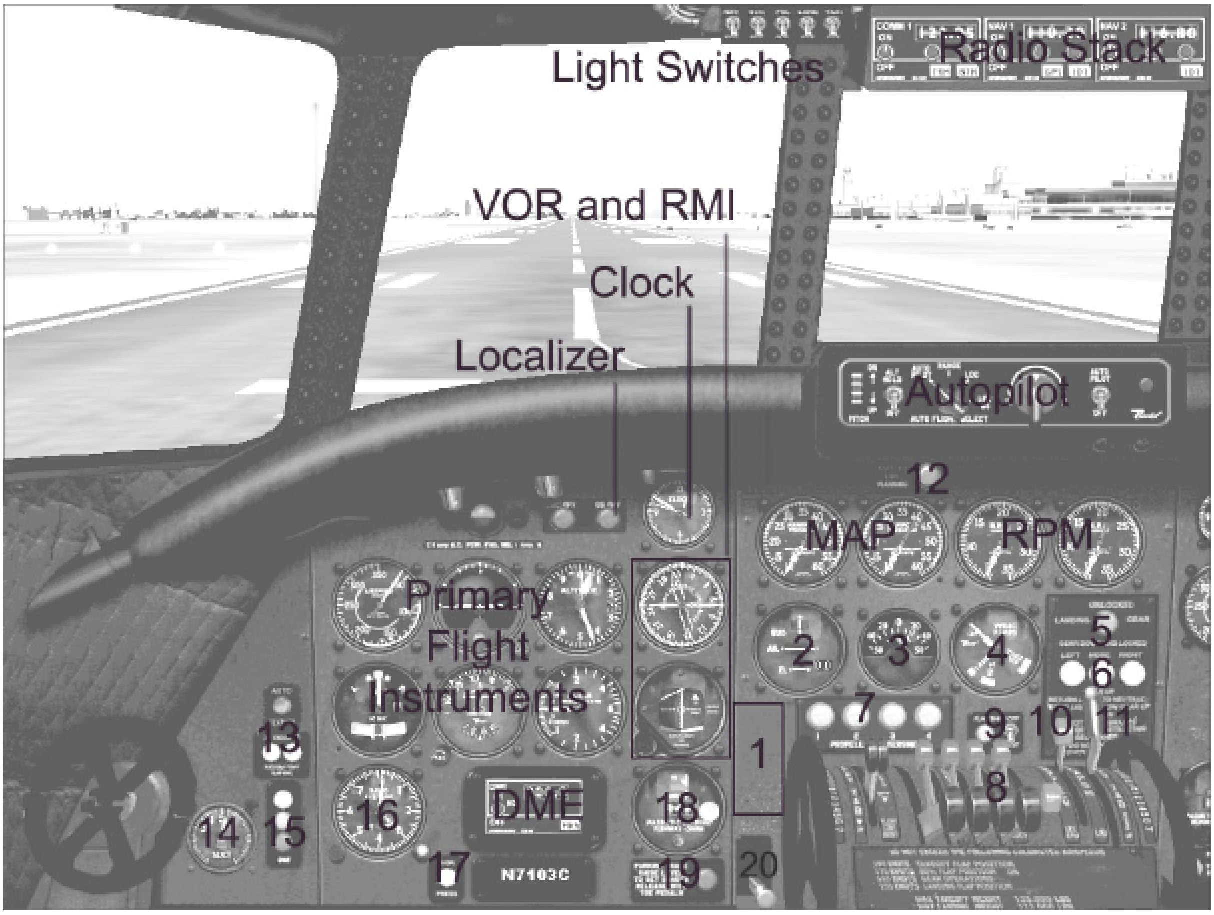
Armistead, E. L.: AWACS and Hawkeyes. MBI 2002

Marson, P. J.: The Lockheed Constellation. Air Britain, 2007

Wilson, S.: Lockheed Constellation. Aviation Notebook Series. Notebook Publications, 2001

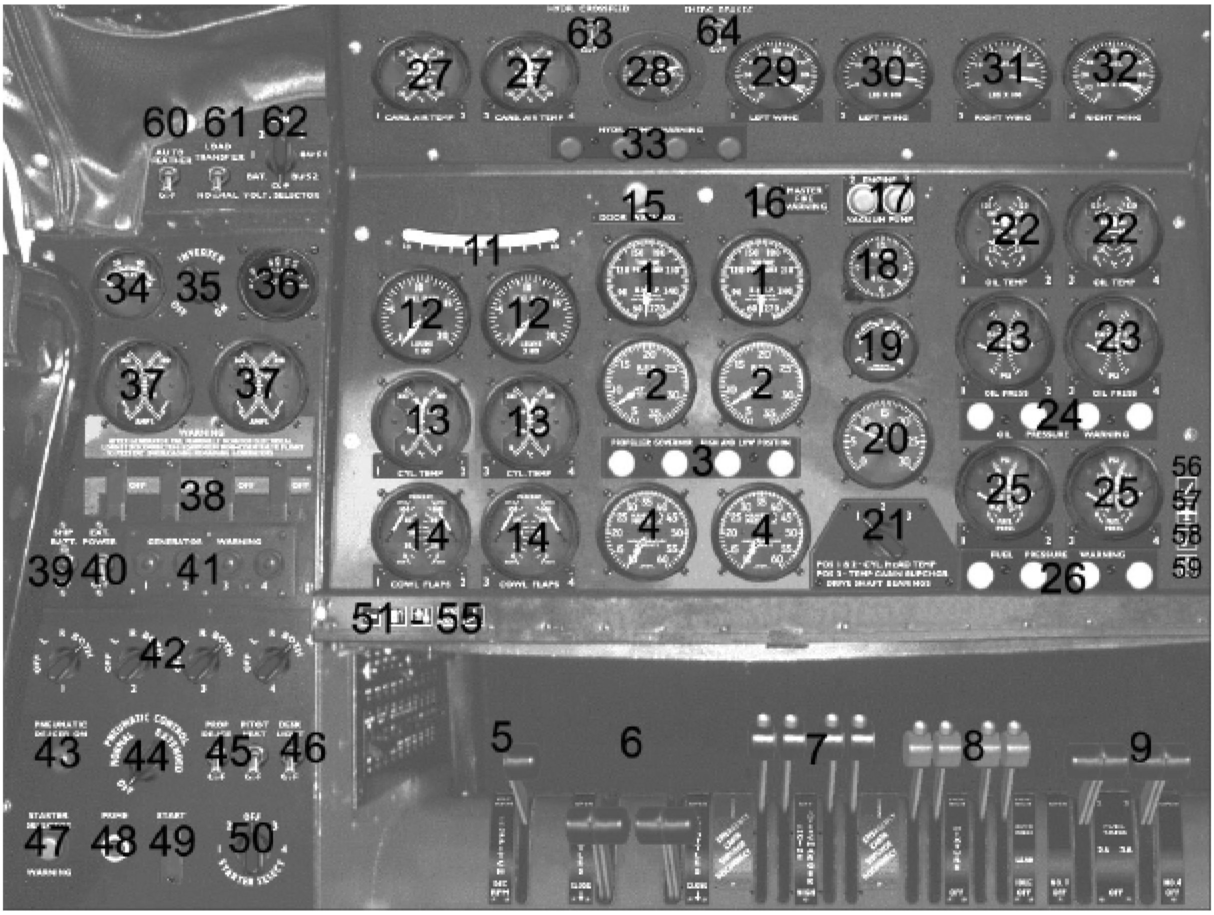
## 3. Panel Layout

Main Panel:




1. SimIcon block
2. Trim indicator
3. OAT gauge (outside air temperature)
4. Flap position indicator
5. Landing gear transit light
6. Gear position indicator
7. Reverser lights
8. Throttles and reverser levers
9. Flap Shut-Off Warning Light and Test Switch
10. Master RPM lever
11. Flap lever
12. Fire Warning Light
13. Vacuum Warning Light
14. Vacuum system gauge
15. OMI Marker Lights
16. Radio Altimeter
17. Hydraulics Warning Light
18. VOR1 radial dial
19. Parking brake light and switch
20. Landing Gear Lever

Flight Engineer's Panel:




1. BMEP
2. RPM
3. High/low prop position warning lights
4. MAP
5. Master RPM Lever
6. Throttles
7. Supercharger switches
8. Mixture levers
9. Tank selectors
11. Deck angle indicator
12. Fuel flow
13. CHT
14. Cowl flap position
15. Door warning light / switch
16. Master Fire warning
17. Vacuum pump warning
18. Clock
19. Synchroscope
20. Sync master engine RPM
21. CHT temp. selector switch
22. Oil temperature
23. Oil pressure
24. Oil pressure warning lights
25. Fuel pressure
26. Fuel pressure warning lights
27. Carburettor air temperature
28. Hydraulic pressure
29. Tank 1 fuel gauge
30. Tank 2 fuel gauge
31. Tank 3 fuel gauge
32. Tank 4 fuel gauge
33. Hydraulic pressure warning lights
34. Main bus voltmeter
35. Inverter switch
36. Avionics bus voltmeter
37. Amperemeter
38. Generator switches (covered)
39. Battery switch
40. Ground power switch
41. Generator warning lights
42. Magneto switches
43. Wing de-icer warning light
44. Wing de-icing control
45. Prop de-ice and pitot heat
46. Panel light switch
47. Engine Start Ignition warning
48. Prime button
49. Start switch (covered)
50. Engine start selector
51. Back to Main Panel
52. Fuel System
53. Fuel dump and Emergency Cut-off
54. Fuel gauges
55. Prop Control
56. Checklist / Status Gauge
57. Toggle Views
58. Engine Auto Start
59. Set Mixture
60. Auto Feather Switch
61. Electric Load Transfer
62. Voltage Selector
63. Hydraulic Crossfeed
64. Emergency Brake

## 4. Description and operation of new systems:

1. Power Management:
The default FS flight model simulates turbocharged engines with wastegate overpressure control. However, the real Super Constellation's R-3350 engines were equipped with superchargers geared to the crankshaft and had no over-pressure control. While still not perfect, throttle operation and manifold pressure (MAP) are now modelled closer to real life. However, it will require more attention than in the release version.

Available MAP depends on ambient pressure (and therefore altitude), but also on engine RPM. At high RPM, the supercharger will turn faster as well and allow higher MAP than at lower RPM. Since it is not modelled in FS, a blue pointer on left of the MAP gauges will indicate the maximum MAP available at current RPM and altitude. For maximum realism, do not exceed this value. The MAP value on the Status gauge will turn blue if available MAP is exceeded.

During climb and descent, MAP will change as ambient pressure changes. You will need to periodically adjust the throttles to maintain desired MAP. Below about 5.000 ft altitude, superchargers are able to exceed maximum allowable MAP. Like in real life, you have to limit MAP yourself to 56.5" for the DA-3 engines of the L-1049G and 58.5" for the 1049H's EA-3 engines as indicated by the red line on the MAP gauges.

**Do not overboost the engines** by just pushing the throttles full forward on take-off. This will result in very unrealistic performance and might cause multiple engine failures.

When shifting supercharger speed during climb, make sure you retard throttle to 20" before shifting blowers to avoid overboost. You will need to adjust throttles periodically during climb and descent as well. The supercharger levers will now be in the low speed position by default. The outboard levers can be moved upward to simulate disconnecting the cabin superchargers. However, cabin supercharging is not simulated.

Ram air effect is simulated now as well, giving about additional 2.5" MAP during climb and cruise. Turning on air intake heat in icing conditions will increase air intake temperature by about 15°C and decrease available power by about 5-6% due to warmer air and increased friction in the hot-air intake duct.

On the FE panel, a blue arc on MAP and RPM gauges indicates the permissible range for 10% lean mixture.

All fuel flow rates are given in lbs/hr/engine, as indicated by the individual fuel flow gauges on the FE panel. The Composite Cruise Control Chart gives the same values.

2. RADIO STACK
The radio stack now also features a second ADF. Switching on the RMI button on ADF2 will slave the twin RMI needle to the ADF2 receiver instead of VOR 2.

3. PROPELLER ANTI-ICE SYSTEM:
The propeller anti-ice action sprays the propeller blades with an anti-ice fluid. The system is activated by a switch on the FE panel, and an anti-ice fluid level gauge is located on the fuel gauge panel. Two 25 gall tanks, one on each side, hold enough fluid for a total of about 1 hour of operation. The left tank supplies propellers 1 & 2 and the right tank propellers 3 & 4. When the anti-ice fluid tanks are empty, the system disconnects itself, and propeller anti-ice action is no more available.

Avoid continuous operation of propeller anti-ice system if not strictly required, because of the limited amount of fluid available.

## 4. HYDRAULIC SYSTEM:

Four hydraulic pumps, one driven by each engine, provide hydraulic power for the units operated by hydraulic pressure. There are two hydraulic circuits. The primary system is connected to hydraulic pumps of engines 1 and 2, and the secondary system is connected to pumps of engines 3 and 4. A hydraulic pressure gauge shows the pressure of both systems and four low hydraulic pressure warning lights allow checking the correct operation of each pump.

The primary system powers flight control surfaces, while the secondary system powers flaps, gears and brakes.

If a hydraulic pump fails, a check valve automatically isolates the failed pump and the remaining pump of the same side supplies the pressure to the corresponding system. An electrically operated crossover valve can connect both circuits, if both pumps fail on the same side, feeding both systems with the remaining operating pumps. The switch for this valve is located on the upper part of the FE panel, next to the hydraulic pressure gauge. A single engine supplies enough pressure to supply a hydraulic circuit.

Unlike in real life, FS will not simulate the loss of control surface boost. But with the starboard engines shut down, you will not be able to extend flaps or gear unless you operate the crossover switch. Neither will the brakes operate without pressure in the secondary circuit.

The ‘Emergency Brake’ allows the use of brakes without a pressurized hydraulic system, using pressure in the hydraulic accumulators. It has enough stored pressure to allow a few braking actions by either the normal or the parking brake. The switch for the Emergency Brake is located on the upper part of the FE panel, next to the hydraulic pressure gauge and opposite to the crossover switch. In the event of a landing with all hydraulic pressure lost, you must select the emergency brakes circuit before landing to have enough pressure from hydraulic accumulators to stop the plane. The Emergency Brake circuit will be engaged before engine shutdown to park the aircraft and released again once the engines have been started and hydraulic pressure is up.

## 5. ELECTRICAL SYSTEM:

The electric system is supplied by four DC generators, a 24 volts battery system and an inverter for AC instruments. An Auxiliary Power Unit (APU) is not simulated here. A connection to an external power supply is available when on ground, with parking brakes set.

The master switch connects the batteries to the circuits, and the external source switch connects the external power source.

There are two electrical buses, BUS 1 and BUS 2. When master battery switch is on and load transfer switch is in NORMAL position (see tool tips), bus 1 is fed by generator 1, generator 2 and battery, and BUS 2 is fed by generator 3, generator 4 and battery. If the load transfer switch is in TRANSFER position, batteries and all generators feed both buses. Use this position if both generators of one side fail.

When external power is connected, both buses are supplied and batteries are recharged, if battery switch is on.

Each generator can be connected or disconnected by the corresponding switch. You can check the amperage supplied by each generator by the corresponding ammeter. Do not overload the remaining generators, if one or several generators fail.

DC voltage from different DC power sources and buses can be checked by the DC voltmeter. There is a DC voltmeter selector switch to select the corresponding sources, with the following positions: OFF, BATTERY, GENERATOR 1, GENERATOR 2, GENERATOR 3, GENERATOR 4, BUS 1 and BUS 2.

The inverter is transforming DC current in AC current, and is supplied by batteries, external power source or DC generators. There is a switch to connect or disconnect it. You can check AC voltage by the corresponding voltmeter.

## 6. FUEL DUMP SYSTEM

NOTE 1: This alternative fuel dump system does not work in FSX. If you use the L-1049G in FS9 and wish to use the modified fuel dump system, please activate the system by renaming the corresponding panel.cfg as described in the installation section of the readme file.

Moving either of the two red handles on the 2D subpanel downwards to the first stop (the red line) has no effect on the fuel dump system. In real life, this position would extend the dump chutes at the wing roots. Moving the left handle further down starts the dumping process from portside tanks 2A, 1, 2 and, if installed, tip tank 2B, while the right handle will dump fuel from the starboard side. Each handle will also start the visible fuel flow effect in spot view. While fuel from each side can be dumped separately, the fuel flow effect will show a trail from all 4 or 6 dump ports due to the way the effect is handled by FS. If you can see the visible trail but the tank gauges don't show any dump then try cycling through the views.

Some minimum fuel is conserved by standpipes. Avoid asymmetric fuel loads of more than a few hundred pounds. While it won’t cause structural damage, it will still cause considerable yaw.

Fuel dump rates are:

| Tank | Capacity (gallons) | Dump rate (gallons per minute) | Minimum fuel (gallons) | Empties in (minutes) |
|---|---|---|---|---|
| 2B | 609 | 63 | 24 | 9.3 |
| 2A | 565 | 46 | 149 | 9 |
| 1 | 1555 | 155 | 145 | 9.1 |
| 2 | 790 | 72 | 122 | 9.3 |
| 5 | 730 | no dumpable fuel | | |
| 3 | 790 | 72 | 122 | 9.3 |
| 4 | 1555 | 155 | 145 | 9.1 |
| 3A | 565 | 46 | 149 | 9 |
| 3B | 609 | 63 | 24 | 9.3 |

Dumping can be stopped and restarted as required. The aircraft's weight will reduce from MTOW to MLW in about 6 minutes with tip-tanks installed, and all tanks will go from full to empty except for a minimum protected by standpipes in about 9 minutes.

To stop the fuel dump, the real-life FE would first move the dump levers to the “closed” position and then return it to the intermediate position for 15 or 30 seconds, extending the dump chutes again and allowing the pipes to drain before finally moving the levers to the closed position. In FS, you do not have to worry about that and moving the levers from open to either the intermediate or closed position will stop the fuel dump. You may still simulate the real-life procedure.

The fuel dump effect will still be visible in red line position for about 5 seconds as long as chute pipes are drained.

The orientation of the emergency shutoff levers has now been corrected, they normally point forward (down) and are activated by being pulled rearward (up), reflecting the real-life operation.

NOTE 2: This gauge does not change the function of the VC overhead fuel dump levers. Operating the red VC levers will still immediately remove all fuel from tanks 1 and 4 (by simulating the release of an external drop tank). Unless crossfeed is activated, both outboard engines will shut down because of fuel deprivation. Therefore, the recommended procedure is to use the 2D panel (Window04).

7. Fuel Cross-Feed System

The Fuel Cross-Feed System allows feeding fuel from any tank to any engine. However, the version included in the original release version suffered from a bug that limited cross-feed under some conditions.

The version included here has this bug fixed. Each engine will draw fuel from the nearest tank available if the corresponding main tank is empty and the cross-feed of the engine is open.

8. Revised Engine Auto Start

NOTE: This option works in FS9 only, FSX will crash. If you wish to install this option, please follow the instructions in the readme file.

Pressing either the Ctrl+E keys or the Engine Auto Start key icon on the right side of the FE panel allows the realistic slow "blade count" before ignition which was done to ensure proper oil circulation in radial engines and also the correct automatic start sequence of 3-4-2-1 instead of the default 1-2-3-4. This sequence was adopted for a number of reasons, one of which was the normal practice for ground personnel to stand by with a fire bottle trolley during engine starts. By starting the inboard engines first, fires could be handled without danger from the outboard props. Starting the starboard engines first also allowed more time to finish passenger loading and to move the steps away.

This system is recommended to those who want to avoid going through a complete "cold start" (it remains an option) or who enjoy watching the start from the outside or at least not from the FE panel. It looks best in spot view or from the VC cockpit or passenger wing views. Although some of the control settings used for a realistic manual start can be skipped, you must ensure that you have:

- fuel
- electric power available, either the battery switch on and if necessary the external power switch on.
- throttles open, best to set at 6-8% for all altitudes up to say Denver (5,400').

Above that you will need a progressively more throttle but above 10,000' it is best to use a normal manual start from the FE panel and a leaner mixture. The reason for this is that Connie models are not designed to work with the FS "use automixture" option and just like the real aircraft the engines will not start on rich mixture.

**Credits:**
Original release version by Manfred Jahn and Team 1049
FDE changes by Luis Pallas
Gauge and panel modifications by Volker Böhme, Luis Pallas, Bill Tyne and Stefan Werner
Supercharger and Fuel Dump code by Doug Dawson, used with kind permission
Alternative engine start system by Doug Dawson and Tom Gibson, used with kind permission

## Power limits: Wright Turbo Compound 972TC18DA-3

| **Limit Power settings** | Low Blower | | High Blower | |
|---|---|---|---|---|
| **Take Off (max 5 min.)** | S.L | 5,500 ft | | |
| BHP | 3250 | 3250 | N.A. | |
| RPM | 2900 | 2900 | | |
| BMEP | 265 | 265 | | |
| Max MAP (inch) | 56,5 | 53,5 | | |
| Max CHT (ºC) | 260 | 260 | | |
| **Max. Continuous (METO)** | S.L | 5,800 ft | 10,050 ft | 16,400 ft |
| BHP | 2700 | 2750 | 2400 | 2450 |
| RPM | 2600 | 2600 | 2600 | 2600 |
| BMEP | 246 | 250 | 218 | 223 |
| Max MAP (inch) | 49 | 47 | 48,5 | 47 |
| Max CHT (ºC) | 245 | 245 | 245 | 245 |

Manual lean max RPM 2400
Manual lean max BMEP: 180 (Low Blower) 170 (High Blower)
Spark advance max RPM: 2400 (Low and High Blower, 10% lean only)
Cruise min. RPM: 1600 (Low Blower) 1800 (High Blower)

| Normal Operating Limits | BHP | RPM | BMEP | Max MAP | FF | Mixture | Max CHT |
|---|---|---|---|---|---|---|---|
| Heavy Max. Climb: LB | 2080 | 2500 | 196 | 41 | | AR | 230 |
| HB | 2080 | 2500 | 196 | 44 | | AR | 230 |
| Normal Max. Climb: LB | 1910 | 2500 | 180 | 39 | 1120 | AR | 230 |
| HB | 1910 | 2500 | 180 | 40 | 1120 | AR | 230 |
| Max. Cruise: LB | 1830 | 2400 | 180 | 40 | 750 | 10% lean | 215 |
| HB | 1730 | 2400 | 170* | 40 | 720 | 10% lean | 215 |
| Descent: Minimum BMEP | 100 | | | | | | |

LB: Low Blower HB: High Blower FF in pph/eng Max CHT in °C
(*) 2400 rpm only.
For 2200>RPM<2400, max BMEP 165.
For RPM<2200, max BMEP 160.
No HB cruise below 14,000 ft

## Power limits: Wright Turbo Compound 988TC18EA-3

| **Limit Power settings** | Low Blower | | High Blower | |
|---|---|---|---|---|
| **Take Off (max 5 min.)** | S.L | 4,000 ft | | |
| BHP | 3400 | 3400 | N.A. | |
| RPM | 2900 | 2900 | | |
| BMEP | 277 | 277 | | |
| Max MAP (inch) | 58,5 | 56 | | |
| Max. CHT (ºC) | 260 | 260 | | |
| **Max. Continuous (METO)** | S.L | 4,800 ft | 10,000 ft | 16,400 ft |
| BHP | 2860 | 2920 | 2410 | 2450 |
| RPM | 2650 | 2650 | 2600 | 2600 |
| BMEP | 255 | 259 | 218 | 222 |
| Max MAP (inch) | 51 | 49,5 | 48,5 | 47 |
| Max. CHT (ºC) | 245 | 245 | 245 | 245 |

Manual lean max RPM:2500
Manual lean max BMEP: 180 (Low Blower) 170 (High Blower)
Spark advance max RPM (10% lean only): 2500 (Low Blower) 2400 (High Blower)
Cruise min. RPM: 1600 (Low Blower) 1800 (High Blower)

| **Normal Operating Limits** | **BHP** | **RPM** | **BMEP** | **Max MAP** | **FF** | **Mixture** | **Max CHT** |
|---|---|---|---|---|---|---|---|
| Heavy Max. Climb: LB | 2080 | 2500 | 196 | 41 | | AR | 230 |
| HB | 2080 | 2500 | 196 | 44 | | AR | 230 |
| Normal Max. Climb: LB | 1910 | 2500 | 180 | 39 | 1120 | AR | 230 |
| HB | 1910 | 2500 | 180 | 40 | 1120 | AR | 230 |
| Max. Cruise: LB | 1900 | 2500 | 180 | 41 | 780 | 10% lean | 215 |
| HB | 1730 | 2400 | 170(*) | 40 | 720 | 10% lean | 215 |
| Descent: Minimum BMEP | 100 | | | | | | |

LB: Low Blower HB: High Blower FF in pph/eng Max CHT in °C
(*) 2400 rpm only.
For 2200>RPM<2400, max BMEP 165.
For RPM<2200, max BMEP 160.
No HB cruise below 14,000 ft

Long Range Cruise settings: L-1049G/H with DA-3 or EA-3 engines

| **Weight 130,000 lb** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Altitude (ft)** | **5.000** | **10.000** | **12.000** | **14.000** | **16.000** | **18.000** | **20.000** | **22.000** |
| BHP | 1570 | 1696 | 1778 | 1755 | 1813 | 1874 | 1938 | 2005 |
| RPM | 2010 | 2240 | 2445 | 2390 | 2420 | 2455 | 2500 | 2600 |
| BMEP | 184 | 179 | 172 | 173 | 177 | 180 | 183 | 182 |
| IAS | 197 | 198 | 198 | 194 | 195 | 195 | 196 | 196 |
| TAS | 212 | 230 | 240 | 235 | 247 | 256 | 264 | 274 |
| FF | 630 | 685 | 730 | 745 | 770 | 793 | 1250 | 1320 |
| Blower | LB | LB | LB | HB | HB | HB | HB | HB |
| Mixture | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | AR | AR |
| Spark | Advance | Advance | Advance | Advance | Retard | Retard | Retard | Retard |
| SFC | 0,401 | 0,404 | 0,411 | 0,425 | 0,425 | 0,423 | 0,645 | 0,658 |
| **Weight 116,000 lb** | | | | | | | | |
| **Altitude (ft)** | **5.000** | **10.000** | **12.000** | **14.000** | **16.000** | **18.000** | **20.000** | **22.000** |
| BHP | 1344 | 1453 | 1499 | 1548 | 1599 | 1596 | 1651 | 1708 |
| RPM | 1815 | 2070 | 2190 | 2315 | 2450 | 2275 | 2330 | 2500 |
| BMEP | 175 | 166 | 162 | 158 | 154 | 166 | 168 | 161 |
| IAS | 190 | 191 | 191 | 192 | 192 | 187 | 187 | 188 |
| TAS | 204 | 222 | 228 | 236 | 244 | 246 | 254 | 262 |
| FF | 540 | 590 | 615 | 640 | 665 | 655 | 675 | 1095 |
| Blower | LB | LB | LB | LB | LB | HB | HB | HB |
| Mixture | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | AR |
| Spark | Advance | Advance | Advance | Advance | Advance | Advance | Advance | Retard |
| SFC | 0,402 | 0,406 | 0,410 | 0,413 | 0,416 | 0,410 | 0,409 | 0,641 |
| **Weight 101,000 lb** | | | | | | | | |
| **Altitude (ft)** | **5.000** | **10.000** | **12.000** | **14.000** | **16.000** | **18.000** | **20.000** | **22.000** |
| BHP | 1142 | 1234 | 1273 | 1315 | 1358 | 1404 | 1423 | 1473 |
| RPM | 1680 | 1910 | 2015 | 2125 | 2250 | 2390 | 2185 | 2295 |
| BMEP | 160 | 152 | 149 | 146 | 142 | 139 | 154 | 151 |
| IAS | 182 | 183 | 183 | 183 | 184 | 184 | 182 | 183 |
| TAS | 196 | 212 | 218 | 226 | 233 | 241 | 245 | 255 |
| FF | 470 | 510 | 530 | 550 | 575 | 600 | 585 | 610 |
| Blower | LB | LB | LB | LB | LB | LB | HB | HB |
| Mixture | 10% l | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. |
| Spark | Advance | Advance | Advance | Advance | Advance | Advance | Advance | Advance |
| SFC | 0,412 | 0,413 | 0,416 | 0,418 | 0,423 | 0,427 | 0,411 | 0,414 |
| **Weight 89,000lb** | | | | | | | | |
| **Altitude (ft)** | **5.000** | **10.000** | **12.000** | **14.000** | **16.000** | **18.000** | **20.000** | **22.000** |
| BHP | 1000 | 1018 | 1116 | 1152 | 1191 | 1231 | 1321 | 1366 |
| RPM | 1600 | 1785 | 1885 | 1990 | 2105 | 2225 | 2120 | 2215 |
| BMEP | 148 | 143 | 140 | 137 | 133 | 130 | 147 | 146 |
| IAS | 177 | 178 | 178 | 178 | 178 | 179 | 182 | 182 |
| TAS | 190 | 206 | 213 | 220 | 227 | 234 | 246 | 255 |
| FF | 420 | 455 | 470 | 490 | 515 | 535 | 550 | 570 |
| Blower | LB | LB | LB | LB | LB | LB | HB | HB |
| Mixture | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. | 10% l. |
| Spark | Advance | Advance | Advance | Advance | Advance | Advance | Advance | Advance |
| SFC | 0,420 | 0,447 | 0,421 | 0,425 | 0,432 | 0,435 | 0,416 | 0,417 |

With tip tanks installed, reduce IAS 2 kts
SFC: Specific fuel consumption
10%l.: Mixture leaned for 10% BMEP drop