lotus simulations

L-39 Albatros

operations manual

v1.3

[inside front cover]

Thank you for purchasing the Lotus Simulation L-39 Albatros. A great deal of time, love, and far too many sleepless nights went into the creation of this aircraft and I hope it brings you many hours of enjoyment in the virtual skies of Flight Simulator X.

This manual contains detailed explanations of all of the L-39's controls, systems, limitations, and flight characteristics. Reading it will make operation of the aircraft a great deal more satisfying and fun, and may prevent the creation of an Albatros-shaped virtual crater or two... or six... or more.

For updates to this L-39 software, support, and free additional paint schemes please visit: www.lotussim.com

What this package includes

- 15 Dual Cockpit Aero Vodochody L-39 Albatros variants (9 military, 6 civilian)
- 5 Single Cockpit L-39 variants (2 military, 3 civilian)
- 1 Reno Racing Jet Class variant "Pipsqueak"
- 2 Special multiplayer formation team models, reduced feature set, ultra-high framerate performance
- 5 variants with the Reality XP ™ Garmin GNS430 GPS integrated into the VC (RXP GPS software not included)

Those interested in repainting the aircraft will find the complete L-39 Paint Kit available for download at: www.lotussim.com

For cockpit instructional videos to augment this manual please visit: www.youtube.com/LotusSimulations

Copyright Information

Credits

Modeling, texturing, animation, flight dynamics, gauge and systems code, additional sound effects, ranting, staying up all night drinking coffee. **- Michael "Lotus" Johnson**

L-39 manual creation, harping on stuff, being annoyingly and helpfully right all the time, and keeping Lotus firmly on track. **- Pebble Garden**

Lotus Simulations website design and creation **- Eric Smith**

L-39 3D Sound Set created by **- Christoffer Petersen - Turbine Sound Studios**

Licensed XML Sound gauge created by **- Douglas S. Dawson**

Checklists and Procedures **- Scott Borchardt**

Testing

Pebble Garden, Mark Harvie, Shaun Coller, Charles Kerber, Eric Smith, Scott Borchardt

L-39 Technical Assistance

Tyson McDowell, Charles Kerber, Bernd Rehn, Pavel Sovak, Dave Riggs, Joe Gano, Ed McDonald, Flavio Kauffman, Uwe Stengel

General Assistance & Advice

Paul Lange, David Brice, Vernon Pellerin

Special Thanks

Pebble: For being my sounding board, sanity check, wingman, and #1 formation flight test pilot for a year, not to mention putting up with an obscene number of Albatros updates.

Tyson McDowell: Without Tyson's generous gift of flight time in the real L-39C, and to a total stranger at that, as well as continued technical assistance, just about everything in this project would have been a complete guess. Thank you Tyson for all of your help and the flight of a lifetime!

Charles Kerber: Chuck, thank you for your massive technical assistance and for putting up with my endless stupid questions on L-39 systems functionality.

Special Thanks (cont)...

Joe Gano: For granting permission to recreate his jet, “Pipsqueak”, and providing related performance information

Bernd Rehn: Thank you for pointing out the smallest of inconsistencies, your excellent feedback and input improved the plane’s accuracy immensely.

Pavel Sovak: For going well out of your way to get me pictures of that insane gunsight, thank you.

Mark Harvie: For constantly breaking the L-39's G-meter, and reminding me not to take it all too seriously.

Shaun Coller: Can you test this manual in DX10 for me? Thanks for all your help man.

Sandra Carter: Lastly, and most of all, thank you Mom. Without your tireless support (and excellent cooking) this Albatros would never have taken flight at all. It exists because of you.

Joe Gano and his L-39, “Pipsqueak”, are engaged in cancer research fund raising activities. For more information on Pipsqueak's cancer connection please visit:

www.warbirdsofdelaware.com/Airplanes/L39/PipsqueakStory/tabid/77/Default.aspx

System requirements

You must have:

- A PC capable of running FSX reasonably well.
- Windows XP, Windows Vista, or Windows 7
- Microsoft Flight Simulator X, with Service Pack 2 or Acceleration installed, or FSX Gold Edition.
- 650 mb free disc space.
- 256 mb ATI or Nvidia video card (Nvidia card with 512 mb or more video memory strongly recommended)

Recommended peripherals

For the best results flying the L-39 I recommend the following:

- Saitek X52 Pro Flight System
- CH Pro Rudder Pedals
- Track-IR version 4 or 5 pro head tracking system.

Installation

Simply double click the installer executable to begin the installation process. The installer should automatically detect your FSX install folder. If it does not then please enter this manually in the window provided. This manual will be installed into a **/Lotussim** folder in your main FSX folder.

Vista / Windows 7 users NOTE

If you experience any problems with the installation, such as switch clicks and other extra sounds in the cockpit not working, please uninstall the L-39 package through your Add/Remove programs function in the windows control panel.

After that right click the original installer executable and select "Run as Administrator", then complete the install process as before.

After Installation

Important!

Please note that the Lotus L-39 contains a large number of files, especially textures, and it is *highly* recommended to perform a full disc defragmentation after installing this package. Windows' built in defrag is largely useless and so I highly recommend downloading Ultimate Defrag or O&O Disc Defragmenter. Both have free trials available if you do not already own one of these excellent programs.

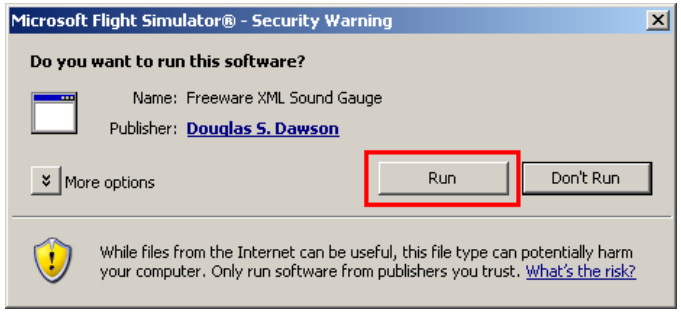
http://www.oo-software.com/home/en/products/oodefrag/

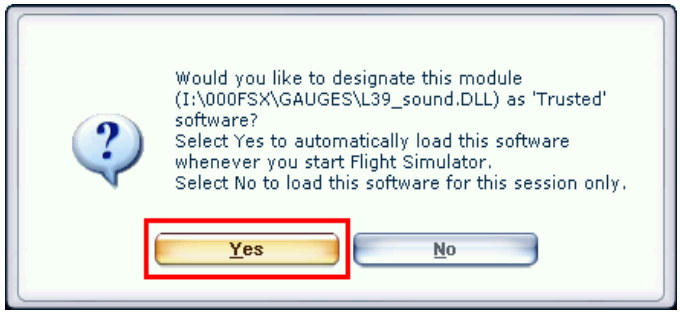
http://www.disktrix.com/ultimatedefrag_home.htm

When performing defragmentation select complete/name or alphabetical sorting for best results. Performing such complete defragmentations on all of your hard drives regularly will prolong their lifespans and dramatically increase performance of texture loading on the L-39 as well as general FSX and system performance.

L-39 Sound Gauge

When first selecting an L-39 to load in the FSX free flight aircraft selection screen you will be asked to "trust" a DLL gauge file by Douglas S. Dawson. Please click "run" and “yes” at each prompt. This gauge is required for all of the system and cockpit sound effects in the L-39. This is a one-time authorization to load the gauge and applies to all versions of the L-39. You will not be asked to do this again by FSX.





Know this before you fly

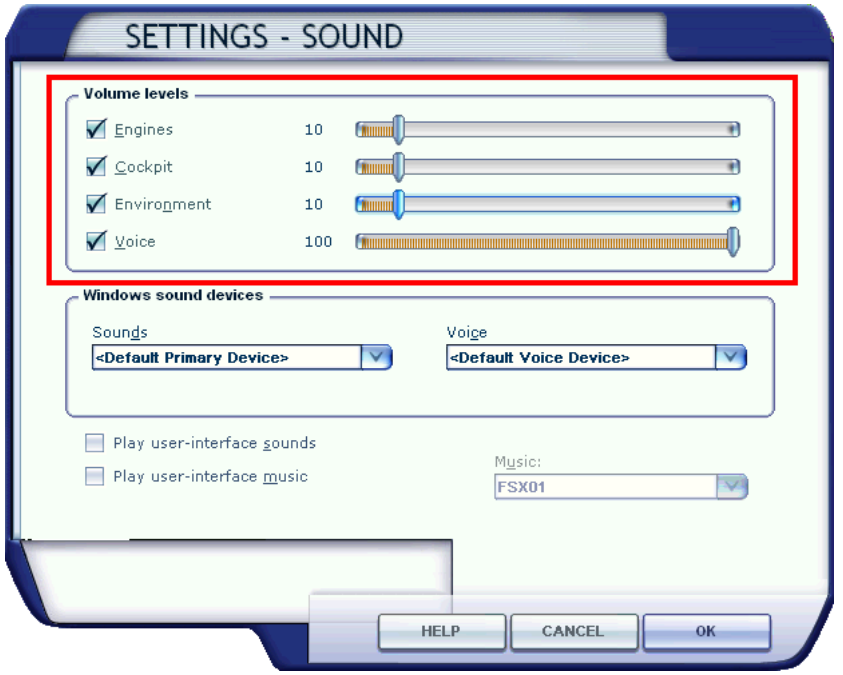
The real life L-39 has several unusual characteristics and many of these have been incorporated into its FSX counterpart for the sake of realism. In addition, a number of systems have been modeled which are not normally replicated in an addon aircraft of this class. Your enjoyment of the Lotus L-39 (and in some cases your survival) absolutely depends on awareness of these items before taking your first flight.

Even if you read nothing else in this manual, please take the time to read this section completely!

Configuration settings

- **Sound settings:** This plane was developed for multiplayer Shared Cockpit flight as its primary use and therefore the sound levels have been arranged differently from most addons in order to accommodate FSX's very quiet multiplayer voice communications.

  Also many of the aircraft's cockpit sounds are run through a separate gauge which does not respect FSX's sound slider levels. These sounds are similarly quieter than those found in most addons. They are designed to match up with low sound slider levels.



Please use the displayed sound settings in FSX for best results, and then control total volume through your keyboard or windows sound control panel.

- **IMPORTANT!: Advanced Animations:**

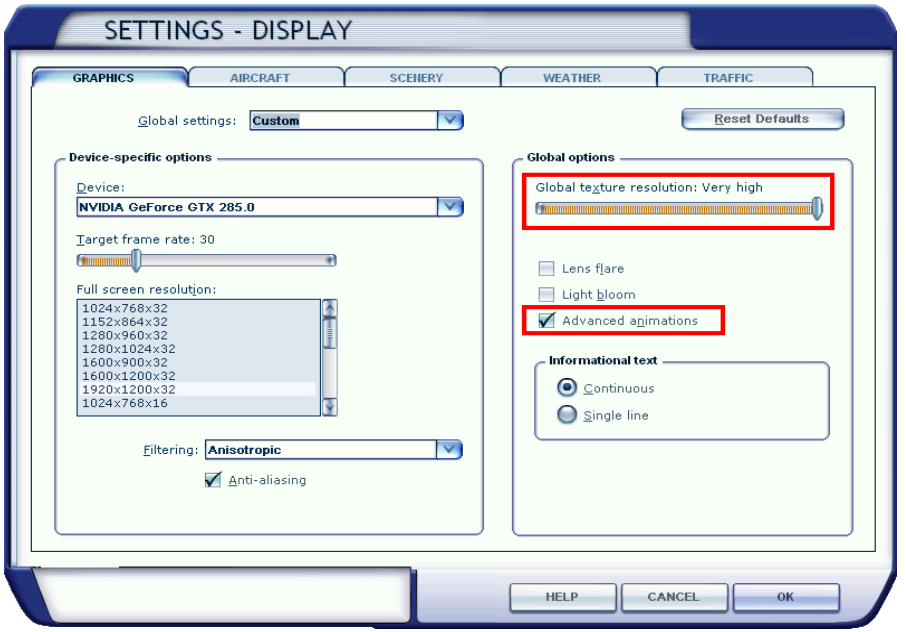
  This setting **must** be enabled in FSX's display settings menu to enable many of the L-39's features, such as the instrument and landing lights, IFR hood, and other goodies.

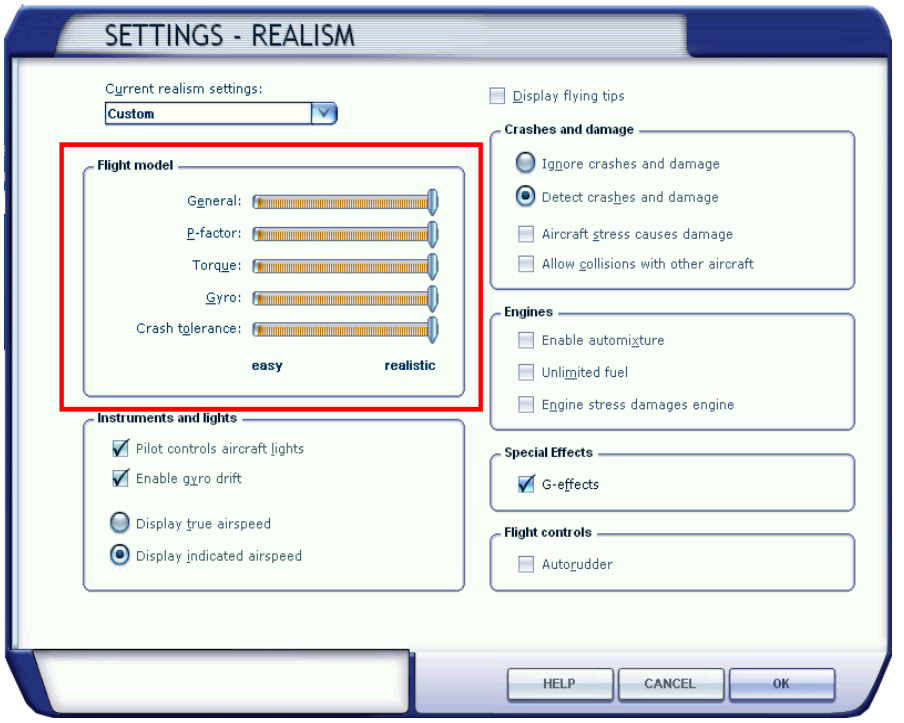
- **IMPORTANT!: Global Texture Resolution Slider:**

  This slider **must** be set to maximum to ensure the best visual results on the aircraft exterior. The L-39 uses mip-maps for performance reasons and without this setting on "very high" the external textures may appear quite blurry. Please also ensure that your videocard's display settings are set to the best possible texture filtering mode. It really does make a big difference in visual quality with almost no loss of performance.

- **IMPORTANT!: Realism Settings:**

  All realism sliders should be set to maximum at all times when flying the L-39. The aircraft was tested and tuned entirely with maximum realism and using lower values will degrade or disable the ability to spin, sideslip, and stall the plane accurately.





Operational considerations

- **Fuel Mixture and Prop Pitch Control:** IMPORTANT! Despite being a jet aircraft the L-39 makes use of FSX's mixture lever and propeller pitch controls internally for fuel and engine functions. If you have either of these functions assigned to sliders or dials on your joystick then make sure that these are in their full 100% or ON positions before loading the L-39 and do not adjust them in flight. Failure to heed this will result in engine control difficulties or flame out.

- **Cockpit cameras + Track-IR:** IMPORTANT! There are two closeup cockpit camera views provided in the front cockpit to view the GPS and Radio Stack. You can cycle through them by pressing the "A" key or "SHIFT-A".

  Unfortunately an unpleasant side effect of Track-IR use is that the device does not respect FSX's camera lock-down parameters and allows free panning on any camera in the cockpit. Because of the placement of the GPS and Radio stack, their closeup cameras have to point nearly straight down to be useful, and if your Track-IR is active you may encounter extreme view panning or gimbal lock problems. Before using either of these views please pause your Track-IR (F9).

  When finished using the GPS or Radio Stack, return to the normal VC view *before* unpausing the Track-IR. If you are in a closeup view and having problems, pause your Track-IR and hit (F12) to centre it. There is unfortunately nothing that can be done to fix this annoying FSX/Track-IR implementation flaw. The L-39 does have a 2D GPS pop-up (shift-2), but no Radio Stack popup.

- **Ground handling:** The real L-39 has no nose wheel steering capability. Above 25 knots airspeed the rudder becomes effective enough to turn the aircraft on the ground but below this speed steering can only be accomplished by differential braking. If you do not have rudder pedals with differential braking capability, then twisting your joystick's rudder function while pulsing the brake key (period) will provide differential braking in the direction of twist. If you find the differential braking to be too difficult even with brake pedals then you can use an alternate aircraft.cfg file which has nose wheel steering enabled for each variant of the L-39. Please see the troubleshooting section at the end of this manual for details on how to enable nose wheel steering via alternate config files if you so desire.

- **Engine response:** The L-39's engine has a very long spool-up time, ranging between 9 and 14 seconds depending on engine age. This is entirely realistic and power changes must be planned for well in advance. 10 seconds doesn't sound like a long time on paper, but it's an eternity when the ground is approaching fast and you need power immediately.

  Please see the Front Cockpit and Handling and Performance sections for tips on extracting the best performance from the engine in various flight conditions.

- **EGT Limiter:** The L-39 employs an exhaust gas temperature limiter / fuel cutout device. If you exceed the temperature limits of the engine it will automatically shut down in flight. This system can be disabled, however doing so may result in serious damage to the engine, or complete failure.

  Please see the Front Cockpit section of the manual for details on EGT limiter operation.

- **No Autopilot:** The real L-39C doesn't have an autopilot so neither does this one.

- **Metric System:** With the exception of the altimeter all of the L-39's instruments are original Russian equipment and use the metric system. Speed is measured in kilometers per hour and all temperatures are in degrees Celsius.
  If you are not comfortable with the metric system or familiar with conversion from Kilometers per hour to Knots then please see the performance and handling section of this manual for a speed conversion chart.

- **Russian Artificial Horizon:** The L-39 uses a Russian attitude indicator which operates very differently from standard western units. Roll is depicted by a banking airplane indicator and pitch and roll are separately displayed. This may require some getting used to but in time most people find it to be a superior representation of aircraft attitude, especially during aerobatics.

- **Basic take off:** Set flaps to half extension, apply brakes fully, throttle to 106% N1 RPM, then brake release. Rotation speed is 160-180 km/h depending on aircraft weight.

- **Flaps:** The L-39 employs an automatic flap retraction and limiter mechanism. The flaps cannot be deployed above 300 km/h and they will retract at this speed if they are already deployed. This is a self protection limitation of the real aircraft. It can be overridden in the case of electrical or hydraulic failure.

See Front Cockpit section for details.

- **Approach and landing:** Reduce speed to 300 km/h, flaps half, gear down. Once below 275 km/h deploy flaps fully. Approach speed is 230-250 km/h depending on weight. Touchdown speed is 165-180 km/h.

- **Fuel System:** Manually removing fuel from the L-39's tanks is unrealistic and may cause engine flameout due to the way its fuel controller works. Similarly changing aircraft from a version with external tanks to a version without them, or to some other aircraft entirely, may result in engine flameout. If removing fuel from tanks manually leave at least 3% fuel in each tank to avoid fuel controller problems. If you desire to fly with partial tanks I recommend setting this up prior to engine start.

  Please refer to the Front Cockpit section of the manual for more detail on the fuel system and fuel gauge.

- **Lights:** All of the L-39's lights are built into the aircraft itself and most of them do not respect the "L" key in FSX. You must turn them on manually using the switches provided in the virtual cockpit. This is a good habit to keep anyway because use of the "L" key in FSX causes all sorts of annoying problems in multiplayer flight.

  See Front Cockpit section for detailed info on operation of the L-39's lights.

- **Short legs:** The L-39 is a training aircraft and not designed for long distance flights. Even with external tanks you will be surprised at how quickly you can burn off all of your fuel. Pay attention to the fuel quantity gauge regularly and if flying at low altitudes and high speed plan for flights no longer than 200-250 nm. Farmers generally don't like having L-39s parked in their fields.

  See performance and handling section for range/fuel consumption data.

- **Elevators pitch up on the ground:** The real L-39 employs a control force reduction system in its elevators to aid the pilot in pulling high-G manoeuvres. A side effect of this system is that the elevators naturally 'fall' into the full up position when at rest. This is purely a visual effect and has no affect on control inputs. Air resistance forces the elevators flat again at approximately 30 knots on the takeoff roll.

Know This Or Die

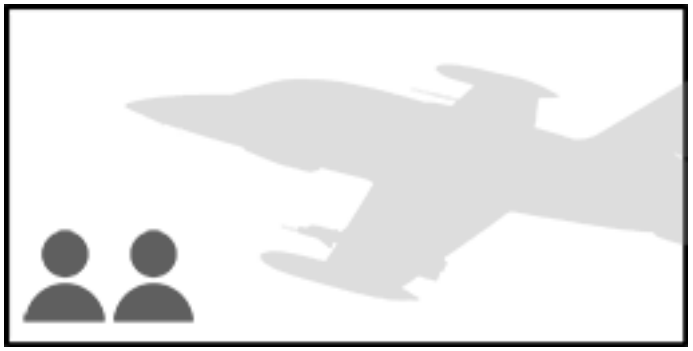
- **Canopy:** Opening either canopy in flight is fatal. You will lose control of the aircraft and crash.
- **Coffin corners:** Flying slower than 170 km/h on an approach with low engine RPM or using violent control inputs with too little airspeed may result in your flight being cut rather short by a stall or spin.
- **Icing:** The L-39 has no surface de-ice ability and limited de-ice for the engine. Flying in icing conditions will degrade the performance of your aircraft and without the de-ice system activated your engine may suffocate and shut down. You may also accumulate ice on the windscreen when flying through clouds.

  See the Front Cockpit section for de-ice system operation details.
- **Cabin pressurization and oxygen:** Cabin pressurization is required for flight above 12000 feet and should always be on. Oxygen is required above 18000 feet or you will lose consciousness due to hypoxia and lose control of your aircraft. Note, the oxygen supply is off by default and this can be a problem if joining a multiplayer session in progress at high altitude.

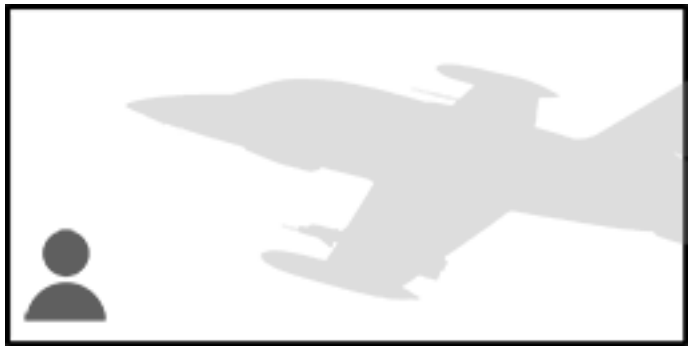
  See Front Cockpit section for details on pressurization and oxygen use.
- **Low thrust to weight ratio:** The L-39 does not have a powerful engine and has relatively high wing loading for an aircraft of this type. When performing vertical aerobatics careful attention must be paid to airspeed and available altitude. There is no afterburner to save you from errors in judgment.
- **Negative G flight:** Inverted flight degrades engine oil and hydraulic systems and causes fuel starvation. Negative G flight can be maintained for a maximum of 20 seconds before engine flame out.

Selection Screen Icons

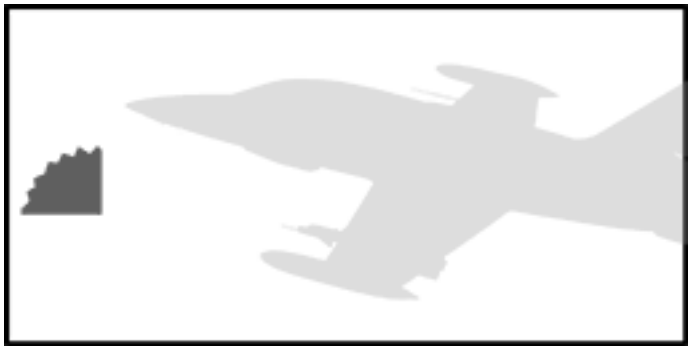
In the FSX aircraft selection screen icons for the L-39 you will find several small "at-a-glance" indicators of the major features on each individual aircraft. The indicators and their meanings are as follows:



Full featured aircraft with both Front and Rear Cockpits

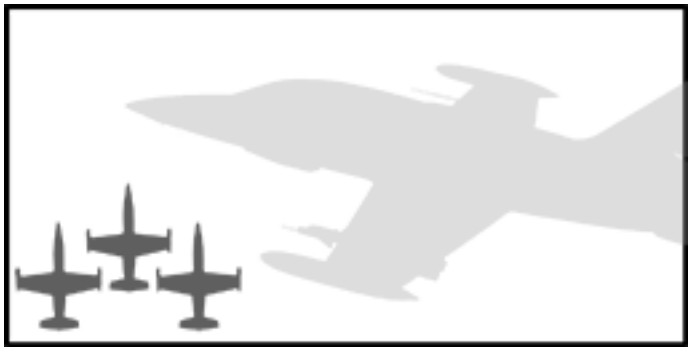


Full featured aircraft with Front Cockpit only



Aircraft contains extending instrument flight practice hood for front seat. This allows IFR flight practice in clear skies.

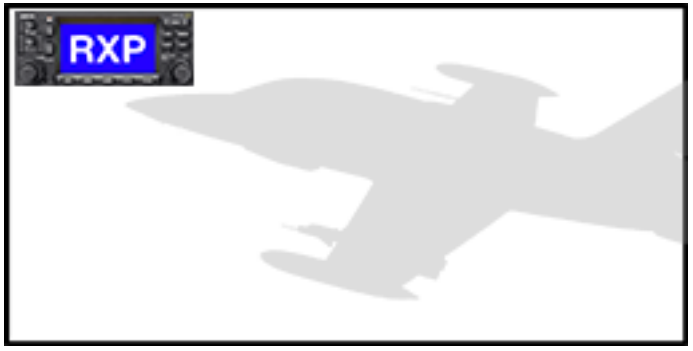
Aircraft is equipped with long range external fuel tanks



Special multiplayer formation team model (front cockpit only, no bump maps, reduced feature set, very high performance external model)

NOTE: This model is intended for use only by large online formation teams or those with very marginal performance computers.

This aircraft has all of the same systems functionality as normal variants, but very few special effects. It is not recommended for singleplayer or normal multiplayer flight.



Reality XP ™ GNS430 GPS integration model. Variants with this icon are pre-configured to use RXP's GNS430 in the virtual cockpit if you have it installed. If you own this addon then no setup is required, you can use these variants straight away. If you do not have this software installed then please do NOT use these models. NOTE: The RXP variants are compatible in shared cockpit with each other, however the GPSes do not synchronize.

For more information and to purchase the Reality XP GNS430 click here:

http://www.reality-xp.com/flightsim/gns430/index.html

Military Variants

Czech Air Force in modern NATO colour scheme with AA-2 Atoll missiles.

Slovak Air Force with long range fuel tanks and IFR hood.

Biele Albatrosy, Slovak Air Force formation team, with long range fuel tanks.

Russian Air Force with IFR hood.

Royal Thai Air Force with IFR hood and unguided rocket pods.

Vjazma Rus Aero Club, Russian Air Force aerobatic team

Civilian Variants

N39ED, privately owned (USA)

N139CK, privately owned (USA)

C-GOZA, privately owned (CANADA)

'Pipsqueak" Privately owned, Reno Racing prepped (USA), fastest L-39 in the world.

Feature List

Performance optimizations

- Highly optimized mesh, textures, and coding for highest possible framerate performance in single and multiplayer sessions.
- All-3D virtual cockpit with no 2D gauge render overhead.

Flight modeling

- Flight dynamics and performance based on real L-39C operations manual, actual L-39C flying experience, and further testing by real L-39 owners.
- Realistic stall buffet effects.
- Realistic spins and side slips.

Systems modeling

- Accurate engine limitations and Saphir starter turbine operation.
- Accurate Ram Air Turbine operation in automatic or manual deployment modes.
- Realistic electrical and hydraulic system controls and limitations.
- Cabin pressurization and diluter demand oxygen systems.
- EGT limiter and self protection mechanisms.
- Fire extinguisher.
- Accurate instrumentation behaviours and limitations.

Virtual cockpit

- Ultra smooth and easy to read 3D gauges in both front and rear cockpits.
- High degree of cockpit functionality and "clickability".
- Cockpits optimized for liberal track-IR use, no holes or missing parts.

- Built from the ground up for Shared Cockpit mode compatibility and online multiplayer training.
- Projected and collimated gun sight in military variants.
- Independent red and white instrument lighting for each cockpit.

Flight training

- Complete set of instructor station failure controls in the rear cockpit for failing front cockpit instruments.
- Extensible IFR hood for the front cockpit in some models, allowing IFR practice in clear weather.
- Fully capable IFR instrumentation.

Graphical goodies

- Dynamic gauge glass reflections, responsive to sun angle.
- Animated rain effects on virtual cockpit canopies.
- Totally unique landing lights which actually properly illuminate the ground and other objects.
- Animated raindrops lit by the landing lights at night.

Audio

- Most cockpit controls and switches have associated sound effects.
- Audible G-suit pump, gives an accurate indication of load factor.
- Aircraft 3D sound set by Turbine Sound Studios.

The L-39 Albatros family of aircraft, designed and built by Aero Vodochody in the Czech Republic, was commissioned by the Soviet Union to be the primary jet trainer for Warsaw Pact air forces, replacing the company's previous development, the ageing L-29 Delphin. It was designed to facilitate training of military pilots, allowing them to transition from simple propeller driven aircraft to complex front line fighters such as the MiG-29 and SU-27. The aircraft was built to be autonomous, requiring very little support equipment, and be highly tolerant of harsh climatic conditions.

Designed in the late 1960s, and making its public debut at the Paris Airshow in 1969, it entered service initially with the Czechoslovakian air force in 1972. The L-39 quickly became the world's most successful and heavily exported jet trainer of all time, with over 4000 examples produced. Although production ceased in 1988 over 900 L-39s remain in service today with some 20 air forces. Following the breakup of the Soviet Union in the early 1990s several hundred aircraft were sold as military surplus and are now in private ownership all around the world, making regular appearances at air shows of all sizes. L-39Cs are also used by several aerobatic teams, including the famous Breitling Jet Team and Vjazma Rus Aero Club.

From a design and engineering standpoint the L-39C was the first single engine jet trainer to 'get it all right' and its design features were heavily imitated in later jet trainers from other manufacturers, such as the British Aerospace Hawk and Aermacchi MB-339.

Various improvements and redesigns have occurred throughout the production life of the Albatros resulting in the ZO, ZA and MS models of the 1980s which featured improved avionics, more hardpoints, and strengthened structures. These improvements ultimately led to the development of the L-159 Alca (Advanced Light Combat Aircraft). With the creation of the Alca the basic L-39 design has grown beyond its trainer roots and has become a formidable attack aircraft in its own right.

This Lotus Simulations rendition recreates the original L-39C. This is the lightest, simplest, and highest performance member of the Albatros family. Among private owners the "C" is widely regarded as the most desirable model.

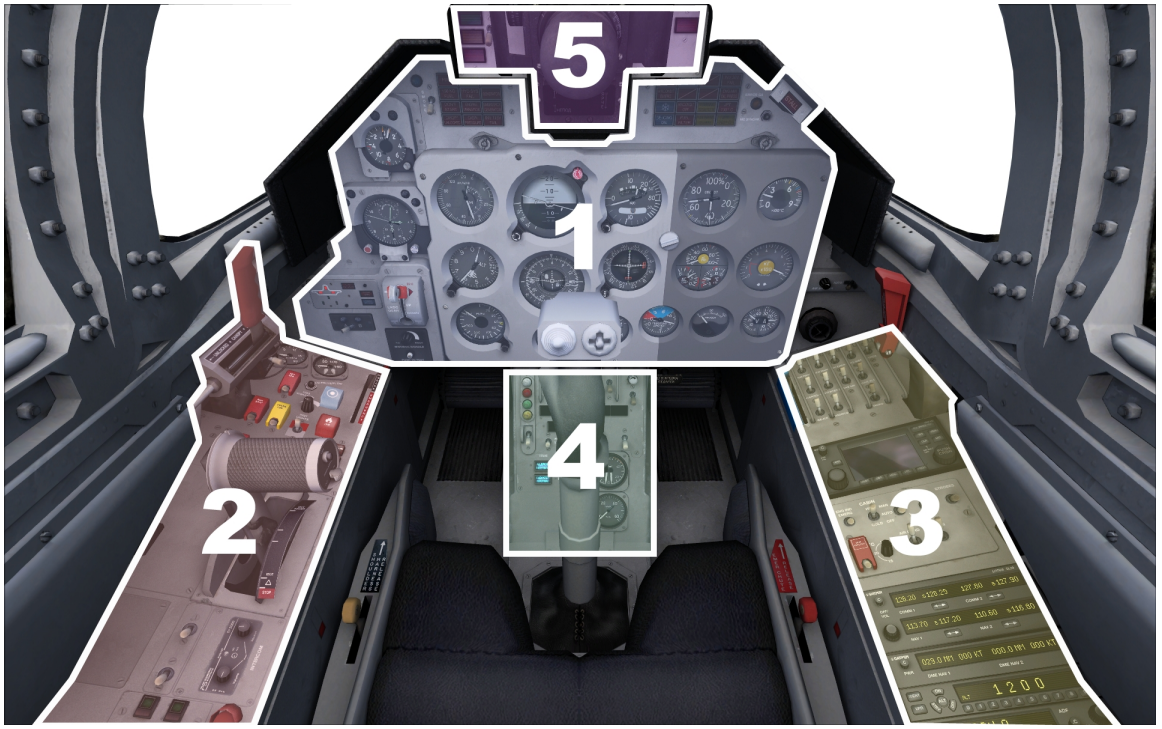
General layout

Welcome to the L-39's "Office". This rendition of the L-39C retains almost all of the original Russian metric equipment as installed by Aero Vodochody for former Soviet Bloc air forces. However, due to the fact that many Soviet instrument navigation aids and associated systems have no equivalent in Flight Simulator, the original radios and IFR instruments have been either slightly repurposed for compatibility with FSX, or replaced by modern western units. Such instrument and radio upgrades are common among modern air forces and private owners still operating the L-39C.

The L-39 is a two place aircraft. The student, or solo pilot, operates the aircraft from the front cockpit and the instructor operates it from the rear cockpit. Many of the front cockpit instruments and controls are duplicated in the rear cockpit for the instructor's use, and some controls, such as the landing gear selector, will default to the rear cockpit in the case of a control conflict.

The L-39 is not certified for solo flight from the rear cockpit. Therefore all applicable systems functionality required for solo flight will be covered in this Front Cockpit section. Items and features unique to the rear cockpit will be covered in a later section.

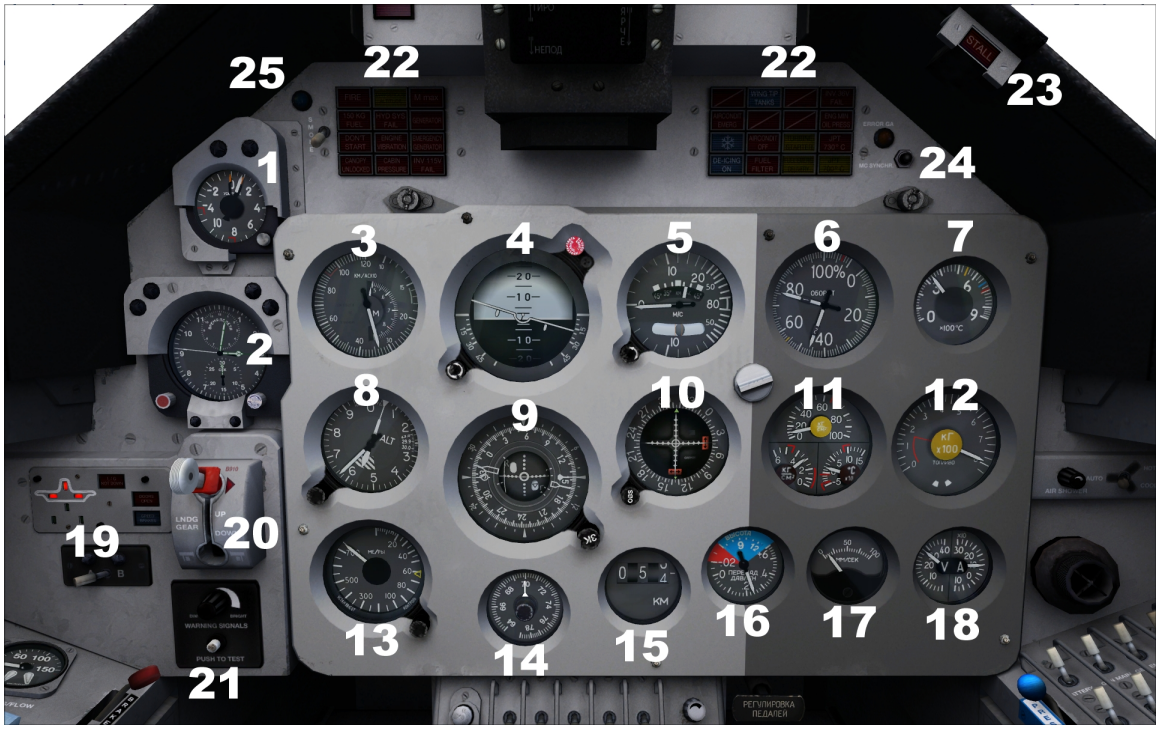
The front cockpit controls and instrumentation are grouped into the five main areas highlighted in this image:



1. Front panel: Contains primary flight and engine management instruments as well as landing gear control and system failure warning lights
2. Left console: Contains throttle, engine and fuel controls, oxygen controls, pitot heat, canopy operation handle, landing lights, and instrument and cockpit light switches
3. Right console: Contains electrical bus switches, emergency hydraulic controls and indicators, external lights, pressurization control, GPS, and communication and navigation radios.
4. Centre pedestal: Contains brake pressure and trim indicators, and weapons arming and release controls (last items not applicable to FSX)
5. Electro-optical gunsight (military models only): Power switch for projected gunsight and weapon delivery parameter warning lights (last items not applicable to FSX)

Front Panel Overview

The main instrument panel in the L-39 is divided into two main sections, light grey on the left and dark grey on the right. The left half contains all of the primary instruments of immediate importance to flight safety. The right half contains secondary or less important instruments and engine management gauges.



1. G-Force meter
2. Clock and Stopwatch
3. Airspeed and Mach Indicators
4. Attitude Indicator
5. Vertical speed, backup bank angle, and slip indicators
6. Engine rpm indicators
7. Exhaust gas temperature gauge
8. Altimeter
9. Horizontal Situation Indicator
10. Garmin Omni-bearing selector
11. Engine fuel pressure, oil pressure, and oil temperature
12. Fuel quantity indicator
13. Radar Altimeter
14. Russian Altimeter calibration (N/A)
15. Analog distance measuring readout
16. Cabin pressurization and pressure differential
17. Engine vibration meter
18. Volt and Amp meters
19. Landing gear position, gear door, and speed brake indicator lights
20. Landing gear position selector
21. Warning lamp test
22. Warning light groups, left and right
23. Stall warning light
24. Gyroscope alignment error indicator and reset button
25. Smoke system switch and indicator light

Front Panel Instrument Details

1. G-Force meter. This gauge indicates current G-force as well as maximum positive and negative G attained during a flight. The white needle shows current G-force and the two orange markers show the max and min G attained. The max and min indicators can be reset by pressing the button on the lower right of the indicator.

2. Clock and stopwatch. The main face of the gauge has indicators for the current local time in hours, minutes, and seconds. A smaller needle on the lower half of the gauge face is a stopwatch with a 30 second period.

   There are two controls for the stopwatch on the lower half of the instrument. Depressing the red button on the lower left of the instrument starts the stopwatch. Depressing the silver button on the right stops the stopwatch. Depressing this button a second time resets the stopwatch to 0 seconds.

3. Airspeed Indicator and Mach Indicator: Indicated airspeed is measured in kilometers per hour. The white arc depicts stall speed in clean and dirty (flaps and gear down) configurations. Inset into the Airspeed indicator on a smaller gauge is the Mach indicator needle. This shows current Mach number for any given altitude. Max airspeed is 910 km/h, max Mach is 0.78.

4. Attitude Indicator: This artificial horizon/attitude indicator is a Russian unit and separates roll and pitch into independent readings, unlike a western unit which combines them.

   Roll is depicted by the banking airplane bar and pitch displays on the scrolling cylinder and is marked in 5 and 10 degree units. The red knob to the top right of the gauge will cage the horizon gyroscopes for aerobatic flight to prevent tumbling. The knob to the bottom left of the gauge allows adjustment of the bank/horizon indicator bar to compensate for head height position in the cockpit.

5. Vertical Speed indicator, slip ball, and backup bank angle indicator: This instrument combines three separate functions. The large primary needle shows current vertical speed in meters per second.

   A quick and loosely accurate rule of thumb is that 10 meters per second is roughly equivalent to 2000 feet per minute. The black ball encased in fluid indicates if the aircraft is in a sideslip. The smaller inset needle is not a turn coordinator in the traditional sense but is actually a backup bank angle indicator to replace the artificial horizon in case of failure. It displays bank in marked degrees up to a maximum of 45 deg.

6. Engine RPM indicator: This instrument displays current RPM for both the N1 and N2 compressor stages of the engine from zero up to the redline of 106.5%. All engine performance readings are discussed in reference to the N1 needle. The yellow marking indicates normal engine idle speed, 56% N1. The engine may be run continuously up to a maximum speed of 103% N1. Beyond this value the engine may gradually overheat.

7. EGT indicator: This instrument displays the current temperature of exhaust gases at the rear nozzle of the engine, in degrees Celsius, and is a primary indication of engine stress and health. The yellow marking indicates the normal temperature operating band in standard flight conditions with moderate power. The blue line indicates maximum allowed continuous running temperature, and the red line indicates the absolute maximum allowed temperature of 730 degrees C. NOTE: EGT sensor voltage is insufficient to display current EGT in both the front and rear cockpit indicators simultaneously. A switch in the rear cockpit controls transfer of EGT sensor indication between front and rear cockpits. The default setting is for the forward cockpit. EGT selection switch operation is covered in the Rear Cockpit section.

8. Altimeter: This is the only Imperial system instrument in the aircraft and measures pressure altitude in feet above sea level. The knob to the lower left of the dial is used to set the reference barometric pressure of the gauge in inches of mercury.

9. HSI: This horizontal situation indicator is a Russian unit and though it looks different from western types its functions are mostly similar. Heading is displayed on the rotating band of numbers in reference to the small white triangle marker at the very top of the gauge. This marker represents your current heading. The obelisk shaped hollow white needle is an omni-bearing selector needle for VOR navigation and takes its input from the NAV 1 radio in the right console radio stack. The knob to the lower right of the dial allows you to rotate this needle to the VOR radial of your choice for instrument navigation. The white needle with a point at one end and circle at the other is the ADF needle for tracking non-directional radio beacons and takes its input from the ADF radio on the right console radio stack. (continued)

Inset into the gauge are the localizer and glideslope needles for the NAV 1 radio. These work just like any other similar system for VOR navigation and ILS approaches. There are two small white holes in the gauge to the top left and bottom right of the localizer and glideslope needles. The TO/FROM flags for NAV1 VOR navigation will appear here as small hollow triangles when applicable, much as they do on a typical western unit.

A complete discussion of HSI operation, VOR/ADF navigation, and IFR flight is beyond the scope of this document. For more information please visit the help and tutorial sections for IFR flight built into FSX.

10. Secondary Garmin OBS: This secondary OBS instrument works in the same way as the VOR function on the HSI and takes its VOR/ILS input from the NAV2 radio. The OBS selection knob on the lower left of the instrument controls current VOR radial selection.

11. Engine Triple-indicator: This instrument combines three readings in a single display. The top needle shows current current fuel pressure in kilopascals per cm². The L-39's engine fuel controller works in stages based on throttle position, so this indicator will read zero at idle engine RPM. Don't worry, fuel is actually flowing. As throttle increases the fuel pressure will rise accordingly. The lower left indicator needle shows engine oil pressure in kilopascals per centimeter squared. The lower right needle shows engine oil temperature in degrees Celsius. These three indications in combination with EGT indicate the general health of the jet engine.

12. Fuel Quantity indicator: This gauge shows the current fuel quantity, in kilograms, in the centre fuselage tank only. Fuel is measured in kilograms instead of litres because energy output is correctly derived from fuels based on their mass, not volume. The L-39 uses a gravity feed system to adjust fuel levels between tanks. Fuel for the engine is always drawn from the centre tank. When the centre tank fuel level drops to around 660 kg the fuel from the wingtip tanks will begin to feed into the main tank at the same rate that the engine consumes it. When this transfer begins the fuel quantity needle will stop moving for a period of time and hold steady at around 650 kg. Once the fuel in the wingtip tanks has been exhausted the WING TIP TANKS light will illuminate on the warning light panel and the needle will continue to move again towards zero as the remaining fuel in the large centre tank is consumed. The red line indicates 150 kg of fuel remaining. If you see this needle move into the red zone then it's time to find a runway right quick.

13. Radar Altimeter: This instrument shows your current instantaneous altitude above ground level by means of a downward facing radar transceiver in the belly of the aircraft. The needle shows current altitude AGL in meters. The yellow triangle bug is the reference altitude for the gauge, often referred to as the decision height. This marker can be adjusted via the knob to the bottom right of the instrument. When current altitude is lower than the bug's setting the "dangerous altitude" light will illuminate on the warning light panel above the main instrument panel. Setting the bug to zero meters effectively disables the warning.

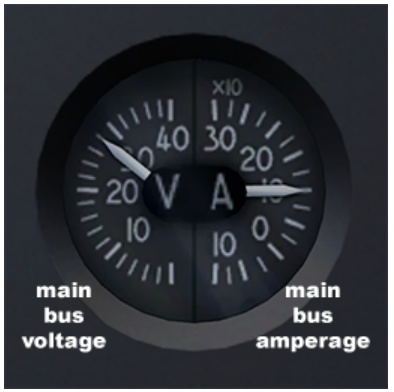
14. Russian Altimeter Calibration unit: Replaced by barometric pressure setting function in fitted western altimeter. Non-functional but nicer looking than a hole in the panel.

15. Analog DME NAV1: This instrument provides an analog readout of distance to the VOR station tuned on the NAV1 radio in kilometers.

16. Cabin Pressurization: This is a two part instrument which gives data on current cabin pressurization parameters. Cabin pressurization level is controlled automatically in the L-39 when the system is engaged. The blue section at the top of the gauge shows the current pressurization cabin altitude in meters, with a range of 0-2000m (approx 6600 feet). The needle on the lower half of the gauge shows the current pressure differential ratio between the cabin and outside air. This needle will vary as the system increases or releases cabin pressure based on current aircraft altitude. If cabin pressurization is disabled or engine power is lost the cabin will quickly depressurize and the needle will read zero differential.

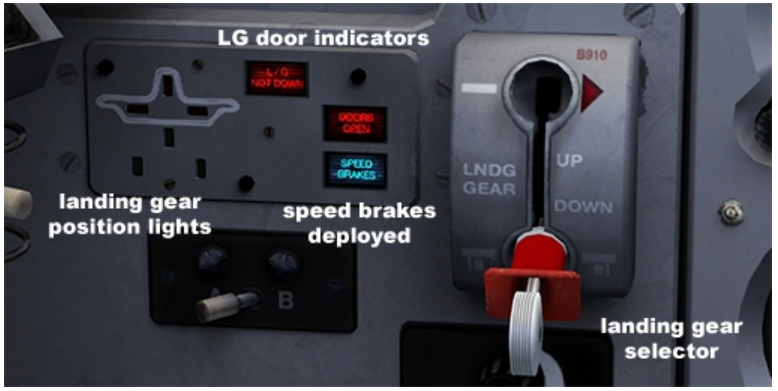
17. Engine vibration meter: This instrument shows the level of engine vibration or out of balance condition in millimeters per second. At idle rpm a reading of 2-8mm is normal and at full power a reading of up to 22mm is allowed. Any values beyond this indicate a serious out of balance condition, possibly caused by component failures.

18. Volt and Amp meters: The left indicator shows current voltage level of the main electrical bus and should read 28V when in normal operation with the engine and generator running, 24V on battery alone. The right needle displays current electrical load on the main bus in amperes.



19. Landing Gear and Speed Brake indicator lights: Green lights indicate that their respective landing gear struts are down and locked. Red lights within the aircraft symbol indicate that they are up and locked. "Gear Doors" and "Gear Not Down" lights indicate that the landing gear is currently in transit and should extinguish when the gear is fully extended or retracted. The SPEED BRAKES light will illuminate blue whenever they are deployed.

20. Landing Gear Selector: Two position lever to control landing gear, retract (up) or extend (down). Note: This control's function can be overridden by the rear cockpit gear selector.



21. Warning Lamp Test button: Depress and hold to test all warning lamps in unison.

22. WARNING LIGHT PANELS (aka: "The Idiot Board")

NOTE: Courses of action and causes of some of the indicator lights below are covered in detail further on in the Front Cockpit and Emergency Procedures sections of the manual.

Left Group (really serious stuff)

FIRE: Illuminates whenever engine or onboard fire is detected.

DANGEROUS ALTITUDE: Indicates when aircraft is below radar altimeter selection bug altitude (below decision height), unless aircraft is on the ground or radar altimeter disabled.

M MAX: Maximum Mach speed exceeded.

150 KG FUEL: Total onboard fuel less than 150 kg (ie: find a runway immediately).

HYD SYS FAIL: Hydraulic fluid pressure in the main reservoir has dropped below acceptable limit.

GENERATOR: The primary engine driven electrical generator is not functioning.

DON'T START: Engine instrument inverter failed or disabled, no electrical power available to engine instruments.

ENGINE VIBRATION: Engine vibration has exceeded acceptable limits (possible component failure)

EMERGENCY GENERATOR: Ram air turbine has been deployed or is in transit but not is providing electrical power.

CANOPY UNLOCKED: One or both of the canopies are not closed and locked.
CABIN PRESSURE: Cabin pressurization has failed or fallen below acceptable limits.

INV 115V FAIL: One or both of the primary 115 volt electrical inverters has failed or is disabled.

Right Group (not immediately life threatening stuff, but mostly bad nonetheless)

WING TIP TANKS: Fuel in the wing tanks has been exhausted. Fuel drawn from centre tank only.

INV 36V FAIL: The secondary 36 volt instrument inverter has failed or is disabled.

AIR CONDIT EMERG: The air conditioning and pressurization systems have failed.

ENG MIN OIL PRESS: Engine oil pressure is below acceptable limits for continuous operation. This is a normal indication during engine startup, in flight it may indicate oil leak or engine damage.

Snowflake: Aircraft has encountered icing conditions. De-icing system should be activated.

AIR CONDIT OFF: Air conditioning and cockpit pressurization is off.

TURBINE STARTER: Saphir starter turbine is engaged and ready to start main engine.

JPT 700: EGT has passed 700 degree limit, engine damage possible

JPT 730: EGT has passed absolute 730 degree limit, engine auto-shutdown or failure imminent

DE-ICING ON: Engine de-ice system active.

FUEL FILTER: Pressure differential on fuel filter past limits, filter clogged, fuel bypass engaged

FUEL EMERG DELIVERY: Auxiliary electric fuel pump engaged

23. STALL WARNING: Housed in a separate indicator to the right of the right hand warning light group. Indicates aircraft is approaching or has entered aerodynamic stall condition. Accompanied by highly annoying warning sound for your enjoyment. (*See Warning Lights – Right Group illustration above.*)
24. Directional Gyroscope alignment error indicator and reset: Heading indicator gyroscopes naturally drift out of alignment over time due to internal friction. If the heading indicator becomes more than 3 degrees out of alignment with the compass the ERROR GA warning light will illuminate. Pressing the MC Synchr. button next to it will realign the heading gyro with the compass. To maintain heading accuracy this reset should be performed regularly but only when in level flight. (*See Warning Lights – Right Group illustration above.*)
25. SMOKE: A smoke system is provided on the L-39 for aerobatic displays. The switch provided will toggle the smoke system on and off. A blue light will illuminate here when the smoke system is active. Note that the smoke system will only operate when the engine is running.

Left Console Overview

The left console contains controls for engine startup and shutdown, Saphir starter turbine operation, emergency fuel supply, flaps, parking/emergency brake, throttle, and the oxygen system among other functions. This console will be divided into forward and aft sections for explanation of the functions available. This section also contains detailed information about throttle use, engine management and limitations, and oxygen system use.

Forward section

NOTE: Most rocker switches on this console are one-way guarded. You must raise the guard first by clicking on it, then the switch underneath can be activated. This is designed to prevent accidental activation of engine controls in flight. Guarded rocker switches must be returned to their default (aft) position before the guard cover can be lowered again.

1. Landing lights switch: This switch toggles the wingtip landing lights on (forward) and off (aft).
2. EGT REG: This switch disables (forward) or enables (aft, covered) the jet engine exhaust gas temperature limiter function. The EGT limiter is on (aft) by default. Warning!: When the EGT limiter is active the L-39's engine will automatically shut down to protect itself when EGT exceeds 730 degrees. If the limiter is disabled via this switch then the engine will continue to run in an overtemp condition until it fails. Note: The EGT limiter is automatically disengaged whenever the flaps and/or landing gear are deployed. EGT is dependent not only on engine rpm and thrust but also on ambient air temperature. Pay close attention to EGT limits on very hot days or during prolonged climbs at high power settings. Disabling the EGT limiter is not recommended except in an emergency.

3. O2 PRESS/FLOW: This instrument indicates available pressure in the oxygen system in kilopascals per cm². This is the only indication of your available oxygen supply. When the oxygen supply valve is open this gauge will show available pressure in the oxygen tanks and the indication will reduce over time as oxygen is consumed. If the oxygen valve is closed it will read zero. Check this instrument regularly during flight above 18000 feet MSL.
4. ENG VIBRATION: Engine vibration sensor test switch. Depress and hold while examining engine vibration meter on the main instrument panel and ENG VIBRATION warning light on the left warning lamp group. Vibration needle should spike to 80 - 100mm during test and lamp should flash.
5. Cockpit flood lights: This black knob toggles front cockpit flood lighting on and off. (NOTE: Also activates external formation lights on Czech Air Force aircraft)
6. ENGINE START BUTTON: (Blue with white circle) This guarded button initiates engine start sequence. For ground starts or air starts with N1 engine rpm below 22% the Saphir starter turbine must be engaged prior to engaging this main engine starter. NOTE: The engine start sequence will not begin unless the throttle is retarded to the idle position. (See engine operation section below for details)
7. Parking/Emergency brake handle: This lever controls the emergency brake. Click to toggle. Forward = Emergency brake OFF. Aft = ON.
8. ENG STOP: Cuts ignition circuit to jet engine, forcing flame out.
9. EMERG FUEL: Emergency electric fuel pump. Provides backup fuel control in the event of engine driven fuel pump failure.
10. INST LIGHTS: Three position switch for instrument lights. Use mousewheel to change between white instrument lights (aft), lights off (middle), and red instrument lights (forward). Low intensity red instrument lights are used for normal nighttime operation, white are better for dawn/dusk or storm conditions.
11. FIRE: Guarded fire extinguisher button. Floods engine compartment with retardant. Use only in case of engine fire indication or visible smoke/flames.
12. TURBO STOP: Shuts down Saphir starter turbine.
13. TURBO START: (black with white circle) Guarded button starts Saphir turbine. (See engine operation section below for details)

14. START MODE: Wet, dry, and normal rotation modes control how fuel is distributed to engine during rotation. Used by maintenance personnel to troubleshoot engine faults. (Not applicable to FSX)
15. Flap position indicator lights: These lights show the current position of wing flaps (up, mid, down).
16. Flap position selector buttons: Depress buttons to control flap position (up, mid, down)

Wing Flaps Operation

IMPORTANT! The L-39's flaps are hydraulically powered and employ a speed sensitive self protection circuit designed to prevent damage to the flaps from accidental or intentional high speed deployment. If the aircraft's airspeed is higher than 300 km/h the flaps will NOT deploy, and if they are already deployed then they will retract automatically. This functionality must be kept in mind on steep approaches. If careful attention is not paid to airspeed the flaps may retract unexpectedly, possibly resulting in a stall.

Canopy Handle

Clicking this handle will open or close the front canopy. IMPORTANT: Opening either of the L-39's canopies while in flight will result in loss of aircraft control. Also note that when opening either canopy the cockpit pressurization system is automatically disabled and must be re-enabled by use of the Pressurization/Canopy Seal lever on the front right console after canopy closing. If either canopy is open the CANOPY UNLOCKED light will illuminate on the left warning lamp group.

Aft section

1. Throttle handle: Controls engine RPM and thrust.
2. Pitot Heat: Depress to activate/ deactivate left and right wing electric pitot tube heaters. Indicators will glow green when pitot heat is active.
3. Fuel Shutoff: Pull lever aft to shut off engine fuel supply (NOTE: This control is tied to FSX propeller pitch function. If you have this function mapped to a joystick slider or control then ensure it is in the full 100% ON position and do not use in flight. Failure to adhere to this limitation may result in unexpected engine flameout.)
4. Oxygen Supply Valve: Click to toggle oxygen supply on and off. When the blue dot on the control faces outboard (away from seat) the oxygen valve is on. Check O2 pressure gauge on forward left console for response and remaining oxygen supply.

Throttle Use / Display

1. The engine can be shut down using an idle-cutoff function on the throttle. Right click in the blue shaded area (left side of throttle handle and stalk) to retard the throttle to the cutoff position. Right click this area again to return it to the idle position prior to engine start up.
2. At full power the throttle can partially obscure some engine and lighting controls. Left click in the green shaded area of the throttle's base plate to hide or show the throttle handle.

These same functions are duplicated in the throttle area of the rear cockpit. IMPORTANT NOTE: While the throttle is in the cutoff position the engine starter will not engage and the throttle will not visually respond to the throttle on your joystick.

Engine Operation

Startup

The L-39 is equipped with a Saphir-5 turbine starter unit allowing self-starting of the aircraft's jet engine. This device is basically analogous to an auxiliary power unit but it does not provide electrical power, only compressed air to rotate the aircraft's jet engine during the start sequence. The engine cannot be started on the ground without first activating the Saphir turbine. The Saphir requires approximately 25 seconds to spool up to a speed capable of providing sufficient air for engine start. When the Saphir is ready to

start the main engine the "TURBINE STARTER" light will illuminate on the right hand warning light panel.

The Saphir turbine will automatically shut down after successful jet engine ignition, or after 10 minutes of running without ignition, whichever comes first. The Saphir can be manually stopped by clicking the "TURBO STOP" switch on the forward section of the left console. Note, the Saphir turbine uses fuel from the aircraft's centre fuel tank for its operation. If no fuel is present in this tank the Saphir will fail to start or shut down if it is running.

NOTE: The main engine starter will NOT engage in any situation unless the throttle is retarded to the idle position. This is a self protection mechanism designed to prevent excess fuel entering the engine during start rotation and causing a hot start, compressor stall, or fire.

Abbreviated Engine Start Procedures (for complete procedure see procedures/checklist section of this manual)

CASE 1: Aircraft On Ground

- Master battery switch on, gen main switch off (forward right console)
- Fuel shutoff lever ON (full forward and guarded)
- Parking Brake ON
- Throttle to IDLE
- Depress TURBO START button (under black cover with white circle)

After 25 seconds:

- TURBINE STARTER light illuminated, Saphir ready for engine start
- Depress ENGINE START button (under blue cover with white circle)
- Observe oil pressure and rpm gauges for increase in values.

- Ignition should occur at approximately 22-24% N1 RPM.

After engine ignition:

- Ensure MIN OIL PRESS warning light out
- Gen main switch on
- Other systems on as required, or per checklists

CASE 2: Aircraft In Flight (Air Restart: flameout, engine windmilling, N1 RPM 22% or higher):

- Trim for best glide speed (290 km/h)
- Ensure fuel shutoff lever ON (full forward and guarded)
- Check fuel quantity (greater than 50 kg)
- Throttle to IDLE
- Depress ENGINE START button (under blue cover with white circle)

If no ignition, or engine windmilling below 22% N1 RPM:

- EMERG FUEL ON
- Depress TURBO START button (under black cover with white circle)

After 25 seconds:

- Throttle to IDLE
- Depress ENGINE START button (under blue cover with white circle)
- If still no ignition... find a nice field to land in... or refer to Emergency Procedures section of manual.

Shutdown

- After landing, engine idle for 2 min to stabilize temperatures
- Parking brake ON
- All electrical systems off (forward right console)
- Master battery ON, gen main OFF
- Pressurization/Canopy seal lever OFF (forward right console)
- Throttle to idle-cutoff position (right click throttle stalk or left side of throttle handle)
- Canopy open
- Master battery OFF

Speed Brake Operation

The L-39 is equipped with two belly mounted and hydraulically powered air brakes to help control airspeed. Extension/retraction time is very rapid, requiring approximately one second to fully deploy. The speed brakes can be toggled with the forward slash "/" key or assigned to a joystick button or slider, and a blue light near the gear indicator lights will illuminate whenever they are deployed. The speed brakes will automatically deploy if indicated airspeed surpasses 910 km/h or if the maximum Mach of 0.78 is exceeded and will remain deployed even if speed drops below redline. In the case of automatic extension they can be retracted by toggling them manually. Note that in the case of a hydraulic pressure loss or system failure they are non-functional and speed can only be controlled by reducing throttle, adjusting aircraft attitude, or deploying flaps.

Engine and throttle management tips for normal operations

As mentioned in the "know before flight" section, the L-39's engine is very slow to respond to throttle changes. A throttle slam from idle thrust to maximum power will take approximately 10 seconds of spool up time. This is a defining characteristic of the real aircraft and has (love it or hate it) been faithfully recreated in this FSX version.

L-39 pilots often say that the primary difference between the Albatros and normal aircraft is that you must fly the engine first and the airframe second. As you become accustomed to flying the aircraft you will learn to plan for power changes well in advance of your thrust needs, especially on approach. Approaches and station keeping in formation flight will present the greatest challenges in throttle management. For formation flight it is standard practice for the lead pilot to keep wingmen aware of his or her N1 RPM settings and to announce changes in throttle and intended RPM targets ahead of time. Station keeping in formation flight is sometimes made easier by using slightly more power than the lead aircraft and adjusting speed with speed brakes as necessary.

Approaches present a unique set of challenges. The L-39's engine is not only slow to respond but quite "peaky" in power output, and very small changes in rpm can have a delayed but dramatic effect on speed. For this reason it is a very common practice to fly approaches with the speed brakes deployed, especially when dealing with runways that are very short or situated in mountainous terrain. A last minute go-around situation with low engine rpm can result in a wrecked airplane very easily. Flying approaches with the speed brakes deployed requires higher power settings to maintain approach speed, but in the event of an emergency go-around the engine will already be near its maximum thrust and the speed brakes can be quickly retracted to remove the drag.

Another constant consideration when managing the throttle is the EGT limiter. The L-39's engine can be run at up to 103% N1 RPM continuously, right up to the point where the airplane runs out of fuel. However, using power settings above this value can only be accomplished for a limited amount of time. The duration that full power can be maintained is limited by the current engine temperature and ambient air temperature. If the EGT limiter is engaged and the exhaust gas temp surpasses the 730 degree maximum the engine will shut down in flight to protect itself from destruction. If the EGT limiter is disabled, or the flaps or landing gear are deployed, the engine will run at full power quite literally until it melts in spectacular fashion.

There are two warning lights on the right warning light group to indicate when the engine is entering an overtemp condition. These are "JPT 700" and "JPT 730". If either of these warning lights illuminate, reduce power immediately to less than 90% N1. Give the engine some time to cool down before increasing back to a maximum RPM of 103%. After an overtemp condition be cautious when increasing throttle and pay close attention to the EGT gauge. Depending on engine and ambient temperature the engine may require several minutes to cool down to a safe operating level. It is possible to damage your engine even with the EGT limiter engaged.

The L-39's throttle travel is non-linear and designed to provide higher resolution of fuel input at high power settings, allowing for fine throttle control between 85-106% N1. This means that at low power settings the throttle is quite coarse in response and very little throttle is required on the ground for taxiing. At very light aircraft weights continuous brake pressure may be required to keep the aircraft stationary.

Please see the emergency procedures section of the manual for information on how to deal with engine related emergencies.

Oxygen system use

The L-39's cabin pressurization does not provide sufficient air pressure to ensure crew safety at high altitudes. It is therefore equipped with onboard oxygen tanks. For flights above 18000 feet MSL oxygen *must* be available and activated to prevent hypoxia and pilot incapacitation. If the oxygen supply is not on or is depleted and the aircraft is above 18000 feet pilot incapacitation will occur within three minutes and control of the aircraft will be lost. Your struggle for breath will be audible. If the O2 supply is depleted or not working then execute an immediate and rapid descent to 17000 feet or less.

The O2 system works on a diluter demand method. Turning on the O2 Supply valve on the aft section of the left console allows oxygen to be delivered to the crew. The system begins delivering oxygen when the aircraft passes above 2000 meters (approx 6000 feet) of altitude. If the aircraft descends below this altitude oxygen delivery is suspended. There is sufficient oxygen onboard for approximately three hours of continuous use, which is generally beyond the endurance of the aircraft. If the oxygen supply is depleted it may be replenished by refilling the aircraft's fuel supply at any fuel station in the simulator, or by manually refilling the fuel tanks to 100%. This can only be accomplished on the ground. If planning several high altitude flights in a single session please double check the O2 function and supply before each departure.

When the oxygen system is activated the remaining tank pressure is displayed on the O2 PRESS/FLOW gauge at the very front of the left console. If the oxygen valve is not on then this gauge will read zero regardless of the actual pressure remaining in the tank.

The oxygen system is self contained and does not require engine ignition or any power source.

NOTE: If joining a multiplayer session in progress, or a saved flight at high altitude please make sure your first action after spawning in is to activate and check the O2 supply. You have about three minutes until "lights out".

Right Console Overview

The right console contains all of the electrical system bus switches, pressurization control, GPS unit, anti-ice system controls, external navigation light switches, communication and navigation radios, hydraulic system gauges, and emergency hydraulic controls. These controls and their functions and associated systems will be covered in individual subsections, starting at the forward part of the console and moving aft.

Electrical bus switches, from left to right, top to bottom:

All switches: Forward = ON, Aft = OFF

- BATTERY: Connects aircraft battery to the bus and controls total electrical power to the aircraft. Required ON for any subsystem to be powered.
- GEN MAIN: Connects engine driven electrical generator to bus. Required ON for battery charging.
- GEN EMER: Connects electrical output from emergency ram air turbine to bus.
- ENG INST: Connects engine instrument inverter to bus. Required ON for engine temp/press/EGT gauges to function.

- GYROS: Connects electric gyroscopes to bus. Required ON for heading indicator and attitude indicator to function.
- INVERTER 1: Connects primary 115V AC inverter to bus.
- INVERTER 2: Connects secondary 115V AC inverter to bus.
- GNS 430: Connects GPS unit to bus. Required ON for GPS to function.
- RADAR ALT: Connects radar altimeter to bus. Required ON for Radar Altitude gauge to function.
- DE-ICE: Connects engine de-ice system to bus. Required ON for engine and windshield de-ice function.
- AVIONICS: Connects communication and navigation radios to bus. Required ON for these to function.
- TANKS: Connects wing tip fuel tank pressurization pump to bus. Switch OFF to disable WING TIP TANK warning light.

Cockpit pressurization lever (*See illustration on previous page.*)

- Lever Forward: Cockpit pressurized, canopy sealed, air conditioning on
- Lever Aft: Cockpit pressurization and air conditioning system off, canopy unsealed

The L-39's cockpit is pressurized up to a maximum cabin altitude of 2000 meters by jet engine bleed air. Above 18000 feet MSL the pressurization pump can no longer maintain adequate cabin pressure and oxygen use is required. When this lever is forward the L-39's cockpit is pressurized and the canopy seals are filled with nitrogen to seal the cockpit from air pressure leaks. This control should always be placed in the forward position before flight. Failure to do so may result in pilot incapacitation if flying above 12000 feet MSL.

Once canopies are closed, sealed, and pressurized, check for positive reading on cockpit pressure differential needle on the front panel.

NOTE: If either canopy is unlocked and opened, the pressurization lever will disable and move aft automatically. The handle must be placed forward again to re-seal and repressurize the cockpit. The system cannot be enabled if either canopy is open. If the system is disabled the AIR CONDIT OFF light will illuminate on the warning light panel.

If pressurization is lost due to engine failure at medium or high altitudes the CABIN PRESSURE light will illuminate on the warning light panel. In the case of engine failure in flight the cockpit will depressurize rapidly. If this occurs, ensure the oxygen supply is on and descend to an altitude below 12000 feet as soon as possible.

GPS

This GNS430 GPS unit as fitted in the L-39 contains all of the same functionality as the standard FSX one. A complete discussion of GPS functions and navigation is beyond the scope of this document. Please see the FSX Help and tutorial system for more information on GPS navigation. Night illumination of the GPS is tied to the instrument lights switch on the left console. If either red or white instrument lights are activated then the GPS buttons will illuminate as well.

Navigation Lights / De-ice switch group

1. NAV LIGHTS: Activates external wingtip and tail navigation lights.
2. STROBES: Activates wingtip strobe lights.
3. BEACON: Activates dorsal anti-collision beacon light.
4. ANTI-ICE: Three position switch, MANUAL MODE ON (forward), AUTOMATIC MODE (middle), and OFF (aft, default position) Use mouse wheel to control.

Anti-ice System Operation

The L-39 is equipped with an anti-ice system to protect the engine and front windscreen from ice accumulation. The aircraft has NO surface de-ice ability. The L-39 is therefore not certified for flight into known atmospheric icing conditions and if such conditions are

encountered every effort should be made to get the aircraft out of them as quickly as possible. The anti-ice system works by taking bleed air from the hot second compressor stage of the engine and feeding it back into the engine air intakes and blowing it over the front windscreen to melt ice.

The anti-ice system has two modes of operation, automatic and manual.

Automatic mode: In the automatic mode (middle switch position) the aircraft's ice sensor is activated and if ice is detected the anti-ice system will automatically engage. When the sensor detects icing conditions a blue snowflake symbol will appear on the warning light group and if in the automatic mode the anti-ice will activate shortly after.

Manual mode: In the manual mode the de-ice system is always engaged whenever the engine is running.

If the de-ice system is active the DE-ICE light will illuminate on the warning light group.

ENGINE ICE: The L-39's engine is very susceptible to suffocation by ice and if you fly into known icing conditions you may experience engine failure within minutes. Once the engine has failed you will have no bleed air to melt the ice with and therefore no way to restart the engine. You've been warned!

CANOPY ICE: If you fly the aircraft through clouds for any period of time you may accumulate some ice on the windscreen even if icing conditions are not present. This is a side effect of a supercooled object (the aircraft) passing through suspended water vapour and is not generally serious. If you accumulate ice on your windshield and canopy place the anti-ice switch into the MANUAL position. Both the engine and canopy de-ice will activate and it should clear quickly. Ice will also melt from your windshield by descending into warmer clear air. Ice can accumulate even on very hot days when flying through clouds due to the very cold temperature of the aircraft's skin during flight. Canopy ice will not be cleared if the system is in automatic mode.

SURFACE ICE: If you accumulate ice on your aircraft you will see it on the wings, nose, and tail surfaces. If you see visible ice on the wings it really is time to "get out of dodge". Remember the L-39 cannot de-ice its wings and performance will suffer dramatically the longer you remain in icing conditions.

NOTE: Shared Cockpit flight introduces some extra anti-ice considerations due to FSX weather mismatch problems in multiplayer. These are covered in the Shared Cockpit / Multiplayer section of the manual.

Radio Stack

The L-39 uses a modern "Garmin-like" group of communication and navigation radios. There are two communication radios, two VOR/ILS navigation radios, an ADF reciever, distance measuring equipment for NAV 1 and 2, a transponder, and an audio control panel for those who like listening to morse code while they fly. These radios contain all of the same functionality as FSX's default ones and are simplified for speed and ease of use rather than absolute accuracy of buttons and functions. In an L-39 there isn't time to fiddle with radio buttons much.

To change COMM 1 & 2 or NAV 1 & 2 radio frequencies: Scroll your mouse wheel over the standby frequency numbers to change them to the desired values and then click the swap button (double arrow) under each to swap them with the active frequency. The previously active frequency will be placed into the standby slot.

To change ADF or transponder frequencies simply scroll your mouse wheel over the numbers.

Audio Panel: At the bottom of the stack is an audio selector panel so that you can audibly verify that you have the correct station tuned for any given radio. Personally, I prefer some kickin' House Music while flying!

Night illumination of the radios is controlled by the instrument light switch on the left console. If either white or red instrument lights are selected the radio stack will illuminate as well.

A complete discussion of radio navigation and communication is beyond the scope of this document, please see relevant sections in the FSX help and tutorial system for more information.

Hydraulic System Overview

The landing gear, flaps, ram air turbine, wheel brakes, and speed brakes on the L-39 all require hydraulic pressure for their operation. To ensure operation of these critical

components the L-39 features a robust hydraulic system with built in redundancy for safety. The hydraulic system has two separate reservoirs: a main reservoir which is used for normal flight operation, and an emergency backup reservoir. The main hydraulic system is continually pressurized by an engine driven pump and provides pressure to the aforementioned items during all normal phases of flight. The emergency hydraulic system is four times larger than the main and is a semi-sealed system. When the jet engine is running the engine driven pump pressurizes both the main and emergency systems. During an engine failure the engine driven hydraulic pump fails as well of course, which means the main system loses pressure rapidly. If the main hydraulic reservoir pressure drops too low then landing gear, flaps, and brakes etc quickly become inoperative. Therefore an interconnect mechanism is provided, allowing the emergency reservoir pressure to feed back into the main reservoir, temporarily restoring power to these functions so that the aircraft can be landed safely.

Hydraulic system pressure gauges

This instrument provides readings of currently available pressure in both the main and emergency hydraulic reservoirs. The left needle shows pressure in the main system and the right needle shows pressure for the emergency system. The main system's pressure is dependent to some degree on the hydraulic pump's rpm, and so will vary somewhat with engine rpm, reading higher at high throttle settings and lower at idle. When a loss of hydraulic pressure is experienced either from system failure or engine failure, the main system pressure needle will drop rapidly to zero and the HYD SYS FAIL light will illuminate on the warning light panel. When the hydraulic system interconnect is activated the pressure reading in the main system should restore to near normal level. This instrument should always be checked prior to approach and landing to verify sufficient pressure is available for flap, landing gear, speed brake and wheel brake operation. Normal pressure readings for the main reservoir are between 120 and 155 kilopascals per cm².

Emergency hydraulic levers

Three of the four red handled levers on the right console are bypass controls for the hydraulic system in the event of hydraulic system or engine failure. The fourth controls the emergency electrical generator.

1. HYD SYST INTERCONNECT: This lever controls interconnection between the main and emergency hydraulic systems. If hydraulic pressure is lost in the main reservoir pull this lever to interconnect and recharge the main reservoir from the emergency backup system. Using the interconnect will restore landing gear, flaps, speed brakes, and wheel brakes to normal operation. When this lever is forward (default) the two systems are separate. When in the UP position the two are interconnected. When the lever is actuated there may be a slight delay in pressure needle operation as interconnection valve opens or closes.
2. GEAR: In the rare case of a complete hydraulic system failure the landing gear may become totally unresponsive, even with the interconnect on. If the landing gear will not deploy, pull this lever to the full up position by clicking on it. Actuation of this lever will release all hydraulic pressure from the lines holding the gear in the up and locked position and the landing gear will fall into place via gravity alone. NOTE: To release the gear door locks and enable gravity drop of the gear, the landing gear selector handle must be in the DOWN position.
3. FLAPS: This is the emergency flap deployment lever. The L-39's flaps in normal operation require both hydraulic and electrical power. If electrical power is lost the normal flap deployment buttons will become ineffective and the flaps will not deploy. Pulling this lever into the UP position will bypass the electrical restriction and deploy the flaps to the full DOWN position. NOTE: Use of this lever also bypasses the 300 km/h self protection circuit for flap operation. They will deploy to the full down position regardless of airspeed. If airspeed is higher than 300 km/h during lever actuation the flaps may become jammed or seriously damaged, badly effecting flight performance! Returning the lever to its default (down) position will retract the flaps to the full UP position if they are deployed and become unresponsive.
4. EMERG GEN: Pulling this lever will manually deploy (up) or retract (down) the L-39's ram air turbine generator. NOTE: Hydraulic pressure must be available in the main reservoir for the turbine to deploy or retract.

Ram Air Turbine (RAT) Operation

The L-39 is equipped with a ram air turbine (abbreviated to RAT from this point on) to provide backup electrical power in the case of generator, engine, or electrical system failure. The RAT consists of an impeller and 9 kilowatt generator in a housing located in the right side belly of the aircraft, aft of the main landing gear wells. When deployed it drops from its housing into the airstream below the aircraft and uses the pressure of the incoming air to generate electrical energy. The RAT is capable of providing electrical power to all of the aircraft's systems when deployed provided that aircraft airspeed is in excess of 180 km/h. Below this airspeed the RAT does not supply sufficient energy and the aircraft's electrical supply will revert to battery power alone.

The RAT operates in both automatic and manual deployment modes. The automatic mode is always on and the RAT will deploy whenever the system senses a loss of generator voltage and/or engine failure. If the RAT deploys automatically it will begin providing electrical power immediately. The EMERGENCY GENERATOR light will illuminate briefly when the rat is in the process of being deployed or retracted and will then extinguish. If the aircraft's main generator returns to normal operation or the electrical fault is corrected then the RAT will shut off and retract again automatically, provided that hydraulic pressure is available. If the RAT is deployed but not providing sufficient electrical power to operate aircraft systems the EMERGENCY GENERATOR warning light will flash continuously.

During an automatic deployment the RAT's manual control lever function will be locked out precluding retraction by this method. It can be forced to retract in one of a few ways though. To force RAT retraction you can turn the GEN EMER electrical bus switch off (aft), or turn the NETWORK switch in the rear cockpit off (aft). NETWORK switch operation has many other ramifications though and should be used only as a last resort. Operation of the network switch will be covered in the Rear Cockpit section of the manual. The RAT will also automatically retract if it senses landing gear wheel touchdown, again provided that hydraulic pressure is available.

If the RAT is deployed manually via the control lever then the automatic retraction/extension mechanism is disabled until it has been manually retracted again.

Centre Pedestal Overview

The centre pedestal below the front instrument panel contains controls for the signal flare dispenser, roll and pitch trim indicators, and pressure indicators for the wheel brakes and emergency brake. Weapon arming and release controls are also contained here on the real L-39 but as they have no real application in FSX (yet...) their functions are not modeled.

Showing or Hiding the control column:

Because the L-39's control column is quite tall and partially blocks some instruments, possibly creating problems for those without Track-IR, provision has been made for hiding it. Click on the leather boot at the base of the control stick (green area shown in the image) to hide or unhide the stick. The control stick in the rear cockpit can be hidden separately in the same way.

Centre Pedestal controls

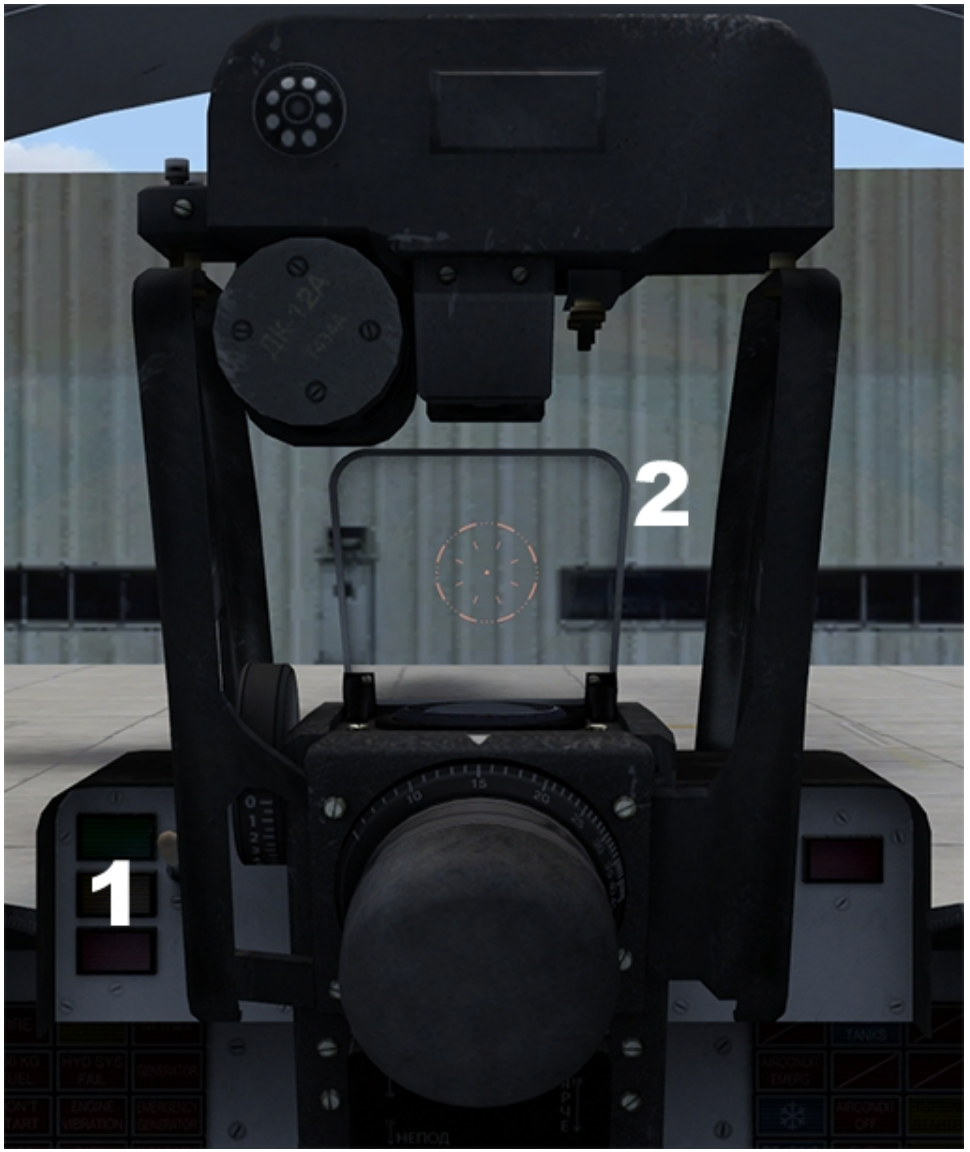
1. Trim Neutral and Pitch Indicators: The two blue indicators will illuminate whenever aileron or pitch trim is in the neutral position. The indicator below them displays current pitch trim position.
2. Wheel Brake Hydraulic pressures: Each needle shows the respective application of wheel brake pressure for the left and right wheels.

   NOTE: The L-39 is equipped with an anti-skid system for the wheel brakes to prevent wheel lockup on wet runways. If electrical power is lost or the Battery switch is off this system is disabled.
3. Emergency Brake Hydraulic pressure: Needle shows wheel brake pressure applied by emergency/parking brake lever. Reads zero when brake disengaged.

Electro-Optical Gunsight

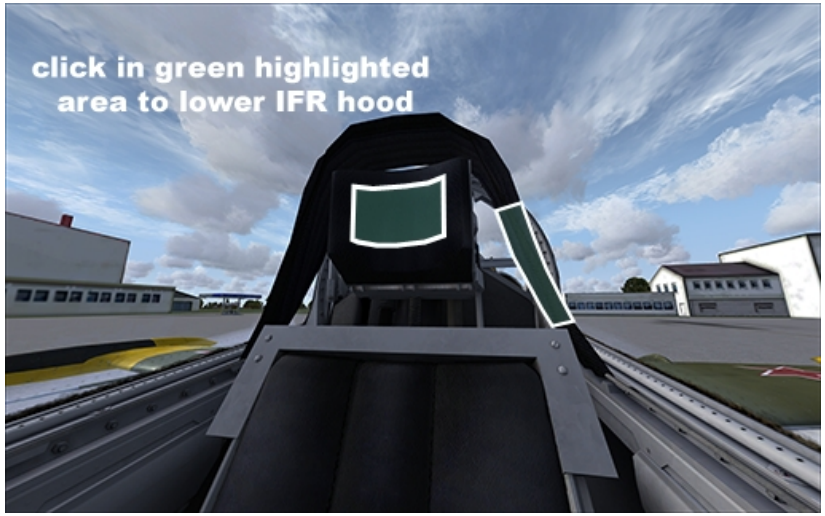
The military variants of the L-39 are equipped with an electro-optical collimated gunsight for simulated weapons delivery and gunnery practice.

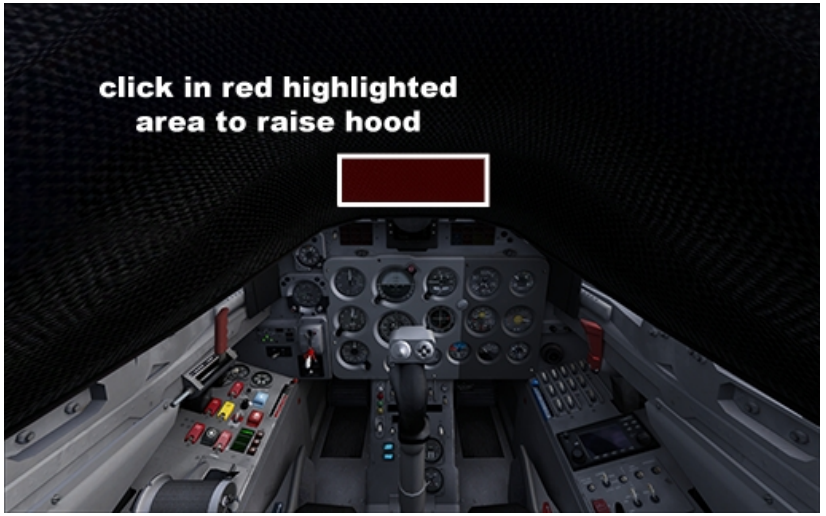
1. Gunsight power switch: Switch to UP position to provide power to gunsight reticule projection. Battery switch must be on.
2. Gunsight combiner glass. The gunsight is collimated and the reticule will only appear when line of sight through the glass is correct and straight ahead. The reticule has a narrow field of display.



Instrument Flight Practice Hood

Four of the L-39 variants are equipped with IFR practice hoods for the front cockpit. When lowered the hood blocks out all of the outside view from the front seat but does not obscure any of the gauges, allowing you to practice instrument flight without the hassle of framerate draining clouds. The IFR hood is animated and extends and retracts with a single click. To lower the hood, turn your view around to face aft in the cockpit (mouse left click + hold down space bar, or Track-IR) and click on the middle of the front seat headrest or left side of the hood, in the areas depicted in green. To raise the hood you can click in the same spot, or for faster retraction on the centre lowest part of the hood, in the area highlighted in red. The hood can also be raised and lowered from the rear cockpit using the left side click spot.





Introduction and Overview

To enter the L-39's rear virtual cockpit press the "A" or "SHIFT-A" keys one or more times. These keys allow you to cycle between the following virtual cockpit cameras in a loop: Front cockpit, GPS closeup, radio stack closeup, and rear cockpit.

The L-39's rear cockpit is specifically designed for flight instructor use, allowing training of student pilots seated in the front cockpit, and has the secondary role of carrying a passenger. Although not all of the front cockpit's controls are duplicated in the rear, most of the primary and emergency controls are, as well as all of the flight instruments. Most of the controls in the rear cockpit work just as they do in the front, and so to avoid redundancy this section of the manual will cover only those items that are unique to the rear cockpit or those that work differently from their front cockpit counterparts. Although the rear cockpit contains all of the primary controls necessary to safely operate the aircraft solo in a pinch, there is no duplicate set of communication and navigation radios, electrical bus functions, de-ice system controls, or pitot heat, and therefore the L-39 is not certified for intentional solo flight from this station.

The primary intent of including the rear cockpit in this L-39 package is to facilitate and encourage Shared Cockpit multiplayer training flights between multiple Lotus L-39 owners and as such many of the functions in the rear cockpit really have little use in singleplayer operations. I highly encourage you to try Shared Cockpit flight though, to really experience all that this plane has to offer. See the Shared Cockpit & Multiplayer section later on in the manual for tips on getting the most from this incredible feature of FSX.

Left Console

The left console contains most of the same items as its front cockpit counterpart, such as engine start and emergency fuel control, oxygen, flaps controls, and fire extinguisher etc, although they are somewhat differently arranged. The Saphir turbine can also be started from this console but it cannot be manually shut down from here. This console also contains the rear cockpit instrument and flood light controls. These work independently but in the same fashion as those for the front cockpit.

The oxygen valve control, landing light switch, and parking brake are physically connected between the front and rear cockpits. Actuation of these controls from either cockpit affects both cockpits at once.

1. EGT IND. switch: This switch to the left of the rear cockpit throttle handle allows transfer of EGT sensor data between the front and rear cockpit EGT gauges. The L-39's EGT sensor does not provide sufficient voltage to display accurate readings on both front and rear EGT gauges at the same time. Moving this switch to the aft position will send EGT readings to the rear cockpit's gauge, and moving it forward sends them to the front cockpit. The switch is forward by default. Whichever gauge is not receiving EGT data will read zero EGT.

Gear Selector Handle

The rear cockpit's landing gear selector handle controls gear function absolutely, completely overriding the front cockpit selector's commands. The aircraft is setup this way so that an instructor can immediately correct improper or unsafe gear commands from the student in the front cockpit. This landing gear handle has three positions: UP, NEUTRAL (middle position), and DOWN.

When this selector is the middle neutral position (default setting) the aircraft accepts landing gear commands from the front cockpit's selector or from the keyboard using the "G" key. If this handle is in

the UP or DOWN positions the landing gear will respond accordingly and will not accept commands from the front cockpit's selector, nor will the "G" key work to cycle the gear. Returning this handle to the neutral position will restore front cockpit and keyboard gear control.

NOTE: This rear cockpit selector handle can only be actuated by scrolling your mouse wheel up or down over it. It is set up this way to avoid accidental actuation in flight by clicking.

Centre Console

The Trainee Instrument Fault Simulation Panel

The rear cockpit of the real L-39 contains several training aids designed to allow the rear seat instructor to simulate failures to many front cockpit instruments and systems, all of which have been accurately recreated in this FSX version for the purpose of Shared Cockpit mode online flight training. These controls are primarily located on the rear centre console. Whenever any of these instrument failure modes are activated they affect the front cockpit only. All of the rear cockpit instruments will continue to work normally regardless of what combination of failures is selected. This allows an instructor in Shared Cockpit multiplayer to gauge a student's performance in dealing with instrument failures, just as it does in the real aircraft.

When using any of the following failure controls during Shared Cockpit flight it is preferable to activate them whilst the aircraft is flying straight and level for maximum effect. In this way the failures are often not noticed by the student for some time.

NOTE: Unlike all the other switches in the L-39's cockpit, none of these failure controls have sounds associated with them. A side effect of how sounds are coded in FSX is that in Shared Cockpit mode both pilots can hear all switches that are clicked by either pilot. Therefore none of these controls make any noise. You wouldn't want your student to know when you're about to make their life miserable... in the dark... in the rain. That would take the fun out of it! It should however be noted that using any of these controls may cause your front seat student to shout at you a lot once they become aware of the failure.

1. Pitot tube failure handle: When activated (handle to right) this control will simulate a blockage of the aircraft's pitot tubes and will cause the front cockpit's airspeed indicator to give erroneous readings as altitude changes. If enabled the airspeed will read higher than it should as the aircraft climbs, and lower than it should as the aircraft descends.
2. Static port failure handle: This control will simulate a blockage of the aircraft's static pressure port causing the front cockpit airspeed indicator, vertical speed indicator, and altimeter to give erroneous readings. When activated the altimeter will freeze at its current altitude, the vertical speed indicator will become frozen at zero indication, and the airspeed indicator will reverse the error caused by a blocked pitot tube, reading lower than it should as altitude increases.

   Turning both levers to the right will combine both static and pitot failures, and will cause the airspeed indicator, altimeter, and vertical speed indicator to completely freeze, regardless of altitude or speed changes.

   Returning these controls to their default (left) position will restore normal function to the front seat instruments.
3. Compass Failure Switch: When activated (up position) this switch will activate an electromagnet contained in the compass causing it to freeze in its current heading.
4. Dir Gyro failure switch: When activated (up position) this switch fails the front cockpit heading indicator, causing it to freeze at its current heading.

Artificial Horizon Failure Switches

5. Roll: Causes the artificial horizon roll gyroscope to fail. Bank bar will display level flight indication, pitch unaffected.
6. Pitch: Causes the artificial horizon pitch gyroscope to fail. Pitch ladder will display level flight indication, bank bar unaffected.

Right Console

The rear cockpit right console contains duplicate emergency hydraulic and generator handles, which are interconnected with the front cockpit's controls, but very few other functions applicable to FSX, mostly weapon arming and release controls. There is however one very important control located here...

1. Network switch: (*One switch to rule them all...*)

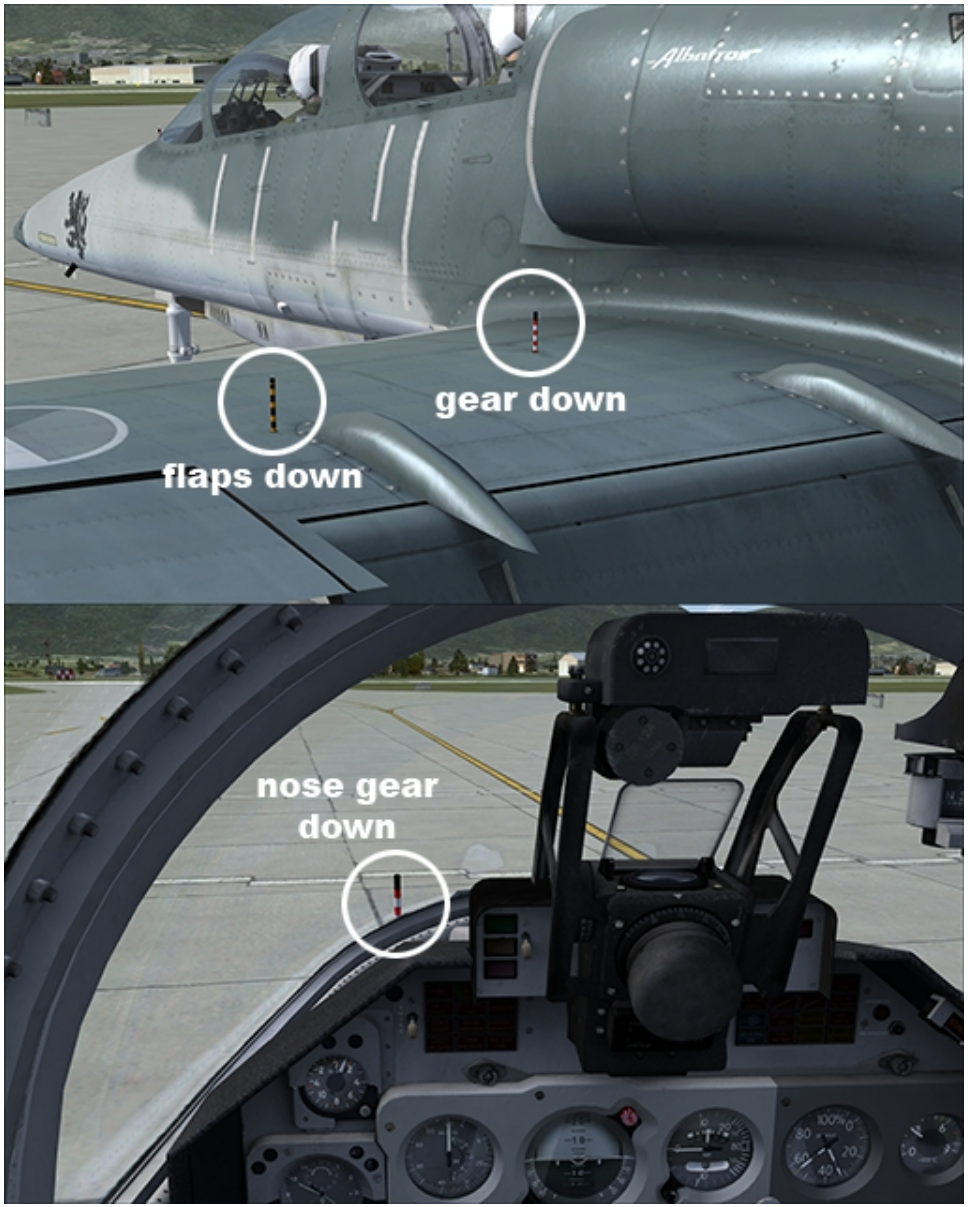
   The network switch controls all electrical power to the front cockpit, with the exception of the radio stack. When in the forward position (default) the switch connects all front cockpit systems to the main electrical bus. Moving this switch to the aft position will cause all electrical power to be lost, allowing an instructor to simulate a generator or electrical failure in the front cockpit. During use of this switch all electrical power is still available to the rear cockpit. While the radios will continue to work many of the radio navigation instruments in the front cockpit's panel will be cut off, making their indications erroneous. The front cockpit's gyroscopes will also fail as they are electrically powered, so the heading indicator and artificial horizon cannot be relied upon. The front cockpit's instrument lights and cockpit flood light will be similarly disabled, as well as flap, trim, and landing gear indications, thereby forcing the student to use the external physical indicators on the wings for verification of flap and gear position. (see below)

   This switch can also be used to force ram air turbine retraction if other methods fail, but should only be done as a last resort.

   NOTE: While the network switch controls power to the front cockpit, the front cockpit still retains the battery and generator switches which control total power to both cockpits and all dependent aircraft systems.

Physical landing gear and flap position indicators

The shape and design of the real L-39 precludes the ability to see the landing gear struts and flaps from the cockpit when they have been deployed and so physical gear and flap indicator barber poles were added to the nose section and wings to give a reliable indication of extension. These indicators are shown in the images below. They are physically attached to the landing gear struts and flap actuators and give a reliable indication of extension in the case of an electrical or normal indicator light failure. When the gear and/or flaps are up these indicators recede into the wings and nose and are not visible. The red and white barber poles indicate gear extension and the yellow and black poles on each wing indicate flap extension.



Integral Boarding Ladders

The L-39 is equipped with integral folding boarding ladders for entry and egress. Press shift-E and then rapidly press the 3 key to deploy or retract them.

Introduction

I believe FSX's new Shared Cockpit multiplayer mode is the single greatest addition to Flight Simulator since 3D terrain. Because of this conviction—and the fact that the real L-39 is uniquely suited for dual-seat training—my primary development goal has been to maintain full shared cockpit compatibility, and push that functionality to its limit.

If you have never tried flying in shared cockpit multiplayer, I strongly urge you to give it a shot. Most people describe their first shared cockpit experience as wonderful and quite surreal, after possibly decades of solo simulator flight. At the one end, it's an immediate and highly satisfying way to learn new skills from a more seasoned pilot, or instruct someone less experienced than yourself, particularly in instrument flight.

At the other, shared cockpit flight offers a unique and often relaxing experience as a passenger. There's no FSX experience quite like a flight through the Swiss Alps at sunset as a passenger in shared mode, with the freedom to admire FSX's impressive scenery instead of worrying about the performance of your aircraft, not to mention the social aspects and opportunity to form new friendships.

All that is required to fly in this mode is:

- Another person who has purchased this Lotus L-39
- the same version of FSX (Acceleration, SP2, and FSX Gold are all compatible with each other)
- a decent internet connection, DSL or Cable

In order to help Lotus L-39 owners find partners to fly in Shared Cockpit and formation with, a special forum has been set up on the Lotus Simulations website for this.

Please visit the "L-39 Multiplayer Speed Dating Service" forum at
http://www.lotussim.com/forums

For any multiplayer flight a good quality microphone headset for voice communications is strongly recommended but not strictly required.

Shared Cockpit can be done over a local area network connection as well, with greatly increased performance over normal internet use.

Limitations and considerations

There are a few limitations and operational considerations to flight in Shared Cockpit mode that should be considered by both pilot and copilot.

Prior to shared flight

When setting up a session with the intent of flying in Shared mode consideration must be given to the position of controls and switches. FSX will synchronize all of the aircraft's controls and switches between the pilot and copilot's systems when the copilot joins the pilot's aircraft, however it is very important that the host does *not* use or alter any controls while the copilot is in the process of joining. Operation of any controls (such engaging the parking brake) during the joining process can result in a mismatched state between the two systems. One pilot might see the parking brake as engaged after joining, while the other sees the opposite.

This L-39 employs a great deal of custom code that can end up mismatched if controls are moved during shared cockpit connection, so it is mandatory that the host leave the aircraft alone until the copilot has finished joining and is fully loaded into the simulator. Once you see the message "(player X) has joined your aircraft" scroll across the top of your screen you are then free to use the aircraft's controls as you see fit.

Transferring control

Shared Cockpit mode is set up so that one pilot has primary control of the aircraft's control surfaces and throttle, and the other pilot does not. The pilot without primary control can still use all other systems and controls in the aircraft though.

Once both pilots are loaded into the aircraft the primary flight controls can be transferred back and forth at any time. To request control of the aircraft yourself, or offer control to the copilot press SHIFT-T. Similarly, to accept control of the aircraft if offered, press SHIFT-T. Whenever a control transfer offer or request has been initiated an appropriate message will scroll across the top of your screen.

Engine Startup

Due to the way the L-39's complex fuel controller works, and how FSX determines permissions in Shared Cockpit, the engine cannot be successfully started by the co-pilot. If you wish to start the aircraft's engine then you *must* have primary control of the plane first. Shutdown of the engine however can be accomplished by either pilot or copilot.

Weather Synchronization Concerns

The operation of some systems, notably the de-icing system, are dependent on weather conditions. Unfortunately in multiplayer FSX does not always maintain proper synchronization of weather conditions between the pilot and copilot's systems. It is common over time for the weather conditions that each pilot sees to deviate. Because of this one pilot may see ice on the windscreen when flying through clouds, while the copilot sees no ice or clouds at all. To delay weather mismatches in Shared mode it is advised that both pilot and copilot should set their "Weather Rate of Change" slider to "none". This slider is located in the Options->Display Settings->Weather menu. Using FSX's Real World Weather (with updates) setting when setting up a multiplayer session seems to result in better performance in this regard, compared to user defined weather or weather themes.

The L-39 has not been tested with Activesky or any other aftermarket weather programs as they are generally not multiplayer compatible at all, so your results if using one of these may vary.

Gamespy vs Direct Connection

Shared Cockpit connection can be accomplished either through Gamespy multiplayer mode or through direct IP connection. Direct IP is by far the better method as Gamespy has some inherent background internet traffic overhead which can add unwanted lag to a session. It's a bit unintuitive at first glance, but direct IP internet connection is available through FSX's LAN mode multiplayer option. Instructions on how to perform a direct IP connection for Shared Cockpit, for both the host and client are included in a subsection below.

Shared Cockpit in large multiplayer sessions

If using shared cockpit mode in a large online session with many other aircraft present, or acting as the host of a session while sharing your aircraft the other pilots in the session may sometimes see your aircraft flying erratically or sliding sideways off into space when your copilot has control. This is a known issue with the way FSX manages data transfer between hosts and clients in multiplayer and unfortunately affects all aircraft in SP2 and Acceleration.

Terrain

With the availability of FSGenesis mesh and other terrain products some consideration must be given to terrain mismatches. Both the pilot and copilot should set their FSX terrain display settings to exactly the same values in the options → display settings → scenery menu. Although not required it is preferable that both host and client have the same aftermarket mesh addons installed for best results. If flying at low level through mountainous terrain with differing mesh, it is best to leave a little more clearance between your aircraft and the ground than you might normally. With different terrain settings or mesh products installed it is quite common for one pilot to see their aircraft as clear of ground while the other is seeing their plane plow through it. This is quite humourous the first time it occurs but after repeated impacts during nap-of-the-earth flight it can get a little tiresome.

Instructor etiquette

As a training tool, especially in the L-39, shared cockpit provides some wonderful opportunities for instructing pilots less skillful than yourself, however for the best

experience (for both parties) please agree with your student on some sort of a flight plan prior to departure. Using the L-39's instrument failure modes on an unwary student, especially in IFR conditions, can be a major turnoff and can result in a frustrated and quick disconnection, to say nothing of putting the student off from the joys of Shared flight. Plan your sessions out with a prospective student and make sure they are comfortable with being given unexpected failures to deal with...before takeoff.

Rapid manoeuvres

Over any network, no matter how fast, there is always some inherent lag. Using rapid or violent control inputs may result in some hitching or jumping of the aircraft on the co-pilot's system, as his or her machine struggles to keep their aircraft synchronized with the pilot's system. Using smooth and progressive control inputs will result in a much better flight experience for the co-pilot.

Voice Comms in Shared Mode:

Although FSX allows players to use a "hot" or "open" mic setting in Shared Cockpit, where they can always hear each other, it is highly recommended for both parties to use "push to talk" mode instead. The L-39 is a complex aircraft and in Shared Cockpit mode there is a lot of data being transferred between the two computers. Using push-to-talk voice communications will reduce bandwidth consumption and result in a smoother flight experience for both pilots. Of course the other plus is that you don't have to listen to your co-pilot's heavy breathing or sneezes!

Rocking motion while taxiing

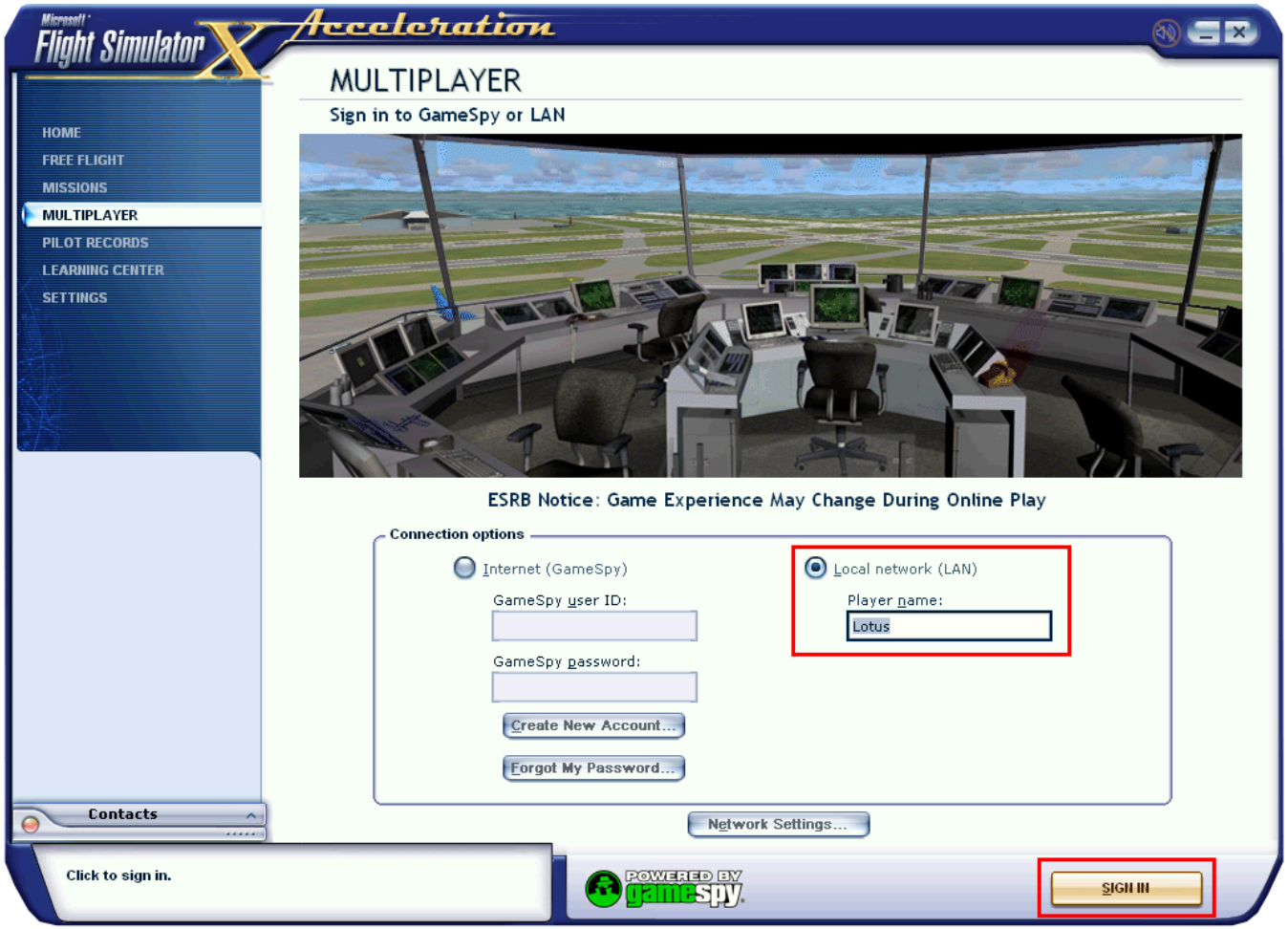
FSX unfortunately has a small bug in its wheel contact point code which can cause an oscillation or rocking motion when narrow wheelbase aircraft (such as the L-39) are taxiing at very slow speeds. You may experience this rocking movement during taxiing if you are not in primary control of the aircraft. There is no known solution for this issue, but the rocking should stop once the aircraft becomes stationary or if speed increases past 5 knots or so on the ground.

How to set up a Shared Cockpit session via direct IP

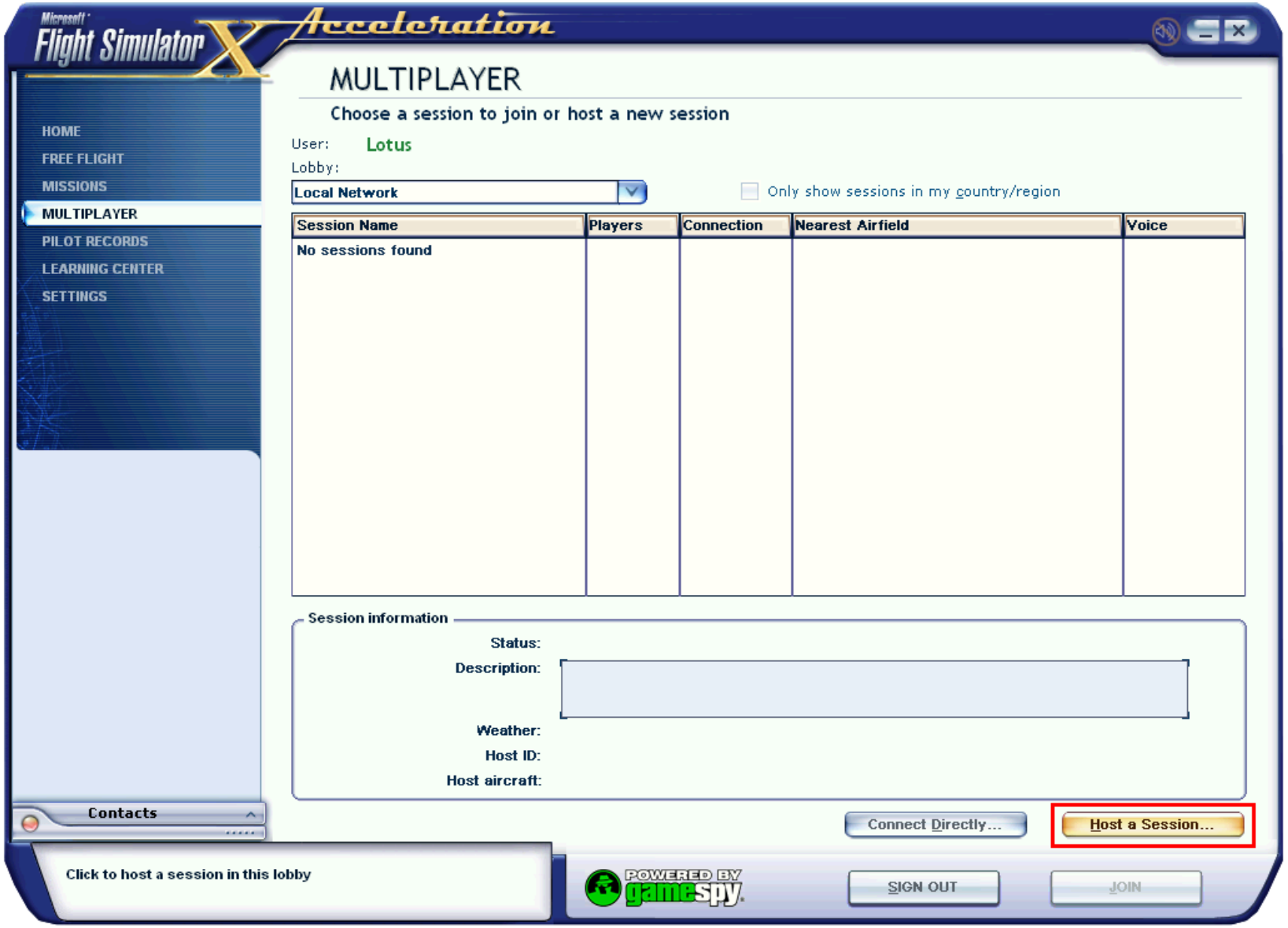
Hosting a Shared Cockpit session

If you are going to host the session, please follow these steps to set up your session and share your aircraft:

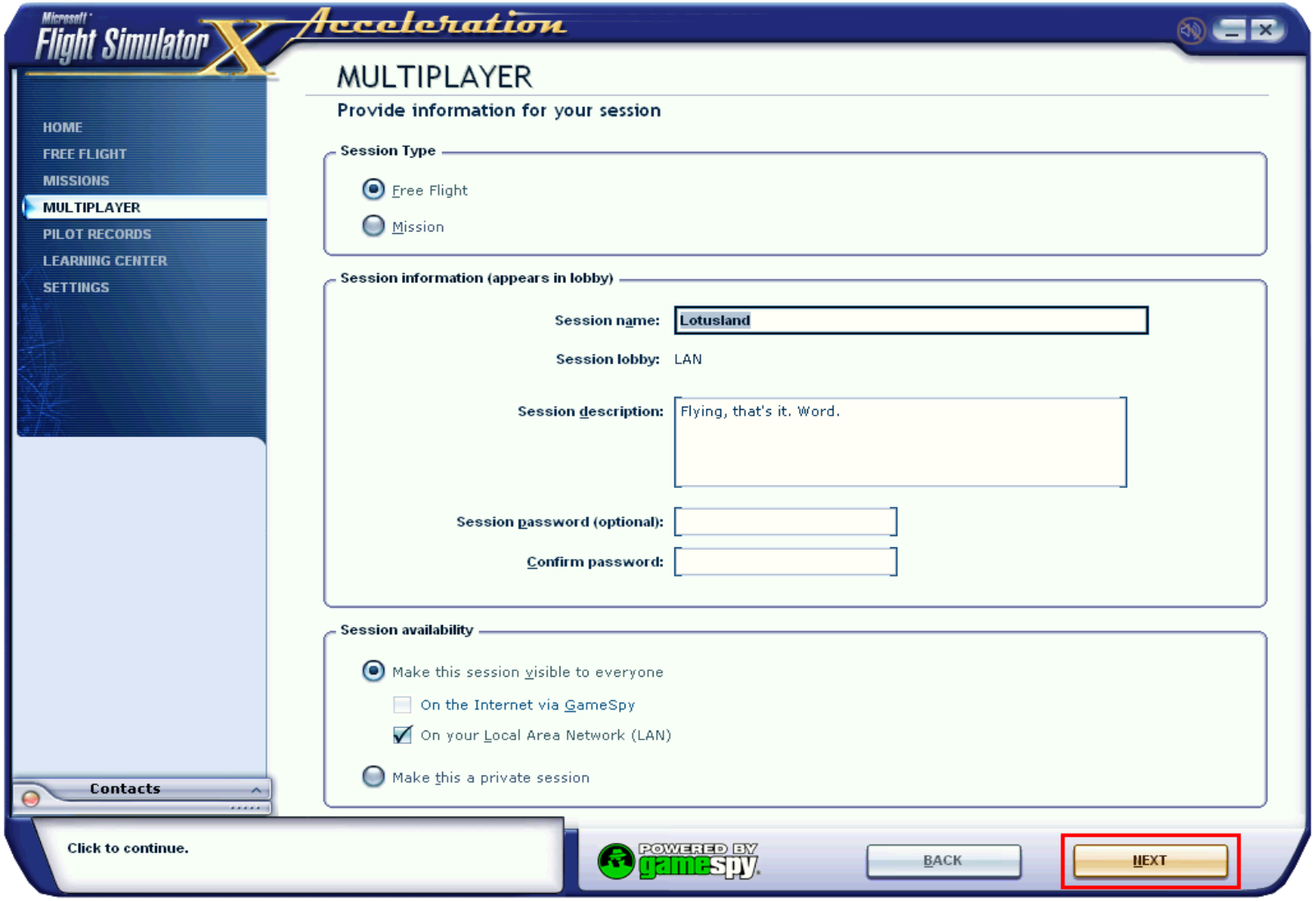
1. Click the Multiplayer tab in the main FSX menu screen. Select Local network (LAN) mode, and enter your own player name in the window provided.



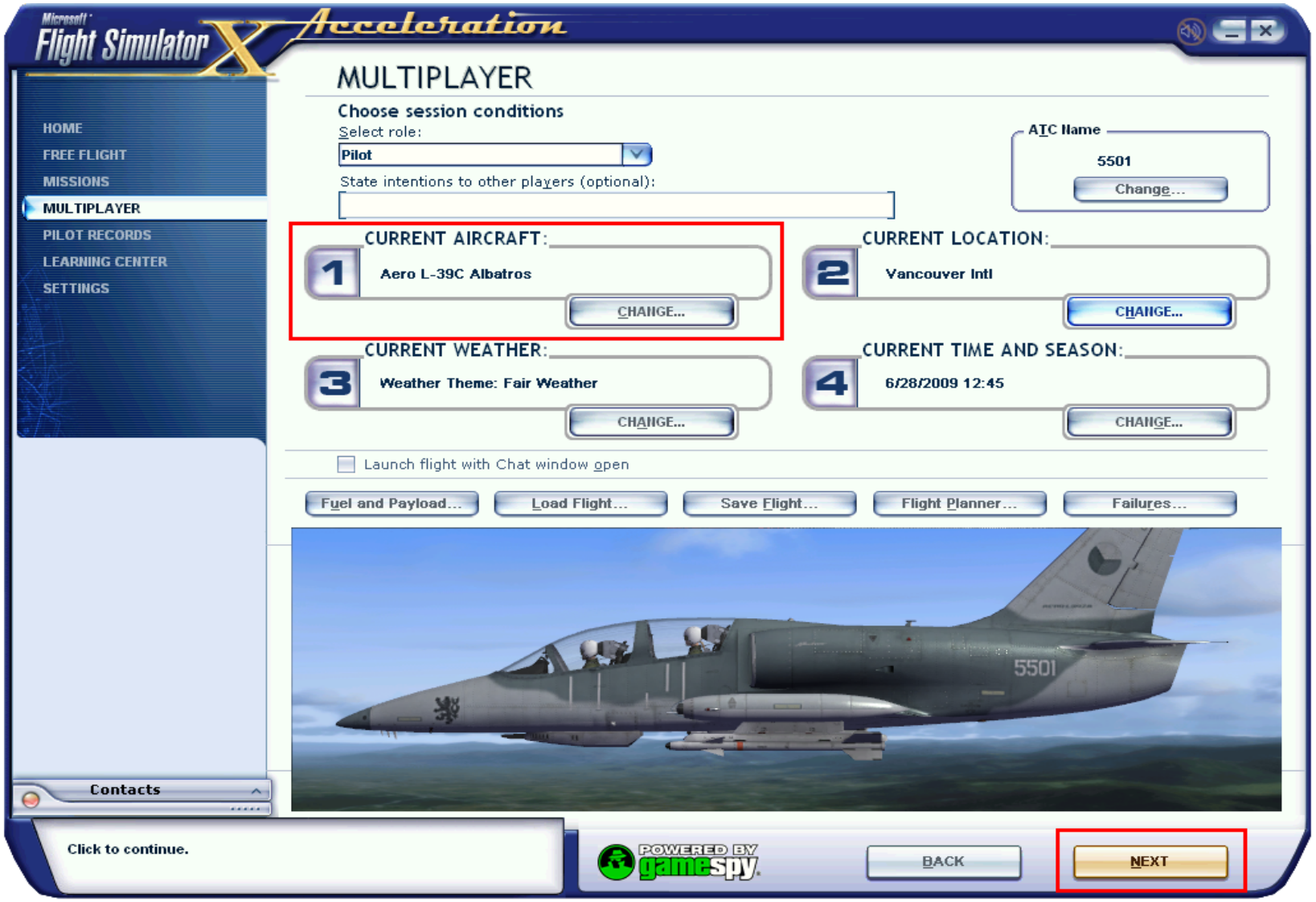
2. Click the "Host a Session" button.



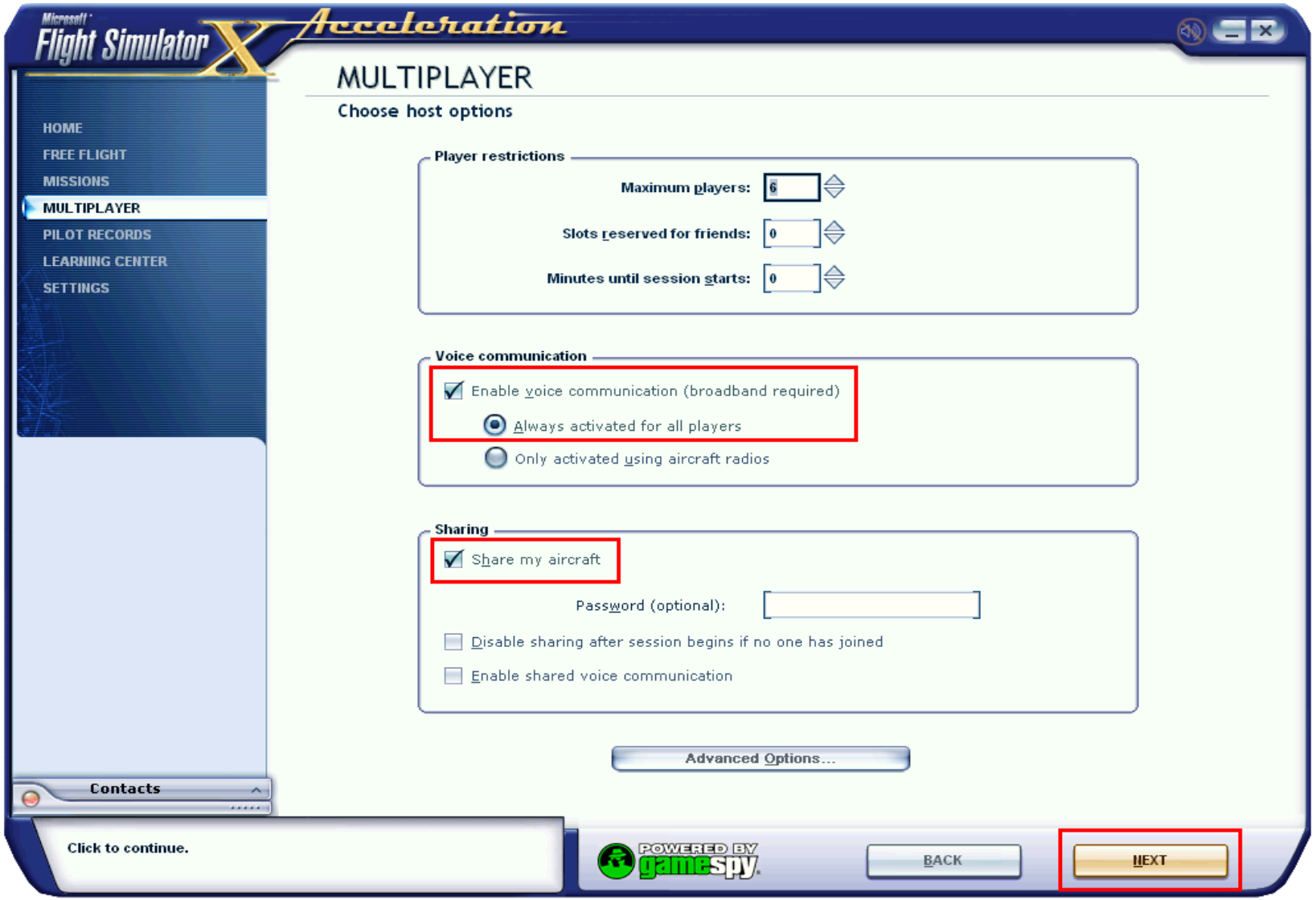
3. Select session type "Free Flight", enter a name for your session, enter a brief description, and then click next.



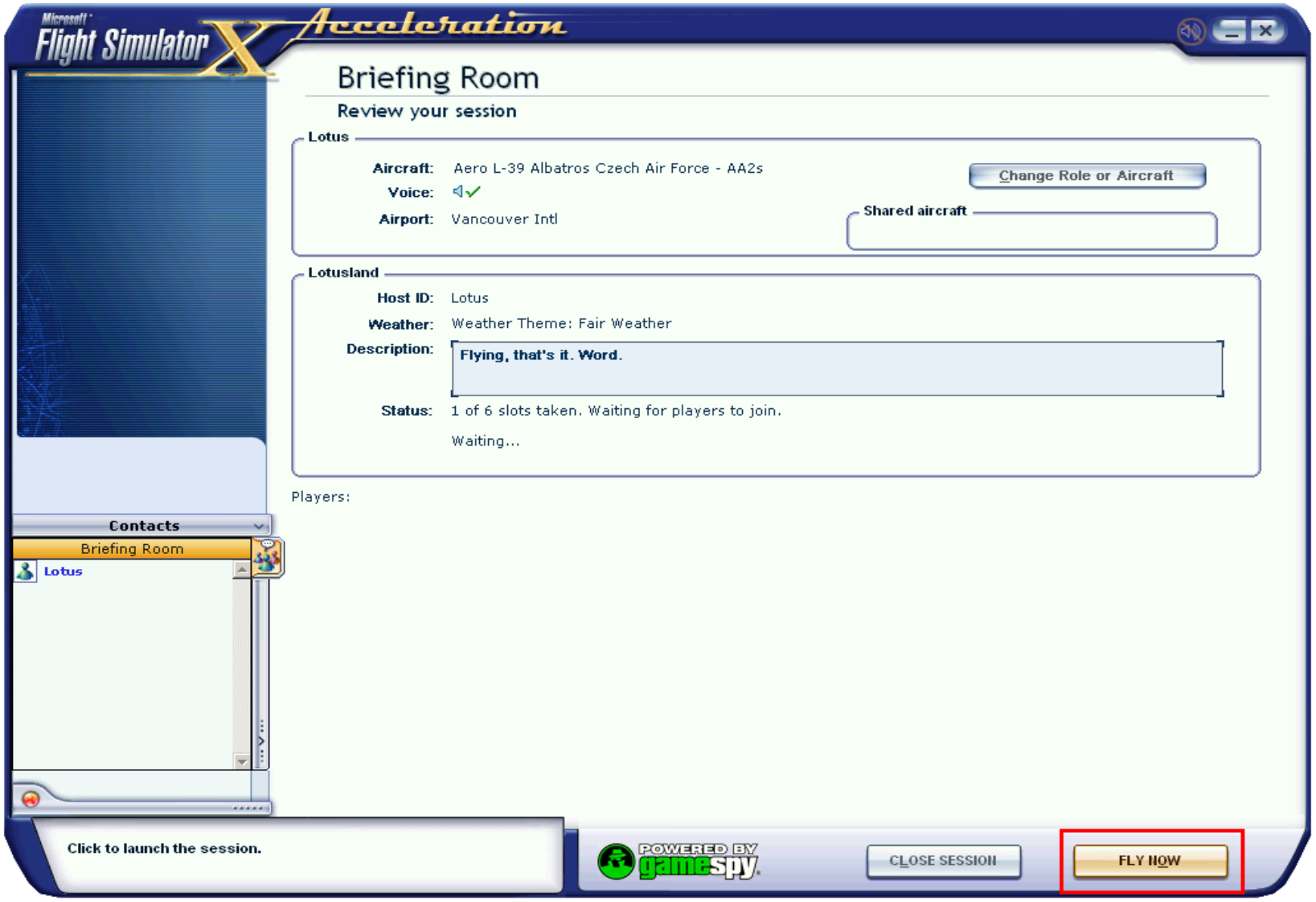
4. Choose a Dual Cockpit L-39 variant for your aircraft, and set your location, weather, and time of day as desired, just as usual in free flight. When done click next.



5. Enable voice communication, always activated for all players. Select "Share my aircraft". You can enable "shared voice communication" below this if you want your microphone to be in "hot" or "always on" mode but leaving this selection unchecked will be better for lag and performance. When finished click next.



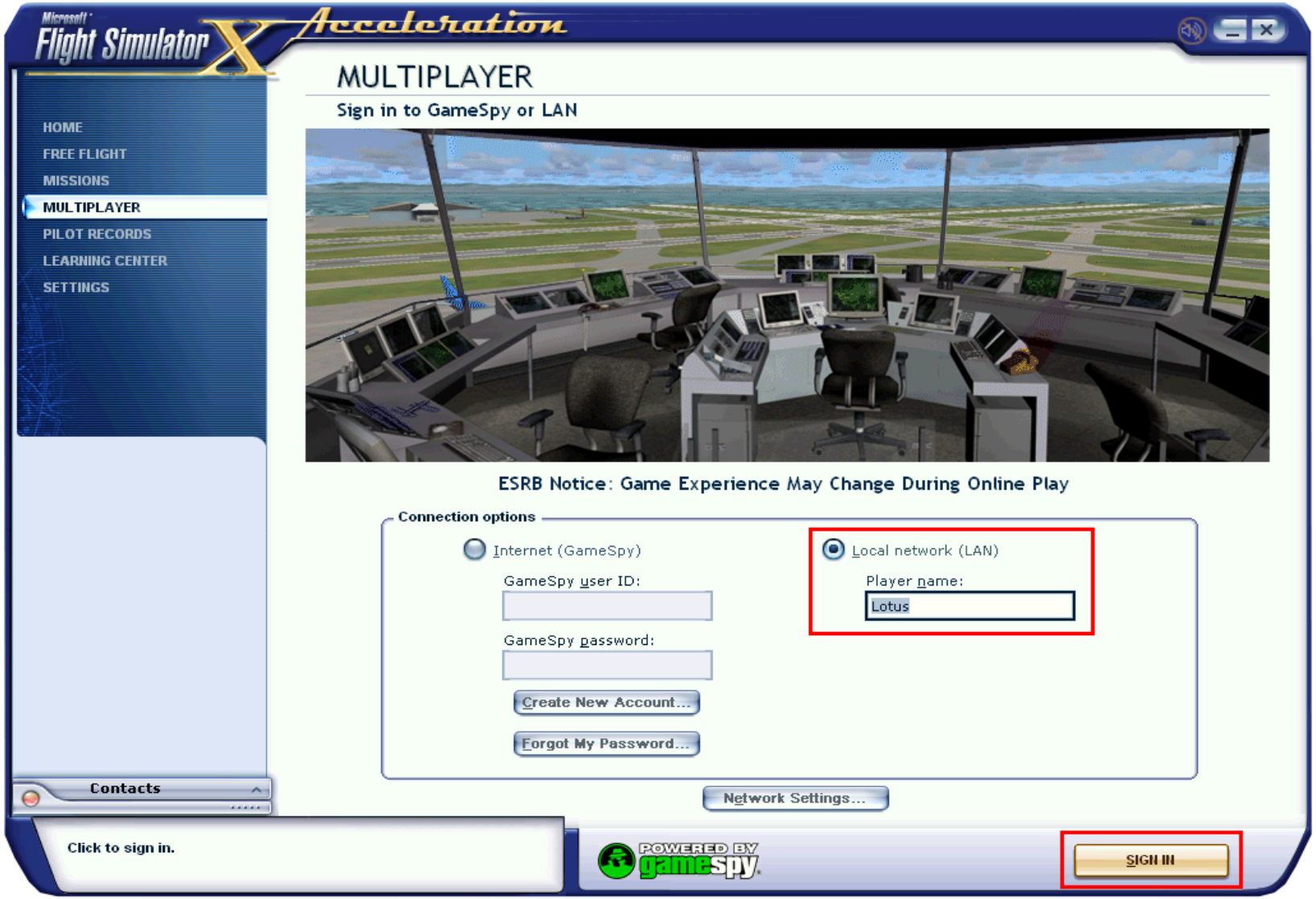
6. Your session is now hosted and players can join. You can click Fly now, or wait for your copilot to join your aircraft before starting the session.



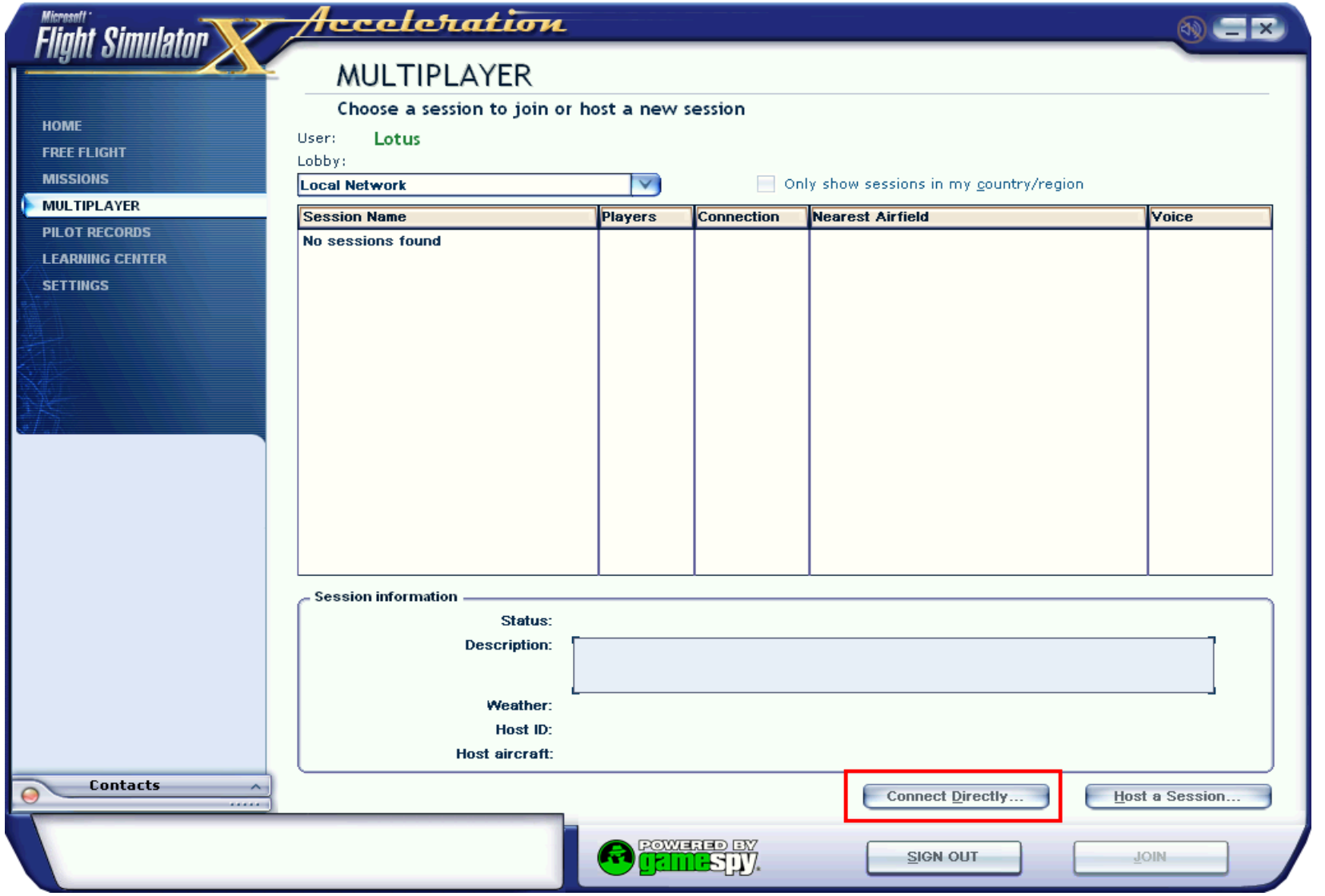
Joining a Shared Cockpit session

If you are joining a session to join a host's shared aircraft then follow these steps below:

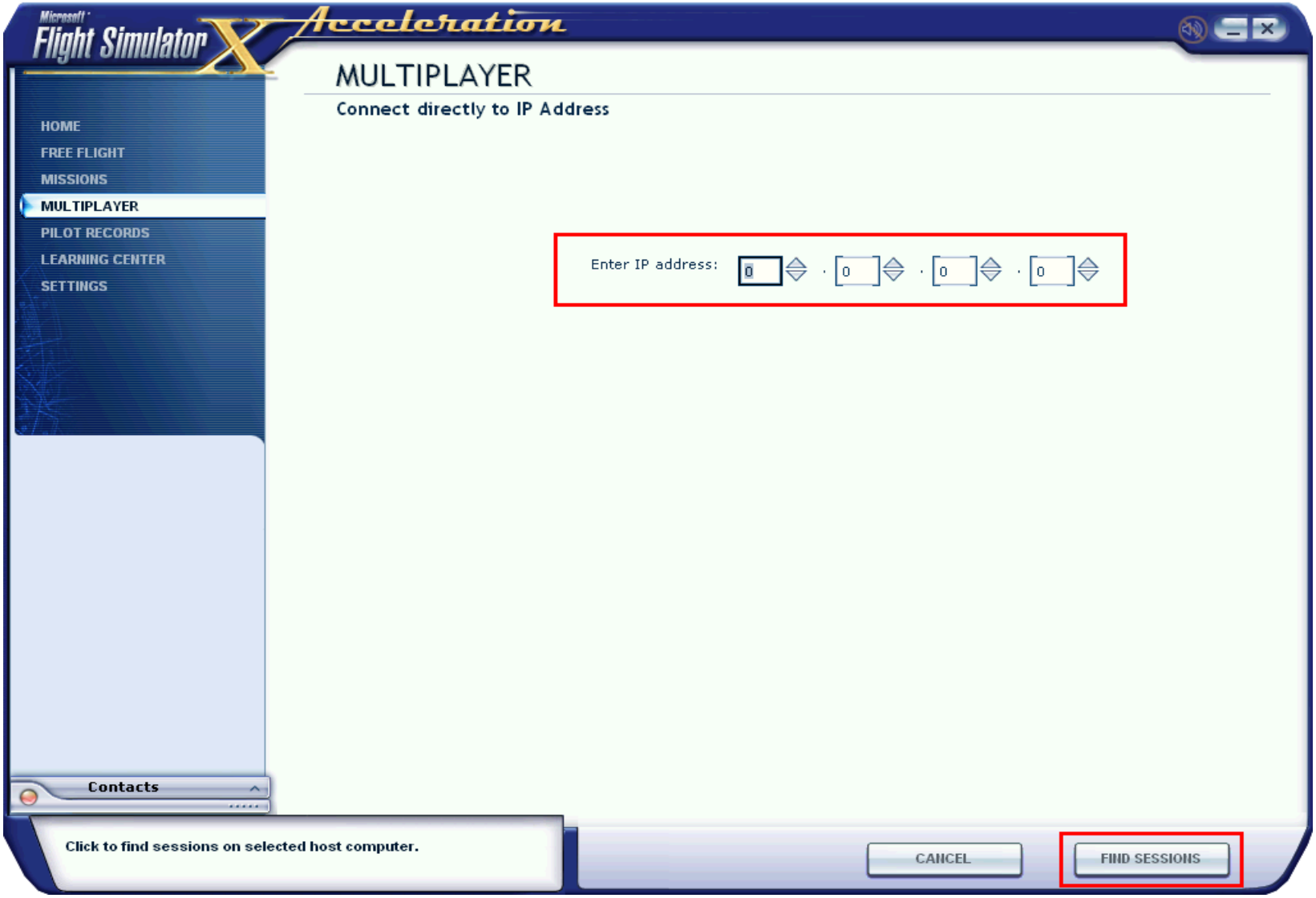
1. Click the Multiplayer tab in the main FSX menu screen. Select Local network (LAN) mode, and enter your own player name in the window provided.



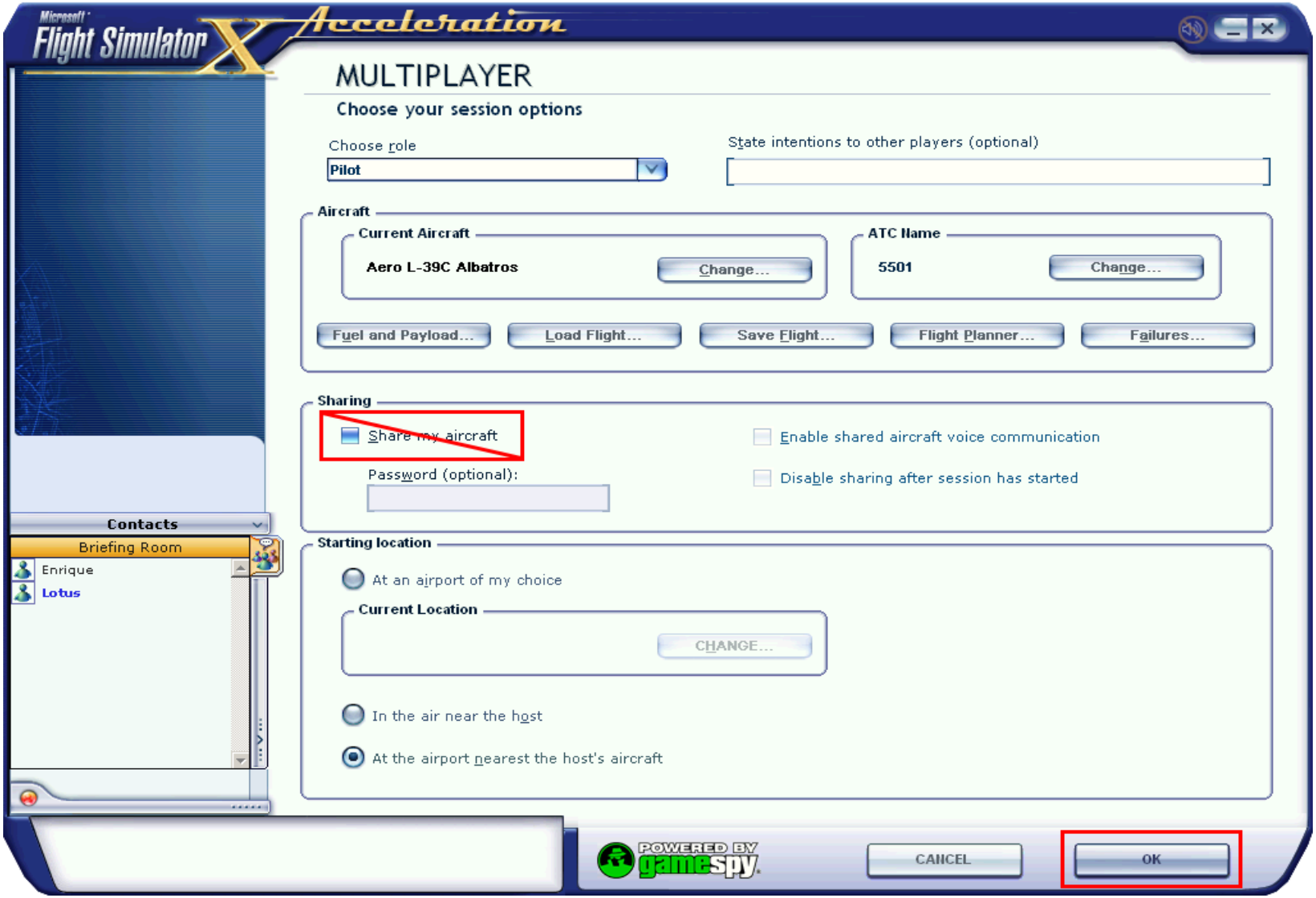
2. Click "Connect Directly".



3. Enter the host's IP address in the window (you should get this information from them via email/chat etc first) then click "Find sessions".

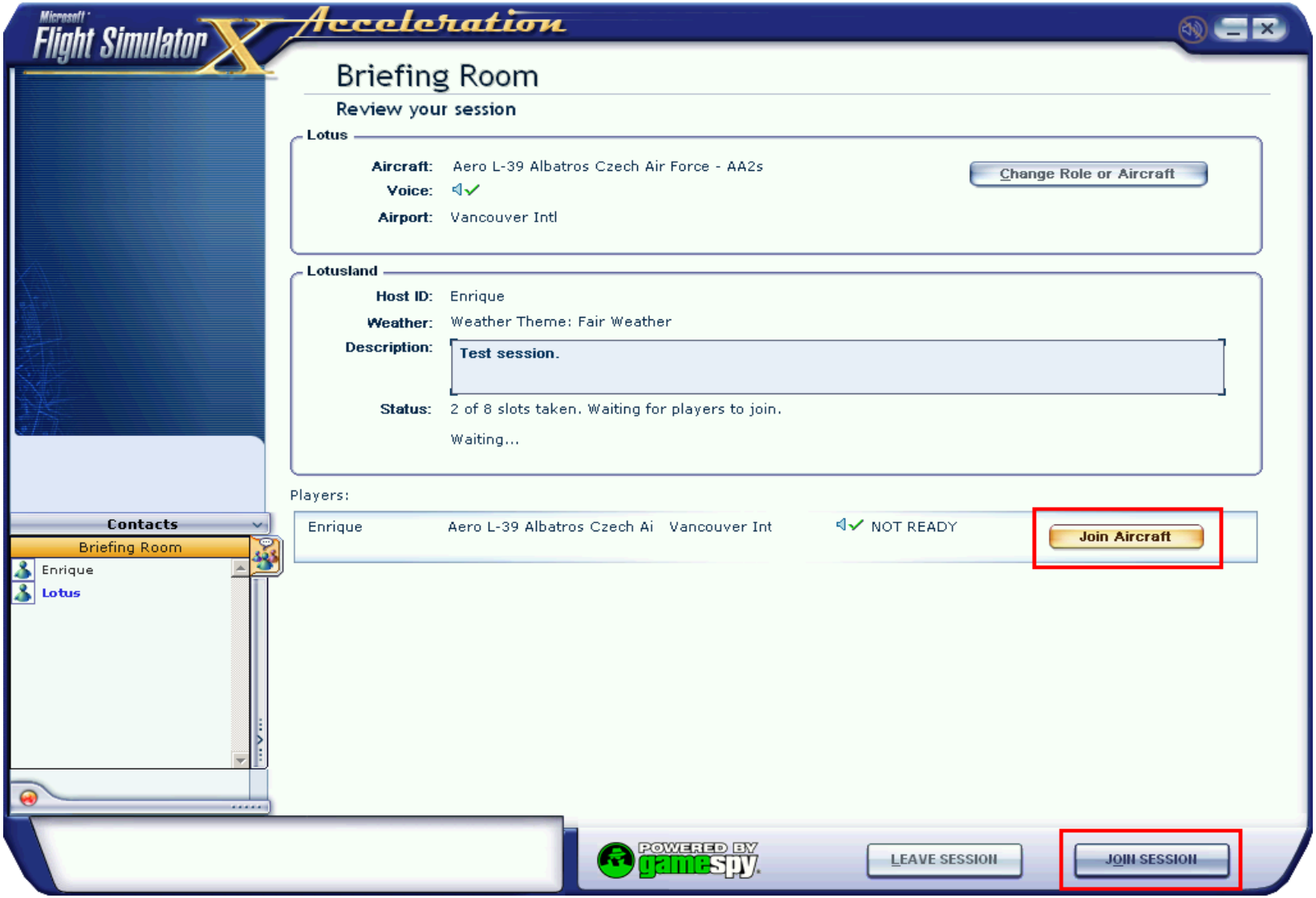


4. After connection you will see this screen. Do not worry about choosing an L-39, you will be joining the host's. Do NOT click "share my aircraft", the host only has to share theirs. This is a common mix up for those first trying Shared Cockpit. Click OK.



5. If the host has shared their L-39 you will see the "join aircraft" button available. Click this button, then click "Join Session". If the host has already started the session you will now be loading into FSX. If the host has not started the session they can do so at this point.

And that's it! Life IS a multiplayer session. Enjoy your flight in the realistic skies...



The L-39 is, for the most part, a pussycat in the sky, and will put up with pilot error, but it can be a bit of a handful in certain flight regimes. This section of the manual contains tips for different phases of flight in order to help you get the best performance from the aircraft, and to avoid certain coffin corners. Regardless of the situation, being smooth with your control stick inputs will yield the best results. Fly the engine first, worry about the airframe second. In any out of control flight situation your best course of action is to let go of the controls entirely and let the aircraft fly itself out. Control inputs in that situation can only aggravate the aircraft.

Takeoff

The L-39C, as you probably know by this point, is not a very powerful aircraft, having a thrust to weight ratio of only 0.37. Its engine, the AI-25TL, although uprated in the Albatros, originally came from the Yak-40 airliner (shh... don't tell anyone) and was selected primarily for its compact size, light weight, and extreme durability, rather than its power output. As such the L-39 can require a surprising amount of runway for a safe takeoff, especially on hot days or at higher altitude airfields. Its initial takeoff performance is not what one would call 'sprightly'.

The standard takeoff procedure is to set flaps to half extension, apply brakes fully once lined up on the threshold, and to release them only once the engine has reached 106% N1. The L-39 has excellent ground effect due to its low wing configuration and relatively short landing gear, so it is preferable to remain in ground effect as long as possible after liftoff. The twin intakes that feed into the throat of the single engine create a great deal of compression, so the L-39 produces considerably more power as airspeed increases during and after the takeoff roll. Therefore to get the best performance (if sufficient runway is

available) I recommend keeping the nose down after liftoff, staying low to the runway while retracting the gear, and allow your speed to increase to 300 km/h or more before initiating your climb. Your initial climb performance will be greatly improved by using this method. If dealing with a short runway or one with obstacles at its far end, perform your initial climb as soon as possible, at around 250 km/h and then level off at a safe altitude and accelerate to 380 km/h before climbing further. Maintain full power, 106%, until reaching 1500 feet AGL and then throttle back to 100-103% for climb out.

Climb

The best angle of climb airspeed for the L-39 is approximately 280 km/h and the best rate of climb airspeed is 380 km/h. The initial climb rate at sea level on a standard day, at standard aircraft weight, is approximately 4000 feet per minute, however this will drop off pretty rapidly by 10,000 feet. The L-39 is a very neutrally balanced aircraft, a point that will become important a bit later on, and this means that little re-trimming is required once you have the aircraft at a stable speed and trim. As mentioned before, during prolonged climbs it is wise to keep an eye on the EGT.

Cruise

The L-39 is not what one would call efficient. In fact the real aircraft is quite a serious glutton for fuel, burning 480 gallons per hour at full power at sea level, and that thirst for fuel has been recreated this FSX version. Altitude has a huge effect on the aircraft's maximum range, so for any long trips you'll be looking for cruising altitudes in the lower flight levels. For best speed in cruise select an altitude of approximately 16000-18000 feet, and for best economy/range aim for altitudes in the 21000-24000 foot range. At 22000 feet with 103% N1 you can expect a range of approximately 400-450 NM on internal fuel (depending on winds) and a ground speed of approximately 320 knots. The L-39C does not have an autopilot, so trips to the fridge for a drink require your trim to be set perfectly. Trim in the aircraft is speed sensitive. Trim inputs at low speeds are coarser and trim at higher speeds is finer.

Descent

Standard procedure in the L-39 is to leave power settings relatively high during descents and to use the air brakes to control speed, unless fuel supply is a concern. The main reason for leaving the brakes out is to mitigate the engine's slow spool time should power be needed immediately, such as to avoid traffic. Aside from this there are really no dramas to a descent.

Landing

Landing the L-39 is not especially difficult, but neither is it as easy as other aircraft. Once again the engine's slow spool up time and the aircraft's slippery shape will present some new challenges, especially for those who are more accustomed to flying propeller driven aircraft.

When setting up for an approach it is best to get the aircraft in landing configuration as soon as possible and stabilize airspeed early. Last minute flap or gear extension makes speed management difficult. If entering a normal downwind arrival to an airport begin by maintaining level flight at 1000-1500 feet AGL and use the air brakes to reduce speed to 300 km/h. A fair bit of trimming will be required as speed drops off. Once below 300 km/h, set throttle to 80-85% N1 rpm, retract the speed brakes and simultaneously extend the flaps to half deployment and lower the landing gear. A nice feature of the L-39 is that the drag imposed by the air brakes is almost exactly equal to that imposed by the combination of landing gear and flaps at half extension. By using this rapid 1-2-3 retract and deploy method you can maintain the same speed without throttle changes while getting the aircraft into landing configuration. Once on final approach lower the flaps to the full down position and re-trim as necessary. A standard 3 degree approach with full flaps works out to be around a 3 meter per second descent on your VSI.

On the base leg and final approach pay *constant* attention to your airspeed and rpm. It is extremely easy to let these get away from you resulting an overspeed condition, which forces flap retraction, or a stall with too little airspeed. If you enter a stall at less than 1000 feet AGL you will probably not be able to recover in time, so rpm and speed management are key to survival. Keep that 10 second engine spool up in mind. A typical power setting for a standard 3-degree approach with flaps full and gear down is approximately 78-83% N1 depending on aircraft weight.

Because the L-39 is a tricky thing to land most pilots get into the habit of leaving the air brakes deployed during an approach, especially when dealing with short runways or landing in mountainous terrain. This method will require you to maintain much higher rpm settings, especially in level flight. During the final approach you will need N1 rpm values closer to 85-90% but should your speed drop too low or a go-around be required you already have the power available and can simply retract the speed brakes to remove the drag. The speed brakes require one second to fully deploy or retract, while the engine requires ten. The safety advantages of this method are clear.

On final approach try to maintain a speed of approximately 220-240 km/h depending on aircraft weight. About three seconds before crossing the threshold of the runway slowly retard the throttle to idle and begin a smooth flare with light aft stick pressure. Because of the aircraft's very neutral balance the elevators on the L-39 are highly effective and very little deflection will be needed to flare. Hold the nose off during the flare until your speed drops below 180 km/h and then allow the aircraft to settle onto the runway. Once the nose wheel touches down brake smoothly to a stop. If landing on a long runway you can also hold the nose off the ground, up to about 8 degrees, and use the body of the aircraft for aerodynamic braking. This is an effective and fun way to stop the aircraft and has the advantage of saving your brake pads. The nose can be held off the runway down to a speed of about 70 km/h.

Overhead break

A common practice for L-39 pilots, and all military fighters, is to use the overhead break method for entering a landing pattern. This method was devised as a way to recover large numbers of aircraft in a short time by reducing the time needed to slow them down when entering a pattern. In an overhead break the aircraft flies at 1000 feet above field elevation directly down the runway in the desired direction of landing and then executes a right or left moderate G and constant altitude turn onto the downwind leg. The advantage of this is that it reduces the amount of time needed to decelerate the aircraft, using induced drag instead of low throttle settings for deceleration, and does not disrupt other aircraft on their final approach.

To execute an overhead break approach:

1. Fly directly down the runway at 1000 feet above field level, in the direction of intended landing, set speed to 400-450 km/h.
2. Set throttle to 80-85% N1.
3. Once your aircraft is at the midpoint of the runway extend the air brakes and immediately execute a hard 180 degree turn, using up to 3G.
4. Rolling out on downwind your speed should be approximately 300 km/h. Retract the air brakes, extend gear, set flaps to half extension, and adjust throttle as needed.
5. Complete base and final legs as per standard approach.

A word of caution when using this approach method is to be mindful of load factor. The L-39 is a high wing loaded aircraft and does not take well to high G manoeuvres with low airspeed, especially at higher aircraft weights. You may have to relax the G loading towards the end of the 180 degree turn to avoid a stall. This consideration will be covered in greater detail in the aerobatic flight section below.

Aerobatics

The L-39 is a fully aerobatic aircraft, and tough as nails. It can withstand load factors ranging from -4 to +8 G and these aircraft have survived brief excursions to +11G without airframe damage. As one L-39 pilot so eloquently put it "There are airplanes which could be considered brick shithouses...and then there's the Albatros". Suffice it to say, you will find it difficult to break this airplane.

However, the L-39, as mentioned previously, does not enjoy high G flight with low airspeed, and will hitch up and stall or even spin if provoked. When performing aerobatics you must pay constant attention to airspeed and load factor. An easy rule of thumb is to take your airspeed and divide it by 100 to find out your available G limit. If you have 400 km/h on the airspeed indicator (at sea level) you have about 4 G available. Surpass this and the aircraft will stall. This available G will also drop off as altitude

increases. At high altitudes, 10,000 feet or more, the aircraft will stall much more easily, so be smooth on the stick.

The L-39 is barely capable of performing a loop from level flight. Most of the time when planning vertical aerobatics you will need to get a run at it. A proper entry speed for a loop is 700 km/h or more. Again the engine's low thrust will ultimately be your Achilles heel for aerobatics, so the old fighter pilot motto "speed is life" applies to every aerobatic manoeuvre in the L-39. When performing a loop, set throttle to maximum, pitch the nose down to accelerate to 700 km/h and then initiate a smooth 4-5 G pull into the vertical. As you pass 90 degrees nose up begin to relax stick pressure to preclude a stall condition. Over the top of the loop you can expect an airspeed of 300-400 km/h depending on the initial entry speed. Keep light stick pressure until airspeed increases back to 400 km/h or more and then begin a progressive pull to 5-6G on the downward side of the loop. Once back in level flight retard throttle to 103% or less and trim as necessary.

Weight has an enormous effect on the aircraft's vertical and aerobatic performance. If flying specifically to practice aerobatics you will get much better performance by flying with half full fuel tanks. Most L-39 aerobatic demonstration teams fly their routines with less fuel than this onboard.

Spins

The L-39 is fully spinnable. Spins in this aircraft are very stable and quite flat, which can make them a bit tricky to get out of sometimes.

To enter a spin:

1. Climb to at least 10,000 feet and maintain level flight at 400-450 km/h, trim as necessary.
2. Retard throttle to idle, maintain level flight as speed reduces by increasing aft stick pressure.
3. At stall warning, pull stick smoothly and slowly full aft, maintain 5-15 degrees nose up attitude.
4. Once airspeed is below the white arc (150 km/h or less), hold stick full aft, apply full rudder, left or right, to initiate spin.

5. After 2/3 to 1 full revolution smoothly centre the stick and rudder. A full spin will develop.
6. Ride the spin until initiating recovery, or impact with ground, whichever comes first.

To recover from a spin:

1. Apply full rudder in direction opposite to spin, ie: If spinning to the left, apply full right rudder.
2. Apply moderate forward stick pressure.
3. After one or two more revolutions the spin should slow and eventually stop, leaving the aircraft in a nearly vertical nose down attitude.
4. As soon as spin stops, centre rudder and stick. Apply full throttle.
5. As speed increases past 400 km/h smoothly pull out of the dive.
6. Return to level flight and trim as necessary.
7. Get addicted. Go back up to 10,000 feet and do it again!

Formation flight and merges

The L-39 is a tricky, challenging, and yet highly satisfying aircraft to fly in formation in multiplayer. However because of the aircraft's limited power and speed capabilities, and total lack of afterburner, it can be difficult for wingmen to reform with the flight leader when they become separated. L-39 pilots use the following procedure to facilitate a rapid regrouping, thus saving time and precious fuel.

If a wingman becomes separated from the leader, they call this out on the radio, and the leader then executes a level 360 degree turn, holding a constant 30 degrees of bank, and holds this turn until the wingman can rejoin. Maintaining a constant bank angle and speed during the turn will carve a very predictable path in the sky, allowing the wingman to predict the leader's position in time. The separated wingman then aims for a point ahead of the leader's aircraft and executes a similar constant turn at an altitude just slightly below that of the leader. The wingman continuously aims for a point ahead of the leader's aircraft thereby turning in a tighter circle, and the difference between the two trajectories closes the gap between the aircraft very rapidly. Once the wingman has closed the gap

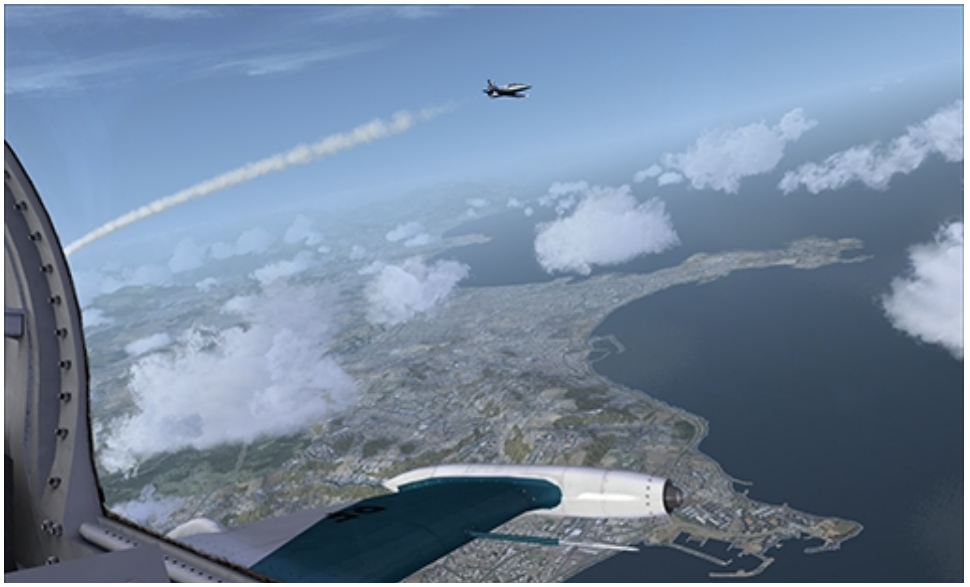
they can climb slightly to slot in next to the leader and use speed brakes to match airspeed if needed. Once the wingman has rejoined, then the leader continues the turn until reaching the desired heading for continued flight.

If you are familiar with the geometry of air combat then you can think of this manoeuvre as a *continuous lead pursuit* by the wingman. If this is not familiar to you then you can think of it as trying to catch a ball, the ball in this case being the flight leader. You're not running to where the ball is currently, you're running to where it will be in a few moments.

How this looks from both the leader and wingman's perspective is illustrated in these images.

Speed Conversion

Kilometers per hour	Knots
100	54
200	108
300	162
400	216
500	270
600	324
700	378
800	432
900	486
1000	540



Performance Specifications

External Dimensions:

Wing span	9.46m / 31 ft
Length	12.13m / 39 ft
Height	4.77m / 15 ft

Weights and Loadings:

Basic empty weight	3400 kg / 7400 lb
Max ramp weight	5670 kg / 12500 lb
Internal fuel capacity	1050 kg / 2314 lb

Performance:

Max level speed (clean)	405 kts / 750 km/h
Never exceed speed	491 kts / 910 km/h
Max rate of climb	21 m/s / 4100 ft/min
Max range (w/ext tanks)	730 nm
Max range (int fuel only)	450 nm
Takeoff run	540m / 1800 ft
Landing run	540m / 1800 ft
Stall speed	85 kts / 158 km/h
Max structural limits	+8G / -4G

These checklists are for Flight Simulator X use only.

Cockpit Entrance

Canopy.....OPEN
Main Switch Panel.....ALL OFF
BATTERY.....ON
Rear Cockpit – Network Switch.....FWD
Rear Cockpit – LNDG GEAR Selector ..NEUTRAL

Left Console

OXYGEN SUPPLY.....ON
FUEL SHUTOFF.....FWD
PITOT HEAT.....OFF
INST LIGHTS.....AS REQ
LNDG LIGHTS.....OFF

Inst Panel/Center Pedestal

LNDG GEAR.....DOWN
G-Meter.....RESET
Altimeter.....SET
Radar Altimeter.....SET DH
Flare Master Arm.....OFF

Right Console

Pressurization.....OFF
ANTI ICE.....OFF
NAV LIGHTS.....OFF
4 Hydraulic Emergency Levers.....FWD

Before Start Checks

HYD SYS FAIL light.....ON
GENERATOR light.....ON
DON'T START light.....ON
EMERGENCY GENERATOR light.....ON
CANOPY UNLOCKED light.....ON
INV 36 V FAIL light.....ON
ENG MIN OIL PRESS light.....ON
AIRCONDIT OFF light.....ON

ENG INST.....ON
DON'T START and INV 36 V FAIL lights out in 5 sec.

Fuel Indicator/Quantity.....CHECK
Throttle.....IDLE
Voltmeter.....22V min
Aft canopy.....CLOSE

Engine Start

BEACON.....ON
TURBO start button.....PRESS
TURBINE STARTER light.....ON in 25 sec
ENGINE start button.....PRESS
RPM, triple engine and EGT.....CHECK
TURBINE STARTER light.....OUT
Oil pressure.....CHECK
HYD SYS FAIL light.....OUT
ENG MIN OIL PRESS light.....OUT

After Start Checks

Gen MAIN.....ON, light OFF
Gen emer.....ON, light OFF
INVERTER I.....ON
INVERTER II.....ON
Canopy.....CLOSE
CANOPY UNLOCK light.....OFF
Pressurization/ECS.....PRESS
AIRCONDIT light.....OFF
DE-ICE.....ON
AVIONICS.....ON
GNS 430.....ON
RADAR ALT.....ON
TANKS.....ON
GYROS.....ON
ANTI ICE.....AS REQ

Taxi Checks

Flight control operation.....CHECK
Flap operation.....CHECK
Speed brake operation.....CHECK
Brakes.....CHECK
Voltmeter.....28V
Hydraulic pressure.....135-150 kp/cm2
Radios/Nav/GPS.....SET
LNDG LIGHTS.....ON
Nav lights.....ON
Taxi clearance.....Request

Before Take Off Checks

Trim.....SET
Speed brakes.....IN
Flaps.....TAKEOFF
Fuel quantity.....CHECK
Flight and Engine instruments.....CHECK
Oxygen SUPPLY.....ON
Warning lights.....ALL OFF
Pitot heat.....ON
StrobeS.....ON

Take Off

Brakes.....ON
Throttle.....FULL
Brake release.....106% RPM
150 km/h.....ROTATE
Positive climb and 220 km/h.....GEAR UP
250 km/h.....FLAPS UP
Trim.....AS REQ

Maintain 370 km/h (200 kts) inside airport airspace.
Maintain 460 km/h (250 kts) Below 10,000 ft MSL

Climb

Throttle.....103%
Best angle of climb speed.....300 km/h
Best rate of climb speed.....390 km/h
10,000 ft Landing/taxi lights.....OFF
18,000 ft set Altimeter.....29.92
Oxygen (6000 ft+).....CHECK

Cruise

Fuel Quantity.....CHECK
Engine Instruments.....CHECK
Performance settings:
High Speed Cruise.....Power 103%
Standard Cruise.....Power 96-99%
Max Endurance Cruise.....Power 85%

Descent

Fuel Quantity.....CHECK
Flight and Engine instruments.....CHECK
Standard Descent.....Power 85% / 450 km/h
Max Range Descent.....Power 56% / 185 km/h
Max Glide (engine out).....290 km/h

18,000 ft set Altimeter .....LOCAL SETTING
10,000 ft Landing/taxi lights.....ON

Maintain 460 km/h (250 kts) Below 10,000 ft MSL
Maintain 370 km/h (200 kts) inside airport airspace.

Approach and Landing

Warning Lights.....CHECK
Fuel Quantity.....CHECK
Hydraulic pressure.....135-150 kp/cm2
Airport ATIS.....CHECK

Initial Approach

Speed .....450 km/h
Power.....Approx 85%
Speed brakes.....OUT
Descent to IAF altitude or pattern altitude of 1,000 ft AGL

Traffic Pattern

As speed decreases below 300 km/h. GEAR DOWN
Flaps.....TAKEOFF
Speed Brakes.....IN
Airspeed.....280 km/h
Power.....Approx 87%

Final

Flaps.....LAND
Speed.....230 km/h MIN
Power.....Approx 81%
Landing gear.....CHECK
Threshold speed.....200 km/h
Flare.....25 ft
Touchdown speed.....180 km/h

Missed Approach

Throttle.....MAX
Speed brakes.....IN
Flaps.....TAKEOFF
150 km/h.....ROTATE
Positive climb and 220 km/h.....GEAR UP
250 km/h.....FLAPS UP
Trim.....AS REQ
Speed .....350 km/h
Power.....Approx 90%

Instrument Approach

Approach to Glide Slope

Speed.....300 km/h
Landing gear.....DOWN
Flaps.....TAKEOFF
Speed Brakes.....IN
Speed below 280 km/h
Power.....Approx 87%
Trim.....AS REQ
Maintain 260 km/h until glide slope intercept

Glide Slope Intercept

Flaps.....LAND
Landing gear.....CHECK
Speed.....230 km/h
Power.....Approx 81%
Threshold speed.....200 km/h
Flare.....25 ft
Touchdown speed.....180 km/h

After Landing Checks

LNDG LIGHTS.....AS REQ
Flaps.....UP
Speed Brakes.....IN
ANTI ICE.....OFF
Pitot heat.....OFF

Engine Shutdown

Parking brake.....ON
Throttle Idle.....2 min
Pressurization/ECS.....OFF
Electrical switches.....ALL OFF
Except ENGINE INST and BATTERY
Throttle to CUTOFF.....PERFORM
ENG INST.....OFF
Battery.....OFF
Canopy.....OPEN
Oxygen SUPPLY.....OFF
Ice Cold Stella Artois.....OPEN

Limitations

Engine RPM

104% to 106.5%.....10 min (EGT dependent)
103% and below.....No Limit

Engine EGT

Max Takeoff.....645 °C
Max in Flight .....670 °C (690 °C w/de icing on)
Max above 25,000 ft.....700 °C

Airspeed

Vne Clean.....910 km/h or 0.8M
Landing gear extend.....340 km/h
Flap extend.....325 km/h

Weight

Max Takeoff Paved.....10,380 lbs
Max Takeoff Un Paved.....10,140 lbs
Max Landing.....10,140 lbs

Other

Zero or Negative G.....20 sec
G Force Limits (w/ flaps + gear).....-1 / +3
Max Crosswind Component.....20 kt

Takeoff Emergencies

Engine Failure During Take-Off

Indication: Loss of power

Actions:

If possible:

1. ABORT TAKE-OFF.....PERFORM

If airborne:

1. THROTTLE.....MAX
2. EMERGENCY FUEL PUMP.....ON
3. If thrust insufficient to maintain safe climb:
4. FORCED LANDING.....PERFORM

Engine Fire During Take-Off

Indication:"FIRE" warning light or outside report from control tower or other aircraft.

Actions:

If possible:

1. ABORT TAKE-OFF.....PERFORM
2. FUEL SHUTOFF.....CLOSE
3. FIRE EXTINGUISHER button.....PRESS
4. BATTERY.....OFF
5. EMERGENCY EVAC.....PERFORM

If airborne:

1. THROTTLE.....MAX
2. LANDING GEAR.....UP

At flame-out landing conditions, if fire persists:

3. THROTTLE.....CLOSE
4. FUEL SHUTOFF.....CLOSE
5. FIRE EXTINGUISER button.....PRESS

WARNING

Do not attempt to restart engine after fire has been extinguished.

6. FORCED LANDING.....PERFORM

Take-Off Abnormalities

Flap Retraction Failure

Indication: Flaps fail to operate as commanded confirmed by electrical or mechanical indicators.

Actions:

1. Airspeed.....Below 300 km/h
2. Flap previous position.....SELECT
3. Electrical and mechanical indicators.....CHECK
4. Land as soon as practicable.

Gear Retraction Failure

Indication: One or more gear components fail to retract or lock in the up position confirmed by elec or mech indicators.

Actions:

1. Airspeed.....Below 330 km/h
2. Aft cockpit gear lever.....NEUTRAL
3. Landing gear lever.....DOWN
4. Electrical and mech indicators.....CHECK
5. Land as soon as practicable.

In-Flight Emergencies

Engine Fire

Indication: "FIRE" warning light or outside report from control tower or other aircraft, loss of engine RPM, high EGT, Co-pilot screaming "I'm on fire" repeatedly.

Actions:

1. THROTTLE.....IDLE
2. Confirm existence of fire

If fire is NOT confirmed:

1. Precautionary landing.....PERFORM

If fire is confirmed:

1. Pressurization/ECS.....OFF
2. FUEL SHUTOFF.....CLOSE
3. FIRE EXTINGUISHER button.....PRESS

WARNING

Do not attempt to restart engine after fire has been extinguished.

4. FORCED LANDING.....PERFORM

Engine Flame-Out

Indication: Loss of power, RPM drop, EGT drop. Suddenly quiet, increased heart rate.

HOT START

CAUTION

Perform the engine hot start if there is a critical lack of time. The regular in-flight start with the APU or the engine wind milling is preferred.

Actions:

1. THROTTLE.....IDLE
2. TURBO START button.....PRESS
3. ENGINE START button.....PRESS
4. Airspeed.....260 km/h
5. Land at nearest airfield.....PERFORM

If engine does not restart:

6. FORCED LANDING.....PERFORM

IN-FLIGHT START (APU)

260 – 350 km/h and engine RPM less than 22%

Actions:

1. THROTTLE.....IDLE
2. TURBO START button.....PRESS
3. TURBINE STARTER light.....ON
4. ENGINE START button.....PRESS
5. EGT and RPM.....RISING
6. THROTTLE.....OPEN

IN-FLIGHT START (WIND MILLING)

Engine RPM more than 22%

Actions:

1. THROTTLE.....IDLE
2. ENGINE START button.....PRESS
3. EGT and RPM.....RISING
4. THROTTLE.....OPEN

EXCESSIVE EGT (ABOVE LIMITS)

Indication: EGT rising or already high.

Actions:

1. THROTTLE.....IDLE
2. EGT REG.....OFF
3. IF EGT IS STABLE.....LAND

NOTE

If the JPT 730ºC warning light is ON, Be aware of possible fire.

If EGT continues to rise:

1. THROTTLE .....CLOSE
2. FORCED LANDING.....PERFORM

Oil System Malfunction

Indication: Oil pressure below 3 kp/cm2. Oil leak visible from other aircraft or control tower.

Actions:

1. THROTTLE.....REDUCE
2. Land as soon as possible.

If ENG MIN OIL PRESS light is flashing:

1. Prepare for engine failure
2. FORCED LANDING.....PERFORM

Fuel System Failure

Indication: Loss of fuel pressure, FUEL FILTER warning light flashing, fuel quantity is zero.

Actions:

1. EMER FUEL PUMP.....ON

If engine stops and fuel quantity is more than zero:

2. THROTTLE.....IDLE
3. ENGINE RESTART.....PERFORM

If fuel quantity is zero:

4. FORCED LANDING.....PERFORM

Oxygen System Malfunctions

Indication: Oxygen quantity is zero, difficulty breathing

Actions:

1. OXYGEN SUPPLY.....ON
2. OXYGEN QTY.....VERIFY

If above 18,000 ft and problem continues:

3. Descend below 18,000 ft
4. Land as soon as practicable

Electrical System Malfunctions

Indication: GENERATOR warning light flashing.

NOTE

The RAT will extend automatically, EMERGENCY GENERATOR light will flash while RAT deploys. Proper operation of the RAT is indicated by 28V output.

Actions:

1. GEN MAIN.....CHECK ON
2. GEN EMER.....CHECK ON
3. SPEED BRAKES.....DO NOT USE

NOTE

The RAT will retract automatically if the RAT emergency lever is in the forward position when main generator power is restored or during landing when the nose wheel touches the ground.

If the EMERGENCY GENERATOR warning light remains on:

4. GEN EMER.....RESET
5. EMERGENCY GEN lever.....AFT
6. Land as soon as practicable.

Total Electrical Failure

Indication: Voltmeter indicates zero, INV 115V FAIL warning light on, everything electrical has stopped working and it's very quiet and dark.

Actions:

1. Recall last fuel qty and calc remaining flight time
2. Descend to nearest VFR airfield.
3. LNDG GEAR.....EMERGENCY EXTEND
4. FLAPS.....EMERGENCY EXTEND
5. Land as soon as practicable

Refer to emergency gear and flap extension procedure.

Hydraulic System Pressure Low

Indication: HYD SYST FAIL warning light on, main hydraulic pressure below 55 kp/cm2.

The following systems are inoperative:

- Speed brakes
- Normal landing gear lowering
- Normal flap lowering
- Normal brakes
- Anti skid

Refer to emergency gear and flap extension procedure.

Landing Emergencies

Forced Landing

ENROUTE TO HIGH KEY:

1. SPEED BRAKES.....IN
2. LANDING GEAR.....UP
3. FLAPS.....UP
4. Airspeed.....260 km/h
5. THROTTLE.....CLOSE
6. FUEL SHUTOFF.....CLOSE

NOTE

For every 5,000 ft of altitude lost, ground distance covered is approx 14 km. Below 10,000 ft the sink rate is approx 9 m/sec.

HIGH KEY:

1. Altitude.....3,300 ft AGL min
2. LANDING GEAR.....DOWN
3. Airspeed.....250 km/h

NOTE

If hydraulic pressure is low, landing gear may need to be extended with the emergency landing gear extension.

LOW KEY:

1. Altitude.....2,200 ft AGL min
2. FLAPS.....AS REQ
3. Airspeed.....250 km/h

NOTE

If hydraulic pressure is low, the flaps may need to be extended with the emergency flap extension.

FINAL APPROACH

1. Aim for first 1/3 of runway
2. Airspeed.....250 km/h
3. FLAPS.....AS REQ
4. Touchdown.....180 km/h

Emergency Landing Gear Extension

Actions:

1. Aft cockpit landing gear lever.....NEUTRAL
2. Airspeed.....Below 330 km/h
3. EMERGENCY HYD GEAR lever.....AFT
4. LANDING GEAR.....DOWN

Emergency Flap Extension

Actions:

1. Airspeed.....Below 300 km/h
2. EMER HYD INTERCONNECT lever.....AFT
3. EMERGENCY HYD FLAP lever.....AFT

NOTE

The flaps will be lowered to the LAND (44 deg) position.

Emergency Gen Extension (RAT)

Actions:

1. EMERGENCY GEN lever.....AFT

Main Landing Gear Extension Failure

Indication: One or both main gear fail to extend or lock in the down position when using main hydraulic system.

Actions:

1. EMER GEAR EXTENSION.....PERFORM
2. Elec. and mech. indicators.....CHECK

If landing gear does not extend:

3. EMER HYD INTERCONNECT lever.....AFT
4. EMERGENCY HYD GEAR lever.....FWD
5. LANDING GEAR.....UP

WARNING

Do not land with main gear in asymmetric condition

6. Belly landing.....PERFORM

Nose Landing Gear Extension Failure

Indication: Nose gear fails to extend or lock in the down position when using main hydraulic system.

Actions:

1. EMER GEAR EXTENSION.....PERFORM
2. Elec. and mech. indicators.....CHECK

If nose gear does not extend:

3. Perform normal landing, holding nose high for aerodynamic braking.

WARNING

Normal braking will not be possible.

Belly Landing

It is preferable to perform a belly landing on a paved runway. Performing a belly landing on an unpaved surface will probably result in a letter of condolence to your family. Avoid a nose-high touch down attitude.

Actions:

1. Runway.....Request imaginary foaming
2. Fuel.....Burn down to minimum
3. Final approach.....Straight in with full flaps

Prior to touch down:

4. GEN EMER.....OFF
5. THROTTLE.....CLOSE
6. FUEL SHUTOFF.....CLOSE
7. ENG INST.....OFF
8. GEN MAIN.....OFF
9. BATTERY.....OFF

CAUTION

Do not use speed brakes, if extended, it is not possible to retract them in an emergency

10. Touchdown speed.....180 km/h
11. Aircraft.....RUN AWAY FROM IT

Asymmetric Flaps

Indication: Uncommanded roll to left or right when flaps extended.

Actions:

1. Control aircraft
2. FLAPS.....SET PREVIOUS POSITION

If by selecting the previous flap position control is regained:

3. LAND with that flap setting. Add 30 km/h for a flaps up landing.

Spin Recovery

Indication: You're getting dizzy.

Actions:

1. STICK.....CENTER and FWD
2. THROTTLE.....IDLE

If in upright spin:

3. RUDDER.....FULL OPPOSITE

If in inverted spin:

4. STICK.....FULL AFT

Known Issues

Compatibility: This package is compatible with FSX SP2, Acceleration, and FSX Gold only. It has not been tested in the original release of FSX (RTM) or with Service Pack 1. Compatibility with these versions is unlikely and is not supported.

DX10: The aircraft has been tested in FSX's DX10 preview mode, and is compatible with it, however real time cockpit shadows have not been enabled. This was a design decision made early in the project. DX10 shadows require all geometry in the cockpit to be closed. On a dual cockpit aircraft such as the L-39 this would require truly massive amounts of extra geometry and would severely damage framerate performance for the majority of DX9 users.

Landing Lights: The landing lights have many of the same restrictions as the FSX default ones, and as such they will display incorrectly on sloped runways, such as those found in Courchevel and Lukla addons. The landing lights work best with light coloured taxiway and runway textures. Very dark aftermarket airport ground textures will reduce their effectiveness. Use the brightest ground textures possible for best results.

Track-IR gimbal lock in closeup cameras: As mentioned in the "know before flight" section, Track-IR implementation in FSX is flawed with respect to VC cameras. There is no known fix for this problem. You must pause and centre your Track-IR when using these views.

Sound looping problems: Occasionally certain sounds in FSX can get stuck in a loop and this is usually caused by rapidly opening and closing canopies or lowering and raising gear. It can also occur when a user tries to raise the gear with the rear cockpit gear

lever in the down position, or vice versa. This is a global problem and not limited to the L-39. Press your Q key twice to toggle your sound off and on and the problem should clear.

Troubleshooting / FAQ

Please read the "Know before flight" section of this manual completely. Most issues that can crop up during use of this L-39 are explained there. A few extra solutions and workarounds are discussed here.

G-Suit pump sound effects:

The L-39 has a g-suit pump in the cockpit to fill the pilots' g-suits with air, delaying loss of consciousness in hard turns, and it is very loud in flight when it activates in the real aircraft. It will engage whenever you exceed 3 G. If it drives you completely nuts you can remove or rename its associated sound files to disable it.

In your FSX/SimObjects/Airplanes/Lotus L-39/Sound folder you will find several .WAV files with the name "gpumprun" and a number after each, as well as gpumprel.wav. Select all of the gpump files and either rename them or move them to another folder.

Renaming or removing these files from the Sound folder will disable the g-suit pump in all variants of the L-39.

Jagged lines in Reno Racer “Pipsqueak” textures:

A side effect of DDS texture compression is that very high contrast diagonal lines sometimes display incorrectly in mip-maps. This may be evident on “Pipsqueak”. To accommodate user preference a set of additional non-mipped textures has been provided for Pipsqueak. You will find them in a subfolder of Pip's texture folder in SimObjects/Airplanes/Lotus L-39-race/texture.pip. Just copy these textures over the ones in its parent folder. You may find that these textures shimmer a bit though.

Enabling nose wheel steering:

If you find the realistic differential braking functions too difficult to use for taxiing the aircraft, you can replace the aircraft.cfg files for the different types of L-39s with alternate versions provided.

In your FSX/SimObjects/Airplane folder you will find the following folders containing all the variants of the L-39:

Lotus L-39	(stock dual cockpit military L-39s)
Lotus L-39-civ	(stock dual cockpit civilian L-39s)
Lotus L-39 SS	(single seat military versions)
Lotus L-39-SS-civ	(single seat civilian versions)
Lotus L-39-race	(pipsqueak reno racer)
Lotus L-39-LR	(military long range tank versions)
Lotus L-39-LR-civ	(civilian long range tank versions)
Lotus L-39-multi	(special formation team models)
Lotus L-39-RXP	(military dual cockpit w/ Reality XP GNS430)
Lotus L-39-RXP-civ	(civilian dual cockpit w/ RXP GNS430)
Lotus L-39-race-RXP	(pipsqueak reno racer w/ RXP GNS430)
Lotus L-39-LR-civ-RXP	(civilian long range tank versions w/RXP GNS430)

Inside each of these folders there is a subfolder called "nose wheel steering config". Within that folder is an alternate aircraft.cfg file which has nose wheel steering enabled. Simply copy this aircraft.cfg file from the nose wheel steering folder into its parent folder, replacing the aircraft.cfg file there.

NOTE!: If you use this alternate configuration file you must make sure that anyone you fly in shared cockpit with makes the same changes or you will get an aircraft mismatch warning error when joining their aircraft. Be sure not to mix and match between Lotus L-39 folders when replacing configuration files or you will end up with incorrect aircraft assignments and damaged airplane functionality. Each aircraft.cfg file is unique for its own type of L-39.

Also please note that if you have added any user made repaint configurations to your aircraft.cfg then these must be duplicated in the alternate config if you want to still use them.

Elevators pitching up on ground:

This is not actually a bug though it is commonly thought to be one simply because it is so unusual. The real L-39's elevators are mass balanced aft and employ a bungee cord like system which reduces the effort required by the pilot in pulling high G loads. A side effect of this system is that the elevators naturally 'fall' into the full up position when at rest. During the takeoff roll they will flatten out again to the neutral position as air resistance overcomes the system. This is purely a visual effect and does not interfere with actual control inputs in the simulator.

Product Support & Forums:

For further assistance with this product please visit the support forum at:
http://www.lotussim.com/forums

For email support please send messages to: lotus@lotussim.com

PLEASE NOTE: Proof of purchase is required when requesting email support or to access the member support forums. Instructions on how to register and provide this information are posted in the public forum. If emailing for support please include your full name and the name of the vendor you purchased the L-39 from (ie: Simmarket, FSPilotshop).

Thank you once again for your purchase of this Lotus L-39C Albatros (and for reading this manual!). This feisty little jet trainer was a labour of pure love, and I hope she provides you with many hours of enjoyment at the controls.

Aerodynamic in the Evening Air...

-Lotus

The raising of an Albatros... fourteen months of development in thirty seconds.

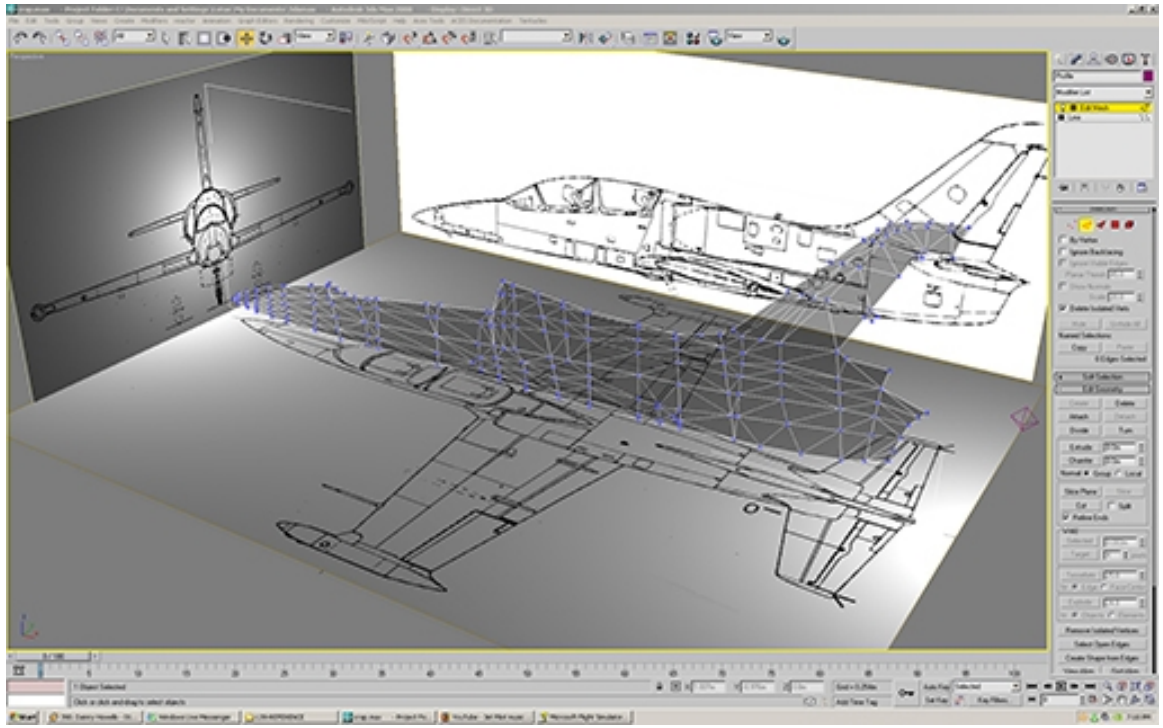


Fig. 1:

April 8, 2008, 11:30 pm. The adventure begins... first polygon, second polygon...

Fig. 2:

First export into FSX. Possible scale issue.

Fig. 3:

Second export. Who says planes have to have three wheels... or two wings?

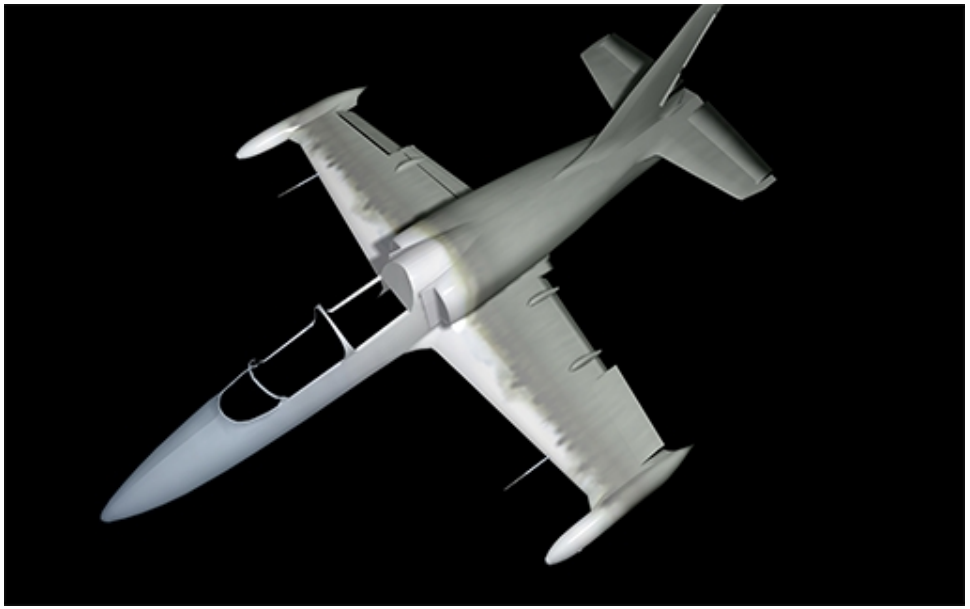


Fig. 4:

Starting to look like an L-39... sorrrrt of.

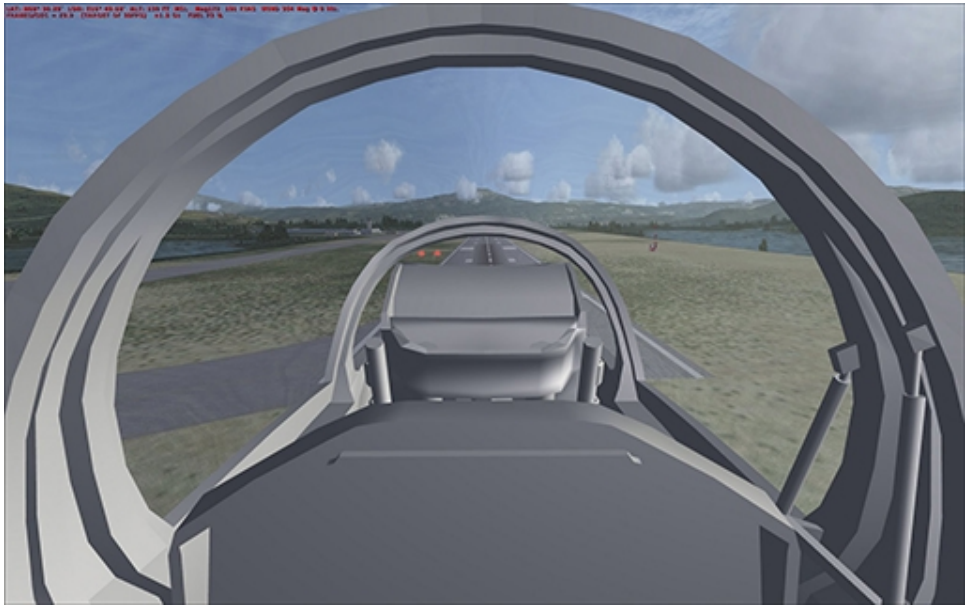


Fig. 5:

First VC export.

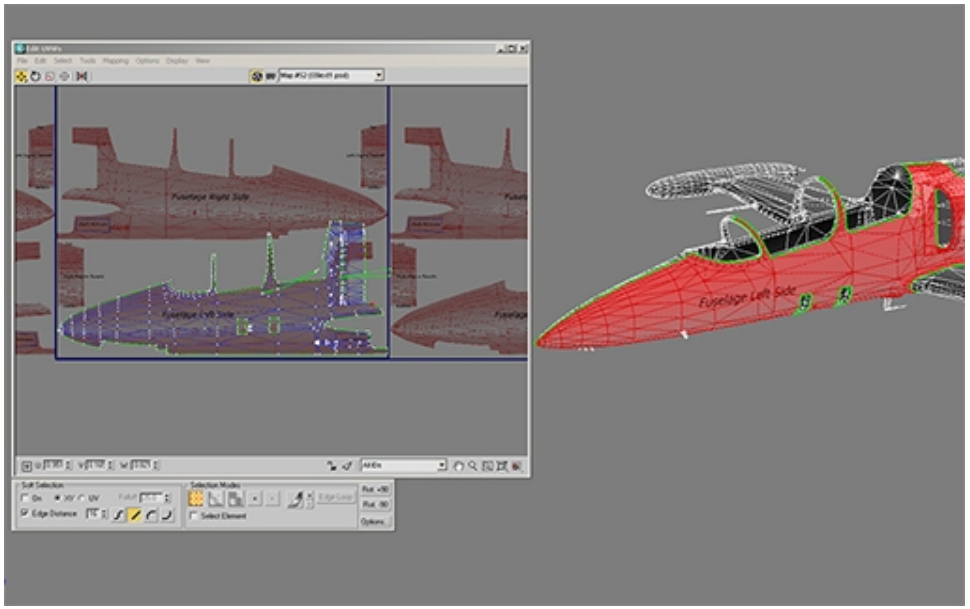


Fig. 6:

The endless joy of UV mapping.

Bottle(s) of aspirin and vodka not shown.

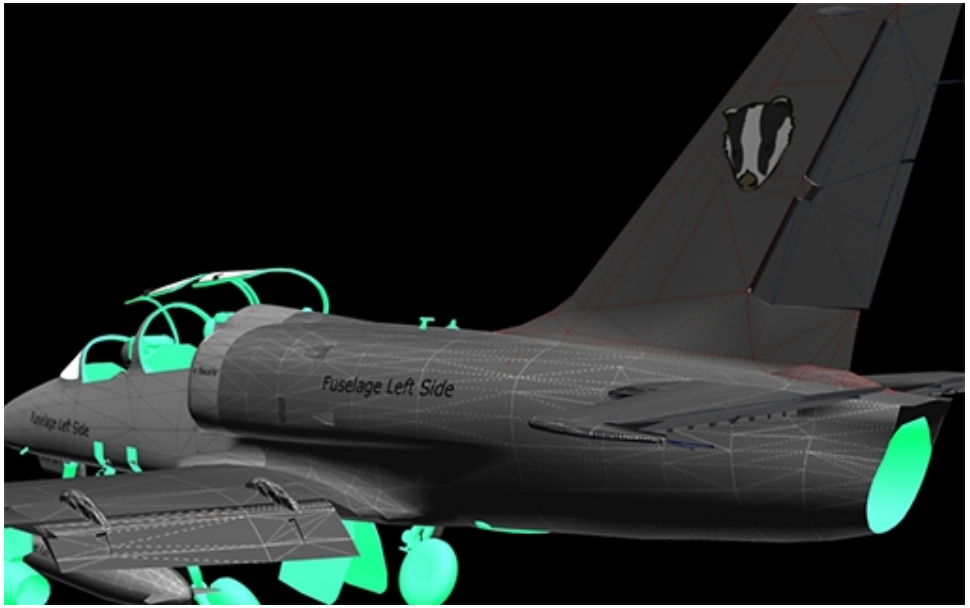


Fig. 7:

The badger monitors development progress closely. He is rarely amused.

Fig. 8:

First 3D gauges. No, really.

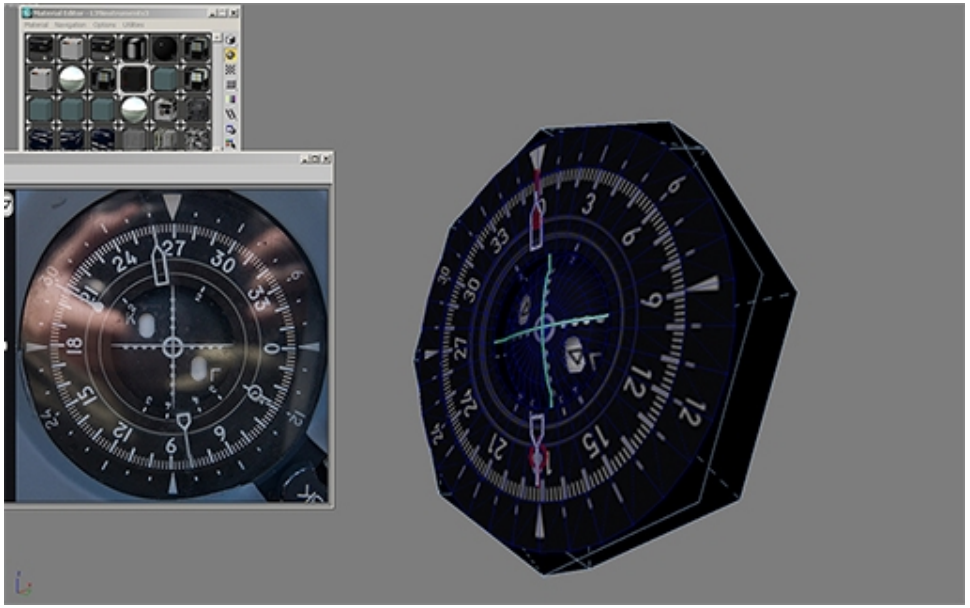


Fig. 9:

The HSI contains the secrets of the universe, but they're written in Cyrillic.

Fig. 10:

First textures.

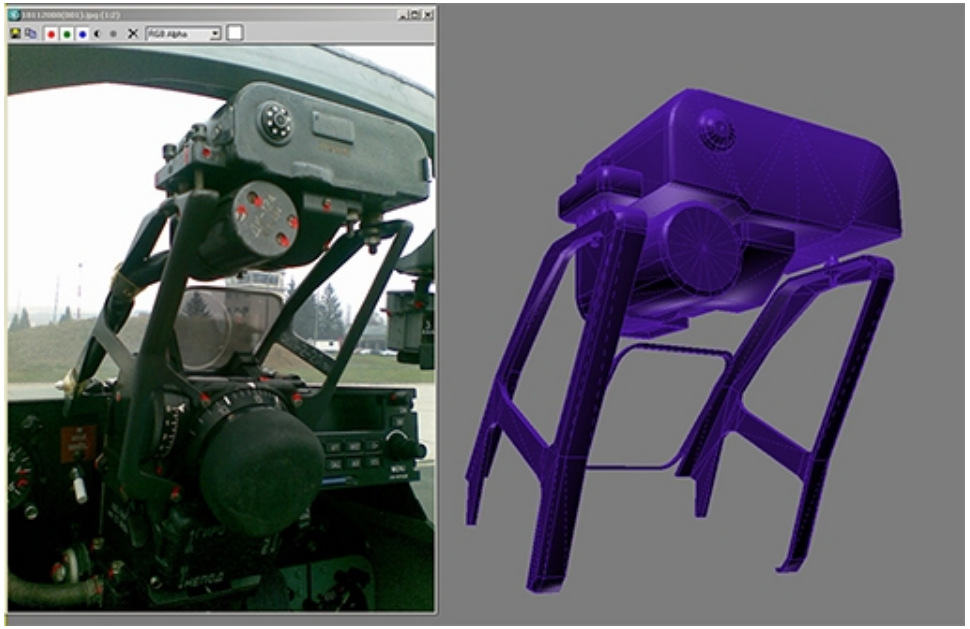


Fig. 11:

The gunsight, aka "That fiddly thing on the dash" aka “The polygon black hole” takes shape.

Fig. 12:

Schizotros rides again. Such is life between paint jobs.

Fig. 13:

Really quite disturbing!

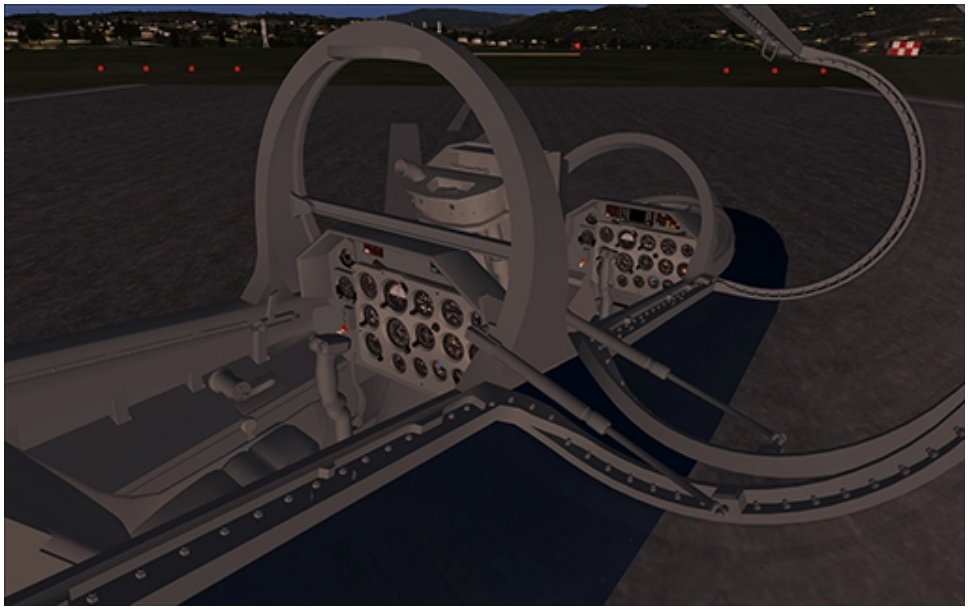


Fig. 14:

VC begins to take final form.

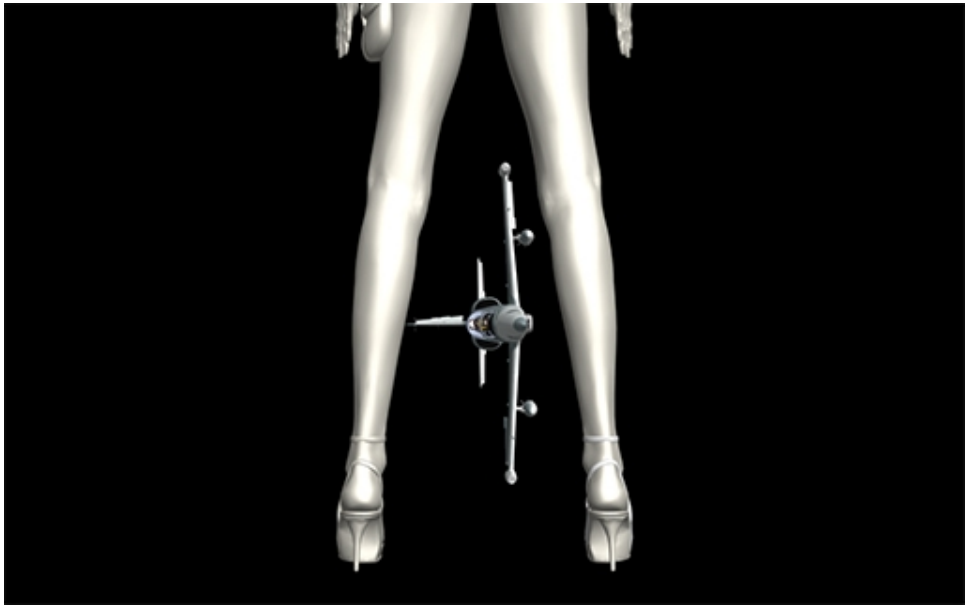


Fig. 15:

It was 4 am. Don't ask.

Fig. 16:

FSX throws hissy fit (one of many) and ejects test pilot through canopy. He came back for his helmet visor later.

Fig. 17:

In a spin...and on fire? No problem... I think.

Fig. 18: July 2009. All grown up, and leaving the nest. Good luck out there little Albatros.