Flying the Basler BT-67 in FSX

Contents

The BT-67 is a Microsoft Flight Simulator X project by Daniel Fürnkäß (paints and research), Manfred Jahn (models), Alexander M. Metzger (flight dynamics and documentation) and Hansjörg Nägele (gauges, animation and documentation). 1 July 2012.

Introduction

Welcome to a simple guide on how to fly the Basler Turbo-67 also known as BT-67. You may know how to operate the default DC-3 and may be familiar with some of its typical flying characteristics. Nevertheless we recommend that you acquaint yourself with the specifics of the BT-67. A good overview is available on the manufacture's web site www.baslerturbo.com. We have used their information as references and tried to match them as closely as possible. Let's look at some specification data:

Table 1: Comparison of BT-67 and Piston Engine DC-3

	BT-67	DC-3
Engines	P&W Canada PT6A-67R turboprop	P&W R-1830 radial
Maximum power	1424 SHP	1200 HP
Propeller	Hartzell 5 Blade 111 inch	HSD 3 blade 138 inch
Cabin Width	7 feet	Same
Cabin Height	6 feet	Same
Cabin Length	42 feet, 2 inches	33 feet, 10 inches
Maximum Take-off Weight (MTOW)	28,750 lbs	26,900 lbs
Zero Fuel Weight (ZFW)	15,700 lbs	17,815 lbs
Maximum Useful Load	13,000 lbs	9,085 lbs
Standard Fuel Capacity	772 USG	800 USG
With Long-range Tanks	1,542 USG	N/A
Range (Standard Cruise – 45 min. Reserve)		
Standard Fuel	950 Nm	1,160 Nm
Long-range Fuel	2,140 Nm	N/A
Single Engine Ceiling	14,000 ft @ 27,000 lbs	9,000 ft @26,200

Courtesy of www.baslerturbo.com

So basically you have an aircraft with more power that can carry more payload and fly further if fitted with the extra fuel tanks.

The major differences are of course the turboprop engines which are lighter, more powerful and more reliable than the P&W Cyclones. Together with the 5-blade propellers the comfort in the cockpit and cabin is significantly improved due to less vibration and noise.

This is the base for an extremely versatile aircraft that can handle a wide range of tasks and can be fitted with interior and exterior facilities for transportation, exploration and flying in hot or extremely cold conditions. Currently BT-67s are used world-wide for Environmental Research in Arctic/Antarctic regions, Geophysical Survey, Drug interdiction and general cargo or fuel transportation – to name a few.

The Cockpit

After the conversion, the cockpit is equipped with a modern panel and the typical engine instrumentation of a twin turboprop including an avionics suite for IFR flying. The power quadrant on the center pedestal has an easy-to-operate set of power, propeller and condition levers. The elevator trim wheel and the aileron and rudder trim knobs are easily accessible to both pilots as are the flaps and the tail wheel lock levers.

We assume you are familiar with the standard instruments in the main panel.

In the overhead panel you find five subsections (from left to right):

- Engine start/light switches/anti-icing
- Propeller settings and fuel dump
- Fire protection and annunciator panel
- Fuel system control
- Electrics

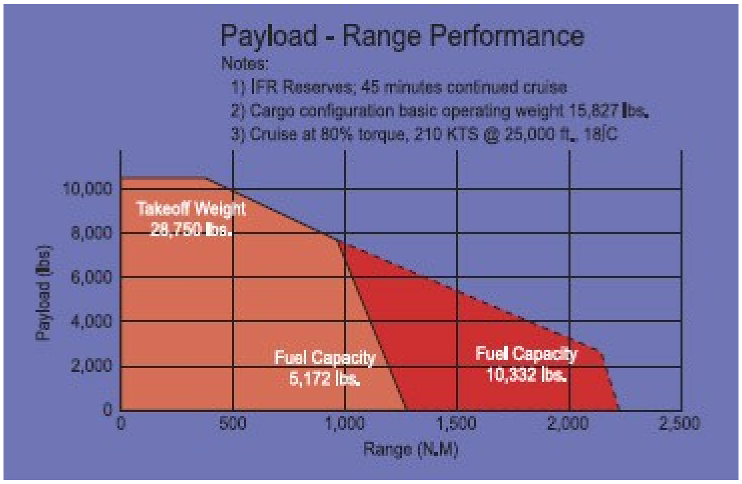
Getting started

The default load in FSX is a crew of two pilots, a maximum of 36 passengers and 950 pounds of cargo distributed in the compartments. The total payload is then calculated to 7610 lbs. With a full load of fuel in the main wing and auxiliary wing tanks (about 50% of the total capacity) you are just below MTOW of 28,750 pounds.

Flight Planning

If your planned flying distance requires the use of the wing tip tanks (distance > 950 Nm for MTOW [max take-off weight]), you need to reduce the payload to avoid an overloaded aircraft. The following Diagram 1 shows you the possible payload over range. The above mentioned default load puts you right at the top line where the red area starts. Any increase in required range and thus more fuel needs to be balanced off the payload that can be carried safely.

Diagram 1: Payload over Range



Courtesy of www.baslerturbo.com

Engine Start Procedure

We assume you have done your proper flight preparation, filled the tanks with the required fuel quantities, have passengers and cargo secured and all doors are closed.

While the flight preparation and start procedure is the same as for any other turboprop type engine with constant-speed propellers, the additional weight capacity results in a higher wing load and an increased inertia on all axes as compared to the original DC-3.

Engine start procedure:

- Set parking brakes
- Battery ON
- Ground Power disconnect
- NAV lights ON
- Beacon ON
- Passenger signs ON
- Check area clear
- Fuel pumps ON – check green light ON
- Ignition START
- Starting engine
    - Condition lever FUEL CUTOFF
    - Prop max RPM
    - Push START button and hold
    - When Ng above 10% set Condition Lever to LOW IDLE
    - Check oil pressure rise and annunciator light extinguishing
    - Check ITT not exceeding 800 °C
- Generator ON
- Avionics ON

After the engine has started, stabilize the RPM at about 1000 for warming up by pushing the condition lever to maximum idle. Once warmed up, pull it back to low idle which should give you about 800 RPM.

Power push-back

The Basler is capable of slowly rolling backwards by applying reverse power. Make sure the tail wheel is locked and you use low idle position on the condition levers. Then set propellers to reverse and the TQ will climb to about 40 % while the propellers stabilize at 1200 RPM. If you want to stop your push-back, press brakes and only then put the propellers back to idle position.

Taxiing

With an aircraft fully loaded, you need to pay special attention to the taxiing procedure. Make sure that the tail wheel is unlocked before you start taxiing. Advance the condition lever for more RPM slowly and let the aircraft start rolling before applying left or right brakes for initiating turns. On snow additional power is needed to overcome the higher ground friction. You may control taxi speed with the condition lever. If heavy loaded, The Basler needs max idle settings (1000 RPM) to start rolling. If slightly loaded the min idle settings (700 RPM) are sufficient. At low speed (<40 kts) the rudder is not sufficient to control direction. So you need to execute steering by differential braking and may support it with differential power settings on the engines. Do not exceed 10 knots on taxiways as it will be difficult to control the aircraft, especially in crosswind conditions.

Note: if you prefer steering the plane via the rudder controls you will have to edit the aircraft-cfg file and activate this option in section [contact points], entry point.0

Execute the "Taxi Checks":

- Check brakes
- Landing lights ON
- Pitot heat ON
- Anti-icing as required
- Flaps to ¼
- Elevators trim "neutral" (zero) for even load distribution.
- Check oil pressure and temperature in green range (annunciator lights OFF)

Take-off

After proper alignment with the runway check your runway heading. Lock the tail wheel and after assurance that you are "ready-to-go" advance power slowly with the brakes still firmly engaged. Only when the engines spool up simultaneously, release the brakes and control initial steering with differential braking. Push the power levers slowly forward to just reach 100% torque (TQ) - watch out not to over-torque the engines and over-speed the propellers. Only from 40 knots the rudder will assist directional control. At about 60 knots – depending on load – the tail will come up but keep the wheels on the runway to accelerate to 80 knots. Then pull lightly on the yoke so that the aircraft gets airborne. Pull up the gear while maintaining a bit of back pressure on the yoke and once the gear is retracted let the aircraft accelerate to 95 knots to put the flaps up. Maintain 1000 feet/min climb rate to accelerate further and once you exceed 130 knots maintain speed while pulling back power to 95% TQ and 1450 RPM. Maintain 135 to 140 KIAS for initial climb as per Table 2 on the following page.

Now it is time to do the "After Take-off Checks":

- Gear UP
- Flaps UP

- Engines Climb (95% TQ / 1450 RPM)
- Fuel pumps ON
- Climb rate / speed Normal (1000 ft/min @135 KIAS)
- Instruments All good

Climb

The cruise climb speed is higher on the BT-67 versus a standard DC-3. It is due to the higher wing load and that needs to be compensated by more lift from increased airflow to avoid too high angle of attacks which may generate too much drag to climb efficiently.

Switch off your Landing Lights when passing 10,000 feet or FL100.

Table 2: Climb Data

Climb Data @ Gross WT. 28,750 lbs 95% Torque, 1425 rpm				
KTAS	ALT.AGL	Fuel flow lbs/hr	Fuel burned lbs.	Rate of climb
133	1000	1140	53	1000
138	3000	1110	99	800
143	5000	1080	166	750
149	7000	1050	216	725
149	9000	1040	271	700
154	11000	1010	333	700

Courtesy of www.baslerturbo.com

Cruise

The Basler has no pressurized cabin. This limits the flight altitude to 10,000 feet without using oxygen masks. Although the BT-67 is capable of flying higher, more than 15,000 feet is not recommended. Watch the distribution of fuel in the tanks during cruise and pump fuel from the auxiliary tanks to the main tanks. When you start your descent the main tanks should be the fullest tanks.

Table 3: Cruise Data

Cruise Data

9500 ft OAT + 11ºC

Torque	TAS	Fuel Flow lbs/hr
90%	196	1020
85%	182	970
80%	177	932
70%	167	860

10500 ft OAT + 10ºC

Torque	TAS	Fuel Flow lbs/hr
95%	207	1040
90%	200	1000
85%	186	950
80%	180	920
70%	169	850

12500 ft OAT + 7ºC

Torque	TAS	Fuel Flow lbs/hr
95%	215	1020
90%	205	1000
85%	191	950
80%	185	920
70%	174	850

14500 ft OAT + 6ºC

Torque	TAS	Fuel Flow lbs/hr
95%	220	1000
90%	210	960
72%	180	840

Courtesy of www.baslerturbo.com

Descent

Calculate your Top of Descent (TOD) with about -1000 feet/min vertical speed. Assuming 180 KTAS as average during the descent, you fly about 3 Nm/min. So you need to calculate 3 Nm distance for your TOD for every 1000 feet of altitude plus about 5 Nm for deceleration to 100 knots entry speed when reaching the airport proximity.

Switch on your landing lights when descending through 10.000 feet or FL100.

Do not forget to adjust your barometric pressure on the altimeters.

Approach and Landing

You should fly your approach pattern with about 100 KIAS and your final approach speed at about 1.3x stall speed. 80 KIAS is a good general target figure.

To slow down from the descent speed of 160 at lower altitudes to 100 KIAS pattern speed, lower the gear at 130 and set flaps ¼ at 120. Then maintain 100 until you start your final descent and set flaps ½ to keep speed constant. Having the runway in sight, you slow down by setting flaps full and maintain 80 KIAS as your final approach speed. You need to quickly add some power to compensate for the flaps drag and increase RPM to maximum (this is needed in the event you have to abort your approach).

Now it is time to do the "Landing Checks":

- Gear — DOWN – 2 lights
- Flaps — FULL
- Engines — Final (30% TQ / 1700 RPM)
- Descent rate / speed — Normal (450 ft/min @80 KIAS)
- Instruments — All good
- Landing lights — ON

Typically you need about 30 % TQ to maintain a stable approach down to the runway. Once you are over the fence, pull back gently the power levers to idle and flare the aircraft to a horizontal attitude for touch down on the main wheels. Pull back on the yoke and brake gently. Use reverser power to support the deceleration.

Unlock the tail wheel and taxi to your parking position and shut down the engines. Welcome!

Appendix A: FSX Basler BT-67 Systems Description

1) Electrical System

The electrical system is of four-buss type (left and right generator, main and avionics bus). Ship battery voltage is **24V**. Setting the external power switch to position **ON** connects the aircraft to a ground power source, but only if the parking brake is set.

NOTE (FSX): External power is only available with installed ***FSX Acceleration Pack*** or with installed ***FSX Gold Edition***. With any other installation (FSX RTM, FSX SP1, or FSX SP2), the external power switch will have no effect.

In case of the electrics is on battery power only (without generators or ground power), the battery is discharging atleast **70%** slower than the **FSX** default effect. Therefore it is no problem to start the engines with a fully charged battery without ground power. However, a discharged battery can be charged at any time by *middle*-clicking the battery switch.

2) Hydraulic System

Hydraulic pressure is supplied by two engine-driven variable displacement pumps. Two hydraulic switches on the overhead panel control the hydraulic pumps of the left and right engine. Normal system pressure is **900 psi**. A minimum pressure of **600 psi** is needed for successful operation of gear, wing flaps, brakes, and ski (if so equipped). In case of failure of both engine-driven hydraulic pumps, a hand pump is used to provide emergency pressure for the hydraulic system, ie. for lowering flaps, gear extension or braking).

Emergency extension of the landing gear

Even with failed engine pumps, gear may still be pumped down using the hydraulic hand pump. For this to work, the gear lever must be in **DOWN** position. The hand pump must be moved (*left-click*: one stroke, *middle-click*: continuous pumping) until the gear lights turn on indicating that the gear is fully down and locked.

NOTE: Do not extend gear above **141 KIAS**.

Wing flaps

Wing flaps are hydraulically actuated and can be lowered in four steps, **25%**, **50%**, **75%,** and **DOWN**.

NOTE: Flaps must be up above **133 KIAS**, otherwise they may take damage.

NOTE (FSX): In case of **FSX** toggles a complete hydraulic failure event, the emergency hand pump will have no effect except that the gear may still be lowered with the emergency procedure described above (this will then take several minutes). However, without hydraulic failure event, but low hydraulic pressure, the emergency hand pump allows operation of flaps, brakes and also gear retraction.

3) Fuel Distribution

The *BT-67* is equipped with four standard fuel tanks and two optional long-range tip tanks for a maximum fuel capacity of **1542 gal** (**10331 lbs,** *FSX: 1 gallon = 6.7 pounds*):

- ***(2)*** *main, 202 gal (1353 lbs) ea.*
- ***(2)*** *inboard auxiliary, 200 gal (1340 lbs) ea.*
- **(2)** wing auxiliary (long-range tanks), 390 gal (2613 lbs) ea.

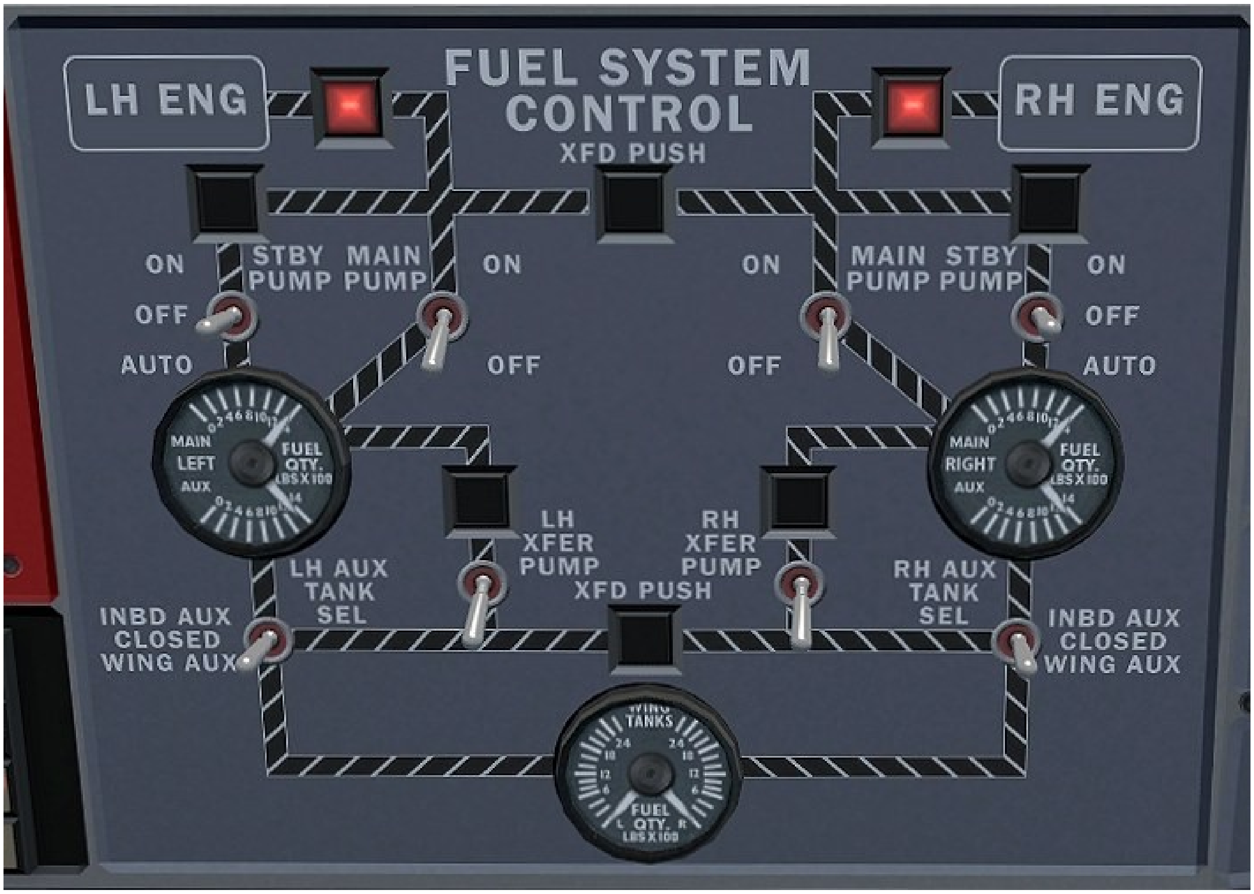


Fig. A-1: Fuel System Control

There are four electrical fuel pumps - **(2)** left and right main, **(2)** left and right standby. The main fuel pumps must be turned **ON** during all stages of flight. The standby fuel pumps are used in case of one or both main pumps have failed. In position **AUTO**, the standby fuel pumps automatically switch on if the fuel pressure of the associated engine (left or right) drops below a critical value. If a standby fuel pump has activated automatically,it remains on until its switch is set back to **OFF**, no matter if the corresponding main fuel pump (of the same wing side) is able to provide satisfactory fuel pressure or not.

NOTE (*FSX*): If one of the standby fuel pump turns on automatically, the standby pump on the opposite wing side will always activate as well (provided it is set to position **AUTO**), regardless if the fuel pressure of the other engine is critical or not.

Recommended switch settings (normal flight):

Main fuel pump switches.............................**ON**
Standby fuel pump switches.........................**AUTO**
Fuel crossfeed valve....................................**CLOSED**

If the fuel crossfeed valve is closed, each engine only can draw fuel from the main tank located on the same wing side, provided at least one the fuel pumps (main or standby) of this wing side are working.

NOTE: If on a wing side both fuel pumps (main and standby) are turned off, the fuel in this main tank of that wing side cannot be used.

With crossfeed **OPEN**, the engines can draw from either main tank. Fuel located in one of the other tanks must be pumped first into a main tank before it can be consumed. In an emergency, both engines can be supplied with fuel even if only one of the four fuel pumps (main or standby) remains active, as long as the crossfeed valve is open and the main tank of the wing side with the running fuel pump still contains some fuel.

For fuel crossfeed operation, the fuel pumps on the receiving wing side must be turned **OFF**, while on the other wing side at least one fuel pump must be active.

NOTE: Even with opened crossfeed valve, an engine won't draw fuel from the other wing side, as long as one of the fuel pumps on its wing side is running. Therefore, those pumps must be turned **OFF** to prevent that fuel from the main tank of the same wing side is consumed.

EXAMPLE: Fuel crossfeed from left to right side (both engines draw from left main tank):

Fuel crossfeed valve...................................**OPEN (PUSHED)**
Left main fuel pump switch…......................**ON**
Left standby fuel pump switch......................**AUTO**
Right main fuel pump switch........................**OFF**
Right standby fuel pump switch...................**OFF**

EXAMPLE: Fuel crossfeed from right to left side (both engines draw from right main tank):

Fuel crossfeed valve...................................**OPEN (PUSHED)**
Left main fuel pump switch…......................**OFF**
Left standby fuel pump switch......................**OFF**
Right main fuel pump switch........................**ON**
Right standby fuel pump switch...................**AUTO**

NOTE: With following fuel pump settings, the left engine draws from the left main tank and the right engine from the right engine (no fuel crossfeed, although crossfeed valve is open):

Fuel crossfeed valve....................................**OPEN (PUSHED)**
Left main fuel pump switch….......................**ON**
Left standby fuel pump switch......................**AUTO**
Right main fuel pump switch........................**ON**
Right standby fuel pump switch...................**AUTO**

However with the above settings, if one main tank becomes empty before the other main tank, none of the engines will fail, because the engine on the wing side with the empty main tank is then fed automatically by the fuel pumps and the main tank from the other wing side.

Fuel transfer

Since engines can only draw from the main tanks, fuel located in other tanks must be transferred into that tanks before it can be consumed. There are two electrically driven transfer pumps, each capable of transferring up to **16 gal/min**. To transfer fuel into a main tank, the fuel transfer pump of that wing side must be turned **ON**.

Fuel only can be transferred from an *inboard auxiliary tank* or from a *wing auxiliary tank* into one or both main tanks. From which tank the fuel is taken is determined by the transfer tank selector switch, which has three positions **INBOARD AUX - CLOSED - WING AUX**

NOTE: It is not possible to transfer fuel from one main tank into the other.

There is a fuel transfer crossfeed valve, allowing to transfer fuel into the main tank of the other wing side (provided, the fuel transfer pump of the receiving side is turned **ON** and running). The *control panel popup (Appendix C)* can be used to monitor the amount of fuel which is transferred by the transfer pumps into each main tank.

EXAMPLE: Fuel transfer from left inboard aux tank into left main tank:

Fuel transfer crossfeed valve…...................**CLOSED**
Left transfer tank selector switch…..............**INB AUX**
Left fuel transfer pump switch......................**ON**

EXAMPLE: Fuel transfer from right wing aux tank into right main tank:

Fuel transfer crossfeed valve…...................**CLOSED**
Right transfer tank selector switch...............**WING AUX**
Right fuel transfer pump switch....................**ON**

EXAMPLE: Fuel transfer from left inboard aux tank into right main tank:

Fuel transfer crossfeed valve…...................**OPEN (PUSHED)**
Left transfer tank selector switch…..............**INB AUX**
Right transfer tank selector switch...............**CLOSED**
Left fuel transfer pump switch......................**CLOSED**
Right fuel transfer pump switch....................**ON**

EXAMPLE: Fuel transfer from left wing aux tank into both main tanks:

Fuel transfer crossfeed valve….................... **OPEN (PUSHED)**
Left transfer tank selector switch…..............**WING AUX**
Right transfer tank selector switch..............**CLOSED**
Left fuel transfer pump switch......................**ON**
Right fuel transfer pump switch...................**ON**

In a fuel transfer crossfeed situation it is recommended to keep the transfer tank selector switch of empty tanks in position **CLOSED** for maximum transfer speed.

EXAMPLE: Transfer crossfeed situation with two supplying tanks (one on each wing side):

Fuel transfer crossfeed valve….................... **OPEN (PUSHED)**
Left transfer tank selector switch…..............**WING AUX**
Right transfer tank selector switch..............**INB AUX**
Left fuel transfer pump switch......................**ON**
Right fuel transfer pump switch...................**ON**

NOTE: In a transfer crossfeed situation with both transfer pumps turned on, the transfer direction is dependent on which of the two transfer pumps was turned on earlier than the other (since there is only one transfer crossfeed line, fuel can only flow in one direction at a given time).

With the above settings, the transfer direction is from right wing side to left wing side, causing the right fuel transfer pump to move **16 gal/min** from the right inboard auxiliary tank into the right main tank, while the left transfer pump takes **8 gal/min** from the right inboard auxiliary tank and **8 gal/min** from the left wing auxiliary tank into the left main tank.

Fuel dump

There are two electrically actuated dump chutes, one for the left and right main tank, which can be opened to dump fuel in case of an emergency. Fuel dump is controlled by two protected switches on the overhead panel, labelled **CLOSED – OFF – OPEN**. In **CLOSED** position, the chutes are retracted. Moving the switches to **OFF** deploys the chutes but still keeps the dump valves closed. Fuel dump is started in **OPEN** position. Each chute can dump up to **60 gal/min.**
Undumpable fuel in each main tank is **24 gal.**

Fuel dump switches…..................................**from CLOSED to OFF**
Passenger no-smoking lights….................. **ON**
Unnecessary electrical systems................. **OFF**
Strobe lights….......................…..................**OFF**

Aircraft attitude……………………………………..**LEVELLED (or slight NOSE-UP)**
Fuel dump switches……………………………….**OPEN**
Main tank fuel indicators………………..…..**MONITOR (for desired amount of fuel dumped)**
Fuel dump switches……………………………….**OFF, then (after 30 SECONDS) set to CLOSED**

There is no dumping provision for the *inboard auxiliary tanks* and *wing auxiliary tanks.* However, fuel in that tanks may be transferred into the main tanks first and then dumped as well.

4) Fire Detection and Extinguishers

The red fire protection panel is placed in the middle of the overhead panel and offers warning lights for engine fire and low fire extinguisher pressure. The fire warning lights can be tested by setting the test switch to position **FIRE TEST**. In this test position, also a fire audio warning should be heard. The **FAULT TEST** position tests the two low pressure lights located below the fire warning lights. The fire warning sound can be silenced by pushing the **SILENCE** button. The fire extinguisher is a 4-bottle system, two for each engine. Extinguishers are discharged by moving the fire extinguisher switches to **NO.1** or **NO.2**. The low pressure light indicates a discharged bottle when extinguisher switch is positioned to **NO.1** or **NO.2**.

NOTE: Since a fire bottle is completely discharged with the first shot, the low pressure warning light will go on shortly after the extinguisher switch has been actuated.

5) De-Icing Equipment

Complete propeller and engine air inlet de-icing system. Bleed air supply for wing and empennage de-icer boots. De-icing switches for propellers, engine anti-ice (labelled **INERTIAL SEP**), and surface de-ice are located on the left front overhead panel.

6) Propeller Auto-Feathering

The auto-feathering arm switches have three positions, **TEST – OFF – ARM**. **TEST** position tests the auto-feather armed indicator light, while **ARM** activates the system. The switch should be set to **ARM** prior to take-off and landing. The system works as follows: The propeller will be feathered automatically, if an engine drastically loses power and throttle lever is advanced more than **60%**. The systems disarms after the first propeller has been feathered and cannot be rearmed for the remaining one. A propeller unfeathers as soon as propeller speed exceeds **1000 RPM**.

NOTE: Even with the switch in **ARM** position, the armed light will stay off as long as the throttle lever position of the associated engine remains below **60%**.

Appendix B: Fuel & Payload Popup

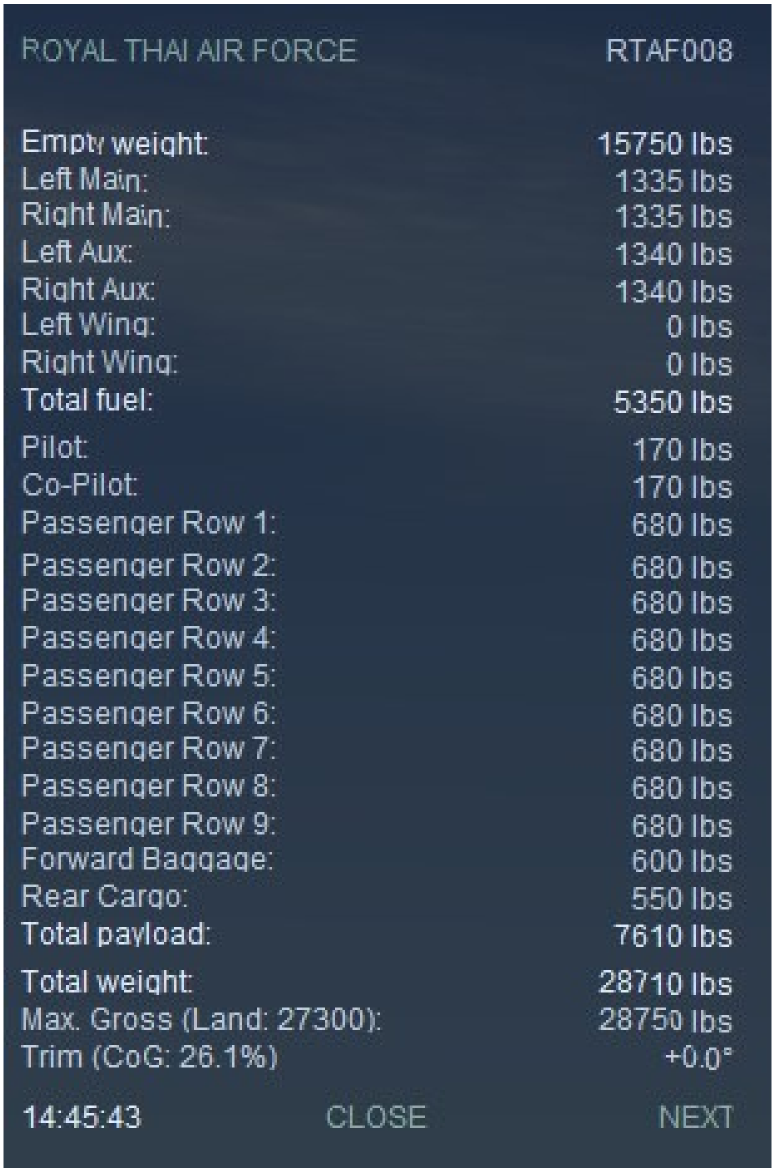


Fig. B-1: Fuel & Payload

This popup is visible in 2D-Cockpit view at the beginning of a flight when the aircraft is loaded. It remains visible in all **FSX** views (2D, VC, chase, tower, map) until it is removed by clicking **CLOSE**. It can be re-opened any time by hitting *Shift-2*. The popup shows various kind of fuel and payload weights, as well as current elevator trim and **CoG** (*center of gravity*) figures and therefore can be used as trimsheet.

Left-click the airline or call sign to contact Air Traffic Control, right-click for Mission Briefing.

While payload can only be displayed in *pounds (lbs)*, the fuel units of measurement can be changed by *middle*-clicking into the current fuel quantity:

- **Pounds** (1 lb = 0.453 kg)
- **Gallons** (FSX: 1 gal = 6.7 lbs)
- **Percent** (of tank capacity)
- **Hours** (remaining air time based on current fuel flow)

With aircraft stopped on ground (parking brake set), it is possible to change the fuel and payload weights by *left/right*-clicking into the weight numbers. The pilot's weight cannot be changed, but the co-pilot can be removed completely by setting his weight to zero.

While it is possible to change the content of each tank separately by clicking into the fuel quantity, it also is possible to apply predefined fuel configurations: Repeat clicking with left or right mouse button into the "**Total fuel:**" field. When clicked, the field temporarily changes to "**Select fuel:**" in blue color and allows picking one of the following four predefined fuel configurations (displayed on the right side of the line):

- **NORMAL** (medium fuel load for more payload capacity)
- **MAX** (all tanks filled **100%**)
- **PATTERN** (minimum fuel for a short flight only)
- **EMPTY** (remove all fuel)

A *middle*-click while it is displayed in blue color chooses the selected configuration. **EMPTY** additionally sets the plane into a *"cold & dark"* condition.

Similar to the predefined fuel configurations, there is also the possibility to choose a predefined payload config:

- **NORMAL**
- **PASS**
- **CARGO**
- **HEAVY**
- **LIGHT**
- **EMPTY**

Repeat clicking with left or right mouse button into the "**Total payload:**" field. When clicked, the field changes to a blue "**Select payload:**" Further clicking cycles through the configurations listed above. *Middle*-click "**Select payload:**" while it is still in blue color to choose the desired configuration. If **NORMAL** is selected, all payload weights are set exactly as specified in the *AIRCRAFT.CFG* file, so that this is equivalent to the default configuration when the aircraft has been loaded from the *FSX* aircraft menu.

NOTE: With **HEAVY** selected, the maximum take-off weight will be exceeded unless some fuel is removed from the tanks.

The total weight figure (shown below the total payload weight) is displayed in red color, if maximum gross weight is exceeded. As long as the lettering is green, total weight is below the maximum landing weight (see *Appendix D: Limits*).

Left-/right-click into elevator trim degrees decreases/increases current setting. *Middle*-clicking trim degrees centers elevator-, aileron-, and rudder-trim.

The digital clock bottom left on the popup can be changed into a stop watch by *middle*-click. When used as stop watch, subsequent left-clicking starts, stops, or resets the timer.

The **NEXT** button calls up the *control panel popup (Appendix C).*

Appendix C: Control Panel Popup

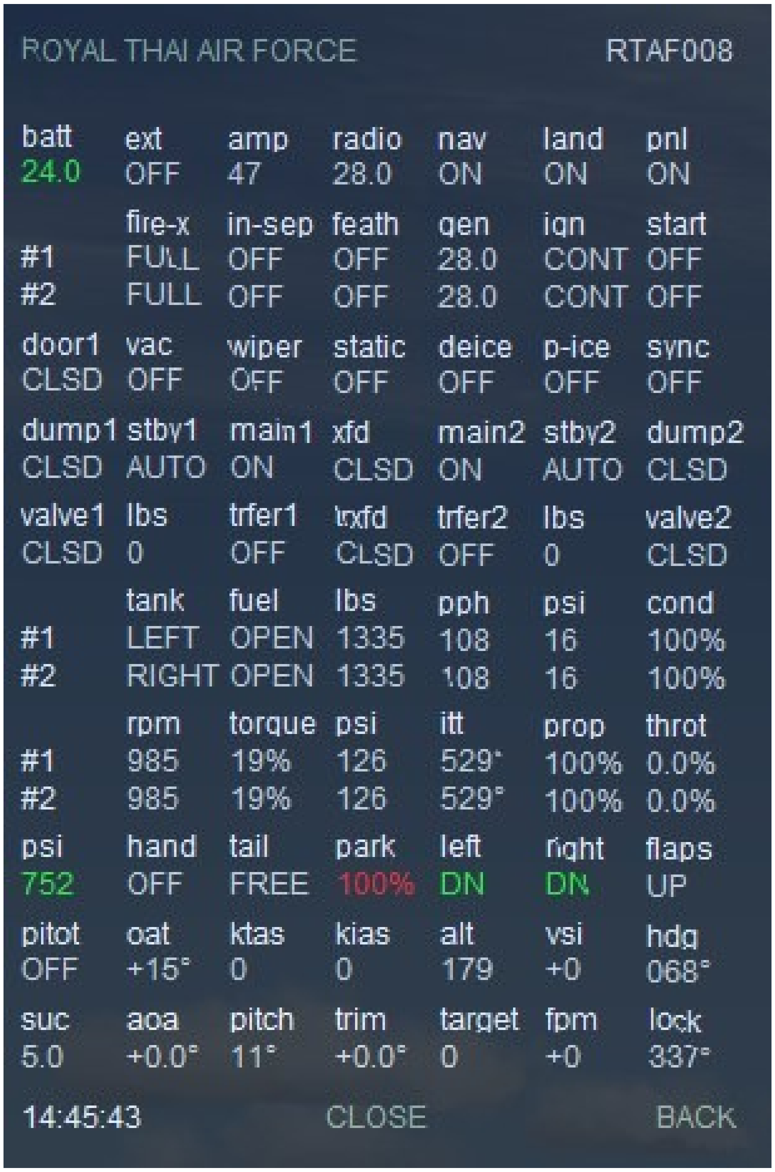


Fig. C-1: Control Panel

The *control panel popup* (*Shift-3 to open independently)* allows to monitor almost all relevant flight instrumentation data. It offers numerous click-areas for multiple action, so that the aircraft can be operated exclusively from within this panel.

The popup is divided into ten sections:

- ELECTRICS
- STARTER TABLE
- SYSTEMS TABLE

- **FUEL PUMPS**
- **FUEL TRANSFER**
- **FUEL TANKS**
- **ENGINES**
- **HYDRAULICS**
- **SPEED/POSITION DATA**
- **AUTOPILOT**

Each section consists of a headline, followed by one or two data lines. Often, a column field in the headline can be *middle*-clicked to change the associated data value in the column below into a different unit of measurement (ie. fuel flow: *PPH - GPH*), or to display other figures (ie. *AMPS - VOLTS***)** in the data field(s). Many data fields can be clicked (with left or right mouse button or mouse wheel), too, for various modifications related to the currently displayed data value. As a general rule, a field is clickable if the mouse arrow shows a *tooltip* when pointing into that field. Usually, the action initiated by a click is similar to operating the corresponding switch or handle in the **VC** (ie. *left*-click: move switch down, *right*-click: move up). Data fields may be displayed in different colors, ie. a red item indicates that the current value needs special attention and if possible, immediate correction by the pilot, because it's not within the limits.

In detail, the tables display the following flight instrumentation data:

Electrics

batt	Battery *voltage* (toggle battery switch, *middle*-click: charge battery)
ext	Ground power *voltage* (toggle external power switch)
amp/volts	Main bus *voltage*, total load *amps*
radio	Avionics bus *voltage* (toggle avionics switch)
nav/bcn/strobe	Navigation, beacon, strobe lights state (toggle)
pnl/cab	Panel, cabin lights state (toggle panel and cabin lights)
land	Landing lights state (toggle landing lights switch)

Starter Table

fire-x	Fire warning, fire bottle *%* (fire warning test, toggle fire extinguishers)
in-sep	Inertial separator (toggle engine anti-ice)
feath	Auto-feathering armed state (toggle auto-feather arm switch)
gen	Generator bus *voltage* (toggle generator switches)
ign	Toggle ignition switches
start	Toggle starter buttons

Systems Table

door1/2/3/

win1/win2/
shade/steps Exits/window/sunshade state (toggle exits/windows/passenger steps, *middle*-click: all exits)

vac Toggle standby vacuum pump
wiper Toggle windscreen wiper
static Toggle alternate static source
deice/ice Surface de-ice state, ice formed *%* (toggle structural anti-icing)
p-ice Toggle propeller de-icing
sync Toggle propeller synchronizer

Fuel Pumps

dump1/chute1/
lbs/gal Left dump chute position, fuel dump quantity *lbs, gal* (toggle left fuel dump switch)

stby1 Toggle left standby fuel pump switch
main1 Toggle left main fuel pump
xfd Fuel crossfeed toggle
main2 Toggle right main fuel pump
stby2 Toggle right standby fuel pump switch
dump2/chute2/
lbs/gal Right dump chute position, fuel dump quantity *gal*, *lbs* (toggle right fuel dump switch)

Fuel Transfer

valve1 Toggle left fuel transfer tank selector switch
lbs/gal Left fuel transfer quantity *lbs, gal*
trfer1 Left fuel transfer pump toggle
trxfd Toggle fuel transfer crossfeed valve
trfer2 Right fuel transfer pump toggle
lbs/gal Right fuel transfer quantity *lbs, gal*
valve2 Toggle left fuel transfer tank selector switch

Fuel

tank Selected tank for each engine
fuel Fuel valves position
lbs/gal/%/hrs Fuel quantity selected for each engine *lbs, gal, %, airtime in hours*
pph/gph Fuel flow *pounds per hour, gallons per hour*
psi Fuel pressure *PSI*
cond Condition lever *%* (set condition lever position, *middle*-click: link/unlink **VC** levers)

Engines

rpm/ng/

ratio/bleed	Propeller *RPM*, N_g *%*, pressure ratio, engine bleed air *PSI*
torque/f-lbs/n2	Torque *%*, *ft-lbs*, N_2 *%*
psi/oil	Oil pressure *PSI*, oil temperature *°C*
itt/egt	Interstage turbine temperature *°C*, EGT *°C*
prop/beta	Propeller lever %, pitch angle (beta) *grads* (set propeller lever position, feathering)
throt	Throttle lever *%* (set throttle position, reverse thrust, *middle*-click: link/unlink **VC** levers)

Hydraulics

psi/eng1/eng2/ emerg	Gear hydraulic pressure *PSI*, engine pump pressure *PSI* (hydraulic pump switch toggle)
hand	Emergency hydraulic pressure *PSI* (toggle hydraulic hand pump)
tail/ski	Toggle tailwheel lock, deploy/retract ski (if so equipped)
brake/park	Toggle brakes, toggle left or right brake, set parking brake, brake failure state
left	Left main gear position (gear toggle)
right	Right main gear position (gear toggle)
flaps	Wing flaps *position*, *%*, *degrees* (deploy/retract wing flaps)

Speed/Position Data

pitot/ice	Pitot heater position, pitot ice formed *%* (toggle pitot heater switch)
oat/inHg/ wind/knots/ amb/surf	OAT, QNH, wind direction, wind speed, ambient conditions, runway surface type
ktas/mach/ kph/mph	True airspeed *knots*, *mach*, *kph*, *mph*
kias	Indicated airspeed *knots*
alt	Indicated altitude *feet* (altimeter calibration)
vsi	Vertical speed *ft/min*
hdg	Gyro heading *degrees* (compass drift correction)

Autopilot

suc	Suction pressure *inHg*
aoa	Angle of attack *degrees*
pitch	Plane pitch *degrees*
trim	Elevator trim position (set elevator trim, *middle*-click: trhree axes trim reset)
target	Autopilot target altitude *feet* (set target altitude, activate **ALT hold**)
fpm	Autopilot vertical speed *ft/min* (set/zero vertical speed)
lock	AP mode (set desired heading *degrees*, select **HDG/NAV/APR/LOC hold**)

Appendix D: Limits

Max Gross Weight	**28,750 lbs**
Max Landing Weight	**27,300 lbs**
VNE	**228 KIAS**
VNO	**180 KIAS**
VLE	**166 KIAS**
VLO	**141 KIAS**
VFE	**133 KIAS**
V SKI DOWN	**105 KIAS**
V2	**100 KIAS** (@ MTOW)
VR	**87 KIAS** (@ MTOW)
V1	**75 KIAS** (@ MTOW)
VREF	**80 KIAS** (@ 25,000 lbs)
Propeller	**1700 RPM** (max, take-off)
Ng	**102%** (max)
Torque	**100%** (max**)**, **95%** (max. cont.)
ITT	**820°C** (max), **1000°C** (engine start)
Fuel pressure psi	**1** (min), **50** (max)
Oil pressure psi	**55** (min), **135** (max)
Oil temperature	**115°C** (max)
Hydraulic pressure psi	**600** (min), **1000** (max)
Starter Motor	**20V** (min)
Fuel Pumps	**20V** (min)
Avionics	**22V** (min)

Appendix E: Starter Error Codes

If a start attempt fails, the *tooltip* of the starter switch (and starter field on the *control panel*) returns an error code giving a hint about what condition or setting is wrong:

! CHECK VOLTAGE

The electrical system cannot provide enough power for the starter motor. Charge battery or connect to ground power source. At least **20V** are required to start an engine.

! REDUCE ALTITUDE

Engine cannot be started above **11500ft**.

! CRASH LANDING

Aircraft/flight situation must be reloaded to clear crash state.

! WAIT – FLOODED

Fuel pump has been turned on with throttle lever opened too much. Turn off fuel pump and open throttle lever completely. Wait until this message disappears, then close throttle and try again.

! FUEL PUMP OFF

Electrical fuel pump must be turned on for engine start.

! CHECK FUEL

Engine cannot be started because it is connected to an empty tank.

! REDUCE THROTTLE POS

Keep throttle lever closed for engine start.

! FUEL PRESS LOW

Fuel pressure is not sufficient for engine start (ie. due to fuel pump failure)

! IGNITION SWITCH

The ignition switch is not in **START** position.

! *OPEN CONDITIONER*

The engine doesn't start because the condition lever is closed.

Appendix F: Tips and Tricks

1) The **VC** throttle-, propeller- and condition levers can be linked by *middle*-clicking any of them. When linked, both engine levers always move simultaneously. This makes it much more convenient to fly from within the **VC**. To unlink the levers, *middle*-click again.

2) A depleted battery can be charged at any time by *middle*-clicking the battery switch.

3) External power is available only on ground with aircraft stopped and parking brake set. Additionally, you must have the **FSX Gold Edition** or the **Acceleration Pack** installed.

4) To activate the starter, the starter button must be held pushed in with the mouse pointer until the starter active light goes out, indicating that the engine is running (automatic starter cut out is at approx. **35% N_g**). You may prefer a different method to start an engine: Instead of *left*-clicking the starter button, a *middle*-click causes the starter button to stay pushed in. This makes your mouse pointer free to open the condition lever when **N_g** reaches **8-10%**. Starter button remains pushed until starter motor is cut out (engine is running) or until it is clicked again (start abort).

5) If you have difficulties starting an engine, check the *tooltip* of the starter button: it returns an *error code (see Appendix E),* giving you a hint about which setting or condition must be changed for a successful start. The same *tooltip* is also available in the starter table on the *control panel popup (Appendix C)*. Additionally, faulty settings are flagged in red color on the *control panel*.

6) The hydraulic hand pump can be *middle*-clicked for continuous movement.

7) Fuel and payload weight changes from within the *fuel & payload popup (Appendix B)* are only possible on ground with the aircraft stopped (parking brake must be activated).

8) Select **EMPTY** as fuel configuration in the *fuel & payload popup (Appendix B)* and the aircraft is set into *"cold & dark"* condition.

9) *Middle*-clicking the yoke trim switches centers all three trim axes, elevator-, aileron-, and rudder trim.

10) For differential braking, you can *left*-click either brake pedal for left wheel brake, and *right*-click for braking the right wheel only.

11) To activate the autopilot holding current altitude and heading, *left*-click the AP button on the yoke. *Middle*-click the AP button to activate **ALT hold** and **HDG hold** using the preset values for target altitude and desired heading degrees.

12) *Control panel* - Make the AP hold current heading and altitude: With autopilot turned off, *middle*-click vertical speed value (column **fpm**). If that value is not zero, *middle*-click again (the first click zeros the value and the second activates the AP.

13) *Control panel* - Activate **HDG hold** with a desired heading course: Repeat clicking into **lock** field until the autopilot heading bug degrees are displayed in the data field below. There, enter the new heading course using *left-/right*-clicks or the *mouse wheel*. Finally, *middle*-click both, **lock** field and the desired heading degrees below. *Middle*-clicking **lock** displays the currently selected AP mode in blue font color, and *middle*-clicking the blue heading degrees activates **HDG hold** with the desired course.

14) *Control panel* - Make the autopilot fly towards a VOR-station: First, enter the NAV-frequency of the desired VOR-station on the NAV1-radio. When a signal is received, center the CDI-needle on the HIS or VOR1-indicator (with visible "TO" flag). Then, *middle*-click **lock** until **NAV** is displayed in blue color in the field below. *Middle*-click **NAV** (while it is still in blue color) to make **NAV hold** active.

15) *Control panel* - Let the autopilot fly an ILS approach: Begin with entering the correct ILS-frequency on the NAV1-radio. Then, enter final runway course on the VOR1-indicator (rotate OBS1-knob until compass rose aligns with final runway heading). Wait until CDI-needle is beginning to move from one side to the other, indicating that the ILS-beam is intercepted. Now *middle*-click **lock** until **APR** is displayed. While displayed in blue color, *middle*-click **APR** to make **APR hold** active as new autopilot mode. The AP is calibrated in such a manner that the aircraft does not climb into the glide slope when flying below the GS-beam. Instead, the AP sets **ALT hold** until the glide slope is reached. After that, **GS hold** will get activated automatically. If the runway ILS does not have a glide slope (localizer signal only), choose **LOC** instead of **APR** as mode. Then use the autopilot target altitude and desired vertical speed (**fpm**) fields to let the AP control the descent, or fly without **ALT hold** using manual altitude control only.