

Ilyushin 76 T

About the aircraft:

This aircraft is built to be as close to the real thing both in performance and look. The performance was designed using the original Pilot's Handbook which can be found at <http://www.il76.boom.ru>. The real aircraft is still handles a little better at high weights which I am not able to reproduce in X-Plane.

The flaps of the real aircraft are more sophisticated than in this model, and of course the real aircraft has a fixed main landing gear. The instruments were made with the help of a lot of cockpit pictures, but could not be made totally faithful to the original. The cockpit instruments are imperial, not metric like in the real aircraft. They are all labeled in Russian, though. You don't have to speak Russian to fly this aircraft, but it helps... In any case please look at the cockpit explanation page of this .pdf where you can find out which instrument is which.

About the real aircraft:

The Il-76 was designed as both a military and civil freighter in the Soviet Union. It is able to operate under extreme climates such as Siberian winter cold or desert heat. The aircraft is loaded via the aft ramp and has a built-in cargo crane making it independent from ground equipment. It can be used for airdropping cargo or paratroopers.

The cockpit is divided into two decks, the top deck being the working places of pilot, first officer and flight engineer and the lower deck containing the work stations of navigator and radio operator. The glass nose makes navigating in areas with few radio navigation facilities (like Siberia) easier. Also part of the crew is a loadmaster responsible for loading, unloading and securing the freight.

Versions are the basic version (Il-76) of which only few examples were built. Then followed the version T (which is also this X-Plane aircraft) and the M version with a tail gun turret. Most M and T versions are withdrawn from service by now. Most Il-76s are of the TD and MD versions which have more powerful engines and a slightly higher maximum take-off weight. TD versions are the civil variant and the MD have gun turrets. Apart from the Soviet Union, the Il-76s flew in a number of other countries such as Cuba, North Korea, Iraq and Libya. After the end of the Soviet Union many Il-76s were released by the Soviet Air Force and started flying for civil operators. That's why it is not uncommon to see Il-76s flying for civil airlines that have the tail gunner cabin (but the guns removed).

Other variants of the Il-76 include air tankers (Il-78), zero-gravity cosmonaut training aircraft (MDK), AWACS aircraft (Beriev-50) or engine testbeds (LL).

The latest variant of the Il-76 is the MF which is a civil aircraft with a stretched fuselage and four Aviadvigatel PS-90 engines. So far it has not found customers.

The Il-76 production plant is located at Tashkent in Uzbekistan.

Il-76s nowadays are flying mostly for cargo charter airlines. By April 2002 the Il-76s are banned from the European Union because they fail to comply with chapter three noise regulations, but before they could often be seen in Western Europe. Freight was almost anything you could imagine: machinery, cigarettes, fresh fish, flowers and from time to time also an Il-76 would be grounded because of arms trafficking. Now many aircraft (beside the area of the former Soviet Union) can be found in Arabia and Africa. Another important role of the Il-76 is relief good delivery. Low charter costs and the ability to land almost anywhere make them a popular freighter that has recently seen service flying to Afghanistan or almost any other region of the earth where disasters like earthquakes or floods have happened.

I hope this is enough inspiration for you if you are looking for some routes to fly with this machine!

All Information given in this file is intended for simulator use only and not to be used in real life aviation!

Some hints on flying:

Take-offs:

Take-offs (especially with maximum take-off weight) are not that easy. Set trim for climbing out and then push the nose down during the take-off run with the rudders. When airborne, immediately retract gear. Maintain a climb rate that allows you to accelerate. Slowly retract the flaps. Always let the aircraft build up speed before retracting the next notch. This is especially important before the final notch. At MTOW be careful to keep the pitch low on climb out. Aim for an Angle of Attack of 5°. At higher Angles the drag is too high for the aircraft to accelerate and maintain a positive climb rate.

Bank angle:

The negative V of the wings (the wings hanging down) mean that if the aircraft is banked, it wants to bank more to the side. It is therefore very important to constantly control and adjust the bank manually. Especially if flying with full flaps you get barely enough lift to stay in the air, so if you don't watch the bank angle, get into a too steep bank angle and loose lift, you will crash. It is very easy to destroy your aircraft if fooling around with different camera perspectives while in landing configuration. Be careful!

Balance:

Use the fuel transfer system and trim to keep the aircraft in balance.

If you have no payload, fill the wing tanks full so the Centre of Gravity is moved aft.

If you have payload the aircraft is more or less trimmed. If you have a lot of fuel, move the Centre of Gravity about 20 inches aft in the "Weight & Balance" screen. Note that the aircraft in landing configuration requires a Centre of Gravity further forward than in clean configuration. It can happen that your Centre of Gravity is too far aft for flying an approach. This normally happens if you have payload and use up the fuel in the central tank first. If you need pitch trim down on your approach, this is a sure indication. Then transfer all remaining fuel to the central fuel tank.

Landing:

Once in landing configuration, it is easiest to set an N1 (depending on the weight of the aircraft and the approach speed resulting from it) and fly the aircraft down the glideslope with the rudder. It is not uncommon for Il-76s to fly approaches with negative pitch. Flaring needs a bit of practice, the wings are mounted high so they catch the ground effect at a little lower altitude than most airliners. Expect it at about 20 feet above ground, reduce N1 to about 70% and increase pitch. You should touch down at a speed of around 110 knots.

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Crosswind:

Because the aircraft has a rather large tail fin, it is easily blown around by crosswind. Crosswind landings require crabbing (turning the nose into the wind while keeping the wings level). In the case of a crosswind blowing from the right, aim your approach on the right side of the runway. When beginning the flare, use rudder to the left and align the aircraft with the direction into which you are travelling. Keep in mind that this direction is NOT the runway heading, because the crosswind is having an impact on your travelling direction. You will have to point the nose somewhat to the left of the runway heading. If you do not do this, your aircraft will tip over as soon as it touches down. Touch down quickly, if your flare takes too long, the crosswind is going to blow you off the runway. Once you have touched down, use rudder to correct your direction and stay on the runway. As soon as you are on the ground, the crosswind is going to blow against the aircraft resulting in a bank to the left. Use ailerons against this. Crosswinds are the hardest part about flying this aircraft, for training set up a 23 knot crosswind with no turbulence or wind shear. After landing, use the replay mode and look at your landing from the runway threshold viewpoint to see what you did wrong (or right).

What can be seen on the side views:



The First Officer's panel.

More or less the same as the Captain's Panel. Note above the front window what seems to be some kind of rail to move the weather radar to the Captain's or First Officer's side.



The First Officer's Side.

The instruments are mostly made up. Something you will probably find in every Il-76 flight deck are tables photocopied from the handbook and put wherever there is some free space.



The Flight Engineer's Station.

Mainly Electric Systems I cannot identify.



The back part of the flight deck.

On the panel there are mostly what seems to be electricity switches. Note how these switches are protected against someone accidentally touching them.

What is behind the cockpit room is mainly my invention. There is a crew rest or loadmaster's room on the left, but I could not find pictures of how they look like, so I made a guess based upon interior pictures of Antonov-12 and Antonov-124 aircraft.

On the right side of the picture (the aircraft's port side) would be the lavatory and some more electronic equipment.

Directly behind the Captain's seat are the stairs that lead to the Navigator's and Radio Operator's stations in the glass nose and to the cargo deck.

Depicted on the icon is the Saint Nikolai, who is the protector of sailors and merchants – and thus maybe also of freighter crews.



This panel contains several electric switches, the APU panel and some other stuff that might be something like the hydraulic system. Left of the captain's seat, on the bottom of the picture, is the Booster (Hydraulic Control Surface System) Panel.



Front left.

The window on the right side of the picture can be opened, you can see the handle for this and what looks like the electricity supply for the window heating.

On the bottom of the picture are some instruments. The inscriptions are made up, but they would make these instruments the aircraft's intercom.

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Flight Envelope:

Maximum Speed (V_{NE}) 320 Knots
 Maximum Mach (M_{NE}) 0.77
 Ceiling 39,600 ft
 Stall Angle of Attack 20°
 Maximum N1 97% (Take-off thrust – maximum 5 minutes)
 Maximum unlimited N1 93%

Economic Operation:

Best economic speed 285 Knots / 0.73 M
 Best Lift/Drag Coefficient Angle of Attack 7.5°
 Maximum recommended Angle of Attack 14°

The check lists are based on the aircraft weight or the current altitude. When starting a flight, write down the aircraft's empty weight and the payload so you can get the current weight by adding the fuel quantity displayed by the gauges in the cockpit.

Take-off

Take off with 30° flaps except for grass or gravel runways where 43° are required.

Take-off weight lbs	198,000	220,000	242,000	264,000	286,000	308,000	330,000	352,000	374,000
					Landing Lights on Flaps set N1=97%				
Rotate V_R knots	100	100	105	105	110	120	130	140	150
Safe Speed with flaps V_2 knots	110	120	120	120	125	130	135	150	160
					Gear Up; Start Flap Retraction				
Safe Speed with flaps retracted knots	160	170	180	190	195	200	205	210	220
					Landing Light off Engines N1<93%				
climb to feet	39,600	39,600	39,600	39,600	39,600	38,775	37,125	35,475	33,000
						as you are losing weight enroute, climb to higher flight levels.			

Descent

Altitude feet	39,600 – 26,400	26,400 – 16,500	16,500 – 13,200	13,200 – Transition Level	TL – 0
Maximum speed	0.75 M	310 knots	310–270 knots	270 knots	245 knots
	Remember that in many countries the maximum speed below 10,000 feet is 250 knots!				
Maximum vertical speed ft/min	-3000	-3000	-2000	-2000	-1400

Landing

Landing weight lbs	198,000	220,000	242,000	264,000	286,000	308,000	330,000	352,000
					Fuel transfered to Central Tank if necessary			
					Speedbrakes armed			
					Landing Lights on			
Gear down speed knots	220	220	220	220	220	220	220	220
					Gear down, five green			
Start flap extension speed knots	210	210	210	210	210	210	210	210
Safe Speed with flaps at 43° knots	115	115	120	125	130	135	140	150
					Touchdown			
					Activate reverse thrust			
Activate wheel brake knots	90	90	90	90	90	90	90	90
Retract thrust reversers knots	25	25	25	25	25	25	25	25

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Fuel Calculations

1. Get the weight at which you want to land. That is the weight of the aircraft + payload + reserve fuel.
Recommended reserve fuel is 30,000 lbs.
2. Look up the weight on the lbs axis of the diagram; get the distance you want to fly.
3. On the diagram, go right by the number of nautical miles you want to fly. The short lines represent 100 NM, the long lines 500 NM.
4. See where the curve is crossing the vertical line you have arrived at.
5. Look left on the lbs axis. The number minus your desired Landing Weight is the enroute fuel.
6. Add 20,000 lbs for take-off and climbing to flight level.

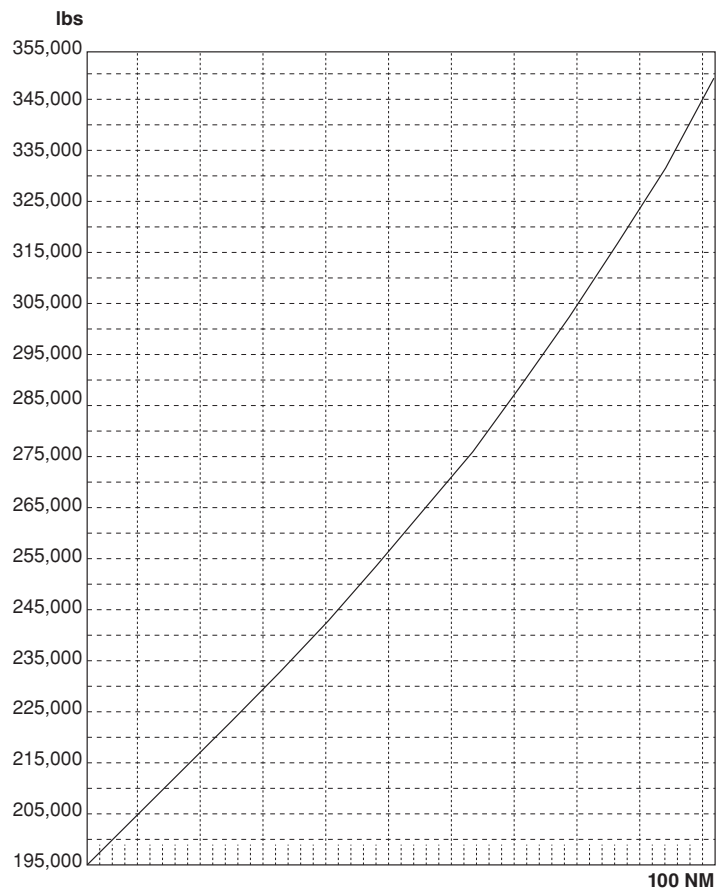
This diagram is based on flying according to the recommended flight levels.

Please also see the example.

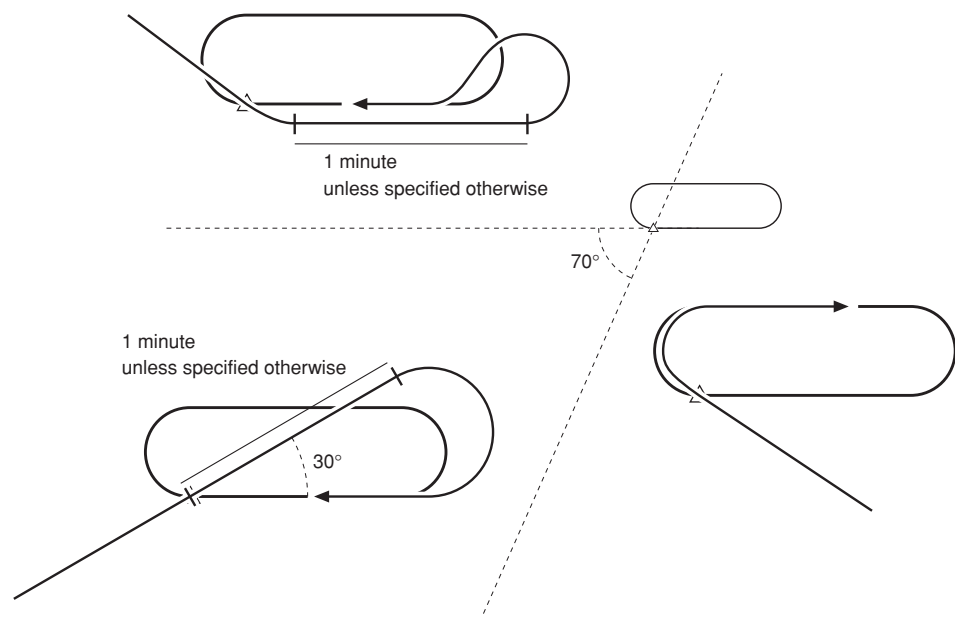
Maximum Weights

for concrete/asphalt runways,
values for grass/gravel runways in brackets

Aircraft Empty Weight 194,000 lbs
Maximum payload 88,000 lbs (66,000 lbs)
Maximum Take-Off Weight 374,000 lbs (335,000 lbs)
Maximum Landing Weight 334,000 lbs (299,000 lbs)
Maximum Fuel at Take-Off 186,000 lbs (146,000 lbs)
Maximum Fuel at Landing 66,000 lbs (53,000 lbs)



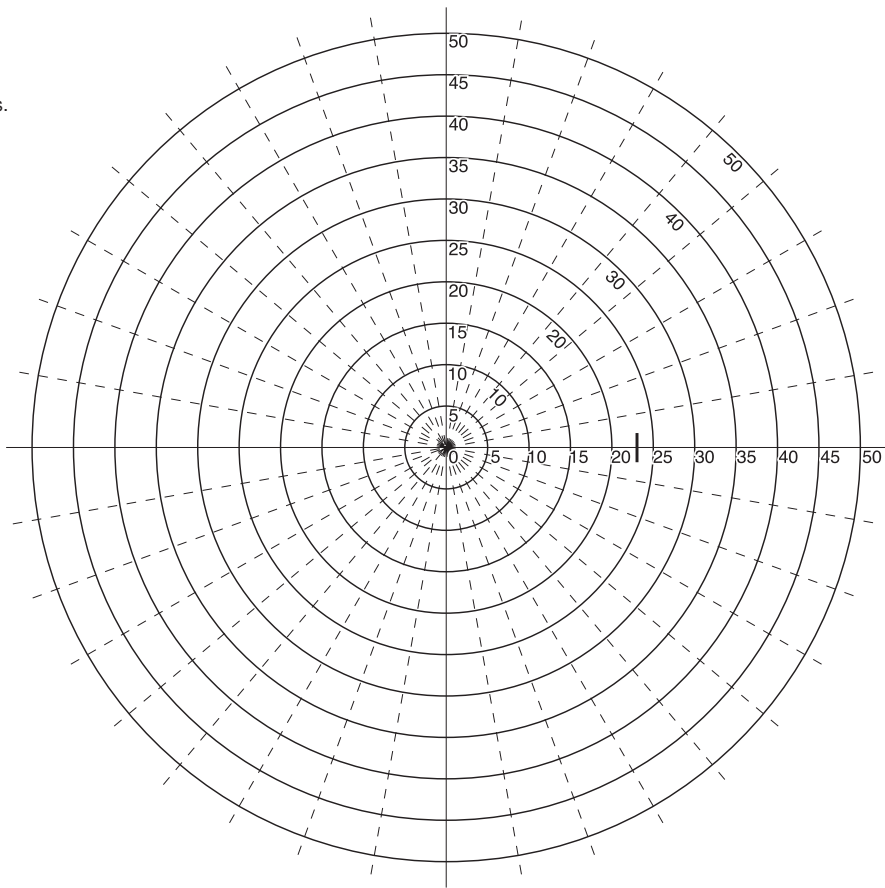
Entering Procedures for Holding Patterns



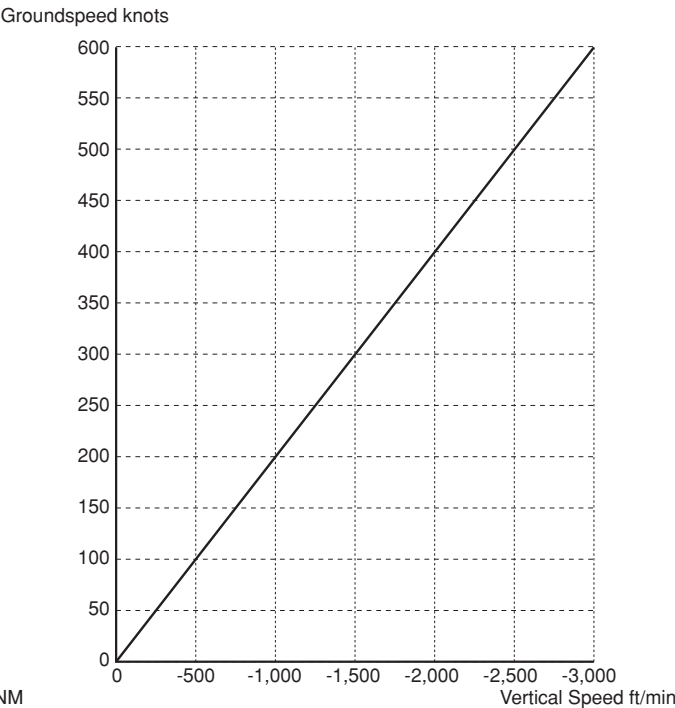
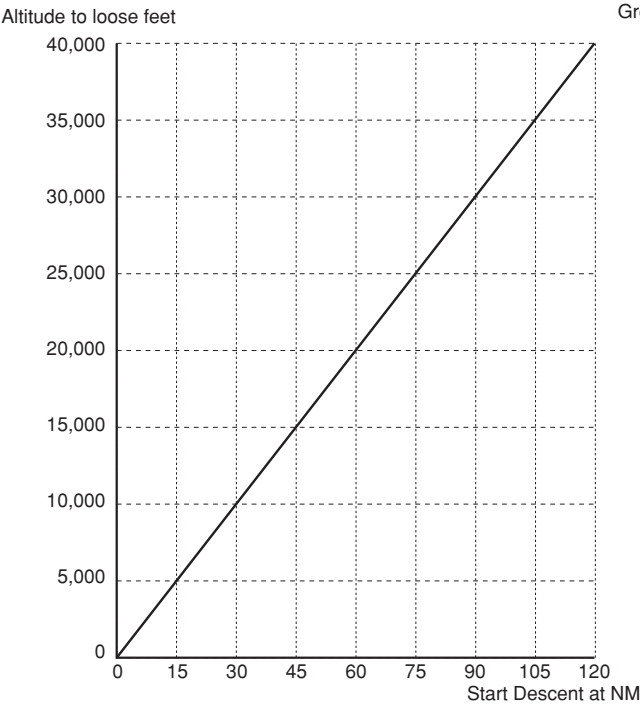
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Crosswind Calculator

The maximum allowable crosswind component is 23 knots.

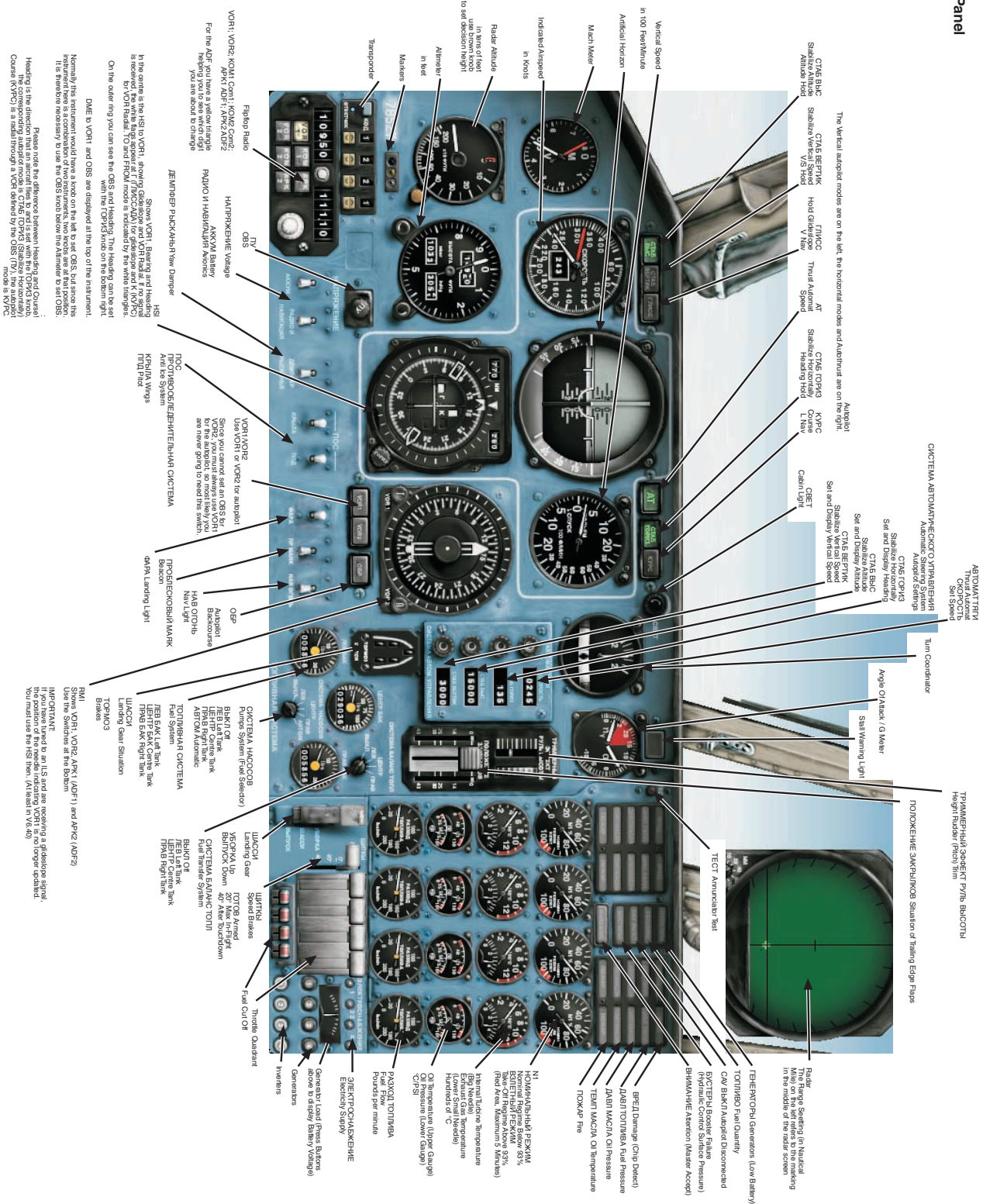


Descent Planner



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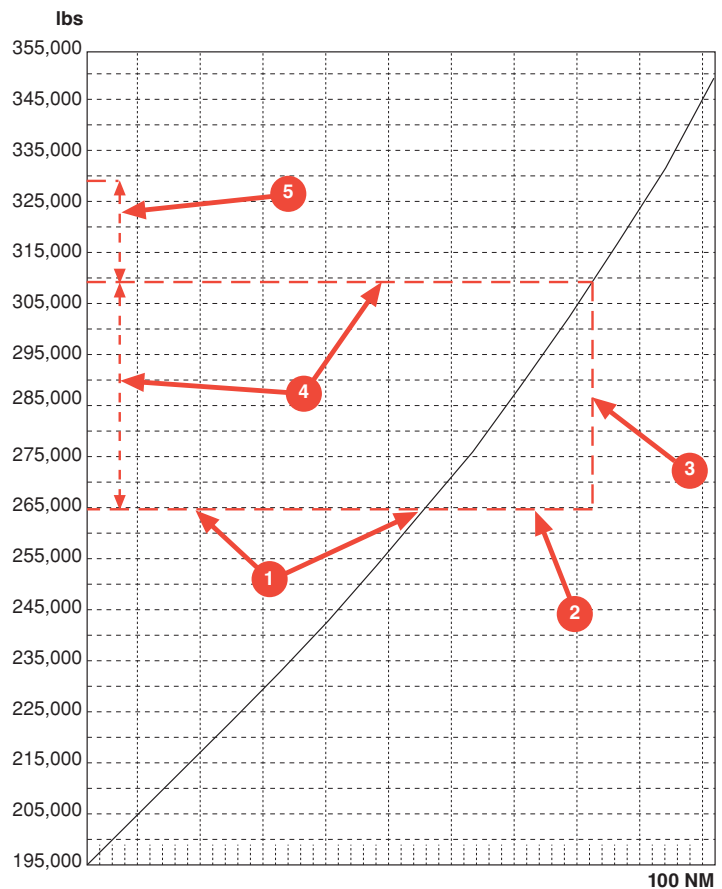
Panel



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Here is an example on fuel calculation to help you understand. It is on an extra page so you don't have to print it out.

1. I want to arrive with my Il-76 (195,000 lbs), 40,000 lbs payload and 30,000 lbs reserve fuel, that is a landing weight of 265,000 lbs.
2. I want to travel 1,300 nautical miles.
3. See where the curve crosses the vertical line.
4. My enroute fuel is $309,000 - 265,000 = 44,000$ lbs
5. My take-off weight is landing weight (265,000 lbs) + enroute fuel (44,000 lbs) + 20,000 lbs take-off and climb fuel = 329,000 lbs; my total fuel thus take-off weight (329,000 lbs) - payload (40,000 lbs) - empty weight (195,000 lbs) = 94,000 lbs.



Here is how to use the crosswind calculator:

1. Get the current wind speed and direction, calculate the angle between wind direction and your landing direction. In this example the wind is at 20 knots and the angle between wind direction and landing direction is 30° .
2. Go down and look up the crosswind component. The black line at 23 knots marks the maximum allowable crosswind component!
3. On the vertical axis you can see the headwind component.

