How to fly the Antonov An-2

Introduction

Considered as one of the safest airplanes in aviation history, the An-2 is an aircraft with a lot of charisma and very specific features. 1000 HP from a nine cylinder radial engine driving a huge four-blade propeller move this 5500 kg (12125 lb) “truck in the skies” predominately low and slow. It can take off and land on a few hundred meters of paved road or grass strip and yet carry 2 tons of fuel and load. The only thing she does not like is crosswind - maximum certified 15 km/h (8 kts).

Developed as an excellent workhorse for transportation of passengers and heavy or spacious goods in the rural areas of the large Russian territory, it is also very popular in other parts of the world due to licensed manufacturing and assemblies. A lot of information can be found on this plane on the web and one of my favorite articles is this one: http://www.seqair.com/Other/UnFalco/UnFalco.html

Let me add a basic piece of advice: Treat and fly her gently – don’t rush her and the An-2 will be rock solid in any condition of flight.

As with any historic plane there are different perceptions between pilots on how to fly and treat the engine best. I had the pleasure to get a lot of information from Jan Spycher (photo left) from Switzerland which allowed me to design the flight dynamics and give information to the sibwings team on details of operation. So expect it to fly very much as “his” An-2 YL-LEV called Anastasija

Extraordinary technical solutions on board

As you can see from the panel, there are many electrical switches and the electrical system is the backbone of all systems. Electric motors drive the upper and lower wing flaps, the cowling flaps and the oil cooler shades. All flight trimming is done by electrical motors on aileron, elevator and rudder. Multiple busses feed from large capacity batteries and are reloaded by the engine driven generator. Panel lighting is limited and all instruments and switches/knobs are illuminated from fluorescent paint that can be refreshed with UV lamps.

Due to its large wing surface with a relatively short fuselage, the aircraft is sensitive to proper trimming depending on the load distribution and the resulting center of gravity (CoG). Further the large area flaps have a huge lift and pitch effect and need to be compensated properly by actuating the electrical trim switch. Otherwise the forces on the steering column get unbearable.

One reason for the good safety performance of the An-2 is the fact that she hardly stalls and if, just starts sinking with still full aileron and elevator controls. The upper wing has slats which are extended automatically by the aerodynamic forces when the angle of attack approaches stall attitude. This typically starts at 65 km/h in clean configuration. Flying with full flaps this allows a well-controlled high angle descent that will not crash the plane when it hits the ground. The decent rate is similar to a parachutist.

Engine settings (recommended)

Power rating	MAP	RPM	Power	Speed	Consumption
	kPa	1/min	HP	Km/h ¦ Nm/h	Kg/h ¦ l/h
Max. continuous	120 ±1.5	2100	815	223 ¦ 120	204 ¦ 283
90% power	111 ±2	2030	737	215 ¦ 116	185 ¦ 257
75% power	99 ±2	1910	614	198 ¦ 107	154 ¦ 214
60% power	89 ±2	1770	491	177 ¦ 96	123 ¦ 171
50% power	82 ±2	1670	416	155 ¦ 84	105 ¦ 145

Rule of thumb:
RPM should be at maximum equal to MAP times 10 plus 1000 (i.e. 90% power: 110 x 10 + 1000=2100). Recommended are 100 RPM below maximum.

Flight preparation

With the default load of 12 passengers with their luggage under their seats, the CoG is at the rear end of the allowed range and requires nearly full forward trim for take-off. Further about 15% rudder right trim is required to keep it straight during take-off run and initial climb. There are no trim indicators except the trim lamps showing the neutral position. So you need to check trim travel time and count the seconds to trim correctly. If you forget that, the plane will take off too early and get you into trouble.

Managing the oil and cylinder head temperatures (CHT) is vital for service life of the engines. Running the separate cowling flaps to control the CHT and the oil temperature is very important. Let her get warm after start and provide enough cooling on hot days while taxiing on ground. Once at cruise you can manage the optimal temperatures nicely with the controls.

There is no tail wheel steering and the brake system is a very specific system as you may have realized watching videos. Unfortunately we cannot reproduce this in FSX. In reality you have a lever on the steering column providing air pressure which then is distributed to the wheel brakes in a ratio depending of your rudder pedal position. The more rudder, the more one sided the brakes are applied.

It is advised to lock the tail wheel for take-off and landing.

For take-off, flaps should be set to 15 (typically) or 30 degrees (shortest take off run).

You need to use differential braking to steer the aircraft. Prop wash supports directional steering but be careful not to roll too fast as with no power the rudder does not help much.

As due to the huge cowling you cannot see anything in front of you, move your head to the side closer to the cockpit windows to get a better visibility on the taxiway or runway.

We have provided a specific FSX view to position you easily.

Take-off

Move the throttle slowly (2-3 seconds) to your desired manifold pressure (MAP). Typically 120 kPa MAP and 2100 RPM are sufficient for a decent runway length. Use 140 kPa MAP and 2200 RPM only if you need to get airborne as quick as possible.

Assuming the proper trim setting, the An-2 basically takes-off by itself! Some pilots recommend forward push on the steering column to get the tail up earlier and provide better visibility on the runway.

Take off with flaps 15, tail starts to raise at 65 km/h and with a soft pull at 85-90 km/h she gets airborne. Releasing the pull to stabilize at 120 km/h for initial climb.

Take-off power only until 50m AGL and then start acceleration to 140 km/h, bring flaps in and then maintain 140 km/h with 120 kPa 2100 RPM. When rising flaps elevator trim needs to be pulled back to about neutral (max trim travel time may take 10 seconds).

Climb

Normal climb speed is 135-145 km/h with 90% power equal to 110 kPa and 2000 RPM. Trim neutral to slightly positive. You may reduce cowling opening flaps to keep CHT at around 180-200°C. You don't need to worry about mixture as the engine is equipped with automatic mixture control when the lever is in the open position.

The turbocharger will provide you with constant MAP up this his critical altitude which is 1500m (5000 feet).

Service ceiling is 4400 m (14425 feet) and it takes about 30 min to reach this.

Cruise

Cruise is typically 160-170 km/h, rarely faster up to 190 km/h. MAP 70-90 kpa depending on desired speed. Typical fuel saving is 80kPa and1700 RPM giving you 150-160 km/h with a fuel consumption of 140-150 l/h (100-108 kg/h)

Descent

Descent flaps 5-10 at 140 km/h
Downwind 130 km/h

Flaps speed limits are 150 km/h down to flaps 30° and 130 km/h for further down.

Final

Initial final reduction to 120 km/h and flaps 10-15
Flaps 10°, 120 km/h, trim 100%ND, 60 MAP gives you a 3°glide.

Short final flaps minimum setting is 15° and 95-100 km/h and touch down with 90 km/h.

Alternative landing at 85 km/h with flaps 30° is flying with a more horizontal pitch attitude which gives better visibility on runway, but difficult to drop tail wheel softly.

The final approach speeds (Vs x 1.3) are 90-86-85 km/h. While 15 and 30° flaps are good to be used for slopes of 3°, the 45° flaps should only be used for steep descent of 4.5° or more. Due to high lift and nose up pitch from flaps, the flaps should only be set at about 30% higher above the final approach speed, as otherwise you may run out of trim range with a tail heavy plane. The aircraft is perfectly stable to fly in clean settings down to 90-100 km/h, depending on weight.

Landing with speed reduction to 85 km/h for 3 wheel touch down requires steering column very much backward.

Pattern flying:

Flaps 5 or 10° should be used during approach and airport pattern which should be flown at 140 to 150 km/h.

- Flaps up and 65/1700 will give you about 145 km/h
- Flaps 5° and 70/1700 will give you about 140 km/h
- Flaps 10° and 80/1700 will give you about 140 km/h.

This is best for downwind leg with decreasing pitch attitude and better forward visibility.

Flaps 15° and engine settings 80/1700 will slow down to 120 km/h and abeam runway threshold reduce engine to 60/1700 to decent with 1.5 m/s (300 feet/min) and 120 km/h. Once on final leg, trim backward and reduce MAP to about 50 so that the aircraft stabilizes at 100 km/h for final approach. Vertical speed can be very well adjusted with small changes on the power lever. Avoid pitch changes on final and maintain pitch attitude to keep speed and a balanced aircraft.

If you prefer a better forward visibility, then set flaps to 30° but keep the same speeds. It requires more power and makes more noise, but I find this easier to land. Use 100 km/h for final and increase RPM to 2100 and maintain 1.5 m/s sink rate which should give you a 3° descent to the runway. The top part of the air intake is a good reference line to target the touch down point. Over the threshold gradually reduce power and speed to 90-85 km/h and hold steering wheel firm backward for 3 wheel touch down. You need a good pull to flare into a 3 point position for landing. Do cut power slowly and flare gently.

Maintain steering wheel fully backward during braking to keep tail wheel firm on ground.

For steep approaches on final you can set flaps to 45°, but be aware that there is no go around possible with this flaps setting. In case of a needed go around, your reduce flaps to 15° and apply full power which will make the plane climb immediately.

The An-2 is very, very sensitive to wind as she flies so slow and has a large fuselage surface that makes it turn into any crosswind. Maximum allowed crosswind is therefore limited to 15 km/h (8 kts) for a full flaps landing.

Conversion Table

Feet	Meters	Nm/h	km/h	feet/min	m/s	km/h GS	m/s 3° glide
1'000	305	30	56	100	0.5	80	1.16
1'500	457	35	65	150	0.8	85	1.24
2'000	610	40	74	200	1.0	90	1.31
2'500	762	45	83	250	1.3	95	1.38
3'000	914	50	93	300	1.5	100	1.46
3'500	1'067	55	102	350	1.8	105	1.53
4'000	1'219	60	111	400	2.0	110	1.60
4'500	1'372	65	120	450	2.3	115	1.67
5'000	1'524	70	130	500	2.5	120	1.75
5'500	1'676	75	139	550	2.8	125	1.82
6'000	1'829	80	148	600	3.0	130	1.89
6'500	1'981	85	157	650	3.3	135	1.97
7'000	2'134	90	167	700	3.6	140	2.04
7'500	2'286	95	176	750	3.8	145	2.11
8'000	2'438	100	185	800	4.1	150	2.18
8'500	2'591	105	194	850	4.3	155	2.26
9'000	2'743	110	204	900	4.6	160	2.33
9'500	2'896	115	213	950	4.8	165	2.40
10'000	3'048	120	222	1'000	5.1	170	2.47