Miltech Simulations U-2

Normal Procedures - Flying the U-2S

The U-2 is easy to fly in the middle of its envelope and hard at both ends: at the top, where the speed band is narrow, and at the bottom, where you land a glider on one wheel. This page is the technique, phase by phase. The checklists tell you *what* to set; this page tells you *how* to fly it. For what the aircraft is like and what to expect, read U2 101 - The Basics first.

Note
Sim values. Performance values are measured in the sim. They may not accurately represent (nor do they intend to accurately represent) the performance of the real aircraft.

Tip
Practise the landing first. Start on the runway, take off, and fly a few patterns before your first long flight. The chase car is on by default (EFB Settings tab).

Before You Fly

- Bind a button to **Toggle water rudder** - that is the yoke SPOILER button for the lift spoilers. Your normal spoiler key or axis only moves the speedbrakes. See Keybinds Guide.
- Use a joystick with a rudder axis or twist grip if you can. On the runway the rudder is your only steering above about 25 kt.
- Know your weight. Takeoff and landing speeds depend on it - the EFB Aircraft tab shows **Gross**, and Specifications and Limitations has the speed tables.

Taxi

On the ground the U-2 rolls on its main wheel and the steerable tailwheel. The two pogos under the wings keep it level. Steer with the rudder pedals.

- **Breakaway:** with the engine running the aircraft stays put at idle. Bring the power up to about 78 % N2 (a little more when heavy) until it moves, then ease it back to what keeps it rolling.
- **Steering:** the tailwheel follows the pedals about half a second late and eases in, so plan your turns ahead. Full pedal holds a 189 ft radius at the main wheel, with the outer wingtip about 240 ft from the centre of the turn. The full turn is there up to about 20 kt and fades to about 1.4° by 25 kt.

With the outside wing tip on the ground the turn comes out wider. Taxi slowly. The EFB option **Taxi steering** on *Easy* takes the delay away and turns down to about 75 ft; above 20 kt it fades out the same way.

- **Brakes:** either pedal brakes the main wheel. There is no differential braking, so you cannot steer with the brakes, and there is no antiskid.
- **Look at the wingtips.** 51 ft of wing each side passes over grass, lights and signs that a fighter would miss.
- Take the wheel chocks off first (EFB Ground tab **Wheel Chocks Off**, or in the walkaround): releasing the parking brake doesn't remove them. Do not move before the INS is in NAV and the SFD attitude is up - moving restarts an unfinished alignment. With the chase car on, the mobile calls "taxi clear" as you start to roll.

Takeoff

Line up on the centreline and stop. This is where the pogo safety pins come out: hold still and, with the chase car on, a pickup pulls up and two technicians walk out, one to each pogo.

Stand still until they have finished and are back at the pickup: the red flags on the pogos are gone and you hear "ground crew clear". The parking brake is not needed for this. If you move off early they stop, and the pins they have not finished stay in.

1. **Run up.** Hold the brakes, throttle to 85 % N2, check N2, EGT and fuel flow and that no master caution is lit.
2. **Release and go.** Brakes off, throttle full. Hold the yoke neutral in pitch. Keep straight with the rudder - the tailwheel steering fades out between about 20 and 25 kt.
3. **Pogos.** Between 60 and 88 KIAS each pogo falls away by itself, one after the other. From that moment you balance on the main wheel: **keep the wings level with the aileron**.They go by airspeed alone - rocking the wings does nothing. With the pogo pins still fitted (no runway crew, or the chase car off) they stay on for the whole flight, unless hard wing rocking in the air snaps them off: four to seven hard roll reversals each.
4. **Liftoff.** Hold the slight nose-up two-point attitude - a little back pressure keeps the tailwheel on the runway - and let the aircraft fly off. Liftoff comes between about 80 and 110 KIAS, depending on weight: about 83 KIAS after about 490 ft at 22,500 lb, and about 103 KIAS after about 1,230 ft at 34,500 lb.
5. **Climb out.** Gear up. Raise the nose smoothly to hold 160 KIAS.The climb is very steep at full throttle - expect about 20° nose up and about 6,000 ft/min when heavy, about 30° and about 9,000 ft/min when light. Keep below 180 KIAS: the AIRSPEED lamp comes on there with the wing faired.

Climb

Hold 160 KIAS until the Mach reaches .715, at about 52,000 ft, then hold M .715. Start at full throttle. From about 45,000 ft watch the EGT and use the vernier to hold **650 - 725 °C**: that is climb power, about 93 - 95 % N1 and 98 - 99 % N2.

At full throttle above about 55,000 ft the EGT runs up to 840 °C, where the engine control holds it in PRI, just under EGT HIGH at 842 °C; in SEC nothing holds it.

- **Turbulence low down:** GUST CONTROL UP unloads the wing. The red line rises to 241 KIAS below 43,000 ft and AIRSPEED HIGH to 230. In heavy turbulence fly 120 - 130 KIAS. Back to FAIRED in smooth air, at 150 KIAS or less, and expect a pitch change. See Gust Control.
- **Autopilot:** once the aircraft is stable, engage the AFCS. Basic mode holds your pitch attitude; above 52,000 ft press MACH at .715 and the AFCS pitches to hold it. ALT and MACH cannot be on together. See AFCS System.
- Run the checks at 18,000 ft (SPOILER switch to ARM, altimeters 29.92) and at 52,000 ft - Takeoff and Climb checklists.
- The climb rate falls from thousands of feet per minute low down to a few hundred at about 59,500 - 73,000 ft, depending on weight. That is the start of the cruise climb - see High Altitude and the Cruise Climb.
- **Heavy controls:** the elevator and ailerons get heavier with speed. At about 155 KIAS the ailerons give a little under 40 % of their low-speed response and the elevator a little under half; at about 195 KIAS the ailerons about a quarter and the elevator under a fifth; near 240 KIAS both are nearly locked.

Full yoke rolls about 20°/s on a flaps-35 approach, about 16°/s at 160 KIAS and about 10°/s at 210 KIAS with GUST CONTROL UP. At high speed the push you need to hold her hardly grows with speed: faired at 180 KIAS,

full nose-down trim leaves a light push; with GUST CONTROL UP the stabilizer trims her all the way to the 241 KIAS red line, with at most a light push close to it. Above about 120 KIAS this help follows the speed only once it has moved about 2.5 kt, then eases in, so after a speed change a light push or pull can stay: trim it out.

Close to the red line the yoke's reach is cut as well: from about 12 kt below the IAS red line the roll travel closes to 30 %, so the roll spoilers stay down, and near the Mach red line both axes close to 65 %. On the approach and at altitude they are light again.

- **Oil quantity:** the reading swings in the climb and descent while the oil itself stays the same: down to about 8.5 qt at 45,000 ft, and back to about 12 at 70,000 ft or in level flight. See Specifications and Limitations.

High-Altitude Handling

Up high you fly M .715 with the autopilot in MACH and let the aircraft climb as the fuel burns. At the top of the cruise climb the usable speed band is about 20 kt wide: the Mach buffet and the red line about 5 - 6 kt above you, the stall 8 - 14 kt below.

Small, slow inputs, 15° of bank, gust control FAIRED, and up here any AOA tone is a stall warning. The technique and the margins are in High Altitude and the Cruise Climb.

Descent

The U-2 is clean and slippery. To come down you put out everything it has and pull the throttle to idle. High up the engine holds a flight idle of about 75 % N1 and 85 % N2, easing to about 69 % and 81 % at 70,000 ft so the aircraft can slow down up there.

1. **Configure.** Gear down, throttle idle, speedbrakes OUT (hold the throttle SPEED BRAKE switch - about 5 seconds), SPOILER switch ARM and landing spoilers LET DN, gust control UP before you pass 180 KIAS.The lift spoilers come up and stay up. Above 105 KIAS the airflow pushes them partly down, so their drag grows as you slow. One wing's give a little more than the other's: a slow roll while they are up at speed may be that, so check with them in before you trim.
2. **Speeds.** M .715 down to 53,000 ft, then 160 KIAS. In smooth air 170 - 180 KIAS with gust control UP, never into the red bar. In rough air 160 KIAS at most, 120 - 130 in heavy turbulence.
3. **Expect** about 1,700 - 2,500 ft/min and about 150 NM from 65,000 ft to the pattern.
4. **On the way down:** windshield anti-fog ON before the canopy fogs, altimeters - PFD and SFD separately - to the local setting at 18,000 ft, oxygen stays ON. See the Descent and Approach checklists.

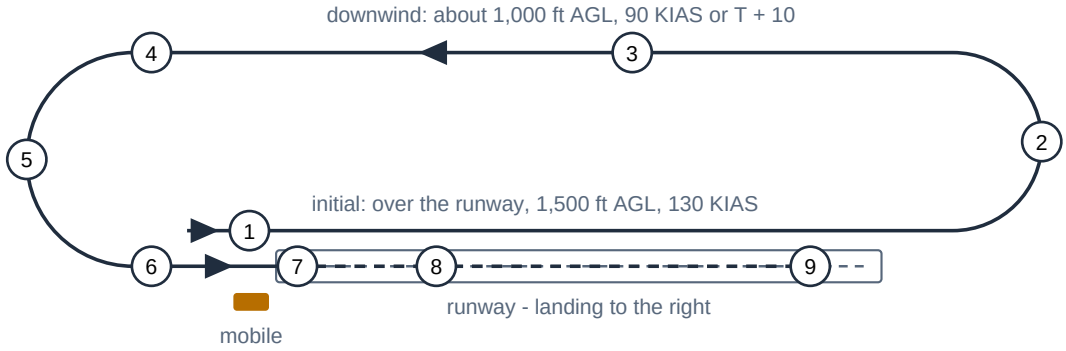
Approach

Before you enter the pattern, clean up and slow down:

- Landing spoilers to LANDING - the lift spoilers go down; the SPOILER switch stays in ARM.
- Gust control FAIRED at 150 KIAS or less: the flaps come back to 0° and the ailerons down by themselves, and the nose goes down. The flap lever does nothing while gust control is UP.
- Work out your T-speed from the fuel you really have: 70 KIAS + 1 kt per 100 gal + 1 kt per 650 lb of zero fuel weight above 18,700 lb.
- Check the fuel balance with the autopilot off: the aileron you need to hold the wings level points to the heavy wing. Fix it now, not on short final.

Fly the standard 360° overhead pattern. The heights and speeds are targets, not limits.

360° OVERHEAD PATTERN - SEEN FROM ABOVE



The numbers follow the LANDING PATTERN checklist. Keep the bank to 30° at most - the AOA rises with the bank.

1. **Initial approach** - over the runway at about 1,500 ft AGL and 130 KIAS.
2. **Turn to downwind** near the far end of the runway: descending, 20 - 30° of bank, speed held with the throttle. Flaps 20 - 35° (35 recommended) below 130 KIAS, then 90 KIAS or T + 10. The flaps pitch the nose down as they run: trim nose up, and with flaps 35 expect to hold some back pressure even at full nose-up trim. AOA about .64: indexer yellow and green, turning green as you slow towards T-speed (green alone from .65).
3. **Downwind** at about 1,000 ft AGL. Gear down, speedbrakes out. Power for a gentle descent at the same speed. BEFORE LANDING checklist.
4. **Turn to final** at about 700 ft AGL, 20 - 30° of bank, coordinated.
5. **90° point** at about 500 ft AGL, still 90 KIAS or T + 10.
6. **Roll out** on the centreline at about 250 ft AGL, on speed. With the gear down and the flaps out, the mobile joins behind the threshold below 1,500 ft.
7. **Threshold** at T-speed, 10 ft at most, throttle idle. AOA about .80: indexer green and red, and the approach beeps turn into the steady 500 Hz flare tone.
8. **Touchdown** on the main wheel and tailwheel together, then the SPOILER button - see below.
9. **Stop** straight ahead on the runway and hold the brakes. The crew fits the pogos.

The Two-Point Landing

The U-2 lands on its main wheel and tailwheel at the same moment, in the same slightly nose-up attitude it sits in on the ground. You fly it down to a few feet, then hold it off and let it settle as the speed bleeds away.

1. **Cross the threshold low and on speed:** T-speed, 10 ft or less, throttle idle. Every knot and every foot too much becomes a long float - the ground effect under this wing is strong.
2. **Hold it off.** As the wing comes into ground effect, keep it a few feet up with gentle back pressure. Raise the nose slowly towards the two-point attitude while the speed decays. Keep the wings level and the nose on the centreline with the rudder.The mobile calls your height: "ten... five... two... one", and "left rudder" or "right rudder" if you drift off the centreline.
3. **Listen to the tones.** At T-speed the approach beeps turn into the steady flare tone. It turns into fast high beeps, the touchdown tone, about 4 kt below T, and the stall tone (1450 Hz) comes about 7 kt below T. That is where the wheels should touch.

The wing itself stalls under a knot later: about 67 KIAS at 22,000 lb and 70 at 24,000 with flaps 35. Right over the runway the ground effect lets her fly about 7 - 9 kt slower, so she may float on in the stall tone: hold her

off until she settles.

4. **Touch down on both wheels together.** Do not drive it on with speed to spare: the main wheel is ahead of the centre of gravity, so a main-wheel-first touchdown can pitch the nose up and lift you off again. Above 750 ft/min the gear is damaged (with crash damage on). Above about 500 ft/min (8.3 ft/s) at 24,300 lb or less, and less when heavier, the cyan HARD LANDING advisory shows the sink rate of the touchdown.
5. **SPOILER button at touchdown.** The lift spoilers kill the lift and keep the aircraft on the runway. Hold the button, or click it to latch them up. Nothing deploys by itself. See Speedbrakes and Lift Spoilers.

Note
Heavy? Above 24,300 lb use the heavy-weight technique: a low sink rate and no full-stall touchdown - fly it onto the runway. The T-speed table is in Specifications and Limitations.

Rollout: Wings Level to a Stop

Once you are down, the landing is not over. The U-2 now balances on one wheel, and the wing wants to fall to one side.

- **Fly the wings** with the aileron all the way down the runway. Left neutral, a wing goes down in a few seconds. Put in aileron against the low wing early - it gets less effective as you slow.
- **Keep straight with the rudder.** The tailwheel only takes over below about 25 kt (full turn below about 20 kt), so go easy on the pedals as you slow down. Keep it firmly on the runway.
- **Brakes as needed** - either pedal, main wheel only, no antiskid.
- As you slow, one wingtip skid settles onto the runway. That is normal.
- If you taxi on without the pogos, put the yoke fully into each turn to keep the wing up.
- When directional control is good: speedbrakes IN, flaps UP, lift spoilers DOWN (SPOILER button again if you latched them).
- **Stop on the runway** and hold the brakes. The pogo truck's crew fits the pogo under the raised wing, the aircraft is levelled, then they fit the other one. The pogos wait for the crew, however late they are. If you move off, they stop and start again when you next stop.

Crosswind

The simulation has no crosswind limit, but the long wing and the single main wheel make every crosswind hard. Start with light winds.

- **Takeoff:** aileron into the wind and rudder for the centreline - full rudder if needed. Stop any yaw at once. Out of rudder, dip the downwind wing slightly. After the pogos drop the wing is all yours: hold it level against the wind. After liftoff hold the ground track with rudder and a slight bank into the wind.
- **Landing:** bank into the wind and hold the centreline with downwind rudder (wing low). Keep it through the touchdown and the rollout, and use the lift spoilers as needed. Expect the upwind wing to need aileron all the way to the stop.
- Lift spoilers up make the aircraft heavier on its wheel - raise them at touchdown, crosswind or not.

Go-Around

If the approach is not right - too fast, too high over the threshold, drifting - go around early. There is no prize for saving a bad U-2 approach.

1. **Throttle full.** From idle the engine takes about 8 seconds to give half its thrust and about 12 for nearly all of it: go around early.
2. **Clean up the drag:** lift spoilers down (landing spoilers in LANDING, SPOILER button released or clicked again), speedbrakes IN - hold the switch about 5 seconds.
3. **Climb** at the pattern speed, 90 KIAS or T + 10, with the AOA in the green. Keep the gear down if you stay in the pattern: with the gear up and 20° of flap or more you get LANDING GEAR NOT DN.
4. **Flaps:** bring them up in steps as you accelerate, and keep below 130 KIAS while they are out (FLAPS DOWN). Re-enter the pattern at 1,500 ft AGL and 130 KIAS.

After a touchdown (touch-and-go, 24,300 lb at most): slow to 50 KIAS, flaps and lift spoilers in, then full throttle - keeping the wings level all the way, because the pogos are gone. They only come back when you stop.

Related pages: U2 101 - The Basics · Checklists · Angle of Attack (AOA) · Speedbrakes and Lift Spoilers · Chase Car and Ground Support Equipment

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