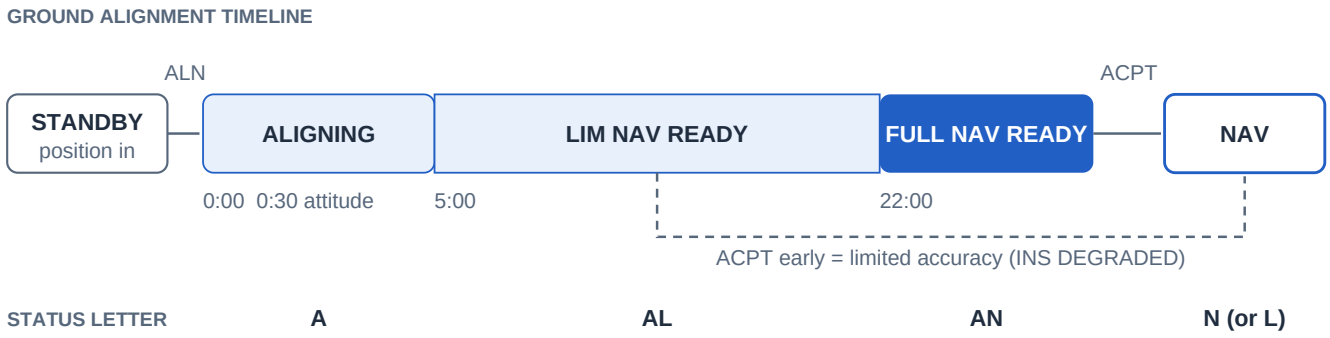
Miltech Simulations U-2

Inertial Navigation System (INS)

The Inertial Navigation System (INS) is the heart of the U-2S cockpit. It supplies the attitude on your PFD, the heading on the HSI, and the navigation solution the autopilot follows. Before it can do any of that it has to be aligned - and that takes time.



You start the alignment (ALN) and you accept it (ACPT). The INS never goes to NAV by itself on the ground.

Tip
Two things make this quick: (1) if you start a flight on the runway or in the air, the INS is already fully aligned; (2) the EFB **Settings** tab has an **INS alignment time** option - *Full* (22 min), *Short* (3 min) or *Instant* (5 s). Your choice is remembered.

The INS Switch

On the right console, three positions:

Position	Function
ON (up)	Powers the INS. It wakes up in **standby** and waits for you to start the alignment.
OFF (center)	Off. An interruption shorter than 8 seconds is ignored; longer than that and the alignment is lost.
LOAD (down, springs back)	The easy way to tell the INS where it is: loads the aircraft's present position and today's date. The switch springs back to OFF - move it up to ON afterwards.

INS Modes and Status Letters

The INS status letter is shown at the top of the PFD (left of the autopilot box). On the PFD it is followed by a digit for the GPS navigation mode and, while overfly is selected, an O; the L or N flashes 21 seconds before a turn point, and 21 seconds before the last DP of the file.

The BCDU shows the same information in five fixed positions at the bottom left - see BCDU, Advisory Letters.

Letter	State	Attitude on PFD?	Navigation?
E (BCDU)	Powered, but the alignment position and the gravity deflection are not both entered yet	No	No

Letter	State	Attitude on PFD?	Navigation?
blank	Standby, position entered, waiting for you to start the alignment	No	No
A	Aligning	After 30 s	No
AL	Aligning - *limited* navigation is available if you accept it now	Yes	Not yet
AN	Alignment complete - *full* navigation is ready to accept	Yes	Not yet
L	Navigating, limited accuracy	Yes	Yes
N	Navigating, full accuracy	Yes	Yes

Ground Alignment, Step by Step

1. **Power.** Battery on, then on the right console switch BCDU and AVP ON.The BCDU takes about 15 seconds to start, the AVP (which drives the MFDs) 7 seconds - or 2 minutes with the EFB option *Avionics startup time* on *Realistic*. See "Power-up". If you want to type the position by hand (step 2), leave the AVP off until it is in - the BCDU pages only work while the AVP is off.
2. **Tell the INS where it is.** Easiest: flick the INS switch to LOAD.
   Or do it by hand on the BCDU, with the AVP still off: menu knob to NAV-1 → <NAV INIT → enter latitude and longitude, then the gravity deflection GN / GE (zeros will do; see the BCDU chapter), then switch the AVP on. The EFB **Flight plan** tab shows your current position in exactly the format to type. The MFD NAV/INIT page shows the alignment position but cannot edit it.
3. **INS switch ON.** The MFD NAV/INIT page shows INS MODE: STBY.If you skipped step 2 it shows ENTER POS / LOAD and the alignment cannot be started.
4. **Start the alignment** - either
   • MFD NAV → INIT: press R1 ALN, then R2 YES; or
   • BCDU NAV INIT (AVP off, INS ON): press the key beside STBY MODE<, the scratchpad shows ALN MODE, press ENT.
5. **Wait, and do not move the aircraft.**

Time	What happens
0:30	Attitude appears on the PFD
5:00	LIM NAV READY - you may accept now for a quick departure with reduced accuracy
22:00	FULL NAV READY

The AQ (align quality) number counts down from 300 as the alignment improves - lower is better.

6. **Accept.** The INS does not go to NAV by itself on the ground - either
   • MFD NAV/INIT: R1 now reads ACPT. Press it, then R2 YES; or

- BCDU (AVP off): NAV-1 → <MODE STAT → press the key beside >FULL NAV READY (or LIM), then ENT.

The status letter changes to N (or L). You are ready to taxi.

> Caution
> **If you move during alignment** Taxiing faster than 3 knots before anything is ready restarts the alignment from zero (ACFT MOVED); it begins again once you stop. If LIM or FULL NAV READY was already showing, the INS simply takes that level and goes to NAV.

Limited Versus Full

If you accept at LIM NAV READY you get the advisory INS DEGRADED. The INS keeps refining in the background and upgrades to full accuracy by itself about ten minutes after the full alignment would have finished.

In-Flight Alignment (IFA)

If the INS loses power in flight for more than 8 seconds, it realigns itself using GPS as soon as power returns: attitude after 30 seconds, full navigation after **7 minutes**, no acceptance needed. You can also command one yourself on MFD NAV/INIT with R4 IFA and confirm YES, or, with the AVP off, on BCDU NAV INIT (>KALMAN RESET key, choice IFA RESTART). Fly straight and level on the standby display until the attitude returns.

About 80 seconds into the in-flight alignment (sooner with the Short alignment option) the INS asks for a heading change: a magenta **CHG HDG 45°** appears beside AQ on NAV/INIT and below AQ on the PFD, and the BCDU MODE STAT page reads IFA CHG HDG 45.

Turn about 45° (40° is enough) and it goes out. The turn is optional - the alignment finishes on time either way. It is not shown with the Instant option.

Accuracy, GPS Updating and Alerts

The INS aligns to the position *you gave it*. Using LOAD gives a perfect start. If you type a wrong position, the INS believes you:

- ALIGN MISMATCH - the entered position is more than 1 NM from where the aircraft really is. Re-enter it before accepting.
- Once in NAV, GPS updating (on by default) quietly pulls the INS position back to the truth within about a minute.
- If you switch GPS updating off (MFD NAV → DATA, "NAVIGATION UPDATE"), any entry error stays and the INS also drifts about 0.6 NM per hour. INS GPS MISMATCH appears when the INS and GPS positions differ by more than 1,000 ft north/south or east/west (2,000 ft in a bank of more than 5°) or 3,000 ft in altitude - with updating off that takes about a quarter of an hour.

It is not tested for 5 minutes after GPS aiding comes back, so the INS can pull itself in first.

The NAV/INIT page also shows the INS unit temperature (INU TEMP): green in normal operation, with alerts at 115, 125 and 135 °F.

Manual Position Update

If you know the INS has drifted, you can correct it over a known point. On MFD NAV → DATA press L4 MAN, select the destination point you are flying over, press R5 FIX exactly overhead, check the DIFF line and press R6 ACPT.

The difference is applied to the INS position. REJ throws it away. With the AVP off, the BCDU does the same update on NAV-2 → <MAN UPDT.

Related pages: Navigation System (INS Steering) · Backup Control Display Unit (BCDU) · Up-Front Control Display (UFCD) · Electronic Flight Bag (EFB)

Miltech Simulations U-2. SIMULATION USE ONLY. This documentation describes the simulated aircraft as delivered in the add-on and must not be used for real-world aviation.