FlyByWire Simulations Documentation

None

None

None

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1. Pilot's Corner

1.1 Pilot's Corner Overview

Welcome to the Pilot's Corner of the FlyByWire Documentation site.

This section is aimed at sim pilots of all levels and covers topics regarding flying an airliner and especially the Airbus A320neo.

1.1.1 Quick Links

Beginner Guide | **Advanced Guides** | **A320neo Pilot Briefing**

1.1.2 Topics

Featured List
Beginner Guide
Advanced Guides
Airliner Flying Guide
A320neo Pilot Briefing
Standard Operating Procedures

Last update: February 23, 2022

1.2 Beginner Guide

1.2.1 Overview

Welcome to the A32NX Beginner's Guide. Although this guide is tailored towards beginners, each topic below may even serve as reminders of proper procedure at different stages of flight for veteran sim pilots.

Each page was reviewed by an A320 type rated pilot and provides accurate information to aircraft operation.

The Preflight page contains guides on how to set up relevant data and configurations before starting your flight. We recommend starting there.

Airline SOP

Please be aware that different airlines may have slightly different procedures at different stages of flight.

For Simulation Use Only

Topics
Preflight
Starting the Aircraft
Preparing the MCDU
Engine Start and Taxi
Takeoff, Climb and Cruise
Descent Planning and Descent
Approach and ILS Landing
After Landing and Taxi to Gate
Powering Down
Abbreviations

If you have any issues or feedback with this guide, please file an issue here:

- **FBW Docs Issues**

For general questions please visit our Discord:

- **Discord Link**

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Guide reviewed by A320 Pilots.

Last update: February 23, 2022

1.2.2 Preflight

Before you start your flight in earnest, we have included various features in the A32NX that assist in configuring the aircraft and in-flight support. Some of these features require the aircraft to be powered on. Additionally, these guides will be linked in the appropriate locations throughout the beginner guide.

Nav Data

The AIRAC cycle (nav data version) of MSFS's nav data is updated during MSFS's regular sim updates. It's important to take stock of what AIRAC cycle you are currently using for your flight planning and if it matches the current AIRAC cycle in MSFS. When using simBrief or other planning tools with older AIRAC cycles you may encounter `NOT IN DATABASE`, `AWY/WPT Mismatch` OR the flight plan import may fail due to outdated/incorrect AIRAC cycle.

Owning a Navigraph subscription gives you access to their standalone nav data addon for MSFS that pairs with their simBrief flight planning. It will provide you with an up-to-date AIRAC alongside any revisions, and ensure compatibility when importing from simBrief or planning your flight manually.

Flight Planning

We highly recommend **not** using the built-in MSFS flight planner (World Map). We recommend using SimBrief as it is a great resource that provides routing and other information to successfully plan your flight.

You can choose to use other software/websites to plan your route but when using simBrief we have a handy import feature as seen in the next section. Additionally, other tools often don't have the most current nav data AIRAC cycle available.

Important Links for Flight Planning

- SimBrief Website (Flight Planning)
- Little Nav Map (Flight Planning and Charts)
- ChartFox (Charts)
- Navigraph (Flight Planning and Charts) **Requires Subscription**
- See our Custom Flight Management System page and the special notes section when using our development version of the aircraft.

Flight Plan Import

If you wish to expedite the process of inputting your flight plan on the MCDU we have incorporated a simBrief import function on the MCDU. Our EFB can also display your generated OFP within MSFS.

SimBrief A32NX Features

The Flight Plan Section in the "Preparing the MCDU" guide contains a sample routing to showcase how to input your waypoints, departure SID, and arrival STAR / procedure.

When inputting your flight plan into the MCDU, discontinuities appearing is an intended feature. The page below describes how to handle these when encountered during your preflight preparations.

Flight Plan Discontinuities

Payload Management

In order to configure your aircraft we have provided options onboard the aircraft to load fuel (via the EFB) and passengers / baggage (via the MCDU). Please see the following page and note any advisories.

Fuel and Weights

EFB Navigraph Charts

To help with navigation during your flight our flyPad EFB can connect to your Navigraph account to provide access to all the enroute charts for your flight!

EFB Navigraph

Last update: December 24, 2021

1.2.3 Starting the Aircraft

This guide will assist you with starting your aircraft. It includes images to assist you with understanding the locations of all buttons and switches.

> **Disclaimer**
>
> The level of detail in this guide is meant to teach a FlyByWire A320neo beginner to start the aircraft correctly.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> You will find many great videos on YouTube on how to fly the FlyByWire A32NX.
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

Chapters / Phases

This guide will cover these chapters in order:

1. Overhead Panel
2. Main Panel

Prerequisites

Aircraft is in a cold and dark state at a gate.

Download FlyByWire Checklist

Cockpit Preparation

To start off, we will begin by doing a few pre-checks in all areas of the cockpit to ensure the aircraft is in an normal position before turning on the batteries.

We begin by looking down at the **bottom pedestal**.

- Place the Parking Brake handle in the `ON` position
- Ensure the Speed Brakes have been disarmed/retracted
- Flaps are retracted
- Weather Radar is switched off
- Engine Masters 1 and 2 are in the `OFF` position
- Engine Mode selector is set to `NORM`
- Thrust Levers are idle

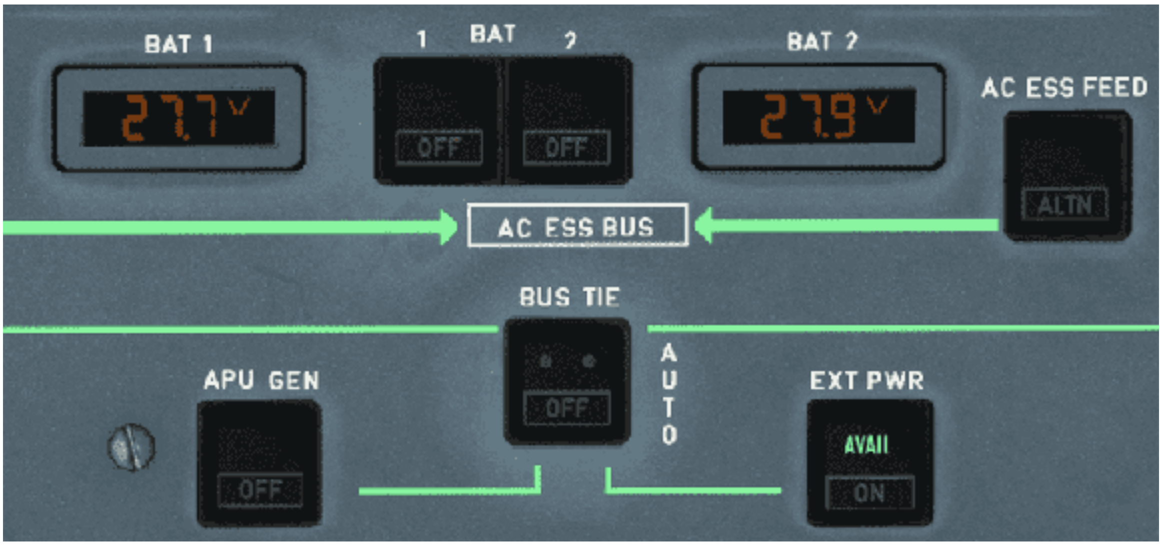
We then direct our attention to the **main panel** and make sure the following is set:

- Gear Lever is down

Then we look up at the **overhead panel**. Make sure the following are in the set position before moving on to starting the aircraft:

- Wiper selectors are in the `OFF` position

Overhead Panel



Batteries

We begin with turning on batteries `BAT 1 AND 2`. We will hear chimes indicating the batteries are on.

Batteries only power a small part of the aircraft. For the rest either ground power, APU or a running engine is required.

Ground Power

If ground power is available, we should see a green `AVAIL` light on the `EXT PWR` button. Push on this button to give power to the aircraft.

> **Ground Power Not Available**
>
> Some gates or stands are not equipped with ground power. In Microsoft Flight Simulator this happens regularly at smaller airports. This is not a bug but a realistic situation. You can then either try to call a Ground Power Unit (GPU) if available at the airport or just use the APU as described in the next step.

APU

If ground power isn't available, we turn on the APU now.

To do this, we simply push on the APU `MASTER SW` and `START`. The APU should be on within one minute.

COVID SOP

Many airlines require the air conditioning to be running prior to passengers entering the aircraft, and remain on until deboarding is complete to ensure proper air circulation. Therefore, turning on the APU even with ground power is now required, as the air conditioning packs need the APU Bleed air to function whenever the engines are not running. Especially if a ground air conditioning unit is not available.

Make sure to turn on APU Bleed on the overhead panel.

Engine Start

APU Bleed Air is required for starting the engines. See Engine Start and Taxi

Real World APU and A/C Start Procedure

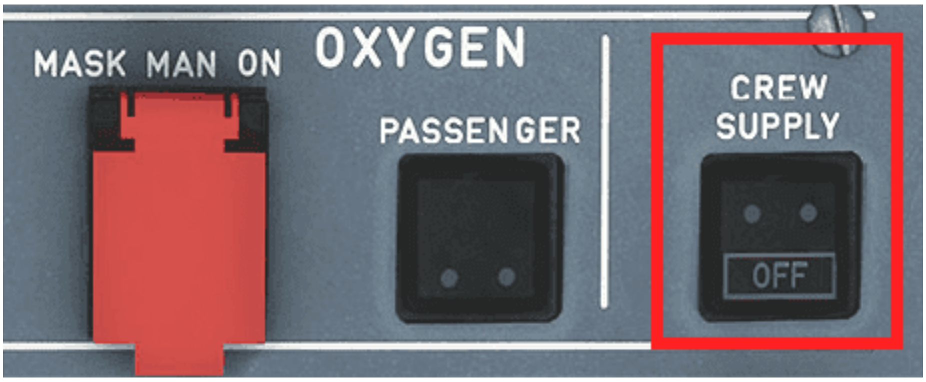
The above process is a simplified version of how real world airline start up the APU (documented in their SOP - Standard Operating Procedures).

Here is a description of an actual real world procedure of a well known airline.

- Check A/C Packs are OFF before powering the aircraft
- Set APU MASTER switch to ON
- Press APU START
  - Some airlines still require the pilot to wait 3sec for the APU flap to open. This is no longer required in the A320neo as the startup sequence waits for the flap to be open automatically.
- Wait until APU START button shows "AVAIL" (or check on lower ECAM APU page)
- Wait 1 min (use CHRONO to time this)
- Set APU BLEED to ON
- Wait 1 min (use CHRONO to time this)
- Set PACK 1 to ON (due of COVID many airlines require both A/C PACKS to be ON)

The two waiting steps are to avoid any APU oil fumes to get into the air conditioning.

After powering the aircraft, we turn on the crew oxygen supply by pushing on the button, diminishing the white `OFF` light.



To align the Inertial Reference System (or IRS), we turn the 3 knobs to the `NAV` position. This will then start the IRS alignment for which we can view the progress on the ECAM display.

To indicate that the aircraft is powered from the exterior, we turn on the `NAV & LOGO` light.

Following this, we set the `STROBE` light to the `AUTO` position.

Tip

Overview of External Lighting configurations

Cabin

We can turn on a few lights to help with visibility inside if it is too dark inside the cockpit.

- The `DOME` light has 3 settings to choose from. We can set it into the `OFF` position, the `DIM` position, or even the `BRT` position.
- The `OVHD INTEG LT` will allow us to see the outlines of the overhead panel. Turning the knob will adjust its brightness.

Passenger Signs

- Seat belts sign - `Set to ON`
- No smoking sign - `Set to AUTO`
- Arm the emergency exit lights - `Set to ARM`

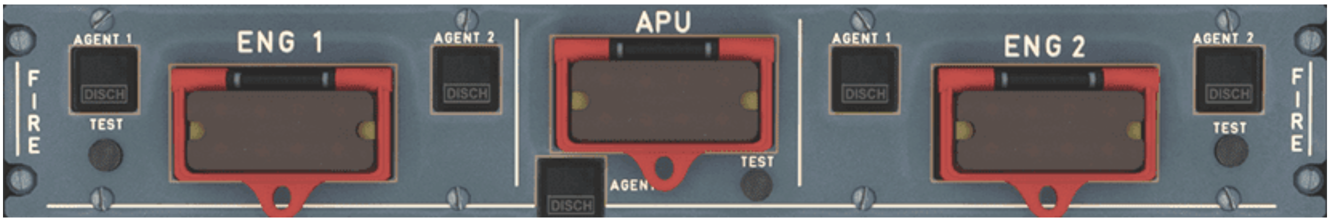
Real World Procedure

The Seat Belts sign is not turned on until fueling is complete.

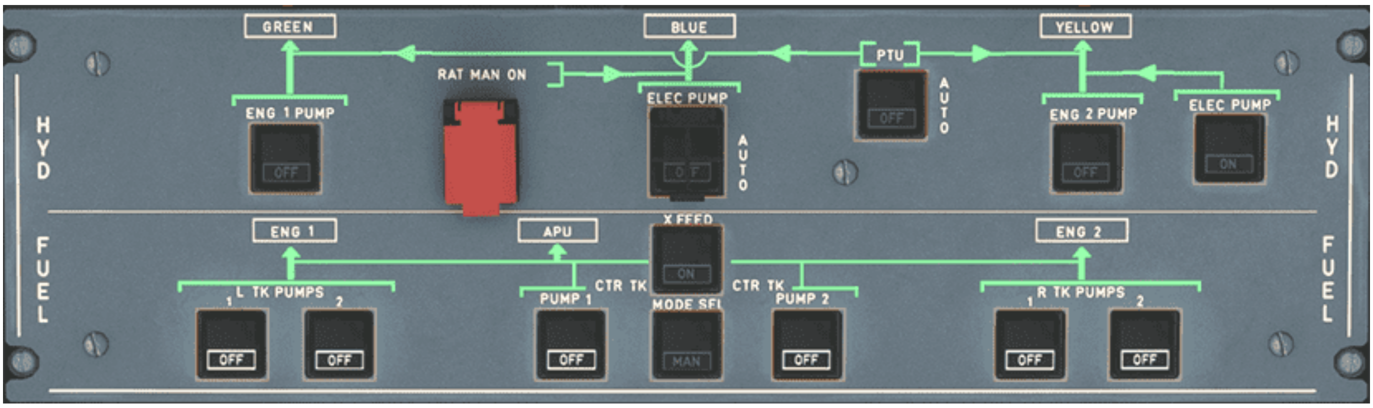
Looking up just a bit we find the `LDG ELEV` knob. This simply means the landing elevation which should be in the `AUTO` position.

Managing the temperatures of the cabin is necessary as well. Simply rotate the 3 knobs as needed.

Looking up at the **hydraulic panel**, we ensure that there are no white lights visible.

> **Fire Tests**
>
> To perform an APU and Engine fire test, hold down the `TEST` button for each of them for 5 seconds minimum to ensure the lights and aural warnings are working as expected. Checking the ECAM during the test will also show if the ECAM is performing as expected during a fire.
>
> 
>

Just below the hydraulic panel, we find the **fuel panel**. Turn on all 6 fuel pumps until the white `OFF` light is no longer visible.

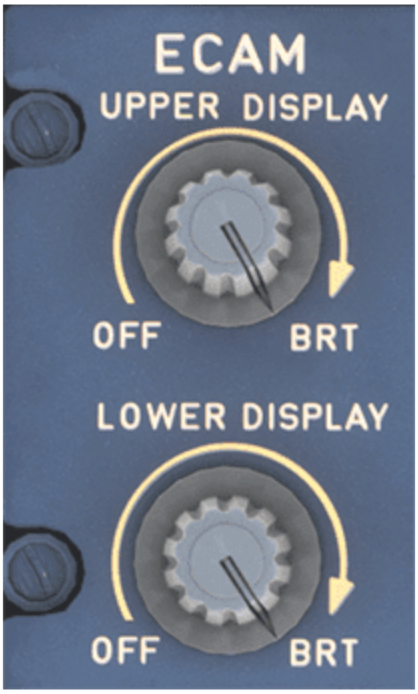


Main Panel

The brightness for each display can be adjusted to make them better readable.

For the PFD and ND, the knobs are in the same location. Look left (or right when in first officer seat) of the PFD and find the brightness knobs for them. Simply turn both knobs as required.

For the ECAM upper and lower display, look just in front of the throttles and find the brightness knobs. Just like the PFD and ND knobs, rotate them as required.



For the ISIS display brightness (just left of the upper ECAM), use the `+` and `-` buttons until the brightness is suitable. While we are at the ISIS display, set the current QNH.

Looking down at the **radio panel**, set the `RMP 1` to the active **ATIS** frequency and set the standby frequency to the **ground** frequency.

After setting correct frequencies, locate the `BARO` reference on the **glareshield**. We can set the barometer to either `inHg` or `hPa` by turning the grey inner selector behind the knob. For this flight ensure that we are set to `QNH`. This can be changed by "pushing" on the BARO knob (the tooltip will have an upwards arrow).

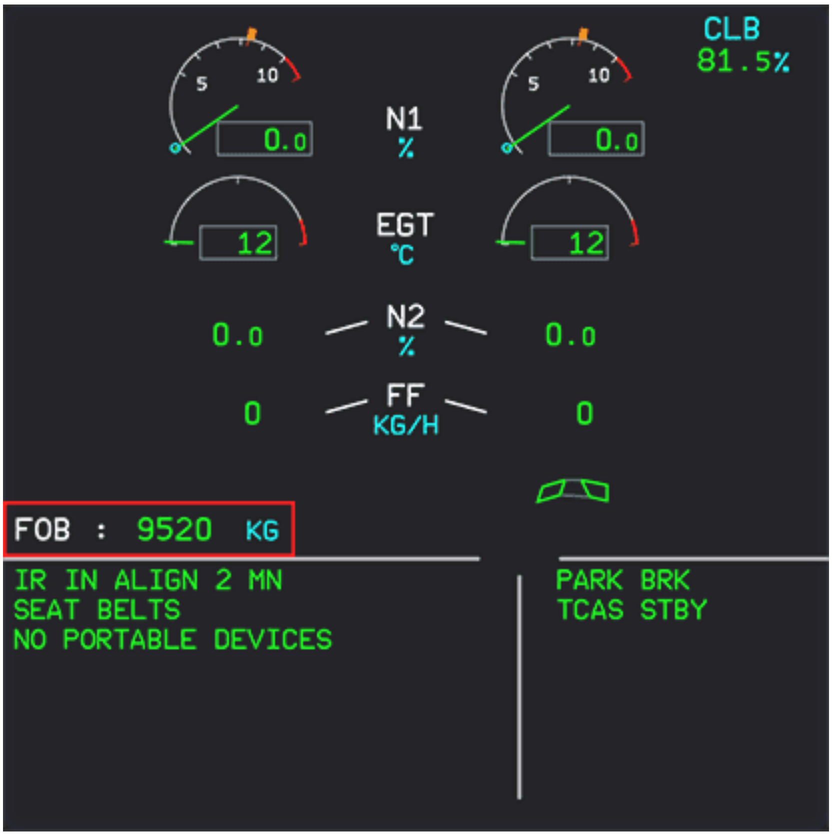
A note on QNH and QFE

Choosing between using QNH and QFE is a little beyond the scope of this guide. In most cases we will be flying using `QNH`.

- **QNH:** Altimeter indicates height above sea level.
- **QFE:** Altimeter indicates height above reference elevation in use (airfield or touchdown). This setting is usually tied to a procedure in use by the airfield, where when on the ground the altimeter will read 0.

Just below the barometer reference, turn on the `FD`. A green light indicates it has been turned on.

Verify on the Upper ECAM that your aircraft has enough fuel for the flight.



If we do not have enough fuel for the flight we can refuel via the flyPad EFB Fuel Page .

At this point we would have completed 5/7 task on the `Before Start` section on the FlyByWire A32NX checklist.

BEFORE START	
COCKPIT PREP	COMPLETED (BOTH)
GEAR PINS and COVERS	REMOVED
SIGNS	ON/AUTO
ADIRS	NAV
FUEL QUANTITY	_____KG.LB
TO DATA	SET
BARO REF	_____SET (BOTH)

This concludes the *Starting the Aircraft* guide.

Continue with Preparing the MCDU.

Last update: October 6, 2021

1.2.4 Preparing the MCDU

This guide will help you prepare the MCDU in the A32NX for your departure. It includes a simple route that you can use to follow along easily and replicate in the simulator.

Disclaimer

The level of detail in this guide is meant to provide a FlyByWire A320neo beginner the ability to adequately program the MCDU to conduct and complete a flight.

A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.

You will find many great videos on YouTube on how to fly the FlyByWire A32NX.
Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

The simBrief route used in this guide

Download simBrief OFP

Prerequisites

Below are a few Prerequisites before programming the MCDU.

Visit Starting the Aircraft to learn more.

- Make sure the aircraft is powered up.
    - External Power OR APU
- Make sure the ADIRS are set to NAV.
- Have a valid flight plan.
- Ensure IFR clearance has been obtained.

Requesting IFR Clearance

Before departing for the flight, we must obtain an IFR clearance from ATC. The clearance may be obtained from clearance delivery or another specific frequency, depending on the airport and available services.

If you are not flying on network and are using the built in ATC menu, simply find the appropriate selection in the menu and request for IFR clearance.

Clearances will usually provide the following information below. As a pilot you would need to read back the clearance correctly or acknowledge it if using the built in ATC menu.

- Cleared to the destination via specified route in the filed flight plan.
- Initial cleared altitude after departure.
- Assigned SID for departure OR radar vectors
- Assigned departing runway.
- Transponder/squawk code.
- Departure frequency.

Additional reading material: The CRAFT mnemonic

Chapters / Phases

This guide will cover the following topics:

1. Understanding the MCDU
2. MCDU Programming
    - **D**ATA
    - **I**NIT A
    - **F**LIGHT PLAN
    - **S**ECONDARY FLIGHT PLAN
    - **R**AD NAV
    - **I**NIT B
    - **P**ERF
3. A32NX simBrief Integration

Understanding the MCDU

During the course of this guide we will be referring to a few key terms which are defined below.

`LSK` for short. These keys are on the left and right hand side of the MCDU screen. They are highlighted in the image below.

- Left hand keys are referenced (in descending order) as `LSK1L - LSK6L`.
- Right hand keys are referenced (in descending order) as `LSK1R - LSK6R`.

These keys are referenced below.

Info

Horizontal Slew Keys | Vertical Slew Keys

These keys scroll between certain pages i.e. `INIT A` and `INIT B` when the INIT page is selected.

These keys scroll vertically on certain pages i.e. `F-PLN` page.

MCDU Programming

D.I.F.S.R.I.P.

Pilots commonly use the acronym above when programming the MCDU. It represents the following flow on the MCDU:

- **D**ATA
- **I**NIT A
- **F**LIGHT PLAN
- **S**ECONDARY FLIGHT PLAN
- **R**AD NAV
- **I**NIT B
- **P**ERF

The simBrief route used in this guide - Available Here

This MCDU page provides various data for the pilots. It has two pages (accessed by using the horizontal slew keys). It will not be used for this tutorial.

DATA includes the pages below:

- Position Monitor
- IRS Monitor
- GPS Monitor
- A/C Status
- Closest Airports
- Equitime Point
- Waypoints
- NavAids
- Runways
- Routes

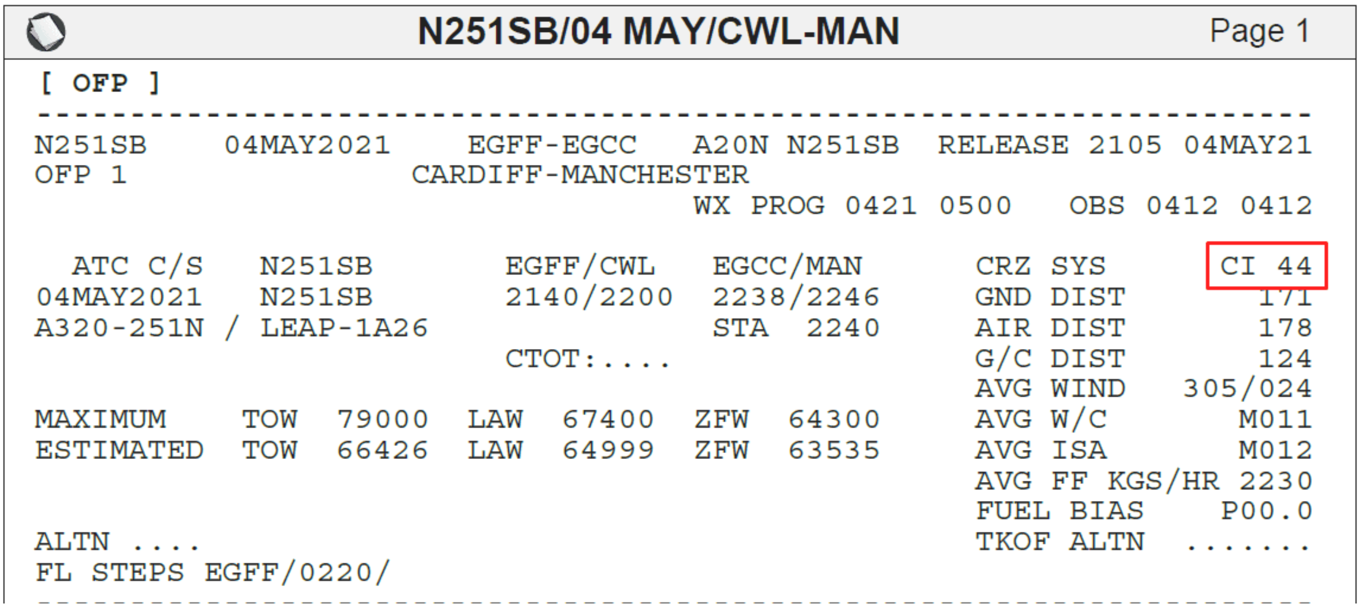
FROM/TO Field

- Using the keypad type in `EGFF/EGCC`
- Once this is in the scratch pad press LSK1R.
- This following screen would show "company routes". Since there are none stored select `Return` using LSK6L.

FLT NBR

- Using the keypad type in `EZY123` and press LSK3L. Feel free to use your own flight number here!
- If you have the Free Text module enabled for your flight, this will enable other users flying the A32NX to send you messages. This will not be covered in this guide.

COST INDEX



N251SB/04 MAY/CWL-MAN Page 1

```
[ OFP ]
-------------------------------------------------------------------
N251SB     04MAY2021     EGFF-EGCC    A20N N251SB   RELEASE 2105  04MAY21
OFP 1                   CARDIFF-MANCHESTER
                                   WX PROG 0421 0500    OBS 0412 0412

  ATC C/S    N251SB       EGFF/CWL   EGCC/MAN      CRZ SYS      CI 44
04MAY2021    N251SB       2140/2200  2238/2246     GND DIST       171
A320-251N / LEAP-1A26                STA   2240    AIR DIST       178
                          CTOT:....                G/C DIST       124
                                                   AVG WIND   305/024
MAXIMUM     TOW  79000  LAW  67400  ZFW  64300     AVG W/C       M011
ESTIMATED   TOW  66426  LAW  64999  ZFW  63535     AVG ISA       M012
                                                   AVG FF KGS/HR 2230
                                                   FUEL BIAS    P00.0
ALTN ....                                          TKOF ALTN  .......
FL STEPS EGFF/0220/
-------------------------------------------------------------------
```

The cost index can be found in the image above.

- Using the keypad type in `44`
- Press LSK5L.

CRZ FL/TEMP

```
N251SB/04 MAY/CWL-MAN                                          Page 1
[ OFP ]
--------------------------------------------------------------------
N251SB    04MAY2021    EGFF-EGCC   A20N N251SB  RELEASE 2105 04MAY21
OFP 1                CARDIFF-MANCHESTER
                                    WX PROG 0421 0500   OBS 0412 0412

  ATC C/S   N251SB       EGFF/CWL   EGCC/MAN      CRZ SYS      CI 44
04MAY2021   N251SB       2140/2200  2238/2246     GND DIST       171
A320-251N / LEAP-1A26               STA   2240    AIR DIST       178
                         CTOT:....                G/C DIST       124
                                                  AVG WIND   305/024
MAXIMUM     TOW  79000  LAW  67400  ZFW  64300    AVG W/C       M011
ESTIMATED   TOW  66426  LAW  64999  ZFW  63535    AVG ISA       M012
                                                  AVG FF KGS/HR 2230
                                                  FUEL BIAS    P00.0
ALTN ....                                         TKOF ALTN  .......
FL STEPS EGFF/0220/
--------------------------------------------------------------------
```

Input the desired cruise flight level in this field. On our OFP this is listed as `0220` or `FL220`.

- Using the keypad type in `220`
- Press LSK6L

This will input FL220 and the temperature as well.

Upon loading the flight plan page there will be three entries. Departure airport, `(DECEL)`, and arrival airport.

Our route for this flight can be found on the 2nd page of the OFP

Routing Disclaimer

Note, that waypoints, STARs, and SIDs may be called differently due to different nav-databases or different AIRAC cycles between simBrief and the simulator.

```
ROUTING:

ROUTE ID: DEFRTE
EGFF/30 BCN1A BCN N864 MONTY MIRSI1A EGCC/05R
```

`EGFF/30 BCN1A BCN N864 MONTY MIRSI1A EGCC/05R`

Inputting a SID

SID

Standard Instrument Departure Route

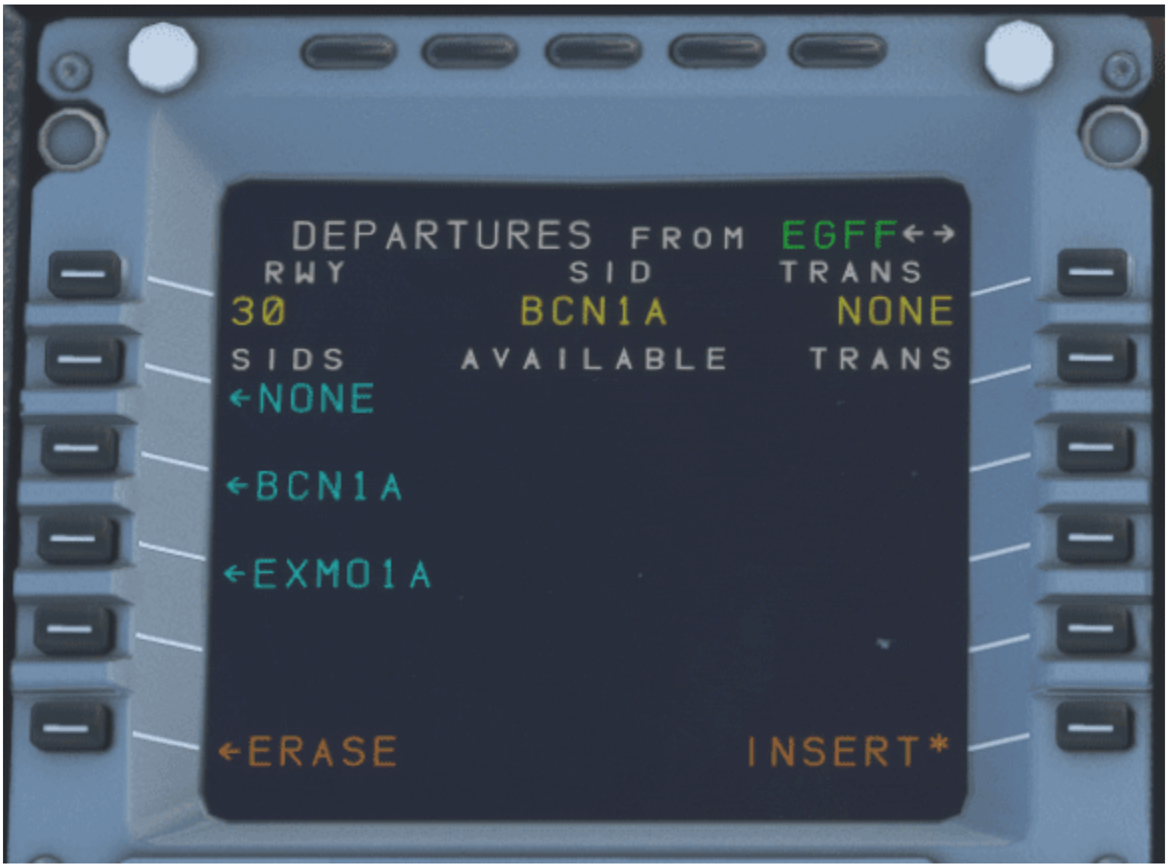
These are procedures that are defined and published that takes a flight from the take-off phase to the enroute phase.

Also see: SIDS and STARS

To program the Standard Instrument Departure (SID):

- Press LSK1L or EGFF (the departure airport)
- Select `DEPARTURE` shown next to LSK1L
- Select the runway we are departing from. In this case `30` using LSK3L
- On the list of SIDs select the `BCN1A` departure

The MCDU should now show at the top of the screen in yellow what is selected for our departure from EGFF.



- Press `INSERT` using LSK6R to program this into the flight plan.

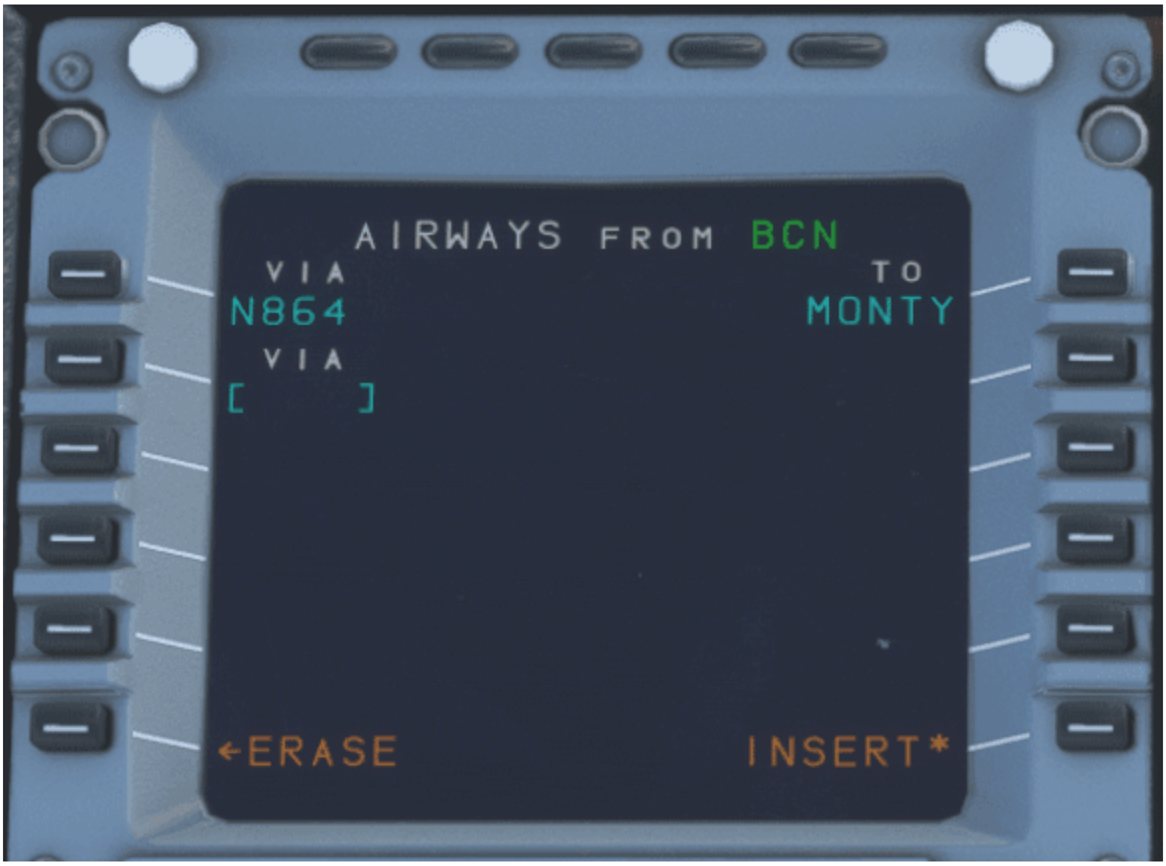
Our flight plan should now have the associated waypoints for the `BCN1A` SID. We can scroll through the flight plan using the vertical slew keys. The SID terminates at `BCN` and this is where we can begin to fill out the rest of the flight plan.

BCN1A ILS Frequency

When selecting a departure SID that pairs with a LOC/ILS frequency, the respective frequency will be auto-populated in RADNAV provided it is available from the navdata.

<u>Enroute Flight Plan</u>

- Press the LSK that matches the location of `BCN` on the MCDU screen.
- Select `AIRWAYS` using LSK5R.
- Using the keypad type in `N864` *(the airway)* and press LSK1L.
- Using the keypad type in `MONTY` *(waypoint)* and press LSK1R.
    - Remember: Airways are on the left and waypoints are on the right.



<u>Planning the Arrival</u>

For the purposes of this guide we will preplan our arrival into EGCC via the `MIRSI1A` STAR into 05R.

> **STAR**
>
> Standard Terminal Arrival Route
>
> Similar to the SID, these are procedures that are defined and published that takes a flight from the last point in a route *(in our case `MONTY`)* to the first point in the approach or the initial approach fix (IAF).
>
> Also see: SIDS and STARS

Find `EGCC` in green in flight plan OR select `EGCC` in white under `DEST` using the corresponding LSK.

- Select `ARRIVAL` using LSK1R
  - We will be shown the approaches available designated by `Type` `Rwy`.
  - For this guide we will shoot for an ILS to keep it simple.
- Use the vertical slew keys to find `ILS05R` and select it using the corresponding LSK.
- Again use the vertical slew keys to find the STAR for this flight `MIRSI1A` and select it using the corresponding LSK.
- We won't have any vias for this flight. Select `NO VIAS` using LSK2L. On the following page we can choose transitions if available, but for this flight we don't.
  - *Note:* Due to the default MSFS flight plan manager we maybe directed to proceed via the `MCT` waypoint anyways for the arrival.
- Insert this STAR into the flight plan using LSK6R.

Verify the flight plan by using the vertical slew keys to scroll through it.

Discontinuity

Discontinuity

The flight plan might contain so called discontinuities. These are breaks in the flight plan and often separate two flight plan sections like the SID and first in-route waypoint or the STAR and the APPR. They are also often inserted when the flight plan is modified.

Sometimes discontinuities are also part of a procedure to indicate that manual input is required (mostly clearance by ATC). The preceding legs are called MANUAL legs.

Discontinuities between waypoints can be cleared from the flight plan by using the CLR key on the MCDU and selecting the LSK left of the discontinuity.

Discontinuities after MANUAL legs cannot be cleared from the flight plan.

See our detailed documentation for Discontinuities

Viewing Flight Plan on ND

We can also verify the route looks correct by selecting `Plan` on the EFIS control panel and watching the ND as we scroll through.

USR Waypoints (only on Stable version)

One thing to note are the USR waypoints the sim inputs into the flight plan. These are pseudo waypoints the simulator creates to draw the flight plan.

There is a small bug in the simulator where the USR waypoint on arrival may bug out and proceed direct to runway. Please be aware and use selected HDG to mitigate this issue.

This page will allow us to input a secondary flight plan. This page is currently inoperable in the A32NX. We will update this portion of the guide when it is usable.

On this page, we would set any frequencies or identifiers needed for the departure and subsequently later enroute those required for the arrival.

For the purposes of this guide we will be using frequencies in the RADNAV page.

If we would like to have additional navaids for the departure, we can input the runway localizer for runway centerline guidance on the PFD and the initial procedure turn, including the BRECON VOR (BCN) to verify the track enroute to BCN. This is a little bit more advanced than this guide allows for but we will cover how to input frequencies.

VOR

On this departure we have the BCN VOR with a frequency of `117.45`

- Using the keypad type in `117.45` and press LSK1L. This will auto populate the identifier of the VOR when within range.
- We can also set the desired course to track `031` and press LSK2L to input it.

Departure ILS

When selecting the SID earlier in the flight plan section, the A32NX should have auto-populated the ILS/LOC frequency. If it hasn't we can manually insert it for centerline guidance on take off.

Our departure runway is EGFF/30 (runway 30) which has a frequency of `110.7`. When inputting a frequency and we are in range of the ILS it will auto populate the indentifier and course. There is no need to fill these fields.

- Using the keypad type in `110.7` and press LSK3 to input it.

Arrival ILS

With an ILS or LOC approach selected, the arrival ILS frequency should be automatically tuned correctly whenever the aircraft is at climb phase or greater and within 250 NM of destination. **Ensure** that we verify the ILS frequency when we reach the arrival phase of the flight - see Approach and Landing (ILS).

Remember our arrival airport/rwy is `EGCC/05R` with ILS05R having a frequency of `111.55`. When inputting a frequency and we are in range of the ILS it will auto populate the indentifier and course. There is no need to fill these fields.

- Using the keypad type in `111.55` and press LSK3 to input it.

ADF

This works much in the same way as the examples above.

To navigate to the `INIT B` page we first have to select the `INIT` button. Once on `INIT A` use the horizontal slew keys to switch the page to `INIT B`.

On this page, we can input our zero fuel weight (ZFW) and zero fuel weight center of gravity (ZFWCG).

> **Important Info**
>
> Fuel and payload have to be set in the aircraft (see link below) and passenger boarding has to be complete for the ZFW/ZFWCG to be correct.
>
> Please see our Fuel and Weights Guide for more information.

The A32NX can auto populate this information.

- Press LSK1R to load in the calculated ZFW/ZFWCG into the scratch pad at the bottom of the MCDU.
- Press LSK1R a second time to input the above calculation into the MCDU. (The empty orange boxes should now be filled in by the scratch pad entry).

Now we can add our fuel on board (FOB). The amount we input in this field can be done in one of three ways:

- Indicated FOB on the upper ECAM.
- We can have the MCDU plan the amount of fuel required.
- The amount indicated in the OFP.

> **Loading Fuel**
>
> Via the EFB - Learn How

ECAM FOB

Look at the upper ECAM and note the FOB indicated. Let's say that amount is `3091 KG`. When inputting the block fuel into the MCDU it is referenced in "Tons" and we should round to the closest decimal point.

- Using the keypad type in `3.1` and press LSK2R.

MCDU Planning

We can choose to have the MCDU provide a recommended amount of fuel for the planned flight.

- Press LSK3R to compute an amount of fuel.

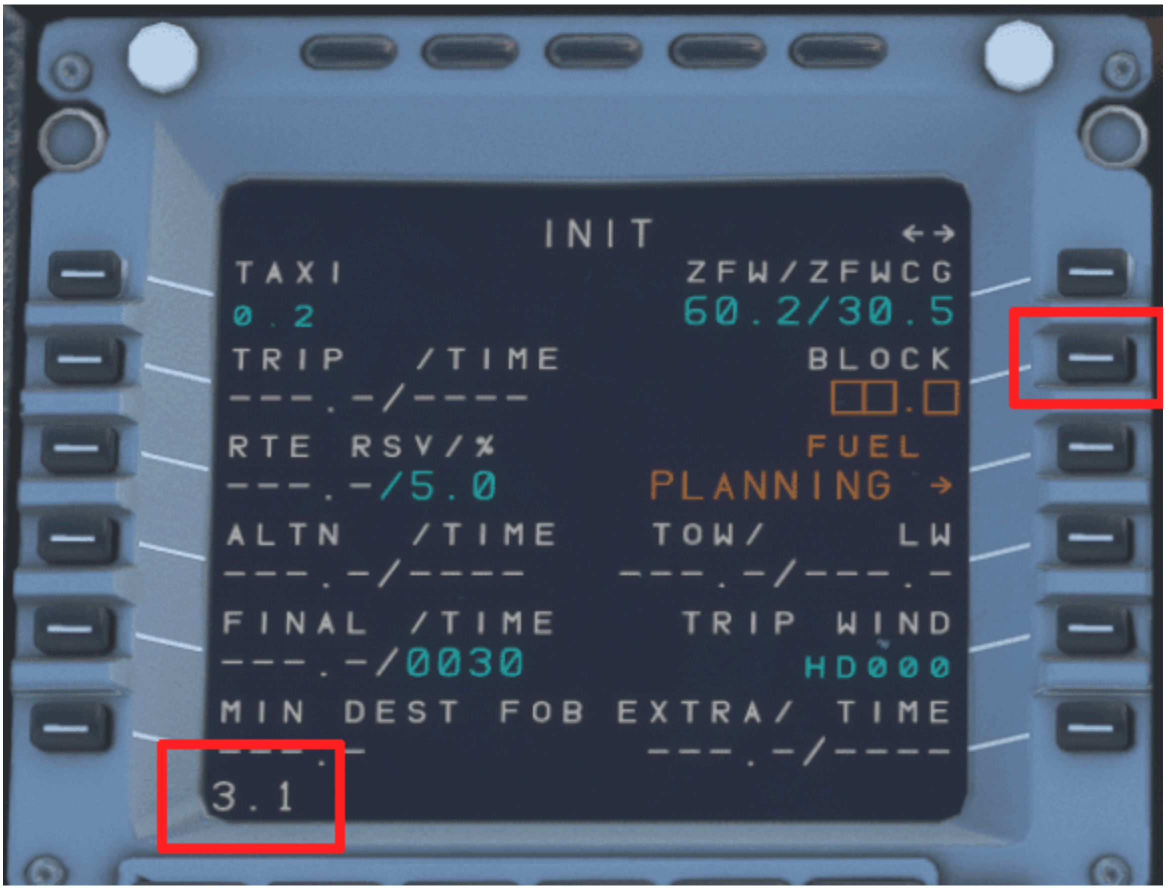
The `Block` field will be populated with a calculated fuel amount.

- Press LSK3R again to confirm the fuel.
- We should load this amount of fuel via the EFB or AOC option.

SimBrief OFP

We can use the planned block fuel stated on the OFP which in this case is `3091 KG`.

- Using the keypad type in `3.1` and press LSK2R
- We should load this amount of fuel via the EFB or AOC option.



The performance page changes based on the relative stages of flight until we land the aircraft. When programming the MCDU on the ground we start on the take-off performance page.

For this flight we will be taking off with a `1+F` flaps configuration.

- Using the keypad type in `1` and press LSK3R

THS Field MCDU

Entry of the THS field is subject to airline SOP and may not be required.

The Trimmable Horizontal Stabiliser (THS) field is where we enter the stabilizer trim for takeoff based on the aircraft's takeoff CG (TOCG). Entering this value in the MCDU will trigger the F/CTL PITCH TRIM/MCDU/CG DISAGREE ECAM caution, if appropriate.

If you have already entered your flaps configuration in the step above, applicable entries are formatted `/X.XDN` or `/X.XUP` representing a trim value and nose down or up respectively.

Examples:

- Nose down trim of 0.4 can be inputted as `/0.4DN`
- Nose up trim of 1.5 can be inputted as `/1.5UP`

For our flight today we need to set a nose down trim of 0.8, input `/0.8DN` into the scratchpad and press LSK3R.

See the After Engine Start section to physically set your trim.

> **For the purposes of simulation** we can use the auto-calculated GWCG on the FUEL PRED page to input a value into the THS field. Since this is not accurate for real world use, you can infer the TOCG and pitch trim by referring to this value right before takeoff to confirm the pitch trim configuration for your flight.
>
> We plan on adding a better visual representation of the TOCG at later time.

- Using the keypad type in `/DN0.8` and press LSK3R

Other valid entries for THS include:

- With flaps setting example: `1/DN0.8`
- Nose up example: `/UP0.5`

We can also choose to set a `FLEX TO TEMP` for the flight. The example we are using today is 60 degrees. (This will normally be calculated via a pilot's company EFB or other tools).

- Using the keypad type in `60` and press LSK4R

What is Flex Temp?

Flex temp is entered into the MCDU enabling the computer to use the pilot specified air temperature to allow for take-off thrust that is less than TOGA but not less than CLB. This is a method of creating cost savings by increasing engine life resulting in reduced overhaul and fuel costs. This value is normally calculated via a pilot's company EFB or other tools.

Unfortunately, A320neo performance data for FLEX temp performance calculators alongside other various tools are not publicly available and are guarded by Airbus. For the purposes of simulation, it's important to note the following:

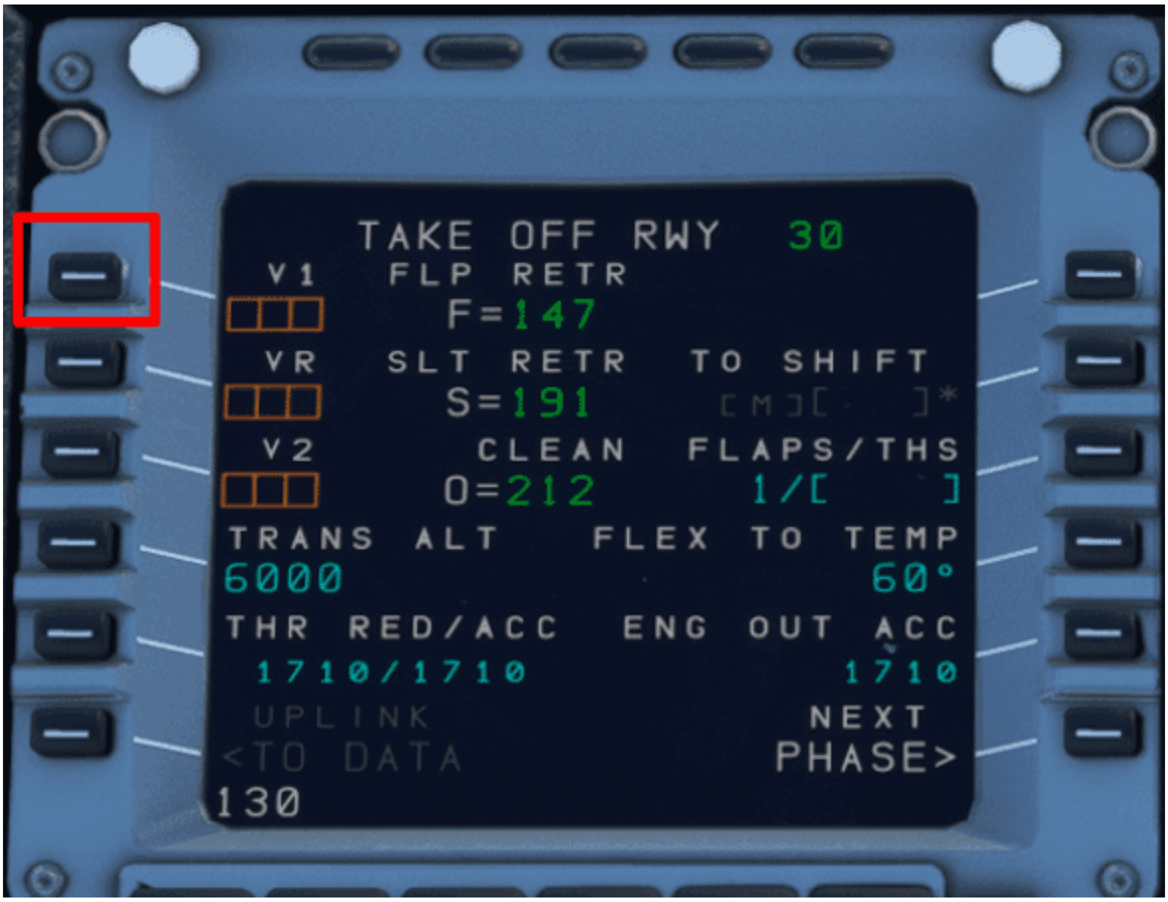
> Typically, Flex temps are above ISA+29C (44C at sea level) and above current temp, but no higher than ISA+55C (70 C at sea level). Usable Flex temps are from 45 C (or current OAT if it is higher) to 70 C.
>
> Additionally, a decent rule of thumb for simulation purposes is to use a lower number if heavy or on a short runway and higher for the opposite.

Our SID chart mentions that the TRANS ALT for this departure is 6000ft.

- Using the keypad type in `6000` and press LSK4L

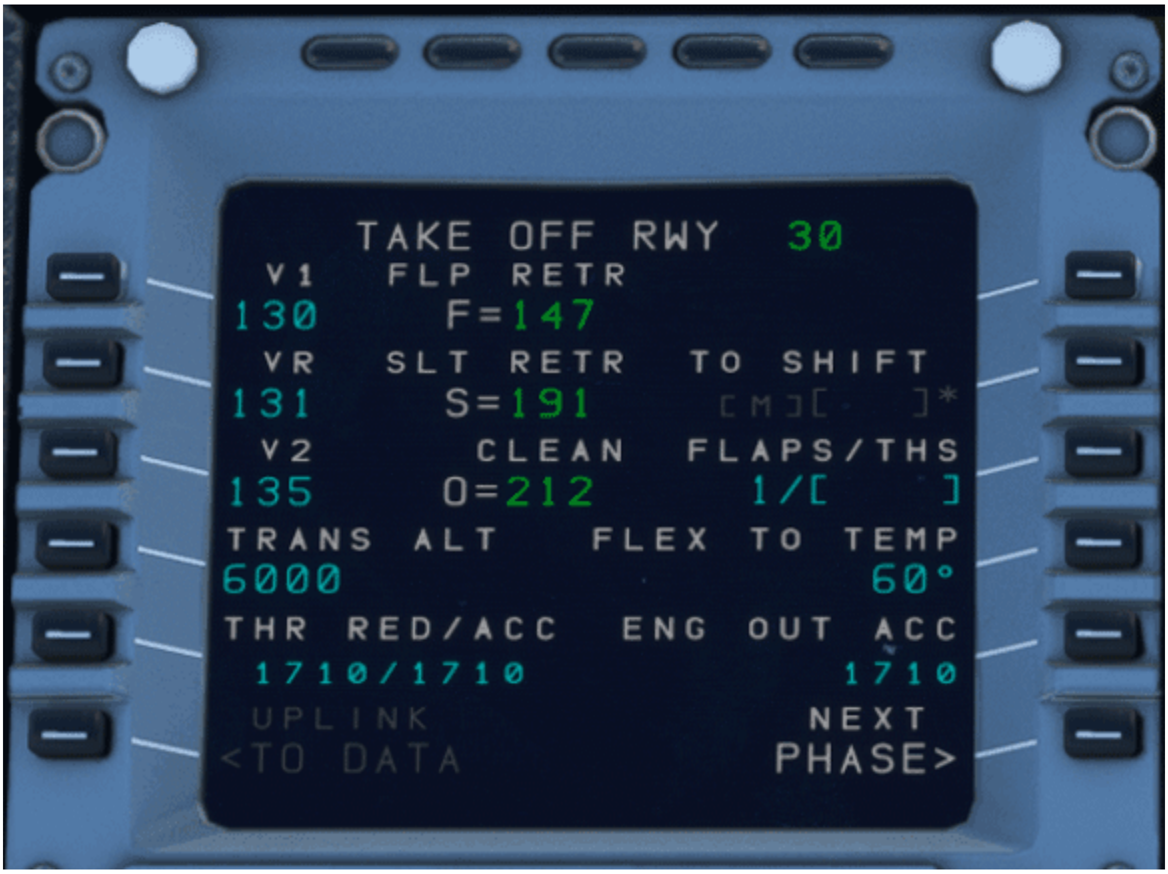
The A32NX can calculate the V-Speeds automatically. To do this simply:

- Press LSK1L to have the calculated V1 speed appear in the scratchpad.



- Press LSK1L again to have 130 inputted into the V1 speed.
- Repeat this procedure for VR and V2.

The performance page should now look like this:



A32NX simBrief Integration

This section has been moved to our dedicated simBrief Integration feature guide.

After setting up the MCDU continue with Engine Start and Taxi

Last update: January 6, 2022

1.2.5 Engine Start and Taxi

This guide will explain the correct procedures to accomplish a pushback with engine start and perform a safe taxi to the departure runway.

> **Disclaimer**
>
> The level of detail in this guide is meant to get a FlyByWire A320neo beginner safely from the terminal to the runway hold short point.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> You will find many great videos on YouTube on how to fly the FlyByWire A32NX.
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

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Prerequisites

- BEFORE START checklist completed
- IFR clearance obtained
- The aircraft is secure
- APU MASTER SW - `Set to ON` and the APU is available
- Beacon light - `Set to ON`

At this time we may request for clearance to push and start from ATC.

Download FlyByWire Checklist

Chapters / Phases

This guide will cover these chapters:

1. Pushback
2. Engine Start
3. After Engine Start
4. Flight Controls Check
5. Taxi
6. General Resources

Pushback

There are several options available to you in MSFS to achieve a successful pushback.

- The flyPad (EFB) ground control screen
- MSFS built in ATC pushback controls
- Third party pushback addons

Once all passengers have boarded and secured we are ready to begin pushback.

Ensure:

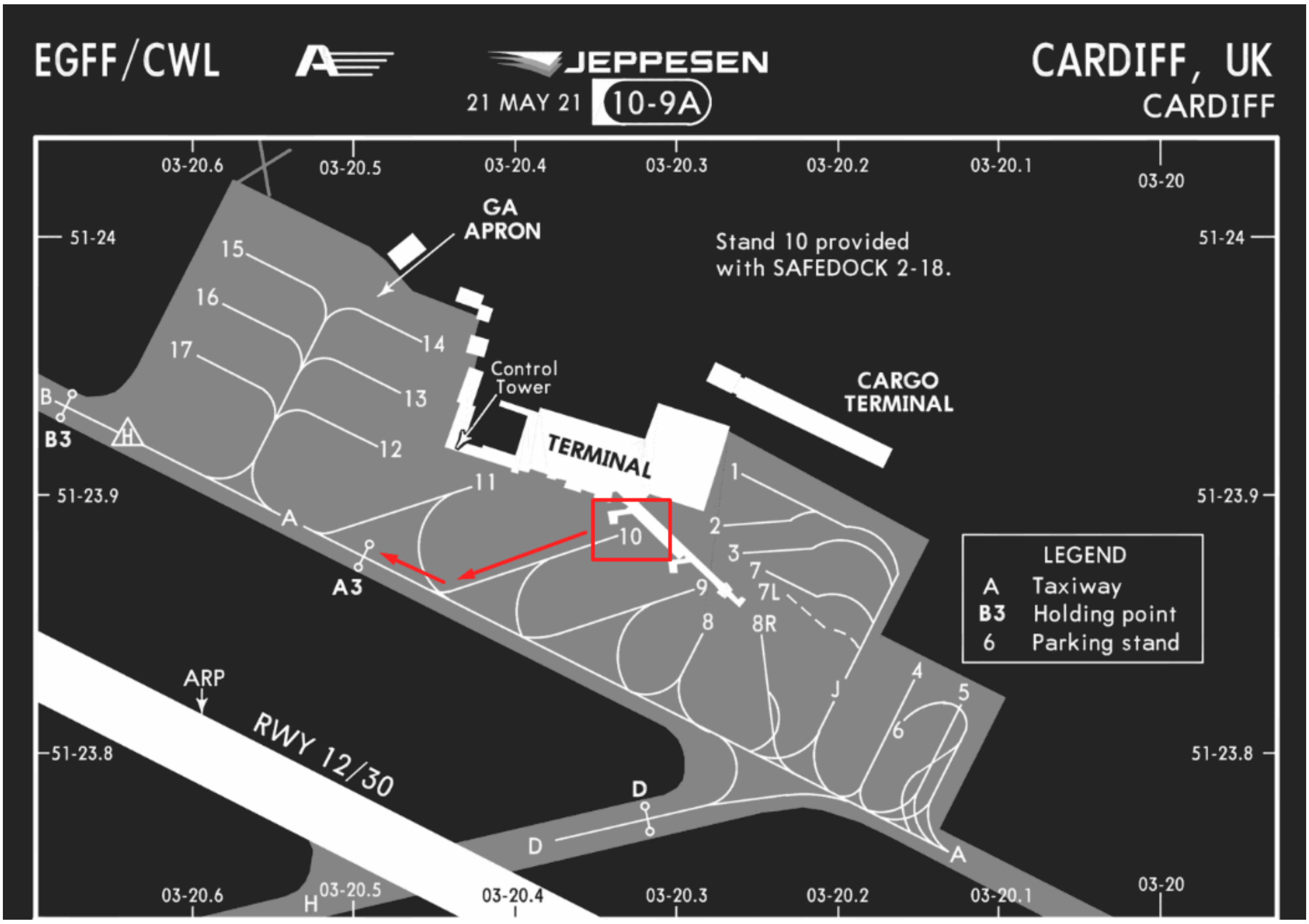
- All doors to the aircraft are armed and secure.
- EXT power has been disconnected.
- APU BLEED - `Set to ON`

For this guide we will assume you are parked at gate 10 at EGFF (Cardiff).

Contact ground ATC and inform them you are ready for push and start. If you are on a network such as VATSIM, a typical response from ground would give you clearance for your request and a direction to face (or any direction). At EGFF you could expect the following push and start clearance from ground:

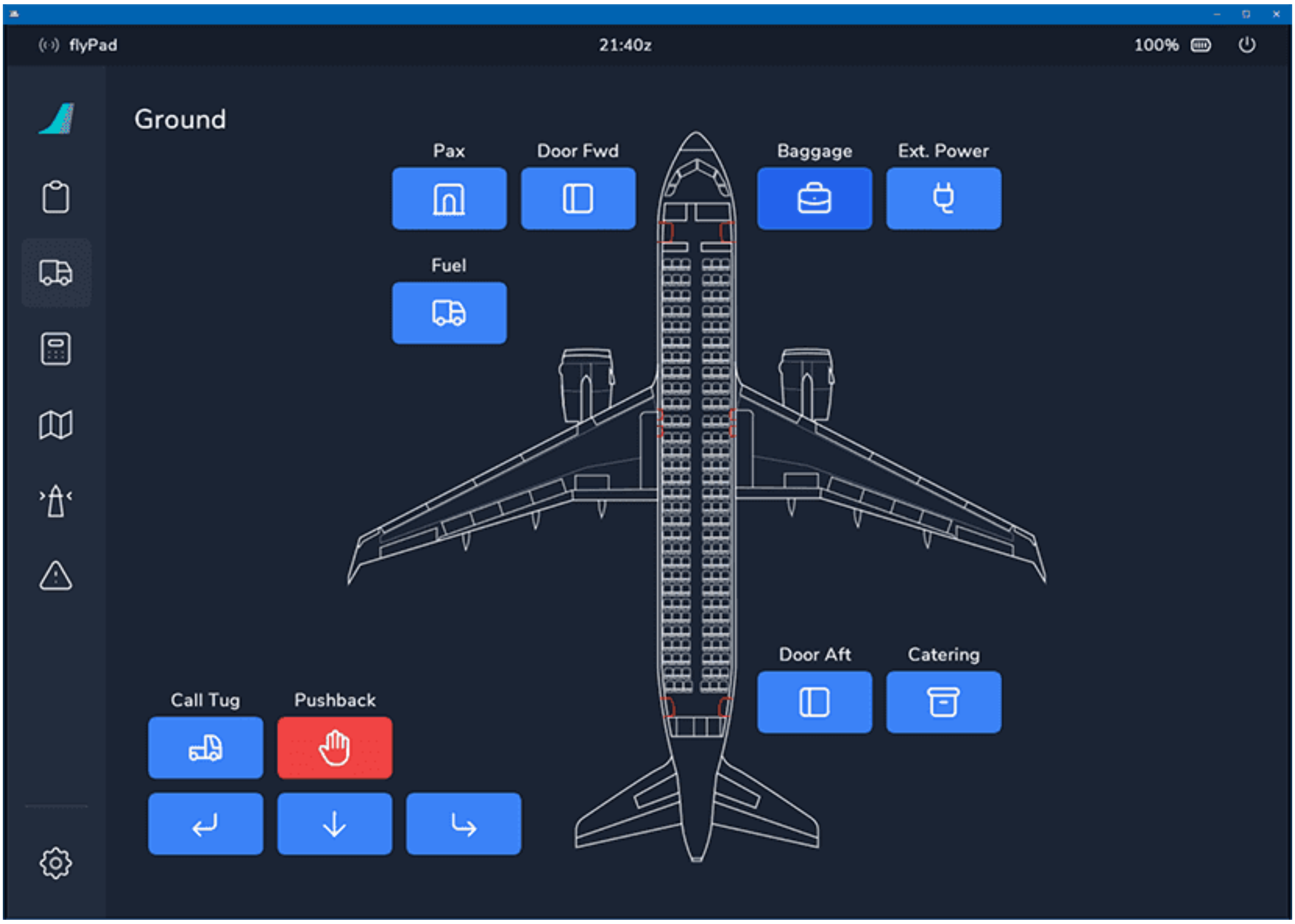
" **Your Aircraft Callsign**, ground. You are clear to push and start onto Alpha 3 facing east."

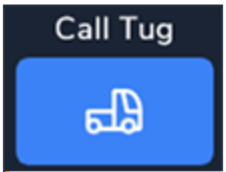
At this point we may begin pushback away from the terminal onto the taxiway Alpha 3.



The FlyByWire A32NX has a ground operations page on its built-in flyPad EFB (Electronic Flight Bag). This page allows to control the pushback of the aircraft and other useful ground operations such as calling the jetway, baggage or catering, etc.

Although Microsoft Flight Simulator also has some pushback functionality built into the default ATC service this guide will only cover the A32NX pushback functionality.





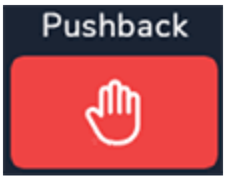
After we received clearance to pushback we will call the pushback tug by pressing the `Call Tug` button on the flyPad.

If a pushback tug is available at this gate or stand it will then start attaching itself to the nose wheel.

Some airports / gates / stands do not show a tug. This functionality still works and you can push back as if a tug is attached. It looks like an invisible tug is pushing the aircraft.

After the tug is attached to the nose wheel we can start pushing back by using these control buttons:

Steer with the left, straight and right buttons to position the aircraft as required.



To stop or pause the pushback press the red button.

Press the `Call Tug` again to release the tug.

Engine Start

Once we are clear of the terminal and/or the ground crew has notified the flight crew it is clear to start engines, we can proceed with the following steps.

Start the chronometer above the ND to help monitor the start up time of the engines.

Using the Chronometer

The chrono button has three states depending on how many times you have pushed the button:

1. First Push - Starts the timer on the ND
2. Second Push - Stops the timer on the ND
3. Third Push - Removes the timer from the ND

Time is represented as *minutes*' *seconds*" i.e. 04'41" equates to 4 minutes and 41 seconds.

Use Cases

There are a few different reasons pilots use the chronometer on the ND:

- Engine startup times.
- Duration of flight.
- Certain procedures such as a visual pattern or circling approach.

Location on the ND:

For this guide will begin by starting engine 2.

Differing airline SOP may have a different engine start order

Note: Bleed Air

The A320neo needs pressurized air to start the engines. This pressurized air is usually generated by the APU for the start of the engines. This is called bleed air as it is a byproduct of a running jet engine where pressurized air is taken from the engine to be used on other systems.

To start the engines, you need to have the APU available and the APU Bleed ON.

In real life you can start the second engine with bleed air (X-Bleed) from the first engine. This is not yet implemented in the A32NX. It would usually not be used at the gate as the APU would be running anyway but it is used during single engine taxi when the second engine is started while rolling to the runway.

Also, in very rare cases the gate or a mobile ground unit has pressurized air to be connected to the aircraft so the first engine can be started without APU. This is usually done when the APU is INOP. Microsoft Flight Simulator does not provide this option.

Start Engine 2 **Start Engine 1**

1. Set the `ENG` mode selector to `IGN/START`
    - Flight crew should hear the packs turn off.
    - The lower ECAM should automatically display the engine parameters screen.
2. Set `ENG 2` Master to the ON position.
    - Pay attention to the ECAMs and note engine parameters as ENG 2 starts up.
    - The engine should take roughly 1 minute to complete its start up sequence - use the chronometer started earlier to time this.

Engine 2 will have successfully started when the following applies (at ISA sea level):

- N1 is at roughly 19%
- N1 reported `AVAIL`
- N2 is at roughly 68%
- EGT settles at about 520°C
- FF is at roughly 290 kg/h

1. Set `ENG 1` Master to the ON position.
    - Pay attention to the ECAMs and note engine parameters as ENG 1 starts up.
    - The engine should take roughly 1 minute to complete its start up sequence - use the chronometer we started earlier to time this.

Engine 1 will have successfully started when the following applies (at ISA sea level):

- N1 is at roughly 19%
- N1 reported `AVAIL`
- N2 is at roughly 68%
- EGT settles at about 520°C
- FF is at roughly 290 kg/h

After Engine Start

Complete the after start flow:

- Set the `ENG` mode selector to `NORM`
- FLAPS - `Set`
  - As defined in the MCDU Preparation guide.
  - Note: If taxiing in icing conditions with rain, slush or snow:
    - Maintain the flaps retracted until the aircraft reaches the holding point of the takeoff run. This action prevents contamination of the slats/flaps mechanism.
- GROUND SPOILERS - `Arm`
- APU BLEED - `Set to OFF`
- APU MASTER SW - `Set to OFF`
- ANTI ICE - `As required`
  - Consider when temperatures are less than 10C and visible moisture.
- PITCH TRIM - `Check`
- RUDDER TRIM - `Zero`

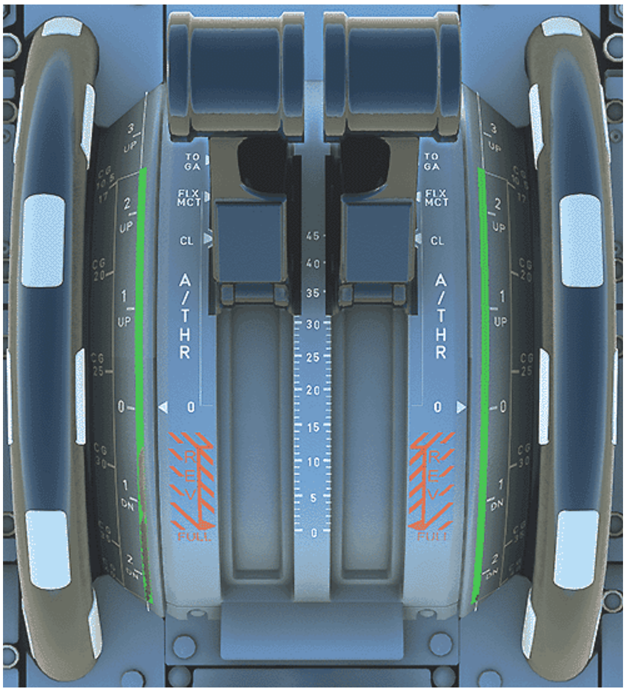
AFTER START	
ANTI ICE	AS RQRD
ECAM STATUS	CHECKED
PITCH TRIM	_____% SET
RUDDER TRIM	ZERO

Perform the AFTER START checklist.

Setting Pitch Trim Advice

While setting the pitch trim is standard operating procedure, a precisely set trim value on the trim wheel is not critical. As long as your center of gravity (CG) is within CG limits, any trim setting within the green band will provide for a safe takeoff in the A320neo. Appropriate trim settings can be found at the bottom of our checklist.

There is a rotation law in the NEO that gives you a consistent rotation rate for any given stick input regardless of other conditions. Upon liftoff, the autotrim becomes active.



For this flight take a look at your throttle quadrant and look for the trim markings closest to the throttle levers. Based on the Preparing the MCDU section we have a general estimate of 30.5 for our CG.

The FlyByWire checklist's trim section at the bottom indicates we would need to set a nose up trim of about 0.2.

The CG scale available in the Asobo's model of the flight deck not entirely accurate for the A320neo.

Flight Controls Check

Airlines may perform the flight controls check at different points depending on their SOP. Most notably the common instances are:

- After completing the AFTER START checklist and before taxi.
- During taxi out.

Using the ECAM control panel press the `F/CTL` button to switch the lower ECAM to the flight controls. Ensure all flight controls are displayed in green.

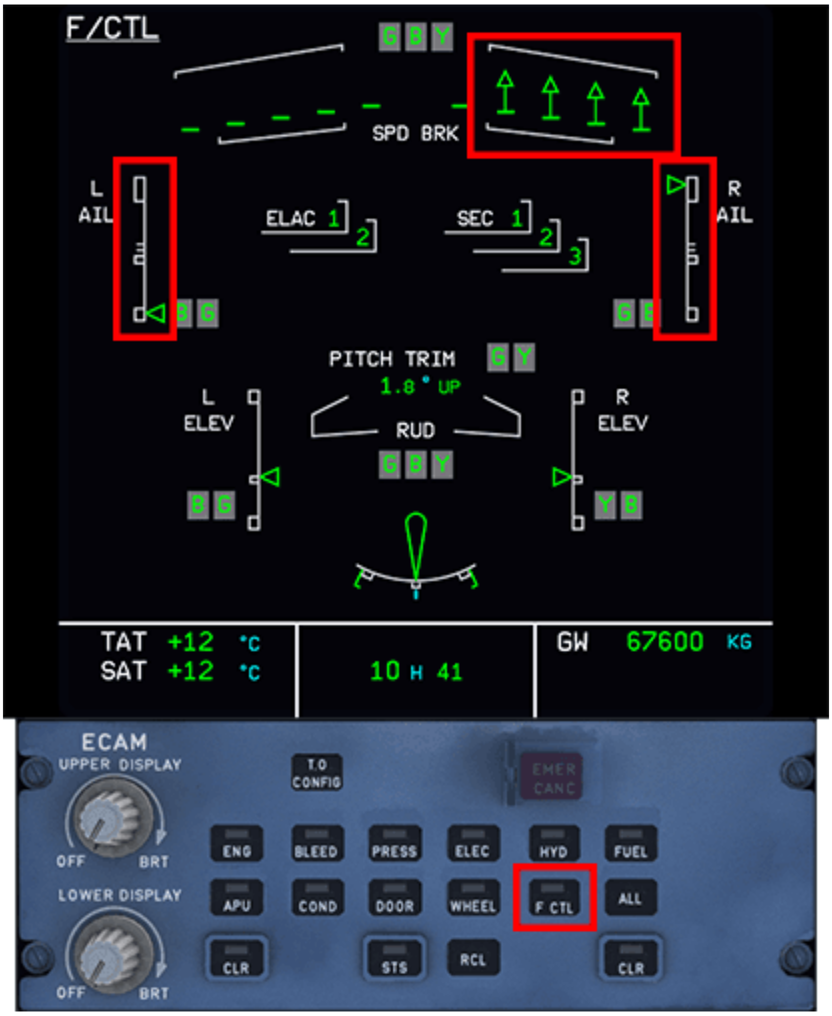
The `F/CTL` ECAM page displays a white scale and green index for the following positions:

- Left and right ailerons position
- Left and right elevator position

Fully deflect the sidestick in all directions and observe that the full range of motion is reflected on the ECAM page. Note the upward arrows in the `SPD BRK` area when moving the ailerons and ensure those are displayed when deflecting the side stick.

Move the rudders and pay attention to the rudder symbol to ensure it moves all the way to the left or right.

Sidestick right full deflection:



Taxi

Taxi Speed + Engine Thrust

The A32NX is perfectly capable taxiing with idle thrust and even gradually accelerate. In certain situations it may be required to provide some thrust to begin rolling.

Standard behavior is to allow the aircraft to reach 30kts and apply brakes to 10kts. Repeat as necessary.

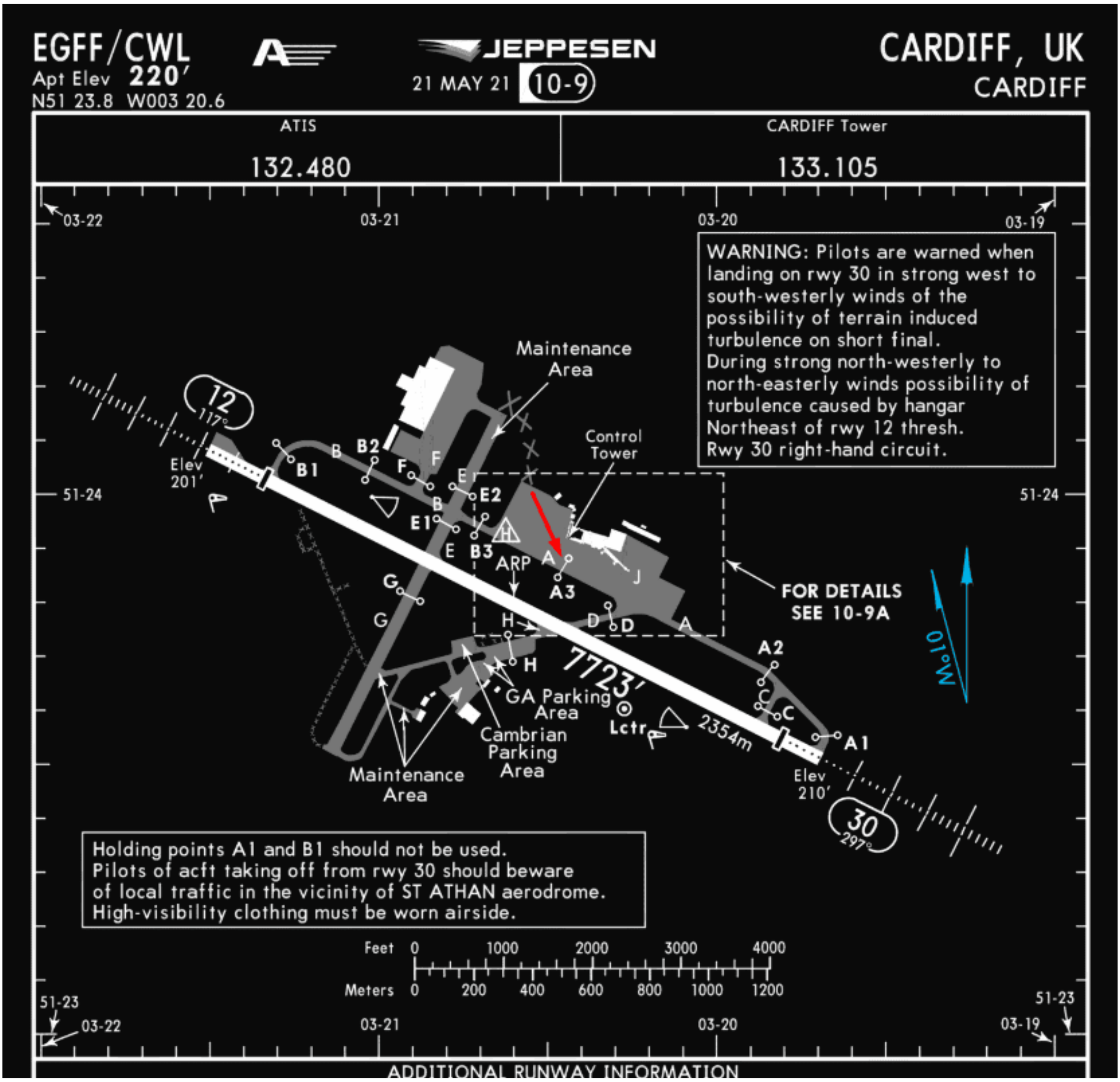
Having charts or diagrams of the airport you are currently in will help you navigate efficiently and safely. There are many resources and applications available online that are either free or paid which you can utilize.

For additional information on signs and markings on the ground please see General Resources below.

After having successfully started the engines we can contact ATC to request taxi clearance. As per our routing in the Preparing MCDU Guide we should be expecting a takeoff from runway 30. As such a sample taxi clearance may be as follows:

"**Your Aircraft Callsign**, ground. Runway 30, taxi via Alpha, hold short of 30 on Alpha 2."

Referencing the airport chart below, the aircraft should be sitting on the Alpha taxiway near the Alpha 3 holding point. Luckily today our clearance is quite simple and we only have to taxi straight ahead and hold at Alpha 2.



Make sure to pay attention to any warnings or notices on the respective taxi chart beforehand so you are aware of any important information while performing your taxi.

Once we have the routing from ATC and have read back the taxi clearance, we are now free to taxi to the runway.

Exterior Lights:

- RWY TURN OFF - `Set to ON`
- NOSE - `Set to Taxi`

Before Moving Safety Check:

- Verify the ground crew is safely away.
- Look to the left and right to ensure clearance from other aircraft or vehicles.
- Release the parking brake.
- Brakes pressure - `Check at Zero`

At this point the aircraft may start rolling. Depending on the weight of the aircraft we may need to add a little power to the engines to get going. Increase power to roughly ~25-30% N1. Be mindful that we are not blasting N1 towards or around the terminal.

- Leave a bit of thrust on and perform a quick brake check to ensure hydraulics and brakes are fully functioning.
    - We don't need to come to a complete stop but merely check the brake pressure status when performing the brake check.
- If an arc is shown above the brake temperature on the WHEEL SD page on the lower ECAM, turn the brake fans on.

If it is required to perform a sharp turn immediately we may need more than ~25-30% N1 and should set the thrust accordingly. Try not to perform the brake check while in a turn as we don't want to come a complete stop while turning.

While underway to the runway perform the following as part of the taxi flow:

- Use the tiller or rudder pedals to steer the aircraft.
    - See Nose Wheel and Tiller Operation
- Perform a flight controls check (if you haven't already).
- Verify the ATC clearance for departure.

It is important to verify and confirm the information in the MCDU as we taxi. This is increasingly important if the ATC clearance changes enroute to the runway.

Takeoff Data/Conditions

In case of a runway or takeoff data change, perform the following:

- FINAL TAKEOFF DATA - `Confirm or Recompute`
- FMS TAKEOFF DATA - `Check/Revise as RQRD`
- REVISED FMS TAKEOFF DATA - `Crosscheck`
- F-PLN (RUNWAY) - `Revise`
- FLAPS lever - `As Appropriate` *Select takeoff position*
- V1, VR, V2 - `Reinsert`
- FLX TO temperature - `Reinsert`

AFS/Flight Instruments

Perform the following:

- F-PLN (SID, TRANS) - `Revise or Check`
    - Check to ensure that the ATC clearance agrees with the flight plan if we are departing using NAV mode.
- INITIAL CLIMB SPEED AND SPEED LIMIT - `Modify or Check`
- CLEARED ALTITUDE ON FCU - `Set`
- HDG ON FCU - `If Required, Preset`
    - If ATC requires a specific heading after takeoff, preset the heading on the FCU. NAV mode will be disarmed and RWY TRK mode will keep the aircraft on the runway track.

This is the FCU (more details are provided in the Take off, Climb, and Cruise Guide):

- BOTH FD (*flight directors*) - `Check on`
- PFD/ND - `Check`
- TAKEOFF BRIEFING - `Confirm`
- RADAR (if required) - `On`

  The current implementation of the weather radar in MSFS will show precipitation along the route. Additional functions are unavailable at this time however we should set the Radar to Sys 1 if required for departure.
- PREDICTIVE WINDSHEAR SYSTEM - `Auto`

  Currently this only clears the warning on the ECAM and does not provide a function in the sim. We should perform this action regardless.

The weather panel is located on the bottom left of the lower pedestal and looks like the following:

- ATC code/mode - `Confirm/Set for Takeoff`
- TERR ON ND - `As RQRD`
- AUTO BRK MAX pb-sw - `On`

Getting Ready for Take off

At this point in the guide you should have performed many of the essential flow items before you line up at the runway. The next guide Take off, Climb, and Cruise will instruct you on performing your final checks and before take off checklist.

For additional information: See the sections below for extended taxi information and visit the General Resources Section on this page to help you understand the different signs and elements found on the ground at an airport.

Speed While Taxiing

Pay attention to the ground speed (visible on the ND) while taxiing.

- **Straight Line**

  Anything up to 30kts is reasonable, but some airports may carry their own local restrictions that should be noted. This is not an absolute rule and is usually typical SOP for airlines in a straight line.

- **90° (Sharp) Turns**

  A good speed would be around 10kts. This provides safety for the flight crew as they perform their safety demonstration/checks.

- **Regular Turns**

  Around 15kts is an acceptable speed with a similar concept to providing safety as described above.

Handy Tips While Taxiing

- **Maintaining Center Line**

  We can use the grey vertical bar in between the PFD and ND as a reference point and keep the taxi line in between the two screens.

- **Turning**

  Using the same bar mentioned above try to "over steer" (keep the nose wheel slightly ahead of the line while we turn). This helps keep the aircraft centered while performing a turn.

  Slow down while turning!

Crossing a Runway

When approved to cross a runway (active or not) perform the following actions:

- Look out the windows and visually ensure that there are no visible aircraft to the left and right.
- Turn on extra lights to ensure the aircraft is visible when crossing:
  - Strobe lights - `Set to ON`
- Inform ATC we have vacated the runway if required.

> **Warning**
>
> Never cross a runway without express permission from ATC and providing a read back of said instructions. Always ensure maximum safety when crossing.

General Resources

This section provides you with information on understanding the different signs and markings you may see while taxiing at the airport.

> **Scenery / Accuracy Issues**
>
> Please be aware that the default scenery or 3rd party sceneries may not be entirely accurate with the posted signage on the ground. However, this guide will explain how to read and understand them.

FAA Quick Reference Guide

The FAA has a handy guide available for download that contains images of all the pertinent signs you may encounter, their purpose, and location at the airport.

Download FAA Guide

There are two types of signage at airports - operational guidance signs and mandatory instruction signs.

Operational Guidance Signs

<u>Location Signs</u>

- These signs are yellow text on a black background. Typically, indicates a specific taxiway or runway your aircraft is on or entering.

<u>Direction/Runway Exit Signs</u>

- Black text on a yellow background. These will have an arrow indicating direction to turn which helps pilots identify what taxiways they are approaching or runway exits towards a specified runway.

Stop Bar Signs

- White text on a blue background. These are non-standard signs that may appear at some airports usually indicating which taxiway a stop bar is positioned. Airports usually use more conventional traffic signs you may see on the road such a regular stop sign. See the FAA Guide for samples.

Mandatory Instruction Signs

Runway Signs

- White text on a red background. These signs inform pilots that a runway intersection is ahead.

Holding Position Signs / Markings

There are typically three very important holding position signs / markings that appear on the ground at airports. At various airports that operate with low visibility these positions are also paired with a line of red lights across a taxiway to help visually indicate the holding positions.

1. Runway Holding Position

  - Two sets of solid yellow lines and two sets of dashed yellow lines indicate a holding position for a runway ahead. These **must never be crossed** without express permission from ATC.

"Holding position markings pattern A ahead of a crossing runway" by Claudius Henrichs CC BY-SA 2.0

2. Taxiway Holding Position

  - Single dashed yellow line. If this is present along your taxi route it will indicate a position that ground control may request you stop and hold short prior to another taxiway.

3. ILS Critical Area

  - Solid yellow lines that look like a railroad or ladder. These are another form of hold short point but indicate a critical area where your aircraft would violate the ILS approach airspace while on the ground.

Taxiway lighting helps the flight crew and ground crew navigate the airport at night or in low visibility and stop at the appropriate locations as given by ATC.

There are usually two types of lighting on taxiways - centerline and edge. Depending on the airport operator the lightning may differ if the airport operates in low visibility conditions.

- Centerline lighting is green on the principal taxiways located along the taxiway centerline. These lights can alternate between green and yellow when a taxiway crosses a runway or highlight a "lead-off" taxiway from a runway to join a taxiway.
- Edge lighting is typically blue and characteristically appears at the edges of a taxiway. Spacing can range from 50 - 200ft apart usually condensing in distance when approaching an intersection.

John Murphy, CC BY-SA 2.0

This concludes the *Taxi*.

Continue with Takeoff, climb and cruise

Last update: December 30, 2021

1.2.6 Takeoff, Climb and Cruise

This guide will explain the correct procedures to accomplish takeoff, climb and establish cruise altitude.

> **Disclaimer**
>
> The level of detail in this guide is meant to get a FlyByWire A320neo beginner safely up in the air and to cruise level under normal conditions while simplifying details which are not (yet) important for a beginner.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> Further reading: A320 Autoflight
> Also you will find many great videos on YouTube on how to fly the FlyByWire A32NX.
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

MSFS Start from Gate or Runways

Microsoft Flight Simulator allows you to start your flight from cold & dark at a gate or directly from the runway with the aircraft ready for takeoff.

For this guide we assume you started cold & dark at the gate and taxied to the runway holding point as per the previous chapters of this beginner guide.

If you did start on the runway you can skip the first part (Lineup) and directly continue reading Takeoff.

Prerequisites

Aircraft is in TAXI state as per previous chapters

Download FlyByWire Checklist

Chapters / Phases

This guide will cover these phases:

1. Lineup
2. Takeoff
3. Initial climb
4. Climb
5. Cruise

Base Knowledge About the Airbus A320 for Flight

This list is focussed on differences to other non-Airbus airliners a user might be used to.

Fly-by-wire system

Traditional mechanical and hydro-mechanical flight control systems use a series of levers, rods, cables, pulleys and more, which pilots move to adjust control surfaces to aerodynamic conditions. Their "hands on" design gives pilots a direct, tactile feel for how the aircraft is handling aerodynamic forces as they fly. On the other hand, mechanical systems are also complicated to operate, need constant monitoring, are heavy and bulky, and require frequent maintenance.

In fly-by-wire systems when the pilot moves flight controls, those movements are converted into electronic signals, which are then interpreted by the aircraft's Electrical Flight Control System (EFCS) to adjust actuators that move flight control surfaces. Computers also monitor sensors throughout the aircraft to make automatic adjustments that enhance the flight.

Because fly-by-wire is electronic, it is much lighter and less bulky than mechanical controls, allowing increases in fuel efficiency and aircraft design flexibility, even in legacy aircraft. And to prevent flight critical failure, most fly-by-wire systems also have triple or quadruple redundancy back-ups built into them. source: BAE Systems

See also: Fly-by-wire Wikipedia

Autotrim

The A320 has a feature called "Autotrim", which makes it unnecessary to hold the sidestick or use the trim wheel for holding the current pitch. This system is always active, even when the **Autopilot** is off (in Normal Law which means under normal circumstances with a fully functional aircraft).

Autothrust

The A320 has **Autothrust** which is similar to Autothrottle (e.g., in a Boeing), but it does not move the thrust levers. Basically the thrust levers are only moved by the pilot and never move on their own. The thrust levers act as a maximum allowed power setting for the autothrust system. During normal flight (after takeoff) the levers stay in the CL climb detent, and the Autothrust system will set engine power accordingly.

Autopilot

The A320's **Autopilot** system works a bit differently from other manufacturer's systems. The A320 FCU controls allow setting certain values and then push or pull the knobs. Pushing usually means automatic control (Managed Mode) and pulling will use the manually selected value (Selected Mode).

Microsoft Flight Simulator knobs

In Microsoft Flight Simulator pushing is clicking the knob "UP" and pulling is clicking the knob "DOWN"

Flight phases

The A320 uses flight phases to manage different parts of a flight. These are preflight, takeoff, climb, cruise, descent, approach, go around, done. They match the PERF pages in the MCDU (see Preparing the MCDU).

Protections

The A320 includes many protections for the pilot which make it nearly impossible to stall or overspeed the aircraft. It's beyond this beginner-guide to go into details (Normal law, Alternate Law, ...)

Situation:

- ATC (Ground or Tower) has instructed us to hold at a runway holding point and wait until we are cleared to "line up" or "take off".
- Aircraft is still in TAXI state (see previous chapters) and parking brakes are set.

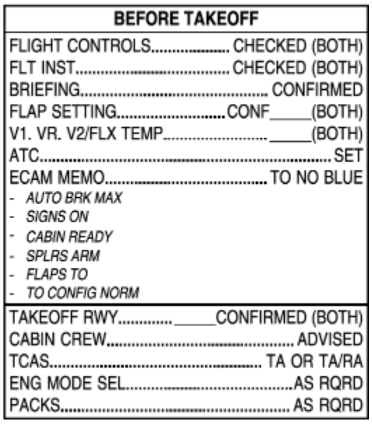
Typically, it is here at the latest that we are asked to switch to Tower ATC frequency for takeoff clearance.

While approaching the runway holding point or at the latest at the runway holding point the **"Before takeoff checklist"** needs to be completed.

Before takeoff checklist

The "Before Takeoff" checklist is divided into two parts:

- **"Down to the line"** (or "Above the line") means **before** "ATC Takeoff Clearance".
- **"Below the line"** means **after** T.O. clearance (when lined up) but before starting the roll.

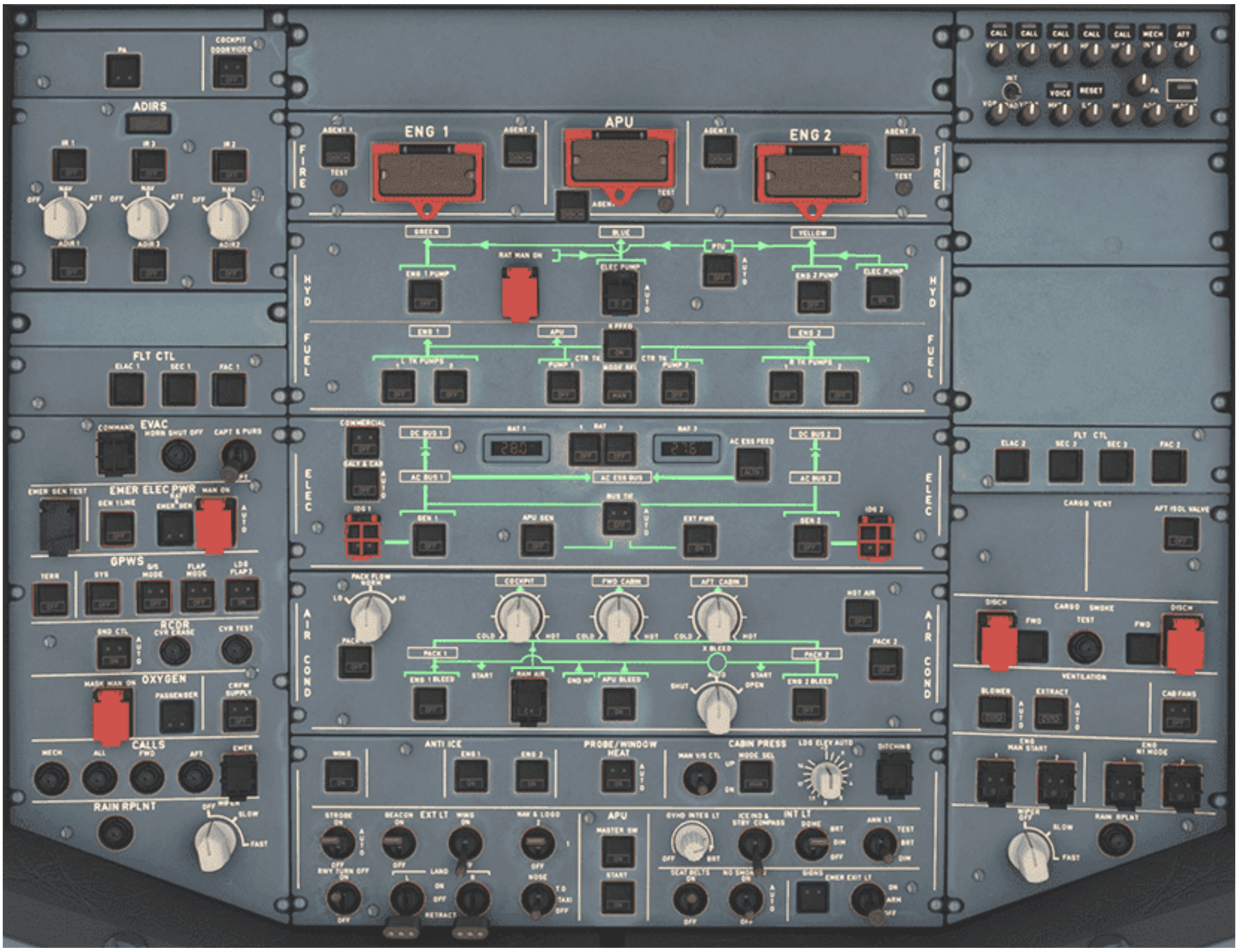


BEFORE TAKEOFF	
FLIGHT CONTROLS	CHECKED (BOTH)
FLT INST	CHECKED (BOTH)
BRIEFING	CONFIRMED
FLAP SETTING	CONF____(BOTH)
V1. VR. V2/FLX TEMP	____(BOTH)
ATC	SET
ECAM MEMO	TO NO BLUE
- *AUTO BRK MAX*	
- *SIGNS ON*	
- *CABIN READY*	
- *SPLRS ARM*	
- *FLAPS TO*	
- *TO CONFIG NORM*	
TAKEOFF RWY	____CONFIRMED (BOTH)
CABIN CREW	ADVISED
TCAS	TA OR TA/RA
ENG MODE SEL	AS RQRD
PACKS	AS RQRD

Preparation and "Down to the line" Checklist pre-T.O.-clearance

The following steps from TAXI setup need to be done and checked:

1. Check OVHD panel: APU off, no lights visible under normal circumstances
(exception: Pack 1+2 might be OFF if part of procedure)



2. Check Flight Controls

3. Check Flight Instruments

4. Check correct FLAPS setting (must be in line with PERF TAKE OFF page)

5. Check V_1, V_R, V_2 speeds and also, if required, FLX temperature setting (PERF TAKE OFF page)

6. Check Squawk

  • check squawk ID number
  • Set to AUTO or On
  • Set ALT RPTG to ON

7. Check COM frequency

  • Tip: set the standby frequency of `COM 1` to the Departure frequency to be able to quickly change after takeoff

8. Check ECAM - no blue writing should be visible for these:

- AUTO BRK MA
    - SIGN ON
    - CABIN REA
    - SPLRS ARI
    - FLAPS TO
    - TO CONFIG NO
- Press T.O. Config button below the ECAM t

9. Check radar panel:

- Set Weather Radar to Sys 1 to show weather on ND
- Check if Predictive Windshear Alerts (PWS) is set to AUTO (should have been set to AUTO during TAXI)

Entering Runway

Before we start rolling we visually check that no other aircraft is on final approach. We can also use TCAS on the ND to check for aircraft in the vicinity.

If everything is clear we release the parking brake and slowly roll onto the runway in the direction of takeoff and come to a stop on the runway's center line.

There is also a *rolling start* where we would not stop but directly apply thrust for takeoff once we are straight on the runway. But, as a beginner, a full stop is recommended, so we can double-check everything.

When we reached our starting point we stop and set the parking brakes.

If we were only cleared to "line up" we wait here until we get clearance to *take off*.

This concludes *Lineup*.

Situation:

- Aircraft is on runway and fully setup for takeoff as per previous chapters.

Preparation and "Below the line" Checklist post-T.O.-clearance

After ATC (Tower) gives clearance to "line up" or "take off" we are allowed to enter the runway.

- To "line up" means that we roll onto the runway and stop at our starting point. We **MUST** wait for ATC to give us "takeoff clearance" before we can continue.
- "Cleared for takeoff" means we are allowed to actually start the takeoff when aligned with the runway.

Shortly before we start our takeoff roll we do the following steps:

- Check `PACKS` as required
  (some airlines take off with Packs `OFF` to allow more power to thrust and save fuel - not necessarily required)
- Turn on landing lights (`LAND`) and check if `STROBE` light is in `AUTO` or `ON`

The correct switch settings are:

- `RWY TURN OFF` lt is `ON` - `NOSE` light is at `T.O.` (T.O. = takeoff)
- `LAND` lights are both `ON`
- `STROBE` is on `ON` or `AUTO`
- `BEACON`, `NAV & LOGO` should have been on during taxi already
- `WING` is `OFF`. It is usually only on for wing inspection and to detect ice accretion on the wing

Lights at Takeoff

Setting the `RWY TURN OFF` light to `ON`, the `LAND` lights to `ON` and the `NOSE` light to `T.O.` minimizes bird strike hazard during takeoff.

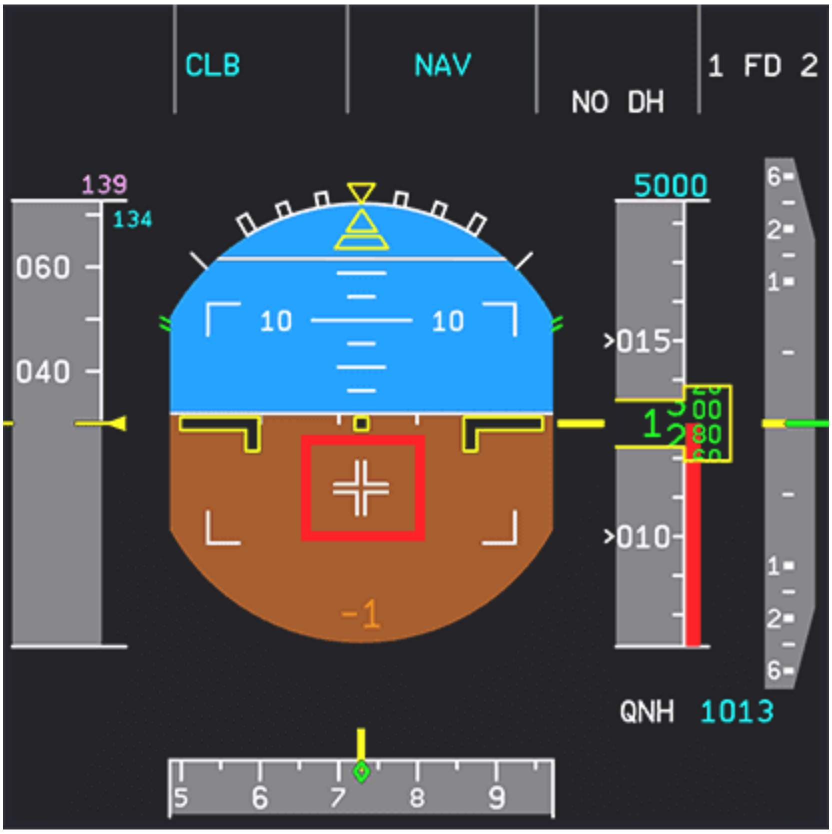
- Check `ENG MODE SEL` as required (should be on `MODE NORM`)
- Set `TCAS` to `TA` or `TA/TR` and traffic to `ALL` or ABV)

A typical standard takeoff follows these steps:

Airline SOPs

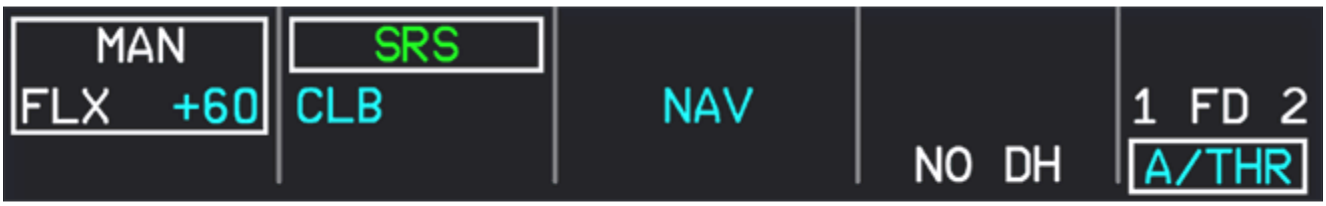
Some airline's SOPs (standard operating procedures) might have a different order for these steps.

1. Release parking brake and hold down manual brakes.
2. Apply thrust slowly to about 50% thrust until both engines are stabilized (N1 stays constant at around 50%) while still holding the brakes.
3. Push sidestick forward half the way to put pressure on the front gear



4. Release brakes and apply `FLX/MCT` or `TO GA` power.
   (depending on if have configured a FLEX temperature, and the runway is long enough for a `FLEX` start)

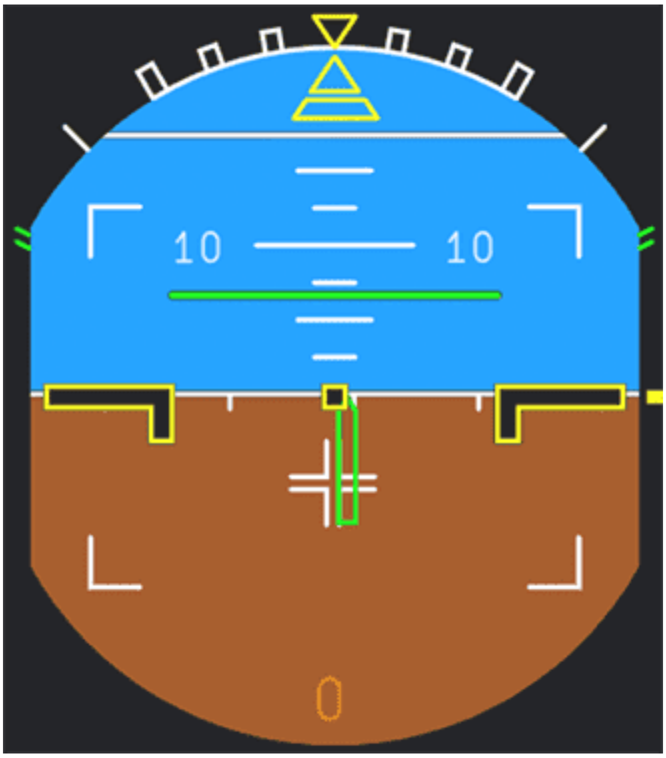
5. The PFD Flight Mode Annunciator (FMA) now shows several things which we should check when aircraft starts rolling:



From the left:

- Thrust: set to MAN FLX +60
- Vertical guidance:
    - Active (green): SRS (pitch guidance to maintain V_2+10)
    - Armed (blue): CLB mode (is next after SRS is done)
- Lateral guidance:
    - Active: RWY (automatic runway axis follow up through ILS use)
    - Armed: NAV (navigation guidance according to HDG knob)
- **Autopilot**, Flight Director, Autothrust:
    - Autopilots are off
    - Flight Director 1 and 2 are ON
    - A/THR (Autothrust) is armed (not active yet)

Vertical and lateral guidance are **only shown** via Flight Director as we have not turned on the **Autopilot** yet and need to be followed manually by the pilot.



6. Keep the aircraft on the center line while accelerating down the runway.

V-Speeds

There are three important speeds for takeoff which we have configured earlier when programming the MCDU's PERF page for takeoff. These are shown on the PFD's speed tape.

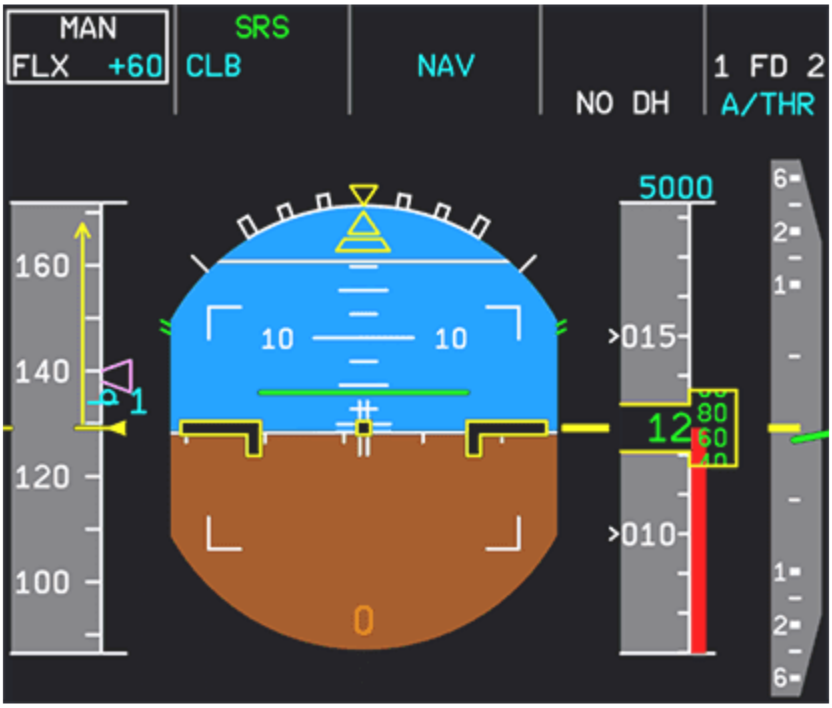
V_1: The speed beyond which takeoff should no longer be aborted. V_1 is depicted as a cyan "1" next to the speedband in the PFD.

V_R: Rotation speed. The speed at which the pilot begins to apply control inputs to cause the aircraft nose to pitch up, after which it will leave the ground. V_R is depicted as a cyan circle next to the speedband in the PFD.

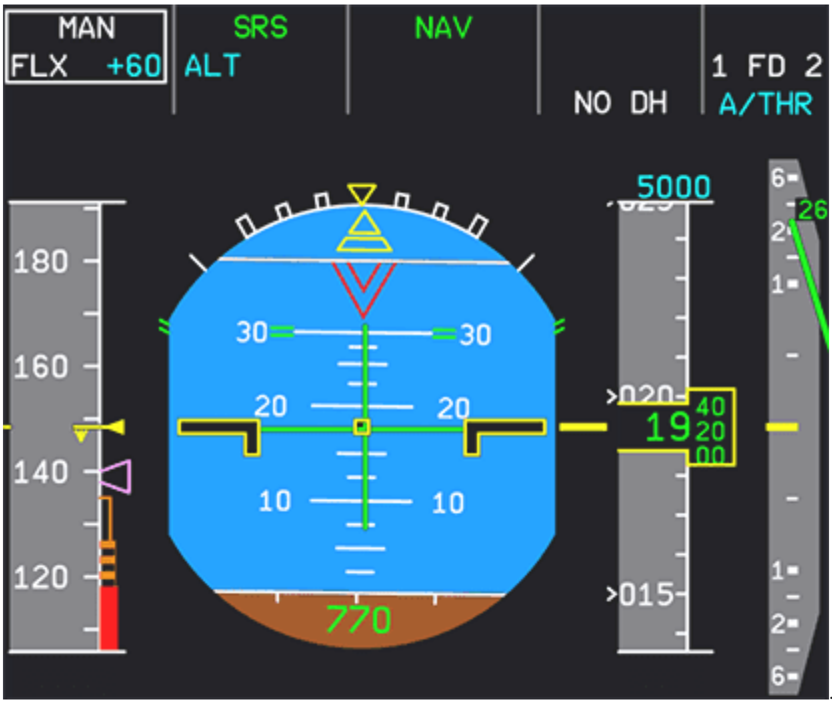
V_2: Takeoff safety speed. The speed at which the aircraft may safely climb with one engine inoperative. V_2 is depicted by a magenta triangle next to the speedband in the PFD.

On a long enough runway V_1 (depicted by "1") and V_R (depicted by "o") are often very close together and can't be clearly distinguished on the PFD speed tape.

- At about 80 knots slowly release the forward pressure on the sidestick until about 100 knots when the sidestick should be in neutral position.
- The throttle hand remains on the thrust levers until reaching V_1 to be able to quickly abort the start. Remove the hand from the thrust levers at V_1 to avoid accidentally aborting after V_1.
- At V_R apply smooth positive backward stick movement on the sidestick and aim for a rotation rate (pitch rate) of 3 deg/sec for about 5 seconds (15°-18° pitch attitude). Once airborne follow the flight director's guidance for pitch attitude.
  Tip: Count one-one thousand, two-one-thousand, etc. and hit 15 deg at five-one-thousand - practice this.



- Once we have confirmed "positive climb" we retract the landing gear.



- We confirm that the landing gear is up by looking at the landing gear annunciators, and the lower ECAM Wheels page.

This concludes *Takeoff*.

Situation:

- Aircraft has left the ground and is climbing at about 15°.
- Gear is up.
- Thrust levers are in FLX MCT or TO GA detent.
- Flaps are still in T.O. position.

After takeoff the aircraft will use `FLX/MCT` or `TO GA` thrust until thrust reduction altitude is reached (typically ~1500ft above runway, this is part of the MCDU setup)

After reaching thrust reduction altitude the `PFD FMA` now shows a flashing *LVR CLB* message to instruct the pilot to move thrust levers to the `CL` detent.

Pull the throttle back into the CL detent.

This activates the **Autothrust** system (FMA shows `A/THR` in white now). In the A320 (and most Airbus models) we will not touch the thrust levers again before final approach and landing (under normal flight conditions).

The aircraft will now climb to the altitude selected in the FCU (in our case 5.000ft).

Activate the Autopilot at this point by pressing the AP1 button on the FCU.

The FMA now shows AP1 in white in the upper right corner.

FCU Autopilot Controls

The FCU (Flight Control Unit) shows three important values:

- SPD "---" : means the **Autopilot** is in Managed Speed mode (e.g. 250knots <10.000ft, 290kts above). If we pull the SPD knob we can select a speed which the **Autopilot** will then apply.
- HDG "---" : means the lateral navigation is in Managed HDG Mode and the **Autopilot** follows the planned route. Dialing the HDG knob will let us select a heading and by pulling the knob we tell the **Autopilot** to fly this heading (Selected Heading Mode).
- ALT "5000" : means the selected altitude is 5000ft

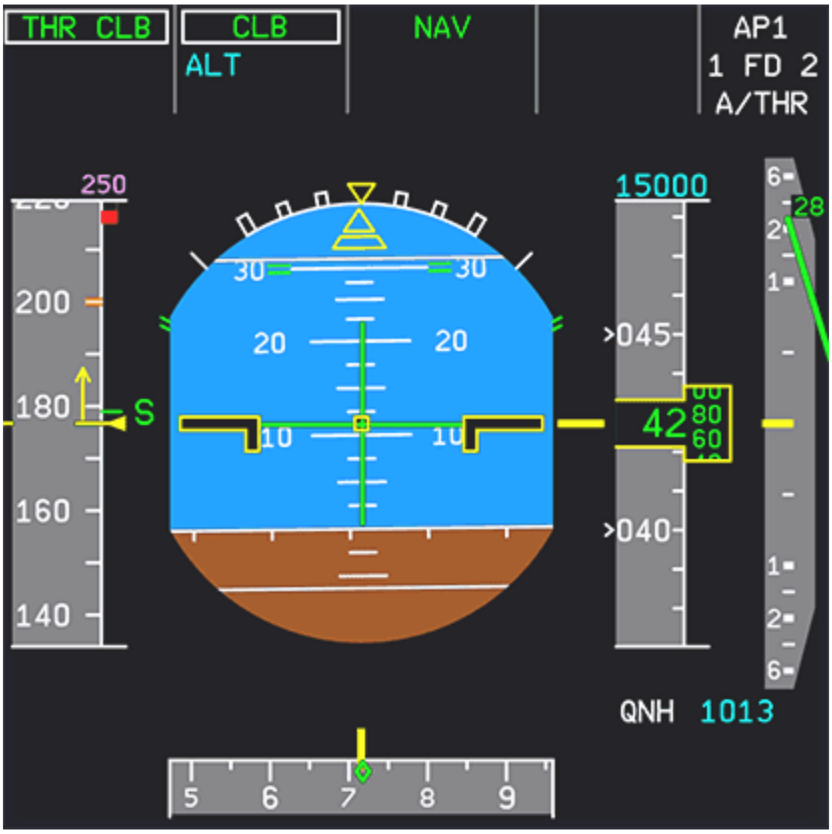
When reaching S-speed retract flaps.
S-speed is signified with an S next to the speed band in the `PFD`.

Flaps during takeoff and climb

Depending on the start configuration there will be different markers next to the speedband in the `PFD` to show when to retract flaps:

- `CONF-2` (Flaps position 2): At "F" and positive speed trend
- `CONF-1+F` (Flaps position 1): At "S" and positive speed trend

We always retract flaps by only one step at a time. So when we took off with `FLAPS 2` (`CONF-2`) we retract `FLAPS` at "F" to `FLAPS 1`. Then at "S" we retract them to `FLAPS 0`.



Now we turn off the `TAXI` and `RWY TURN OFF` lights. We do this as they are sitting on the front gear and are now within the gear housing getting hot.

Lastly we disarm the `SPEED BRAKE` and turn on the `PACKS` if we turned them off for takeoff.

Now complete the "After takeoff checklist"

1. Landing gear up
2. Packs on
3. Flaps retracted
4. Check Baro setting: above transition altitude (defined in the `ECAM PERF` page) set it to `STD` by pulling the baro knob. A flashing baro value in the `PFD` will remind us in case we forgot.

AFTER TAKEOFF / CLIMB	
LDG GEAR..	UP
FLAPS..	RETRACTED
PACKS..	ON
BARO REF.................................. ______	SET (BOTH)

This is usually a good time to contact ATC Departure to check in with your current altitude. In most cases ATC will now give us a higher climb altitude. If we did not receive a higher altitude we have to level off at the previously cleared altitude (cleared by ATC or navigational charts). If we have the **Autopilot** activated it will level off automatically at the Selected Altitude.

This concludes the *Initial Climb*.

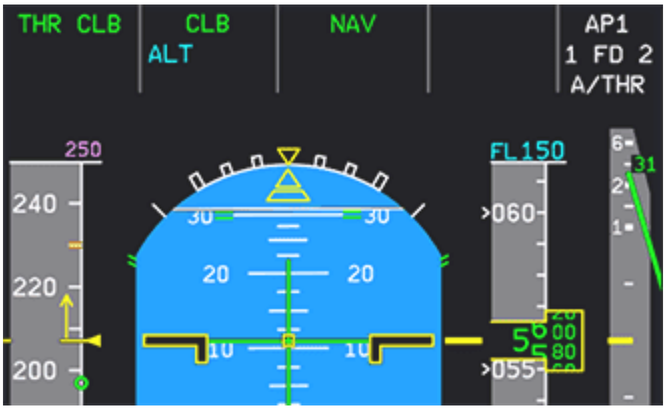
Situation:

- Aircraft is climbing to or is at our initially cleared climb altitude.
- *After takeoff checklist* is completed.
- ATC has given us clearance for further climb.

Dial the newly cleared altitude into the FCU. (e.g., 15.000ft) and push for managed climb (CLB) or pull for open climb (OP CLB)

The aircraft will now continue climbing while managing thrust and pitch level. The **Autopilot** ensures that the aircraft stays at the Selected or Managed Speed setting and climbs to the new altitude while managing thrust automatically.

The PFD's `FMA` now shows:



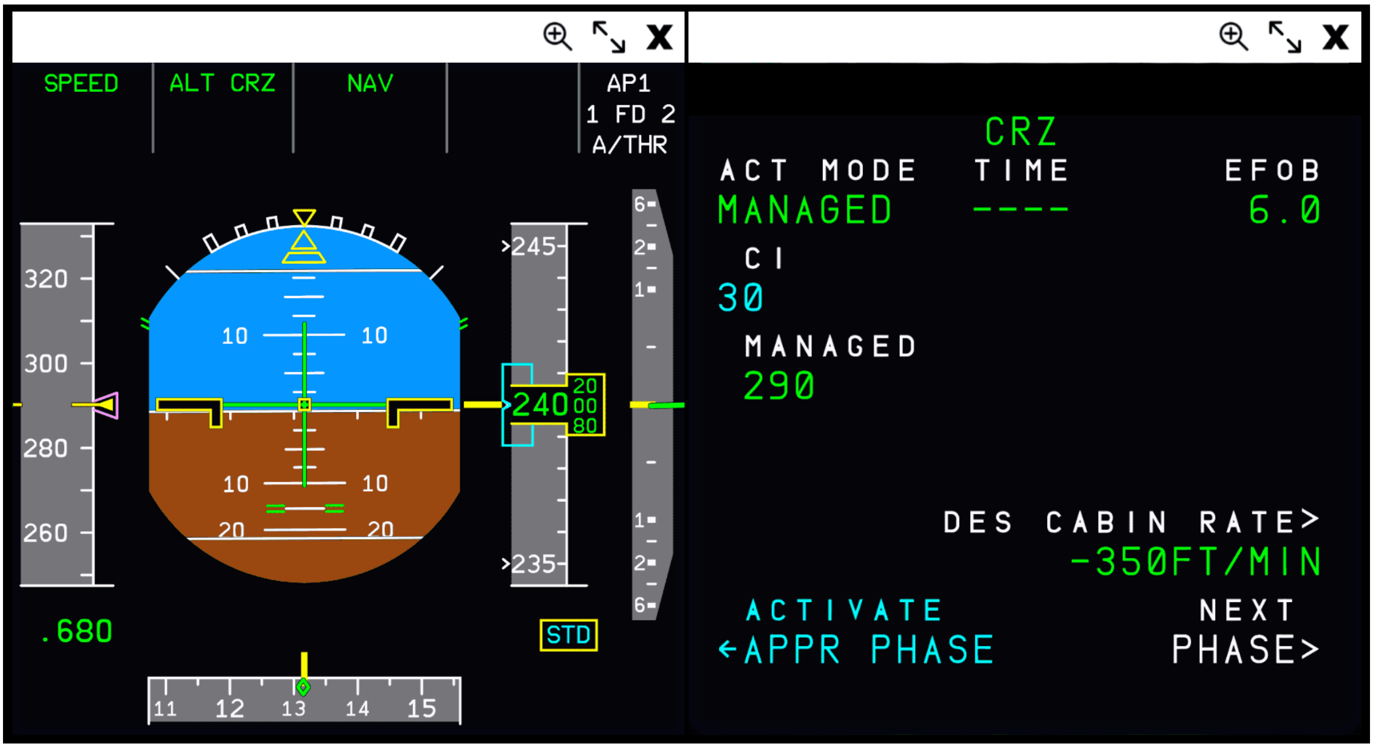
Thrust level is `THR CLB`, vertical mode is `CLB` (ALT mode armed), lateral mode is NAV.

Typically, the climb to the flight plan's cruise level (e.g., FL210) happens in several steps (step climbs). Each to be instructed and cleared by ATC.

Passing 10,000ft
Turn off landing lights and when the aircraft is stable (weather, no turn, etc.) you can turn off the seatbelt signs. The aircraft will now accelerate to CLB speed (defined in `MCDU PERF CLB` page).

Repeat the climb process above until cruise level (e.g. FL240) is reached.

MCDU and PFD at cruise level:



This concludes the *Climb*.

Situation:

- Aircraft has leveled off at planned cruise level.
- Speed is cruise speed as per ECAM PERF CRZ page.
- **Autopilot** is ON.
- Speed is in Managed Mode.

This is usually the quietest time of the flight. It allows time to double-check the systems by going through all ECAM pages, etc.

Regular ATC frequency changes with altitude and position check-ins are common.

Here are some **typical activities** which might happen during cruise mostly on request from ATC or other circumstances like weather, traffic, etc.

- **Altitude change (also called flight level change)**
  Like before during climb set your new altitude in the FCU and push the ALT knob. The aircraft will descent or climb to the new altitude automatically.
- **Course change with Selected Heading** (given or cleared by ATC)
  Dial heading knob to the desired heading and pull knob for Selected Heading Mode. The aircraft will automatically change course to the new heading. If you want the aircraft to follow the planned route again you can push the knob for Managed Heading Mode.
- **Direct course to a waypoint (DIR TO)**
  ATC regularly instructs us to go "direct to (waypoint) XYZ". Use the ECAM DIR page to select the waypoint from the plight plan's list of waypoints. In rare cases it is a waypoint not in the current flight plan then you can enter a new waypoint in the MCDU and put it into the upper left entry field. Select DIRECT* on the rght bottom to execute the change.

- **ATC requests specific speed**
  Sometimes ATC requests a specific speed to keep separation between aircraft. Pull the speed knob to switch to Selected Speed Mode. The current speed will be preselected. Dial to the desired speed. The aircraft will immediately begin to target the new speed by either increasing or decreasing thrust.

At some point (200-300NM from destination) we would start with descent-planning and setting up the aircraft for descent and approach.

Descent, Approach and Landing will be covered in later chapters of this beginner guide.

This concludes the *Cruise*.

Continue with Descent Planning and Descent

Last update: March 15, 2022

1.2.7 Descent Planning and Descent

This guide will explain the correct procedures to plan and fly a descent from cruise altitude through STAR and Instrument Approach up to the final approach.

The actual final approach (ILS approach) will be covered by a separate chapter.

> **Disclaimer**
>
> The level of detail in this guide is meant to get a FlyByWire A320neo beginner safely from cruise level down to the ILS glideslope.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> Also you will find many great videos on YouTube on how to fly the FlyByWire A32NX.
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

Prerequisites

Aircraft is in `CRUISE` state and phase as per previous chapters

Download FlyByWire Checklist

Chapters / Phases

This guide will cover these phases:

1. Descent and Approach Planning
2. Starting the Descent
3. Flying the STAR and Approach
4. Intercepting ILS

Base Knowledge: Route, Star and Approach

Basics

As we have learned in previous chapters a flight route begins with an origin airport and a SID to safely guide the aircraft away from the airport to the first waypoint on their actual route. Similar to a SID the arrival to an airport is done via a STAR (Standard Terminal Arrival Route) and an IAP (Instrument Approach, often APPR) to safely bring the aircraft into a position to land on the destination airport safely and with as little ATC communication as possible.

STAR

A Standard Terminal Arrival Route (STAR) ensures safe and efficient traffic from the last en-route waypoint to the initial approach fix (IAF) of the Instrument Approach (IAP). It separates aircraft, avoids conflicts and helps with noise abatement through specific routing, levels/altitudes, speed restrictions and checkpoints often with holding areas.

One main objective is, to do this with a minimum of communication between the ATC controller and the pilot. As the STAR is part of the flight plan a pilot can simply continue from the normal route into the STAR if ATC has not given any other instructions. Sometimes ATC might give an explicit clearance for the STAR or change the STAR to manage traffic and landing situation (different runways, etc.).

Often a STAR contains a clearance point which mustn't be passed without explicit clearance by ATC. If clearance is not given then a holding must be flown as described in the charts.

Please also have a look at our airliner guide's SIDs and STAR section SIDs and STARS

Find a good overview over charts in our airliner guide: Reading a Chart

Approach

The Instrument Approach (IAP or APPR) has similar objectives as a SID or STAR - safely bring an aircraft into a position to land while ensuring separation between multiple aircraft, avoiding terrain, support with noise abatement, etc.

IAP are often designed for handling maximum traffic in even bad weather conditions. With only little traffic and good weather it is quite common that ATC instructs the pilot to leave the approach route by giving the pilot heading vectors for a more direct route to the Final Approach Fix (FAF, also called final approach point).

When flying with Online ATC (VATSIM, IVAO, PilotEdge, ...) expect being vectored to the FAF quite often.

Understand important ILS approach chart features here: Approach Chart

ILS

The Instrument Landing System (ILS) is one of several modern forms of helping an aircraft during its final approach to land even in non-optimal weather situations. ILS uses a localizer for lateral guidance and a glideslope for vertical guidance from the Final Approach Fix down to a minimum at which the pilot needs to perform the final landing sequence visually.

Modern airlines like the A320 are even able to use the ILS to land fully automatically as long as the runway's ILS supports it.

Understand important ILS approach chart features here: Approach Chart

> **Microsoft Flight Simulator and navigation charts**
>
> Although Microsoft Flight Simulator allows some flight planning through the user interface it is highly recommended to use navigational charts when flying airliners. MSFS' flight planning does not provide sufficient information to correctly fly a STAR or an approach.
>
> There are several good sources for charts - free or subscription based. A good free solution is Chartfox which only requires a free VATSIM account. One of the most known subscription based sources for charts is Navigraph. It is planned to integrate both solutions into the FlyByWire A32NX flyPad in the future.
>
> Also, often a simple internet search will do the trick: Search for "<airport icao code> charts": E.g., "EDDM charts"

> **Pilot's responsibility**
>
> It is the sole responsibility of the pilot to conduct proper flight planning and especially proper descent planning. It is not at all ATC's task to do descent planning for pilots by giving descent instructions. On the other hand ATC often actually gives descent instructions, especially on common routes, as they want the aircraft in their responsibility to be at certain altitudes when approaching the destination airport. Nevertheless pilots must know when approaching their top of decent and if necessary need to pro-actively request clearance to descend from ATC.
>
> Good descent and approach planning is the foundation for a successful landing. It has to be done early during the flight or even before the flight.

Situation:

- Aircraft is in `CRUISE` state and phase as per previous chapters.
- Distance to destination is ~200NM (on a short flight start as early as possible and maybe even before the flight).

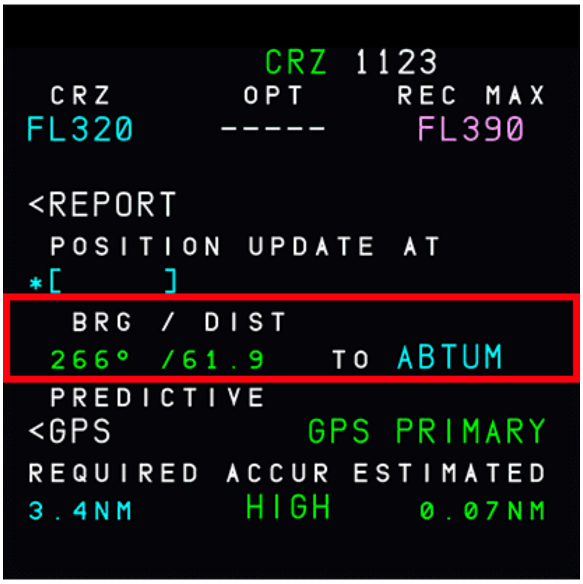
Important Data Points for Descent Planning:

- **Cruise Flight Level:** The higher we fly the earlier we need to start descending. Also for short flights a too high cruising altitude can make it impossible to actually descend to the destination airport in time. Therefore verify your flight plan if overall distance and flight level make sense.
- **Flight Plan Constraints:** STARs often have flight level (FL) or altitude constraints which we must adhere to. We must plan our descent so we can meet these altitude constraints even when they themselves are still far away from the destination airport.
- **Speed**: STARs also regularly have speed constraints which we need to take into consideration as slowing down will cost time and is hard to do while descending. If we start our descent too late we might not be able to slow down in time as required by a constraint.

- **Aircraft capability and passenger comfort:** Although not a big concern in the A320neo, general aircraft capabilities and passenger comfort also come into play. Descending with -4000ft/min is no fun for a passenger.

Step-by-step Guide for Descent Planning:

1. Read the STAR chart and determine if there are altitude and/or speed constraints which we need to consider.
2. Consider the STAR and APPR route as optional and do not count on them to be flown and available for descending. ATC might want to vector us to a different runway or at least shortcut our approach. But they won't be able to if we are still too high for the final approach.
3. Determine the first constraint you need to meet. This could be a STAR waypoint with an altitude constraint, the Final Approach Fix altitude or even the airport (or runway) elevation itself.
4. Calculate the required distance needed to descend to that waypoint with a standard descent angle of 3°. We can use the FlyByWire flyPad in the cockpit or a simple rule of thumb calculation (details below).
5. Use the MCDU PROG page's DIST function to read out the current distance to this waypoint. It is also possible to use the MCDU flight plan page, maps or the NDs distance rings to help determining the current distance.



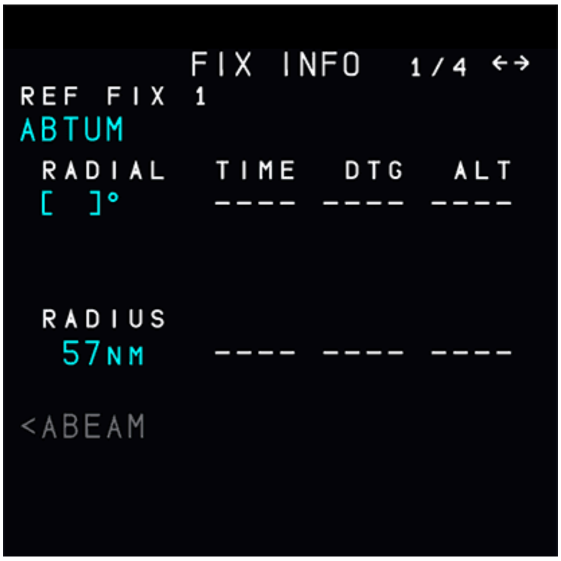
FIX INFO in Development Version

Fix Info Distance Ring

Also a great aid for knowing when to descend is the new FIX INFO feature available in the Development Version.

You can add a ring around a waypoint or fix with a specified distance. As we need 57NM for our descent from FL320 to FL140 at ABTUM we can set the fix distance ring to 57NM.

Now we can easily see or TOD (top of descent) on the ND.



The MCDU FIX INFO page can be access by selecting the first waypoint on the F-PLN page and pressing LSK 1L "FIX INFO".

See our feature guide Fix Info for how to use this function.

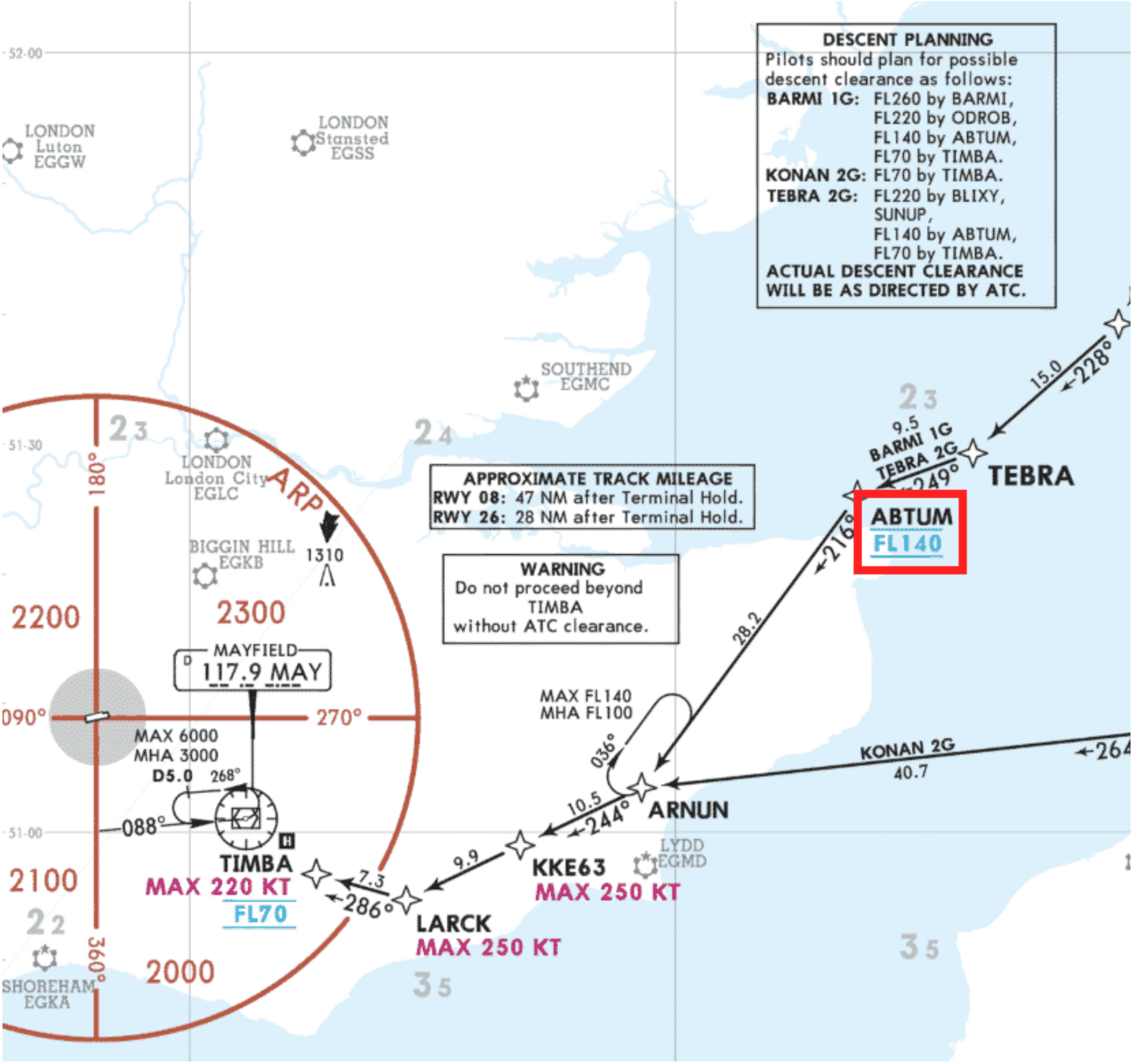
Available in the Development version!

How to Calculate the Required Distance for Descent

Example data:

- Flight to EGKK via STAR TEBRA 2G.
- Flight level FL320.
- STAR constraint at waypoint ABTUM "at FL140".

Example chart:



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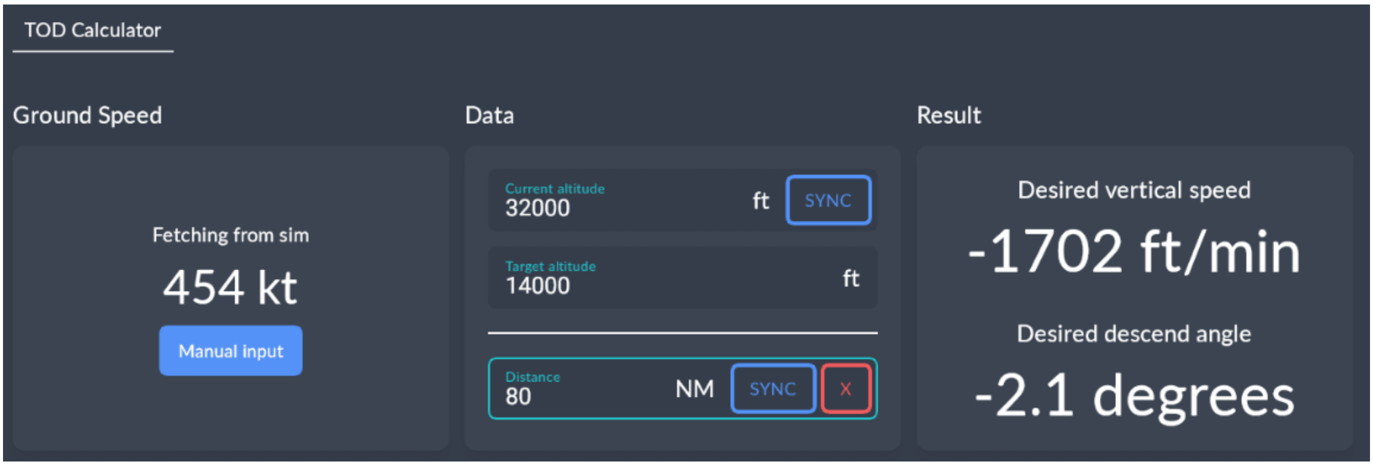
"Navigraph Charts are intended for flight simulation use only, not for navigational use."

Using the flyPad:

Standard calculation with 3° descent path:

Calculation with a specific distance to calculate the required descent velocity (V/S):



Using "Rule of Thumb":

```
Distance = "Altitude difference" * 3 / 1000 + margin**

Altitude difference: 32000 - 14000 = 18000
Times 3:             18000 * 3 = 54000
Divided by 1000:     54000 / 1000 = 54
Plus margin (~10%):  59 NM
```

Margin can be lower for headwind and larger for tailwind. Some pilots also change the margin to compensate for slowing down while descending.

As can be seen on the chart there will be a further descent to TIMBA at FL70 and after that (not visible on the chart above) there will be a descent to the final approach which will be at 2000ft at the Final Approach Fix FF26L.

The same methodology/calculation as our initial descent can be applied to these descents as well but they require less planning as they are usually designed in a way that an aircraft with a 3° descent angle can make these descents with ease.

ATC will quite often instruct certain altitudes within the STAR and APPR which deviate from the STAR and APPR charts. Please expect such instructions at any time.

Advanced Arrival Planning

> ⚠ **Important Notice**
>
> The following is a more advanced process for planning our arrival. It is obviously important when we want to have a more realistic experience but in Microsoft Flight Simulator you can skip this part for now.
> Also this process is best done with an Online ATC service as the built-in MSFS ATC does not provide the necessary information at the right time.

Before we descend we should also reconfirm our destination runway and input or update our destination data into the MCDU PERF APPR page. This is typically done about 50NM before the starting the descent.

Honeywell MCDU and PERF APPR Page

It is important to note that when entering a value in the `TRANS ALT` field on this page that the flight crew reference the appropriate `TRANS LVL`. In this spec of the MCDU, Honeywell has not yet corrected the field to reflect `TRANS LVL` as the value required.

As a quick reminder, when descending from cruise the flight crew is moving from a "Flight Level" to a local altimeter for arrival which is where the `TRANS LVL` value is derived from.

We can obtain this data from the destination airport's ATIS information and the airport charts.

From ATIS we get: `QNH`, `TEMP`, `MAG WIND` and `TRANS LVL` - if not refer to the approach chart.

ATIS Example:

```
GATWICK INFORMATION K TIME 2020, RUNWAY IN USE 26L
TRANSITION LEVEL FL70, SURFACE WIND 260,7 KNOTS
CAVOK TEMPERATURE +16, DEW POINT +12, QNH 1018,
ACKNOWLEDGE RECEIPT OF INFORMATION K AND ADVISE AIRCRAFT
TYPE ON FIRST CONTACT
```

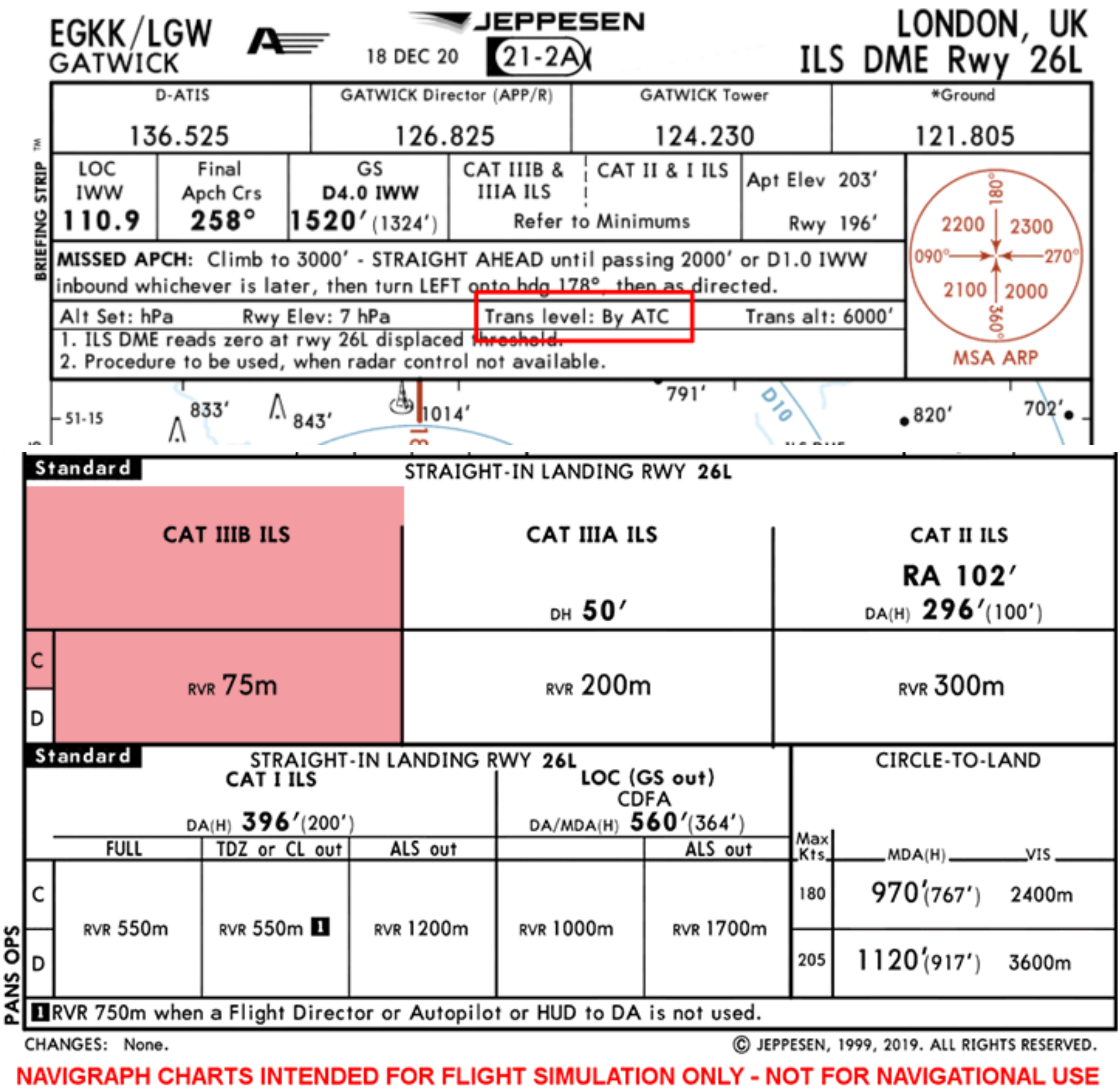
From the chart we get `Trans level` and `BARO` (=MDA) or `RADIO` (=DH).

- CAT I ILS uses MDA and is entered into the `BARO` field.
- CAT II/III ILS use DH which is put in the `RADIO` field.
- `BARO` is based on barometric altitude whereas `RADIO` is based on radio altitude (distance to ground).

Trans level: By ATC

In the particular example below the `Trans level` field states `By ATC`. If you are not flying on a network such as Vatsim or IVAO you can try the following things:

- Search online for the real life D-ATIS at your arrival airport (much like the ATIS example above).
- Use the `Trans ALT` + 1000 ft.
    - **Development Version:** If you have imported your flight plan via our simBrief integration this value would be autopopulated for you.



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The A320neo is capable of a CAT IIIB ILS approach and has an approach category of "C" - see the red area on the chart. (see Wikipedia Aircraft approach category)

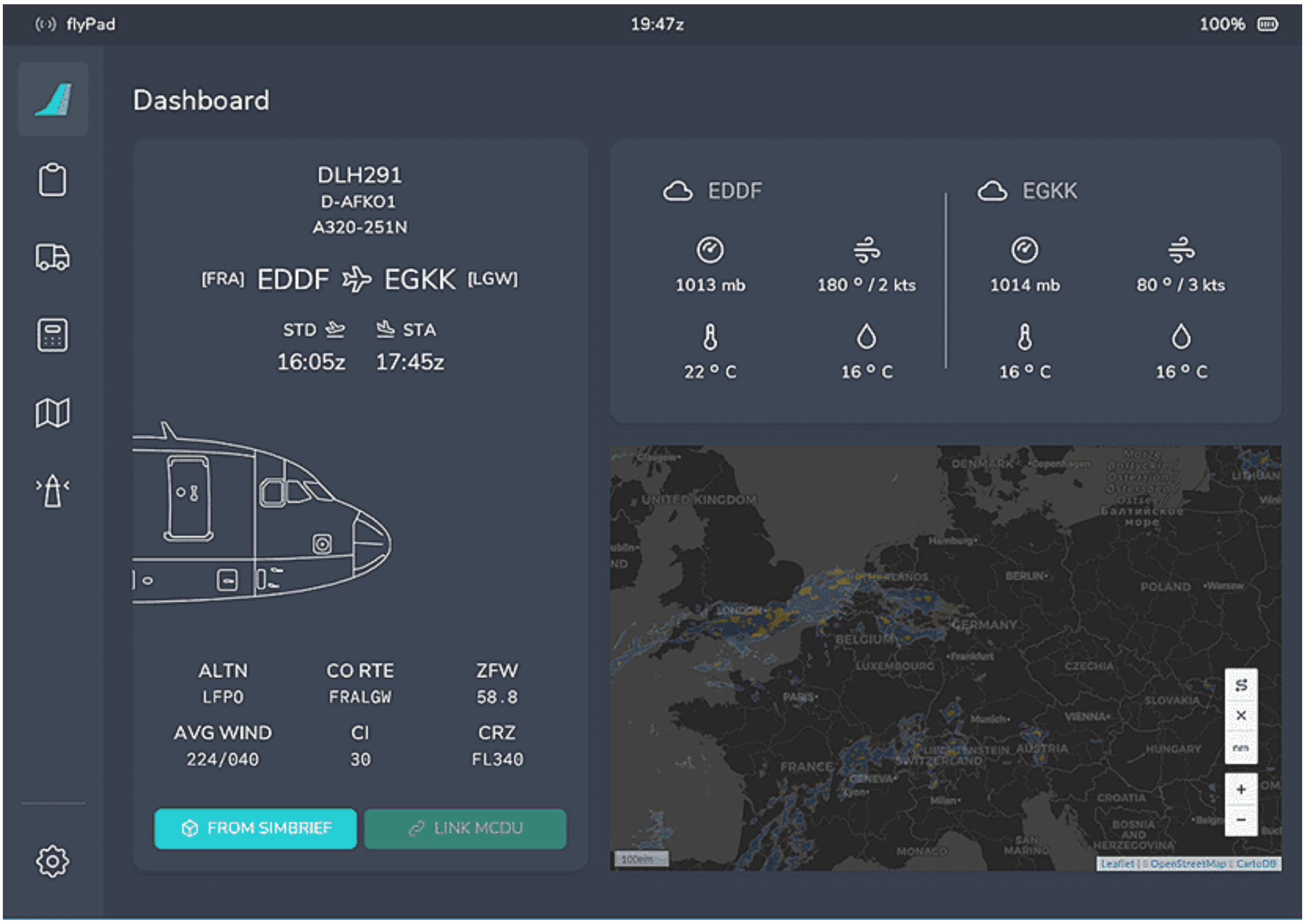
In this chart for EGKK 26L ILS there is no DH for CAT IIIB defined - so we can enter "NO" or "NO DH" into the `RADIO` field.

If we are using Microsoft Flight Simulator without any Online ATC services (VATSIM, IVAO, PilotEdge, ...), and using the MSFS built-in ATC, you usually can't request ATIS information for the destination airport at this point. MSFS ATC makes ATIS only available once close to the destination airport.

If we are flying with Online ATC you can request ATIS via the `MCDU-ATSU-AOC` page or your Online ATC network's client at this time.

We can in any case request the METAR weather information for the destination airport via the same page.

If we used Simbrief for flight planning we can also see METAR information on the flyPad after importing the Simbrief plan to the flyPad.



Once we have confirmed the destination runway and the destination data we are set for the approach and we can continue focus on the descent.

This concludes *Descent and Approach Planning*.

Situation:

- Aircraft is in `CRUISE` state and phase as per previous chapters.
- Descent and approach planning is done.
- First descent point (altitude at certain waypoint) is identified.
- Distance to descent point is calculated, which is called TOD (top of descent).

A few minutes before we reach our calculated descent point (TOD) we request clearance for descent from ATC if not already given a descent instruction before.

Do NOT start the decent without clearance from ATC.

> **TOD marker A320**
>
> The FlyByWire A32NX has not implemented the TOD (top of descent) marker on the `ND` yet. Usually the A320 has a downward pointing arrow at the TOD to support the pilot with the decision when to descent. Ultimately it is still the pilot's responsibility to calculate and validate the TOD.

When clearance is given we can start our descent to the flight level or altitude ATC has given us.

For descending we set the new flight level or altitude in the `FCU` with the `altitude selector`. We can then either push the selector for Managed Altitude Mode (constraints are respected, also know as VNAV) or pull the selector for `Selected Altitude Mode` (constraints are ignored). You can also use the `V/S selector` to set a specific descent vertical velocity. Pull the `V/S selector` to start the descent.

ATC typically will not clear us to our final target altitude directly but will give us several step descents down to our required altitude.

Also ATC will often still expect us to respect the STAR's constraints although they might have given us a lower clearance. We should then only descent to the constraint's altitude.

> **VNAV in the FlyByWire A32NX**
>
> The scenario that we are cleared to a lower altitude or flight level with altitude constraints above the clearance is an ideal scenario for the called so "VNAV" autopilot mode which would be activated by using "`Managed Altitude Mode`" (pushing the `ALT selector`). The autopilot will automatically level off at the constraint and continue descending when the constraint is no longer valid.
>
> Unfortunately the current version of the FlyByWire A32NX does not yet support VNAV. This is planned to be implemented in one of the next versions.

We repeat the process until we have reached our desired final approach altitude.

> **Airline SOPs**
>
> Some airline's SOPs (standard operating procedures) might have a different order for the following steps.

At 10,000ft Procedure

- `LAND` lights selector: SET
  - `LAND` lights may be switched ON, according to the airline policy/regulatory recommendations
  - Landing lights on the A320neo cause drag as they are extended from under the wings
- `SEAT BELTS` switch: ON
- `EFIS` Option push button: `CSTR` on both sides
- `LS` push button: As required
  - Select `LS`, if an ILS, GLS or LOC approach is intended
  - The PFD displays the LOC and glide scales and deviation symbol, if there is a valid /LS or GLS signal.
  - Check that the /LS/GLS identification is displayed on the PFD.
- `RAD NAVAIDS` (`RNAV` page on MCDU): Selected/Identified
  - Ensure that appropriate radio NAVA/OS are tuned and identified.
    - Currently the FlyByWire A32NX does not auto tune NAVAIDS
  - For NDB approaches, manually select the reference NAVAID.

Approach Checklist

APPROACH	
BRIEFING..	CONFIRMED
ECAM STATUS..	CHECKED
SEAT BELTS..	ON
BARO REF................................. _____	SET (BOTH)
MINIMUM.................................. _____	SET (BOTH)
ENG MODE SEL......................................	AS RQRD

Cabin Crew

In real life the cabin crew will be asked to prepare the cabin for landing at some point during the descent. The exact moment and process might differ between airlines but most seem to do this when the Seatbelt Signs are turned on (typically at the latest at 10,000ft).

The Cabin Crew will notify the pilots either by a "Cabin Ready" button (A320neo) or by a call to the cockpit (A320ceo) once they are ready and strapped in themselves. Typically we will be in final approach by that time.

This concludes *Starting the Descent*.

Situation:

- Aircraft is in `DES` phase.
- Descent has started (we are after TOD).
- We have not yet reached the first waypoint of the STAR.
- `MCDU PERF APPR` page is filled (beginner can skip this - see chapter Advanced arrival planning).

Flying the STAR and Approach is very similar to any other part of the route within the flight plan. Apart from descending and adhering to constraints the lateral flight path just follows the programmed route.
Let the **Autopilot** do this for you and just adjust altitude and speed according to the charts or the ATC instructions.

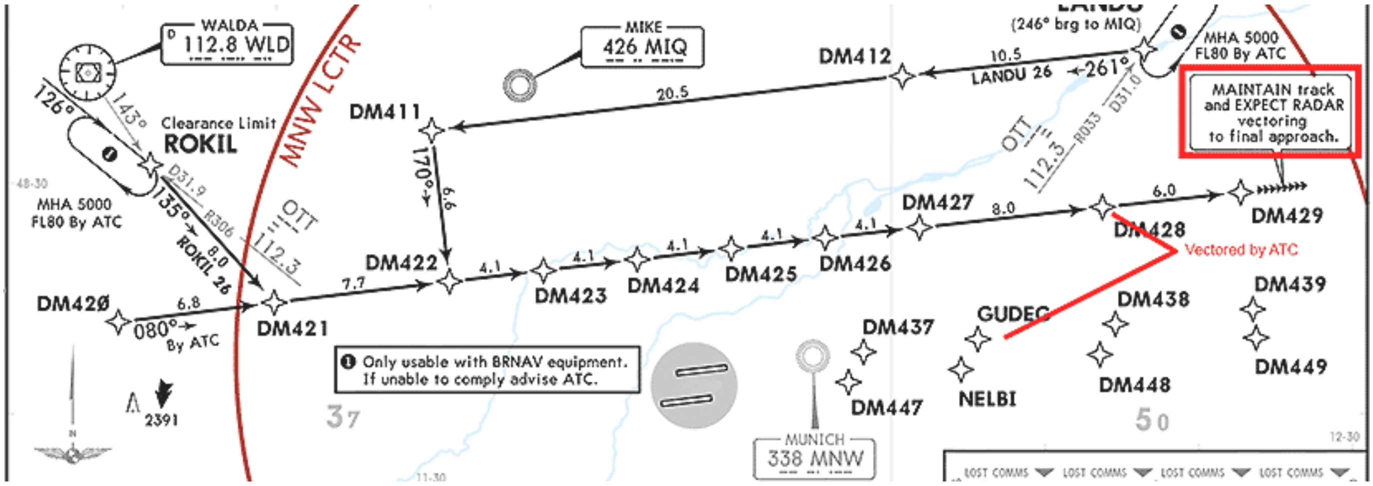
> **Passing 10,000ft**
>
> If we are passing 10,000ft within the STAR remember the At 10,000ft Procedure and the Approach Checklist from the previous chapter.

At some point during the descent and when close enough to the airport we will be instructed by ATC to contact ATC Approach for the airport we are flying into.

Be prepared for ATC instructions to deviate laterally from the STAR or Approach route to separate from other aircraft or to shortcut the approach when there is little traffic. ATC will then typically give you new heading instructions (heading vectors) and will guide you the rest of the STAR and Approach with additional heading instructions up until intercepting the ILS localizer.

Example for shortcuts:

ROKIL STAR/Transition EDDM (Munich) 26R - it is only in times with a lot of traffic that we would have to fly the whole downwind part of this transition.



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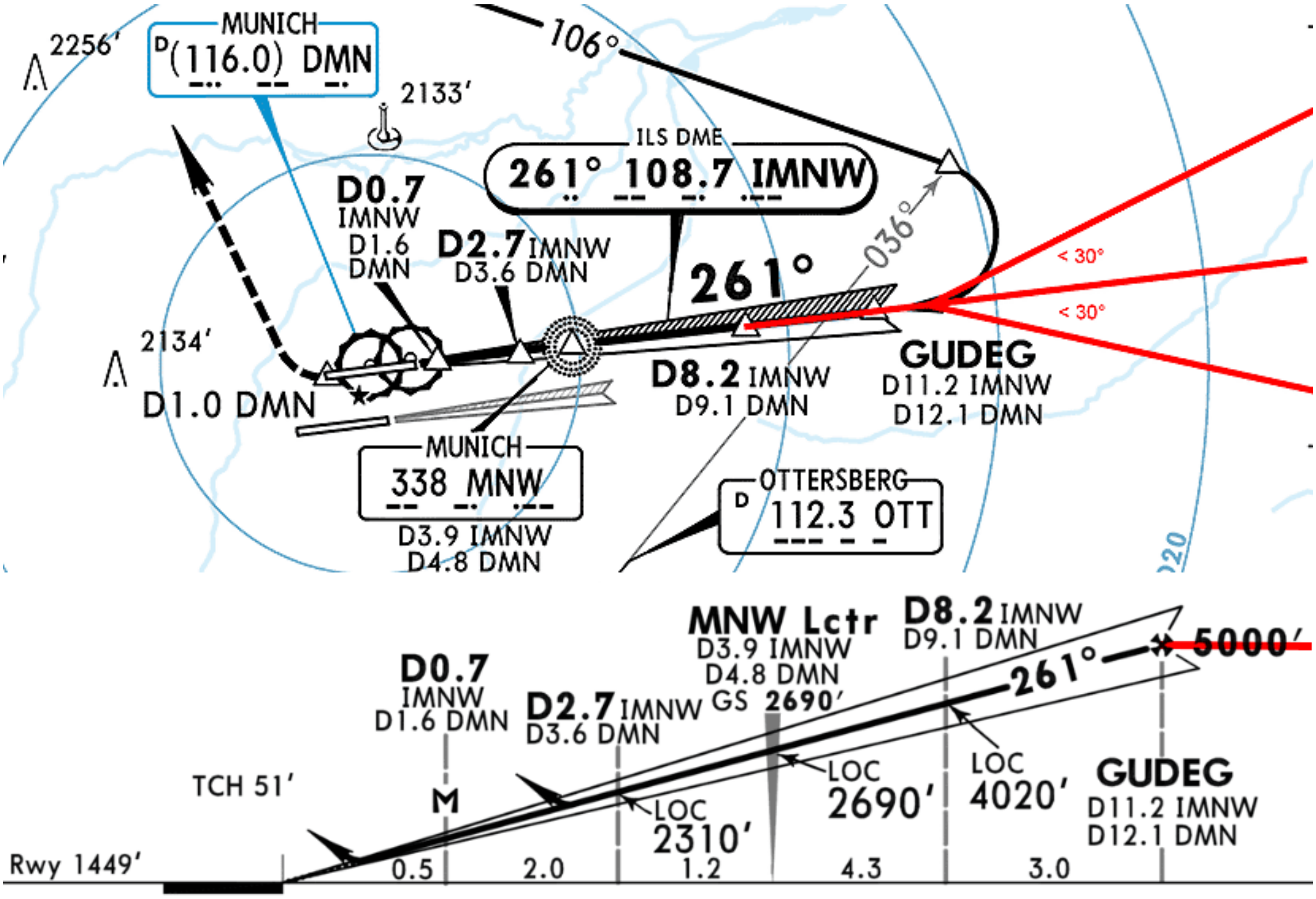
"Navigraph Charts are intended for flight simulation use only, not for navigational use."

Situation:

- Aircraft is in `DES` phase.
- Aircraft is setup for flight <10,000ft (`seat belt signs` on, `landing lights` on, etc.).
- We are either within the IAP (Instrument Approach) and at the correct altitude and speed or at a heading vector, altitude and speed instructed by ATC.

At the end of the Instrument Approach (or by ATC vectoring) we will be on a path to the Final Approach Fix and/or intercepting the ILS localizer and eventually the ILS glidescope.

To intercept the ILS we need to be on the correct altitude and should not have an approach angle larger than 30°.



More details regarding the ILS approach and landing in the next chapter.

This concludes *Intercepting ILS*.

Continue with Final Approach and Landing

Last update: March 15, 2022

1.2.8 Approach and ILS Landing

This guide will explain the correct procedures to fly a final approach and conduct an ILS landing.

> **Disclaimer**
>
> The level of detail in this guide is meant to get a FlyByWire A320neo beginner currently on approach to intercept the ILS and land the aircraft safely on the runway.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> You will also find many great videos on YouTube on how to land the FlyByWire A32NX.
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

---

Prerequisites

Aircraft is on approach shortly before intercepting the ILS and is still in phase and state `DES` as per previous chapters.

Download FlyByWire Checklist

Chapters / Phases

This guide will cover these phases:

1. Intercepting the ILS Localizer
2. Intercepting the ILS Glideslope
3. Preparation and Checklist for Landing
4. Landing
5. Vacate Runway

---

1. Intercepting the ILS Localizer

Situation:

- Aircraft is in `DES` phase.
- Aircraft is setup for flight <10,000ft (`seat belt signs` on, `landing lights` on, etc.).
- We are within the IAP (Instrument Approach) and either:
    - at the altitude and speed from the chart (Final Approach Fix altitude and 250 knots if there are no other speed restrictions on the chart).
    - or we are at a heading vector, altitude and speed instructed by ATC.

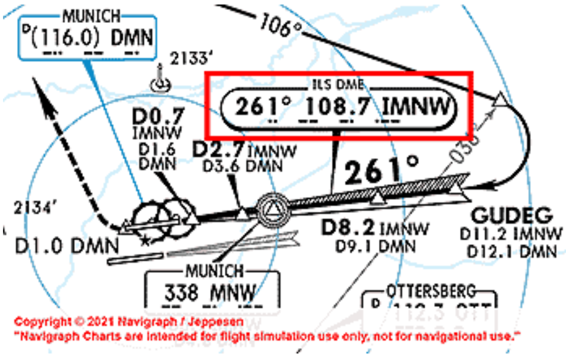
At the end of the Instrument Approach (or by ATC vectoring) we will be on a path to the Final Approach Fix and/or a path to intercept the ILS localizer and eventually the ILS glideslope.

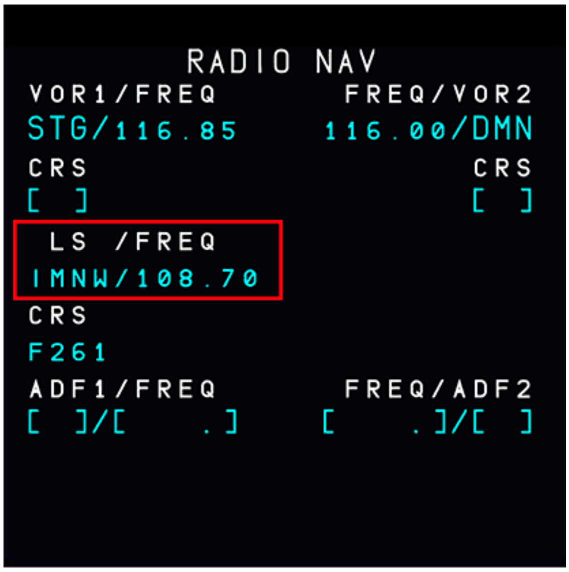
As a last instruction from ATC Approach we usually are instructed to contact Tower ATC when fully established on the ILS localizer.

To intercept the ILS Localizer we follow these steps:

- Verify that the correct ILS frequency is tuned in the `MCDU-RNAV` page. We find the correct frequency on the approach chart.

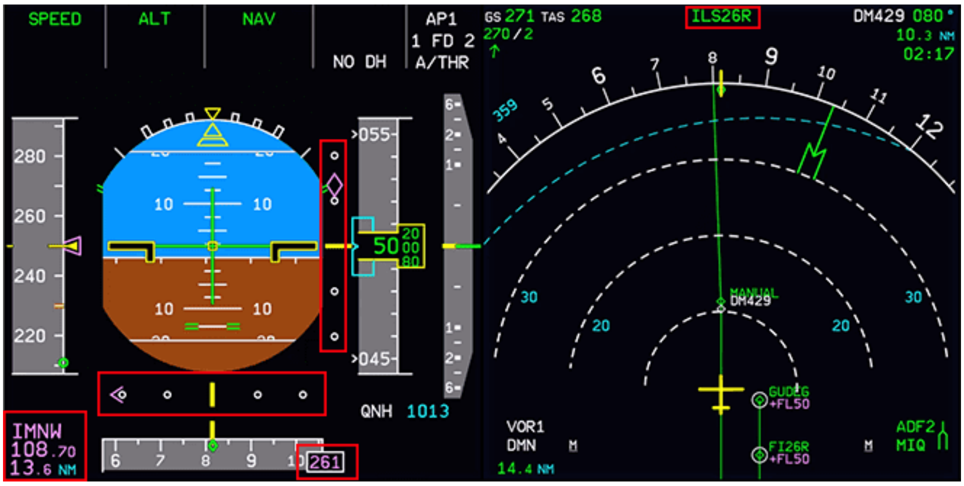
Check ILS frequency



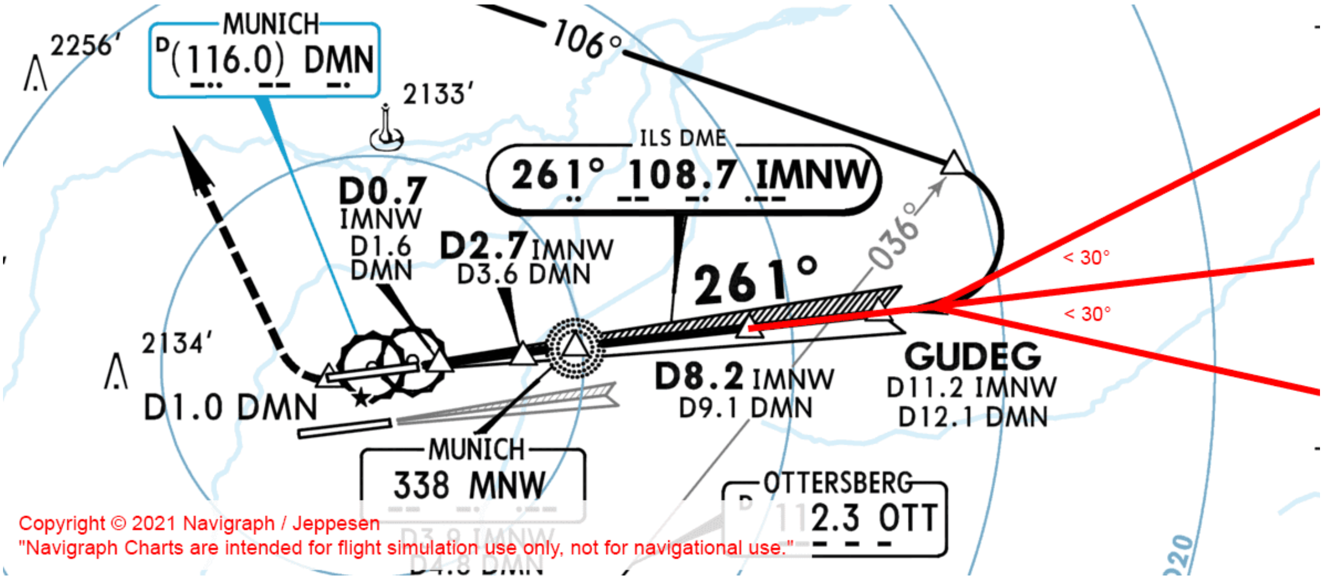


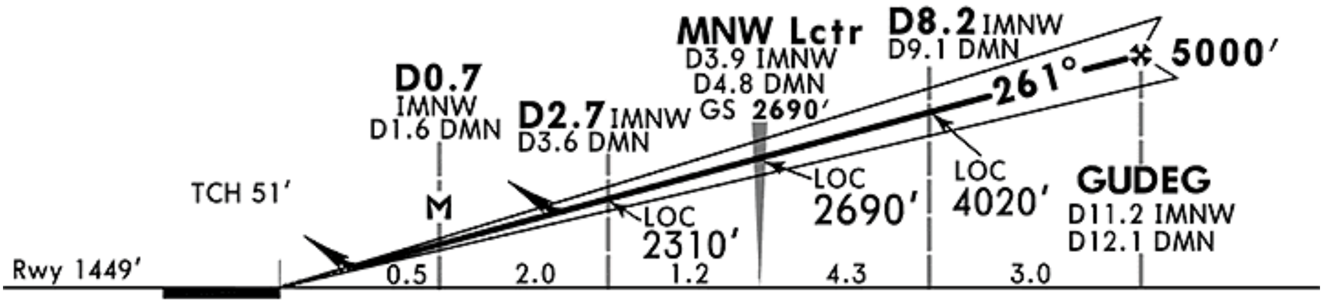
- Turn on the `ILS localizer and glideslope scales` with the `LS` button on the glareshield if not already done before.

Turn on ILS scales



- Make sure we are on the correct altitude (5,000ft in this example) and we should not have an approach angle larger than 30°.



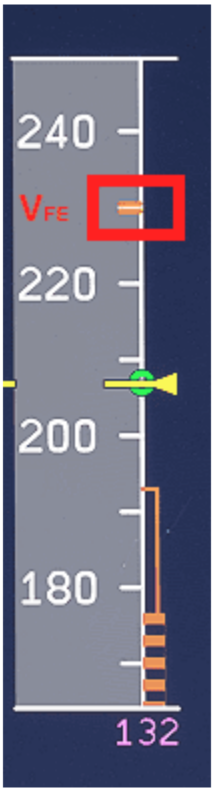


- Optional: Turn on `ROSE LS Mode` for the `ND` (can also be on F.O.'s side). The ROSE LS Mode shows the deviation from the localizer approach heading path.

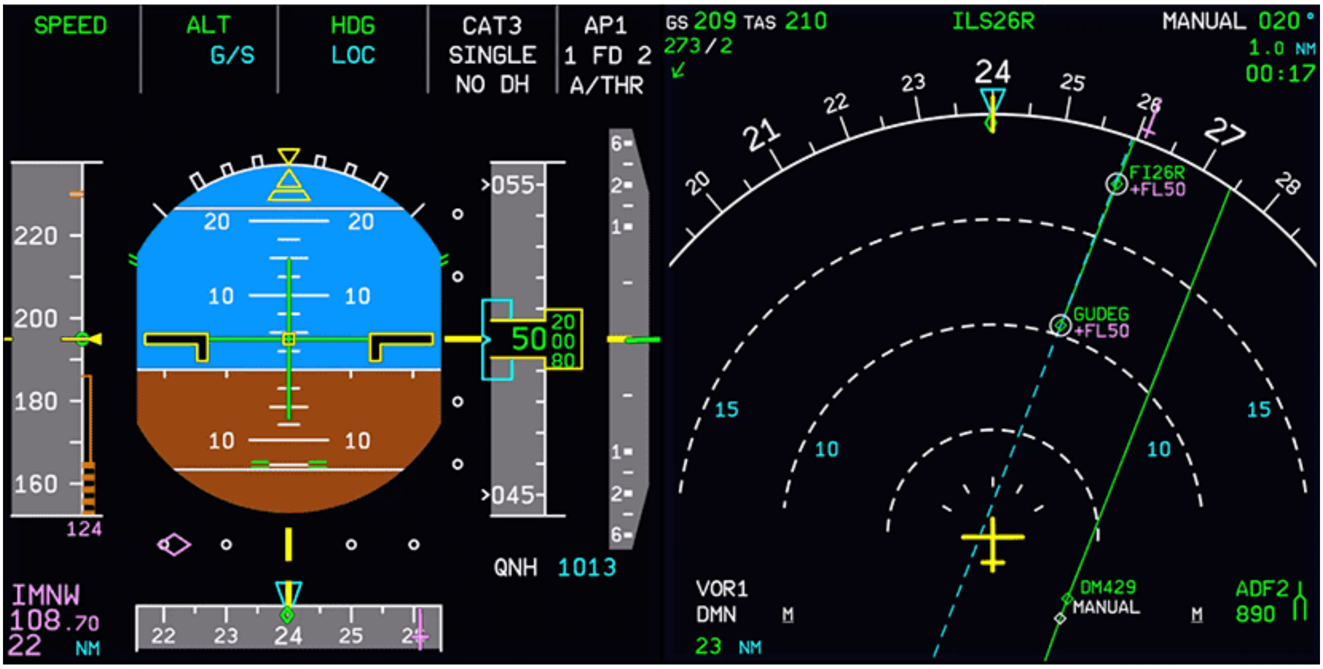
- Activate the `APPR` phase in the `MCDU-PERF` page. This is usually automatically done by the aircraft at a certain point during the approach, but we make sure that at this point at the latest it is activated. In `APPR` phase the `Autopilot` together with "Managed Speed Mode" reliefs the pilot of a lot of stress by managing the speed according to flaps setting automatically (S-Speed after `FLAPS 1`, F-Speed after `FLAPS 2`, V_{app} after landing flap selection).

- Set `SPEED` to `Managed Speed Mode` (push the `Speed Selector`). The aircraft should now decelerate to `green dot` speed.

- Set `FLAPS` to 1 at about V_{FE} -15 knots (but never before speed is below V_{FE}) for the first slat/flap configuration (`CONF1`). The aircraft will then decelerate further to prepare for the next flaps configuration. Our target is to be in CONF 1 and at S-speed by the time you need to set flaps 2 (CONFIG 2) before the glideslope intercept (S-speed will be slow enough to set flaps 2).



- Turn on `APPR` in the `FCU` to command the aircraft to intercept the ILS localizer. The aircraft will keep the current heading until the localizer is captured and guides the aircraft towards the runway. The `lateral ILS localizer scale` shows the `deviation marker` moving towards the middle of the `lateral deviation scale`. Also the lateral `FMA` shows `LOC` in blue (armed).

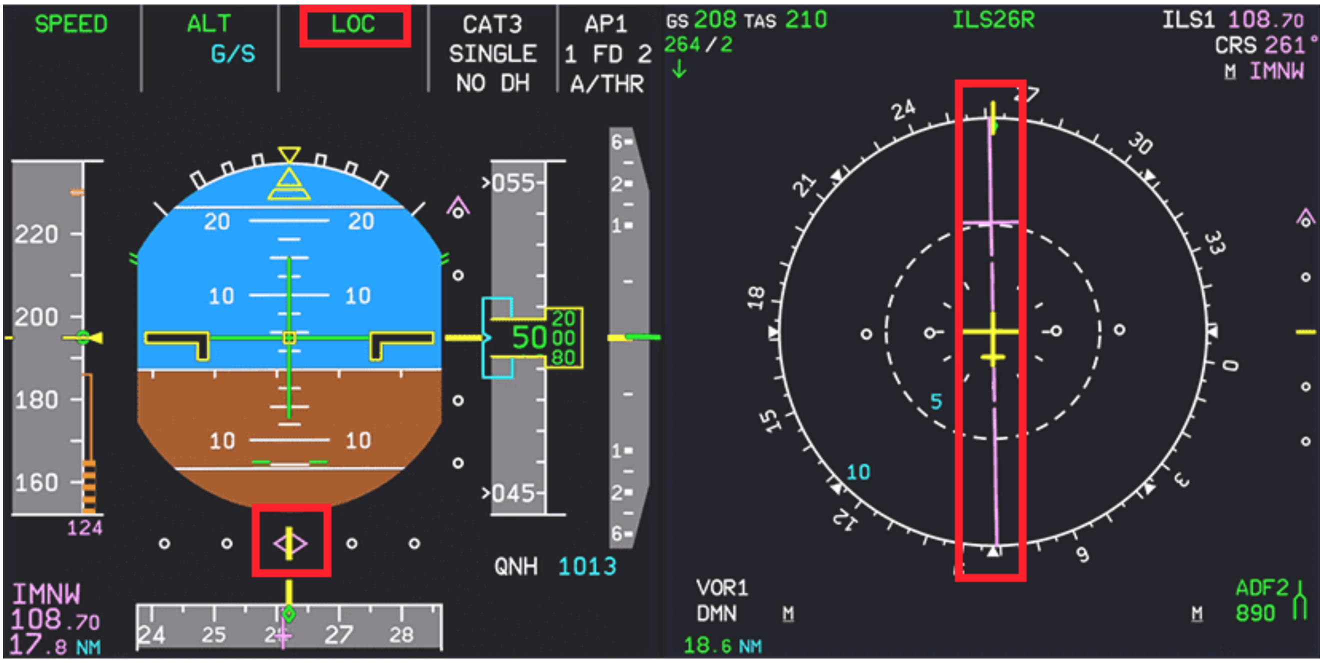


What is the blue dashed line?

You might ask what the blue dashed line is. It is part of the new FIX INFO feature available only in the Development version for the time being. It allows to draw distance rings or radial lines from navigation fixes. For this illustration it helps us to visualize the localizer signal path at 261° into the runway which we are going to capture with the APPR mode.

> ⚠ **Arming APPR**
>
> Using `APPR` also arms the glideslope descent (G/S) and the aircraft will descend as soon as it captures the ILS glideslope signal. Do not descend without ATC clearance and only when directly on the ILS localizer path as only then obstacle clearance is guaranteed. To help with this you can use the `LOC` button first (only localizer capture) and when cleared for approach press `APPR`

- When we are established on the ILS localizer (the lateral `FMA` shows `LOC` in green) we will contact Tower ATC and report that we are established on the ILS localizer (including call sign and runway).



Tower ATC will then give us clearance for ILS approach for the target runway. This clears us to descend on the ILS glideslope.

Do not descent without explicit clearance from ATC.

This concludes *Intercepting the ILS Localizer*

---

2. Intercepting the ILS Glideslope

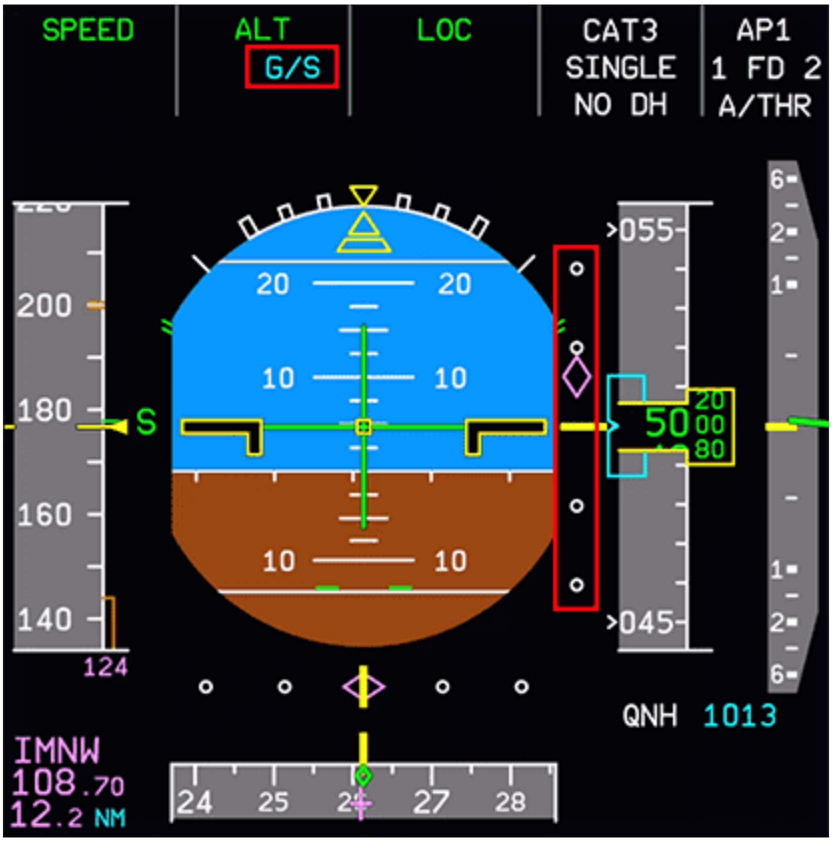
Situation:

- Aircraft is in `APPR` phase
- Aircraft is established on ILS localizer
- Configuration is `CONF1` at S-Speed (`FLAPS 1`)

After ATC has given us clearance for ILS approach we can also start descending using the ILS glideslope.

Check that the `APPR` button is activated on the `FCU` to arm the ILS glideslope descent mode.

The vertical `FMA` now shows `G/S` (glideslope) in blue.

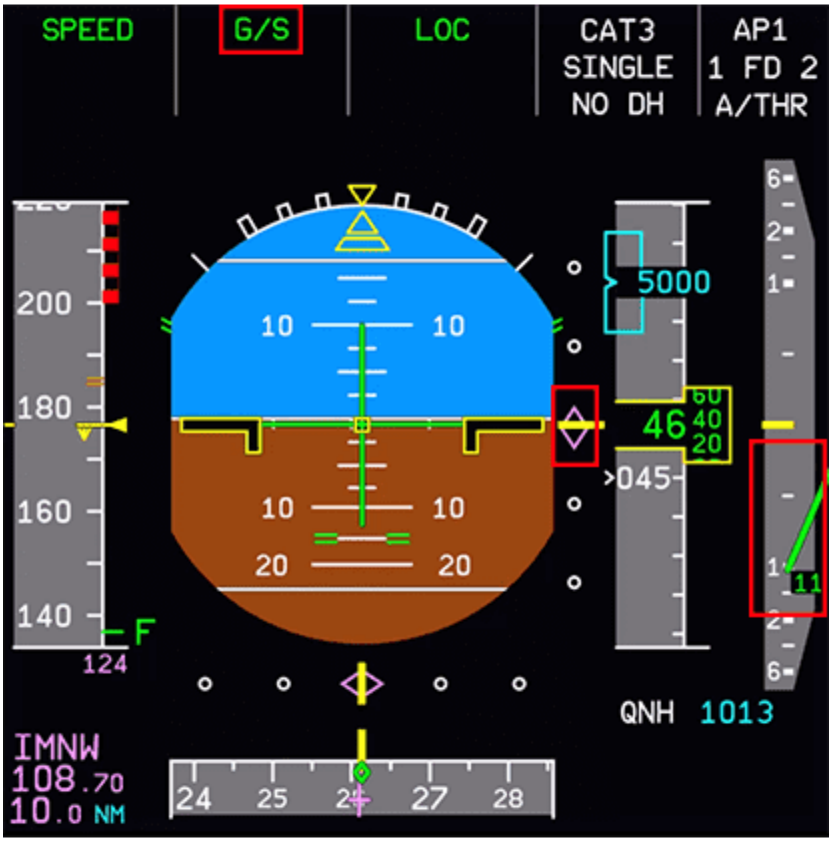


This is a good time to set `Flaps 2` (check that the speed is below the V_{FE} for the next flap setting) as slowing down once we are descending along the glideslope can be difficult. We need the drag from the flaps if we do not want to let the gear down too early (which also would help us slowing down).

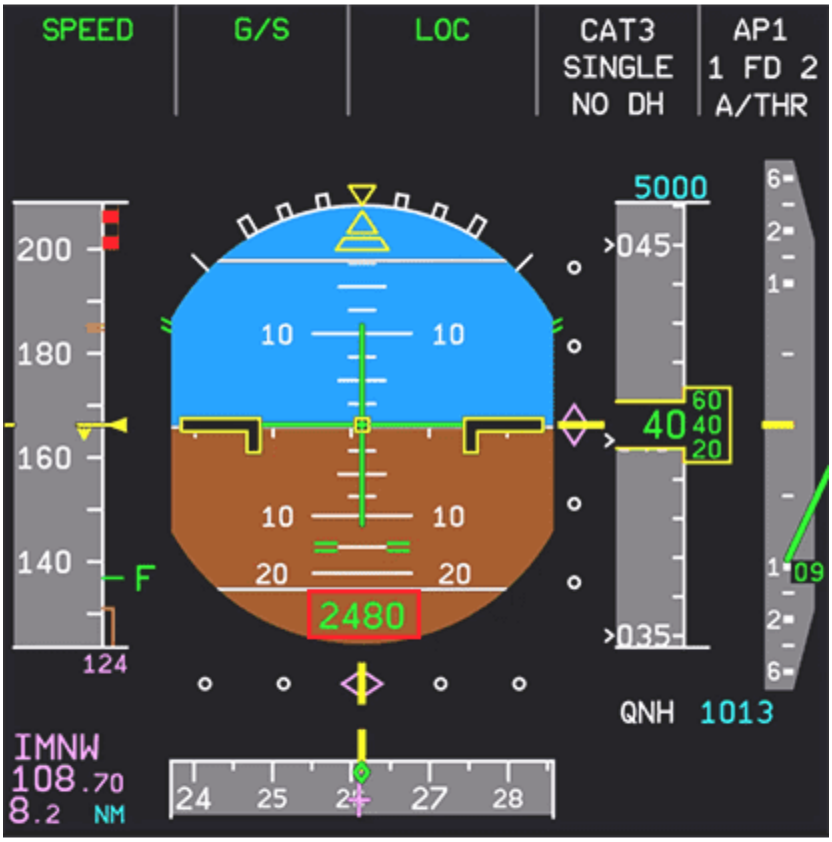
> There is different guidance when to set `FLAPS 2` at different airlines or Airbus. But for beginners we recommend to go to `FLAPS 2` before starting the glideslope descent. Airbus guidance for example is `FLAPS 2` during glideslope descent at about 2,000ft which only works if speed is already reduced enough.

> **ATC instructed approach speed**
>
> The A320 `Autothrust` will manage speed during approach automatically and will reduce speed further with each flap setting. In real live and also when flying with Online ATC like VATSIM we need to expect that ATC instructs us to stay at a certain speed (e.g. 160 knots until 5 NM to the runway). In this case we would use `Selected Speed Mode` (select a speed in the `FCU` and pull the knob) until the instructed distance to the runway where we would then go back to `Managed Speed Mode` and drop the gear then as well as setting flaps to 3 and flaps to full - see below.

The aircraft will start descending when the deviation marker is in the middle (we have captured the ILS glideslope). The vertical `FMA` will now display `G/S` in green.



We are now descending along the glideslope. The radio altimeter comes alive at 2,500ft above the ground to display the actual precise height above ground.



This concludes *Intercepting the ILS Glideslope*

3. Preparation and Checklist for Landing

Situation:

- Aircraft is established on ILS localizer and glideslope
- Flaps are set to 2

At this point we would prepare the aircraft for a possible missed approach and go-around by setting the go-around altitude in the FCU (see *MISSED APCH* procedure in the charts). We skip this for this beginner guide.

To set us up for the final approach we do the following steps:

- `Gear down` : Sometime between 2,500ft and 1,500ft , typically around 5-6NM from runway.
- Turn on `RWY TURN OFF` lights and set `NOSE` light to `T.O`.
- Set `FLAPS 3` and shortly after `FLAPS FULL` (always check speed before setting flaps otherwise you might end up in an overspeed situation).
- Going `FLAPS FULL` will reduce our speed to V_{app}.
- Arm `Autobrakes` (`Low` when dry, `Med` in rain or snow or a short runway).
- Arm `Speedbrake` by pulling up the `Speedbrake` lever (Speedbrake must be retracted to arm).

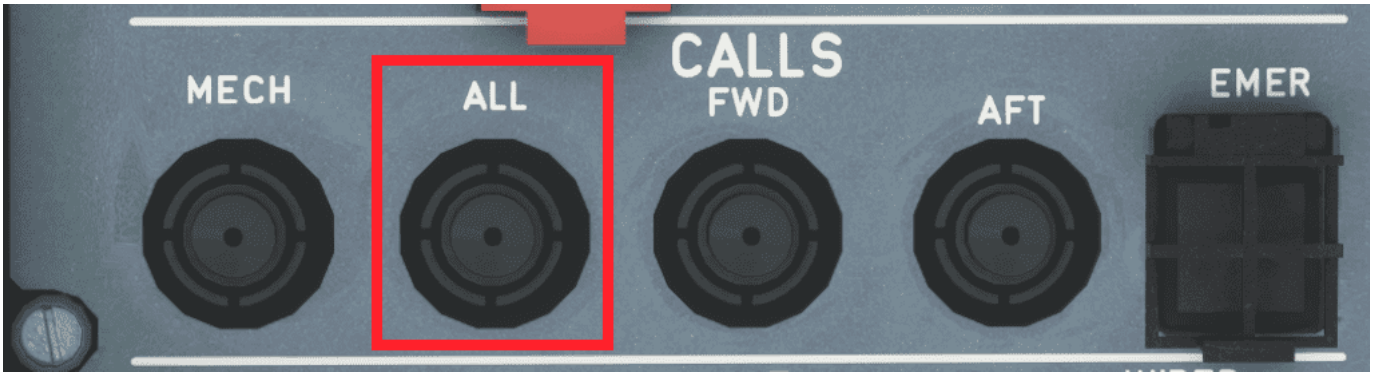
We need to be fully setup and stable at 1,000ft above the ground.

Cabin Crew

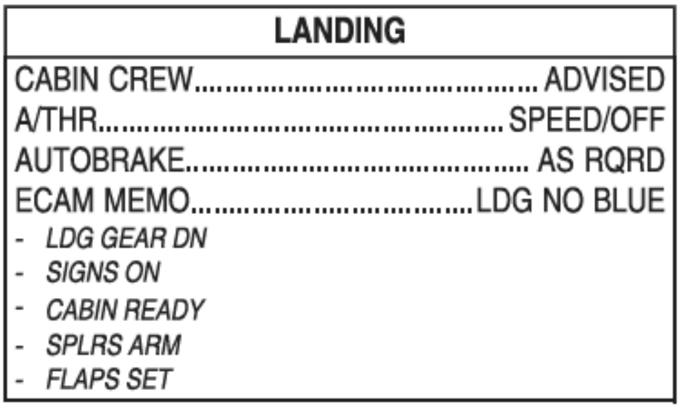
In real life the cabin crew will have been asked to prepare the cabin for landing during the descent. The exact moment and process might differ between airlines but most seem to do this when the `Seatbelt Signs` are turned on during descent (typically at the latest at 10,000ft).

The Cabin Crew will notify the pilots either by a "Cabin Ready" button (A320neo) or by a call to the cockpit (A320ceo) once they are ready and strapped-in themselves.

In the Microsoft Flight Simulator we simulate this by pressing the `CALLS ALL` button on the left of the overhead panel. This will set the "Cabin Ready" status as shown in the ECAM and there will be a short announcement playing "Cabin Crew take your seats for landing".



Complete the **Landing Checklist**



LANDING	
CABIN CREW	ADVISED
A/THR	SPEED/OFF
AUTOBRAKE	AS RQRD
ECAM MEMO	LDG NO BLUE
- *LDG GEAR DN*	
- *SIGNS ON*	
- *CABIN READY*	
- *SPLRS ARM*	
- *FLAPS SET*	

For the landing we have our hand on the thrust levers for a potential go-around so we can quickly push the levers forward into `TO GA`.
We do not move the levers until the last seconds before landing.

This concludes *Preparation and Checklist for Landing*

---

4. Landing

Situation:

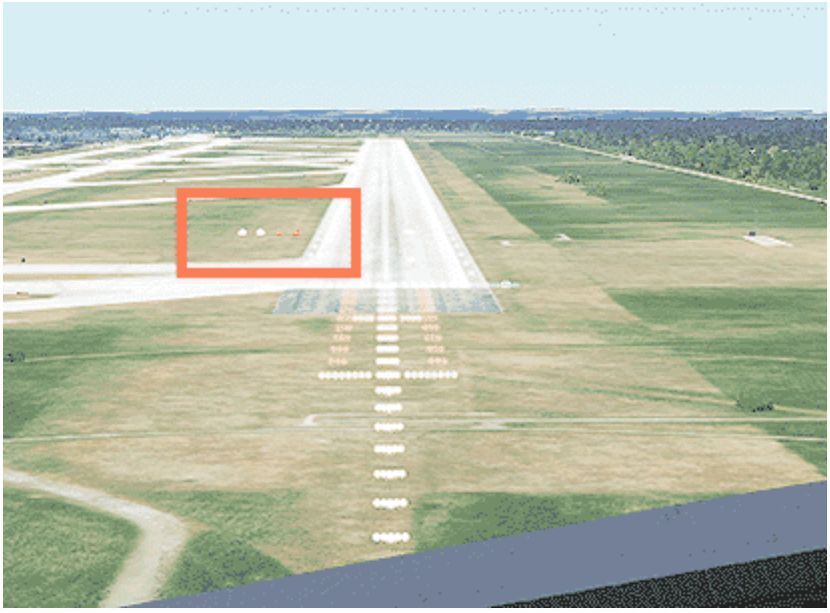
- Aircraft is fully setup for landing as per previous chapters.
- Configuration is `FLAPS FULL`.
- Aircraft is at about 1,000ft above the ground.
- Wind is calm (no crosswind for this beginner guide).

Although the A320 can do an automatic landing (**Autoland**) we will do a manual landing as this is more common and also more fun.

We MUST get landing clearance from ATC before we actually are allowed to land. Without landing clearance we must do a go-around (not part of this beginner guide) before touching the runway. Usually ATC will have given us clearance at this point. Late clearance is rare and communicated to us beforehand.

Next we turn the **Autopilot** `OFF` at about 500ft above the ground by pressing the `AP1` button on the `FCU`. We leave the **Autothrust** on so we don't have to worry about thrust and speed at all (Leaving **Autothrust** on for landing is common for the Airbus).

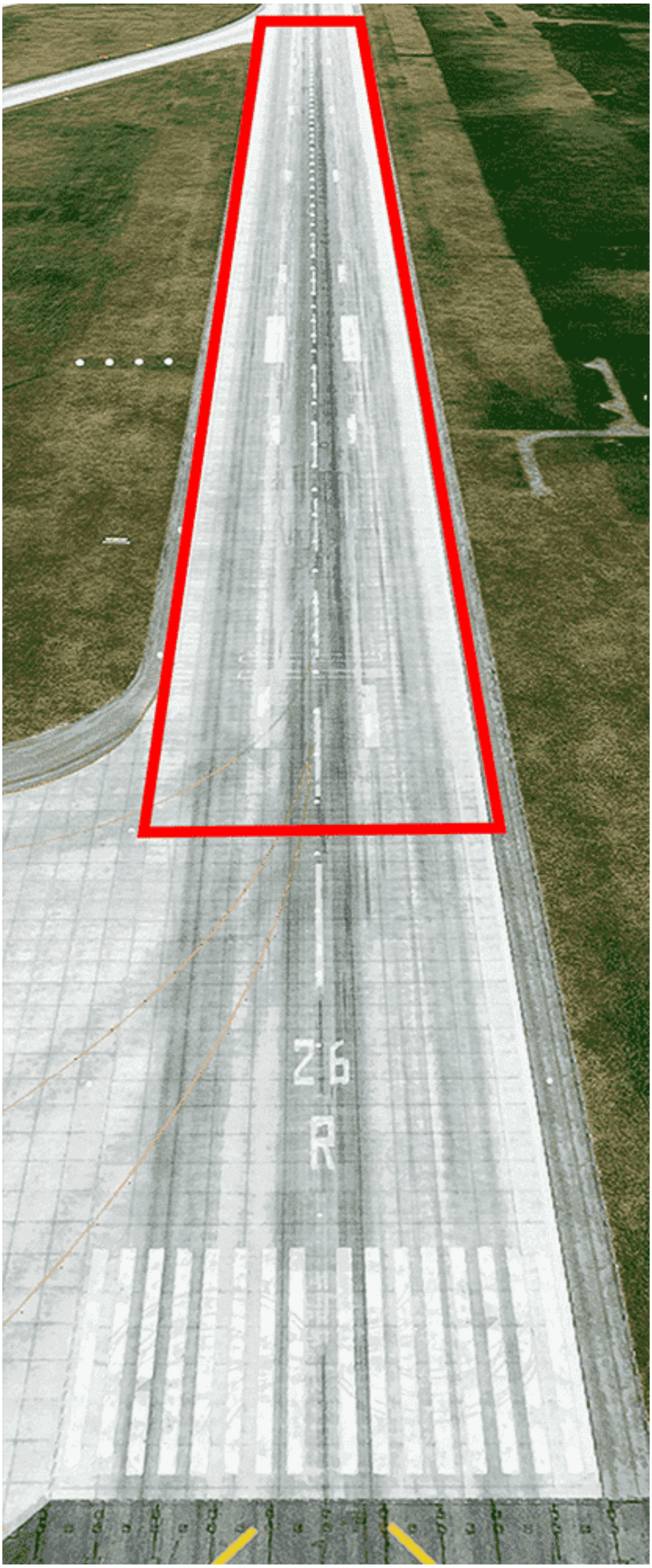
Now look out at the PAPIs which guide us vertically down to the correct touchdown point. We want two white lights and 2 red lights.



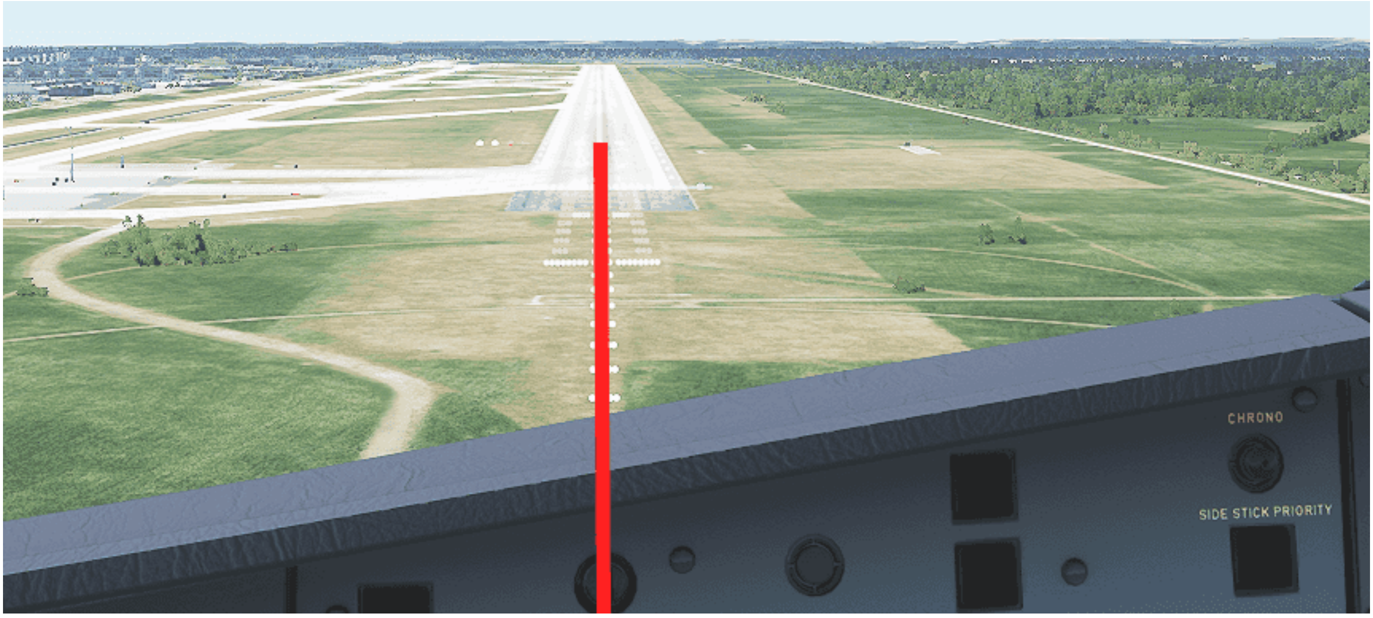
See also Wikipedia:PAPI

We correct our pitch only very carefully when too high (3-4 white) or too low (3-4 red). We don't need a lot of input to the sidestick to correct.

We aim for the middle of the touchdown zone which is marked by the touchdown zone markers.


26
R

Also we try to aim for the center line of the runway in a way that it points directly under us.



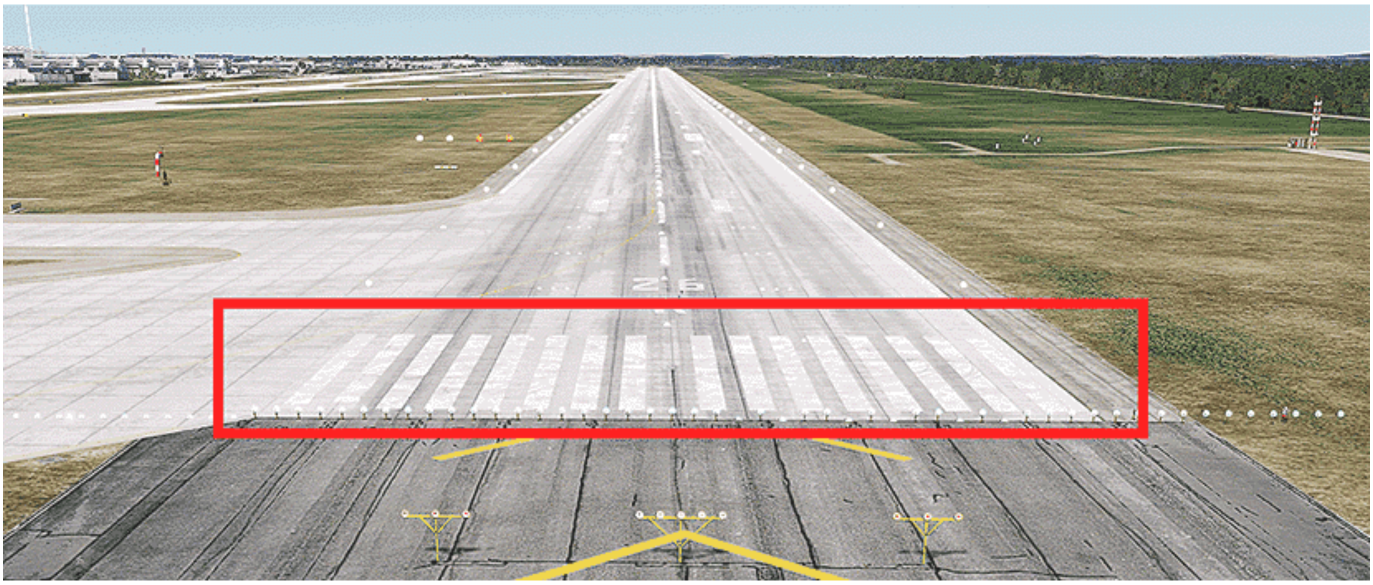
Correct your final heading and bank very carefully. We should not need to correct much at this point.

> **Crosswind landings**
>
> Crosswind landings are beyond the scope of this beginner guide. There are many good tutorials for crosswind landings in the A320 on Youtube.

Once over the runway threshold we look towards the end of the runway to better judge our pitch especially for the so called **Flare**.

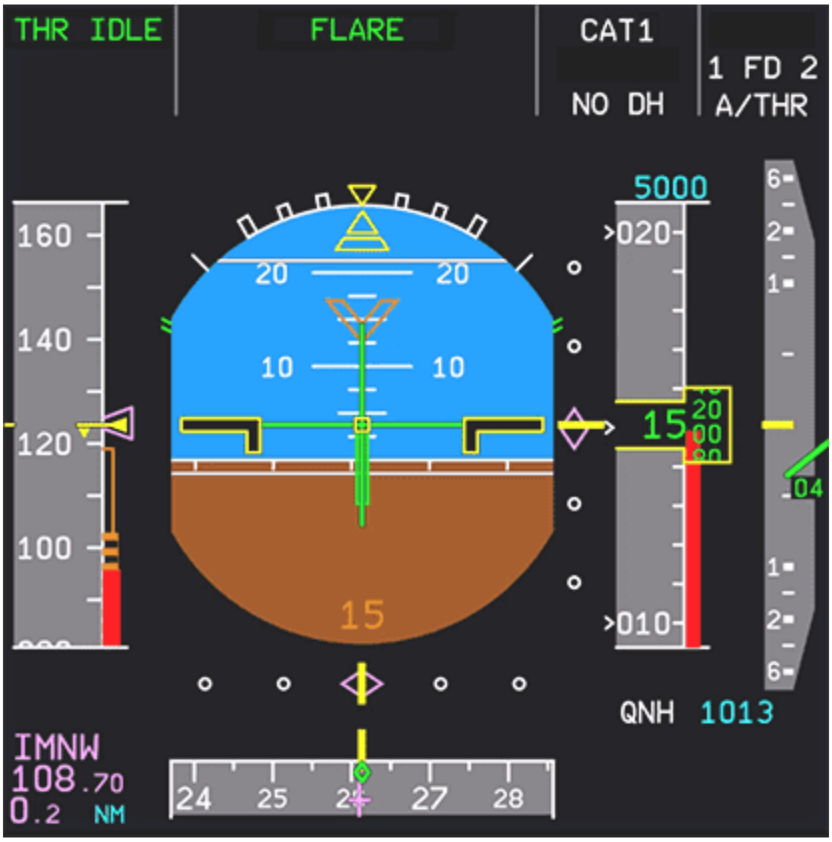
> **Flare**
>
> The flare follows the final approach phase and precedes the touchdown and roll-out phases of landing. In the flare, the nose of the plane is raised, slowing the descent rate and therefore, creating a softer touchdown, and the proper attitude is set for touchdown. [...] In the case of tricycle gear-equipped aircraft, the attitude is set to touchdown on the main (rear) landing gear. (source: Wikipedia: Landing flare)

At the runway threshold we should be about 50ft above ground and prepare to set the thrust levers to idle and flare.



At about 30ft we start our flare by pulling back on the sidestick carefully. We only need a few degrees in positive pitch and hold the aircraft there. Too much flare will cause the aircraft to float down the runway, too little will cause a harder landing.

At about 10-20ft we pull back the thrust levers to idle (the aircraft also sounds the callout "retard retard ...") so the we are at idle thrust **before** we touch the ground.



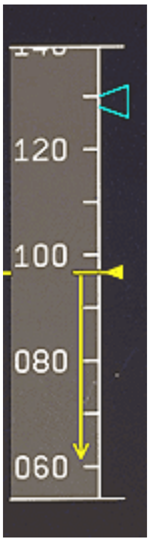
We hold the attitude of the aircraft until it settles on the ground. **Do not push the sidestick forward (nose down) once flared.** We let the aircraft settle to the runway while holding the pitch.

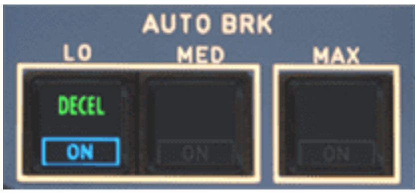
Practice this!!

On touchdown of the main gear the `Speed Brakes` will deploy automatically (we have armed them earlier) and we pull the thrust levers into the reverse position.

We let the front gear settle gently on the runway (don't slam it down) and hold the center line of the runway while we are reducing speed. The speed reduction should be monitored on the `PFD` speed band and the speed trend arrow.

The `Autobrakes` should now have activated and started to further decelerate the aircraft. This can be checked by the `Autobrake` annunciators.





The upper ECAM should now show the engines in reverse mode (`REV`) and the lower ECAM shows the `Speed Brakes` (spoiler) deployed. Also you should notice that the brakes actually get hotter.

At about 60knots we put the thrust levers back to idle and at about 40 knots we release the `Autobrakes` by braking manually which deactivates the `Autobrake`.

This concludes *Landing*

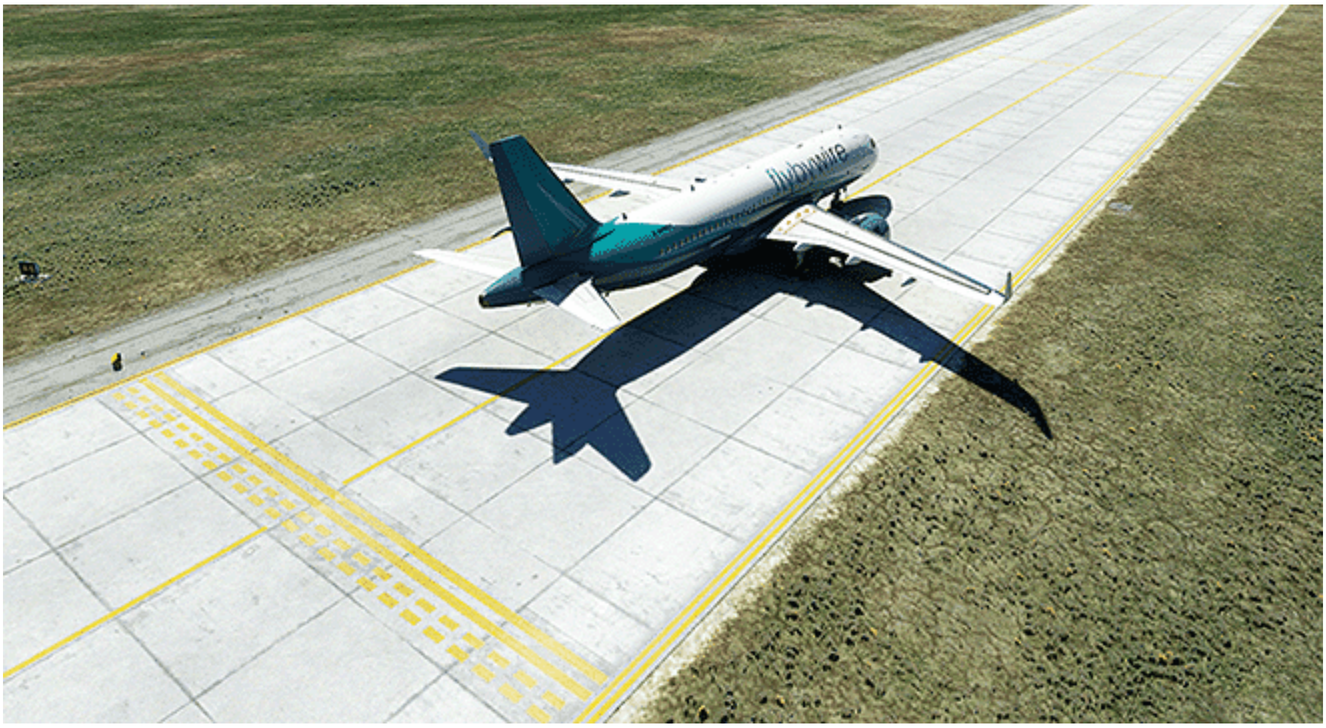
5. Vacate Runway

Situation:

- Aircraft has landed and is still on the center line of the runway.
- Speed is < 40 knots.

We look for the next runway exit and slow down to about 15 knots before we start turning off the runway.

We continue rolling forward until we passed the runway entry marker with the **full length** of our aircraft.



We can now safely stop the aircraft and do our "After Landing" checklist.

If ATC did not already contact us on the ground we would contact them now to let them now we have vacated the runway. They will give us taxi instructions so we can continue taxiing to our gate once we have completed the after landing tasks.

After landing tasks in simulation

In real live the A320 will have two pilots which can actually do things in parallel. Talking to ATC, taxing the aircraft and do the after landing tasks. In the simulation we are typically alone so it is absolutely ok to stop once we have fully vacated the runway and do these things one after the other. Talking to ATC and getting taxi instruction, do the after landing tasks and checklist, taxiing to gate.

This concludes *Vacate Runway*

Continue with After Landing Steps

Last update: January 1, 2022

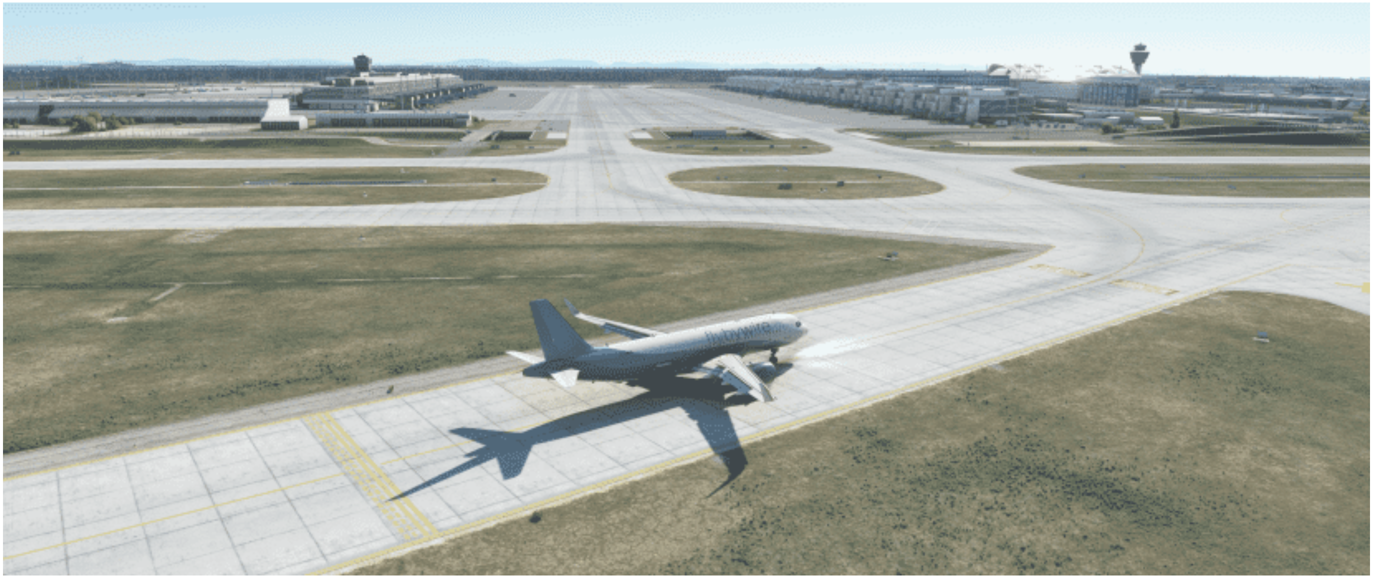
1.2.9 After Landing and Taxi to Gate

This guide will explain the correct procedures after we have landed and vacated the runway and then taxiing to the designated gate.

> **Disclaimer**
>
> The level of detail in this guide is meant to get a FlyByWire A320neo beginner from the runway to the designated destination gate.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> Further reading: A320 Autoflight
> Also you will find many great videos on YouTube on how to fly the FlyByWire A32NX.
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube

Prerequisites

Aircraft has vacated the runway completely and has been brought to a stop on the taxiway as per previous chapters.



Download FlyByWire Checklist

Chapters / Phases

This guide will cover these phases:

1. After Landing
2. Taxi to Gate

Situation:

- Aircraft has vacated the runways completely and has come to a stop on the taxi way as per previous chapters.
- Flaps and Ground Spoilers are still deployed.
- ATC has been informed that we vacated the runway.

Simulation vs. Real Life

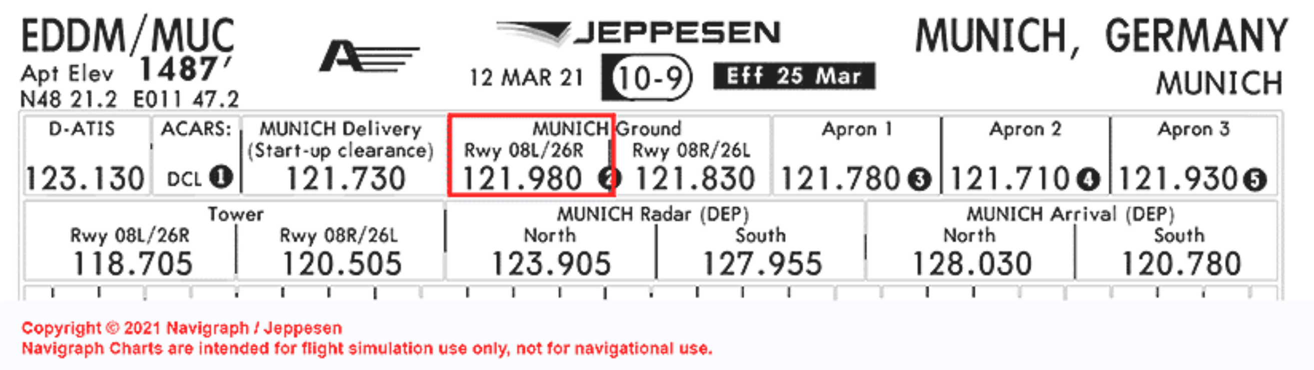
In real life the A320 will have two pilots who can actually do things in parallel. Talking to ATC, taxing the aircraft and do the after landing tasks.

In the simulation we are typically alone so it is absolutely ok to stop once we have fully vacated the runway and do these things one after the other.

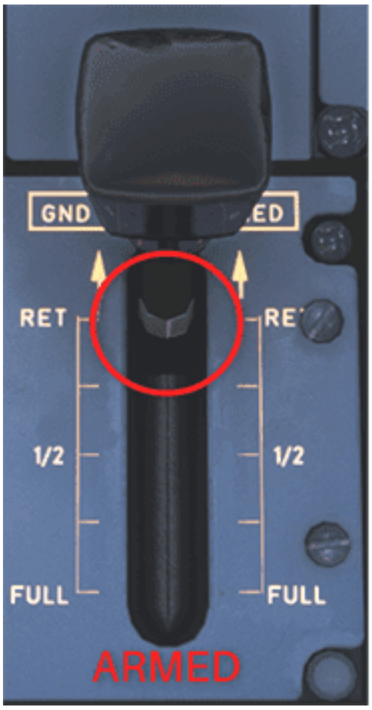
ATC Tower will usually hand us off to ATC Ground and they will give us taxi instructions for our destination gate. Write them down and read them back as usual but you don't have to move immediately unless ATC explicitly tells you to. Online ATC understand that the after-landing- tasks do take some time.

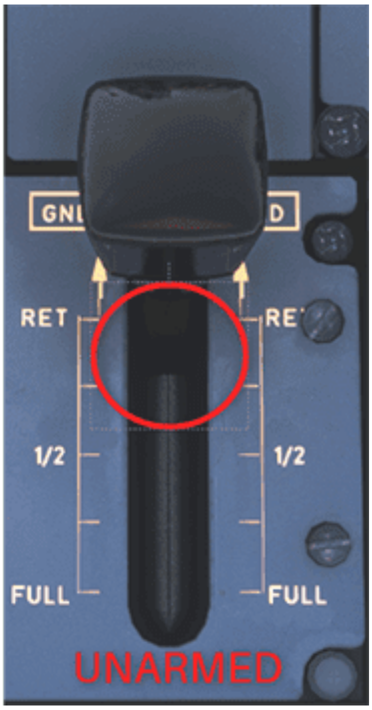
Immediate steps after vacating the runway:

• Set your radio frequency to the one assigned by ATC or the airport charts.



• Disarm the `Speed Brake` lever (Ground Spoilers) by pushing down on the lever.





• Set your `ENG MODE` selector to NORM in case you set it to IGN/START before.

• Retract your `FLAPS` to 0.

• Set your `TCAS` to STANDBY.

- Set your `RADAR` and Predictive Windshear System (`PWS`) to OFF.

- Start your `APU` by clicking the `APU MASTER SW` button then the `APU START` button.

- Turn `ANTI ICE` OFF if not required.
- Set your exterior lights:
  - Set your `NOSE` light to TAXI.
  - Set `RWY TURN OFF` light to ON.
  - Set your `STROBE` lights to AUTO/OFF (If you are crossing runway keep them ON until you vacate the runway).
  - For `LAND` lights, you can choose to retract them or turn them off.

- Turn the brake fan (`BRK FAN`) on if you get a hot brakes ECAM warning.

- Complete the **After Landing** checklist.

AFTER LANDING	
FLAPS	RETRACTED
SPOILERS	DISARMED
APU	START
RADAR	OFF
PREDICTIVE WINDSHEAR SYSTEM	OFF

This concludes *After Landing*

Situation:

- Aircraft on taxiway directly after runway.
- **After Landing** checklist is completed.
- ATC Ground has given taxi instructions.

Taxiing

Make sure to also read the Taxi section of the Engine Start and Taxi chapter.

Use your charts to follow the ATC taxi instructions to the designated gate.

Crossing a Runway

When approved to cross a runway (active or not) perform the following actions:

- Look out the windows and visually ensure that there are no visible aircraft to your left and right.
- Turn on extra lights to ensure your aircraft is visible when crossing:
  - Strobe lights - `Set to ON`
- Inform ATC you have vacated the runway if required.

> **Warning**
>
> Never cross a runway without express permission from ATC and providing a read back of said instructions. Always ensure maximum safety when crossing.

Turning into the Gate

When turning into the gate turn off your `NOSE` light and your `RWY TURN OFF` lights to not blind the ground personnel. This of course is only done at this point if enough lighting is available to safely park into the gate.

This concludes *Taxi to Gate*

Continue with Powering Down

Last update: October 6, 2021

1.2.10 Powering Down

This guide will explain the correct procedures to power down the aircraft when at the gate after arriving at the destination and taxi to the designated gate.

Obviously this is not strictly required in a simulator but for interested sim pilots this might be an interesting process for a more realistic experience.

> **Disclaimer**
>
> The level of detail in this guide is meant to help a FlyByWire A320neo beginner to correctly shut down the aircraft.
>
> A *beginner* is defined as someone familiar with flying a GA aircraft or different types of airliners. Aviation terminology and know-how is a requirement to fly any airliner even in Microsoft Flight Simulator.
>
> Check out the FlyByWire YouTube Channel as well: FlyByWire on YouTube
>
> You will find many great videos on YouTube on how to fly the FlyByWire A32NX.

Prerequisites

- Aircraft is at the gate after landing and taxi as per previous chapters.

Download FlyByWire Checklist

Chapters / Phases

This guide will cover these phases:

1. Parking at the Gate
2. Disembarking Passengers and Baggage
3. Securing the Aircraft

Preface

Shutting down and securing an aircraft is an important part of the overall procedure. Obviously less important in a simulator as the next flight will have the aircraft start in a cold and dark state again.

If we want to actually do a turn around and start a new flight directly the procedure will be a little different as we would not turn off certain systems and at some point simply start with the preparation of the aircraft procedure again.

1. Parking at the Gate

Situation

- We arrived at the designated gate after taxiing from the runway where we landed.
- Aircraft is in taxi state as per previous chapters.
- Engines are still running.
- Lights are still in taxi configuration (`RWY TURN OFF` set to on and `NOSE` is to taxi, `LAND`-ing lights are off).
- `APU` has been turned on during taxi and is `AVAIL`, `APU BLEED` is off.
- **After Landing** checklist is completed.

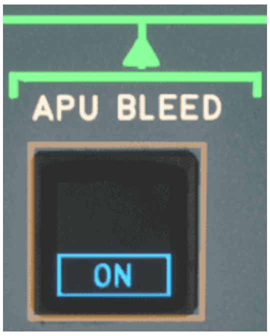
At the gate:

Steps after arriving at the gate:

- Set parking brake (`PARK BRK`).

- `NOSE TAXI` and `RWY TURN OFF` lights are usually turned off even before we turn into the gate to not blind the ground personnel. This of course is only done if enough lighting is available to safely park into the gate. Turn them off if they were used to assist in parking.

- Turn on `APU BLEED` before we turn off the engines.



- Shut down the engines by setting the `ENG 1` and `ENG 2` master switches to off.

- Wait until `N1` is below 5%.

- Turn off `Seat Belt` sign.

- Turn off `BEACON` (leave `NAV & LOGO` on as long as the aircraft has power from external or APU, `STROBES` can remain on AUTO).

- Complete **Parking** checklist.

PARKING

APU BLEED........................ON
ENGINES..........................OFF
SEAT BELTS.......................OFF
EXT LT...........................AS RQRD
FUEL PUMPS.......................OFF
PARK BRK and CHOCKS..............AS RQRD
Consider HEAVY RAIN

If external power is available the ground crew would have connected it by now and we can turn on `EXT PWR`. Turning off the APU depends on the turn around time. For a shutdown we do this after the passengers have disembarked to still have airflow in the cabin. See last chapter.

This concludes *Parking at the Gate*.

2. Disembarking Passengers and Baggage

Situation:

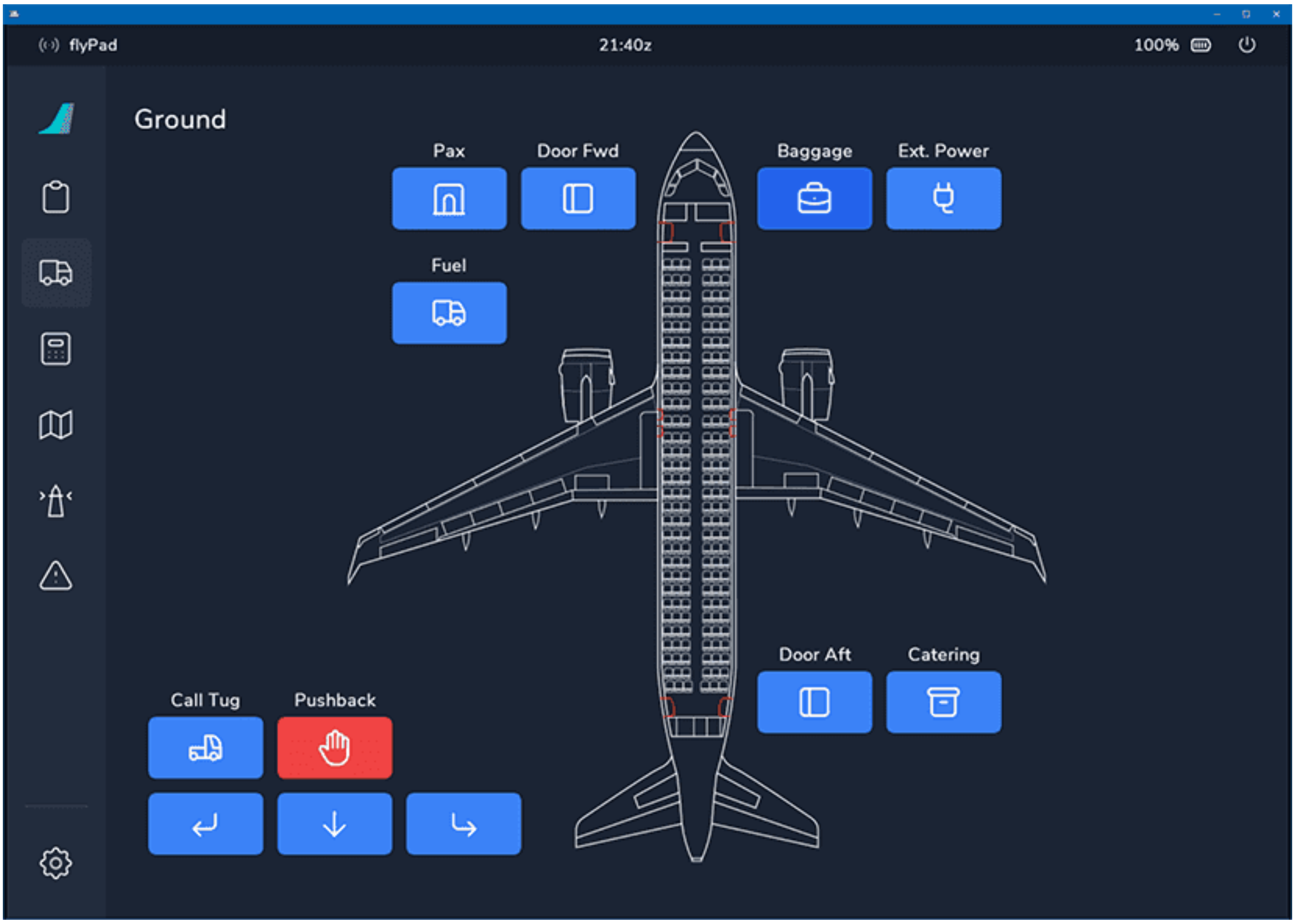
- **Parking** checklist is completed.

In real life there are many things that begin automatically after parking at the gate. The jetway is connected to the aircraft, doors are opened, passengers disembark, cargo is unloaded, etc. The pilots don't have to do much to trigger these steps.

In the simulator though we would have to trigger them by ourselves. For this we use the FlyByWire flyPad's ground functionality or the Microsoft Flight Simulator's built-in ATC to start these procedures. There are also some nice add-on tools out there which help with this.

Taking care of passengers and luggage with the FlyByWire flyPad:

- Go to the flyPad (view can be activated by `Ctrl+0`).
- Connect the jetway (PAX).
- Call cargo/baggage (Baggage).



Obviously this would take a while in real life and we would not be able to shut down the aircraft before everybody is disembarked.

For a turn around we would start preparing the aircraft for the next flight and the cabin crew would coordinate everything from disembarking the passengers, cleaning and resetting the cabin.

After refuelling the pilot would signal the cabin crew that they could let the new passengers board the aircraft once the cabin is ready.

This concludes *Disembarking Passengers and Baggage*.

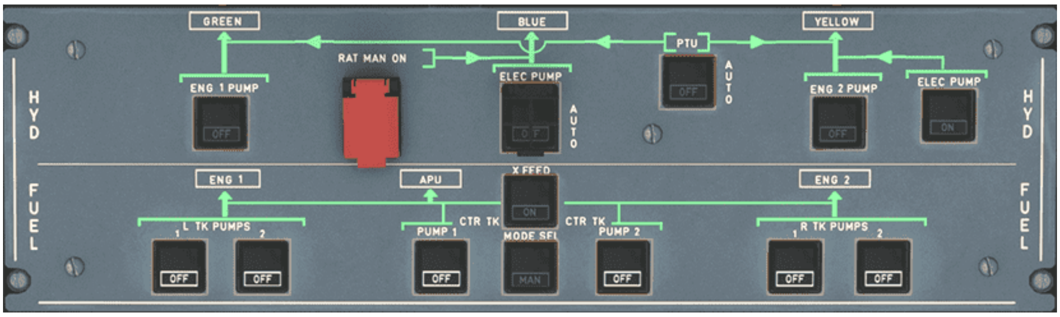
3. Securing the Aircraft

Situation:

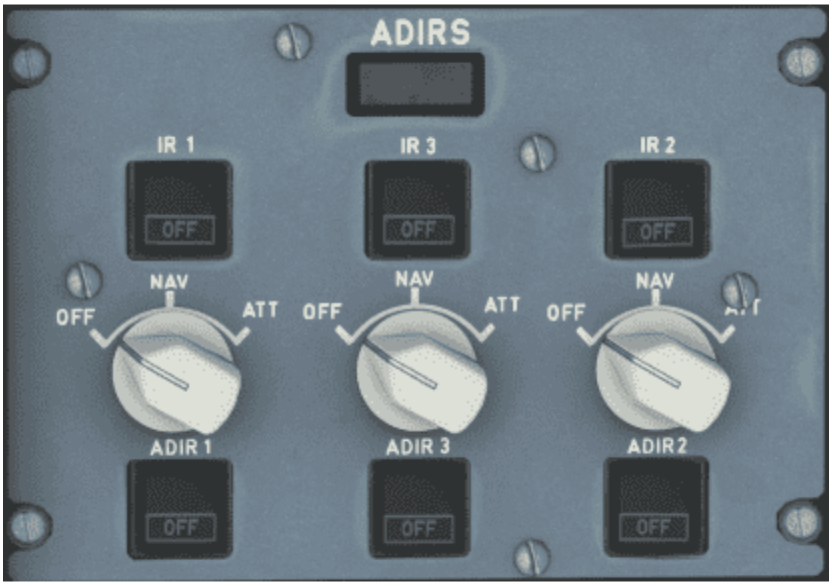
- **Parking** checklist is completed.
- Aircraft is empty (no passengers or cargo).
- Cabin is cleaned and ready for shutdown.

To secure the aircraft we follow these steps:

- Turn off all fuel pumps.



- Turn off the `ADIRS`.



- Turn off `OXYGEN`.

- Turn off `APU BLEED`.

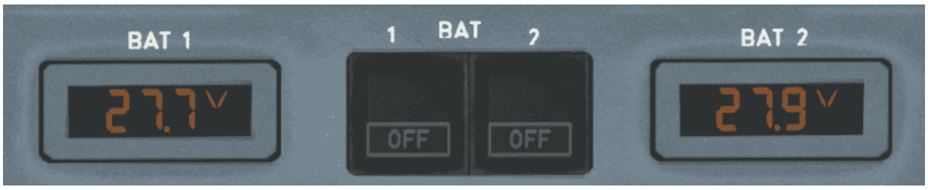
- Turn off emergency exit lights `EMER EXIT LT` and no smoking lights `NO SMOKING`.

- Optional or depending on airline SOPs: Reset air conditioning, lighting and screen brightness.
- Turn off `APU MASTER` (expect the APU to still be AVAIL for a few minutes if you also had APU Bleed on shortly before as it needs a cool down period).

- Wait 2 minutes for the APU FLAP door to close before you turn off power as this needs either APU or external power.
- Turn off `EXT PWR` if it has been turned on before

- Turn off `NAV & LOGO` lights (as aircraft no longer has power).

- Turn off `BAT 1` and `BAT 2`.



Now the aircraft is back in a cold and dark state.

This concludes *Securing the Aircraft*

Last update: October 21, 2021

1.2.11 Airbus Terms and Abbreviations (Selection)

V-Speeds

V-Speed	Term
V1	The highest speed during take-off that you can reject the take-off and still stop on the runway.
V2	Take-off safety speed, where if an engine fails, climb out and control is still guaranteed.
VA	Maximum design maneuvering speed, the maximum speed to do full control deflection in normal or alternate law.
V_{APP}	Speed for flying down the approach.
VD / MD	Maximum structural design limit speed and Mach
VF	Design Flap Speed
V_{FE}	Maximum Flap Extended Speed.
V_{FEN}	Predictive V_{FE} at next flap/slat position
V_{FTO}	Final Takeoff Speed
V_{LE}	Maximum gear extension speed, often lower than the operating speed to prevent gear door damage.
V_{LO}	Maximum gear operating speed, which means the max speed for the gear being down.
V_{LOF}	Lift-off Speed
V_{LS}	Lower Selectable Speed
V_{MAX}	Airbus for the maximum speed for the current configuration, represented by black and red strip at the top of the airspeed indication.
V_{MCA}	Minimum speed in the air that if one engine fails and the other is at TO thrust, you can still control the aircraft with the primary flight controls up to a bank of 5 degrees.
V_{MCG}	Minimum speed on the ground that if one engine fails and the other is at TO thrust, you can still control the aircraft with the primary flight controls.

V-Speed	Term
V_{MO} / M_{MO}	Maximum operating speed, also has M_{MO} for maximum Mach number.
VR	Rotate speed, the point where you lift the nose off the runway.
V_{REF}	Reference speed for a normal approach, what you aim to touchdown roughly at.
V_S	Stalling Speed at which Airplane is Controllable
V_{S1}	Stalling Speed or Minimum Steady Flight Speed obtained in a specified Configuration
V_{SO}	Stalling Speed or Minimum Steady Flight Speed in the Landing configuration
V_{SW}	Airbus for when the stall warning will activate, represented by a black and red strip at the bottom of the airspeed indicator, when there has been a failure to affect the flight control laws.
VX	Speed of Best Angle of Climb
VY	Speed for Best Rate of Climb
$V_{\alpha MAX}$	Airbus for the speed that the maximum angle of attack (AoA) can be without the aircraft stalling, shown by the top of a red strip at the bottom of the airspeed indicator.
$V_{\alpha PROT}$	Airbus for the speed that the angle of attack (AoA) protection will become active to stop the aircraft from stalling, shown as being the top of the black and amber strip at the bottom of the airspeed indicator.

Additional Speeds

V-Speed	Term
F	Minimum speed at which the flaps may be retracted at takeoff (i.e., CONF 2/3). Also the minimum speed in approach when in CONF 2 or 3
S	Minimum speed at which the slats may be retracted at takeoff. Also the minimum speed in approach when in CONF 1.
O or GD	Green dot speed, engine-out operating speed with flaps up, best lift-to-drag ratio speed, also corresponds to final takeoff speed.

Abbreviations

Abbreviation	Term
A.ICE	Anti-ice, Anti-icing
A/BRK	Autobrake Aircraft
A/THR	Autothrust
ABV	Above
ACARS	Aircraft Communication Addressing and
ACAS	Airborne Collision Avoidance System
ACCEL	Acceleration/Accelerate
ACCU	Accumulator
ACFT	Aircraft
ACK	Acknowledge
ACP	Audio Control Panel
ACQ	Acquire
ACQN	Acquisition
ACT	Active
ADD	Addition, Additional
ADF	Automatic Direction Finder
ADIRS	Air Data/Inertial Reference System
ADIRU	Air Data/Inertial Reference Unit
ADR	Air Data Reference
ADS	Air Data System
ADV	Advisory
AESS	Aircraft Environment Surveillance System

Abbreviation	Term
AESU	Aircraft Environment Surveillance Unit
AEVC	Avionics Equipment Ventilation Computer
AFFIRM	Affirmative
AFIS	Airline In Flight Information System
AFM	Aircraft Flight Manual
AFS	Automatic Flight System
AFTR	After
AGL	Above Ground Level
AGS	Air Generation System
AGU	Air Generation Unit
AGW	Actual Gross Weight
AI	Anti-Icing
AIDS	Aircraft Integrated Data System
AIL	Aileron
AIRCOND	Air Conditioning
AIS	Audio Integrated System
AIS	Aeronautical Information Service
ALIGN	Alignment
ALLWD	Allowed
ALPHA	Angle-of-Attack
ALPHANUM	Alphanumerical
ALS	Approach Light System

Abbreviation	Term
ALT	Altitude
ALT ACQ	Altitude Acquire
ALT TO	Alternate To
ALTM	Altimeter
ALTN	Alternate, Alternative
AMB	Ambient
AMP	Ampere
ANN	Annunciator
ANN LT	Annunciator Light
AOA	Angle Of Attack
AOC	Airline Operational Control
AOG	Aircraft On Ground
AP	Autopilot
AP/FD	Autopilot/Flight Director
APPR	Approach
APPROX	Approximately
APU	Auxiliary Power Unit
APU AFE	APU Automatic Fire Extinguishing Control Unit
ARMD	Armed
ARMG	Arming
ARND	Around
ARPT	Airport

Abbreviation	Term
ARR	Arrival, Arriving
AS	Airspeed
ASD	Accelerate Stop Distance
ASI	Airspeed Indicator
ASP	Audio Selector Panel
ASSY	Assembly
ASYM	Asymmetric(al)
AT	Autothrottle / Autothrust
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATCI	Air Traffic Control and Information
ATCK	Attack
ATIS	Automatic Terminal Information Service
ATS	Autothrottle / Autothrust System
ATSU	Air Traffic Service Unit
ATT	Attitude
AUTOLAND	Automatic Landing
AVAIL	Available
AVAIL	Availability
AVG	Average
AVIONICS	Aviation Electronics
AVNCS	Avionics

Abbreviation	Term
AWY	Airway
B	Blue
B/C	Business Class
BARO	Barometric
BAT	Battery (Electrical)
BCF	Brake Cooling Fan
BCN	Beacon
BCS	Brake Control System
BCU	Brake Control Unit
BETW	Between
BEW	Basic Empty Weight
BKUP	Backup
BL	Bleed
BLK	Block
BLK	Black
BLW	Below
BM	Beam
BRDG	Bridge
BRG	Bearing
BRK	Brake
BRKNG	Braking
BRKR	Breaker

Abbreviation	Term
BRKS	Brakes
BRKT	Bracket
BRT	Bright, Brightness
BT	Bus Tie
BTL	Bottle
BTN	Button
BU	Battery Unit
BUS	Busbar
BYP	Bypass
C	Celsius, Centigrade
C/B	Circuit Breaker
C/L	Check List
C/M	Crew Member
CAB	Cabin
CAB PRESS	Cabin Pressurization
CAPT	Captain
CAS	Collision Avoidance System
CAT	Category
CAUT	Caution
CAUT LT	Caution Light
CFDS	Centralized Fault Display System
CHAS	Chassis

Abbreviation	Term
CHG	Change
CHK	Check
CHM	Chime
CIDS	Cabin Intercommunication Data System
CK	Check
CKD	Checked
CKPT	Cockpit
CL	Climb
CLB	Climb
CLG	Ceiling
CLK	Clock
CLR	Clear
CLR ALT	Clearance Altitude
CLRD	Cleared
CLRNC	Clearance
CLSD	Closed
CLSG	Closing
CM	Centimeters
CMD	Command
CNCT	Connect
CNCTD	Connected
CNTOR	Contactor

Abbreviation	Term
CNTR	Counter
CO	Company
CO RTE	Company Route
COM	Communication
COMP	Compass
COND	Condition
CONT	Continue, Continuous
COOL	Cooling
CORR	Correct
COUNT	Counter
CPT	Capture
CRG	Cargo
CRK	Crank
CRZ	Cruise
CSL	Console
CSTR	Constraint
CTK	Center Tank
CTL	Control
CTL	Central
CTLR	Controller
CU	Control Unit
CUR	Current

Abbreviation	Term
CW	Clockwise
CY	Cycle
DAC	Digital to Analog Converter
DADC	Digital Air Data Computer
DADS	Digital Air Data System
DAMP	Damping
DAU	Data Acquisition Unit
DB	Decibel
DB	Data Base
dB	Decibel
DB	Database
dB(A)	A-Weighted Decibel
DC	Direct Current
DCDU	Datalink Control and Display Unit
DCP	Display Control Panel
DECEL	Decelerate
DEG	Degree
DEGRADD	Degraded
DEL	Delete
DES	Descent
DEST	Destination
DET	Detection, Detector

Abbreviation	Term
DEV	Deviation
DFDAMU	Digital Flight Data Acquisition and Management Unit
DFDAU	Digital Flight Data Acquisition Unit
DFDR	Digital Flight Data Recorder
DFDRS	Digital Flight Data Recording System
DH	Decision Height
DI	Deicing
DIBU	Door Illumination Ballast Unit
DIFF	Differential
DIR	Direct, Direction, Director
DIR TO	Direct to
DISC	Disconnect, Disconnected
DISCH	Discharge, Discharged
DISCNTY	Discontinuity
DISRMD	Disarmed
DIST	Distance
DISTR	Distribute, Distribution, Distributor
DITCH	Ditching
DLK	Data Link
DLY	Delay
DMD	Demand
DME	Distance Measuring Equipment

Abbreviation	Term
DN	Down
DOW	Dry Operating Weight
DPI	Differential Pressure Indicator
DR	Door
DSPL	Display
E	East
EC	Engine Control
ECAM	Electronic Centralized Aircraft Monitoring
ECM	Engine Condition Monitoring
ECS	Environmental Control System
ECU	Electronic Control Unit
EE	Electrical and Electronic
EEC	Electronic Engine Control
EFCC	Electronic Flight Control Computer
EFCS	Electrical Flight Control System
EFCU	Electrical Flight Control Unit
EFIS	Electronic Flight Information System
ELAC	Elevator Aileron Computer
ELAPS	Elapsed Time
ELEC	Electric, Electrical, Electricity
ELEV	Elevator
ELS	Emergency Lighting System

Abbreviation	Term
ELT	Emergency Locator Transmitter
ELV	Elevation
EMER	Emergency
EMLS	Emergency Lighting System
ENG	Engine
ENG OUT	Engine Out
ENT	Entry
ENV	Envelope
EO	Engine Out
EO ACCEL ALT	Engine Out Acceleration Altitude
EPU	Emergency Power Unit
ERR	Error
ERS	Erase
ESC	Escape
ESD	Electronic System Display
EST	Estimated
ET	Elapsed Time
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETE	Estimated Time En Route
ETO	Estimated Time Over
ETOPS	Extended Range Twin Engined Aircraft Operations

Abbreviation	Term
ETT	Estimated Time for Takeoff
EVAC	Evacuation
EWD	Engine/Warning Display
EWS	Electronic Warning System
EXT	Extend, Extension
F	Fuel
F	Fahrenheit
F	Minimum Flap Retract Speed (EFIS)
F/CTL	Flight Controls
F/O	First Officer
F/S	Fast/Slow
F/W	Failure Warning
FAA	Federal Aviation Administration
FAC	Flight Augmentation Computer
FACS	Flight Augmentation Computer System
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAIL	Failed, Failure
FAWP	Final Approach Waypoint
FBW	Fly-by-wire
FCC	Flight Control Computer
FCCS	Flight Control Computer System

Abbreviation	Term
FCCU	Flight Control Computer Unit
FCGU	Flight Control and Guidance Unit
FCMC	Fuel Control and Monitoring Computer
FCMS	Fuel Control Monitoring System
FCOM	Flight Crew Operating Manual
FCPC	Flight Control Primary Computer
FCPI	Flight Control Position Indicator
FCST	Forecast
FCTN	Function
FCU	Flight Control Unit
FD	Flight Director
FDR	Flight Data Recorder
FDU	Fire Detection Unit
FE	Flight Envelope
FEC	Flight Envelope Computer
FES	Fire Extinguishing System
FF	Fuel Flow
FG	Flight Guidance
FGES	Flight Guidance and Envelope System
FGS	Flight Guidance System
FL	Flight Level
FLDK	Flight Deck

Abbreviation	Term
FLEX	Flexible
FLP	Flap
FLT	Flight
FLT CTL	Flight Control
FM	Flight Management
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMCS	Flight Management Computer System (FMC and CDU)
FMCU	Flight Management Computer Unit
FMGC	Flight Management and Guidance Computer
FMGEC	Flight Management Guidance and Envelope Computer
FMGES	Flight Management Guidance and Envelope System
FMGS	Flight Management and Guidance System
FMS	Flight Management System (FMCS and AFS sensors)
FNA	Final Approach
FNCP	Flight Navigation Control Panel
FNSG	Flight Navigation Symbol Generator
FOB	Fuel On Board
FPA	Flight Path Angle
FPL	Flight Plan
F-PLN	Flight Plan
FPM	Feet per Minute

Abbreviation	Term
FREQ	Frequency
ft	Feet, Foot
ft/mn	Feet per Minute
FTK	Fuel Tank
FU	Fuel Used
FUSLG	Fuselage
FWC	Flight Warning Computer
FWD	Forward
FWS	Flight Warning System
FWSD	Flight Warning and System Display
G	Green
g	Gram
G/S	Glide Slope
GA	Go-Around
GDNC	Guidance
GEN	Generator
GLS	GNSS Landing System
GMT	Greenwich Mean Time
GND	Ground
GNSS	Global Navigation Satellite System
GP	Glide Path
GPCU	Ground Power Control Unit

Abbreviation	Term
GPS	Global Positioning System
GPU	Ground Power Unit
GPWC	Ground Proximity Warning Computer
GPWS	Ground Proximity Warning System
GR	Gear
GS	Ground Speed
GSHLD	Glareshield
GW	Gross Weight
GYRO	Gyroscope
H	Hot (Electrical Point)
h	Hour
h	Height
H NAV	Horizontal Navigation
HCU	Hydraulic Control Unit
HDG	Heading
HDG/S	Heading Selected
HI	High
HLD	Hold
HOLD	Holding
HP	High Pressure
Hpa	Hecto Pascal
HPA	High Power Amplifier

Abbreviation	Term
HR	Hour
HRS	Hours
HSI	Horizontal Situation Indicator
HUD	Head Up Display
HYD	Hydraulic
HZ	Hertz
I/P	Intercept Point
IAF	Initial Approach Fix
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IDENT	Identification, Identifier, Identify
IF	Initial Fix
IFR	Instrument Flight Rules
IGN	Ignition
ILS	Instrument Landing System (LOC and G/S)
IM	Inner Marker
IMU	Inertial Measurement Unit
in	Inch
IN	Inch
IN HG	Inches of Mercury
INA	Initial Approach
INB	Inbound

Abbreviation	Term
INBD	Inboard
INCR	Increase
INCR	Increment
IND	Indicator
INFO	Information
INHI	Inhibit
INHIB	Inhibit, Inhibited, Inhibition
INIT	Initial(ization)
INOP	Inoperative
INS	Inertial Navigation System
INST	Instrument
INTCP	Intercept
INTERCOM	Intercommunication
INV	Inverter
IPDU	Ice Protection Data Unit
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	Inertial Sensor Assembly
ISO	International Standardization Organisation
JEP	Jeppesen
kg	Kilogram
kg/m^3	Kilograms/Cubic Meter

Abbreviation	Term
KHZ	Kilohertz
KIAS	Knots Indicated Airspeed
kPa	Kilo Pascal
KT	Knot(s)
KV	Kilo Volt
KVA	Kilovolt Ampere
kW	Kilowatt
L	Length
L	Litre or Liter
L	Left
L ECAM DU	Left ECAM Display Unit
L/D	Lift/Drag
L/G	Landing Gear
LAND	Landing
LAT	Lateral
LAT	Latitude
LAV	Lavatory
lb	Pound
LB	Pounds
lbf/in^2	Pounds force per square inch
LB-FT	Pound - Force - Foot (Torque)
LB-IN	Pound - Inch

Abbreviation	Term
LCD	Liquid Crystal Display
LCH	Latch
LD	Load
LDG	Landing
LDG GR	Landing Gear
LED	Light Emitting Diode
LGERS	Landing Gear Extension and Retraction System
LGMS	Landing Gear Management System
LH	Left Hand
LIM	Limit, Limitation, Limiting, Limiter
LKD	Locked
LO	Low
LO PR	Low Pressure
LOC	Localizer
LP	Low Pressure
LP VALVE	Low Pressure Valve
LS	Landing System
LT	Light
LTD	Limited
LTG	Lighting
LTS	Lights
LVL	Level

Abbreviation	Term
LVL/CH	Level Change
LVR	Lever
LW	Landing Weight
LWR	Lower
M	Maneuvering Speed (EFIS)
M	Magenta
m	Meter
M	Mode
M	Mach Number
M	Mach
MA	Milli-Ampere
MAG	Magnetic
MAINT	Maintenance
MAN	Manual
MAX	Maximum
MAX CLB	Maximum Climb
MAX DES	Maximum Descent
MB	Millibars
mbar	Millibar
MCDU	Multipurpose Control & Display Unit
MCT	Maximum Continuous Thrust
MCU	Master Control Unit

Abbreviation	Term
MDA	Minimum Decision Altitude
MDA	Minimum Descent Altitude
MDH	Minimum Descent Height
MEA	Minimum En Route IFR Altitude
MED	Medium
MEM	Memory
MFD	Multifunction Display
MGT	Management
mile/h	Miles per Hour
MIN	Minimum
min	Minute
MIN FUEL	Minimum Fuel
MIN TIME	Minimum Time
MISC	Miscellaneous
ml	Milliliter
MLG	Main Landing Gear
MM	Middle Marker
mm	Millimeter
M_{MO}	Mach Max Operating Speed
M_{MO}	Maximum Operating Mach
Mn	Mach Number

Abbreviation	Term
MON	Monitor, Monitoring, Monitored
MRW	Maximum Ramp Weight
MSG	Message
MSTR	Master
MTO	Maximum Take-Off
MTOW	Maximum Design Takeoff Weight
MTR	Meter
MWARN	Master Warning
MWC	Master Warning Computer
MWP	Master Warning Panel
MWS	Master Warning System
MZFCG	Maximum Zero Fuel Center of Gravity
MZFW	Maximum Design Zero Fuel Weight
n	Load Factor
N	Newton
N	Normal
N	North
N/A	Not Applicable
N/P	Next Page
N/W	Nose Wheel
N/WS	Nose Wheel Steering
N1	Low Pressure Rotor Speed

Abbreviation	Term
N1	Engine Fan Speed
N1.D	N1 Descent
N2	High Pressure Rotor Speed
NAV	Navigation
NAVAID	Navigation Aid
ND	Navigation Display
NDB	Navigation Data Base
NDB	Non-Directional Radio Beacon
NDB	Non-Directional Beacon
NEG	Negative
NLG	Nose Landing Gear
NM	Nautical Mile
Nm	Moment (Newtonmeter)
NO	Normal Operation
No	Number
NORM	Normal
NOTAM	Notice to Airmen
NW	Nose Wheel
O	Open
O2	Oxygen (Symbol)
OAT	Outside Air Temperature
OEW	Operational Empty Weight

Abbreviation	Term
OFFR	Off/Reset
OFST	Offset
OK	Correct
OLW	Operational Landing Weight
OM	Outer Marker
OMS	Onboard Maintenance System
OMT	Onboard Maintenance Terminal
OP	Operational
OPP	Opposite
OPS	Operations
OPT	Optional
OPT	Optimum
OPTL	Optional
OPU	Overspeed Protection Unit
OTOW	Operational Take-Off Weight
OUT	Outlet
OUT	Output
OUTR	Outer
OVFL	Overflow
OVHD	Overhead
OVHT	Overheat
OVLD	Overload

Abbreviation	Term
OVPRESS	Overpressure
OVRD	Override
OVSP	Overspeed
OVSTEER	Oversteer
OVV	Overvoltage
OWE	Operating Weight Empty
OXY	Oxygen
OZ	Ounce
P	Pressure
P/B	Pushbutton
P/BSW	Pushbutton Switch
P/L	Payload
Pa	Pascal
PARK	Parking
PAS	Pitch Attitude Sensor
PAX	PAX Announcement Entertainment &
PAX	Passenger
Pb	Pressure Ambient
PCT	Percent
PCU	Power Control Unit
PED	Pedestal
PERF	Performance

Abbreviation	Term
PF	Pilot Flying
PFD	Primary Flight Display
PG	Page
phi	Bank Angle
phi N	Nominal Bank Angle
PHR	Pounds per Hour
PLT	Pilot
PMP	Pump
PMU	Power Management Unit
PNEU	Pneumatic
PNL	Panel
POS	Position
PPM	Parts per Million
PR	Pressure
PRB	Probe
PREV	Previous
PRGM	Program
PRI	Priority
PROC	Procedure
PROG	Progress
PSU	Power Supply Unit
PTR	Push to Reset

Abbreviation	Term
PTT	Push to Test
PTT	Push-to-Talk
PTU	Power Transfer Unit
PW	Pratt and Whitney
PWR	Power
QFE	Baro Pressure Setting for Airfield Altitude
QFE	Field Elevation Atmospheric Pressure
QFE	Pressure Setting for Airfield Altitude
QNE	Sea Level Standard Atmosphere Pressure
QNH	Baro Pressure Setting for en Route Altitude
QNH	Sea Level Atmospheric Pressure
QNH	Pressure Setting for En Route Altitude
QNH	Sea Level Pressure
R	Red
R	Radius
R	Release
R	Reset
R	Right
R/C	Rate of Climb
R/D	Rate of Descent
R/H	Radar Height
R/L	Reading Light

Abbreviation	Term
r/min	Revolutions per Minute
R/T	Receiver Transmitter Unit
R/T	Radio Transmit
RA	Resolution Advisory
RA	Radio Altimeter, Radio Altitude
RAD	Radio
RAT	Ram Air Turbine
RCDR	Recorder
RCLM	Runway Center Line Marking
RCLS	Runway Center Line Light System
RCVR	Receiver
RCVY	Recovery
RDY	Ready
RECOG	Recognition
REFLNG	Refueling
REFUEL	Refueling
RET	Retract
RET	Return
RETR	Retract
REV	Reverse
REV	Revise, Revision
RF	Radio Frequency

Abbreviation	Term
RMP	Radio Management Panel
RMU	Radio Management Unit
RNAV	Area Navigation
RNG	Range
RNI	Radio Navigation Indicator
RPLNT	Repellent
RPTG	Reporting
RQRD	Required
RR	Rolls Royce
RST	Reset
RSV	Reserve
RSVR	Reservoir
RTE	Route
RTG	Rating
RTN	Return
RTO	Rejected TakeOff
RTOLW	Runway Takeoff and Landing Weight
RTOW	Runway Takeoff Weight
RTR	Router
RTRSW	Rotary Switch
RTU	Radar Transceiver Unit
RUD	Rudder

Abbreviation	Term
RVR	Runway Visual Range
RVS	Reverse
RVSN	Reversion
RWY	Runway
S	South
S	Minimum Slat Retract Speed (EFIS)
s	Second
S/C S/D	Step Climb Step Descent
SAT	Static Air Temperature
SATCOM	Satellite Communication
SBL	Symbol
SC	Single Chime
SD	System Display
SEAL	Sealing
SEC	Spoiler Elevator Computer
SEC	Secondary
SEC	Secondary Computer
SEG	Segment
SEL	Select, Selected, Selector, Selection
SELCAL	Selective Calling System
SEQ	Sequence, Sequential
SER	Serial Number

Abbreviation	Term
SER	Serial
SGU	Symbol Generator Unit
SHT	Short
SI	Slip Indicator
SID	Standard Instrument Departure
SIG	Signal
SIM	Simulation
SL	Sea Level
SLT	Slat
SMK	Smoke
SNSR	Sensor
SPAD	Scratchpad
SPD	Speed
SPD/M	Speed-Mach
SPEC	Specification
SPLR	Spoiler
SPLY	Supply
SRS	Speed Reference System
STAB	Stabilizer
STAR	Standard Terminal Arrival Route
STARTG	Starting
STAT	Static

Abbreviation	Term
STBY	Standby
STDY	Steady
STRG	Steering
STRUCT	Structure
STS	Status
SURF	Surface
SVCE	Service
SW	Switch
SYS	System
T	True
T	Turn
T	Trim
T	Time
t	Tonne
T/C	Top of Climb
T/D	Top of Descent
T/R	Thrust Reverser
TA	Traffic Advisory
TACAN	Ultra-high Frequency Tactical Air Navigation Aid
TACH	Tachometer
TAS	True Airspeed
TAT	Total Air Temperature

Abbreviation	Term
TBC	To Be Confirmed
TBU	Time Base Unit
TBV	Transient Bleed Valve
TC	Takeoff Charts
TCAS	Traffic Alert and Collision Avoidance System
TEMP	Temperature
TGT	Target
THR	Thrust
THROT	Throttle
THS	Trimmable Horizontal Stabilizer
TK	Ground Track Angle
TK	Tank
TKE	Track Angle Error
TLA	Throttle Lever Angle
TMA	Terminal Control Area
TMR	Timer
TO	Takeoff
TO/APPR	Takeoff/Approach
TOD	Takeoff Distance
TOGA	Takeoff/Go Around
TOGW	Takeoff Gross Weight
TOR	Takeoff Run

Abbreviation	Term
TOT	Total
TOW	Takeoff Weight
TOW	Towing
TR	Thrust Reverser
TRANS	Transition
TRANSF	Transfer
TRGT	Target
TRIG	Trigger
TRK	Track
TRK	Track (angle)
TROPO	Tropopause
TRT	Turn Round Time
TRU	True
TST	Test
TT	Total Time
TURB	Turbine
TWR	Tower
TWY	Taxiway
TX	Transmission (TCAS to Transponder)
TYP	Typical
UHF	Ultra High Frequency
V	Volt, Voltage

Abbreviation	Term
V	Valve
V/L	VOR/LOC
V/L	VOR/Localizer
V/S V1 V1 V2	Vertical Speed
V2min	Critical Engine Failure Speed Decision Speed
VACU	Vacuum
VCTREND	Airspeed Tendency
VDF	Very High Frequency Direction Finding Station
VDR	VHF Data Radio
VEL	Velocity
VERT	Vertical
VFR	Visual Flight Rules
VHF	Very High Frequency
VHV	Very High Voltage
VIB	Vibration
VLF	Very Low Frequency
VOL	Volume
VOR	Very High Frequency Omnirange Station
VOR.D	VOR-DME
VORTAC	Visual Omni-Range Tactical Air Navigation
VSI	Vertical Speed Indicator
W	Weight

Abbreviation	Term
W	Watt
W	West
W/V	Wind Direction and Speed
WAI	Wing Anti-Ice
WARN	Warning
WB	Wide Body
WD	Warning Display
WDO	Window
WG	Wing
WHL	Wheel
WR	Weather Radar
WS	Wind Speed
WT	Weight
WX	Weather Mode (ND)
WXR	Weather Radar
X	Cross
X	Trans Crossbleed
X BLEED X FEED	Crossfeed
X LINE	Crossline
X VALVE	Cross Valve
XFR	Transfer
XING	Crossing

Abbreviation	Term
XPDR	Transponder
XPNDR	Transponder
X-TALK	Cross-talk
XWIND	Crosswind
Y	Yellow
Y/C	Economy Class
YCR	Economy Class-Rear
YE	Year
Z	Greenwich Mean Time
ZC	Zone Controller
ZFCG	Zero Fuel Center of Gravity
ZFW	Zero Fuel Weight
Zp	Pressure Altitude
Zpi	Indicated Pressure Altitude

Last update: January 10, 2022

1.3 Advanced Guides

1.3.1 Overview

Welcome to the A32NX Advanced Guides.

This is a collection of guides and tutorials for real A320 features which go beyond the scope of our beginner guide. This collection will grow over time as we add topics and also add features to the A32NX add-on.

Each page was reviewed by an A320 type rated pilot and provides accurate information to aircraft operation.

Airline SOP

Please be aware that different airlines may have slightly different procedures at different stages of flight.

For Simulation Use Only

Important Pages

A.FLOOR

Topics:

Quick Links

Flight Phases

Flight Planning

Flight Guidance

Protections

If you have any issues or feedback with this guide, please file an issue here:

- FBW Docs Issues

For general questions please visit our Discord:

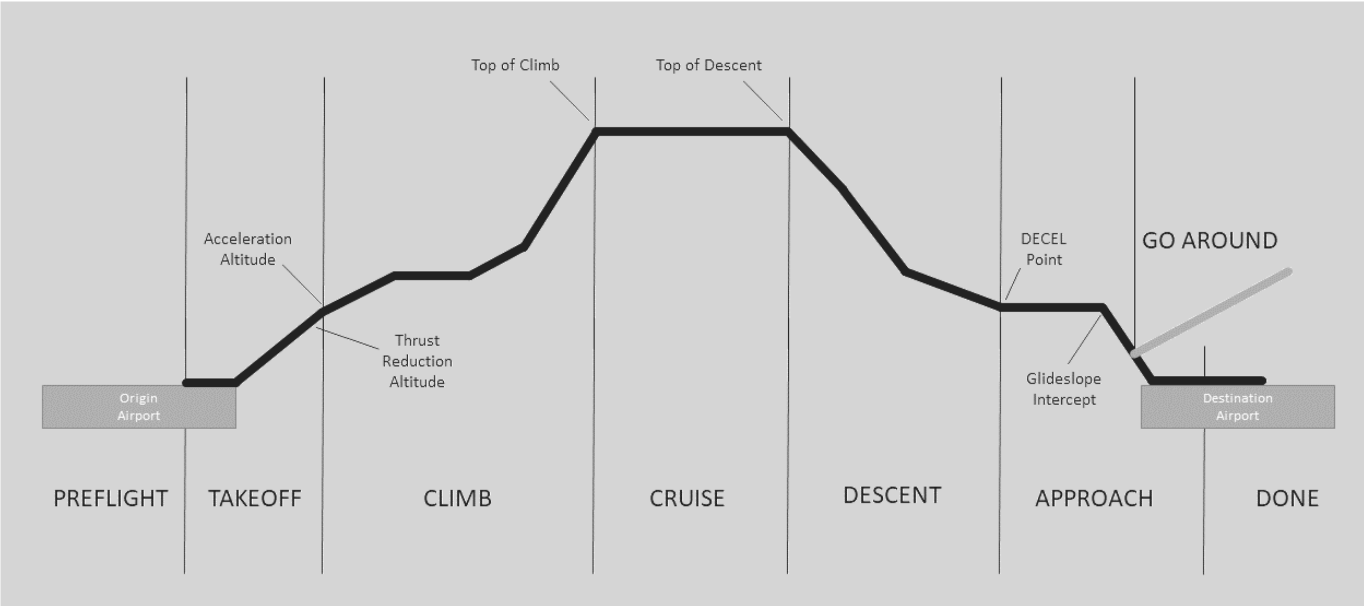
- Discord Link

Last update: February 23, 2022

1.3.2 Flight Phases

The A320 flight management system defines a set of flight phases each flight will sequence through.

It is important to understand these flight phases as they have an impact on planning a flight as well as on the lateral and vertical guidance of the aircraft.



The most prominent place where these phases become visible are the MCDU PERF pages where all phases, apart from PREFLIGHT and DONE, have their own page.

PREFLIGHT Phase

During the PREFLIGHT phase the pilot initializes the Flight Management Guidance Computer (FMGC) and sets up various systems in the aircraft.

Flight planning and performance planning happen during this phase.

TAKEOFF Phase

The TAKEOFF phase starts when applying take off thrust (FLX or TOGA) and extends until reaching the acceleration altitude.

Autopilot can be engaged at 100ft above ground or 5 seconds ofter takeoff, whichever is later.

At thrust reduction altitude the thrust levers are normally set in the climb thurst detent (CL detent). The FMGC is in managed mode at this point guiding the aircraft vertically and laterally along the flight plan.

CLIMB Phase

The CLIMB phase extends from the acceleration altitude to the top of climb (ToC) cruise flight level (displayed and modifiable on the MCDU PROG page).

The FMS guides the aircraft and commands acceleration when above the terminal area speed restriction altitude.

The system observes speed/altitude constraints that have been entered in the flight plan.

When all managed modes have been selected and confirmed, the FMS gives speed, altitude, and lateral guidance during climb.

CRUISE Phase

The CRUISE phase extends from the top of climb (ToC) point to the top of descent (ToD) point.

It may also includes intermediate climbs as well as en route descents. At anytime, the pilot can define a step climb to determine the cost and time savings of flying at a different flight level. Step climbs and descents are entered on the MCDU STEP ALTS page which is accessed from a VERT REV page or from the MCDU F-PLN page A.

The FMS transitions to the descent phase when a subsequent descent is initiated within 200 NM of the destination and no preplanned step descent exists in front of the aircraft.

DESCENT Phase

The DESCENT phase starts at the top--of--descent point (which is less than 200 NM from destination) by pushing the ALT knob for a managed descent or pulling the ALT knob for an open or selected descent from the cruise altitude.

The pilot is required to confirm and initiate all descents from cruise altitude by pushing or pulling the ALT knob on the FCU. The managed descent does not occur until the pilot initiates the descent following clearance from ATC.

APPROACH Phase

The APPROACH phase starts when the pilot activates and confirms the approach on the PERF descent page, or when the approach deceleration pseudo waypoint (DECEL) is passed and the aircraft is below 9500 ft AGL in managed flight.

GO-AROUND Phase

The GO-AROUND phase is activated when the thrust levers are moved to the TOGA position while in the APPROACH phase. The FMS then guides the aircraft through the missed approach procedure.

To return to the APPROACH flight phase, activate and confirm the APPROACH phase on the PERF GO-AROUND page.

DONE Phase

The DONE phase is activated after the aircraft has been on the ground for at least 30 seconds and all engines are shut down.

During the done phase, the FMS clears the active flight plan in preparation for reinitialization.

Last update: November 29, 2021

1.3.3 Flight Planning

Fix Info

Not available in the Stable Version

The MCDU FIX INFO pages are used to create waypoint intersections of the flight plan with radial, radius, and abeam intercept points associated with a waypoint.

These lines or circles are displayed on the ND and also used to compute intercept waypoints which are then added to the active flight plan.

The A32NX has implemented the display of these lines and circles on the ND.

> The computed intercept waypoints and ABEAM functionality are not yet implemented. This page will be updated as soon as these features are implemented.

Fix info is a powerful supplemental tool for pilots to improve situational awareness and easier, more precise navigation.

Common Use Cases

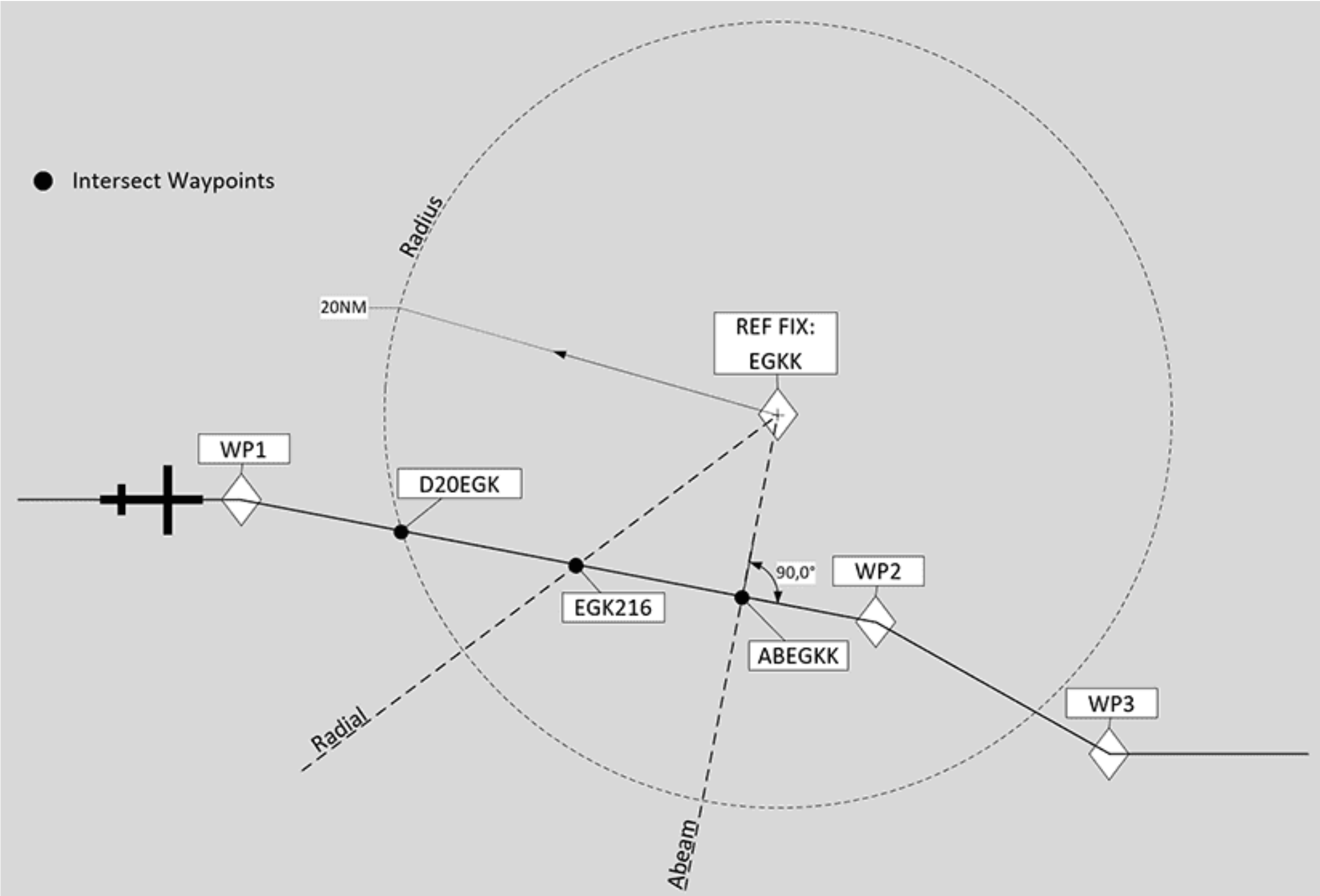
- Top of descent circle, to display the exact point on the lateral path when to start a descent into a specific fix.
- ILS localizer extension line, to easier identify where the localizer beam should be in extension from the runway.
- VOR intercepting.
- Go Around procedure aid.

Examples of FIX INFO Intercept Waypoints

In the example below we assume a flight plan route passing WP1, WP2 and WP3 with the flight route shown as a line.

A reference fix (REF FIX) named EGKK is used to show the three different methods of creating intercept waypoints.

- Radial:
    - A Radial is a line from the REF FIX at a specific angle as known from common VOR navigation.
- Radius:
    - A Radius is a circle of a certain radius around the REF FIX.
- Abeam:
    - An Abeam is a line from the REF FIX onto the flight path meeting the flight path at a 90° angle.



After entering a radial, radius or abeam the FMS calculates if an intersection with the flight path is possible and provides the option to create a waypoint into the flight plan.

> Be aware this is not implemented in the current version of the A32NX yet.

These waypoints will be named systematically with the type of interception and the REF FIX name.

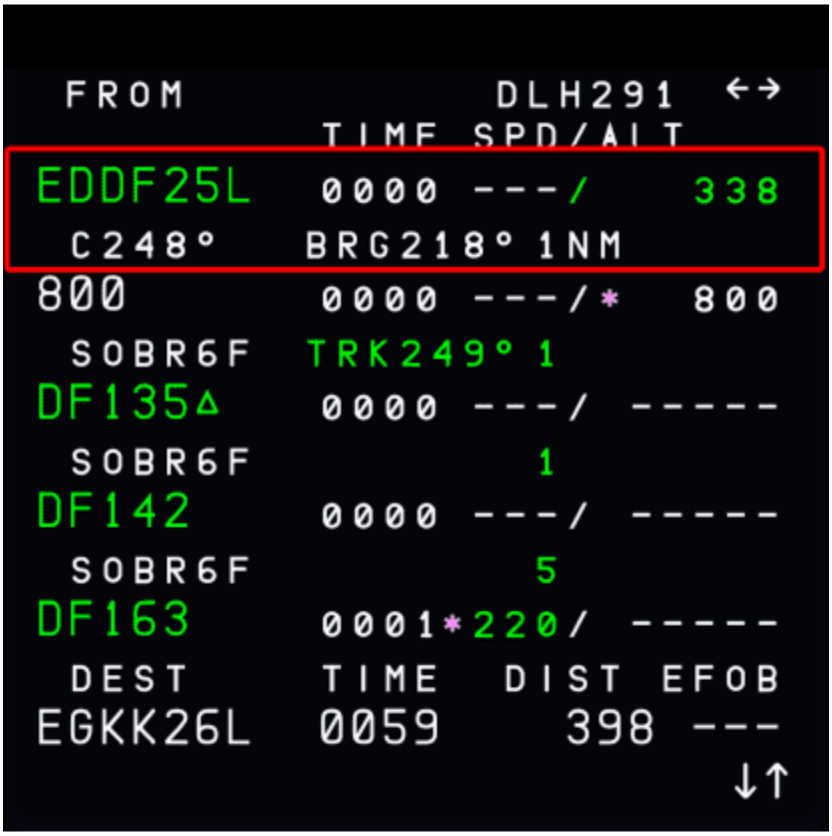
In our example we get three different intercept waypoints which can be added to the flight plan.

- D20EGK:
    - Radius intercept waypoint at the intersection of a circle with radius 20 around the REF FIX EGKK with the current flight path.
- EGK216:
    - Radial intercept waypoint at the intersection of a radial line from the REF FIX EGKK at a 240° angle.
- ABEGKK:
    - Abeam intercept waypoint at the intersection of the perpendicular line from the REF FIX EGKK onto the flight plan.

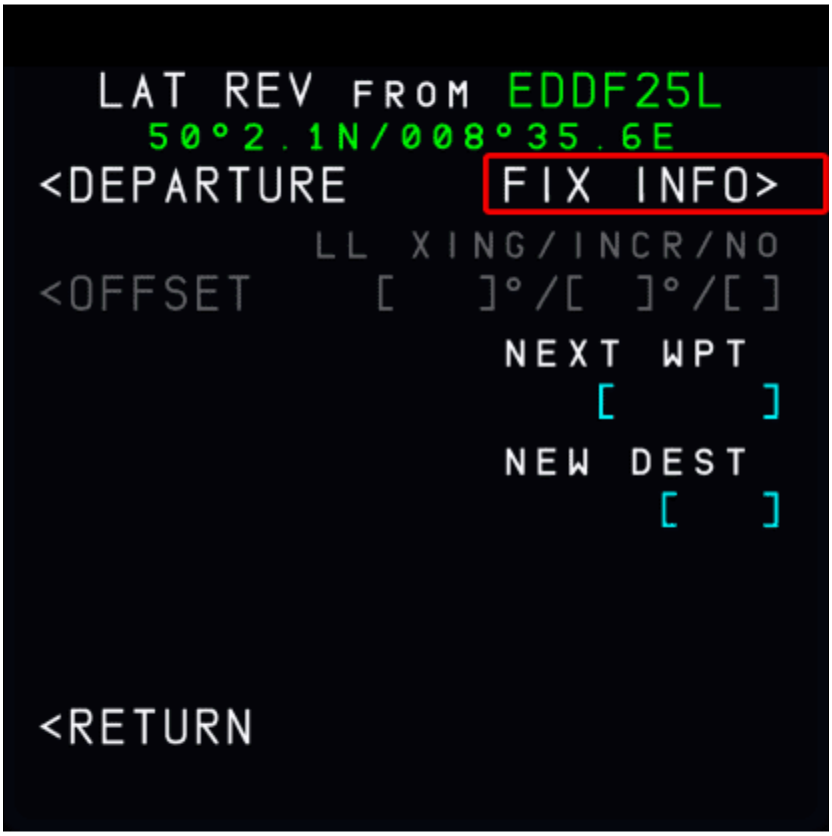
1) Where is the FIX INFO page?

You will find the option to select the FIX INFO page on the top most waypoint of your active flight plan.

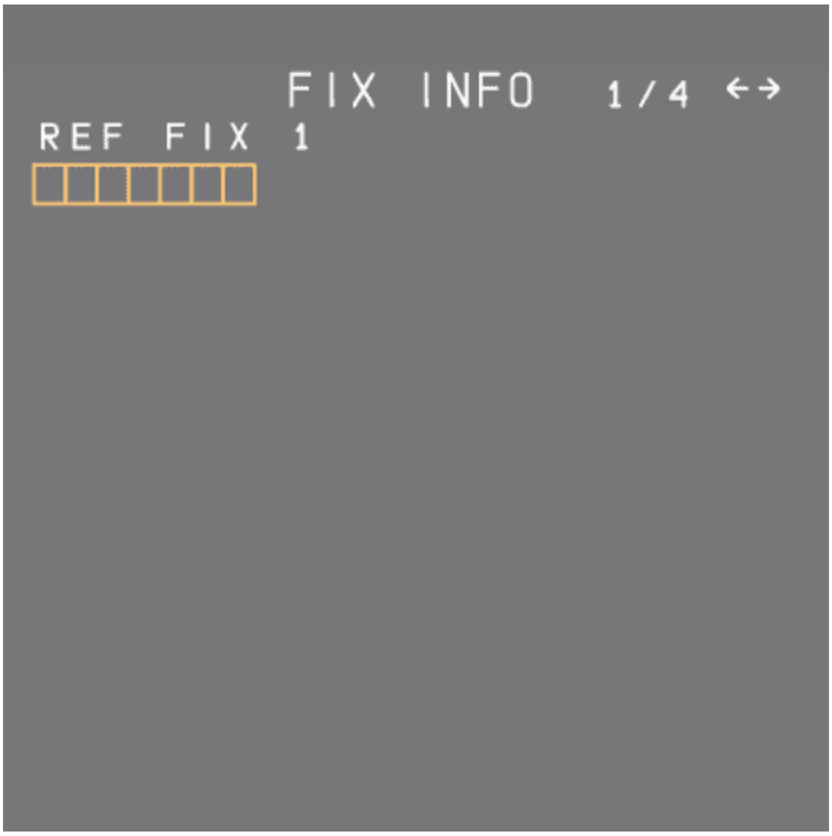
For this go to the MCDU F-PLN page and select the top most waypoint with the left LSK (line select key).



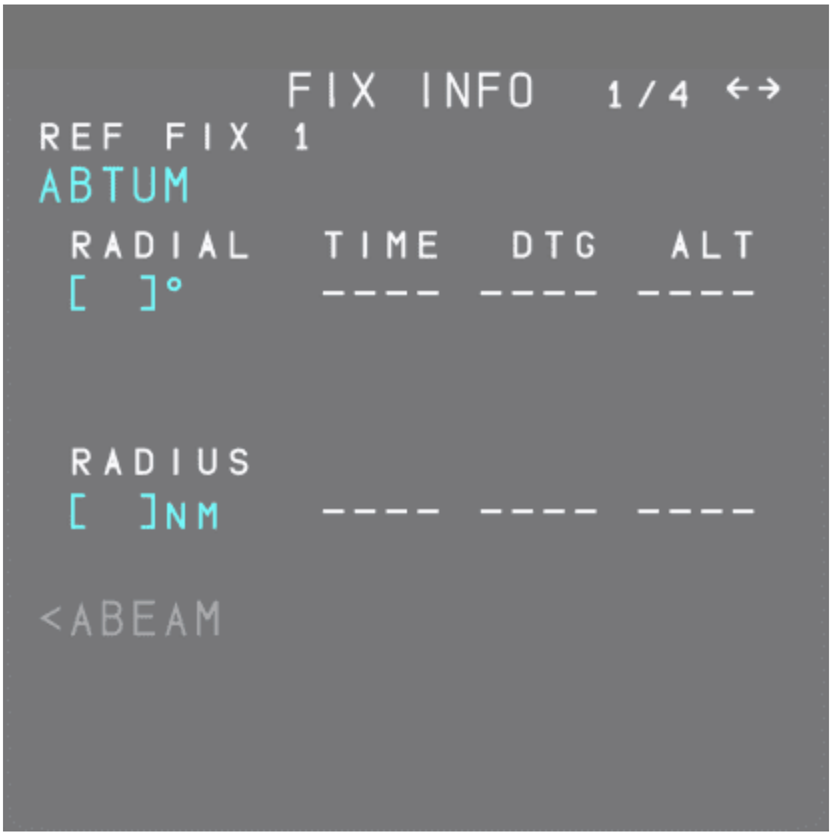
This brings up the lateral revision page for this waypoint and also displays the FIX INFO page option. Press the right LSK next to `FIX INFO`



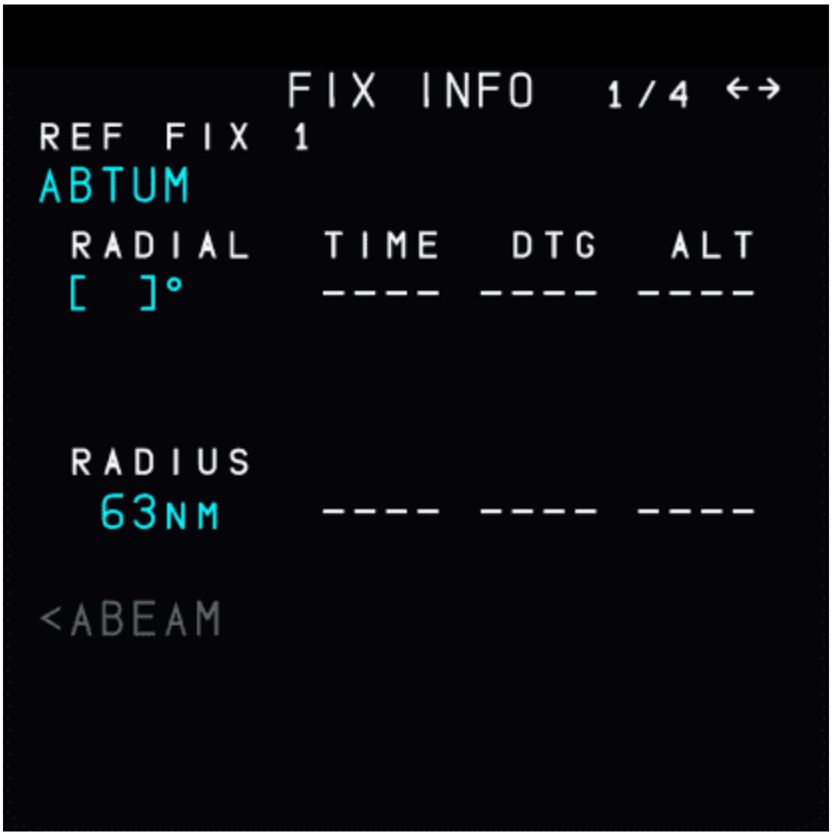
2) Enter a Navigation Fix



3) Enter Radial or Radius



With radius 63NM around the waypoint ABTUM:



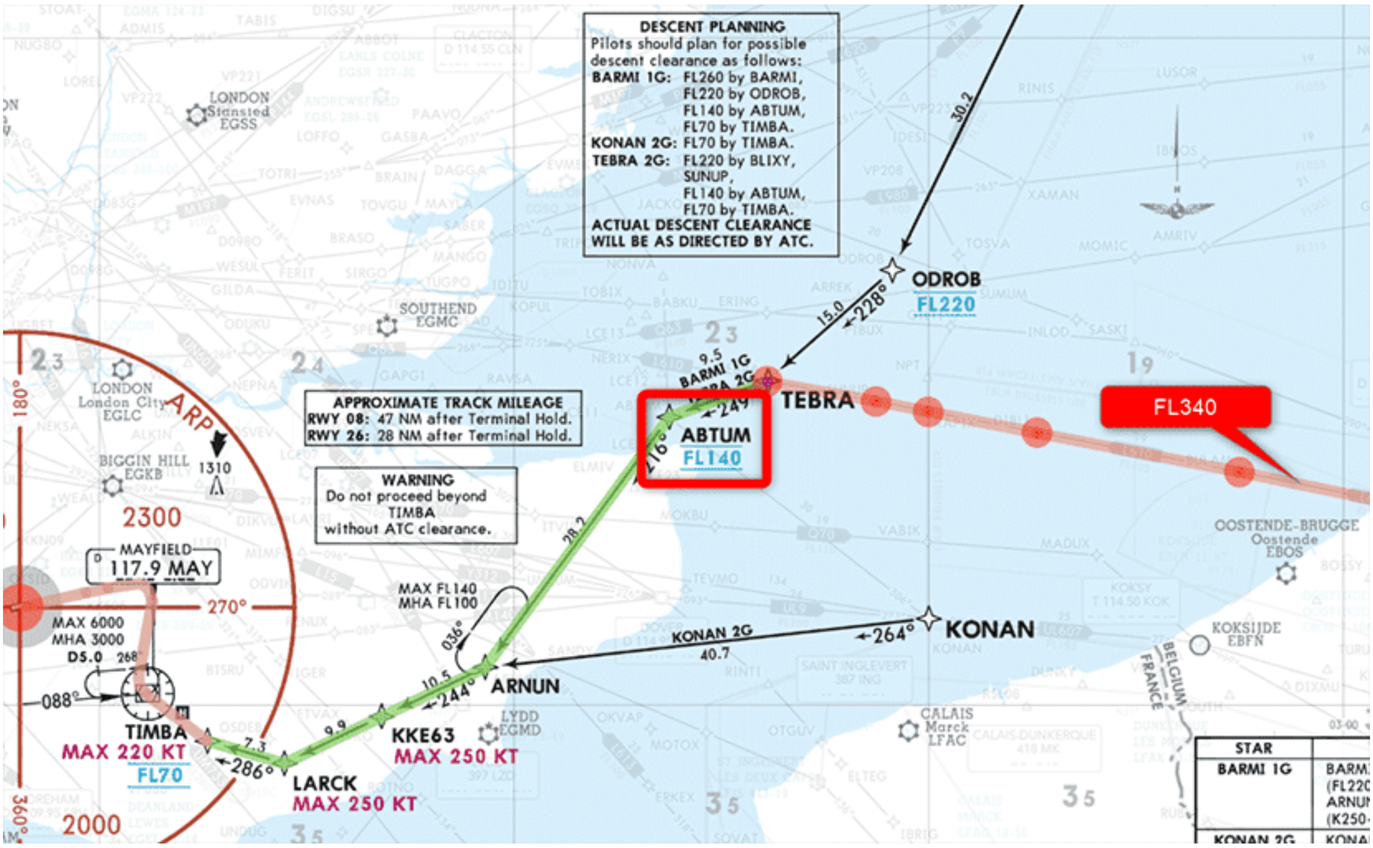
4) Additional Fix Info Pages

You can define up to 4 different fixes by selecting the horizontal slew navigation button to go to the next page.

Top of Descent Circle

FL340 with arrival TEBRA2G into Gatwick EGKK.

A descent is required at 63NM before ABTUM as calculated by the flyPad Top of Descent calculator.



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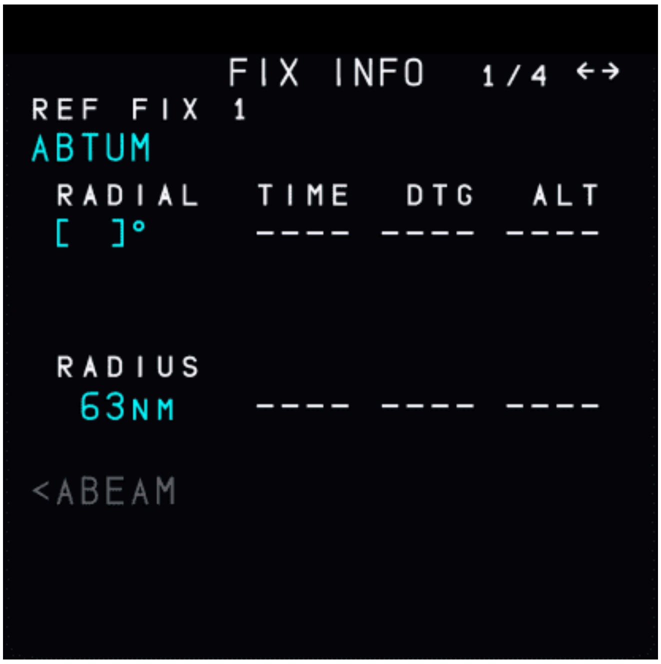
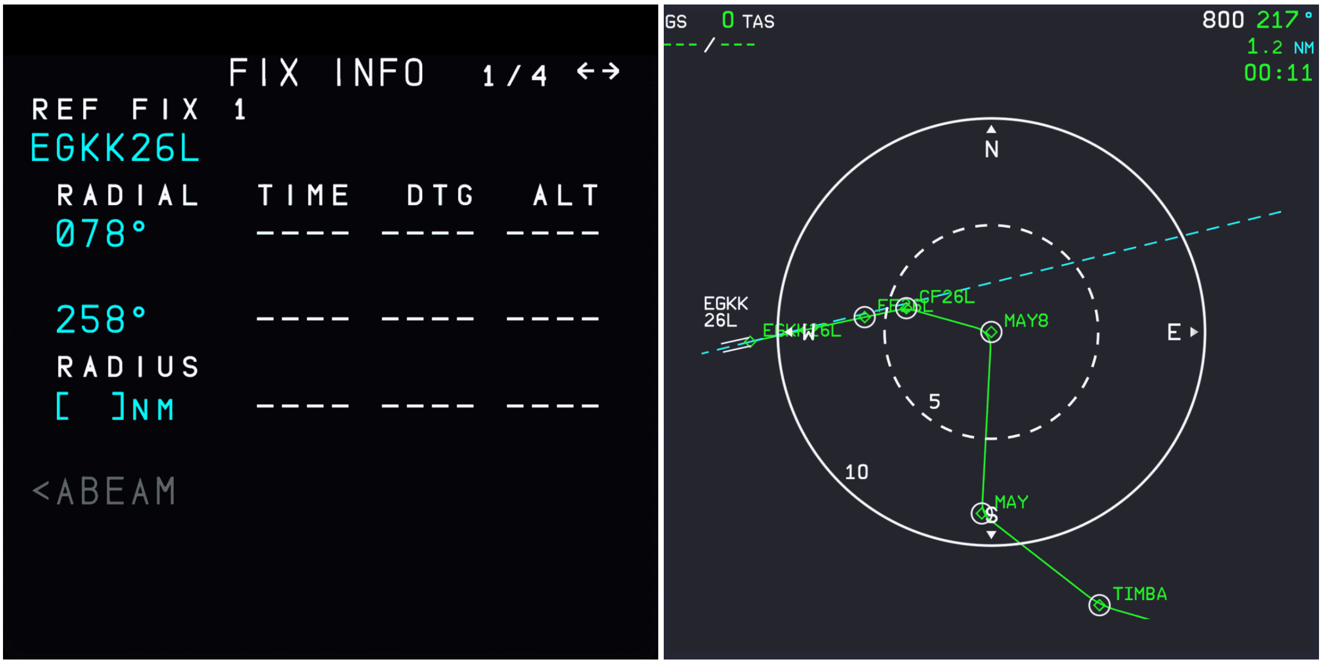
"Navigraph Charts are intended for flight simulation use only, not for navigational use."



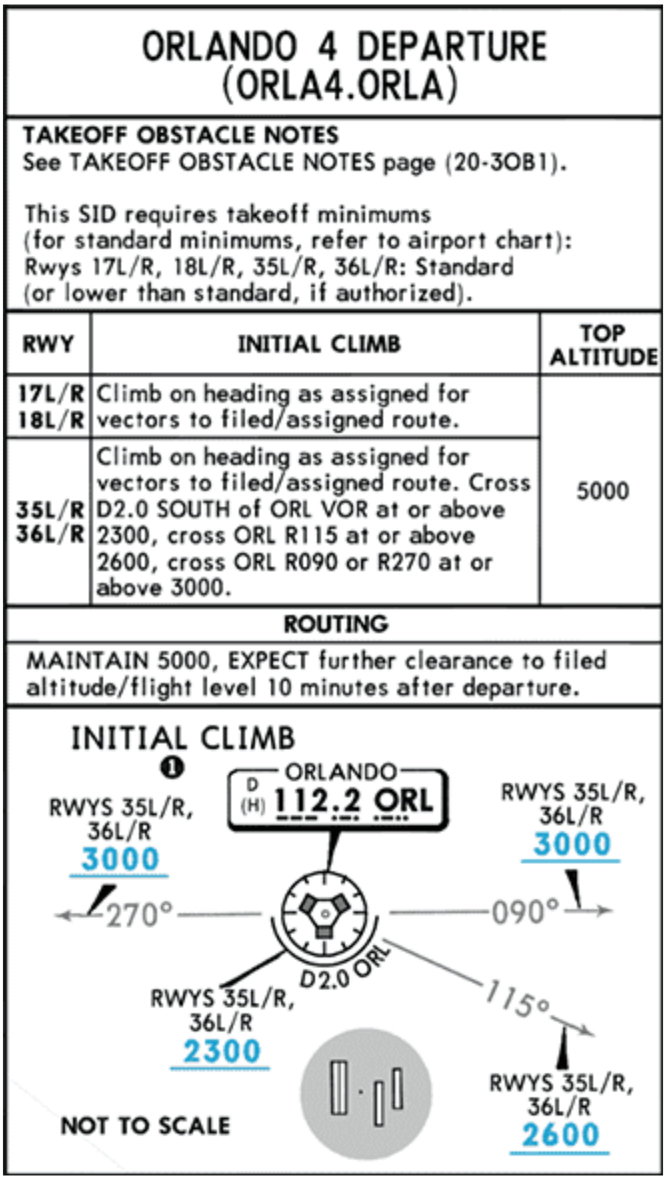
ILS Localizer Extension Line

To visualize the ILS localizer for the approach the runway fix can be used to display a radial line corresponding to the ILS track course.



VOR Intercept in SID

In this scenario we have a departure on 36R in KMCO (Orlando) with the ORLANDO 4 DEPARTURE SID (ORLA4). This departure expects ATC to assign headings after departure to intercept the filed/assigned route.



ORLANDO 4 DEPARTURE
(ORLA4.ORLA)

TAKEOFF OBSTACLE NOTES
See TAKEOFF OBSTACLE NOTES page (20-3OB1).

This SID requires takeoff minimums
(for standard minimums, refer to airport chart):
Rwys 17L/R, 18L/R, 35L/R, 36L/R: Standard
(or lower than standard, if authorized).

RWY	INITIAL CLIMB	TOP ALTITUDE
17L/R 18L/R	Climb on heading as assigned for vectors to filed/assigned route.	5000
35L/R 36L/R	Climb on heading as assigned for vectors to filed/assigned route. Cross D2.0 SOUTH of ORL VOR at or above 2300, cross ORL R115 at or above 2600, cross ORL R090 or R270 at or above 3000.	

ROUTING

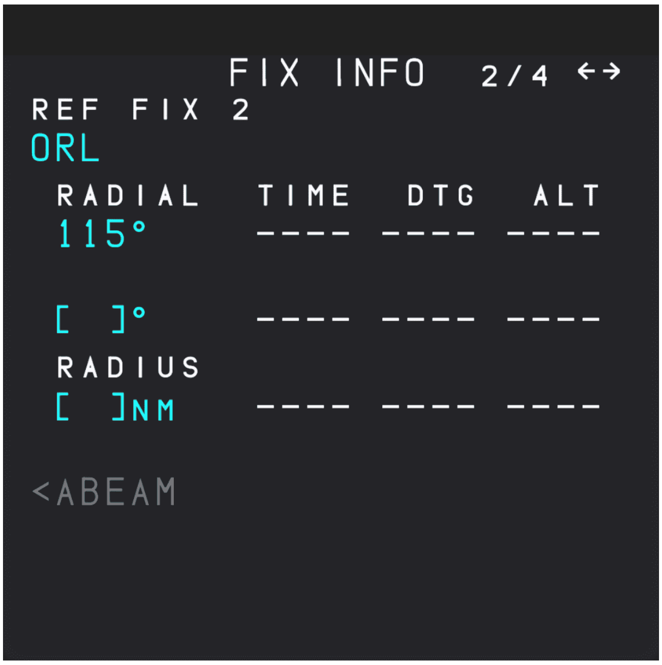
MAINTAIN 5000, EXPECT further clearance to filed altitude/flight level 10 minutes after departure.

As you can read in the Initial Climb description for 36R we need to meet certain altitudes at different positions in relation to the ORL VOR.

- Cross ORL D2.0 south of ORL at or above 2.300ft
- Cross ORL R115 at or above 2.600ft
- Cross ORL R090/R270 at or above 3.000ft

To visualize these points we can use the fix info page to define a 2NM distance circle and 2 lines for R155 and R090/270 on the ND.


FIX INFO 1/4 ←→
REF FIX 1
ORL
RADIAL TIME DTG ALT
270° ---- ---- ----
090° ---- ---- ----
RADIUS
2NM ---- ---- ----
<ABEAM


FIX INFO 2/4 ←→
REF FIX 2
ORL
RADIAL TIME DTG ALT
115° ---- ---- ----
[ ]° ---- ---- ----
RADIUS
[ ]NM ---- ---- ----
<ABEAM


GS 0 TAS
---/---
500 322°
0.5 NM
00:04
N
ORL
W
E
5
10
S


GS 0 TAS
---/---
500 322°
0.5 NM
00:04
27
28
29
30
31
32
33
34
ORL
7.5
5
KMCO
0.4R

Leg Types

Type	Supported in A32NX	Description
TF	CFMS 1.0	Track to a fix defines a great circle track over ground between two known databases fixes.
RF	CFMS 1.0	Constant Radius Arc defines a constant radius turn between two database fixes, lines tangent to the arc and a center fix.
VM	CFMS 1.0	Heading to a manual termination defines a specified heading until a Manual termination.
AF	CFMS 1.5	Arc to a fix defines a track over the ground at a specified constant distance from a database DME NAVAID.
CA	CFMS 1.5 (partially)	Course to an altitude defines a specified course to a specific altitude at an unspecified position.
CF	CFMS 1.5	Course To fix defines a specified course to a specific database fix.
CI	CFMS 1.5 (partially)	Course to an intercept defines a specified course to intercept a subsequent leg.
CR	CFMS 1.5	Course to a radial termination defines a course to a specified radial from a specific database VOR NAVAID.
DF	CFMS 1.5	Direct To fix defines an unspecified track starting from an undefined position to a specified fix.
HA, HF, HM	CFMS 1.5	Racetrack course reversal (Holds) or altitude termination (HA), single circuit terminating at the fix (base turn) (HF), or manual termination (HM) leg types define racetrack pattern or course reversals at a specified database fix.
IF	CFMS 1.5	Initial fix defines a database fix as a point in space and is only required to define the beginning of a route or procedure.
CD	Planned	Course to a DME distance defines a specified course to a specific DME distance that is from a specific database DME NAVAID.

Type	Supported in A32NX	Description
FA	Planned	Fix to an Altitude defines a specified track over the ground from a database fix to a specified altitude at an unspecified position.
FC	Planned	Track from a fix from a distance or FC leg—defines a specified track over the ground from a database fix for a specific distance.
FD	Planned	Track from a fix to a distance measuring equipment (DME) distance defines a specified track over the ground from a database fix to a specific DME distance that is from a specific database DME NAVAID.
FM	Planned	Fix to a manual termination or FM leg— defines a specified track over the ground from a database fix until manual termination of the leg.
PI	Planned	Procedure turn or PI leg—defines a course reversal starting at a specific database fix and includes outbound leg followed by a left or right turn and 180° course reversal to intercept the next leg.
VA	Planned	Heading to Altitude termination defines a specified heading to a specific altitude termination at an unspecified position.
VD	Planned	Heading to a DME distance termination defines a specified heading terminating at a specified DME distance from a specific database DME NAVAID.
VI	Planned	Heading to a Next Leg Intercept defines a specified heading to intercept the subsequent leg at an unspecified position.
VR	Planned	Heading to a radial termination defines a specified heading to a specified radial from a specific database VOR NAVAID.

Source: Instrument Procedures Handbook (IPH) - Chapter 6

Last update: February 15, 2022

Discontinuities

Discontinuities are breaks in the flight plan and often separate two flight plan sections like the SID and first in-route waypoint or the STAR and the APPR. They are also often inserted when the flight plan is modified.

There are basically two types of discontinuities:

- Discontinuities between two waypoints in the flight plan
- Discontinuities after a MANUAL leg (Manual Termination)

These discontinuities can and should be cleared from the flight plan by using the CLR key on the MCDU and selecting the LSK left of the discontinuity.

Normal Discontinuity in the MCDU F-PLN Page

If the discontinuity is not deleted and the aircraft overflies the waypoint before the discontinuity, the NAV mode automatically reverts to the HDG (TRK) mode. The pilot then needs to use DIR TO to fly to the next waypoint.

Sometimes discontinuities are also part of a procedure to indicate that manual guidance is required (mostly directed by ATC). The preceding legs are called MANUAL legs (Manual Termination leg).

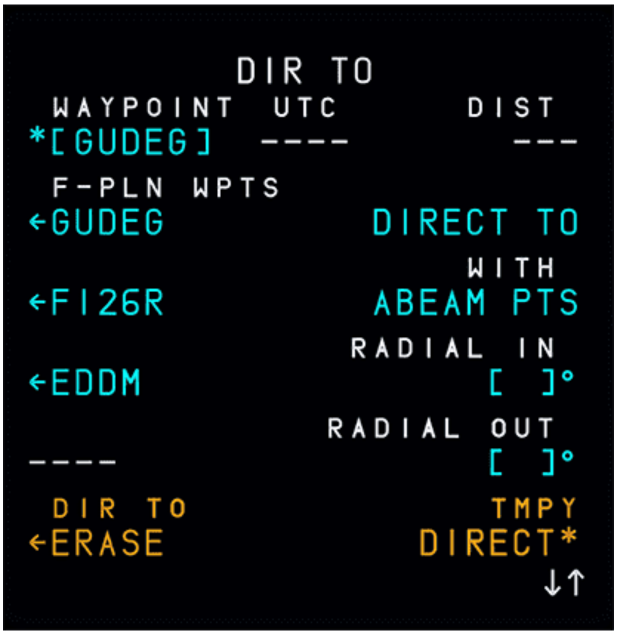
A MANUAL leg stays on a constant TRK or HDG and has no termination point.

The core principle of a MANUAL leg is that air traffic control (ATC) will give the flight crew headings (vectors) or a direct-to instruction to guide the aircraft to the planned approach path.

If no ATC is available (or when using MSFS ATC) the user must use heading mode (Selected HDG) or direct to (DIR TO) to guide the aircraft to an appropriate intercept course for the approach.

Discontinuities after MANUAL legs cannot be cleared from the flight plan.

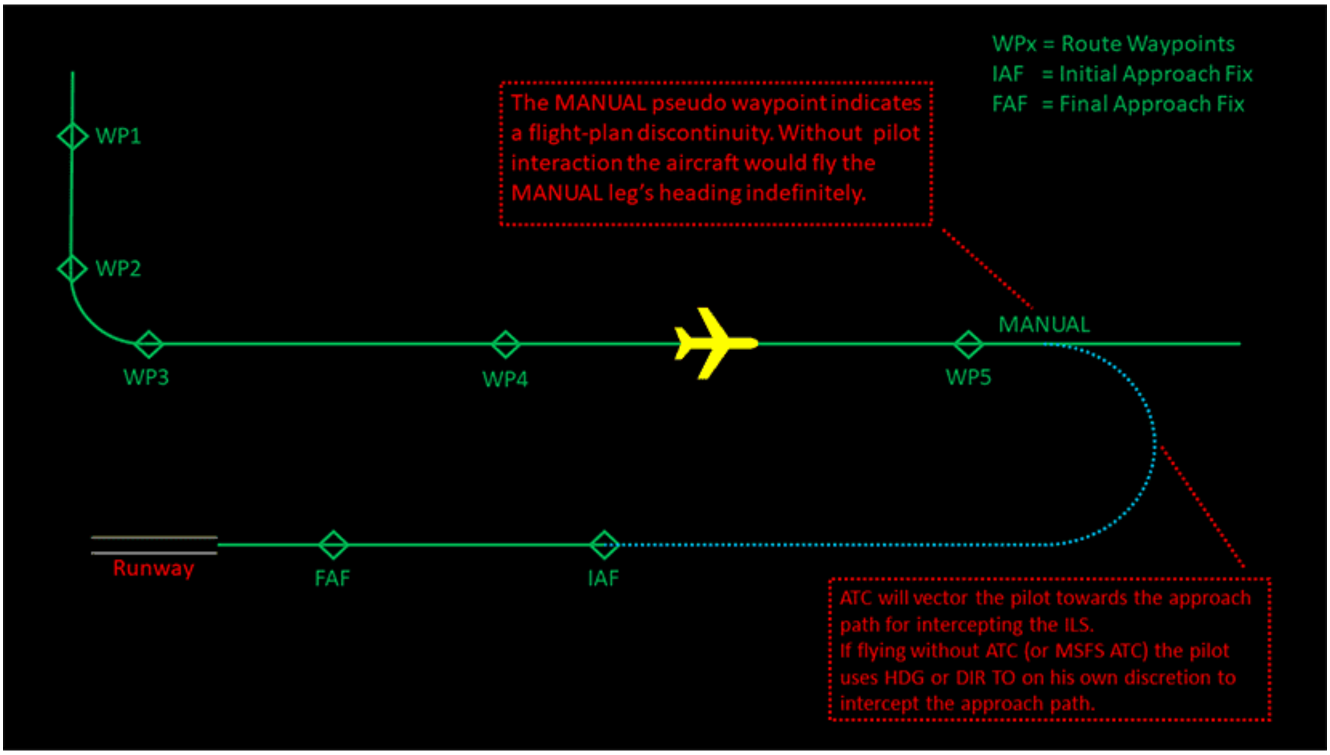
DIR TO to next waypoint or Selected HDG



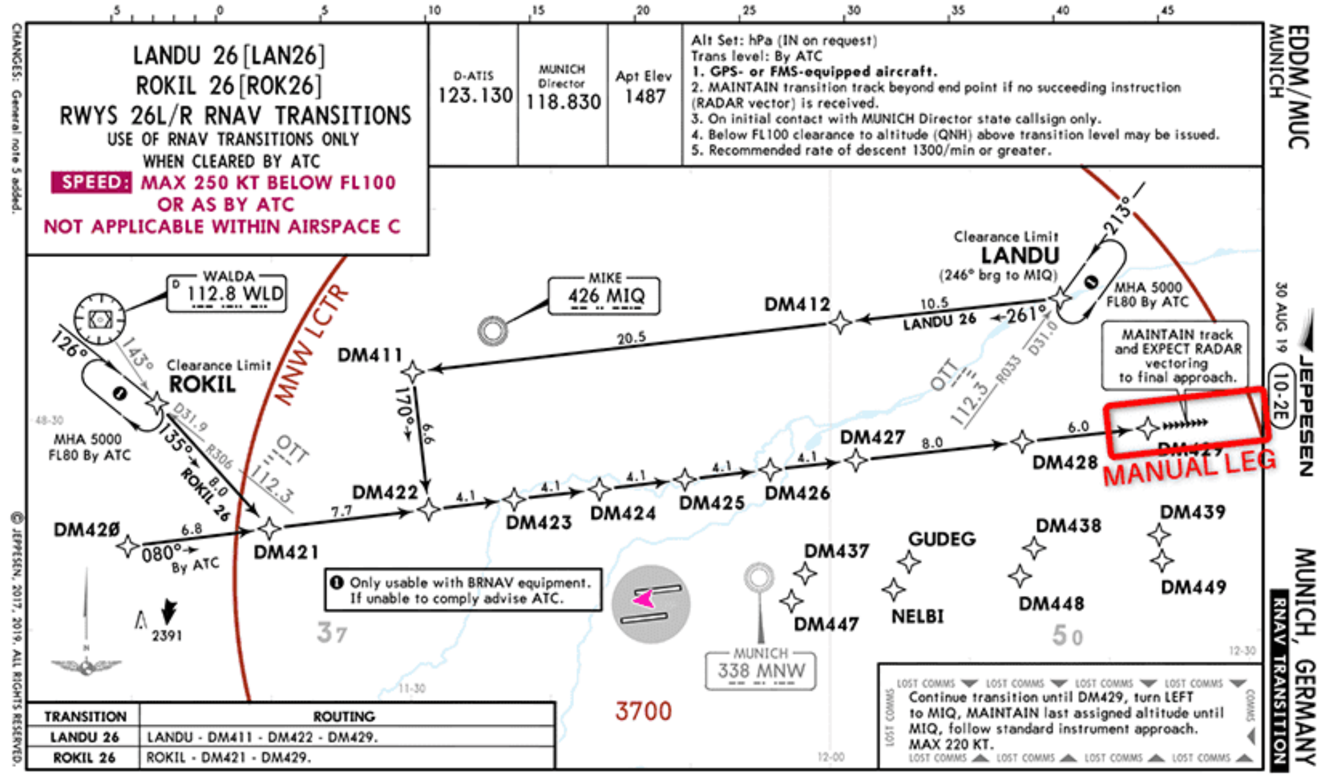
If the aircraft is flying into a MANUAL leg, NAV mode remains engaged and predictions assume that the aircraft will fly a direct leg from its present position to the next waypoint.

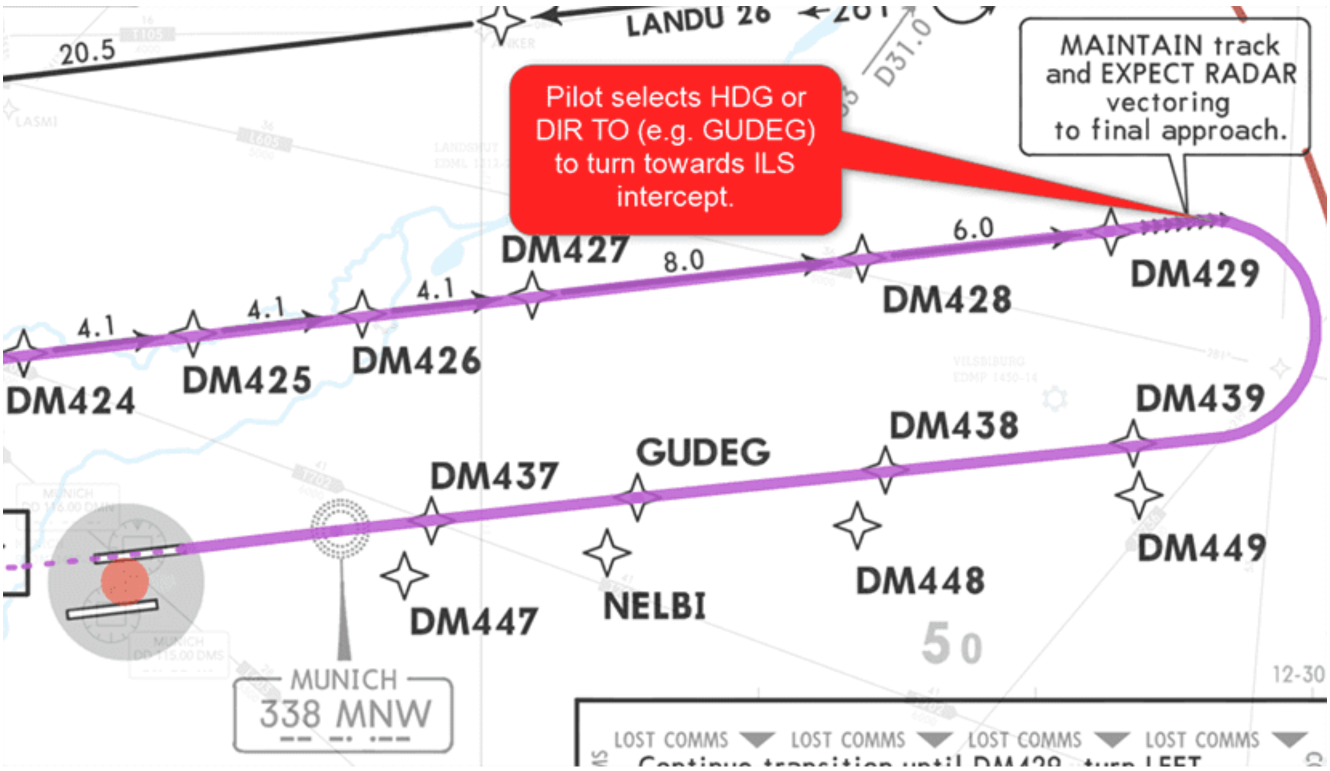
Illustrations for MANUAL Legs

Conceptual principle of a MANUAL leg



Example chart with Manual leg





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"Navigraph Charts are intended for flight simulation use only, not for navigational use."

Manual leg in ND Plan Mode and in ARC Mode

MANUAL label to be removed!

The MANUAL label on the ND will be removed in a future version as it is not displayed in the real aircraft.

Last update: March 14, 2022

1.3.4 Flight Guidance

Flight Guidance in the A320

The flight management and guidance system (FMGS) performs navigation functions and lateral and vertical flight planning functions. It also computes performance parameters and guides the aircraft along a pre-planned route.

It generates and sends commands to the FADECs, autothrust system, autopilot, and flight director to control aircraft roll, pitch, speed, and thrust. This gives three-dimensional flight management with fully automatic, optimized flight performance and guidance.

The primary flight plan is used for lateral guidance and automatically sequences route legs. The current aircraft position is used to determine the required steering commands (AP and FD) to achieve the desired flight plan path.

Vertical guidance is available for TAKEOFF, CLIMB, CRUISE, DESCENT, and APPROACH phases of the flight plan. The flight planning capability lets the pilot enter published departure, arrival, and approach segments with individual pseudo waypoints that include speed/altitude constraints. These constraints, as well as the entered cruise altitude and cost index, define the vertical profile.

Two types of autopilot and flight director modes are available to guide the aircraft:

Managed modes

When the aircraft is using managed targets, the Flight Management and Guidance System (FMGS) guides it along lateral and vertical flight paths and speed profiles computed by the Flight Management function (FM) from data in the MCDU. FM manages the guidance targets.

Managed Modes are activated when the corresponding knob on the FCU is pushed in provided that the aircraft meets the necessary engagement conditions. E.g. Managed Heading (NAV) requires a valid flight plan defined in the MCDU.

Selected modes

When the flight crew is using selected targets, the FMGS guides the aircraft along lateral and vertical flight paths and speed profiles to meet targets that the flight crew has selected manually on the FCU. The flight crew selects the guidance targets.

Selected Modes are activated by pulling the corresponding knob in the FCU.

Pulling and Pushing Knobs in Microsoft Flight Simulator

Using the legacy Cockpit Interaction System you can push and pull knobs on the FCU like this:

The following guidancve modes are available and displayed in the PFD's FMA as either active or armed. See our PFD FMA documentation.

Guidance	MANAGED	SELECTED
LATERAL	NAV, APP NAV	HDG-TRK
	LOC*, LOC	
	RWY	
	RWY TRK	
	LAND	
	GA TRK	
	ROLL OUT	
VERTICAL	SRS (TO and GA)	
	CLB, DES	OP CLB, OP DES
	ALT CST*, ALT CST	ALT*, ALT
	ALT CRZ	EXPEDITE
	G/S*, G/S	
	FINAL, FINAL APP	
	FLARE	
	TCAS	
SPEED	FMGC REFERENCE	FCU REFERENCE
	(ECON, Auto SPD, SPD LIM)	
	EXPEDITE	

Last update: November 29, 2021

Traffic Alert and Collision Avoidance System

The initial implementation of TCAS is available in the development and experimental branch at this time. Please note details about this system and it's functions will come at a later time.

Our TCAS supports online network traffic services (Vatsim / IVAO).

- No support for offline AI traffic (sim limitation)
- No support of multiplayer (MSFS) traffic (sim limitation)
- Possible false detection of ground traffic
- Possible ghost TA / RA due to jumping traffic (*improvements and changes expected*)

A Quick Note on TCAS Performance

TCAS relative altitude is now based on plane altitude (true altitude) for both airplanes. This should work exactly as intended for MSFS airplanes relative to one another (though not as the IRL TCAS works). It can still be somewhat of an issue when on a network with non-MSFS airplanes.

The reason for this is that MSFS is the only sim that should correctly compute the true altitude. Depending on the atmospheric conditions, an MSFS airplane flying in the same weather and with the same baro setting as a non-MSFS airplane may be at a different true altitude than the non-MSFS airplane. Said differently, each aircraft could be at the same altitude in their respective simulator, but TCAS would show them at different altitudes.

This is not just a TCAS issue. It is an issue that VATSIM and all the other networks are struggling with so that ATC sees all airplanes, regardless of sim, at the right altitudes, at least relative to one another.

Last update: February 25, 2022

1.3.5 Protections

Normal Law Protections in the A320

The A320 has various flight envelope protections which protect the aircraft from entering certain critical situations while Normal Law is active.

The guides in this section shall cover some of the main envelope protections of the A320's Normal Law.

Control Laws

The fly-by-wire principle of the A320 uses several "Laws" on how to control the flight control surfaces in relation to the pilot's input to side stick.

- Normal Law:
  - normal conditions even after single failure of sensors, electrical system, hydraulic system or flight control computer
- Alternate Law:
  - activated after certain double (or triple) failures
- Direct Law:
  - Mainly after double or triple IRS failure
- Mechanical Backup (after loss of all electrical power):
  - Trim wheel
  - Rudder pedals

The different laws will support different types of protections and change the relationship between pilot's stick input and flight control interfaces.

High Speed Protection (HSP) aims to protect the aircraft from overspeed situations and activates latest when V_{MO}+6kt or M_{MO}+0.015 speeds (maximum operating speeds in knots or mach) are reached.

See also V-Speeds

Engagement Conditions

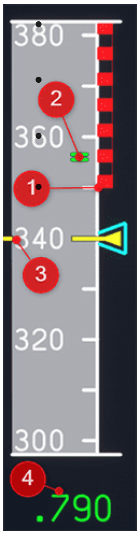
HSP is activated at or above V_{MO} or M_{MO} speeds (maximum operating speeds in knots or mach), depending on flight conditions.

Disengagement Conditions

HSP is deactivated when speed is reduced below V_{MO}/M_{MO}.

Indication and warnings

The overspeed limits are shown on the speed band on the PFD as a black and red strip and a pair of green lines.



1: V_{MAX} = Lowest of V_{MO}, M_{MO}, V_{LE}, V_{FE}

2: V_{MO} + 6kt or M_{MO} + 0.01 Overspeed Protection becomes active

3: Actual Airspeed Reference Line

4: Current Mach speed

High Speed Protection is usually accompanied by the Overspeed Warnings:

- Continuous repetitive chime
- Master warning light
- Overspeed red message on ECAM
- Red and black strip along the PFD scale

Protective Actions

- Automatic AP disconnection (V_{MO} + 15kt or M_{MO} + 0.04)
- When V_{MO} + 6kt or M_{MO} + 0.01 is reached a positive load factor demand is automatically applied (pitch up action)
- When full nose-down stick is maintained speed is limited to around V_{MO} + 16kt and M_{MO} + 0.04 (pilot nose-down authority is reduced)
- When sidestick is released at HSP activation, the airplane will slightly overshoot V_{MO}/M_{MO} and fly back towards the envelope.
- When sidestick is released the aircraft's bank angle will return to 0° (instead of 33° outside of HSP)
- Bank angle limit is reduced from 67° to 40°
- Pitch trim is frozen

Recommended Action to Recover

- Extend Speed Brake
- Increase pitch
- Reduce thrust and/or activate A/THR

The Angle of Attack Protection protects against stalling the aircraft.

> **Angle of Attack**
>
> "The Angle of Attack is the angle at which relative wind meets an Aerofoil. It is the angle formed by the Chord of the aerofoil and the direction of the relative wind or the vector representing the relative motion between the aircraft and the atmosphere."
>
> Based on the article Angle of Attack (AOA), Source: www.skybrary.aero.

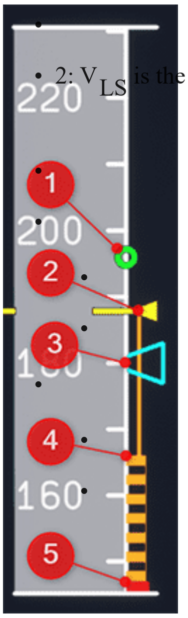
The angle of attack is commonly called α (alpha) which we will use in the following sections.

Engagement Conditions

The High Angle of Attack Protection is engaged when:

- Current angle of attack ia greater than α_{prot} (in Normal Law) when above 100ft RA
- Below 100 ft RA during the landing, when α_{max} is reached

Indications and Warnings



- 1: Green Dot Speed is the best lift-to-drag ratio speed in the clean configuration.
- 2: V_{LS} is the lowest selectable speed and provides an appropriate margin to the stall speed. The autopilot will not go below this speed if autothrust is active.
- 3: Selected speed in the FCU
- 4: α_{prot} limit
  - this speed is maintained when side stick is neutral
  - if sidestick if deflected aft this will eventually activate α_{floor} A/THR protection - see Alpha Floor Protection
- 5: α_{max} is the speed with the maximum angle of attack (AoA) the aircraft will allow
  - this speed is maintained when side stick is deflected fully aft
  - it has a small margin before reaching the stall AoA

Protective Actions

- Automatic AP disconnection
- If α becomes greater than α_{prot} then angle of attack will become proportional to stick deflection. Autotrim will stop which results in a nose-down tendency.
- If α reaches α_{floor} the autothrust system will apply go-around thrust. See Alpha Floor Protection.
- α_{max} cannot be exceeded even with the pilot pulling the stick full backward. In other words the aircraft cannot be stalled in Normal Law by the pilot's pitch up stick input.
- Bank angle limit is reduced from 67° to 45°

Recommended Action to Recover

- Push sidestick forward to reduce pitch and gain speed.
- If Alpha Floor Protection (α_{floor}) is activated see next chapter Alpha Floor Protection

The Alpha Floor Protection automatically sets TOGA thrust when a very high angle of attack is reached.

Engagement Conditions

Alpha Floor Protection **engages** after lift-off until 100ft RA before landing, when:

- α is >α_{floor}
  - 9.5° in CONFIG 0, 15° in CONFIG 1 and 2, 14° in CONFIG 3, 13° in CONFIG FULL
- Sidestick deflection is >14° when either
  - High Angle of Attack Protection is active, or
  - the Attitude Protection for pitch is active.

> ⚠ **The above values for α_{floor} and sidestick deflection are not modelled realistically in Microsoft Flight Simulator.**

Alpha Floor Protection is **inhibited**, when:

- speed is above 0.6 Mach
- TCAS mode is engaged

Indications and Warnings

If the α_{floor} (A.FLOOR) protection is triggered the Autothrust FMA shows this symbol with a flashing amber border.

Protective Actions

Alpha Floor Protection signals the autothrust system to set TOGA thrust. Thrust lever positions are ignored.

As α_{floor} also implies α_{prot} see High Angle of Attack Protection for additional actions.

Recommended Action to Recover

See our specific guide on how to recover from A.FLOOR: A.FLOOR and TOGA LK

Manoeuvre Protection, also called Manoeuvre Protection, enables immediate PF reaction, by pulling the sidestick to full aft without any risk of overstressing the aircraft.

The load factor limit is:

- -1.0 to +2.5g load factor for clean configuration
- 0 to +2.0g positive load factor for other configurations

Indication and warnings

The lower ECAM displays the load factor (G LOAD) in amber, when the value is above 1.4g or below 0.7g for more than 2s.

To protect the aircraft from excessive pitch attitudes this protection limits pitch angels in the following ways:

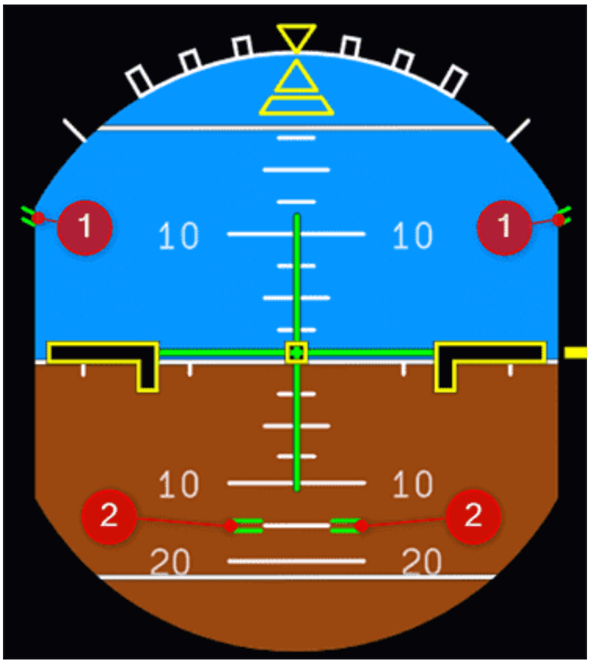
- Nose up limited to 30° in CONF 0 to 3
  - Progressively reduced to 25 ° at low speed
- Nose up limited to 25° in CONF FULL
  - Progressively reduced to 20 ° at low speed
- Limited to 15° nose down

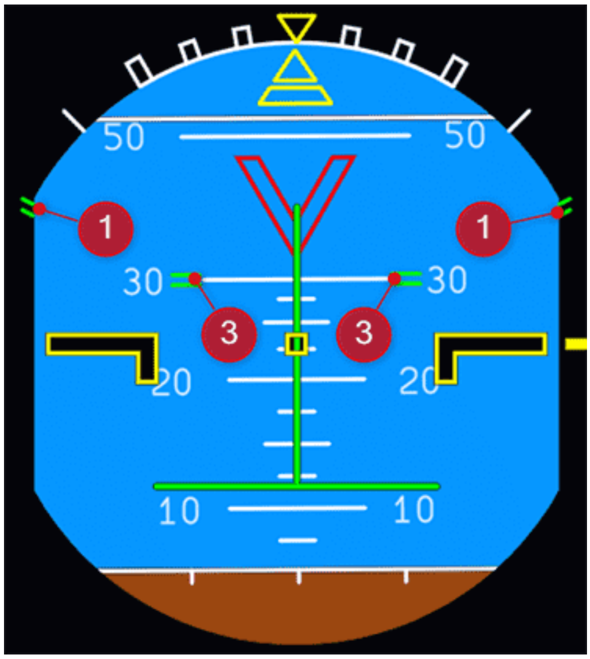
If these limits are approached, the aircraft's pitch rate decreases and will stop at the limit.

The flight director bars disappear when pitch exceeds 25° up or 13° down. They appear again when pitch returns to 22° up or 10° down.

Pitch Attitude Protection supports high speed protection, high load factor protection, and high AOA protection.

PFD Attitude Indicators





- 1: Bank limit indicator at 67°
- 2: Pitch down limit indicator at -15°
- 3: Pitch up limit indicator at 30°

Bank angle during normal conditions is limited at 67° if the pilots holds the sidestick fully deflected laterally.

If the sidestick is neutral and the bank angle is no greater than 33°, the system will hold that bank angle.

If the bank angle was greater than 33° and the sidestick is released to neutral the system reduces the bank angle automatically to 33° and holds it there.

If these limits are approached, the aircraft's roll rate decreases and will stop at the limit.

If High Angle of Attack Protection is active the bank angle is limited to 45°.

If High Speed Protection is active the bank angle is limited to 40° and will roll back to 0° when the sidestick is released to neutral.

The autopilot disconnects and the flight director bars disappear when bank angle exceeds 45°. They appear again when bank angle is less than 40°.

See PFD Attitude Indicators.

> ⚠ **Not yet available in the A32NX on Microsoft Flight Simulator**

Windshear Protection is available during take off and approach phases when:

- at takeoff 3s after lift off up to 1.300ft RA
- at landing from 1.300ft RA to 50ft RA
- as least CONF 1

Indication and warnings

- Visual “WINDSHEAR” red message displayed on both PFDs for a minimum of 15s.
- Aural synthetic voice announcing “WINDSHEAR” three times.

Recommended Action to Recover

- Flight Director pitch order based on the speed reference system (SRS).
- Pilot must set TOGa thrust immediately and follow the FD pitch order to execute optimum escape maneuver.

> **Not yet available in the A32NX on Microsoft Flight Simulator**

If the aircraft's energy level is going below a threshold an aural low-energy "SPEED SPEED SPEED" alert warns the pilot to increase thrust, in order to regain a positive flight path angle through pitch control.

It is available in Configuration 2, 3, and FULL. The FAC computes the energy level with the following inputs:

- Aircraft configuration
- Horizontal deceleration rate
- Flight path angle.

The aural alert is inhibited when:

- TOGA is selected, or
- Below 100 ft RA, or
- Above 2 000 ft RA, or
- Alpha-floor, or
- the ground proximity warning system alert is triggered, or
- in alternate or direct law, or
- if both radio altimeters fail.

During deceleration, the low-energy aural alert is triggered before alpha floor (unless alpha floor is triggered by stick deflection). The amount of time between the two alerts depends on the deceleration rate.

Last update: January 10, 2022

Alpha Floor and TOGA LK

Alpha floor protection is a safety feature of the envelope protection system designed for low speed protection in Normal Law (aircraft fully operational).

This feature is part of our custom autopilot and autothrust system - available in all versions of the A32NX.

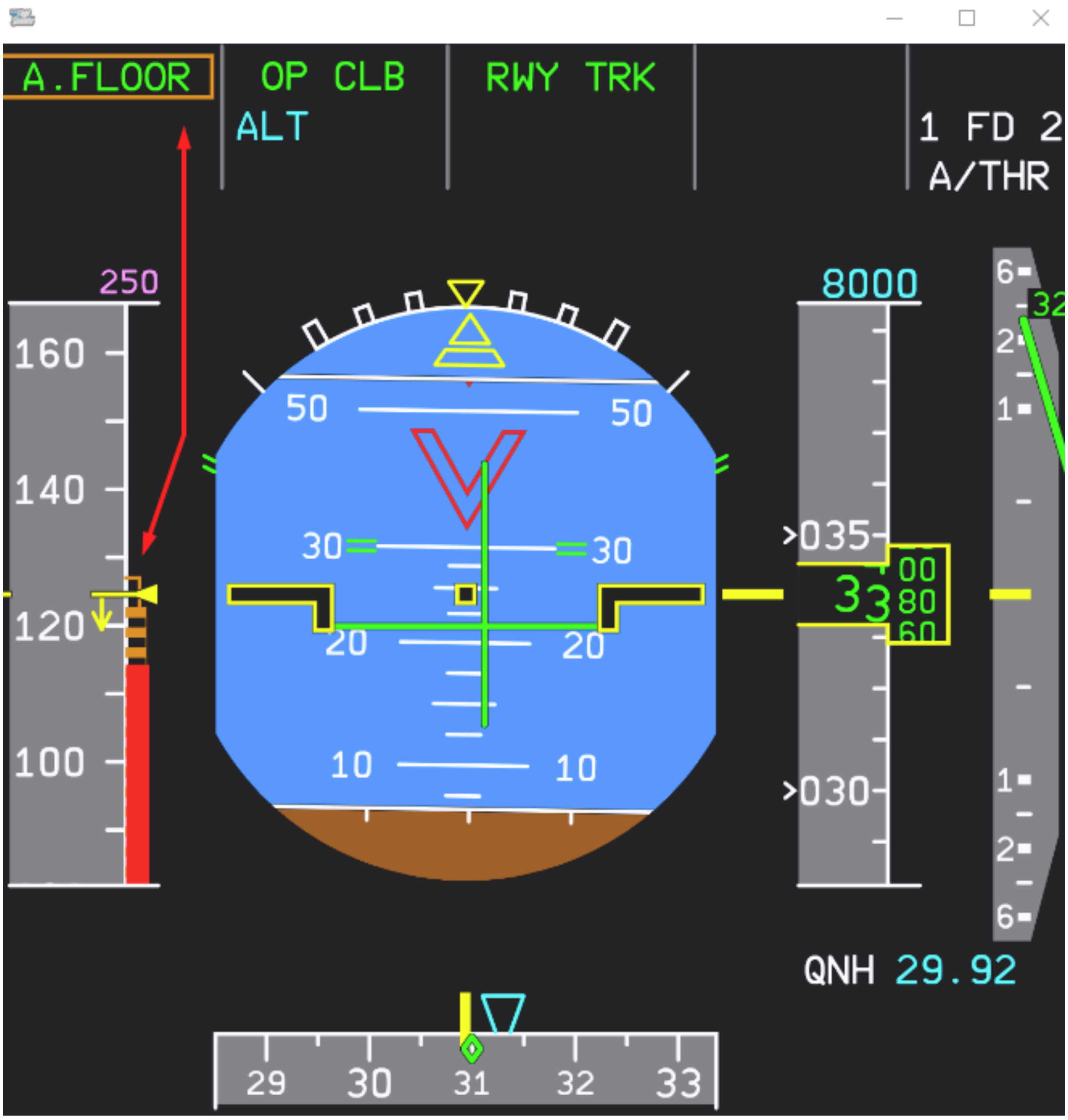
Trigger Conditions

When the angle of attack and airspeed of the aircraft reaches the alpha floor protection range indicated by the amber and black band on the PFD speed page. Simply put, A.FlOOR will trigger when approaching a stall in the aircraft's current configuration.

> **Reactivation of autopilot will not be possible when in A.FLOOR conditions**

FMA Indications

When A.FLOOR protection is active this will be indicated in the left most FMA on the PFD in green with a flashing amber box around it.

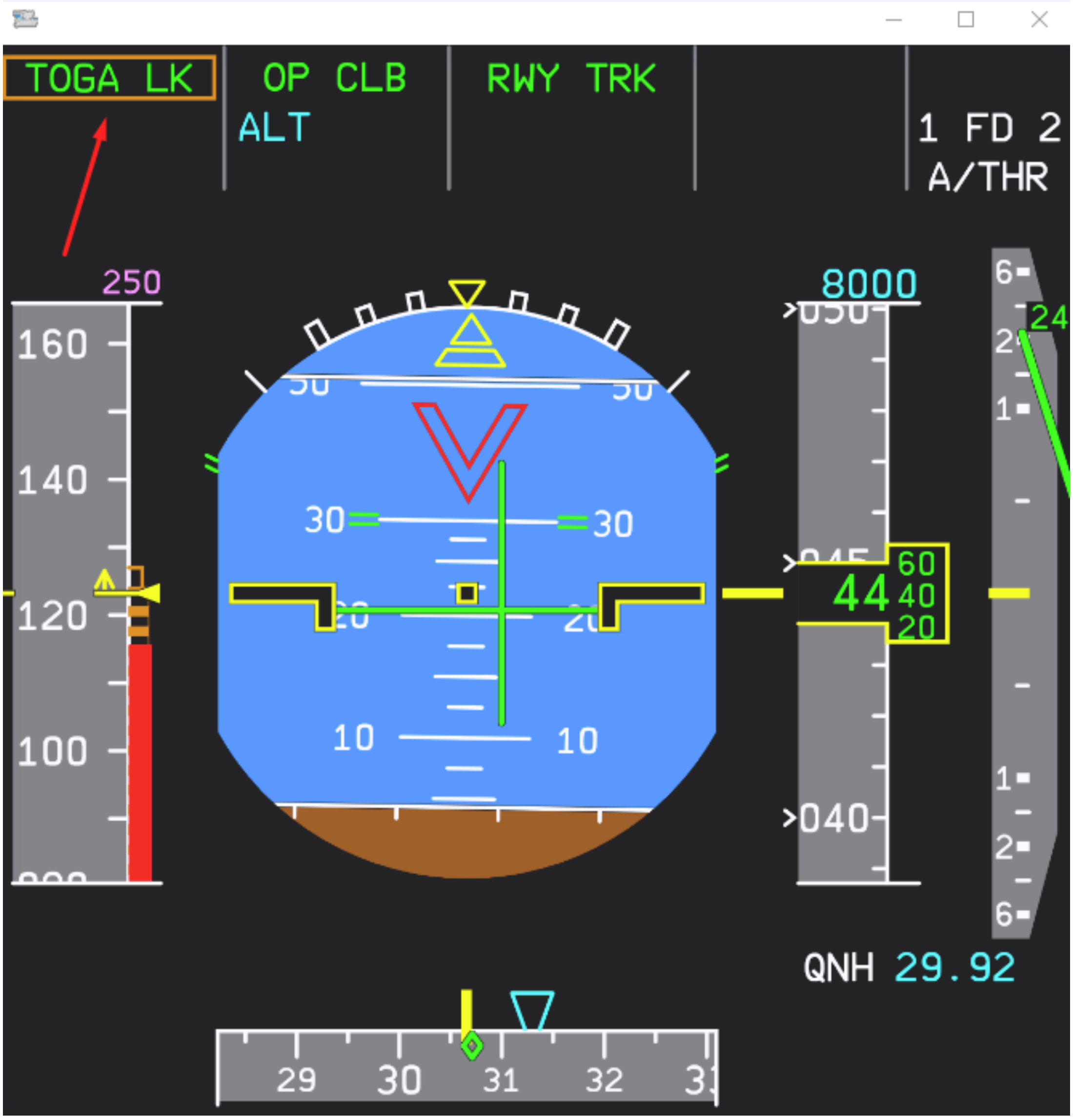


Resolving A.FLOOR

To recover from the A.FLOOR condition and prevent further stall conditions, manually pitch the nose downwards to increase your speed and to reduce the angle of attack. When angle of attack is sufficiently reduced and the aircraft speed is out of the alpha protection range you can safely switch autopilot back on.

Note: In most situations the A.FLOOR condition will be followed by a TOGA LK FMA indication on the PFD.

This indication typically appears after triggering A.FLOOR protection where TOGA (take off go around) thrust has been set automatically and "locked". This autothurst mode will be kept active until the crew has safely resolved the previous A.FLOOR condition.



Resolving TOGA LK

Resolution of TOGA LK is quite simple and accomplished in a few easy steps.

1. Disconnect the autothrust on the flight control unit (FCU).
2. Set the new position for the thrust levers (or return to CLB detent).
3. Reactivate autothrust.

After these steps are complete you should be able to resume your flight normally with autothrust and autopilot enabled.

Last update: December 7, 2021

1.3.6 Data Management

Stored Waypoints

The MCDU allows the flight crew to enter and store custom waypoints.

There can be up to 99 waypoints stored. To see the stored waypoints you need to select `DATA` on the MCDU and move to the second page with the lateral arrow key.

These waypoints can be used in the flight plan (MCDU F-PLN page) in the same way as any other fix by entering the fix ident.

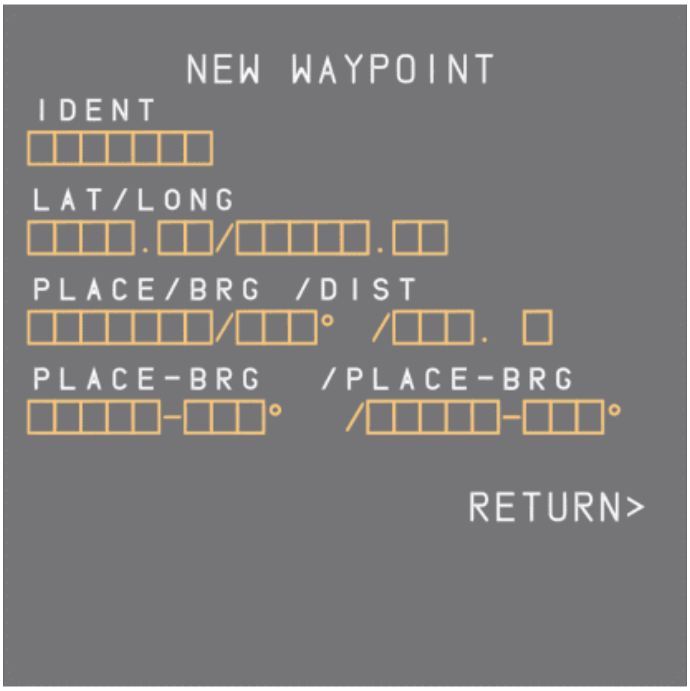
> These stored waypoints are not persisted and not stored on your PC. This is similar to the configuration of most real world aircraft where the waypoints will also be erased after the flight (when in the DONE phase).

The following chapters will explain how to create, use and delete these stored waypoints.

There are three ways to create new custom waypoints:

1. Enter a new unique identifier into the scratchpad and insert it into the flight plan as if inserting a normal additional waypoint. This will bring up the `NEW WAYPOINT` page with the identifier already filled out.
2. Press the LSK 5R (5th on the right) of `NEW WAYPOINT` on the `STORED WAYPOINT` page
3. By directly entering the new waypoint in one of the three formats into the scratchpad on the F-PLN page and inserting it into the the flight plan. In this case the FMS will generate a default name (PBDnn, PBXnn, or LLnn, where nn is the storage number of the stored waypoint).

New Waypoint Page



Enter a unique name for your waypoint into the scratchpad and press the LSK 1L left of the IDENT field.

Here you have then 3 methods of creating a new waypoint.

This creates a point at an exact latitude and longitude.

The format is:

<latitude>/<longitude>

- latitude is 4 digits with one decimal digit and N or S (for Northern or Southern hemisphere)
- longitude is 4 or 5 digits with one decimal digit and E or W (for Eastern or Western hemisphere)

Example for LL

Detailed Format Description

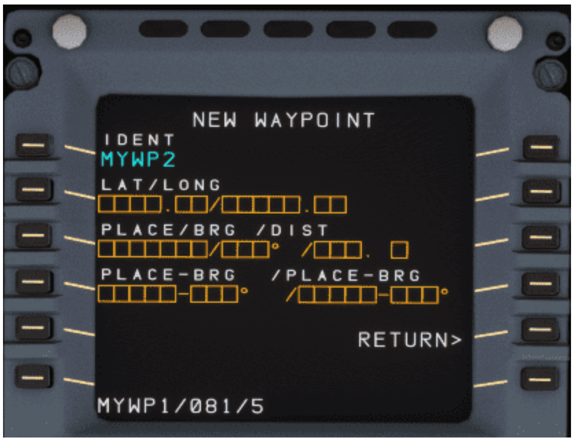
	Format	Range	Units
LAT	DDMM.MB or BDDMM.M		
	DD is degrees	DD: 0-90	Degrees
	MM.M is minutes	MM.M: 0.0-59.9	Minutes and tenth of minutes
	B is direction	B: N or S	
	Leading 0 may be omitted		
	Displayed as DDMM.MB		
LONG	DDDMM.MB or BDDDMM.M		
	DDD is degrees	B: E or W	
	MM.M is minutes	DDD: 0-180	Degrees
	B is direction	MM.M: 0.0-59.9	Minutes and tenth of minutes
	Leading 0 may be omitted		
	Displayed as DDDMM.MB		

This creates a point at a specified bearing and distance from another fix.

The format is:

<ident1>/<bearing>/<distance>

Example for PBD



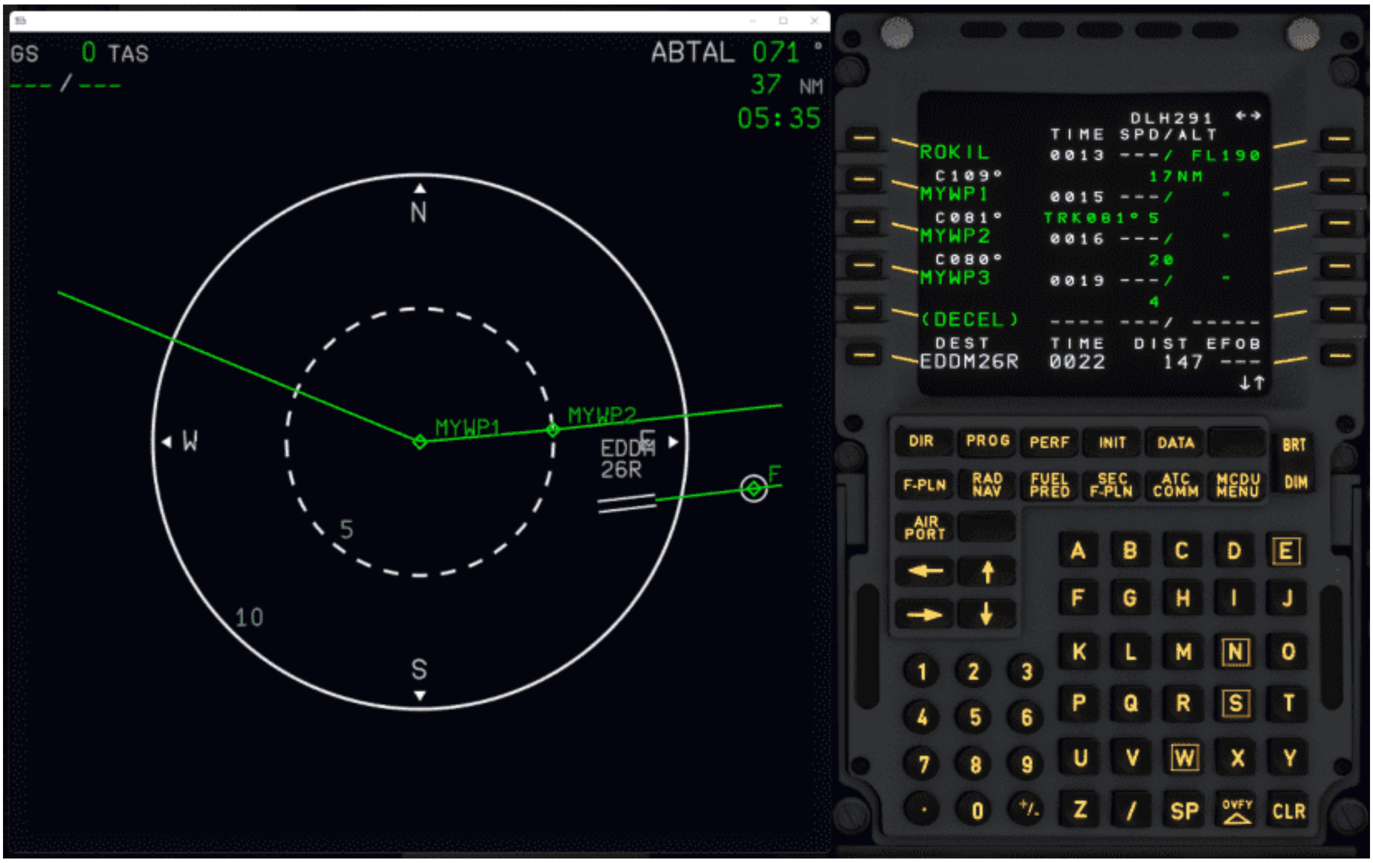
This creates a point at the intersection of a line on a bearing from one fix, and a similar line on a bearing from another fix.

The format is:

<ident1>-<bearing>/<ident2>-<bearing>

Example for PBX

Stored waypoints can be added to the flight plan as any other navigation fix. Just enter the ident and press the LSK left of the place where you want to insert the waypoint.

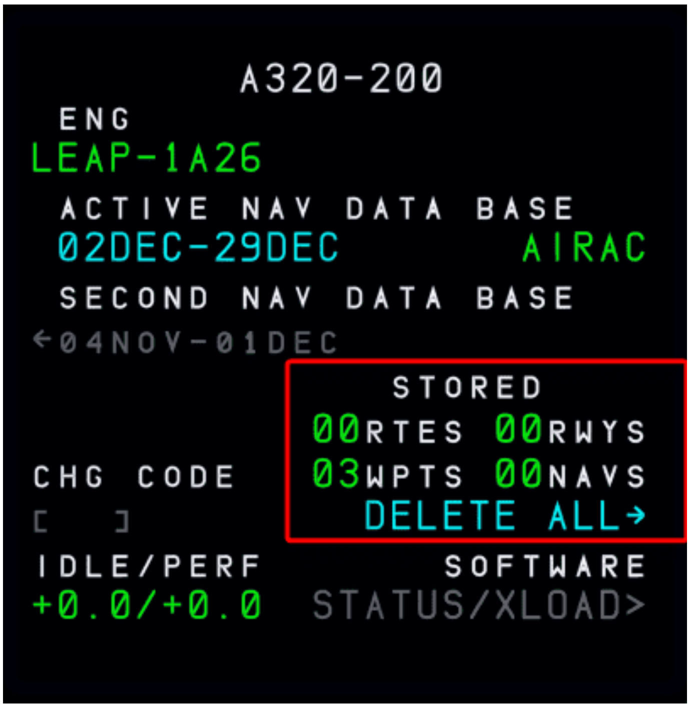


You can delete a single or all stored waypoints at any time. If you try to delete any waypoints used within the FMS the waypoint will be retained and a scratchpad message `F-PLN ELEMENT RETAINED` appears.

Single stored waypoints can be deleted from the list of stored waypoints by calling up the stored waypoint's page and use CLR on the identifier to delete it.

To delete all stored waypoints use the `DELETE ALL` option from any stored waypoint page.

Alternatively you can use the `MCDU DATA A/C STATUS` page to delete all stored waypoints.



Last update: February 15, 2022

1.4 Airliner Flying Guide

1.4.1 Overview

This is a rough basic guide to general airliner terminology and flying techniques that can be generally applied to most aircraft in the simulator, with a focus towards the Airbus A320 Family and the FBW A32NX add-on.

For Simulation Use Only

Author Credit: *Shomas on Discord (A320 Pilot)*

Topics
Types of Approaches
Navigation
Understanding Altitude References
METARs/TAFs/ATIS

Last update: February 23, 2022

1.4.2 Types of Approaches

Different Approaches Available

To land any aircraft, the first step is to start an approach that will bring you to a position where you can see the runway. There are a multitude of different approaches, divided into three terms, precision, non-precision and approach with vertical guidance.

Depending on what equipment the airfield has, what the aircraft is capable of, what the pilot is certified to do and the weather that is on the airfield will determine which of these approaches you will do. Here are some of the more common ones you may see in an airliner.

A precision approach will give you full guidance, both vertically and laterally, to guide you down to a point where you can see the runway. This information can come from a set of radio beacons on the ground, satellite information or from a controller.

Approach Type	Equipment Used	Used For
Instrument Landing System (ILS)	A localiser and glideslope radio beacon	Most precise available, the most common for airliner operations.
GBAS Landing System (GLS)	GPS Satellite systems and ground transmitters	A new alternative to ILS, for difficult approaches
Precision Approach Radar (PAR)	A radar dish and a controller	Commonly as a backup, or at military airfields

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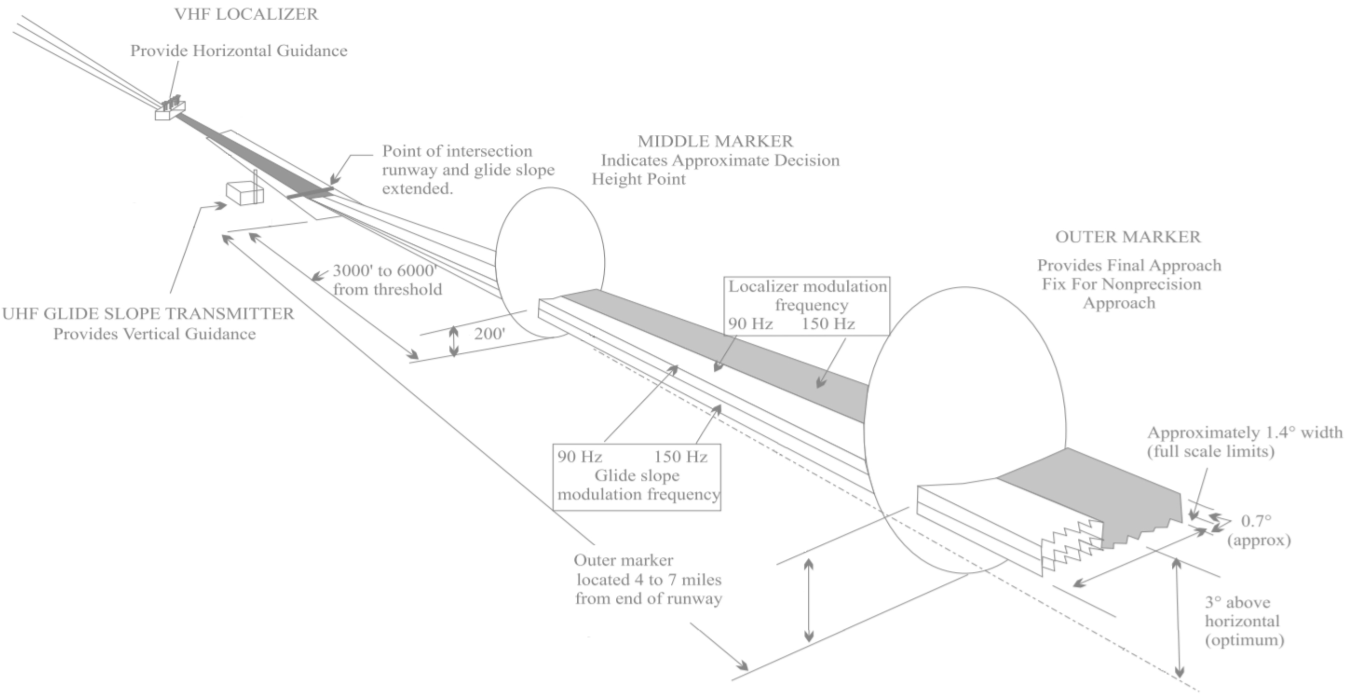
ILS



ILS DiagramSimplified, U.S. Dept. of Transportation, Federal Aviation Administration, Public domain, via Wikimedia Commons

Using a localiser beacon at the end of the runway, and a glideslope beacon at the side, the aircraft is guided along two radio signals to the touchdown point. These can be accurate enough to position the aircraft all the way down to touchdown and steer it along the runway. The pilots need to tune the ILS frequency into their aircraft's radio navigation system to receive the correct signals.

GLS

Like an ILS, but instead of using a set of radio beacons, the aircraft is guided by being fed information from a set of ground stations, which are in turn fed details about the position of the aircraft through GPS satellites.

Not common, but as they do not need radio signals that go out in straight lines, the station can guide the aircraft around curves and turns to avoid terrain and built up/sensitive areas. Only some aircraft are equipped to do GLS and is only an option on the A320 family.

PAR

This is an approach where a controller, with an advanced radar, steers you towards the runway while telling you corrections to your heading or altitude. To the pilot, the controller will give you corrections such as, “Left 2 degrees”, “Right 3 degrees”, “Slightly high, correcting”, to bring you towards the runway.

When all other systems fail, this system can be used as a backup to provide these kinds of approaches, and several large international airports will practice these to keep the controllers skills current. Military airfields commonly use them as they can be setup much quicker than an ILS for use in temporary airfields and only rely on a radar, which can be portable.

A non-precision approach officially can only give you lateral guidance to the point where you can see the runway. This is fed either to the pilots either using a single radio beacon or by satellite navigation, but these cannot tell you if you are too high or low. The only way is to use a table off an aviation chart that shows you at what altitude you need to be at certain distances.

Approach Type	Equipment Used	Used For
Localiser Only (LOC)	A localiser that would be part of an ILS system normally	Some airports only have localiser but also when ILS glideslopes have failed.
VOR-DME or VOR Only	A VOR beacon with/without a distance from a DME	Old style approaches, where ILS cannot be used.
NDB-DME or NDB Only	A NDB beacon with/without a distance from a DME	Old style approaches, where an ILS cannot be used
LNAV Only	GPS or the aircraft's position inside the flight management computers	Approaches where there are no radio beacons in the area
Approach Surveillance Radar (ASR)	A radar dish and a controller (No altitude compared to PAR)	Commonly as a backup, or at military airfields.
Visual	Pilots eyeball!	Where there is no issue with the weather and the runway is already in sight

These approaches are all flown traditionally with just a beacon pointer, a localiser giving left/right corrections, or a controller giving rough headings. With a helpful co-pilot who will be using the altitude table to check if you are high or low, you keep correcting down towards the runway. As the term non-precision hints, these approaches are nowhere near as accurate as a precision approach and as such can require quite good weather to be able to attempt them. VOR and NDB beacons are slowly disappearing due to maintenance costs and the more useful APV approaches being made available.

A newer kind of approach, that uses both lateral and vertical guidance from sources such as GPS satellites, and does not require the use of radio beacons at all. At the time of writing, these approaches were not yet classed as precision, as they do not quite have the accuracy required but are constantly getting better with each new design. They are now flown very similarly to an ILS and do not require much input from the pilots.

Approach Type	Equipment Used	Used For
RNP/ RNAV	Satellite GPS systems and the aircraft's on board positioning system	Approaches where there are no radio beacons in the area
RNP-AR	Satellite GPS systems and the aircraft's onboard positioning system	As per RNP/RNAV but allow curved approaches with margins as little as 0.1 NM.

The Different Categories of ILS

MDA and DA

Due to differences between established regulations by EUROCONTROL and the FAA it is critical that pilots use and understand the difference between Minimum Descent Alittude (MDA) and Decision Altitude (DA) where appropriate. This ensures that there is no discrepancy between which minimum to use for the type of approach planned.

While the information provided below can suffice as a guideline it is always best to understand the minimums posted on the approach plate as your minimum criteria.

Read More Here

With the ILS system, there are several categories that have different requirements from the pilots, the aircraft, the weather and the airport equipment. They are known as CAT, short for category, and are listed as both roman numerals and Latin numbers:

ILS Category	Autoland Required (in the Airbus)	Weather (Normally)	MDA/DA or DH
CAT I	No (May also be unsafe due to interference)	Cloud base above 200ft Visibility 550m	MDA/DA
CAT I LTS (Lower Than Standard)	Yes	Cloud base above 200ft Visibility 400m or 450m	MDA/DA
CAT II	Yes	Cloud base above 100ft Visibility 300m	DH
CAT IIIA	Yes	Cloud base above 100ft Visibility 200m	DH
CAT IIIB	Yes (2 Autopilots)	Cloud base above 50ft Visibility 75m	DH (can be 0)
CAT IIIC	Yes (2 Autopilots)	Cloud base above 0ft Visibility 0m	DH (can be 0)

As the weather gets progressively worse, the higher the category you need to use, which in turn requires more advanced equipment both on the airfield and in the cockpit. To be able to do this, pilots are required to retrain on low visibility operations every year.

The CAT IIIC can be performed without ever seeing anything at all but this is not in practice yet as there has not been a system designed for the aircraft to be able to leave the runway and go to the parking stands completely blind. The A320 family are capable of everything including CAT IIIC.

MichaelDiederich CC BY-SA 3.0

Minimums and MDA/DH

So, you have picked your approach and are flying towards the runway, but how close can you get before you decide it is a bad idea and to try again somewhere else? This is where the minimums come into effect. These are fixed values that decide how low you can go on the approach, and when you get to this altitude, you cannot go any lower until you can see the runway.

Minimum Type	Defined As	Approaches Used In
MDA (Minimum Descent Altitude)	Altitude Above Mean Sea Level	LOC, LDA, SDF, VOR NDB, LNAV, ASR, Visual
DA (Decision Altitude)	Barometric Altitude Above Mean Sea Level	CAT I ILS LNAV / VNAV, LPV, RNP, PAR, GLS
DH (Decision Height)	Radio Altitude Above Ground Level	CAT II ILS CAT III A/B/C ILS

These are defined in feet, (or meters if that airspace uses meter altitudes) and can be found at the bottom of the aeronautical chart that is published for that approach. Each approach to each airport will have a separate value, changing due to obstacles, terrain, and other things that may get in the way while descending towards the runway.

Expanded Information from FAA Instrument Procedure Handbook

Chapter 4: Approaches in the FAA IPH provides more context on the definition of the different types of minimums.

MDA - the lowest altitude, expressed in feet MSL, to which descent is authorized on final approach or during circle-to land maneuvering in execution of a standard instrument approach procedure (SIAP) where no electronic glideslope is provided.

DA - a specified altitude in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

DH - with respect to the operation of aircraft, means the height at which a decision must be made during an ILS, MLS, or PAR IAP to either continue the approach or to execute a missed approach. CAT II and III approach DHs are referenced to AGL and measured with a radio altimeter.

Source: FAA IPH - FAA-H-8083-16B; Chapter 4

Download FAA IPH

Now depending on the aircraft you are flying, depends on the minimums you are allowed to use. These are grouped together by the approach speed of your aircraft, while in normal landing configuration at the maximum landing weight that it is certified to do.

- The higher the maximum weight approach speed means:
- The higher category is required, which means:
- The higher minimums are used.

Aircraft Category	Approach Speeds	Typical Aircraft
A	< 91 knots	C172 PA28 SR22 DC3
B	91 - 120 knots	ATR72 C17 S340 TBM850
C	121 - 140 knots	A320 A380 737 MD80
D	141 - 165 knots	A340 A350 747 777 787 MD11
E	166 - 210 knots	Concorde and specialist military

CATEGORY	A	B	C	D
S-ILS 23	928/18 200 (200-½)			
S-LOC 23	1060/24 332 (400-½)			1060/40 332 (400-¾)
CIRCLING	1200-1 472 (500-1)		1200-1½ 472 (500-1½)	1280-2 552 (600-2)

ILS_RWY_23_KBUF.jpg: The original uploader was Centpacrr at English Wikipedia. Derivative work: Atmoz, Public domain, via Wikimedia Commons

In the above example, which is for the ILS or LOC/DME for Runway 23 at Buffalo Airport, NY in the USA, this chart uses a format designed by the Federal Aviation Administration (FAA) of the USA. Each chart designer unfortunately has slight differences compared to each other, but the basics are usually the same. So, for the above approach:

	MDA (ft)	Visibility (in 100s of ft (USA))	Visibility (m)	Height above the ground (ft)
ILS CAT I RW23	928	1800	550	200
LOC RW23 (Category ABC)	1060	2400	730	332
LOC RW23 (Category D)	1060	4000	1220	332

N.b. The brackets in the above image are used by the FAA for military operations, nothing to worry about in an airliner!

In this example, for Paris Charles De Gaulle Airport, ILS or LOC/DME for runway 26L:

CAT	ILS				LOC		
	DA (H)	RVR	OCH CAT 1	OCH CAT 2 (1)	MDA (H)	RVR	OCH
A	520 (200)	550	141	54	710 (390)	1100	385
B			152	67			
C			178	78			
D			188	94			
DL			194	94	-	-	-

SIA, CC BY-SA 4.0 https://creativecommons.org/licenses/by-sa/4.0, via Wikimedia Commons

	MDA (ft)	Visibility (m)	Height above the ground (ft)
ILS CAT I R26L	520	550	200
LOC 23	710	1100	390

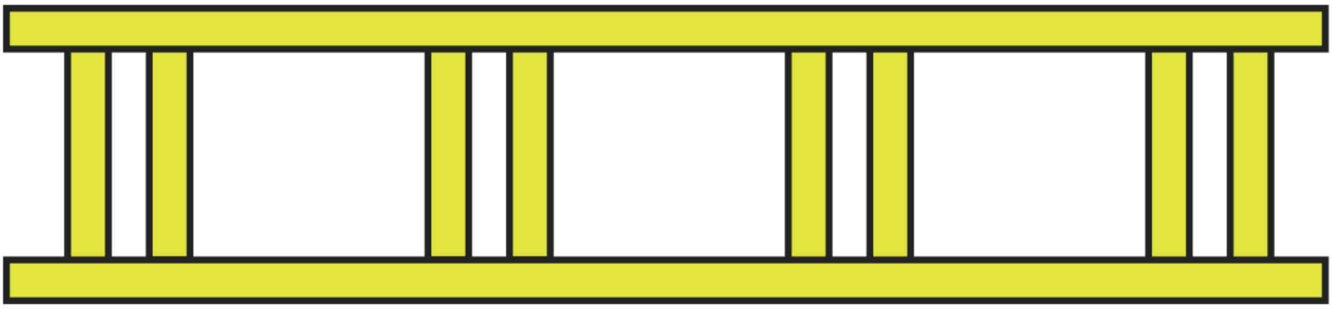
As this chart is now designed differently, it has described the MDA as a DA for the ILS. Now this is just a difference between charts and countries, some use one terminology over the other. Also to note is the inclusion of OCH values. These are the obstacle clearance heights of all possible objects on the approach path, so if you descend below this, then there is a possibility of a collision. These OCH values are not used by the pilots in an approach but are used by the professional bodies who design the approaches as to what the minimums values should be.

Autoland

Autolands are, unlike what the media might want everyone to think, not used all that frequently! The only time it is fully used is in conditions of bad weather, where the clouds are too low or the visibility not far enough to continue to do a normal manual approach. Special rules must be in place to prevent any interference with the aircraft, as this is a precise manoeuvre with not much room for error.

To fly an Autoland, the approach you are flying must be a CAT II ILS or higher. This means that only certain airfields can perform these, where the localiser and glideslopes have been certified as accurate enough to guide the aircraft to a successful landing. An airfield with anything such as an offset ILS, where the ILS is not aligned with the runway, will not be able to offer an Autoland approach.

The airfield must also be in Low Visibility Procedures (LVPs). This aims to reduce the chance of anything interfering with the ILS signals by reducing the amount of vehicles and aircraft near the runway at any time. Special holding points that are further back from the runway are used, and an ILS critical area is established. The image below is a form of LVP ILS holding point.



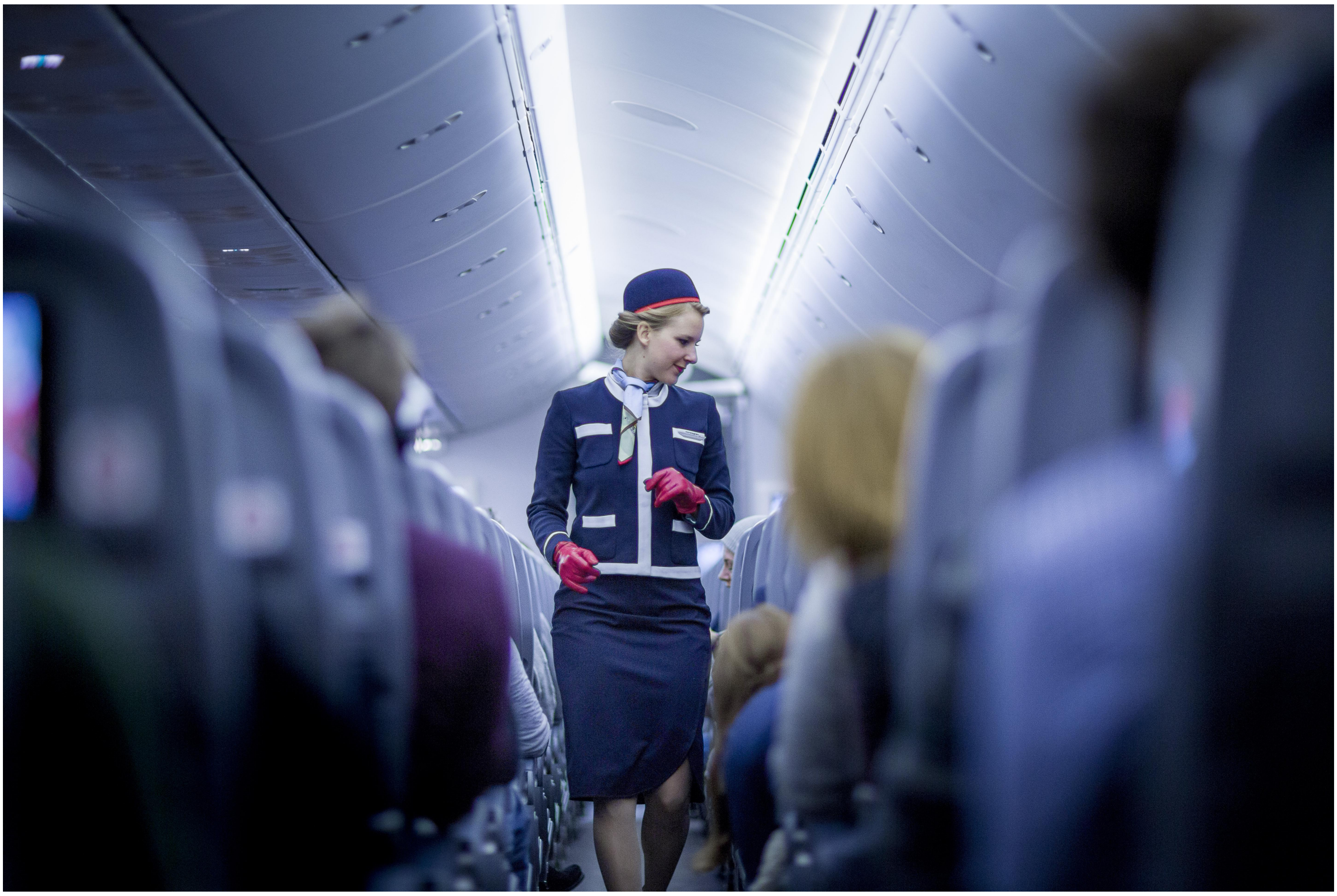
Claudius Henrichs, CC BY-SA 4.0 https://creativecommons.org/licenses/by-sa/4.0, via Wikimedia Commons

No vehicles or aircraft are allowed into this area while an Autoland is being made. This has the knock-on effect of slowing down operations at an airfield, as the normal rate of landings is now not allowed to reduce interference. From personal experience, an A380 vacating the runway at 90 degrees was enough to force an A320's autopilot to disconnect as the ILS signal was lost, which is something you do not want to happen when you cannot see anything!

The aircraft must first be certified as capable of doing an Autoland and have all the equipment functioning that it was certified with. Many systems used must have a backup, especially for the very low visibility approaches such as CAT IIIB/C, including dual autopilots. If any of these systems fail, the aircraft is normally reduced in its landing capability to a lower Category of ILS. The Airbus has an extra Red warning light in front of the pilot's eyesight which flashes if any Autoland equipment fails while the aircraft is performing an Autoland. Depending on when this happens, this can force the pilots to do a go-around to prevent an accident.

UR-SDV (GFDL http://www.gnu.org/copyleft/fdl.html or GFDL http://www.gnu.org/copyleft/fdl.html), via Wikimedia Commons

Another rule onboard is the banning of the use of personal electronic devices (PEDs). This is required to prevent any sort of interference with the onboard equipment on the aircraft as it is that sensitive to radio signals. Normal approaches do not require this level of protection, so many airlines now allow the use of devices during all phases of flight. As testing all possible devices that a passenger could possibly bring on board is a bit impractical, a complete ban is enforced to cover all potential issues. Nowadays, some aircraft have removed the No Smoking sign and replaced it with a No Electronic Devices sign to account for the change in times. A prerecorded public announcement is usually played and the flight attendants will check for devices being used before the approach is made.



Pilots must be certified to commence autolands and are regularly tested in simulators to keep them in check. Most airlines require their pilots to do emergency exercises while recertifying their Autoland qualification, including with engine problems and Autoland failures. At the author's airline, the captain is also required to be the pilot flying during an Autoland, with the first officer calling out changes to the aircraft state and monitoring the performance of the aircraft for any deviation.

In the Airbus, a Quick Reference Handbook (QRH) is carried in the cockpit which includes, as well as emergency procedures, a list of equipment and guidebook briefing to complete an Autoland approach. With the possibility of being so low to the ground without being able to see, in the last stages of an Autoland approach the crew are focused and nonimportant radio calls are ignored to prevent distractions.

The Airbus will have several Flight Mode Annunciators (FMAs) display during an Autoland:

FMA	Description
LAND	Appears at 350ft AGL and locks in the final guidance
FLARE	At or below 40ft AGL, and flares the aircraft for landing
ROLLOUT	On touchdown, keeps the aircraft straight on the runway until the autopilot is disconnected

Last update: October 4, 2021

1.4.3 Navigation

Reading a Chart

Reading Chart Sample 1

1 2 3 4 5 6 7 8 9 10

The category of aircraft allowed to do this approach (A, B, C & D).

The altitude of the airfield (392ft) and altitude of the runway touchdown (317ft)

A top-down picture of the approach (solid line), go-around (dotted line), dangerous airspace (red area), the airport layout and obstacles nearby.

A box in the top-left corner showing local holding waypoints (MOPAR) with speed limits (230 knots) and altitude limits (between FL070 and FL110).

The transition altitude (5000ft).

The missed approach described in text form.

The minimums box for this approach.

A box describing, depending on your groundspeed, how long it will take you to get to the runway from the first point you start to descend and what vertical speed is expected.

The ILS frequency (108.35), its identifier (DSU) and that is has a DME linked to it.
The magnetic variation of the area (0 degrees).

Special notes for this approach that may be different than normal.

A side-on view of the approach, with starting altitude (4000ft), inbound course (265 degrees), slope of the glideslope (3.0) and distances to the runway for several points along the bottom.

A distance-altitude check box, where the altitude you should be at for different distances is described. This is useful to check in case there are any issues with any of the radio beacons you are using.

AIP
FRANCE

AD 2 LFPG IAC RWY26L FNA -ILS CAT123 LOC
03 JAN 19

APPROCHE AUX INSTRUMENTS
Instrument approach
CAT A B C D

PARIS CHARLES **DE GAULLE**

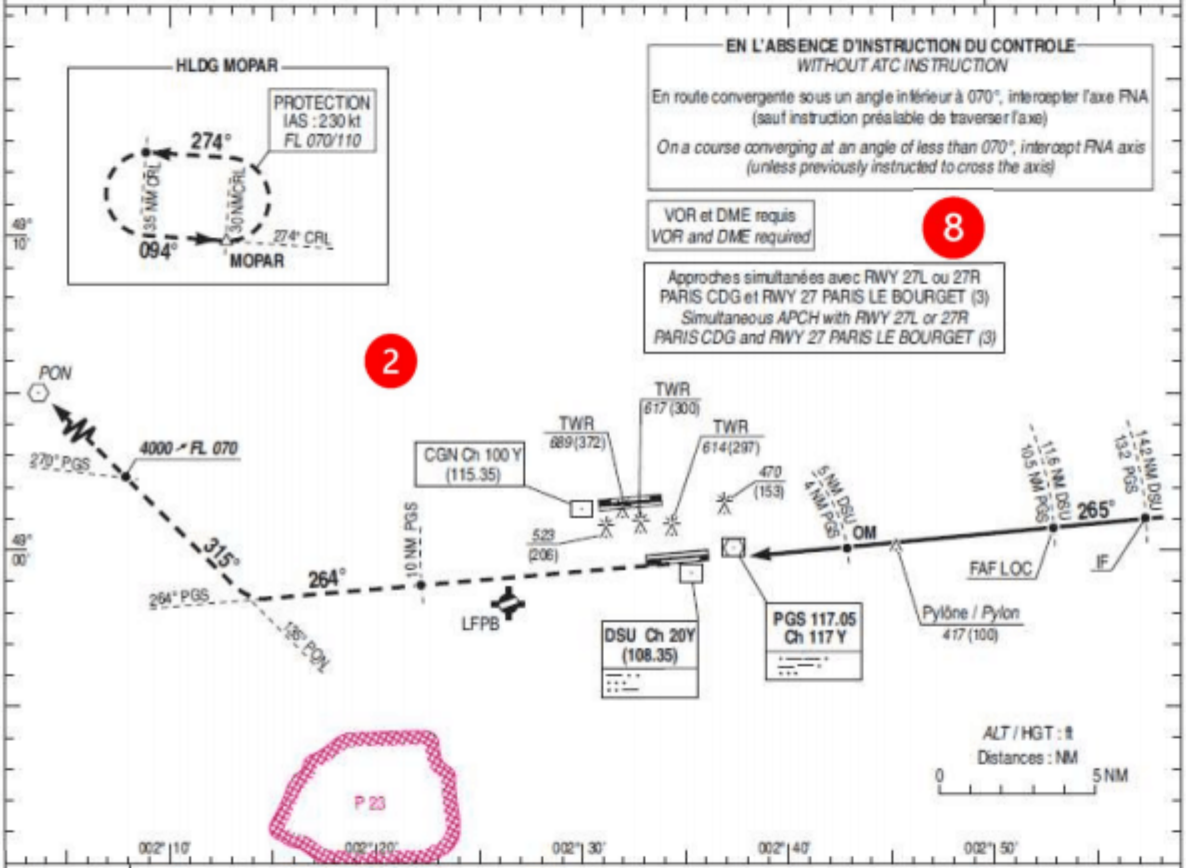
1 *ALT AD : 392*, ***THR : 317 (12 hPa)***

FNA ILS CAT I *ou/or* CAT II *et/and* CAT III *ou/or* LOC RWY 26L

FREQ : Voir / *See* AD 2 LFPG IAC COM 01

ILS - DME	VAR
DSU 108.35	0°
RDH : 57	(15)

7



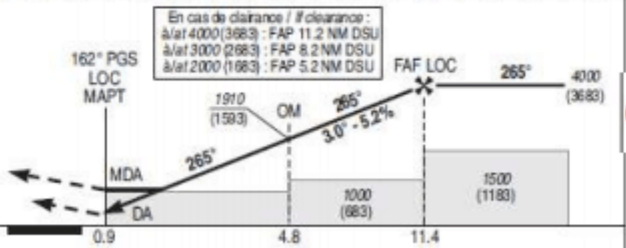
3

TA : 5000

API : Monter **dans l'axe** vers ***4000*** (3683) puis prévoir guidage radar. En cas de panne radio, monter dans l'axe vers ***4000*** (3683). **A 10 NM PGS**, suivre **RDL 264° PGS** (RM 264°) pour intercepter et suivre **RDL 135° PON** (RM 315°). **Au croisement du RDL 270° PGS**, monter ***FL 070***. **A PON**, procéder **MOPAR**. Monter à 1200 (883) avant d'accélérer en palier.

4

Missed APCH : Climb ***straight ahead*** *up to* ***4000*** *(3683) then plan radar guidance. If radio failure, climb* ***straight ahead*** *up to* ***4000*** *(3683).* ***At 10 NM PGS****, follow* ***RDL 264° PGS*** *(MAG 264°) to intercept and follow* ***RDL 135° PON*** *(MAG 315°).* ***When crossing RDL 270° PGS****, climb up to* ***FL 070***. ***At PON****, proceed* ***MOPAR****. Climb up to 1200 (883) prior to level acceleration.*



9

THR ← (NM)	0.9	4.8	11.4
DME DSU ← (NM)	1.1	5	11.6
DME PGS ← (NM)		4	10.5

MNM AD : distances verticales en pieds, RVR et VIS en mètres / *vertical distances in feet, RVR and VIS in metres.* REF HGT : *ALT THR*

5

CAT	ILS				LOC			*MVL/Circling* (2) 26L → 26R	
	DA (H)	RVR	OCH CAT 1	OCH CAT 2 (1)	***MDA*** (H)	RVR	OCH	***MDA*** (H)	VIS
A	***520*** (200)	550	141	54	***710*** (390)	1100	385	***920*** (600)	3000
B			152	67				***920*** (600)	3000
C			178	78				***1020*** (700)	3500
D			188	94				***1070*** (750)	4000
DL			194	94	-	-	-	-	-

APPR : RWY 26L homologuée pour CAT 2 et 3
RWY 26L homologated for CAT 2 and 3

DME DSU NM	11	10	9	8	7	6
ALT	***3820***	***3500***	***3190***	***2870***	***2550***	***2230***
(HGT)	(3503)	(3183)	(2873)	(2553)	(2233)	(1913)

DME DSU NM	5	4	3	2
ALT	***1910***	***1590***	***1270***	***960***
(HGT)	(1593)	(1273)	(953)	(643)

10

Observations / *Remarks* : (1) Base OCH : NIL. (2) MVL : voir consignes LFPG AD 2.20. (3) Mouvements simultanés : voir consignes LFPG AD 2.22.
(1) OCH Base : NIL. (2) Circling : see instructions LFPG AD 2.20. (3) Simultaneous movements : see LFPG AD 2.22.

6

		70 kt	85 kt	100 kt	115 kt	130 kt	160 kt	185 kt
FAF - THR	11.4 NM	9 min 46	8 min 02	6 min 50	5 min 57	5 min 15	4 min 16	3 min 42
VSP (ft/min)		370	450	530	610	690	850	980

NOTE

All approach charts, no matter the designer, will have this information provided to you as a bare minimum.

However, the layout may be significantly different, so a quick 5 minutes to look at the charge can make all the difference before starting an approach.

Reading Chart Sample 2

1 2 3 4 5 6 7 8 9 10

One of the starting waypoints of the arrival (RILAX), including a holding pattern with Minimum Holding Altitude (FL110) and Maximum (FL200).

A radio beacon used on this arrival (Trasadingen VOR), with its identifier (TRA), frequency (114.3) and Morse code (-.-..-).

The airfield that this approach is designed for (Zurich), with the runway layout and an on-airfield radio beacon (Kloten VOR).

The names of the arrivals and where they terminate (AMIKI).

The location of the waypoint (NEGRA) defined by radio beacons (TRA & KLO), by the distance and direction from each of them (track 087 at 40.2 nautical miles/track 066 at 39.2 nautical miles).

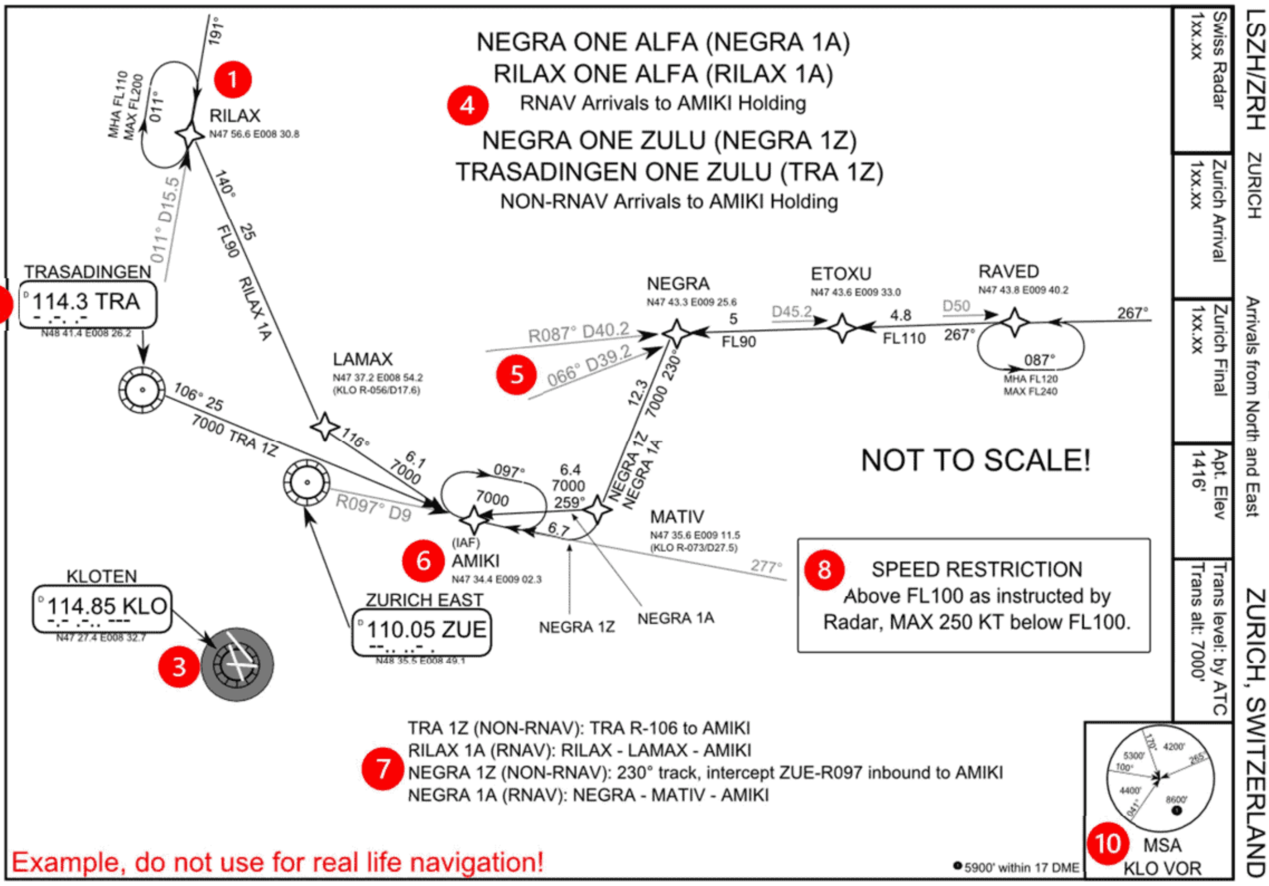
The initial approach fix or IAF (AMIKI), which is normally where the arrival will end and the approach chart will start from.

A text description of the route for each arrival.

Special notes for this arrival that may be different than normal.

A box with ATC frequency information, the airport altitude (1416 feet) and the transition level and altitude (by ATC/7000ft).

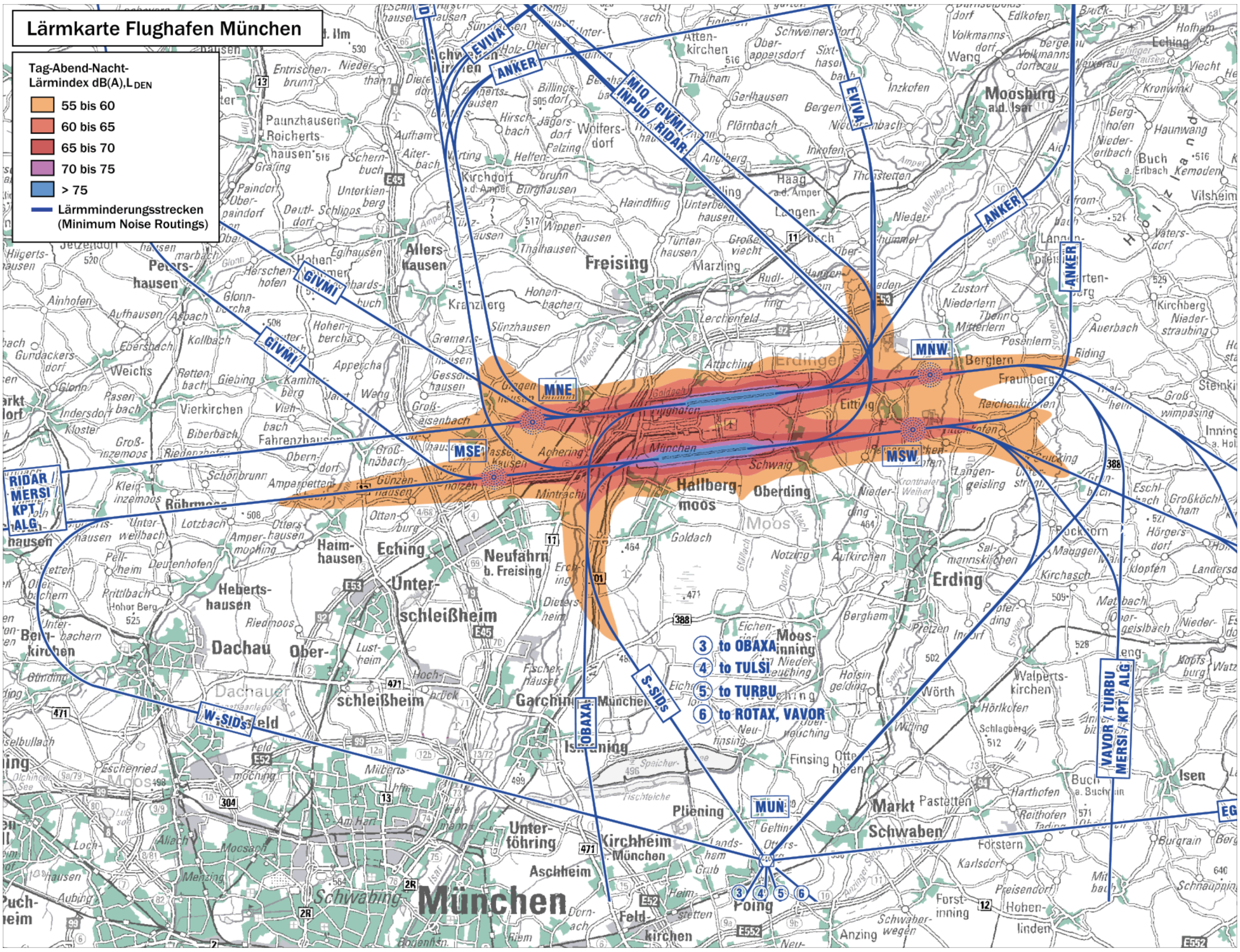
The minimum safe altitude (MSA), which below this you are in danger of hitting terrain. This is traditionally based on a 25 nautical mile ring around a VOR beacon (KLO), and different segments are split up by tracks into the beacon.



SIDs and STARS

As much as an airway might be the highway/motorway of the sky, SIDs and STARs are the roads that lead you to and from it. An airport will have multiple SID/STARs for each runway, which will take you a different direction usually to a waypoint which connects to an airway. The airport will publish a chart for each SID and STAR, which should be checked by the pilots and followed unless cleared to do otherwise.

These are the roads away from the airport, navigating around obstacles while keeping the aircraft safe from others with altitudes. Usually, an IFR clearance that you receive on the ground will have a SID or some form of departure instruction, which will depart you from the runway in use and connect onto the rest of your flight plan.



By Alexrk2 - own work, usingDigitale Topographische Karte 1:250.000, © GeoBasis-DE / BKG 2016 (GeoNutzV)Strategic noise maps (DF 4 and DF 8), European Environment AgencyMinimum Noise Routing (SID), opennav.com, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=51978317

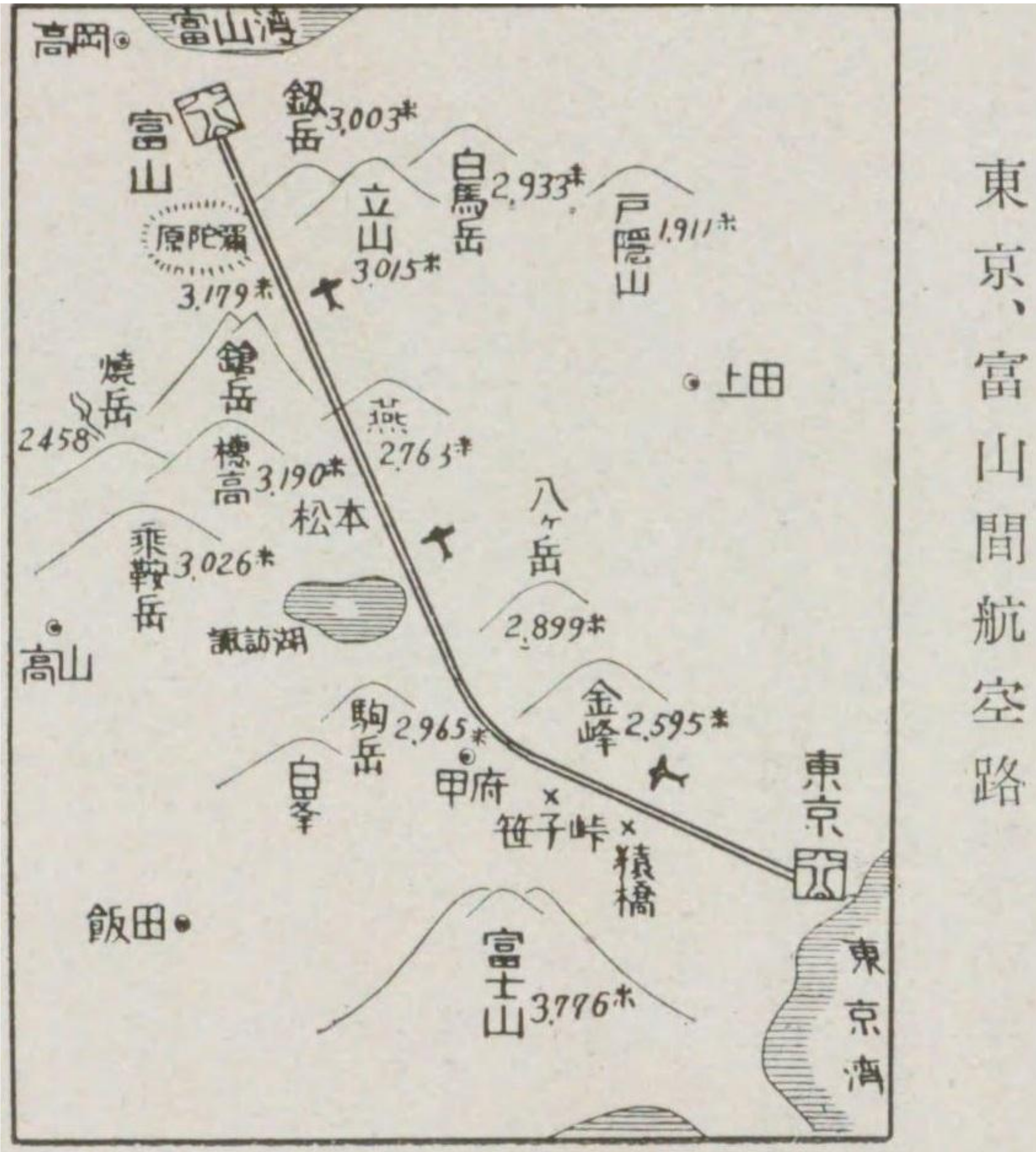
In the above image, you can see all the possible SID routes out of Munich Airport (EDDM). Although the diagram is a noise map, you can see that all routes have a common part to start with when they leave the runway, until they start turning away to their respective waypoints. This means that the noise of departing aircraft is confined to a particular area as best as possible, hopefully away from built up areas.

Where a SID is the route out of an airport, the STAR is the way in. Extremely similar in design to the SID, this will route you down from the end of an airway normally, until ending at the start of the approach for the runway you are landing on. A STAR will have a route that also keeps it clear of obstacles/terrain etc. and give hard altitudes for the pilot to descend to when cleared. Some of these charts will also have holding patterns listed on them for controllers to keep aircraft out of the way to wait until the flow of traffic allows them to land.

LNAV and VNAV

With the advent of more complex autopilots and reference systems inside aircraft, aircraft systems are now much more capable of knowing their position in three dimensions. From earlier technology such as the CIVA INS, to the complex fully automated RNP approaches without any radio guidance that we have now, the terms LNAV and VNAV have become commonplace within the airliner world.

The earliest form of navigation would involve a compass and looking out of the cockpit windows for landmarks, or possibly setting a heading and correcting for weather over distance.



By 港湾協会第九回通常総会富山準備委員会 - 港湾協会第九回通常総会富山準備委員会編、『富山県の産業と港湾』、1936年（昭和11年）5月、港湾協会第九回通常総会 富山準備委員会, Public Domain, https://commons.wikimedia.org/w/index.php?curid=49569993

LNAV allows for the aircraft to navigate across the world using fixed points in space, such as waypoints or radio beacons. These are defined using a latitude and longitude which are compared, in basic terms, against the aircraft's known latitude and longitude to allow navigation towards them.

To know of the position of the aircraft, the Inertial Reference Systems (IRS) are aligned while the aircraft is stationary at the gate which sets a baseline position. This is then updated during flight using tracks and distances from radio beacons or has GPS data fed to it to keep accurate. Without these, as IRS systems are not perfect, the position becomes a guess, and the aircraft will slowly drift off route. This was a particular problem crossing the ocean on older aircraft, where there are no radio beacons and GPS was not invented yet, resulting in the aircraft being possibly miles off course when it eventually arrived overhead land.

VNAV allows for an aircraft to climb and descend using a calculated path to optimise the flight. It will maintain restrictions on SIDs and STARs, plan the ToD (Top of Descent) and minimise fuel burn while still allowing for the aircraft to get into a position to land. For VNAV to work correctly, the aircraft's computer systems must be correctly set with the correct weights, route, weather and performance information.

With a good database inside the MCDU, the Airbus family can fly an entire SID or STAR with no interaction from the pilots, if the data has been checked beforehand. Speed and altitude restrictions are followed to match the chart information.

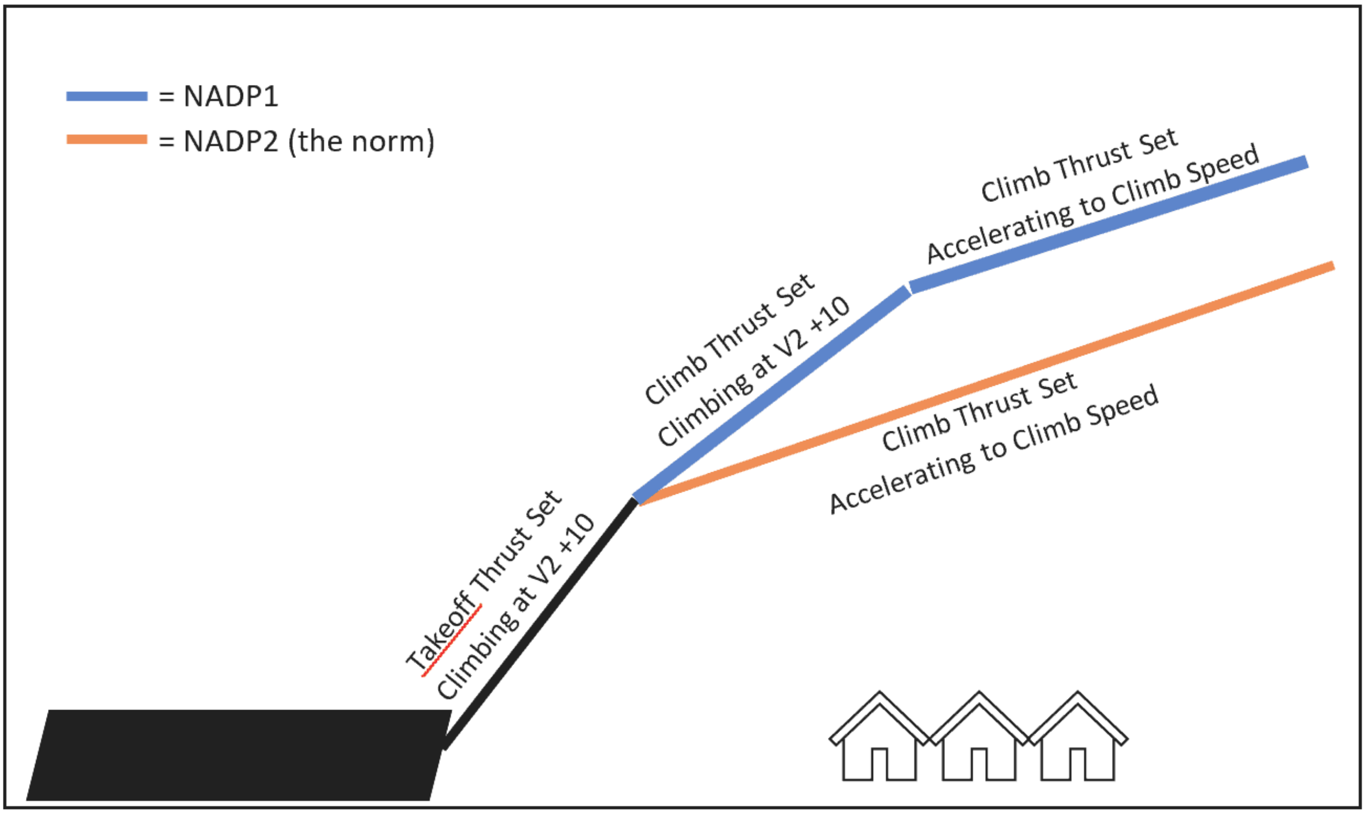
The Airbus Flight Management will try to calculate a 3-degree path from the start of the runway you are landing on, working backwards through your flight plan to achieve all the restrictions until it arrives at your current cruising altitude. This will generate a point on the Navigation Display for the top of descent where if the altitude is set lower than the cruising level, and you push for DES, then the aircraft will follow the 3-degree path. The altitude always needs to be set lower than your current altitude, as the Airbus will stop at whatever is set in the FCU i.e., it will not carry on with the VNAV path. Unlike the Boeing fleet, the Airbus will also not automatically descend at ToD and requires a descent mode to be selected.

Noise Abatement (NADP1 vs 2)

To reduce the noise effects on local residents, some airports require the use of noise abatement procedures to help keep the noise levels down. On the airport, the reduction of the use of the APU and using more external power helps, plus the requirement to ban the use of anything more than idle reverse on landing unless the aircraft performance needs it. The big change that prevents a lot of noise is the use of NADP. These Noise Abatement Departure Procedures change the way aircraft climb out from the airport to help keep noise levels down at buildings that are directly under the flightpath.

NADP1 requires you to climb to your thrust reduction altitude, but instead of accelerating at the same time, you hold the speed until you get to a higher acceleration altitude. This means that over the same distance, you will be higher than the normal procedure, also known as NADP2. And being higher over the buildings means you will generate less noise.

Airports will describe in their airfield documents which departure you should be doing, but the standard method of NADP2 is probably in 80/90% of airports across the world. Common example airports with NADP1 are Paris LFPG, San Francisco KSFO on certain runways and Geneva LSGG.



Credit - Shomas Pilot on Discord

Last update: August 23, 2021

1.4.4 Understanding Altitude references

QNH/QFE/STD and in.Hg/hPA

These codes are all related to settings on your altimeter, which can give you several readings depending on what you use.

Part of the “Q-codes” created by the British Government in roughly 1909, these are used to set altimeters to a specific reference. These, unlike most acronyms in the aviation world, do not have any direct meaning for their letter combinations, though some instructors think of the letters FE in QFE as being for “field elevation”.

QNH is the setting of the altimeter so that it will read the altitude above mean sea level (MSL) based on the location where that altimeter reading was set. This is to say that if you landed on an ocean, this setting would cause the altimeter to read zero. QNH is the most used reference in airline operations and several airlines prohibit flying using a QFE reference.

QFE is the setting of the altimeter so that it will read the height above the airport that you are landing or departing from. The aim is for the altimeter to read approximately zero when the wheels of the aircraft touch down on the runway. Very commonly used during General Aviation flying or during early instruction.

STD (standard) is the setting of the altimeter to reference to ISA conditions. ISA is an internationally developed and recognized model of how air pressure, temperature, and density vary with altitude, and for pilots, this means a QNH of 1013 hPa or 29.92 in.Hg.

To fly a flight level (i.e., FL350 as opposed to 35000ft), all aircraft are required to be set to STD to remove any chances of differences between QNH causing aircraft to be closer to each other than the altimeters are indicating. The change from being on a QNH to STD happens at the transition altitude, and at the transition level vice-versa. A QNH/QFE is required to be set before landing. To set the STD in the Airbus, pull the dial that sets the altimeter, and push to return to QNH.

These two acronyms are the measure of the pressure around you, just as much as kg/lbs or cm/feet. In.Hg stands for inches of mercury, commonly used in the USA, Canada and Japan. The rest of the world commonly uses hPA, the hectopascal. The weather reports in the country you are flying to/from, will have the altimeter setting reported in the measure that that country uses.

As you may fly from a country that uses one setting, to another country that uses the other setting, aircraft usually have a dial or switch that will allow the pilots to change from one measure to the other. In the Airbus, this is a turning switch behind the dial that sets the altimeter.

Transition Altitudes and Transition Levels

Transition altitudes and levels are the changeover points for the altimeter references to be changed. The transition altitude in the climb, and the transition level in the descent.

In the climb, the transition altitude is where you would switch from QNH to STD, and your altitudes will become flight levels. Every clearance ATC will give you above this will be called a Flight Level, and everything below will be called an altitude.

This altitude is found on the departure or arrival charts of the airport you are departing from and will vary from airport to airport except for some countries. Usually, the demands of air traffic control or the terrain around the airfield will define what the altitude will be for that airport. In the USA and Canada, this is fixed at 18000ft to reduce complexity, whereas in other countries such as the UK or the Netherlands, this can be as low as 3000ft.

In the descent, this is where you would change from STD to QNH and is vice-versa to the transition altitude. However, depending on the pressure at the airfield on that day, this is not a fixed value and changes to accommodate high- or low-pressure waves. This means it can only be assigned to you by information from ATC, such as using an ATIS or by being told it through radio communications.

In the Airbus, transition altitudes or levels can be selected in the performance page of the MCDU. As you cross over the altitude or level, the altimeter setting on the PFD in front of the pilot will flash to remind them to change over to the new setting. Some airlines only use transition altitudes in their MCDU, even in the descent.

A common technique is to change the reference as soon as you are cleared to an altitude or FL, to prevent it being forgotten, as this can cause TCAS issues when aircraft are not separated by safe amounts.

Last update: August 22, 2021

1.4.5 Reading METARs/TAFs/ATIS

METAR

These are weather reports created by an on-airport weather station and tend to be released every 30 minutes for most airports around the world. These have a standard layout as:

AIRPORT ID - DATE/TIME - WIND - VISIBILITY - WEATHER - CLOUD - TEMP/DEWPOINT - QNH - REMARKS

Metar Decoding

AIRPORT ID | DATE/TIME | WIND | VISIBILITY | WEATHER | CLOUD | TEMP/DEWPOINT | QNH | REMARKS

It always starts with the airport ID as the 4 letter ICAO code

- EGLL = Heathrow UK
- KDEN = Denver, USA etc.

Then follows the Date and Time in the format of DDTTTTZ. So, the date in two digits, followed by the Zulu (UTC) time in four digits. The time is always referenced in Zulu no matter what time zone you are in. For example: 032050Z = The 3rd day of that month, 20:50Z or 8:50PM UTC time. If this is followed with AUTO, it means that the weather station is publishing the METARs without any intervention or checks by a human controller.

The wind field is written as direction in degrees true followed by the strength in knots. So 36011KT is a wind of 11 knots coming from 360 degrees (north). Some countries still use meters per second (MPS) which will replace the KT so you know which measure is in use. A G can also be added for gusts, e.g. 36011G28KT.

The letters VRB can replace the direction to say it is blowing in a variable direction. After the wind, there can be two directions with a V in between if a strong variable wind is blowing. 240V350 means the wind is varying between 240 degrees and 350 degrees.

The visibility field comes next, with prevailing distance in meters in four digits and goes up to 9999 if it is greater than 10km visibility. Some countries use statute miles which will be labelled SM.

If there is a minimum visibility in a certain direction, this will come next as the same format as the prevailing distance but with a direction afterwards in letters, for example 1500NW will mean that in the northwest direction it is down to 1500m.

RVR is the final option, which shows the distance you can see down a runway in meters. It will be in the format of the runway designator/meters, and can have a D, N or U to show its decreasing, staying the same or going up, such as R28L/1000D.

The weather field can have multiple codes written in it, to describe the current conditions.

These can be mixed, with the max of one from each column at a time. For Example:

```
-TSRA = Light Thunderstorms and Rain
+SHSN = Heavy Showers of Snow
VCFC = Vicinity Funnel Cloud
```

First is Intensity	Second is Description	Third is the Weather
Light (-)	Patches (**BC**)	Mist (**BR**)
Moderate ( )	Blowing (**BL**)	Dust Storm (**DS**)
Heavy (+)	Drifting (**DR**)	Dust (**DU**)
Vicinity (**VC**)	Freezing (**FZ**)	Drizzle (**DZ**)
	Shallow (**MI**)	Funnel Cloud (**FC**)
	Partial (**PR**)	Fog (**FG**)
	Showers (**SH**)	Smoke (**FU**)
	Thunderstorm (**TS**)	Hail > 5mm (**GR**)
		Small Hail (**GS**)
		Haze (**HZ**)
		Ice Crystals (**IC**)
		Ice Pellets (**PL**)
		Dust Devils (**PO**)

`EGLL 031150Z AUTO 26004KT 9999 FEW026 OVC035 08/07 Q0994`

London Heathrow, UK, weather recorded on the 3rd day of the month at 11:50Z time. Automatic observation by the weather station. Wind 260 degrees at 4 knots. Visibility 9999m (greater than 10km). Few clouds at 2600ft above the airfield, overcast clouds at 3500ft above the airfield. Temperature 8°C, dewpoint 7°C. QNH 994 hPa.

`LFPG 031130Z 21018KT 9999 FEW020 BKN024 BKN034 12/08 Q0997 TEMPO 25025G40KT 3000 SHRA FEW015CB SCT020TCU`

Paris Charles de Gaulle, France, weather recorded on the 3rd day of the month at 11:30Z time. Wind 210 degrees at 18 knots. Visibility 9999m (greater than 10km). Few clouds at 2000ft above the airfield, broken clouds at 2400ft above the airfield, broken clouds at 3400ft above the airfield. Temperature 12°C, dewpoint 8°C. QNH 997 hPa. Temporarily wind 250 degrees at 25 knots gusting 40 knots, 3000m visibility in showers of rain, few cumulonimbus clouds at 1500ft and scattered towering cumulus at 2000ft.

`VHHH 031130Z 10010KT CAVOK 20/11 Q1021 NOSIG`

Hong Kong International, weather recorded on the 3rd day of the month at 11:30Z time. Wind 100 degrees at 10 knots. Ceiling and visibility okay. Temperature 20°C, dewpoint 11°C. QNH 1021 hPA. No significant weather

`KJFK 031151Z 32012KT 9SM -SN OVC070 M01/M05 A2948 RMK AO2 SNE14B45 SLP981 4/011 P0000 60000 70002 T10111050 11006 21017 53013`

New York JFK, USA, weather recorded on the 3rd day of the month at 11:51Z time. Wind 320 degrees at 12 knots. Visibility 9 statute miles. Light snow. Overcast clouds at 7000ft. Temperature -1°C, dewpoint -5°C. QNH 29.48inHg. (This is then followed by remarks about the snow conditions and temperature variations, too much detail for this guide).

`EGCC 031120Z VRB2KT 1500 200SW R23R/150D R23L/100N FG VV000 8/8 Q1030`

Manchester, UK, weather recorded on the 3rd day of the month at 11:20Z time. Wind variable at 2 knots. 1500m prevailing visibility, 200m visibility to the south-west. Runway 23R has a visibility of 150m and decreasing, Runway 23L has a visibility if 100m but unchanging. Fog. Vertical visibility of 0, (cannot see upwards due to the fog). Temperature and dewpoint both 8°C. QNH 1030hPa.

TAF (Terminal Area Forecast)

A TAF is a forecast of the weather that is going to be at that airport for a length of time. It follows a similar format as the METAR in using the same weather codes but has the addition of timespans and probabilities.

The timespans are written as date/hour, in the format DDTT/DDTT, so 0312/0409 will mean the timespan is from 12Z on the 3rd until 09Z on the 4th.

The probabilities are either 30% or 40%, 30 meaning unlikely and 40 meaning likely. These are written as PROB30 or PROB40. No idea why its these figures, just always has been!

`EGLL 031100Z 0312/0418 29010KT 9999 BKN024 PROB30 TEMPO 0312/0313 6000 RA BKN012 BECMG 0318/0321 21008KT PROB30 TEMPO 0403/0410 3000 BR BKN003 TEMPO 0410/0418 7000 -RA BKN008 PROB30 TEMPO 0415/0418 3000 RADZ BKN003`

London Heathrow, UK, TAF created at 1100Z on the 3rd day of the month.

Between 12Z on the 3rd until 18Z on the 4th, weather is primarily, wind 290 degrees 10 knots, visibility greater than 10km and broken clouds at 2400ft.

Probability of 30%, temporarily between 12Z and 13Z on the 3rd, 6000m visibility in moderate rain, clouds broken at 1200ft.

Weather changing and becoming, between 18Z and 21Z on the 3rd, wind 210 degrees 8 knots.

Probability of 30%, temporarily between 03Z and 10Z on the 4th, 3000m visibility in mist, clouds broken at 300ft.

Temporarily between 10Z and 18Z on the 4th, 7000m visibility in light rain, clouds broken at 800ft.

Probability of 30%, temporarily between 15Z and 18Z on the 4th, 3000m in rain and drizzle with clouds at 300ft.

What does this all mean to us though? The weather at Heathrow for the next 24 hours or so is going to be a bit wet, with short bursts of rain bringing the visibility and cloud down, that is about it really!

Sheba_Also 43,000 photos, CC BY-SA 2.0 https://creativecommons.org/licenses/by-sa/2.0, via Wikimedia Commons

ATIS (Automatic Terminal Information Service)

Now using the METAR or TAF is good for seeing what is happening at an airport throughout the day or generally as a guide, but it does not tell us much about what is happening at the airport at the time when we want to land.

This is where the ATIS comes in, which is a message transmitted over a specific radio frequency that gives a spoken reading of the current weather and useful information on the airfield such as the runways in use or if any taxiways are closed. These are always started and ended with a letter, “Information Charlie”, which is told to the departure or approach controllers when you first speak to them to confirm that you have listened to the latest ATIS information. This message changes after so many minutes depending on the airport's updating frequency, and when it does, the next letter in the alphabet is then used at the start and end of the new message.

Now to make things easier, Digital ATIS is starting to be used throughout the world, which allows for the aircraft to print out a text version of the ATIS from a distance beyond the range of the radio frequency. This means that the workload in the cockpit is much less, as some ATIS radios can only be received in the descent. Here is an example of a DATIS:

09FEB20 1124Z
EGCC ARR ATIS W
EGCC ARR ATIS W 1121Z
ARRIVAL RWY 23R
RWY23R SFC WET WET WET
TRANSITION-LEVEL FL 70
SINGLE RWY OPERATIONS.
PILOTS BE ADVISED MODERATE TURBULENCE
HAS BEEN REPORTED ON FINALS
29021G53KT 1200 +RA BKN011CB 12/11
Q0978 QFE0969
ACKNOWLEDGE RECEIPT OF INFORMATION W
AND ADVISE AIRCRAFT TYPE ON FIRST
CONTACT WITH MANCHESTER APPROACH
RADAR

Credit - Shomas Pilot on Discord "I guess you can see why I saved this one"

As you can see, this is information W, Whiskey for Manchester, UK EGCC. The weather information is written out in a METAR like format, but with the addition of a QFE as well.

The extra airfield information starting from the top on this particular ATIS is:

- The arrival runway (23R)
- The runway state (Wet at the start, middle and end)
- The transition level (FL70)
- That single runway operations are in effect
- That moderate turbulence has been reported (due to the 53kt wind!)
- And to acknowledge the information and tell them your aircraft type when you first contact the approach controller

Last update: November 4, 2021

1.5 Standard Operating Procedures

We have created our very own standard operating procedures (SOP) valid for the A32NX.

They are available for download or preview online via the links below.

For Simulation Purposes Only

1.5.1 Checklist

An in-flight checklist for flight crew operations. Items critical in regard to flight safety are on this list.

Download **Online Preview**

1.5.2 Normal Procedures

This document can be considered as an overview of what to do during each phase of flight with comments about each location and item.

Download **Online Preview**

Last update: December 5, 2021