Long hauling

How do I fly my heavy around the sky?!

1. Introduction

Flying long-haul routes presents unique challenges and opportunities for pilots and aviation professionals. From navigating vast distances and managing diverse global weather phenomena to meticulous flight planning and specialized communication protocols, long-haul operations require a deep understanding of complex systems and environments. This text delves into critical aspects of long-haul aviation, exploring topics such as weather patterns, efficient route planning, and operational considerations for heavy aircraft. Whether traversing the Intertropical Convergence Zone, managing oceanic airspace communications, or adhering to airport wingspan limits, mastering these elements is essential for safe, efficient, and successful long-haul operations. Further topics are EROPS, and an extended look at fuel planning. As these are rather complex and demanding topics, they will be covered in a different, separate newsletter in future.

2. Global weather phenomena

When flying long hauls, you will travel big distances across the planet. As we navigate through the sky, we encounter different weather conditions and phenomena's, which have a big impact on safe and efficient operation. To understand the danger of such phenomena, some of the most well-known ones will be brought to you in the following texts.

The Intertropical Convergence Zone (**ITCZ**) is a dynamic weather phenomenon near the equator (most seen in the sub-Saharan areas in Africa) where trade winds from both hemispheres meet, creating a band of intense thunderstorms, heavy rain, and turbulence. For long-haul flights, especially those crossing tropical regions, the ITCZ poses operational challenges, including deviations for operational safety. Its location shifts seasonally, influenced by ocean temperatures and solar heating, requiring careful route planning. Effective planning ensures minimal delays and a smoother journey through this unpredictable zone.

Adding to the ITZC, **trade winds** are steady easterly winds found in tropical regions between 30°N and 30°S. Their consistent direction and speed make them a significant factor in aviation, especially for long-haul flights over oceans and equatorial regions. Aircraft traveling westward often face headwinds, increasing fuel consumption and flight time, while eastbound flights benefit from tailwinds for greater efficiency. Seasonal variations and interactions with phenomena like the **ITCZ** require pilots and dispatchers to carefully plan routes. Understanding trade wind patterns is essential for optimizing fuel use and ensuring smooth operations on intercontinental journeys.

Ice crystal icing (ICI) is a significant concern for long-haul flights, especially when traversing tropical or subtropical regions with extensive convective weather systems. At cruising altitudes, typically above 20,000 feet, aircraft engines may ingest supercooled ice crystals, which can melt, refreeze, and accumulate on internal components. This can lead to engine power loss, surge, or even flameout, posing a serious safety risk during long-haul operations over remote areas or oceans where diversion options are limited. This can mostly be avoided by circumnavigating storm cells on the upwind side.

A further phenomenon to be covered is the **Jet stream**. Jets streams are high-altitude, fast-moving air currents formed by the temperature contrast between polar and tropical regions, typically found at the tropopause. In civil aviation, they play a critical role in route planning, as aircraft can exploit tailwinds within jet streams to save fuel and reduce flight times on west-to-east routes. Conversely, flying against a jet stream results in decreased ground speed, requiring careful planning to minimize fuel usage on east-to-west legs. Seasonal variations and shifts in jet stream intensity, influenced by atmospheric conditions, necessitate forecasting tools for efficient flight path adjustments.


Figure 1: Clouds along a jet stream over Canada (Source: Wikimedia)

Finally, we come to the last phenomena to be presented, called clear air turbulence. **Clear Air Turbulence** (CAT) occurs in cloudless regions, typically near the jet stream, where abrupt changes in wind speed or direction (wind shear) develop at the boundary of air masses. It often forms on the cold air side of a jet stream, with strong winds perpendicular to mountain ranges (e.g. "Föhn") or strong temperature gradients in the upper atmosphere. Since CAT is not visible on radar, pilots rely on advanced forecasting models, atmospheric data, and reports from other aircraft to anticipate and avoid turbulent zones. Altitude adjustments and rerouting are common mitigation strategies during long-haul flights.

3. Flight planning

Serious flight planning is a basic requirement for every flight, regardless of whether you are flying VFR or IFR, short-haul or long-haul. For long-haul flights, however, there are some special things to consider, some of which will now be briefly presented.

As you'll be flying for a long time, it's important to plan with enough fuel to deal with some unforeseen situations along the way. For example, there may be weather along the route that you want to avoid. On the other hand, it's important not to take too much fuel. For every extra ton of fuel you take, you will burn around 100kg additionally for every hour you fly. So, if you plan with way more fuel than required, you will end up increasing the fuel costs significantly and make your flight less efficient.

As unforeseen situations may arise at any point along the route, a suitable alternate airport should always be available to ensure a safe landing. To be prepared for such an event, suitable enroute alternates should be included in the flight planning. A suitable alternate airport must meet many criteria, such as sufficient runway length, facilities to handle the aircraft and its load, and weather conditions that allow safe operation. To fulfil the latter criteria, the weather conditions at the alternate airports should also be checked regularly during the flight.

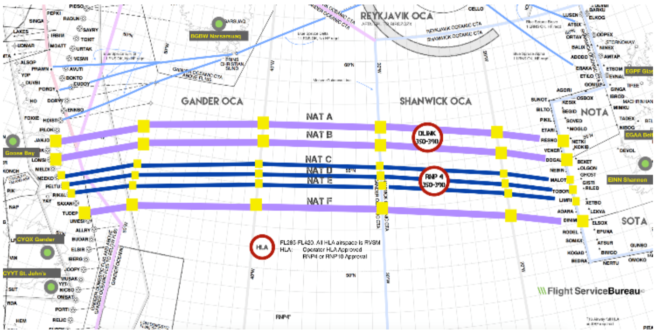

Figure 2: North Atlantic Tracks (Source: [Wikimedia])

There are fixed routes over the North Atlantic and the Pacific, known as the NAT and PACOTS. The North Atlantic Tracks (NATs) are prescribed routes for transatlantic flights that extend from the east coast of North America to western Europe within the North Atlantic Ocean, ranging from 29,000 to 41,000 feet. These routes are used to separate aircraft over areas of low radar coverage and to optimize one of the world's busiest airspaces. The NATs are controlled by Oceanic Control Centers (more on this in the next chapter), which also control any other traffic within their airspace, are dynamic routes that change according to the wind situation over the Atlantic and are designated by letters (westerly tracks start at the beginning of the alphabet, easterly tracks start at the end of the alphabet). NATs are an Organized Track System (OTS), which you can't enter your FMS as an airway, because they alternate daily.

The active NAT tracks alternate depending on the time of day, the eastbound tracks are usually effective from around 0100z to 0800z, the westbound tracks from around 1100z to 1900z. You can see the active NAT tracks on this website or by using a flight planner like SimBrief.

The Pacific Organized Track System (PACOTS) operates in a similar way to the NATs but is located across the Pacific Ocean, extending from Japan and Southeast Asia to Hawaii and the West Coast of North America. Like the NAT tracks, the PACOTS change depending on the time of day, the eastbound PACOTS tracks are usually between 0500z and 1000z to 2100z and are designated with numbers, the westbound PACOTS tracks are from 1900z to 0800z and are designated with letters.

There are some FIRs that use the metric system rather than feet when assigning altitude, for example China. If your autopilot can't set the altitude in meters itself, you will have to use conversion tables to convert feet to meters and vice versa. Those tables can be found in the ICAO Annex 2 and differ depending on the rules in the airspace.

TRACK**											
From 000 degrees to 179 degrees***						From 180 degrees to 359 degrees***					
IFR Flights			VFR Flights			IFR Flights			VFR Flights		
Level			Level			Level			Level		
Standard Metric	Metres	Feet	Standard Metric	Metres	Feet	Standard Metric	Metres	Feet	Standard Metric	Metres	Feet
0030	300	1 000	–	–	–	0060	600	2 000	–	–	–
0090	900	3 000	0105	1 050	3 500	0120	1 200	3 900	0135	1 350	4 400
0150	1 500	4 900	0165	1 650	5 400	0180	1 800	5 900	0195	1 950	6 400
0210	2 100	6 900	0225	2 250	7 400	0240	2 400	7 900	0255	2 550	8 400
0270	2 700	8 900	0285	2 850	9 400	0300	3 000	9 800	0315	3 150	10 300
0330	3 300	10 800	0345	3 450	11 300	0360	3 600	11 800	0375	3 750	12 300
0390	3 900	12 800	0405	4 050	13 300	0420	4 200	13 800	0435	4 350	14 300
0450	4 500	14 800	0465	4 650	15 300	0480	4 800	15 700	0495	4 950	16 200
0510	5 100	16 700	0525	5 250	17 200	0540	5 400	17 700	0555	5 550	18 200
0570	5 700	18 700	0585	5 850	19 200	0600	6 000	19 700	0615	6 150	20 200
0630	6 300	20 700	0645	6 450	21 200	0660	6 600	21 700	0675	6 750	22 100
0690	6 900	22 600	0705	7 050	23 100	0720	7 200	23 600	0735	7 350	24 100
0750	7 500	24 600	0765	7 650	25 100	0780	7 800	25 600	0795	7 950	26 100
0810	8 100	26 600	0825	8 250	27 100	0840	8 400	27 600	0855	8 550	28 100
0890	8 900	29 100				0920	9 200	30 100			
0950	9 500	31 100				0980	9 800	32 100			
1010	10 100	33 100				1040	10 400	34 100			
1070	10 700	35 100				1100	11 000	36 100			
1130	11 300	37 100				1160	11 600	38 100			
1190	11 900	39 100				1220	12 200	40 100			
1250	12 500	41 100				1310	13 100	43 000			
1370	13 700	44 900				1430	14 300	46 900			
1490	14 900	48 900				1550	15 500	50 900			
etc.	etc.	etc.				etc.	etc.	etc.			

Figure 3: Example of a conversion table (Source: ICAO Annex 2)

4. Communication

Certain environments you may find yourself in on a long-haul flight have special ways of communicating. One of the best-known examples is oceanic airspace. Due to the size of the Atlantic Ocean, VHF doesn't have enough range (around 550km) to reach flights in oceanic airspace, so HF is used. HF is also used in remote areas, such as parts of Africa. One of the disadvantages of HF is that the audio quality is much poorer than VHF and there is constant background noise. In real life, most communication in remote areas happens via SATCOM or CPDLC, given that the aircraft is equipped suitably. In order to be able to communicate with each other, some special phraseology and systems are used, more information on topics such as HF communications, CPDLC, SELCAL and oceanic procedures can be found on this website.

In some parts of Africa there is an IATA-established inter-pilot frequency (126.9), which pilots use to give position reports. This frequency was created because the service provided in certain FIRs was of questionable safety. You can read more about this topic here.

5. Operating a heavy

Operating a heavy aircraft, brings challenges with it. Be that on ground or once you are air born. The following passages will bring the most important factors closer to you.

Wingspan Limits

As pilots, we’re acutely aware of how critical wingspan limitations are, especially for long-haul aircraft with larger wings. The size of the wings determines which taxiways and gates an aircraft can use, and this is classified by the ICAO code letter system. For instance, wide-body aircraft like the Boeing 777 or Airbus A380 fall into the higher categories (E and F), requiring careful coordination with ground controllers to ensure safe navigation around airports. We rely on strict adherence to these guidelines to prevent conflicts with other aircraft and the airports infrastructure.

ICAO Aerodrome reference codes

The reference code system is the guideline for pilots on the ground. For large long-haul jets, like the Airbus A380, navigating an airport's complex network of taxiways can be as intricate as flying the aircraft itself. Proper taxiing also includes monitoring tight turns to avoid clipping wingtips—another reason why clear communication with ground operations is vital. Such information can be found on the airport taxi charts, or sometimes on type specific taxi charts.

Code letter	Wingspan	Typical type
A	< 15m	C172
B	15m<x<24m	C700
C	24m<x<36m	A320
D	36m<x<52m	B767
E	65m<x<52m	B777
F	65m<x<80m	A380

Speeds and Wakes

Long-haul flying involves managing a broad range of speeds, from slower taxiing to the high speeds required for takeoff and cruising. Another critical factor is wake turbulence—the powerful air currents left behind by aircraft. As pilots, we follow the strict spacing rules, applied to us by ATCOS, to avoid these wakes, especially during takeoff and landings. Effective speed and wake management not only ensures a smooth flight but also reduces risks for other aircraft sharing the skies and runways. To meet wake turbulence requirements, strict adherance to speed instructions is crucial.

Figure 4: Wakes created by a landing heavy MD-11 (Source: Wikimedia)

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