Cross-Atlantic Flights

The Real Thing…

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Introduction

At **7:52 A.M., May 20, 1927** the history of non-stop transatlantic flights started. That day Charles Lindbergh with his aircraft named "Spirit of St Louis" took off from Roosevelt Field, Long Island with destination the other side of the Atlantic Ocean. On the evening of May 21, he crossed the coast of France, followed the Seine River to Paris and touched down at Le Bourget Field at 10:22P.M. The first non-stop transatlantic flight had duration of thirty-three and one half-hours and distance of 3.500 miles.

Since the first transatlantic flight, many changes-improvements have been made in the way these flights are executed.

This document is an attempt to brief, (with as simple words as possible but with a touch of professionalism also), all FlightSimmers who are interested on Atlantic Crossing procedures. This is a nice document to **start with**, but as Cross-Atlantic flight has a great amount of information and procedures related to it, be advised that may be things that are **not** mentioned in here.

Also, please have in mind that in **online flying** there may be specific procedures, **slightly simplified** from the ones followed in real life due to simulation limitations. As a result, if you fly online you will have to check also the appropriate vACCs' or ARTCCs' websites that are responsible for the North Atlantic Area, some of which are also listed in our Links section.

We will monitor an eastbound flight of Olympic Airways, **OAL412**, from **KJFK to LGAV** in order to cover each issue as it unfolds in front of the cockpit crew in real life. Any differences in operation and procedures for westbound flights will be covered in Appendix A.

For any **comments** you may have or if you would like to **use this document** not only for your personal use, please contact us, Krikor Michikian and Vangelis Hassiotis.

So, let's start.

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Chapter 1 - Navigation

1.1 About Navigation

Navigation means knowing where you are, where you want to go, and having a good idea of how much time and fuel it will take you to get there.

Therefore, the necessary actions in order to get to your destination, at the estimated time of arrival are:

- The **proper calculation of the course** and **fuel consumption**.
- The **accurate flying** of the aircraft and last but not least
- The correct prediction of the **winds-aloft** and **enroute weather**.

Well, in order to comply with the above prerequisites you have to start with correct **flight planning** at the airline dispatch office.

Four are the documents that you need:

- The **weather charts and weather forecasts (TAF)**
  METARs are nice to have, but keeping in mind that you will arrive in your destination in more or less 10 hrs, these METARs will become pretty much outdated. A good use for the METARs though, is the crosschecking of the destination Temperature with the clothing you have packed in your suitcase… Just kidding, METARs are always nice to have, after all weather forecasts (TAF) are only predictions -pretty good ones we'd rather say-.
- The **NOTAMs**
- The **NAT tracks message,** and of course
- The **computerized flight plan** (see Appendix M).

Lets start examining these documents one by one assuming that we are going to fly from KJFK to LGAV (New York to Athens). **We are Olympic Airways' flight OAL412**.

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1.2 The weather charts and weather forecasts

What we basically need is the **High Level Significant Weather Chart**, in order to check the enroute weather.

What we are looking for is:

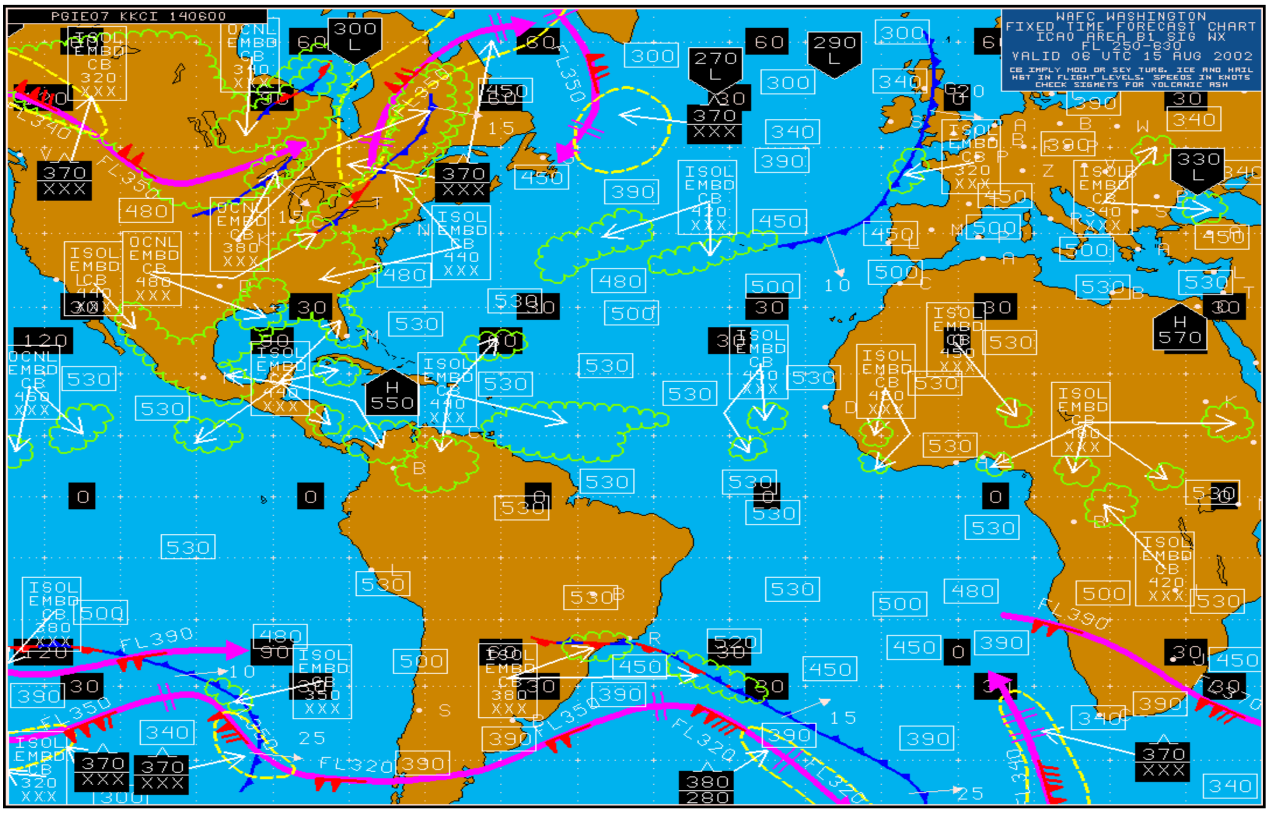
- Fly as far as possible from areas with thunderstorms
- Avoid CAT areas.(see Appendix N - Abbreviations for explanation of CAT)
- Try to get advantage from the jetstreams if possible
- Have a rough idea of the tropopause height along our route, and also
- Have an overview of the whole weather scene around our route. i.e. how will the weather be at the enroute alternates, how will the weather be at the destination and its alternates etc.

High level SIGWX charts are valid at specific fixed times: **0000, 0600, 1200, and 1800 UTC**. They show significant en-route weather phenomena over a range of flight levels from 250 to 600, and associated surface weather features.

Always keep in mind that the chart portrays the weather picture at a specific time. In order to have a rough overview of the weather at another time instance we have to calculate the weather phenomena movement and extrapolate accordingly.

Below you may see an example of a High Level Significant Weather **(High SIGWX)** Chart provided by **A.W.C.** (Aviation Weather Centre) site. An excellent source for **current High SIGWX Charts**.

High SIGWX Chart Example



(Check Appendix K for SIGWX Charts Symbol Explanation)

After checking the weather chart, we have a look at the **TAFs** (Terminal Aerodrome Forecasts) for the destination, the destination alternates, and the enroute alternates. Great importance must be given to the forecasts for the **North Atlantic airports**, i.e.

- CYQX (Gander), CYYR (Goose Bay) and CYHZ (Halifax) in Canada
- BIKF (Keflavik) in Iceland
- EINN (Shannon) in Ireland
- EGPK (Prestwick) in UK
- LPAZ (Santa Maria) and LPLA (Lajes) in Azores
- BGSF (Sondre Stromjford) in Greenland

since these are the only airports that may become “handy”, when you have entered North Atlantic Airspace, should a situation arise…

Then again a last look at the destination **METAR (**Meteorological Aeronautical Report) is a wise think to do, as it is the only place that the destination Temperature is stated. Believe us, you will need that figure, when its time for the passenger announcements. (Another place to find the destination Temperature is the newspapers that are luckily loaded on the aircraft!)

But if you are at home getting prepared for your online flight, you may find the most current **METARs** and **TAFs** in the **N.W.S.** (National Weather Service) site and of course you may also check Appendix K for further information.

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1.3 The NOTAMs

The same general idea that applies to weather, applies to NOTAMs as well. We have to check for NOTAMs in order to find if there is anything that may affect our flight.

Accordingly **we check the NOTAMs** for:

- The departure airport
- Enroute airports
- Enroute navigation facilities
- Navigational warnings
- Destination airport and alternates

as well as the NOTAMs for

- The preliminary destination and its alternates

if and only if the flight is conducted using the **Re-release procedure** (explained later on, here).

An excellent source for **current NOTAMs** (and not only) is the US NOTAM Office site.

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1.4 The NAT tracks message (Introduction)

Well, trying to be very brief about this (as there will be a more thorough explanation later on for the NAT crossing procedures) the NAT track message is a document that has the coordinates of the tracks that connect the North American continent with the European one (Westbound during the morning hours and Eastbound during the evening hours). In airline operations, the flight dispatcher chooses the track that suits the flight he is planning, taking mostly into consideration the shortest time and weather phenomena along the track.

More about this later on, here.

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1.5 The Flightplan

The look of this document varies from one airline to another. However the context of the document is the same, either the flight is conducted with a C-152 or an A380 (we are not sure though if the space shuttle uses one).

Most of the aviators have a quick look:

- At the route
- The FLs
- The tropopause height

so that they know the approximate route they will be flying and the turbulence tendency they will be encountering, and can then concentrate to the most important piece of this document. The Fuel Requirements.

More Information about the ICAO Flight Plan and the Computerized version of it may be found in Appendix M.

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Chapter 2 - Preparation

2.1 The Fuel Requirements

The basic fuel figures consist of the following *(as in our example we will be flying an A340-300, the figures will be for this aircraft)*:

- The **Taxi fuel,** which is the total amount of fuel expected to be used prior to T/O including the APU consumption. 500Kgrs, but as KJFK has a lot of taxi time we raise that to **750Kgrs**

- The **Trip fuel,** which you can calculate knowing your fuel consumption. The amount must include:
  - T/O and climb, taking into account the expected departure routing and procedures
  - Cruise from Top of Climb (TOC) to Top of Descent (TOD), including step climbs
  - Descent to the Initial Approach Fix (IAF), taking into account the arrival routings and procedures
  - Approach and landing at destination

- The **Reserve or Contingency fuel.** Most airlines use some kind of a percentage of the trip fuel to encounter any deviations on the trip fuel due to deviations from forecasted meteorological conditions, deviations of a specific airplane from the expected fuel consumption data, deviations from planned routings and/or cruising levels, etc. **(we will assume the 5% for our example)**.

- The **Alternate fuel.** This must include:
  - A Go-Around from the applicable MDA/DH at the destination airport to the Missed approach altitude,
  - Climb from missed approach altitude to the cruising level,
  - Cruise from TOC to TOD,
  - Descent to the IAF, taking into account the arrival routings and procedures,
  - Approach and landing at destination alternate.

  (If two destination alternates are required, then alternate fuel must be sufficient to cover the alternate requiring the greater amount of fuel)

- The **Final reserve fuel** is the fuel to hold for 30 minutes at 1500ft AAL in ISA conditions upon arrival at the Alternate airport. The fuel consumption is determined according to the estimated Landing Weight . In order to be on the safe side though, we can use the fixed amount of **2800Kgrs** of fuel that corresponds to the Max Landing Weight figures of an A340-300 (190.000 Kgrs).

These are the **minimum fuel requirements**. The flight crew however, can decide to take any amount of extra fuel they want; after all, they are the ones flying the aircraft...

Now, what if the minimum fuel amount required, is more than the max fuel amount we can carry on a specific flight?

This can happen for many reasons:

- Restricted T/O weight due to a short runway
- Forecasted headwinds
- Remote destination alternates
- Luckily, an aircraft full of passengers and cargo

We must find a way to **take less fuel** and still be **legal**. And here applies the Re-release procedure.

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2.2 The Re-release procedure

In every profession there are some tricks used in order to make our lives easier. Such one is the Re-release procedure. Keep in mind though that it is absolutely **safe and legal**.

The concept rests on the following facts.

Flight planning is made between two points on the ground. What if, however, we **split** our flight into **two** portions:

- Departure (KJFK) to a mid-air point and
- Mid-air point to destination (LGAV)

Why should we want to do this? Trust us. Let us finish our reasoning and we are sure that you will get the point.

Let's assume now, that we somehow managed to get to that predefined mid-air position from now on called **Re-release point** or **Redipatch point (RP)**.

In order to get from the **Re-release point** to our **destination** (LGAV) we need the following amount of fuel:

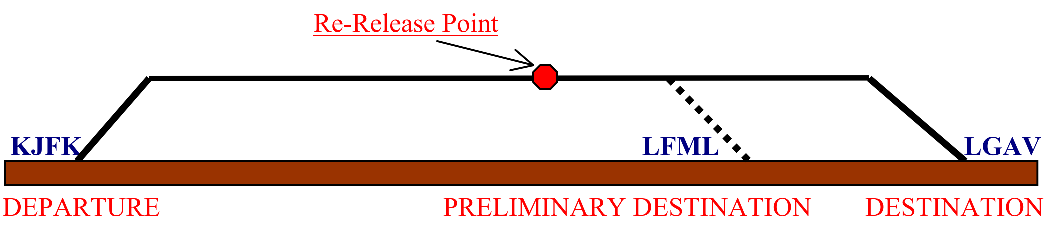
- Trip fuel (from RP to LGAV)
- 5% of contingency fuel (for the leg from RP to LGAV)
- Alternate fuel
- Final Reserve Fuel

(No need for taxi fuel. We are already in the air)

If we add now, to the above calculated fuel, the trip fuel from our **departure** (KJFK) to the **Re-release** point and the taxi fuel, we have a fuel figure that can fly us from KJFK to LGAV and that is **less** than our original calculation as we have used the 5% for a **portion** of the flight (RP-LGAV) and not for the whole flight (KJFK-LGAV).

However, there is a very important point here that we have to take into serious consideration. Although the above calculation comes "handy" because we can fly from KJFK to LGAV with less fuel than our original calculations (i.e. the calculation without using the **Re-release procedure**, in other words, the spliting of the flight into two portions) it is not absolutely legal. Remember we did **not** use the 5% contingency fuel for the whole flight KJFK-LGAV but we arbitrarily used the **5% of the leg between the Re-release point to LGAV**.

Let's see how we can overcome this small legal issue here.



Let us assume that our destination is not the originally planned Athens (LGAV) but is an hypothetical destination Marseilles (LFML).

If we can load the aircraft with the amount of fuel required to fly from KJFK to LFML via the RP, we can legally start our flight having defined that preliminary destination in our flight plan and giving a promise that we are going to make a **decision** approaching the RP. **What kind of decision?** Be patient. We will cover this in a couple of minutes.

Keeping in mind that Marseilles -our hypothetical destination, from now on called **Preliminary destination**,- is closer than LGAV but still beyond the RP, and the fuel amount required is such an amount that is less than the maximum fuel we can carry today (remember the question in page 6), we can start the flight without dissembarking passengers or leaving cargo behind. The good part is that we are absolutely legal.

*The ATC as destination has our scheduled destination, but in the remarks portion of the FPL there is a note starting with the prefix **RIF/**, which means **Reclearance In Flight**, and where the route from the Redispatch Point to our Preliminary Destination is written.*

As a rule of thumb, it is best for the Redispatch point to be situated:
1. Within 1 hour from the preliminary destination
2. Within 3 hours from the scheduled destination

(For westbound flights, an optimum position for the redispatch point is the 50W meridian).

Let's review the above-mentioned concept to our example Flightplan below so we can see it with numbers:

FUEL TO PRELIMINARY DESTINATION

REQUIREMENTS	TIME	FUEL
PRELIM DEST	0729	49920
5PC OR RES	0022	2500
ALT LIRF	0102	6520
HOLD ALT	0030	2800
TAXY		750
MIN REQ	0923	62490

FUEL TO SCHEDULED DESTINATION

T/F TO RP	0646	47220
RP TO DEST	0156	9500
5PC OR RES	0012	1000
ALT LGTS	0040	4440
HOLD ALT	0030	2800
TAXY		750
MIN REQ	1004	65710
RCLR EXTRA	0000	0
TTL REQ	1004	65710
EXTRA		.. ..
TTL O/B		.. ..

In case we had to fly to LGAV with **no Re-release procedure** we would need the following amount of fuel:

Taxi	**: 750Kgrs**
Trip [T/F TO RP+RP TO DEST]	**: 56.720Kgrs**
Reserves 5%	**: 2.840Kgrs**
ALTN	**: 4.440Kgrs**
Final Reserve fuel	**: 2.800Kgrs**
TOTAL	**: 67.550Kgrs**

➢ Now let's assume we cannot take that amount of fuel because our T/O weight is restricted from the runway of departure in KJFK, and we cannot disembark neither passengers nor cargo. **What can we do?**

Step 1.

File a flight plan stating your intention to fly to a **Preliminary destination** in case your fuel consumption enroute does not help you to fly to your scheduled destination.

(FPL-OAL412-IS
-A343/H-SHIWXDRY/C
-KJFK2145
-N0481F330 HAPIE3 YAHOO DCT DOVEY/M082F330 NATY 43N050W/M082F370 NATY SEPAL/M082F370 UN470 NOVAN/M082F360 UN470 CGC UN460 LMG ARA/M082F370 UB34 NEMES NEMES1A
-LGAV0842 LGTS LGRP
-EET/KZBW0007 KZNY0034 LPPO0245 EGGX0329 LFFF0507 LIMM0623 LIBB0706 LGGG0750
60W0115 50W0201 40W0245 30W0329 20W0412
RIF/BEROK/M082F360 UB25 GEN/M082F370 UW709 LAGEN UW712 ENOBA UW707 KEPPO G7 NIZ/M082F340 G7 MTG DCT LFML
REG/SXDFB SEL/FHDS)

Step 2.

Determine your fuel amount, which should be the greater of:

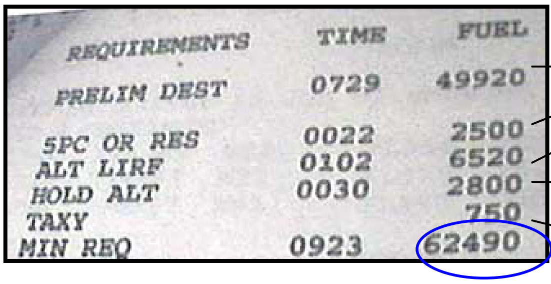
A. The sum of:
- Taxi fuel
- Trip fuel to the **preliminary destination**
- Contingency fuel, 5% of the trip fuel **to the preliminary destination**
- Alternate fuel
- Final reserve fuel

Or

B. The sum of:
- Taxi fuel
- Trip fuel to the scheduled **destination via the re-release point**
- Contingency fuel, 5% of the trip fuel **from the re-release point to the scheduled destination**
- Alternate fuel
- Final reserve fuel

Accordingly:

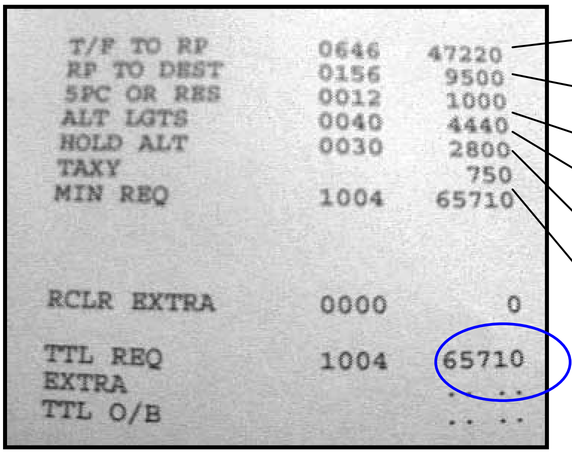
A. FUEL TO PRELIMINARY DESTINATION



REQUIREMENTS	TIME	FUEL
PRELIM DEST	0729	49920
5PC OR RES	0022	2500
ALT LIRF	0102	6520
HOLD ALT	0030	2800
TAXY		750
MIN REQ	0923	62490

Trip fuel to LFML (Marseilles)……………..49.920 Kgrs
5% Contingency fuel (2.496 rounded to)……2.500 Kgrs
Fuel to ALTN Rome Fiumicino……..………6.520 Kgrs
Final Reserve Fuel…………………………..2.800 Kgrs
Taxi fuel……………………………………..750 Kgrs

B. FUEL TO SCHEDULED DESTINATION



T/F TO RP	0646	47220
RP TO DEST	0156	9500
5PC OR RES	0012	1000
ALT LGTS	0040	4440
HOLD ALT	0030	2800
TAXY		750
MIN REQ	1004	65710
RCLR EXTRA	0000	0
TTL REQ	1004	65710
EXTRA		.. ..
TTL O/B		.. ..

Trip fuel to Redispatch point……………..47.220 Kgrs
Trip fuel from Redispatch point to LGAV...9.500 Kgrs
5% Contingency fuel
(475 but min 1.000 by company policy) ..…1.000 Kgrs
Fuel to ALTN Thessaloniki…………..……..4.440 Kgrs
Final Reserve Fuel…………...……………..2.800 Kgrs
Taxi fuel……………………..………………..750 Kgrs

What have we got so far? Let's review the fuel figures.

67.550 Kgrs from KJFK to LGAV direct
and
65.710 Kgrs from KJFK to LGAV using the Re-release procedure (65.710 Kgrs is the greater of options A and B)

In both cases we T/O from KJFK and we land at LGAV, **but** in the second case we need 1.840 Kgrs less of fuel. *(Which means 1.840 divided by 80Kgrs a passenger, equals 23 passengers.)*

But that's not all,...

...we have done it on paper, we are **LEGAL** to start the flight but there is one thing more…

In-flight, prior to reaching BEROK (our Redispatch point) we have to calculate our fuel figures again.

If the fuel on board over BEROK equals to:

➢ Trip fuel from Redispatch point to LGAV	9.500 Kgrs
➢ Contingency fuel	1.000 Kgrs
➢ Fuel to ALTN Thessaloniki	4.440 Kgrs
➢ Final Reserve Fuel	2.800 Kgrs
TOTAL	17.740 Kgrs, we then continue to LGAV...

...this is the decision we were talking about earlier.

Before determining the final amount of fuel we are going to take, which is called **Block Fuel,** there are a couple of other things related with the fuel and the **Zero Fuel Weight** (ZFW).

(ZFW is the weight of the aircraft fully loaded for the flight if we exclude the fuel amount. The Max ZFW for the A340-300 we are using in our example is 178.000Kgrs).

Our T/O weight must be:

- Lower than our Max Take Off Weight as limited by the structural limit weight of the aircraft which is 275.000Kgrs
- Such a weight that it is possible to T/O from the runway and satisfy all climb limitation during our departure, should a critical engine fails at V1
- Such a weight that is possible to stop in the runway should a critical engine fails before V1

Also, our T/O weight *(which is the ZFW plus the block fuel minus taxi fuel)* must be:

- Equal to or less than the sum of the Max Landing Weight (190.000Kgrs) and the trip fuel weight

Good airmanship means that you should also check the planned ZFW against the actual one. Keeping in mind that both all of the fuel calculations and consumption are based on the planned ZFW, if the actual ZFW is greater then we have to reconsider, as

- Fuel consumption may be greater
- We may not be able to climb immediately to the flight planned cruising level, meaning again increased fuel consumption

Speaking about figures, the fuel calculations so far were based on 169.000 Kgrs of ZFW. Here are more figures for the same flight so you can make your comparisons:

➢ Trip fuel from KJFK to LGAV 2000ft below Cruising level	: 57.652 Kgrs
➢ Trip fuel from KJFK to LGAV 3000Kgrs below planned ZFW	: 55.859 Kgrs
➢ Trip fuel from KJFK to LGAV 3000Kgrs above planned ZFW	: 57.430 Kgrs

Hopefully we are now ready to decide our **Block Fuel**, it will be for training purposes rounded to **66.000 Kgrs (~65.710Kgrs)**. We say for training purposes, as we don't believe that there is anyone out there that would take the exact minimum amount of fuel, even though it is legal for one to do so.

Well, let's crosscheck our decision:

- **ZFW + Block Fuel** **< Max Taxi Weight (275.900)**
- 169.000 + 66.000 = 235.000 which is OK
- **ZFW + Block Fuel - Taxi fuel** **< Max T/O Weight (275.000)**
- 169.000 + 66.000 – 750 = 234.250 which is OK
- **T/O weight - Trip fuel** **< Max Landing Weight (190.000)**
- 234.250 - 56.720 = 177.530 which is OK

It's time to go to the aircraft now. You must always start for the aircraft enough time before the Estimated Time of Departure (ETD). Not for the reason of the pre-flight, as it might have crossed your mind, but for the reason that between the dispatch office and the aircraft, rest the duty free shops, and most probably you will have a big list in your pocket (even bigger if you happen to be married!!!).

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2.3 Going to the aircraft

The purpose of this tutorial is the transatlantic flight, and we will try to skip the usual preflight stuff you do in any other flight.

- Therefore, after arriving at the aircraft, before seating on your seat, you do the preflight checks. Consequently, you go outside the aircraft to make the external inspection. After finishing the walk-around, you can then go back to the cockpit and take your seat. It will be a long flight, and the secret is to have everything in order in the cockpit and especially the paperwork.

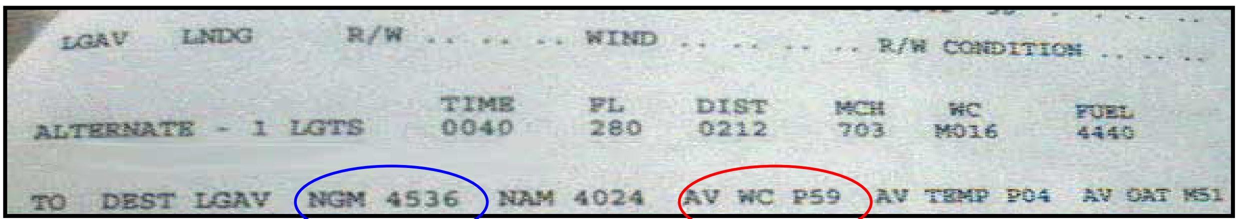
- After taking our seat, we take out the flightplan. The good thing with A340s is that we have …a table. So we open it and place the FPL in order to write easily. A wise first thing to do is to write down the ATIS. Kennedy ATIS freq is 128.72. If you are SATCOM equipped you can even call +17189958188 or you can even call from your cellular if money does not matter to you!

"This is Kennedy airport information 'V' 20.51z Wind190/17 visibility 10 miles. Ceiling scattered 5000CB, Broken 13000, Overcast 25000. Temperature 27, Dewpoint 22. QNH 29.89 Arrival VORDME22L Approach & VORDME13L Approach. Departing Rwy13R. Several cranes around Kennedy airport. On the interest of noise abatement please use the advised runway. On initial contact with Kennedy Ground please state that you have information 'V'"

We now have the weather data and we know the Rwy in use that is 13R for T/O. Let's load the FMS.

- Assuming we have loaded the FMS with all the available to us data from the flight plan, we can do nothing else but wait for the handling agent to bring us the Load Sheet, the document that has the final figures, Passengers – ZFW – trim of T/O C.G. - etc.

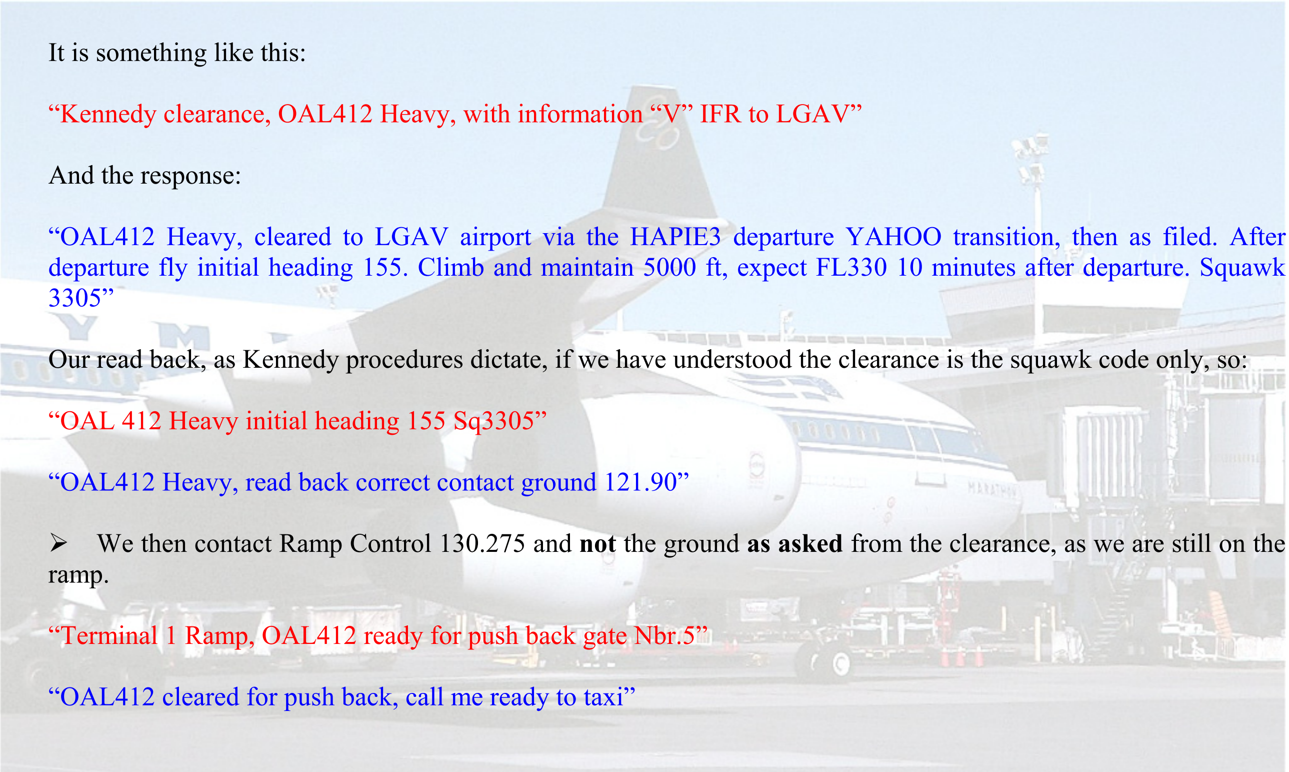
What is imperative to do though, to verify that the data we have entered in the FMS is in accordance with the flightplan, is to **compare** total miles on the FMS with the total nautical ground miles (NGM) on the flight plan, which must be pretty much close. You may have up to **70 – 80 miles difference**, especially for the flight from KJFK to LGAV, and that is because in the FMS we enter the expected arrival in LGAV which is NEMES1C for Rwy03L, while in the FPL the dispatcher has planned the long way, which is NEMES1A for Rwy21L, to be on the safe side.


LGAV LNDG R/W .. .. .. WIND .. .. R/W CONDITION .. .. ..
ALTERNATE - 1 LGTS TIME 0040 FL 280 DIST 0212 MCH 703 WC M016 FUEL 4440
TO DEST LGAV NGM 4536 NAM 4024 AV WC P59 AV TEMP P04 AV OAT M51

➢ After the handling agent brings us the Load Sheet, we first examine that everything is calculated correctly; we then enter the actual ZFW and ZFW C.G. in the FMS. It is a good habit to check how much fuel the FMS estimates to have in LGAV. Of course this might change in flight, but if you have entered the enroute step climbs and the average wind component shown on the picture above with red circle (+59), you will have a pretty much realistic figure.

➢ The next step is to determine the T/O speeds (V1, VR, and V2). After this is done all preflight procedures are completed. We just need the "go" from our handling agent to close doors and fly away.

➢ Assuming all doors are closed, we ask for our clearance from 135.05



It is something like this:

"Kennedy clearance, OAL412 Heavy, with information "V" IFR to LGAV"

And the response:

"OAL412 Heavy, cleared to LGAV airport via the HAPIE3 departure YAHOO transition, then as filed. After departure fly initial heading 155. Climb and maintain 5000 ft, expect FL330 10 minutes after departure. Squawk 3305"

Our read back, as Kennedy procedures dictate, if we have understood the clearance is the squawk code only, so:

"OAL 412 Heavy initial heading 155 Sq3305"

"OAL412 Heavy, read back correct contact ground 121.90"

➢ We then contact Ramp Control 130.275 and **not** the ground **as asked** from the clearance, as we are still on the ramp.

"Terminal 1 Ramp, OAL412 ready for push back gate Nbr.5"

"OAL412 cleared for push back, call me ready to taxi"

➢ By this point "BEFORE START Checklist" is already completed, and we are ready to go. We coordinate with the ground engineer and commence push back. After the push is complete, we have started the engines, and we have read the "AFTER START Checklist", we ask for taxi.

Most of the times the engine start commences after or during the push back, depending on the area behind the aircraft. There are of course some cases that a crew must start one or two of the engines while docked on the gate.

Three of the main cases are:

➢ *Auxiliary Power Unit (APU) not serviceable for pneumatic air supply, so we need an external pneumatic source to start the engines,*
➢ *APU not serviceable for electrics, so we need an external electrical source to start the engines, and/or*
➢ *APU not serviceable for both pneumatic air supply and electrics.*

“Terminal 1 OAL412 ready to taxi”

“OAL 412 roger, contact ground 121.900”

“Ground OAL412 Heavy ready to taxi holding short on N, good afternoon”

“OAL 412 Heavy good afternoon, hold short of A, monitor ground on121.650”

“OAL412 we will monitor 121.650, short of A”

What "monitor" means, is to tune on 121.650 but not speak to them, the ground controller will contact us. This is a common procedure in Kennedy, and especially in heavy traffic airports. Therefore we wait for them to call us.

“OAL412, Kennedy Ground, taxi to holding position 13R via N and P, give way to the American flight on your right.”

“OAL412 for Rwy 13R via N, P we will give way to the American”

Normally we now check our brakes, and start taxiing.

During taxi both pilots check their flight controls for full and free movement, review the T/O briefing from the pilot flying, and read the “BEFORE TAKE OFF Checklist”.

In the next 5 minutes to 2 hours time (this is how much it may take you to taxi due to traffic, something that you have to take into consideration when deciding Block Fuel) you change to tower, enter the runway and T/O for an initial heading of 155 degrees and for 5000ft as previously cleared.

At 500ft you can engage the “slave” (Autopilot) who takes over assuming you have loaded correctly the FMS. We now have approximately 8 hours and 40 minutes to take the controls again.

We now have plenty of time to discuss the North Atlantic crossing procedures.

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Chapter 3 - NAT

3.1 Introduction to NAT operations

Over the high seas, the lower limit of all **NAT Oceanic Control Areas** is **FL055** with **no upper limit**. Nat region, airspace, at or above FL055 is **class A** controlled airspace, and below FL055 is **class G** uncontrolled airspace.

Flights shall be conducted in IFR (even if VMC) when operating at or above FL060.

What is so unique about this portion of the flight?

Two things we would say:

- Not a lot of airports in the vicinity
- No navaids (VOR, NDB) to navigate with. Of course we now have INS, IRS and GPS but anyway.

Let's examine these factors one at a time.

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3.1.1 "Not a lot of airports in the vicinity"

What does "Not a lot of airports in the vicinity" mean for us? We are an A340 that means we have 4 engines. Should an engine fail we are not even in an emergency situation. But what happens if another engine fails too?

Engine failures are very rare phenomena, however, if you are so unlucky to have an engine failure, in order to be safe, you have to presume that you are so unlucky that a second engine will fail too. In this case, according to regulations you must be within 120 minutes of flight time from an airport. This means that:

A 3-engine flight, may not continue when its track passes through areas that it can not reach a suitable airport within 120 minutes when flying with 2 engines.

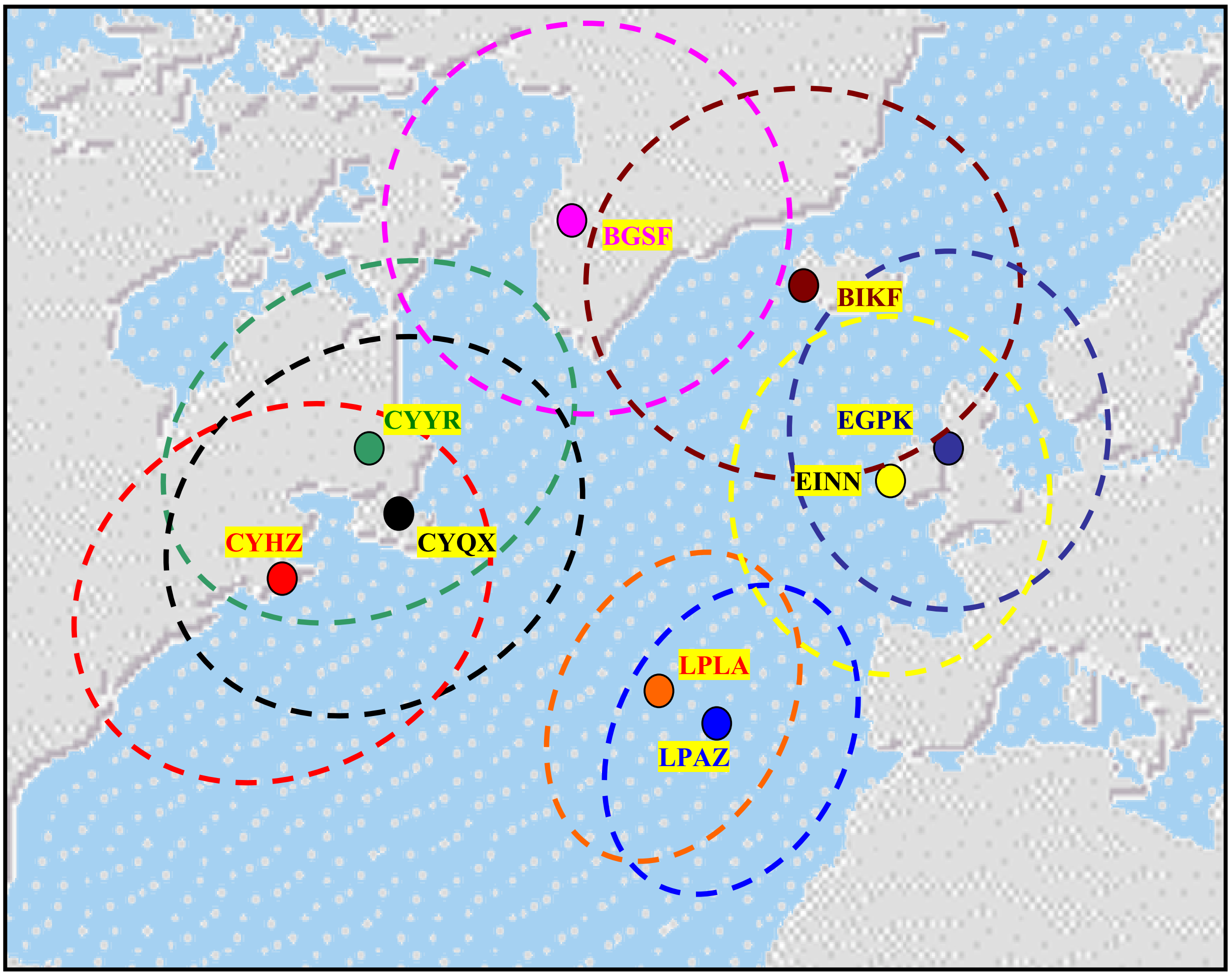
Operationalwise, this means that if the NAT track you are following brings you in an area outside of the circles shown in the diagram below, and in the remote case that an engine fails, you must alter your course immediately to bring the aircraft, in the most direct manner, within one of the closest circles. A circle is considered active if the airport in its centre is operational.

For example,

- The airport Rwys and Navaids are operational
- Its Rescue and Fire Fighting Capability is the one your aircraft requires
- MET conditions are OK for IAPs
- Etc.

Data used for the circles:

Radius : 120 minutes with the Long Range Cruise-LRC speed for 2 engines out, at your 2 engines out ceiling.
Altitude : Initial FL330 with driftdown to FL140 (the 2 engines out ceiling for the A340-300)
Temperature : ISA+15,
Gross Weight : 254 Tons,
Winds : Max annual winds (85% reliability)



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3.1.2 "No navaids (VOR, NDB) to navigate with"

This is not absolutely true, as there are **fixed** trans-Atlantic tracks. Usually however the great circle track between 2 points, departure and destination lies in the area between the 46N-48N parallels. (About Great Circles check also Appendix J)

Therefore we fly over the ocean and nothing else below.

Most of the problems arise from ATC. No VORs or NDBs to separate aircraft and no Radar coverage too. Someone must define specific tracks that there should be enough separation between them (60nm presently), with reporting points at specific intervals (every 10 degrees of longitude) so the controllers can separate traffic.

One of the questions that arised at the beginning of the implementation of these procedures was if they should make these tracks fixed. The answer was easy...

- The variability of the wind patterns would make a fixed track system unnecessarily penalizing in terms of flight time and consequent fuel usage.
- Nevertheless, the volume of traffic along the core routes is such that a complete absence of any designated tracks (i.e. a free flow system) would currently be unworkable given the need to maintain procedural separation standards in airspace largely without radar surveillance.

As a result, an **Organized Track System (OTS)** is set up. Each OTS is comprised of a set, typically 4 to 7, of parallel or nearly parallel tracks, positioned in the light of the prevailing winds to suit the traffic flying between Europe and North America. The designation of an OTS ensures that aircraft on adjacent tracks are separated for the entire oceanic crossing - at the expense of some restriction in the operator's choice of track. In effect, where the preferred track lies within the geographical limits of the OTS, the operator is obliged to choose an OTS track - unless he flies above or below the system. Where the preferred track lies clear of the OTS, the operator is free to fly it by nominating a **random** track.

Trans-Atlantic tracks, therefore, fall into three categories:

- **OTS (**which is issued twice daily and comes in the format of the NAT track message),
- **Random**
- **Fixed**

At this point, we feel the need to clear out some things about NAT region, so there are no confusions later on.

Within NAT region there are two distinct airspaces.

- MNPS airspace (FL285 and FL420)
- RVSM airspace, which is established within the confines of MNPS airspace and its associated transition areas

The purpose and requirements of the above-mentioned airspaces are discussed later on. What is important to keep in mind though, is that when flying within the geographical limits of the **OTS** you must respect the requirements of both MNPS and RVSM areas. When flying a **random track** at an altitude within MNPS (that already includes RVSM airspace) you again must respect the requirements and procedures of these areas.

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3.2 Specific operational procedures of the NAT region

The NAT airspace is divided into the following seven FIRs/CTAs:

- Bodø Oceanic
- Gander Oceanic
- New York Oceanic
- Reykjavik
- Santa Maria
- Shanwick
- Søndrestrøm

The most common ones for our flight are the Shanwick, Gander, and more rarely New York and Santa Maria.

Three major axes dominate the traffic in NAT airspace:

- First, there is the axis linking **Europe to North America** (excluding Alaska).
- Second, there is the axis linking the **Eastern seaboard of North America with the Caribbean, South America and Bermuda.**
- Third, there is the axis linking **Europe to the Caribbean and South America**.

A substantial proportion of NAT traffic, operating between cities in Europe and those in North America operate on the first axis.

The major traffic flow between Europe and North America takes place in two distinct traffic flows during each 24-hour period due to passenger preference, time zone differences and the imposition of nighttime noise curfews at the major airports.

- The majority of the Westbound flow leaves European airports in the late morning to early afternoon and arrives at Eastern North American coastal airports typically some 2 hours later - local time - given the time difference.
- The majority of the Eastbound flow leaves North American airports in mid/late evening and arriving in Europe early to mid morning - local time.

The appropriate Oceanic Area Control Center (OAC) constructs the Organized Track System (OTS) after determination of basic minimum time tracks; with due consideration of airlines' preferred routes and taking into account airspace restrictions such as danger areas and military airspace reservations.

The **night-time OTS** is produced by Gander OAC and the **day-time OTS** by Shanwick OAC (Prestwick), each incorporating any requirement for tracks within the New York, Reykjavik, Bodø and Santa Maria Oceanic Control Areas (OCAs).

The controllers of the Oceanic Area Control Center (OAC) that plan the NAT tracks, co-ordinate with adjacent OACs and domestic ATC agencies to ensure that the proposed system is viable. They also take into account the requirements of opposite direction traffic and ensure that sufficient track/flight level profiles are provided to satisfy anticipated traffic demand. The impact on domestic route structures and the serviceability of transition area radars and navaids are checked before the system is finalized.

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3.3 The NAT Track Message

The agreed OTS is published by means of the NAT Track Message. A typical time of publication of the daytime OTS is 0000 UTC and of the nighttime OTS is 1200 UTC.

This message gives full details of the co-ordinates of the organized tracks as well as the flight levels that are expected to be in use on each track. In most cases there are also details of domestic entry and exit routings associated with individual tracks (e.g. 'EUR RTS WEST…' or 'North American Routes (NAR)').

- In the westbound (daytime) system the track most northerly, at its point of origin, is designated Track 'A' (Alpha) and the next most northerly track is designated Track 'B' (Bravo) etc.
- In the eastbound (night-time) system the most southerly track, at its point of origin, is designated Track 'Z' (Zulu) and the next most southerly track is designated Track 'Y' (Yankee), etc.

The originating OAC identifies each NAT Track Message, within the Remarks section appended to the end of the NAT Track message, by means of a 3-digit Track Message Identification (TMI) number equivalent to the Julian calendar date on which that OTS is effective.

For example, the OTS effective on February 1st will be identified as TMI 032. (The Julian calendar date is a simple progression of numbered days without reference to months, with numbering starting from the first day of the year. January 1st will be identified by TMI 001) Any subsequent NAT Track amendments affecting the entry/exit points, route of flight (co-ordinates) or flight level allocation, for an OTS on a given day, will include a successive alphabetic character, i.e. 'A', then 'B', etc., added to the end of the TMI number.

The hours of validity of the two Organized Track Systems (OTS) are normally as follows:

Daytime OTS	1130 UTC to 1800 UTC **at 30°W**
Nighttime OTS	0100 UTC to 0800 UTC **at 30°W**

Oceanic airspace outside the published OTS is available, subject to application of the appropriate separation criteria and NOTAM restrictions. It is possible to plan the flight to join or leave an outer track of the OTS.

In conclusion, when crossing the Atlantic, either way, there are 4 possibilities:

- You fly in daytime OTS westwards if passing 30W between 1130 UTC to 1800 UTC
- You fly a Random Track westwards if flying outside the above mentioned hours
- You fly in nightime OTS eastwards if passing 30W between 0100 UTC to 0800 UTC
- You fly a Random Track eastwards if flying outside the above mentioned hours

If an operator wishes to fly partly or wholly outside the OTS,

- Knowledge of separation criteria
- The forecast upper wind situation
- Correct interpretation of the NAT Track Message

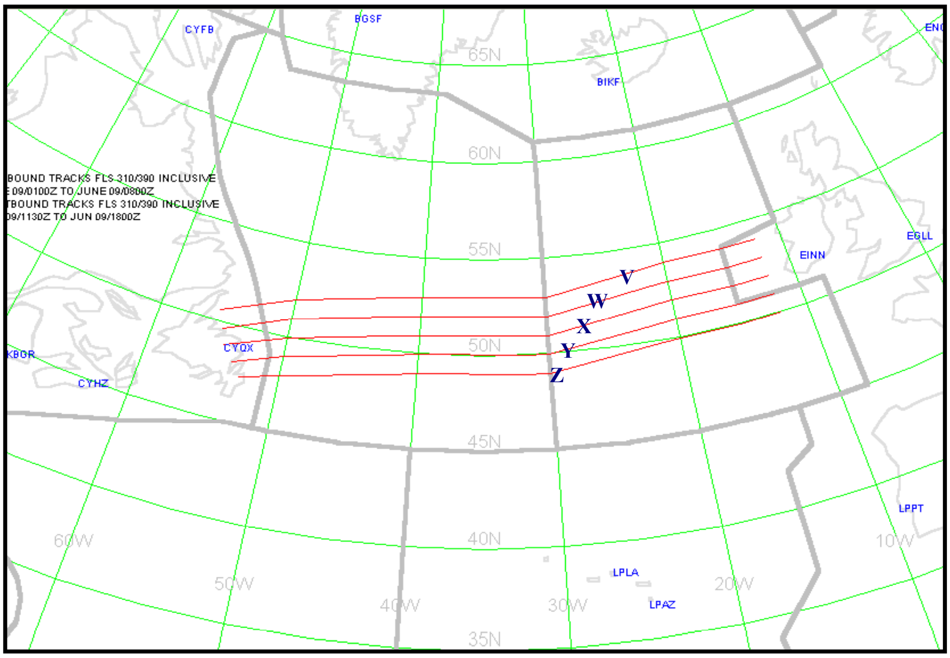
will assist in judging the feasibility of the planned route.

An example of NAT Tracks Message is following…

NAT-1/2 TRACKS FLS 310/390 INCLUSIVE JUNE 09/0100Z TO JUNE 09/0800Z PART ONE OF TWO PARTS- V DOTTY 52/50 53/40 53/30 54/20 DOGAL BABAN EAST LVLS 310 320 330 340 350 360 370 380 390 WEST LVLS NIL EUR RTS WEST NIL NAR N109 N113- W CYMON 51/50 52/40 52/30 53/20 MALOT BURAK EAST LVLS 310 320 330 340 350 360 370 380 390 WEST LVLS NIL EUR RTS WEST NIL NAR N93B N97B- X YQX 50/50 51/40 51/30 52/20 LIMRI DOLIP EAST LVLS 310 320 330 340 350 360 370 380 390 WEST LVLS NIL EUR RTS WEST NIL NAR N77B N83B- Y VIXUN 49/50 50/40 50/30 51/20 DINIM GIPER EAST LVLS 310 320 330 340 350 360 370 380 390 WEST LVLS NIL EUR RTS WEST NIL NAR N61B N67B- END OF PART ONE OF TWO PARTS	NAT-2/2 TRACKS FLS 310/390 INCLUSIVE JUNE 09/0100Z TO JUNE 09/0800Z PART TWO OF TWO PARTS- Z YYT 48/50 49/40 49/30 50/20 SOMAX KENUK EAST LVLS 310 320 330 340 350 360 370 380 390 WEST LVLS NIL EUR RTS WEST NIL NAR N51B N57A- REMARKS: 1. CLEARANCE DELIVERY FREQUENCY ASSIGNMENTS FOR AIRCRAFT OPERATING FROM MOATT TO BOBTU INCLUSIVE: MOATT - SCROD 128.7 OYSTR - DOTTY 135.45 CYMON - YQX 135.05 VIXUN - YYT 128.45 COLOR - BOBTU 119.42 2. TRACK MESSAGE IDENTIFICATION 160. 3. MNPS AIRSPACE EXTENDS FROM FL285 TO FL420. OPERATORS ARE REMINDED THAT MNPS APPROVAL IS REQUIRED TO FLY IN THIS AIRSPACE. IN ADDITION, RVSM APPROVAL IS REQUIRED TO FLY WITHIN THE NAT REGIONS BETWEEN FL290 AND FL410 INCLUSIVE. REFER TO INTERNATIONAL NOTAM CYA0080/02. 4. 80 PERCENT OF GROSS NAVIGATIONAL ERRORS RESULT FROM POOR COCKPIT PROCEDURES. ALWAYS CARRY OUT PROPER WAYPOINT CHECKS. 5. NAT USERS FLIGHT PLANNING EASTBOUND VIA A699 MUST FLIGHT PLAN FOCUS DIRECT LOMPI THEN FPR. NAT USERS FLIGHT PLANNING EASTBOUND VIA A700 MUST FLIGHT PLAN ENGLE DIRECT CARAC THEN FPR. 6. NAT EASTBOUND SCENARIO 4 IN FORCE. SEE CFMU A.I.M. FOR ROUTING DETAILS. REFER TO EGPX A0880/02 OR EGTT G0160/02. END OF PART TWO OF TWO PARTS

As seen from the example of NAT Tracks Message, the acceptable FLs to be in the OTS are 310 320 330 340 350 360 370 380 390. ***These, however, change from track to track and from day to day****. If you want to fly at a FL that is not specified in the track message, you can ask for it and the controller may assign it to you,* ***however,*** *in any case, if flying below OTS FLs you must be MNPS or RVSM approved if flying* ***within*** *the vertical limits of these areas.*

A graphical display of the NAT TRACKS MESSAGE



Picture above has been taken using NATPLOT V1.5 which you may find here.

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3.4 Minimum Navigation Performance Specifications (MNPS)

MNPS airspace has been established between FL285 and FL420. Longitudinal separation between in-trail aircraft using the Mach Number Technique is 10 minutes and aircraft that satisfy MNPS are separated laterally by a minimum of 60 NM. To ensure the safe application of the reduced separation minima, only MNPS certified aircraft are permitted to operate within the MNPS airspace.

The navigational requirements for unrestricted MNPS airspace operations are the following:

➢ **Two** fully serviceable Long-Range Navigation Systems (LRNSs). A LRNS may be one of the following:
- An Inertial Navigation System (INS);
- A Global Navigation Satellite System (GNSS);
- A navigation system using the inputs from one or more Inertial Reference System (IRS) or any other sensor system complying with the MNPS requirement.

Note: only two GNSSs currently exist: the Global Positioning System (GPS) and the Global Orbiting Navigation Satellite System (GLONASS)

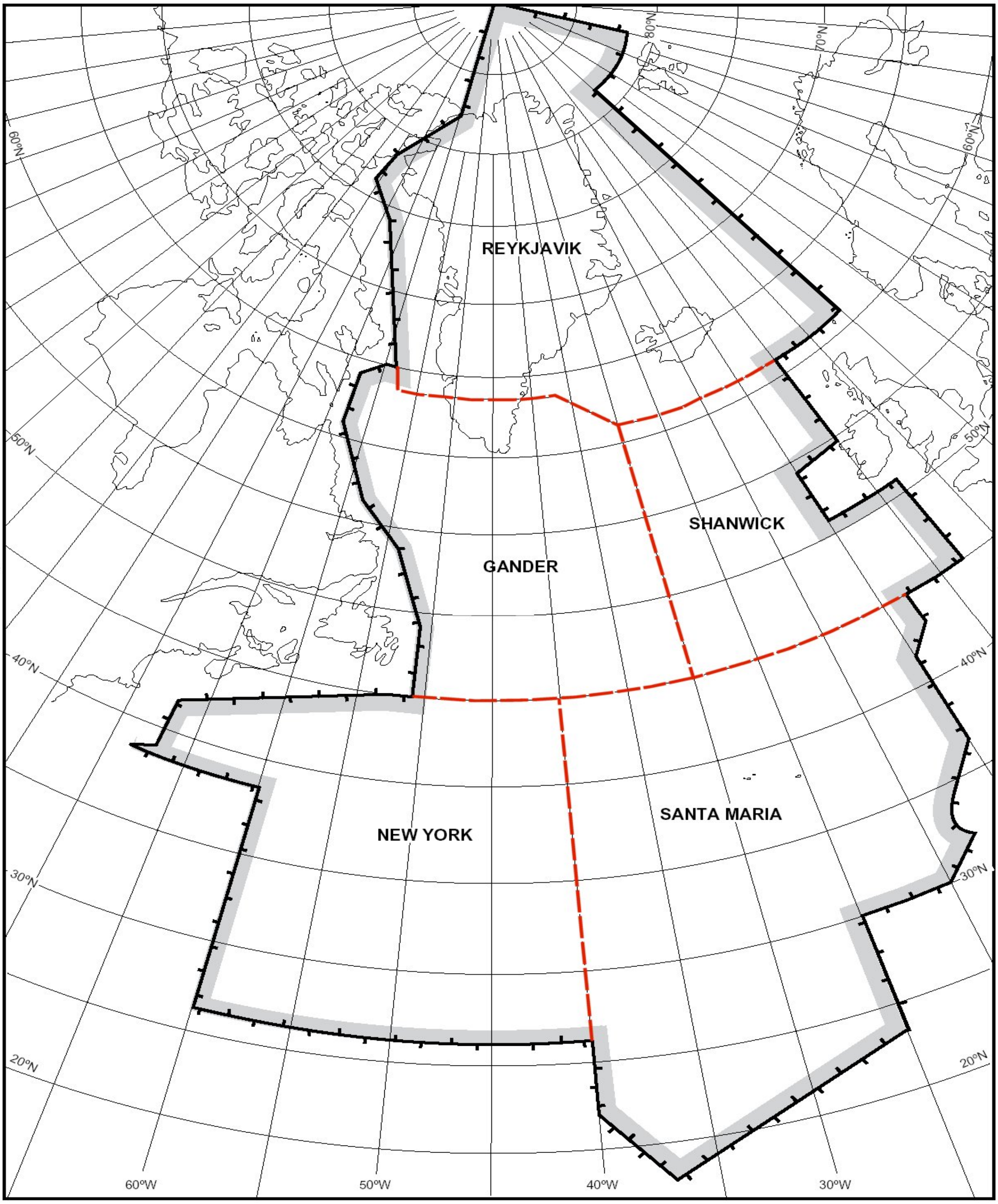
➢ Each LRNS must be capable of providing to the flight crew a continuous indication of the aircraft position relative to desired track.

➢ It is highly desirable that the navigation system employed for the provision of steering guidance is capable of being coupled to the autopilot.

A number of special routes have been developed for aircraft equipped with only one LRNS and carrying normal short-range navigation equipment (VOR, DME, ADF). It should be recognized that these routes are within MNPS Airspace, and that State approval must be obtained prior to flying along them. These routes are also available for interim use by aircraft normally approved for unrestricted MNPS operations that have suffered a partial loss of navigation capability and have only a single remaining functional LRNS.

An 'X' must be entered into Item 10 of the ICAO flight plan to indicate that the aircraft is approved for flight at MNPS airspace.+

Minimum Navigation Performance Specifications (M.N.P.S.) Airspace



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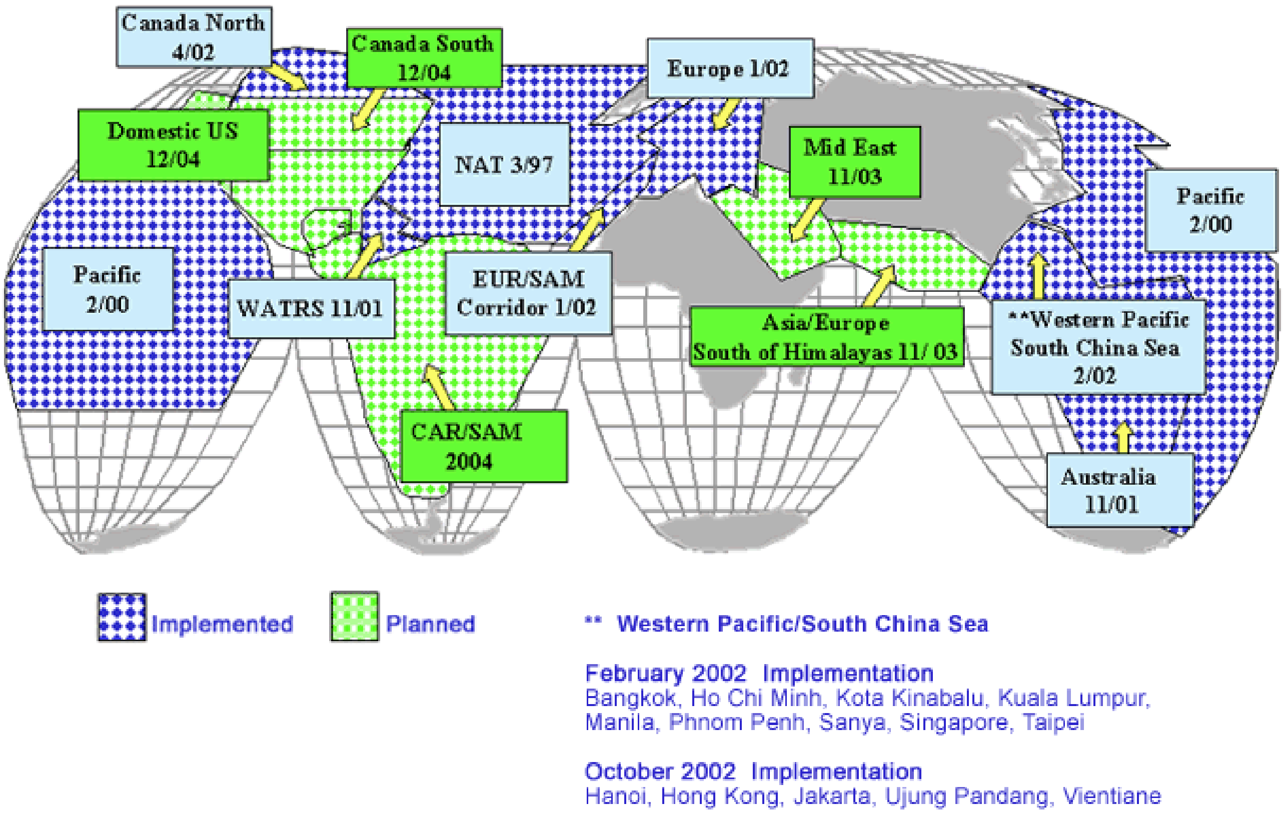
3.5 Reduced Vertical Separation Minima (RVSM)

RVSM airspace has been established within the confines of MNPS airspace and associated transition areas. In **RVSM** airspace, **1000 ft vertical separation** is applied between approved aircraft. Currently, RVSM is only applied between **FL 290 and FL 410 inclusive**. To ensure the safe application of the separation minimum, only RVSM approved aircraft are allowed to operate within RVSM airspace.

RVSM Status Worldwide
(Month/Year Implemented or Planned)



The minimum equipment required for operations at RVSM levels is the following:

- **Two** fully serviceable independent primary altitude measurement systems;
- **One** automatic altitude-control system;
- **One** altitude-alerting device.

A functioning Mode-C SSR Transponder is also required for flight through radar controlled RVSM transition airspace.

In particular it must be noted that if following a failure of an Air Data Computer (ADC), both the Captain's and Co-pilot's altimeter instruments are connected to a remaining single functional ADC, this arrangement does **not** meet the RVSM Minimum Aircraft System Performance Specification requirement for **two independent primary altimetry systems.**

When checking altimeters (pre-flight or in-flight), confirmation is necessary that all altitude indications are within the tolerances specified in the aircraft operating manual. **At least two primary altimeters must at all times agree within plus or minus 200 feet.**

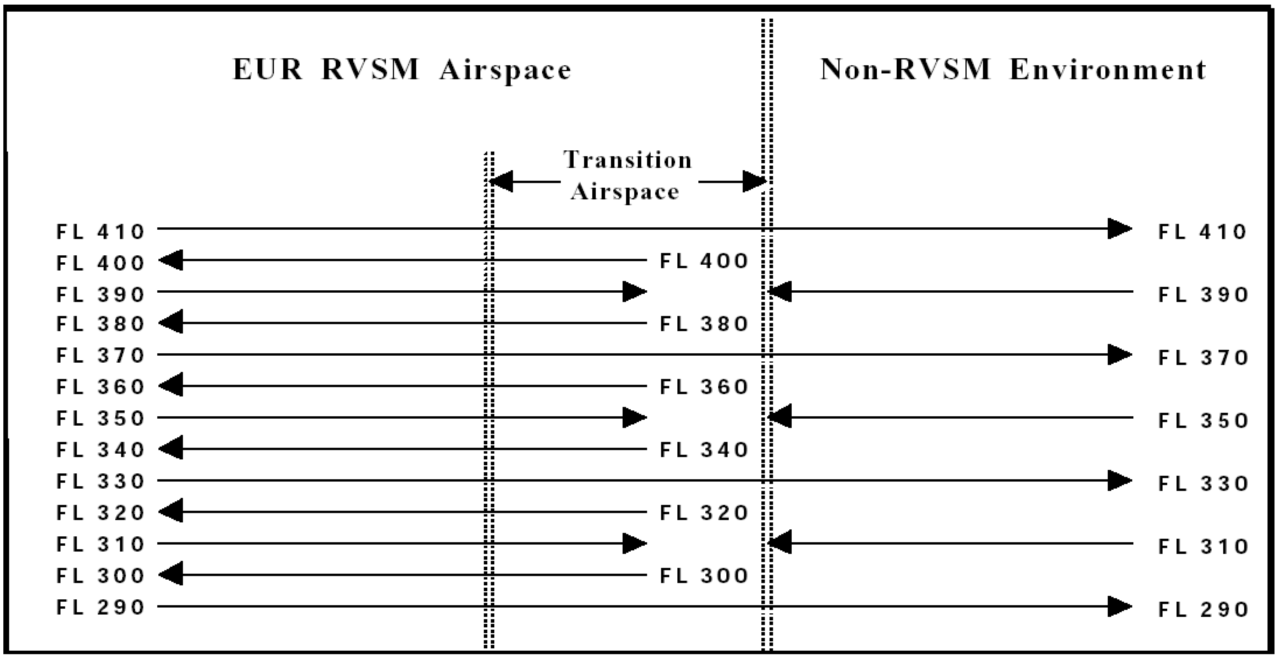
If at any time the readings of the two primary altimeters differ by more than 200 ft, the aircraft's altimetry system should be considered defective and ATC must be informed as soon as possible.

When changing flight levels within RVSM airspace **all vertical speeds should be within 500 to 1000 ft per minute.** This can reduce the likelihood of TCAS TAs and RAs occurring and should also help to ensure that the aircraft neither undershoots nor overshoots the cleared flight level by more than 150 feet.

In-flight, entering, flying at and leaving RVSM levels one automatic altitude-control system should be operative and engaged throughout the cruise. This system should only be disengaged when it is necessary to retrim the aircraft, or when the aircraft encounters turbulence and operating procedures dictate.

A 'W' must be entered into Item 10 of the ICAO flight plan to indicate that the aircraft is approved for flight at RVSM levels.

TABLES OF CRUISING LEVELS
(ICAO Annex 2, Appendix 3)



In order to enable non-RVSM approved aircraft operating to/from the NAT Region to be climbed/descended through the EUR RVSM airspace, State authorities responsible for the following FIRs may establish designated airspace within their FIRs for this purpose: Bodø (Domestic), Stavanger, Trondheim, Scottish, Shannon, London, Brest, Madrid, Lisboa.

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Chapter 4 – Enroute

4.1 Communications

Air/Ground voice communications in the NAT region are mainly conducted on HF. The quality of HF is largely dependent on propagation factors. Because of high noise levels and other difficulties, HF communications are conducted through a third party, **who has no executive ATC authority,** to relay communications for controllers. The absence of direct controller-pilot communications remains a major limitation in the provision of ATS in the NAT Region.

A great disadvantage of HF communication is the great degree of static that you can hear in the frequency. That makes it impossible to have the frequency on for a long period of time. Here comes the Selective Calling System (SELCAL). This system has a unique code for the specific aircraft (for its approved area of operation) that consists of four letters.

Whenever the controller must pass you a message, he calls you through that code and some kind of bell rings in your cockpit (just like a telephone). Then the crew knows that the controller is asking for them, they open the frequency and call the controller. That's it. (You may **hear** this bell ringing in Appendix A)

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4.2 Getting the clearance to enter NAT airspace

Back to our flight now.

According to our FPL we are going to use NAT "Y"

The NAT Track message for the today's flight would look something like this:

……………………..
……………………..
……………………..

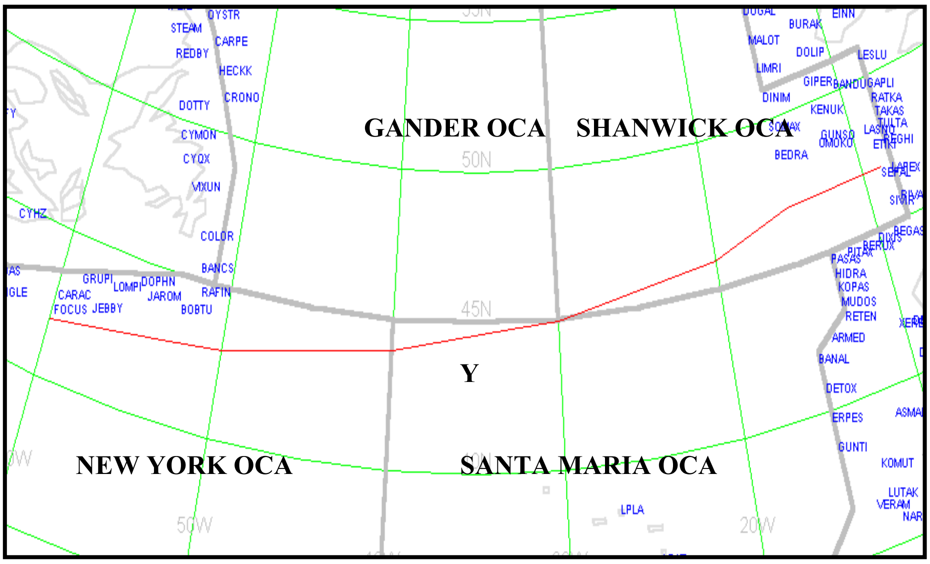
Y 42/60 43/50 44/40 45/30 46/20 47/15 SEPAL
EAST LVLS 310 320 330 340 350 360 370 380 390
WEST LVLS NIL
EUR RTS WEST NIL

REMARKS:

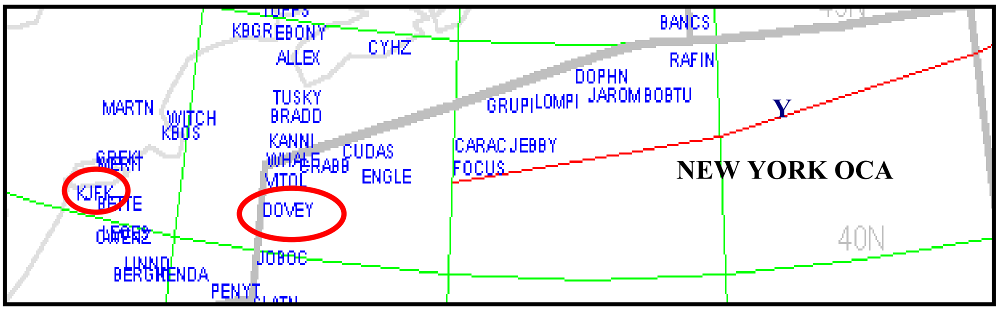
1. CLEARANCE DELIVERY FREQUENCY ASSIGNMENTS FOR AIRCRAFT OPERATING
FROM MOATT TO BOBTU INCLUSIVE:
MOATT - SCROD 128.7
OYSTR - DOTTY 135.45
CYMON - YQX 135.05
VIXUN - YYT 128.45
COLOR - BOBTU 119.42

2. TRACK MESSAGE IDENTIFICATION 185.
……………………..
……………………..
……………………..

If we have a look at the Jeppesen Atlantic Orientation Chart AT(H/L)1, we will see that we **enter the NAT region through New York OCA**. This means that our NAT crossing clearance will be given to us through New York Domestic Control, without having to change to other frequencies. While the procedures in case we entered NAT airspace from Gander are slightly different.



We are now cleared to fly direct to DOVEY point which we estimate at 22.42z The time now is 22.10z that gives us enough time to discuss **the scenario of entering NAT region through Gander OCA**.



➢ **Entering NAT Region through Gander OCA Scenario**

Let’s assume that the date is January 12 and that we are going to enter NAT region from CYMON point for track T. We can see on the previous extract of NAT track message that the clearance delivery frequency is the 135.05

Therefore, what we basically do is tune that frequency on our second comm box, and wait until we hear the controller speaking to other aircraft. As a rule of thumb we will be able to hear him at approximately 350-250 n.m. before CYMON.

We must have ready the estimate for CYMON and must know our max FL.

When ready we ask for our clearance like this:

"Gander OAL412, Good evening"

"OAL412 Gander, good evening, go ahead"

"OAL 412 requesting oceanic clearance via track 'T' from CYMON estimating at 23.15z M ,82 FL340 maximum FL360"

"OAL412 sby"

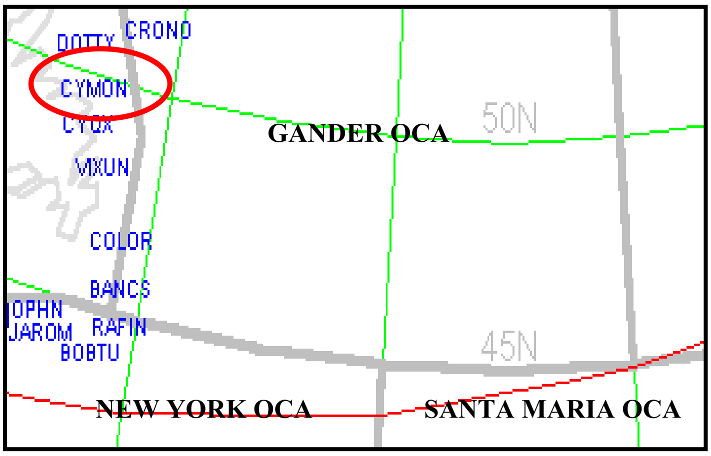
So we wait…
…. and wait.

"OAL 412 Gander"

"OAL 412 go ahead sir"

"OAL412 copy clearance from Gander"

"OAL 412 go ahead sir"



"Gander clears OAL412 via track 'T' from CYMON, expect FL340 M ,82"

"OAL412 is cleared via track 'T' TMI number 012, from CYMON expect FL340 M ,82"

"OAL412 read back correct, return to domestic, have a nice flight"

We can observe four things in this conversation:

1. Gander cleared us to expect FL340. In order to climb to FL340 we must ask permission from the ATC that we are in contact with (After all he is just a clearance delivery). So in order to avoid any misunderstandings he uses the word expect, and we must use it too in our read back

2. When we read back our clearance after the track ID (e.g. 'T') we said TMI number 012. This is the NAT Track Message Identification (TMI) number. It is imperative that we read it back, so Gander knows we have the correct NAT track message. *(If we do not have the correct track message, Gander will have to read all the coordinates of our assigned track and we must do the same on our read back.)*

3. Controllers are humans like us. And despite what telecommunication regulations say, we can use welcoming phrases like, good evening or good afternoon. 99,9% of the time they will use it too. **A very important note though, please don't do this with Roger Wilco, we have enough lag, we do not need more. Thanks.**

4. Even though FL 340 is used to be given to westbound flights e.g. in Europe, in OTS this rule does not apply since the traffic flow is one-way. This way O.T.S. has more flight levels available.

Well the time is already 23.05z and if you think that we missed our DOVEY position report you are mistaken. That's why we are 3 pilots in Long-Range Flights. Actually we are now 2. The third member is resting in the Cockpit Crew Rest (Absolutely legal if you have any doubts).

End of Entering NAT Region through Gander OCA Scenario.

Back to our flight now.

"OAL412 Heavy New York, I have your Oceanic Clearance"

"OAL412 go ahead, sir"

"OAL412 you are cleared via Track 'Y' from 42N060W M ,82 FL370"

"OAL412 is cleared via track 'Y' TMI number 185, from 42N060W FL370 M ,82"

"OAL412 read back correct, climb now to FL370"

"New York, OAL412, we are too heavy right now for FL370. We will let you know when we will be ready"

"OAL412 roger that. Advice me ready to climb to FL370"

Some notes again:

- New York is an ATC so he does **not** have to say expect FL370.
- When a controller asks you to do something you are not obliged to do so. Just say unable and explain. Most of the times they understand your problem. Don't overdo it though.

Well, in about 25 minutes we will be reaching 42N060W. We have already burned some fuel and our Gross Weight now allows us to climb to FL370, so:

"New York OAL412 Heavy ready for FL370"

"OAL 412, New York climb to FL370"

Upon reaching FL370: "New York OAL412 Heavy maintaining FL370"

"OAL 412, New York. Maintain FL370 contact NEW YORK Radio on 6628 primary and 8825 secondary for SELCAL check 60W report on this frequency"

"OAL 412, New York Radio on 6628 primary and 8825 secondary. 60W report with you"

What did the controller tell us?

He told us to contact New York Radio on HF frequencies 6628 and if no contact in 8825, for SELCAL.

- *When using HF communications, pilots should maintain a listening watch on the assigned frequency, unless SELCAL is fitted, in which case they should ensure the following sequence of actions:*

(1) Provision of the SELCAL code in the flight plan; (any subsequent change of aircraft for a flight will require passing the new SELCAL information to the OAC);

(2) Checking the operation of the SELCAL equipment, at or prior to entry into Oceanic airspace, with the appropriate aeradio station. (This SELCAL check must be completed prior to commencing SELCAL watch);

(3) Maintenance thereafter of a SELCAL watch.

- *Flight management staffs and crews of aircraft equipped with 12-tone SELCAL equipment should be made aware that SELCAL code assignment is predicated on the usual geographical area of operation of that aircraft. If the aircraft is later flown in geographical areas other than as originally specified by the aircraft operator, the aircraft may encounter a duplicate SELCAL code situation. Whenever an aircraft is to be flown routinely beyond the area of normal operations or is changed to a new geographic operating area, the aircraft operator should contact the SELCAL Registrar and request a SELCAL code appropriate for use in the new area.*

➢ *When acquiring a previously owned aircraft equipped with SELCAL, many aircraft operators mistakenly assume that the SELCAL code automatically transfers to the purchaser or lessee. This is not true. As soon as practical, it is the responsibility of the purchaser or lessee to obtain a SELCAL code from the Registrar, or, if allocated a block of codes for a fleet of aircraft, to assign a new code from within the block of allocated codes. In the latter instance, if 12-tone equipment is involved, the Registrar should be consulted when there is any question as to the likely geographical area of operation and the possibility of code duplication.*

➢ *For better reception purposes due to propagation, as during the night some ionised layers of the atmosphere change position or they even disappear, lower HF frequencies are preferred, while in daytime you will most probably encounter higher frequencies such as 13297. (See also* *Appendix L* *for information on the ionised layers).*

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4.3 In the NAT region

New York asked us also to make our 60W position report with them. To comply with this we keep listening to New York on VHF and we tune 6628 on the HF box:

"#$%@*&^*&@&^&^*@^" **This is the static we were talking about.**

"#$%@*&^*&@&^&^*@^ New York Radio, New York Radio. OAL412 on 6628 #$%@*&^*" Most probably this guy monitors a lot of frequencies and when initiating contact with a station we should state the HF frequency, all off the digits and not just the first ones, as some people do.

#$%@*&^*&@&^&^*@^ OAL 412 New York Radio. Go ahead "#$%@*&^*&@&^&^*@^

"#$%@*&^*&@&^&^*@^ OAL412 SELCAL check on FHDS "#$%@*&^*&@&^&^*@^

#$%@*&^*&@&^&^*@^ FHTS "#$%@*&^*&@&^&^*@^

"#$%@*&^*&@&^&^*@^" Negative. SELCAL on FH**D**S #$%@*&^*&@&^&^*@^"

#$%@*&^*&@&^&^*@^ FHDS &^*&@& roger &@&^&^*@^ FHDS #$%@*&^*&@&^&^*@^

And we wait. In less than a second there is a ringing in the cockpit, an orange CALL button is flashing on the HF.

Thanks heaven the SELCAL works, we do not have to keep it open all the way.

#$%@*&^*&@&^&^*@^ OAL412 SELCAL check OK "#$%@*&^*&@&^&^*@^

And that's it.

(You may **hear** a voice sample of 2-way communication in Appendix A)

Approaching the Ocean and prior to entering MNPS Airspace, the accuracy of the LRNSs should be thoroughly checked, if necessary by using independent navigation aids.

➢ When appropriate, the navigation system, which in the opinion of the pilot, has performed most accurately since departure should be selected for automatic navigation steering.
➢ An altimeter crosscheck should be also carried out shortly before entering RVSM airspace; **at least two primary altimeters must agree within plus or minus 200 ft.**
➢ The readings of the primary and standby altimeters should be recorded to be available for use in possible contingency situations.

We are now passing over 42N060W it's 23.15z Just as planned. We have to give a position report.

"New York OAL412 Heavy position"

"OAL 412, New York. Go ahead"

"New York OAL412 Heavy position 42N060W 23.15z FL370 Estimating 43N050W 00.01z Next 44N040W"

"OAL 412, New York. Position received, radar service terminates. Next call on HF. Goodnight"

"Goodnight, sir"

And the only thing that you can hear in the cockpit now is the conversation between the cockpit crewmembers.

The rest of the crossing is position reports such as the one we just gave to NY.

There is however a couple of things to take care of:

- 30 minutes after our entry to Oceanic airspace, i.e. at 23.45z we must change our transponder code to 2000.
Why is that? Why we just don't turn off the transponder, as there is no radar surveillance in NAT airspace?
Well, we need the transponder to be operational because even though there is no radar surveillance the onboard Traffic Collision Avoidance System (TCAS) uses the transponder. We must have it on so that other aircraft can see us and we can see them. Why then change the code to 2000? The reason is that when we arrive in European coastline we do not want to trouble the European controllers with our transponder code. Imagine what will happen if we keep our initial squawk 3305, and the French Control has assigned the same code to an other aircraft. I think this clears it all.

- We must tune our second comm box on 123.45 the Oceanic Air to Air frequency

- And if we have a third box we can tune to 121.50 the international distress frequency

Approaching 050W we have already changed the transponder to 2000 and it seems that we have lost a minute, we were estimating at 00.01z and the time is 00.02z As long as we are within 3 minutes we don't have to revise our estimate. After all, as someone said once, "*it is an estimate not a promise*".

"New York Radio, New York Radio. OAL412 position"

There is still static in the frequency, don't assume it just disappeared. But let's keep this document to a professional level.

"OAL 412 New York Radio. Go ahead"

"New York Radio OAL412 position 43N050W 00.02z FL370 Estimating 44N040W 00.46z Next 45N030W"

"OAL 412, New York Radio. Position 43N050W 00.02z FL370 Estimating 44N040W 00.46z Next 45N030W. Your 40W report with Santa Maria on 5598"

"OAL412 40W position on 5598 with Santa Maria"

Approaching 40W we tune 5598 and "Santa Maria Radio, Santa Maria Radio, copy New York. OAL412 on 5598"

Note the phraseology when contacting Santa Maria. **"…copy New York…".** Position reports for aircraft operating on tracks through successive points on each boundary should also be made to the ACC serving the adjacent OCA.

However we only expect an answer from the ACC the area of whom we are entering.

"OAL412 Santa Maria. Go ahead"

"Santa Maria Radio OAL412 position 44N040W 00.46z FL370 Estimating 45N030W 01.30z Next 46N020W SELCAL FHDS"

"OAL412 Santa Maria Radio. Position 44N040W 00.46z FL370 Estimating 45N030W 01.30z Next 46N020W on 30W contact Shanwick on 8879 sby for SELCAL FHDS"

After seeing that SELCAL operates normally again "Santa Maria Radio OAL412 SELCAL check OK 30W with Shanwick on 8879"

- Sometimes for westbound tracks on OTS
- Always for westbound Random tracks
- Never on Eastbound flights

the controller may ask you to give **MET reports**.

What they mean is that they want wind direction & velocity, and temperature at the reporting points as well as the mid-points, without however giving a special report for mid-point. For example if we were to give MET reports (something that will never happen in reality, as we are an Eastbound flight) our last report would like:

"Santa Maria Radio OAL412 position 44N040W 00.46z FL370 Estimating 45N030W 01.30z Next 46N020W minus56 220/55 4330N 045Wminus60 270/80"

That translates to:

W/V at 44N040W : 220/55 *(Always True. The only magnetic wind in aviation is the one the Tower gives us)*
Temp at 44N040W : - 56
W/V at 4330N045W : 270/80
Temp at 4330N045W : - 60

Well, by this time in the aircraft we are really bored and sleepy.

- **Here is a question for you.**

Gander Oceanic is based on Gander. NY Oceanic in NY. Santa Maria Oceanic in Azores, Santa Maria. But what about Shanwick. There is no such city what's the story?

As we are told, it may not be true, there was an argument between **Shan**non and Prest**wick** about the name of the OAC as they both control the airspace.

We gave you a hint, did you get it?

We are now approaching 30W and we have already tuned on 8879 “Shanwick Radio, Shanwick Radio, copy Santa Maria. OAL412 on 8879 position ”

“OAL412 Shanwick. Go ahead”

“Shanwick OAL412 position 45N030W 01.30z FL370 Estimating 46N020W 02.13z Next 47N015W SELCAL FHDS”

“OAL412 Shanwick. Position 45N030W 01.30z FL370 Estimating 46N020W 02.13z Next 47N015W SELCAL FHDS”

And the same procedure with the SELCAL again.

The time passes dully we would rather say and if you care look on your 10 o’ clock position you will be able to see the dawn by now. Quick the sunglasses! Not even Count Dracula is afraid of the sun that much.

We are approaching 20W and something tells me it will be the last report on HF. No I can assure you, this is my first crossing too.

“Shanwick OAL412 position”

“OAL412 Shanwick. Go ahead”

“Shanwick OAL412 position 46N020W 02.13z FL370 Estimating 47N015W 02.36z Next SEPAL”

“OAL412 Shanwick. Position received approaching 015W call Brest control on channel 132.015”

“OAL412 approaching 15W Brest on channel 132.015, good morning sir”

At this point we would like to note that Shanwick told us to contact a channel not a frequency. Due to shortage of VHF R/T frequencies in the European airspace a decision was made to reduce the frequency spacing from 25KHz to 8,33KHz. **Nowadays, the carriage of 8.33 kHz channel spacing capable radio equipment is mandatory for operations in the whole ICAO EUR region for flight above FL 245.** The date for the introduction of Mandatory Carriage of 8.33 kHz channel spacing capable radio equipment was October 7th, 1999. Aircraft equipped with 8,33KHz comm boxes must enter the letter’Y’ in field 10 of the Flight Plan. During 8,33 operation, the word **‘channel’** must be used by both the pilot and the controller as a unique identification to avoid mistuning.

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4.4 Entering Europe

So, 132.015 and “Brest bonjour, OAL412 approaching SEPAL, maintaining FL370”

“Bonjour, Olampic 412. This is Brest control. Maintain FL370 Squawk 2405”

“OAL412 squawking 2405”

“Olampic 412, identified. Are you requesting higher today?”

“Negative sir, FL370 is just fine for us, merci”

Well, even though we are sure you already understood, we have exited the Oceanic airspace and we are under the radar control of Brest ATC. The rest of the route is like any other Trans-European flight. Europe is also RVSM, meaning odd levels Eastbound. We will overfly France, we will enter the Italian airspace over Torino. We will then fly to Florence and Ancona. We will fly along the eastern coastline of Italian peninsula, Brindisi, and we will enter the Hellenic (Greek) airspace at NOSTO point.

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4.5 Back home

"Athina Kalimera, Olympic 412, approaching NOSTO FL370"

"Kalimera Olimpiaki 412. You are identified 5nm northwest of NOSTO. ARAXOS NEMES maintain FL370"

"NOSTO ARAXOS NEMES FL370, OAL412. May we fly direct to NEMES from present position?"

"Negative OAL412. Not yet. I will let you know"

"OAL412 Efkaristo"

No matter how many times you have seen Greece from above, it is always a view you would not like to miss. It probably has to do with the feeling flying back home. When we come to think about it NOSTO (the FIR point we entered Greece) in the Greek language means exactly this, return to homeland.

"Olimpiaki 412 set course to NEMES"

"Direct NEMES OAL412, Thanks"

Approaching our descent point, we have already written down the ATIS. It will be ILS for Rwy03L.

"Athina control, OAL412 is ready for descent"

"OAL412 descent to FL170 to be level by NEMES please"

"FL170 to be level by NEMES, OAL412"

And the way we go down. The good thing with the new technology is that you have all the information you need in front of you. No need for thinking when to start the descent or with what rate to descent. The bad thing is that in this way the pilot tends to stay out of the "loop".

"OAL412 contact approach 119.1. Kalimera kirie"

"Approach 119.1 OAL412, kalimera"

"Athens Approach, kalimera OAL412"

"OAL412, Athens Approach, you are identified, fly left heading 070 descent to 7000ft on QNH 1024. You are number one, keep high speed. Kalimera"

"Left 070, descent to 7000ft on 1024. OAL412"

Have you ever wanted to meet a person whose voice you hear every time, for the last 12 years or so?

Well, we have. We think we already know the guy, and we think he feels the same too. At least we hope so.

"Olympic 412 left heading 040 descend to 3000ft cleared for the ILS03L"

"Left 040 down to 3000ft, cleared ILS03L, OAL412"

And, Flaps 1… Localizer alive… Flaps 2… Glide Slope alive, set Go-Around altitude…

Gear Down, Flaps 3, Landing checklist to Flaps.

Full Flaps and Landing checklist completed.

500’ ... 400’

“100 Above”

Minimum

50’… 40’… 30’… 20’

Retard, retard, retard

10’… 5’

“Ladies and Gentlemen, welcome to Hellas”

That’s the end of our flight but **NOT** the end of our “tour” in the Atlantic Crossing Procedures. Further down you will find some extremely useful additional Information categorised in Appendixes. We hope you enjoyed this flight as much as we did.

Happy Landings,
Krikor Michikian and Vangelis Hassiotis

Athens, Greece
1st October 2002

- Contact us via e-Mail
- Document Homepage (Tutorials Section)

Hellenic vATC
WHERE SIMULATION MEETS WITH REALITY

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APPENDIX A - Westbound flights procedures

The purpose of this Appendix is to discuss the differences between the Eastward Atlantic crossing with the Westward one. In the parent document our example was based on the flight of Olympic Airways OAL412, which was an eastward crossing flight. Let's assume now that we are following OAL423, a westward flight with initial destination CYUL (Montreal Dorval).

When entering NAT airspace from Europe there are 2 main possibilities:

- You enter through Shanwick OCA
- You enter through Santa Maria OCA

(You can enter NAT also through Reykjavik OCA and Bodo OCA. However most of the flights fly through Shanwick and Santa Maria.)

Procedures are basically the same. The flight in question, OAL423, will fly through Shanwick OCA, and here is the procedure.

By consulting the Jeppesen Atlantic Orientation Chart AT(H/L)1 we can figure the Shanwick Oceanic VHF coverage boundaries. A quick way to remember them is to contact Shanwick after passing the English Channel. There are 3 primary frequencies:

- 123.95MHz, for aircraft registered in states west of 30W
- 127.65MHz, for aircraft registered in states east of 30W
- 135.52MHz, as instructed by ATC

Olympic Airways is the national carrier of Greece. Greece lies approximately between the 20th and 29th East meridians and the 42nd and 34th North parallels. Therefore, passing the English Channel we will call 127.65 for the oceanic clearance. Of course the later you ask for the clearance the better, as you will have a more exact estimate for the oceanic entry point. However don't overdo it. Don't call for the clearance 10 minutes earlier!!!

- **Here is a voice sample of the two-way communication between the pilot and the controller.**

(Double click on the icon)

Shanwick OAL423 GoodAfternoon

OAL423 Shanwick GoodAfternoon

OAL423 requesting Oceanic clearance via track C from MALOT, estimating MALOT 12:44, FL350 Max FL360, Mach .82

OAL423 Shanwick copied standby

(Double click on the icon)

OAL423 Shanwick clearance…

OAL423 Go ahead sir

OAL423 to Montreal via track C from MALOT maintain FL350 Mach decimal 82

OAL 423 is cleared via track C from MALOT FL350 M ,82 TMI number 220

OAL423 correct return to domestic Good bye

OAL423 Good Bye

(Double click on the icon)

Shanwick Shanwick OAL423 on 5649

OAL423 Shanwick

OAL423 SELCAL check on JK-PQ
……
……
SELCAL check OK, OAL423

Note that standard phraseology may not always be used. This does not mean however, that it is an example to follow.

In case we would be entering NAT airspace through Santa Maria OCA, oceanic clearance should be requested at least 20 minutes before reaching Santa Maria OCA boundary, from Santa Maria control on VHF 132.07 or on HF via Santa Maria radio.

The hereby-described procedure is not applicable to flights that originate too close to the NAT boundaries. These flights should either request clearance as soon as possible after take-off (for example the UK flights) or for departures from Belfast, Edinburgh, Prestwick or more generally from airports close to Shanwick OCA boundary, with entry points between 48N and 60N, should contact respective local ATC, in order to obtain their oceanic clearance at least 30 minutes before their departure. Of course there are some minor exceptions, which can be read in the official documentation.

The rest of the westward flight and its procedures are exactly as the Eastward one. There is though one more thing to discuss that has to do with the routing a flight must follow after exiting NAT airspace over the North American continent. The North American Routes (NAR).

*(For the purpose of simplicity NARs were not mentioned during our eastward crossing example with OAL412. NARs, though, are applicable to **both** Eastward and Westward flights. For Eastwards flights dictate the routing to the Oceanic entry fix, while for Westward flights dictate the routing after exiting oceanic airspace)*

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APPENDIX B - The North American Routes - (NAR)

The **objectives** of the NAR System are:

- To provide an organized air traffic interface between the NAT oceanic and domestic airspace.
- To organize the fluctuating and reversing traffic flows in the most efficient possible manner, consistent with the needs of aircraft operators and air traffic services.
- To expedite flight planning.
- To reduce the complexity of route clearances and thereby minimize the confusion and error potential inherent in lengthy transmissions and readbacks.
- To minimize the time spent in the route clearance delivery function.

The NAR system is designed to accommodate major airports in North America where the volume of NAT traffic and route complexity dictates a requirement. It is for the use of traffic entering/exiting the NAT and consists of a series of pre-planned routes from/to coastal fixes and identified system airports. Most route are divided into two portions:

- **Common portion,** is the portion of the route between a specified coastal fix and specified Inland Navigation Fix (INF). Some routes have only a common portion.
- **Non-Common portion,** is the portion of the route between a specified INF and a system airport.

The routes are within the high-level airspace structure with a transition to/from system airport.
The routes are prefixed by the abbreviation "N", with the numbering for the common portions oriented geographically from south to north. The odd numbers have eastbound application while the even numbers apply to westbound.

B.1 Flight Plan Requirements

- ***Westbound:***
  Organised Track System (OTS) Traffic:
  NAR routes should be planned for flights operating in the OTS, crossing 30W, between 1130-1500 UTC

  Random Route Traffic:
  There is no requirement to flight plan via NAR routes for flight operating outside of the OTS.

- ***Eastbound:***
  Organised Track System (OTS) Traffic:
  NAR routes should be planned for flights operating on the OTS, crossing 30W, between 0200-0500 UTC. There are some exceptions for Moncton FIR/CTA.

  Random Route Traffic:
  There is no requirement to flight plan via NAR routes for flights operating outside of the OTS.

What is the practical application of the NARs though?

Imagine we are following Track B en-route to Kennedy (KJFK), the details of which are as follows:

B 52/15 53/20 54/30 53/40 51/50 CYMON
EAST LVLS NIL
WEST LVLS 310 330 340 350 360 370 390
EUR RTS WEST GIPER
NAR N146B N148B-

First, the line "NAR N146B N148B" shows us which of the North American Routes should be used from the **coastal fix "CYMON"**.

Now that we know the applicable NARs we need to have a look at the **“Westbound Routes – Common Portion”** in the Enroute section of the airway manual that we most probably carry on board, in order section to see the routing to the designated **inland fix.**

The section will generally have the following information:

N142B	Cymon	Direct (267072 583nm)	Allex
N144B	Cymon	Direct (269/075 572nm)	Ebony
N146B	Cymon	Direct (273/078 578nm)	Topps
N148B	Cymon	Direct (280/087 510nm)	Miils

In this case, we see that the routes are from **CYMON** to either **TOPPS** or **MIILS** via a direct track. Next, we need to look at the section entitled **“Westbound Routes – Non-Common Portions”** and check to see which of the routes (if any) accommodate our destination.

Looking first at MIILS we see that there is NO non-common portion serving Kennedy; however, looking at **TOPPS** we can see there is a routing to our destination as follows:

Topps	Emjay J174 ATR 085 radial ATR V308 OTT	Andrews
	ENE BAF J77 PTW J48 ODF Macey arrival	Atlanta
	ENE Nelie J75 MXE V378 BAL	Baltimore
	Scupp	Boston
	Emjay J174	Charleston, SC
	ENE BOS J75 CMK J75 GVE LYH Majic arrival	Charlotte
	ENE BAF J77 SAX J6 LIT BYP	Dallas/Ft. Worth
	Seaer J79 LFV J174 HTO J121 SIE	Dover
	ENE BAF J77 SAX J6 LRP V143 Robrt AML	Dulles
	Emjay J174 DIW AR14 Metta AR1 Hobee Mrlin arrival	Ft. Lauderdale
	ENE BAF J77PTW J48 MOL J22 VUZ JAN AEX Daisetta arrival	Houston
	ENE Kennebunk arrival	Kennedy
	Seaer J79 LFV J174 HTO J121 Manta V276 Gamby	McGuire
	Emjay J174 DIW AR14 Metta AR1 Hobee Heatt arrival	Miami
	ALB V213 SAX	Newark
	Emjay J174 ORF J121 CHS J79 OMN Bitho arrival	Orlando
	Seaer J79 LFV J174 HTO J121 Brigs VCN Cedar Lake arrival	Philadelphia
	ENE CTR HNK HNK 271 radial J190 SLT Grace arrival	Pittsburgh
	Emjay J174 SWL Argal arrival	Raleigh/Durham
	ENE BAF J77 SAX J80 VHP Vandalia arrival	St. Louis
	UFX YXI TVC PMM Pullman arrival	Chicago
	YOW J546 YSO J558 YXU J545 DJB J83 APE Cince arrival	Cincinatti
	YOW J546 YSO J597 YQO V464 Spica	Detroit
	Ombre V352 Maire Maire arrival	Montreal/Dorval
	VLV J565 V363 Catog arrival	Montreal/Mirabel
	ENE Nelie J75 CMK J75 TAY J85 GNV Dades arrival	Tampa
	YOW J546 V300 YSO V37	Toronto

And with procedure, the flight dispatcher concludes his planning. Our routing is now shaped as follows:

- **Track B,** which is 52N015W - 53N020W - 54N030W - 53N040W - 51N050W - CYMON
- **NAR 146B,** meaning after CYMON direct to TOPPS, and then
- **TOPPS - ENE (Kennebunk VOR)- Kennebunk arrival to KJFK.**

There is just one thing worthy of discussion right here. If we were careful when we were examining the NARs we would see the parenthesis for example for the N146B that reads (273/078 578nm). This is the track to and from, and the distance between CYMON and TOPPS. In case someone wonders why the to-from tracks are not reciprocal, the answer is that there are **Great Circle Tracks.** Unfortunately this is the topic of another tutorial, but for some general information and useful links regarding Great Circles check also Appendix J)

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APPENDIX C - Comm failure in NAT

In the event of failure of HF communications every effort should be made by the pilot to relay position reports through other aircraft. An air-to-air VHF frequency has been established for worldwide use when aircraft are out of range of VHF ground stations, which utilise the same or adjacent frequencies. This frequency, **123.45 MHz,** may be used to relay position reports. If necessary initial contact for such relays can be established on **121.5 MHz.**

Solely when flying in the Shanwick OCA, pilots of aircraft, which is Satellite Communications (SATCOM) equipped, who have experienced total HF failure and are unable to relay by any other means, may, as a last resort, make contact with the Shanwick HF aeradio station on a special SATCOM number.

The following procedures are general guidance for aircraft operating in or proposing to operate in the NAT Region, which experience communications failure. These procedures are intended to complement and not supersede State procedures/regulations. It is impossible to provide guidance for all situations associated with a communications failure.

C.1 General

The pilot of an aircraft experiencing a two-way communications failure should set Code 7600 on his Transponder. The pilot should attempt to contact any ATC facility or another aircraft and inform them of the difficulty and request they relay information to the ATC facility with which communications are intended.

C.2 Communication failure prior to entering NAT region

Due to the potential length of time in oceanic airspace, it is strongly recommended that a pilot experiencing communications failure whilst still in domestic airspace does not enter the OCA but adopts the procedure specified in the appropriate domestic AIP and lands at a suitable airport. However, if the pilot elects to continue, then, to allow ATC to provide adequate separation, one of the following procedures should be followed:

- If operating with a received and acknowledged Oceanic Clearance, the pilot must enter oceanic airspace at the cleared oceanic entry point, level and speed and proceed in accordance with the received and acknowledged Oceanic Clearance. Any level or speed changes required to comply with the Oceanic Clearance must be completed within the vicinity of the oceanic entry point.
- If operating without a received and acknowledged Oceanic Clearance, the pilot must enter oceanic airspace at the first oceanic entry point, level and speed contained in the filed flight plan and proceed via the filed flight plan route to landfall. **The initial oceanic level and speed must be maintained until landfall.**

C.3 Communication failure after entering NAT region

- If cleared on the filed flight plan route, the pilot must proceed in accordance with the last received and acknowledged Oceanic Clearance, including level and speed, to the last specified oceanic route point (normally landfall) then continue on the filed flight plan route. After passing the last specified oceanic route point, the flight should conform to the relevant State procedures/regulations.
- If cleared on other than the filed flight plan route, the pilot must proceed in accordance with the last received and acknowledged Oceanic Clearance, including level and speed, to the last specified oceanic route point (normally landfall). After passing this point, the pilot should conform with the relevant State procedures/regulations, rejoining the filed flight plan route by proceeding, via the published ATS route structure where possible, to the next significant point contained in the filed flight plan.

Aircraft with a destination within the NAT Region, should proceed to their clearance limit and follow the ICAO standard procedure to commence descent from the appropriate designated navigation aid serving the destination aerodrome at, or as close as possible to, the expected approach time.

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APPENDIX D - ETOPS ("Engines Turn Or Passengers Swim")

ETOPS is an acronym for *Extended-Range Twin-Engine Operations*. Without an ETOPS rating, an aircraft with only two engines must be able to get to an airport where it can safely land within 60 minutes if an engine fails in-flight. ETOPS rated aircrafts may extend this limit.

Approximately 50% of all NAT crossings are ETOPS operations. Most are operating under either 120 or 180 minute ETOPS route limitations (although expansion to 207 minutes is being introduced in some oceanic regions). ETOPS rules require that suitable en-route alternate airports, which meet all Operations Specifications limitations, are named prior to dispatch and then monitored while affected aircraft are en-route.

Mid-point NAT en-route alternate airports are limited to those in: The Azores, Bermuda, Greenland and Iceland. The 180-minute ETOPS operations often preclude a need for mid-point alternate airports.

Due to the geography involved, a rather large selection of potential ETOPS alternate airports are located on the eastern side of the Atlantic, within Europe. There are well over a dozen international airports with infrastructure capable of supporting ETOPS diversions: in Belgium, France, Ireland, Norway, Portugal, Spain, the Netherlands and UK.

The same cannot be said for the western side of the Atlantic. With the exception of Newfoundland and Nova Scotia, most of eastern and northern Canada is uninhabited or very sparsely populated. Most areas are isolated and have very primitive infrastructures.

In determining ETOPS alternate minimums, the dispatcher must consider airport conditions in addition to simple runway lengths and approach aids. For instance, Keflavik in Iceland is an excellent airport, with long runways and state-of-the-art NAVAIDS. However, since the airport is on the extreme end of a peninsula jutting out into the North Atlantic, it is exposed to high winds and extreme maritime conditions. Some operators determine alternate minima based on the availability of particular NAVAIDS. Periodically though, particularly in winter months, Keflavik experiences low cloud ceilings and winds in the 40-50 knot range. This combination may still provide acceptable landing conditions for a particular runway but may preclude the use of NAVAIDS on other runways, due to excessive crosswinds. As a result, the alternate airport weather minimums for Keflavik may be quite high when only one single runway/NAVAID combination can be considered.

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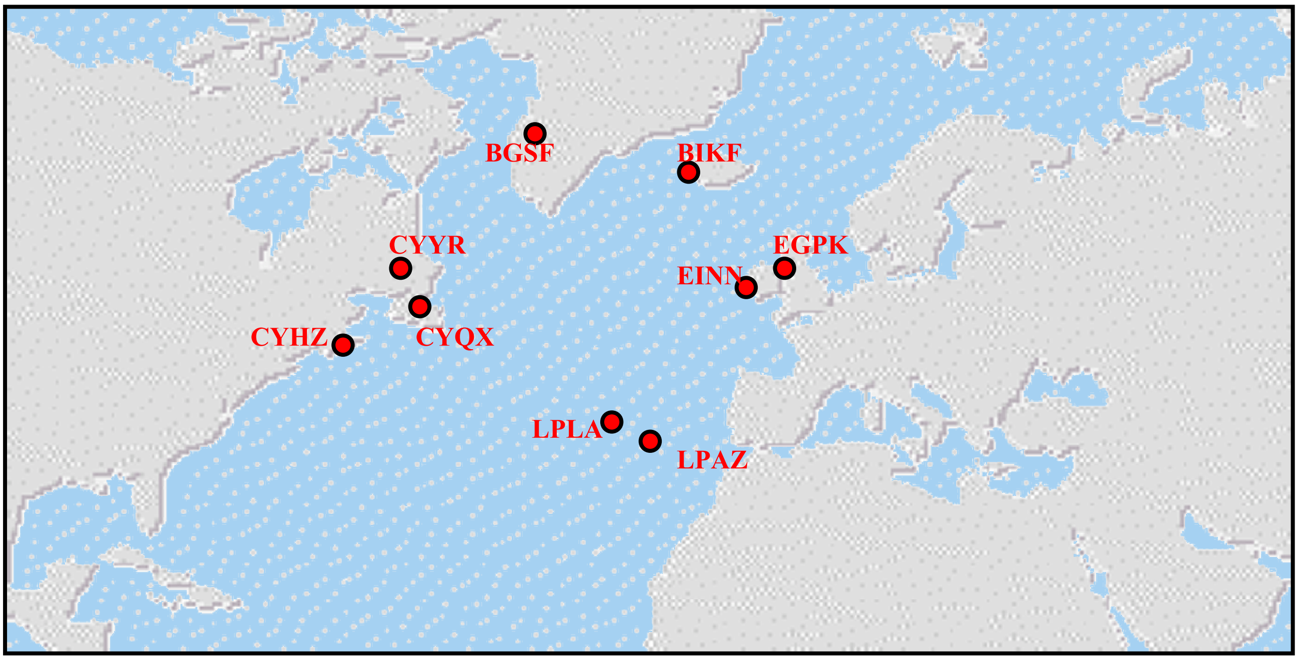
APPENDIX E - NAT Airports Data



Airport Name	ICAO ID	Position	Elev.	RWYs and Lengths	RWYs and Lengths
GANDER	CYQX	N48 56,4 W054 34,1	496’	**04/22** 10500’ HIRL, ALS22, HIALS04	**13/31** 8900’ HIRL, ALS 31, HIALS 13
HALIFAX	CYHZ	N44 52,9 W063 30,5	477’	**06/24** 8800’ HIRL, HIALS24 ODALS06	**15/33** 7700’ HIRL, ALS33, HIALS15
GOOSE BAY	CYYR	N53 19,2 W060 25,6	160’	**08/26** 11046’ HIRL, ALS26, HIALS08	**16/34** 9580’ HIRL, ALS34
KEFLAVIK	BIKF	N63 59,1 W022 36,3	171’	**02/20** 10200’ HIRL, HIALS SFL20	**11/29** 10056’ HIRL, HIALS29, HIALS SFL11
LAJES	LPLA	N38 45,7 W027 05,4	180’	**15/33** 11906’ HIRL, HIALS SFL	-
SANTA MARIA	LPAZ	N36 58,4 W025 10,3	308’	**18/36** 10000’	-
SHANNON	EINN	N52 42,1 W008 55,5	46’	**06/24** 10495’ HIRL, HIALS	**13/31** 5643’ PCN17/R/D/W/U
PRESTWICK	EGPK	N55 30,5 W004 35,2	65’	**03/21** 6001’ HIRL, HIALS21	**13/31** 9800’ HIRL, HIALS
SONDRE STROM.	BGSF			**10**	

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APPENDIX F - Standard Air to Ground Message Types and Formats

F.1 Routine Position Reports

- The phraseology used to indicate the next position on the assigned route is “ESTIMATING”,
- For the following subsequent position “NEXT”.
- “ABLE” or “REQUEST”, is used as applicable for the acceptable or requested next higher FL position or time.

Content and Data sequence:

a. “Position”
b. Flight identification
c. Present position
d. Time over present location (hours and minutes)
e. Present FL
f. Next position on assigned route or OCA entry point
g. Estimated time for next position or OCA entry point
h. Next subsequent position
i. Next higher FL acceptable or requested at Position or Time
j. Any further information e.g. MET data or company message (Fuel on Board for twin aircraft)

F.2 Request Clearance

- In conjunction with routine position report, to request a change of Mach Number, FL, or route and to request Oceanic Clearance.

Content and Data sequence:

a. “Request Clearance”
b. Flight identification
c. Present or last reported position
d. Time over present or last reported position (hours and minutes)
e. Present FL
f. Next position on assigned route or OCA entry point
g. Estimated time for next position or OCA entry point
h. Next subsequent position
i. Requested Mach Number, FL , or Route
j. Any further information or clarifying remarks

F.3 Request a change in Mach Number or route

- To request a change in Mach Number, or route when a position report message is not appropriate.

Content and Data sequence:

a. “Request Clearance”
b. Flight identification
c. Requested Mach Number, or Route
d. Any further information or clarifying remarks

F.4 Revised Estimate

- To update time estimate for next position

Content and Data sequence:

a. “Revised Estimate”
b. Flight identification
c. Next position on route
d. Revised estimate for next position (hours and minutes)
e. Any further information

F.5 When Able Higher

- To pass information on position or time a climb to the next higher FL is acceptable or a clearance for higher FL is requested when inclusion in a position report message is not appropriate.

Content and Data sequence:

a. Flight identification
b. Requested or acceptable FLs
c. At position or time

F.6 Miscellaneous Message

- To pass information or make a request in plain language that does not conform to the content of other message format. No message designator is required, as the ground station will insert this.

Content and Data sequence:

a. Flight identification
b. General information or request in plain language and format free

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APPENDIX G - Miscellaneous

G.1 Wake Turbulence

Any pilot who encounters a wake turbulence incident when flying in NAT MNPS Airspace or within an adjacent RVSM transition area should ensure that a detailed report is provided to the ATC.

When flying within NAT MNPS Airspace (but **not** in adjacent domestic airspace RVSM transition areas), if considered necessary, the pilot may offset from cleared track by up to a maximum of 2 nm (upwind) in order to alleviate the effects of wake turbulence. ATC should be advised of this action and the aircraft should be returned to the cleared track as soon as the situation allows. It must be noted, however, that such a manoeuvre is considered a contingency procedure and ATC will not issue a clearance for any such lateral offset.

G.2 TCAS Warnings

In the event that a Traffic Advisory (TA) is issued, commencement of a visual search for the threat aircraft should be carried out and preparation made to respond to a Resolution Advisory (RA), if one should follow. In the event that an RA is issued, the required manoeuvre should be initiated **immediately**, subsequently adjusting power and trim.

*Note that manoeuvres should never be made in a direction opposite to those required by the RA, and that RAs should be disregarded only when the potentially conflicting traffic has been **positively** identified and it is evident that no deviation from the current flight path is needed.*

All RAs should be reported to ATC:

- Verbally, as soon as practicable; and
- In writing, to the Controlling Authority, after the flight has landed, using the necessary procedure and forms.

Pilots should be aware that under certain conditions in NAT RVSM airspace, TCAS equipment utilizing Version 6.04a Logic can issue nuisance Traffic Advisories relating to another aircraft which is following the same track but is correctly separated vertically by 1,000 ft above or below. Such TAs will normally be issued when the two aircraft are separated horizontally by 1.2 nm, this being the approach criterion used in the 6.04a Version Logic. Logic Version 7 will correct this anomaly and eliminate such nuisance TAs.

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APPENDIX H - Special Procedures for In-Flight Contingencies

A number of in-flight contingencies may be encountered in NAT airspace, just like in any other region.

- Inability to maintain assigned level due to weather (for example severe turbulence);
- Aircraft performance problems; or
- Pressurization failure.

If these are the case a rapid descent, turn-back, or diversion to an alternate airport may be required. The pilot's judgement will determine the specific sequence of actions taken, having regard to the prevailing circumstances.

If an aircraft is unable to continue its flight in accordance with its ATC clearance, a revised clearance should be obtained whenever possible, prior to initiating any action, using the radio telephony distress (MAYDAY) signal or urgency (PAN PAN) signal as appropriate.

If prior clearance cannot be obtained, an ATC clearance should be obtained at the earliest possible time and, in the meantime, the aircraft should broadcast its position (including the ATS Route designator or the Track Code as appropriate) and its intentions, at frequent intervals on 121.5 MHz (with 123.45 MHz [Air to Air] as a back-up frequency).

Until a revised clearance is obtained the specified NAT in-flight contingency procedures should be carefully followed. In general terms, the aircraft should be flown at a flight level and/or on a track where other aircraft are least likely to be encountered. Maximum use of aircraft lighting should be made and a good look-out maintained.

The general concept of these NAT in-flight contingency procedures is, whenever operationally feasible, to offset from the assigned route by 30 nm and climb or descend to a level which differs from those normally used by 500 ft if below FL410 or by 1000 ft if above FL410.

Initially, the aircraft should leave its assigned route or track by turning 90° to the right or left whenever this is possible. The direction of the turn should be determined by the position of the aircraft relative to any organized route or track system (e.g. whether the aircraft is outside, at the edge of, or within the system). Other factors that may affect the direction of turn are: direction to an alternate airport, terrain clearance and levels allocated on adjacent routes or tracks.

Subsequently, an aircraft that is able to maintain its assigned flight level should, once established on the offset track:

- Climb or descend 1000 ft if above FL410
- Climb or descend 500 ft when below FL410
- Climb 1000 ft or descend 500 ft if at FL410

An aircraft that is unable to maintain its assigned flight level should, whenever possible, minimize its rate of descent while acquiring the 30 nm offset track; and for the subsequent level flight, a flight level should be selected which differs from those normally used: by 1000 ft if above FL410 or by 500 ft if below FL410.

Before commencing any diversion across the flow of adjacent traffic, aircraft should, whilst maintaining the 30 nm offset track, expedite climb above or descent below the vast majority of NAT traffic (i.e. to a level above FL410 or below FL285), and then maintain a flight level which differs from those normally used: by 1000 ft if above FL410, or by 500 ft if below FL410. However, if the pilot is unable or unwilling to carry out a major climb or descent, then any diversion should be carried out at a level 500 ft different from those in use within MNPS Airspace, until a new ATC clearance is obtained.

If these contingency procedures are employed by a twin engine aircraft as a result of the shutdown of a power unit or the failure of a primary aircraft system the pilot should advise ATC as soon as practicable of the situation, reminding ATC of the type of aircraft involved and requesting expeditious handling.

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APPENDIX I - Weather Deviation Procedures for Oceanic-Controlled Airspace

The following procedures are intended to provide guidance for deviations around thunderstorms. The pilot's judgement shall ultimately determine the sequence of actions taken. ATC shall render all possible assistance.

If an aircraft is required to deviate from track to avoid weather an ATC clearance shall be obtained at the earliest possible time. The pilot shall inform ATC when weather deviation procedures have been terminated. To indicate that priority is desired the pilot may obtain a rapid response when initiating communication by stating, **"Weather Deviation Required"** or by using the urgency call **"PAN".**

If a revised ATC clearance cannot be obtained and deviation from track is required the pilot shall take the following actions:

- If possible, deviate away from organised track or route system
- Establish communication with and alert nearby aircraft, on the frequency in use, on 121.50MHz or 123.45MHz
- Watch for conflicting traffic both visually and by reference to the TCAS
- Turn on all aircraft exterior lights
- For deviations of less than 10 nm, aircraft should remain at the FL assigned by ATC
- For deviations of greater than 10 nm, when the aircraft is approximately 10 nm from track, initiate a level change based on the following criteria:

Route Centerline/Track	Deviations>10nm	Level change
East 000°-179° magnetic	**LEFT of course** **RIGHT of course**	**DESCEND 300ft** **CLIMB 300ft**
West 180°-359° magnetic	**LEFT of course** **RIGHT of course**	**CLIMB 300ft** **DESCEND 300ft**

- When returning to track, be at its assigned FL, when the aircraft is within approximately 10 nm of centerline, and
- If contact was not established prior deviating, continue to attempt to contact ATC to obtain a clearance.
- If contact was established, continue to keep ATC advised of intentions and obtain essential traffic information.

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APPENDIX J – Concorde Operations on the NAT and Great Circles

- A few questions about Concorde operations on the North Atlantic are answered in **Donal Leahy**'s document, which you may find at the Irish Aviation web page.

- A thorough explanation about **Great Circles** is presented in **Dr. Robert Hunt**'s Article **"Time and Motion"**, from Issue 7 of Plus Magazine and of course we should also mention the **Great Circle Mapper** website with an interactive **GC calculator** and an excellent faq page.

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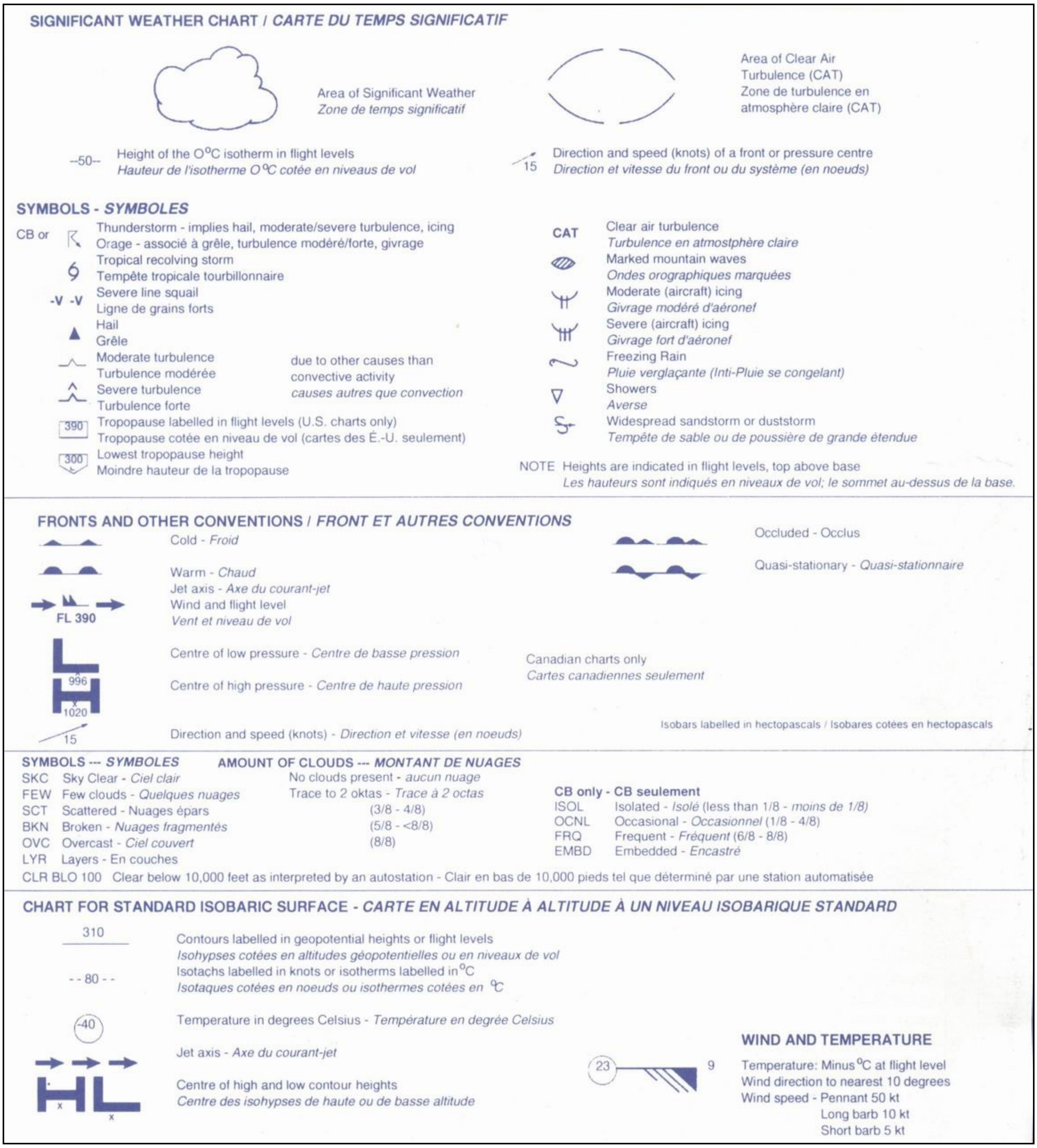
APPENDIX K - METARs – TAFs – SPECI METARs – Explanation - Samples

K.1 SIGWX Charts Symbol Explanation



K.2 METAR

METAR - Meteorological Aeronautical Report. Also referred to as an Actual.

A METAR is a coded weather bulletin of the observed weather at a specific location or Aerodrome and has the following basic format:

METAR CCCC DDHHmmZ (AUTO) DDDSSGSSKT VVVV(D) (RD/VVVV) WW NNNhhh(VVhhh) TT/TdTd QPPPP REWW TTTTT (RMK) =

K.3 TAF

TAF - Terminal Aerodrome Forecast

A detailed forecast of expected weather elements at an aerodrome that significantly affects the movement of aircraft.

A TAF has the following basic format:

TAF CCCC DDHHmmZ DDFMTL DDDSSGSSKT VVVV WW NNNhhh(VVhhh) TXTtTt/HHZTNTtTt/HHZ { BECMG HHHH / FMHHmm / TEMPO HHHH } {PROB % HHHH} =

K.4 SPECI - Special METAR

A **SPECI** is the same as a METAR but issued when the following criteria is met:

1. Mean surface wind direction has changed by 30 degrees or more, the mean wind speed before and/or after the change being 20Kt or more.
2. Mean surface wind speed has change by 10Kt or more, the wind speed before and/or after the change be 30Kt or more.
3. Wind Gusts have increased by 10Kt or more, the mean wind speed before and/or after the change being 15Kt or more.
4. Visibility changes to or pass:

a. 1500 or 3000m (SPECI) - 150, 350, 600, 800,1500, 3000m (TAF)
b. 5000m where significant numbers of VFR flights are operating.

5. Runway visual range changes to or pass 150, 350, 600, 800m.
6. When any combination of weather in the significant weather table begins, ends or changes intensity.
7. Height of the base of the lowest cloud layer of BKN or OVC extent, changes to or passes:
   a. 100, 200, 500 or 1000ft.
   b. 1500ft where significant numbers of VFR flights are operating.
8. When the amount of cloud below 1500ft changes from:
   a. SKC, FEW, SCT to BKN or OVC
   b. BKN or OVC to SKC, FEW, SCT
9. When the sky is obscured and vertical visibility changes to or pass 100, 200, 500, 1000ft.
10. Increase in temperature of 2 degrees Celsius or more.

K.5 Explanation of Terms:

- **CCCC** - Location or Place
  Four letter ICAO ID's designators are is used. (see: Locations)

- **DDHHmmZ** - Date/time of compilation
  DD - Day, HH - Hour, mm - Minutes
  Z - Time Zone, Z=Zulu or GMT.

- **AUTO** - Used when the observation is done by an automatic weather station.

- **DDDSSGSSKT** - Wind (see: VRB)
  DDD - Wind Direction in degrees
  SS - Wind Speed, G - GUST, KT - Knots
  Wind direction from True North, wind speed is measured in knots(KT).
  Gust is added only if the average wind speed is exceeded by 10KT or more of the mean windspeed for previous 10 minutes. (1KT = 1.85 Km/h)

  Other units that may be used to measure wind speed are:
  KMH - Kilometres per hour,
  MPS - Metres per second.

- **WW** - weather (see: NSW)
  Used to report significant weather. The table below shows the abbreviations.

Significant Weather

QUALIFIER		WEATHER PHENOMENA		
Intensity or Proximity 1	**Descriptor 2**	**Precipitation 3**	**Obscuration 4**	**Other 5**
- Light	MI Shallow	DZ Drizzle	BR Mist	PO Dust/sand whirls
Moderate (no qualifier)	BC Patches	RA Rain	FG Fog	SQ Squalls
+ Heavy	PR Partial	SN Snow	FU Smoke	FC Funnel Clouds (tornado or waterspout)
VC Vicinity	DR Low Drifting	SG Snow Grains	VA Volcanic Ash	SS Sandstorm
	BL Blowing	IC Ice crystals (diamond dust)	DU Widespread Dust	DS Duststorm
	SH Shower(s) TS Thunderstorm	PE Ice pellets	SA Sand	
	FZ Freezing (supercooled)	GR Hail	HZ Haze	
		GS Small hail And/or snow pellets		

- **VVVV** - Horizontal Visibility (see: CAVOK, RVR - Runway visual range)
  In South Africa visibility is measured in meters.

  The following increments are used:
  - 10m - below 100m
  - 100m - below 1000m
  - 500m - between 1000m and 5000m
  - 1000m - between 5000m and 9000m
  - 9999 - 10Km and above.

  Some countries use statute mile(SM) as a unit to measure visibility.

- **D** - Direction
  When the horizontal visibility is not the same in all directions, a minimum and maximum visibility may be given followed the direction.

  Values for D are:
  N - North, NE - Northeast, E - East, SE - Southeast, S - South, SW - Southwest, W - West, NW - Northwest.

- **NNNhhh** - Clouds (see: CAVOK, NSC, Cloud Type, Cloud Atlas)
  NNN - Cloud amount, shown by the following abbreviations:
  - FEW - 1 to 2 octas
  - SCT - 3 to 4 octas
  - BKN - 5 to 7 octas
  - OVC - 8 octas

  hhh - Cloud height in feet above station level (or AGL).

- **VVhhh** - Vertical visibility
  When the sky is obscured and instrumentation is available to measure vertical visibility, hhh is given in increments of 100ft.

- **TT/TdTd** - Temperatures
  TT - Temperature, Td - Dewpoint Temperature
  Temperatures in South Africa are measured in Celsius.

- **QPPPP** - QNH
  Q - indicator for QNH, PPPP - Pressure value.
  Measured in hecto Pascal (HPa), 1 Hpa = 1 mB(millibar)

- **REWW** - Recent Significant Weather (see: WW, NSW)

- **TTTTT** - Trend Forecast
  This type of forecast is used to indicate significant changes in the weather expected within a two hour period from the time of issue of the Metar.

- **RMK** - Remark
  Used supply additional information that do fall within the boundaries of the general code. One such example is the tops of CB that are visible from the point of observation but the cloud may be 200Km away.
  Eg. RMK CB DISTANT SW.

- **=** - Indicates the end of the report/bulletin

- **CAVOK**
  Visibility greater than 10Km, no cloud below 5000 ft or minimum sector altitude, whichever is the lowest and no CB or over development and no significant weather.

- **NOSIG** - No Significant Change
  Nosig is added to the METARs of locations where no forecaster is available to give trend forecast. It is omitted with Auto METARs and those from smaller locations.

- **RD/VVVV** - Runway visual range
  At aerodromes where instruments are used to measure visibility this group will be included in the METAR when significant.

- **RD/** - Runway designator/point where the visibility is measured.

- **VVVV** - Visibility.

- **RD/VVVVvVVVV** - This format is used when the visibility fluctuates at a runway point.
  The fluctuation is considered significant when the visibility during the last 5 seconds changes by 50m or 20% of the mean visibility of the previous 10 minutes.

  v - tendency for the visibility to change by 100m or more from the mean,
  terms used are: U - upward, D - downward, N - no tendency.

- **NSW** - No significant Weather (TAF only)

- **NSC** - No Significant Cloud.

- **VRB** - Variable
  Used when windspeed is less than 3KT or during a violent thunderstorm when wind direction can not be determined.

- **Cloud Types**

  Abbreviations for cloud used in METAR, TAF and Sigwx Charts.
  - CB - Cumulonimbus
  - TCU - Towering Cumulus

  Abbreviations used only in Sigwx Charts.
  - ST - Stratus
  - SC - Stratocumulus
  - CU - Cumulus
  - NS - Nimbo Stratus
  - AC - Alto Cumulus
  - AS - Alto Stratus

  The following cloud types are not considered to be significant to aviation and therefore not in any aviation forecasts:
  - Ci - Cirrus
  - Cs - Cirrostratus
  - Cc - Cirrocumulus

- **DDFMTL** - Period of validity
  DD - Day, FM - Hour, start of the period, TL - Hour, end of period
  Eg 120312 - Taf is valid for the 12th day of the month, from 03:00z until 12:00z.
  Two sets of TAFs are issued in South Africa:
  FC-TAF: TAF valid for 6 to 9 hours, updated in 3 hour intervals.
  FT-TAF: Valid for 18 to 24 hours, updated at 6 hour intervals.

  Note: Not all locations have FT-TAFs.

- **TXTtTt/HHZTNTtTt/HHZ** - Forecast Max and Min temperature
  TX - Indicator for Maximum temperature
  TtTt - Temperature value in Celsius
  TN - Indicator for Minimum temperature
  HH - Forecast hour, i.e. the time(hour) when the temperature is expected
  Z - Time Zone indicator, Z=GMT.

{ BECMG HHHH / FMHHmm / TEMPO HHHH (TLHHmm)}
{PROB % HHHH}

- **HHHH** - Period of validity
  HH on the left is the hour indicating the start of time while HH on the right will be the end of the period.
  Eg. 1317 - a change from 13:00Z to 17:00Z.

- **BECMG** - Becoming
  Used to indicate a gradual change in some of the forecast elements.
  TAF - BECMG is always followed by a time group(HHHH) and does not exceed 4 hours.
  TREND(METAR) - This forecast is only 2 hours and need not be followed by a time.

- **FMHHmm** - From
  HH - Hour, mm - minute from when the change is expected.
  TAF - Used when a significant change in all elements is expected at a specific time.
  TREND(METAR) - Used with BECMG and may be used to indicate a change in some or all the elements, e.g. BECMG FM2015.

- **TEMPO** - Temporary fluctuation in some of the elements lasting for periods of
  30 minutes or more but not longer than one hour with each instance and does not cover more than half of the total period indicated by HHHH.

- **TLHHmm** - Until (used in METAR only)
  HH - Hour, mm - minute until when the change is expected to stop.
  TL may be used with FM.

- **PROB %** - Probability
  % - percentage, only 30 or 40 is used. If a higher probability is expected TEMPO is used.

K.6 METAR and TAF Samples

- METAR FADN 130430Z 29003KT 9000 SKC 11/08 Q1024 NOSIG=

  Explanation:

  Location Durban(FADN), 13th at 04:30 utc, wind direction 290 degrees at 3 knots, visibly 9000m, clear skies(SKC), temperature 11 degrees / dewpoint temperature 8 degrees, QNH 1024 Hpa(mB), no significant change expected(NOSIG), end of bulletin(=).

- METAR FAJS 170530Z 35007KT 0500 R/21R0150 R/03L0300V0700 FG OVC000 FEW///CB T07/07 Q1025 FM0535 TL0615 0100 RMK THUNDER=

  Explanation:

  Location Johannesburg Int. Airport(FAJS), 17th at 05:30 utc, wind 350 degrees at 7 knots, visibility 500m, designator on runway 21 right - visibility 150m, at designator 03 left visibility 300m with a tendency to increase to 700m, fog,overcast cloud at 0ft, few Cumulonimbus cloud of which the observer is unable to determine the cloud base(///), temperature 7 degrees / dewpoint temperature 7 degrees, QNH 1025 Hpa. Here the observation ends and the trend forecast begins, from 05:35 until 06:15 the visibility is expected to be 100m. RMK signifies the end of the trend forecast and the observer remarks that thunder was heard at the time of observation.

What is **significant** about the remark in this case is, if the observer had heard no thunder during the time of observation, the term FEW///CB would not have been included in the METAR.

- TAF FAAB 130600Z 130918 13005KT CAVOK PROB30 TEMPO 0916 6000
-SHRA BKN100 TX21/12ZTN14/03Z=

  Explanation:

  Location Alexander Bay, issued on the 13th at 06:00 utc, valid for the 13th from 09:00 until 18:00, wind 130 degrees at 5 knots, cloud and Visibility OK, 30% probability temporary change between 09:00 and 16:00, visibility 6000m, light showers of rain, broken cloud at ten thousand feet, forecast max temperature 21 degrees at 12:00, forecast min temperature 14 deg at 03:00, end.

- TAF FAJS 130900Z 131212 240010KT 7000 SCT025 FEW030CB BKN070 TEMPO 1220 18015G25KT 2000 TSRA BKN005 BECMG 2224 BKN015 TEMPO 0306 2000 BCFG BKN003 PROB40 0406 0500 FG OVC000 FM0815 03007KT 9999 SCT020 TX23/12ZTNM01/03Z=

  Explanation:

  Location Johannesburg International Airport, issued on the 13th at 09:00, valid for the 13th from 12:00 until 12:00(14th), wind 240 degrees at 10 knots, visibility 7000m, scattered cloud at 2500ft, few Cumulonimbus cloud at 3000ft, broken cloud at 7000 ft, temporary change between 12:00 and 20:00, wind 180 degrees at 15 knots - gusting 25 knots, visibility 2000m, in a thunderstorm with rain, broken cloud at 500ft, gradual change(becoming) between 22:00 and 24:00, broken cloud at 1500ft, temporary change between 03:00 and 06:00 2000m vis, fog patches, broken cloud at 300ft, 40% probability, between 04:00 and 06:00, visibility 500m, fog, overcast cloud at 0ft, total change from 08:15, wind 30 degrees at 7 knots, visibility 10Km or more, scattered cloud at 2000ft, forecast max temperature 23 degrees at 12:00, forecast min temperature -1 degrees at 03:00, end of forecast.

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APPENDIX L - The Ionosphere - Ionised Layers - Ionospheric propagation

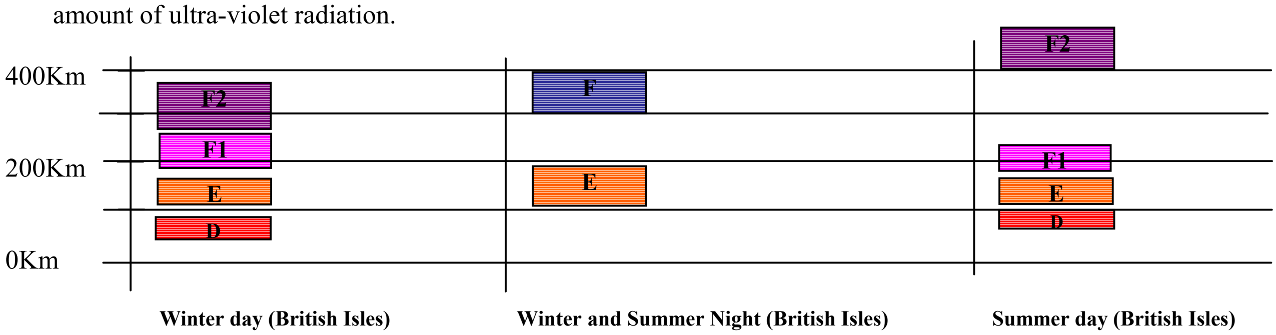
L.1 The Ionosphere

Ultra-violet light from the sun can cause electrons to become separated from their parent molecules of the gases in the atmosphere. The molecules are left with resultant positive charges and are known as ions. The intensity of this ionization depends on the strength of the ultra-violet radiation and the density of the air. The part of the atmosphere in which this process occurs is called the ionosphere, extending from about 50Km to at least 400Km above the earth's surface. The ionosphere is therefore situated above the stratosphere (which lies above the troposphere).

Within ionosphere exist several definite **ionised layers.** When a radio wave enters such a layer, refraction occurs causing the wave to be bent away from its straight path. The amount of refraction depends on the frequency, the angle at which the wave enters the layer, and the intensity of ionisation. Under certain circumstances the wave may be bent so much that it is returned to earth as a **"sky wave".**

L.2 Ionised Layers

During daytime hours there are four main ionisation layers designated D, E, F1, and F2 in ascending order of height. At night, when the sun's radiation is absent, ionisation still persists but it is less intense, and fewer layers are found. Since the strength of the sun's radiation varies with latitude, the structure of the ionosphere varies widely over the surface of the earth. Another factor affecting the layers is the state of the sun, since sunspots affect the amount of ultra-violet radiation.



Let's examine the ionised layers.

- **D-Layer** is a non-reflecting layer occurring only during daylight hours. It is the lowest layer and though its ionisation is too weak to cause appreciable refraction, radio waves (particularly LF and MF signals) are considerably attenuated by it. The practical effect on LF and MF transmissions is the up-going waves are absorbed by the D-Layer, so that sky wave reflections from higher layers are very weak or completely absent by day in these frequency bands.

- **E-Layer** is strongly ionised by day and remains weakly ionised at night. It produces skywaves in the HF band by day and the HF, MF, and LF bands at night.

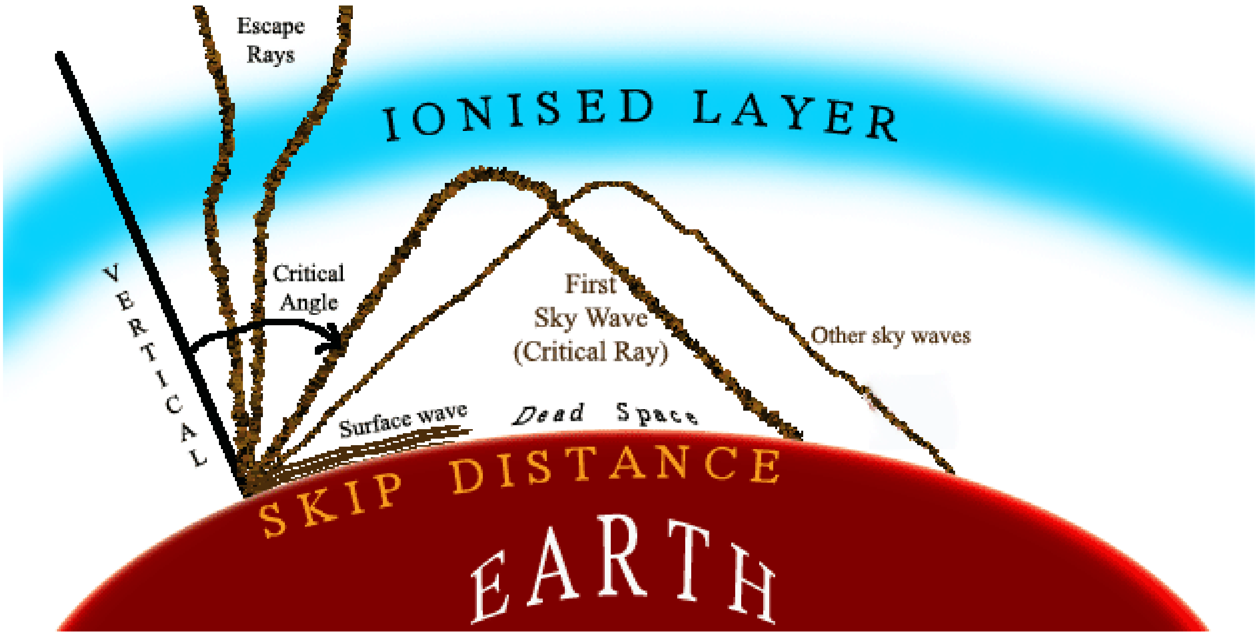
- **F, F1, and F2 Layers.** At night there a single F-layer above the E-layer, but in the daytime the F-layer divides into two (the F1 and F2 layers). The F-layers, being the highest, are the most strongly ionised and produce HF sky waves by day and copious sky waves in the HF, MF, and LF bands at night.

L.3 Ionospheric propagation

Propagation in the ionosphere depends largely on frequency. Below about 100KHz an ionised layer acts as an almost perfect reflecting surface and very long ranges are obtained. The wave in effect travels as if between two concentric conducting spheres (the earth and the ionised layer). Range is not unlimited though, because the imperfect conductivity of the two surfaces causes attenuation.

At higher frequencies the wave penetrates the layer and is refracted. For a given frequency and state of the ionosphere, the amount of bending will depend on the angle at which the wave penetrates the layer.

From the figure below it can be seen that waves travelling nearly vertically may escape through the layer. Waves travelling at a greater angle to the vertical suffer more refraction. When the angle is increased to the **"Critical Angle"** total reflection occurs, producing the **"first sky wave".** Waves making an angle with the vertical that exceeds the critical angle will also produce sky waves. The range from the transmitter within which sky waves are not received under a given set of conditions is known as **"Skip Distance"**.



- **Critical angle depends largely on frequency. The higher the frequency the greater the critical angle.**

- **Therefore as skip distance is to be reduced, a lower frequency has to be used. This is most significant in choosing the optimum frequencies for HF communications.**

- **As frequency is reduced, the critical angle decreases.** The frequency at which the critical angle is zero is called the "Critical Frequency". This is the highest frequency that will give vertical reflections, with any higher frequency a wave travelling vertically would escape through the layer.

It should be noted that for frequencies above about 30MHz, waves generally escape through the layers without being reflected, regardless of the angle the wave makes with the vertical. Therefore sky waves are relatively rare in the VHF and higher frequency bands.

It is worth mentioning the **various factors that determine whether sky waves will be received at a given point remote from a transmitter**.

These factors are:

- Frequency band in use (sky waves are fairly rare in VHF and higher frequency bands)
- Range of receiver from transmitter (sky waves are not received within the skip distance)
- Frequency in use (skip distance depends on frequency)
- State of the ionosphere, which varies with :
  - Time of day
  - Season of year
  - State of sun

Important note:

Don’t try to understand this by comparing the behaviour of “Roger Wilco” with the above text as “Roger Wilco” is governed by a whole set of different rules.

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APPENDIX M – The ICAO Flight Plan

Following is the ICAO Flight Plan of the flight OAL412. Let's try to understand it line by line and also introduce **some** of the other entries we can use in a FPL :

(FPL-OAL412-IS
-A343/H-SHIWXDRY/C
-KJFK2145
-N0481F330 HAPIE3 YAHOO DCT DOVEY/M082F330 NATY 43N050W/M082F370 NATY SEPAL/M082F370 UN470 NOVAN/M082F360 UN470 CGC UN460 LMG ARA/M082F370 UB34 NEMES NEMES1A
-LGAV0842 LGTS LGRP
-EET/KZBW0007 KZNY0034 LPPO0245 EGGX0329 LFFF0507 LIMM0623 LIBB0706 LGGG0750
60W0115 50W0201 40W0245 30W0329 20W0412
RIF/BEROK/M082F360 UB25 GEN/M082F370 UW709 LAGEN UW712 ENOBA UW707 KEPPO G7 NIZ/M082F340 G7 MTG DCT LFML
REG/SXDFB SEL/FHDS)

FPL-OAL412-IS

- FPL means that the message that follows is a Flight Plan
- OAL412 is our callsign and
- I - means we are an IFR flight,
  Other entries:
  - *V for VFR*
  - *Y if IFR first then VFR*
  - *Z if VFR first then IFR*
- *S* – means the flight is a scheduled air service
  Other entries:
  - *N if non scheduled air transport operation*
  - *G if General Aviation*
  - *M if military*
  - *X if other than any of the defined categories above*

-A343/H-SHIWXDRY/C

- A343 is the type of aircraft (Airbus 340-300)
- /H is the wake turbulence category
  Other entries:
  - *M if medium*
  - *L if light*
- SHIWXDRY are the radio communication, navigation and approach aid equipments. This is quite interesting.

  Let's list all possibilities:
  - **C** **LORAN C**
  - **D** **DME**
  - **F** **ADF**
  - **G** **GNSS**
  - **H** **HF RTF**
  - **I** **Inertial Navigation**
  - **J** **Data Link**
  - **K** **MLS**
  - **L** **ILS**
  - **M** **OMEGA**
  - **O** **VOR**

- **R** **RNP type certification**
- **T** **TACAN**
- **U** **UHF RTF**
- **V** **VHF RTF**
- **W** **RVSM Approved**
- **X** **MNPS Approved**
- **Y** **Carriage of 8,33KHz spacing comm equipment**
- **Z** **Other equipment**

➢ -/C is the surveillance equipment meaning Mode A transponder (4 digits 4096 codes) and Mode C
Other entries:

A meaning Mode A transponder (4 digits 4096 codes)
X meaning Mode S transponder without both aircraft identification and pressure altitude transmission
P meaning Mode S transponder with pressure altitude transmission, but no aircraft identification
I meaning Mode S transponder with aircraft identification, but no pressure altitude transmission
S meaning Mode S transponder with both aircraft identification and pressure altitude transmission
N meaning Nil
D meaning ADS capability

➢ **-KJFK2145** is the departure airport and time

➢ **-N0481F330 HAPIE3 YAHOO DCT DOVEY/M082F330 NATY 43N050W/M082F370 NATY SEPAL/M082F370 UN470 NOVAN/M082F360 UN470 CGC UN460 LMG ARA/M082F370 UB34 NEMES NEMES1A**

N0481F330 Cruising Speed and Cruising Level (481Kts and FL330). For Knots we use **N**, for Mach number we use **M**, for Kilometers per Hour **K**. Now for Flight Level we use **F**, for altitude in hundreds of feet we use **A**, for altitude in tens of meters **M** and **VFR** for uncontrolled flights.

Following is the route including in each case the changes of altitude and/or speed and/or flight rules.

NAT Y means that we have planned for North Atlantic Track Y and following are the coordinates of the track.

➢ **-LGAV0842 LGTS LGRP** Airport of destination, estimated duration of flight, and the alternates

➢ **-EET/KZBW0007 KZNY0034 LPPO0245 EGGX0329 LFFF0507 LIMM0623 LIBB0706 LGGG0750**
60W0115 50W0201 40W0245 30W0329 20W0412

Are the Estimated Elapsed Times to significant points or FIR boundaries. In the above example the first line has the FIR bounadies' elapsed time, and the second line has the oceanic points' elapsed time.

➢ **RIF/BEROK/M082F360 UB25 GEN/M082F370 UW709 LAGEN UW712 ENOBA UW707 KEPPO G7 NIZ/M082F340 G7 MTG DCT LFML**

RIF – means Reclearance In Flight. Remember that the flight was planned using the method of Re-release. So, BEROK, as we have already explained, is our redispatch point and follows the rest of the route to our preliminary destination which is LFML

➢ **EG/SXDFB** Is the registration of the aircraft

and

➢ **SEL/FHDS** Is the SELCAL code of the aircraft

M.1 ICAO Flight Plan form

(Although Airlines use ***Repetitive Flight Plan****s, this is how our flight plan would look)*

FLIGHT PLAN
PLAN DE VOL

PRIORITY
Priorité
≪≡ FF →

ADDRESSEE(S)
Destinataire(s)
≪≡

FILING TIME
Heure de dépôt
→
ORIGINATOR
Expéditeur
≪≡

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR
Identification précise du(des) destinataire(s) et/ou de l'expéditeur

3 MESSAGE TYPE
Type de message
≪≡ (FPL

7 AIRCRAFT IDENTIFICATION
Identification de l'aéronef
— OAL412

8 FLIGHT RULES
Règles de vol
— I

TYPE OF FLIGHT
Type de vol
S ≪≡

9 NUMBER
Nombre
—

TYPE OF AIRCRAFT
Type d'aéronef
A343

WAKE TURBULENCE CAT.
Cat. de turbulence de sillage
/ H

10 EQUIPMENT
Équipement
— SHIWXDRY/C ≪≡

13 DEPARTURE AERODROME
Aérodrome de départ
— KJFK

TIME
Heure
2145 ≪≡

15 CRUISING SPEED
Vitesse croisière
— N0481

LEVEL
Niveau
FL330

ROUTE
Route
→ HAPIE3 YAHOO DCT DOVEY/M082F330 NATY
43N050W/M082F370 NATY SEPAL/M082F370 UN470 NOVAN/M082F360 UN470 CGC
UN460 LMG ARA/M082F370 UB34 NEMES NEMES1A
≪≡

16 DESTINATION AERODROME
Aérodrome de destination
— LGAV

TOTAL EET
Durée totale estimée
HR MIN
0842

ALTN AERODROME
Aérodrome de dégagement
→ LGTS

2ND ALTN AERODROME
2e aérodrome de dégagement
→ LGRP ≪≡

18 OTHER INFORMATION
Renseignements divers
— EET/KZBW0007 KZNY0034 LPPO0245 EGGX0329 LFFF0507 LIMM0623 LIBB0706
LGGG0750 60W0115 50W0201 40W0245 30W0329 20W0412
-RIF/BEROK/M082F360 UB25 GEN/M082F370 UW709 LAGEN UW712 ENOBA UW707
KEPPO G7 NIZ/M082F340 G7 MTG DCT LFML -REG/SXDFB -SEL/FHDS)≪≡

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)
Renseignements complémentaires (À NE PAS TRANSMETTRE DANS LES MESSAGES DE PLAN DE VOL DÉPOSÉ)

19 ENDURANCE
Autonomie
HR MIN
— E / 1005

PERSONS ON BOARD
Personnes à bord
→ P / TBN

EMERGENCY RADIO
Radio de secours
UHF VHF ELT
→ R / ~~U~~ V E

SURVIVAL EQUIPMENT/Équipement de survie
POLAR DESERT MARITIME JUNGLE
Polaire Désert Maritime Jungle
→ S / ~~P~~ ~~D~~ M J

JACKETS/Gilets de sauvetage
LIGHT FLUORES UHF VHF
Lampes Fluores
→ J / L F ~~U~~ ~~V~~

DINGHIES/Canots
NUMBER CAPACITY COVER COLOUR
Nombre Capacité Couverture Couleur
→ D / 06 → → C → ≪≡

AIRCRAFT COLOUR AND MARKINGS
Couleur et marques de l'aéronef
A / BLUE WHITE OLYMPIC AIRWAYS

REMARKS
Remarques
→ N / ≪≡

PILOT-IN-COMMAND
Pilote commandant de bord
C /)≪≡

FILED BY / Déposé par

SPACE RESERVED FOR ADDITIONAL REQUIREMENTS
Espace réservé à des fins supplémentaires

M.2 Computerized Flight Plan

```
FLT OAL 412                 ORGN KJFK   DEST LGAV   ALT LGTS DIV TO ..
CFP REF JWX7L  A/C SX-DFB A/C TYPE  A340-313 CRZ M820 VALID   /0345Z
ALL WEIGHTS IN KGS

FPL ZFW 169000   FPL TOF  64960   FPL TOW 233960   FPL LW 177240   KGS

CPN   61639 ENTRY  66915 EXIT 140572                       CTOT .. ..
NY
SYNOPTIC RTE. KJFK HAPIE3 YAHOO DCT FIR DCT DOVEY DCT N42W060 DCT
N43W050 DCT N44W040 DCT N45W030 DCT N46W020 DCT N47W015 DCT SEPAL
UN470 CGC UN460 LMG UG21 BEBIX UP860 BALSI UY11 TOP UB25 ANC UL612
ARA UB34 NEMES NEME1A LGAV             ESTIMATED TIME OVER
                                              REVISED TIME OVER
ATC CLR.                                             ACTUAL TIME OVER
         ----------  ----------  ----------  ----------  ----------
T/OFF    R/W ...... WIND ......     R/W CONDITION .. .. .. ..

POSN     LAT      LONG      AWY   FL    MN TAS   SD   ST   ETO  RTO  FREM/K
FREQ   ISA/    MORA  WIND   MTR   AFL   SR GS    TD   TT   TH   ATO  AFREM

KJFK   N4038.4 W07346.7   DEP MANEUVERING            003 .:.. .:.. 064960
                                                    0003
       LATITUDE - LONGITUDE                  TAS     SECTOR DISTANCE
FIR    N4028.5 W07315.5 HAPIE3 CLB          391   26  004 .   . .   . 063360
       P04 . .   27 31/006 126  . .         397 0026 0007  39
       WIND VELOCITY                                      FUEL REMAINING
HAPIE  N4023.2 W07259.0 HAPIE3 CLB          391   14  002 .   . .   . 062860
       P04 . .   27 31/006 127  . .         397 0040 0009  39   .  ..  ..
TOP of CLIMB    MIN. OFF ROUTE ALT.             GROUNDSPEED
TOC             (x 1000)  HAPIE3 330        391  108  015 .   . .   . 059360
       P04 . .   20 25/078 091  . .    00 430 0148 0024  38   .  ..  ..
            MAGNETIC TRACK                 TROPOPAUSE HEIGHT
YAHOO  N4104.2 W06944.8 HAPIE3 330 820 481   45  005 .   . .   . 058770
       P04 . .   20 25/078 091  . .    01 551 0193 0029  37   .  ..  ..
       ISA   SID - AIRWAY or DIRECT   MACH Nbr.      SECTOR TIME
FIR    N4105.6 W06847.4 DCT      330 820 482   44  005 .   . .   . 058210
       P04 . .   20 25/088 104  . .        565 0237 0034  39   .  ..  ..
                                 FL                TOTAL TIME
DOVEY  N4107.0 W06700.0 DCT      330 820 482   81  008 .   . .   . 057180
       P04 . .   20 25/088 106  . .    01 565 0318 0042  39   .  ..  ..
                                          TOTAL DISTANCE
42060  N4200.0 W06000.0 DCT      330 820 482  320  033 .   . .   . 053260
       P05 . .   20 25/100 099  . .    00 582 0638 0115  40   .  ..  ..
                  SHEAR FACTOR (the vectorial difference of wind per 1000ft)
43050  N4300.0 W05000.0 DCT      330 820 483  448  046 .   . .   . 047780
       P05 . .   20 26/110 102  . .    01 593 1086 0201  41   .  ..  ..

44040  N4400.0 W04000.0 DCT      370 820 474  441  044 .   . .   . 042780
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      P05 . .  20 26/120 101   . .  04 594 1527 0245  42   .  . .. ..

45030 N4500.0 W03000.0 DCT     370 820 475  434  044 . . .  . 038040
      P05 . .  20 27/125 098   . .  04 598 1961 0329  39   .  . .. ..

46020 N4600.0 W02000.0 DCT     370 820 475  427  043 . . .  . 033420
      P05 . .  20 28/119 094   . .  05 590 2388 0412  37   .  . .. ..

47015 N4700.0 W01500.0 DCT     370 820 476  216  023 . . .  . 031000
      P06 . .  20 28/094 083   . .  04 561 2604 0435  34   .  . .. ..


SEPAL  N4700.0 W00845.0 DCT    370 820 476  257  028 . . .  . 028090
       P05 . .  20 28/074 097  . .  03 549 2861 0503  33   .  . .. ..

LAPEX  N4700.0 W00800.0 UN470  370 820 476   31  004 . . .  . 027740
       P06 . .  20 27/064 096  . .  03 540 2892 0507  33   .  . .. ..

KOLEK  N4636.8 W00524.5 UN470  370 820 476  110  012 . . .  . 026470
       P06 . .  20 27/060 107  . .  03 534 3002 0519  33   .  . .. ..

NOVAN  N4619.3 W00342.0 UN470  370 820 476   73  008 . . .  . 025620
       P06 . .  20 26/053 108  . .  02 523 3075 0527  34   .  . .. ..

DEGIS  N4615.6 W00321.3 UN470  360 820 476   15  002 . . .  . 025440
       P05 . .  20 25/051 108  . .  00 515 3090 0529  35   .  . .. ..

TIOCH  N4600.5 W00201.0 UN470  360 820 475   58  007 . . .  . 024730
       P04 . .  23 23/052 108  . .  01 506 3148 0536  35   .  . .. ..

DILRA  N4551.0 W00113.5 UN470  360 820 474   35  004 . . .  . 024300
       P04 . .  23 22/057 109  . .  02 493 3183 0540  35   .  . .. ..

CGC    N4539.6 W00018.7 UN470  360 820 474   40  005 . . .  . 023800
116.20 P03 . .  31 21/060 109  . .  02 486 3223 0545  36   .  . .. ..

FOUCO  N4545.3 E00028.8 UN460  360 820 473   34  004 . . .  . 023390
       P02 . .  31 21/060 083  . .  00 508 3257 0549  36   .  . .. ..

DIBAG  N4547.4 E00047.3 UN460  360 820 473   13  002 . . .  . 023240
       P02 . .  31 21/060 083  . .  01 506 3270 0551  36   .  . .. ..

LMG    N4549.0 E00101.5 UN460  360 820 473   10  001 . . .  . 023120
114.50 P02 . .  45 21/060 083  . .  00 505 3280 0552  36   .  . .. ..

BEBIX  N4557.0 E00124.0 UG21   360 820 473   18  002 . . .  . 022860
       P02 . .  45 21/060 065  . .  00 519 3298 0554  37   .  . .. ..

ADAKO  N4558.5 E00205.8 UP860  370 820 472   29  004 . . .  . 022510
       P02 . .  87 21/059 089  . .  00 497 3327 0558  37   .  . .. ..

VALKU  N4559.9 E00249.1 UP860  370 820 471   30  003 . . .  . 022150
       P02 . .  87 20/056 089  . .  00 494 3357 0601  38   .  . .. ..
```

```
ADEKA  N4556.5 E00310.8 UP860  370 820 471   16  002 . . . . 021950
       P02 . .  87 20/053 104  . .  00 478 3373 0603  38  . . .. ..

THR    N4552.9 E00333.2 UP860  370 820 471   16  002 . . . . 021760
109.00 P02 . .  87 20/049 104  . .  00 477 3389 0605  39  . . .. ..

MADOT  N4543.8 E00430.8 UP860  370 820 471   41  005 . . . . 021240
       P02 . .  79 20/044 104  . .  00 476 3430 0610  39  . . .. ..

MEBAK  N4542.5 E00438.9 UP860  370 820 471    6  001 . . . . 021170
       P02 . .  72 20/040 104  . .  01 473 3436 0611  39  . . .. ..

RUSIT  N4540.1 E00453.4 UP860  370 820 471   10  001 . . . . 021040
       P02 . . 123 20/040 104  . .  01 473 3446 0612  38  . . .. ..

GIPNO  N4533.6 E00531.8 UP860  370 820 471   28  004 . . . . 020690
       P02 . . 123 19/038 104  . .  01 471 3474 0616  38  . . .. ..

BALSI  N4528.7 E00557.7 UP860  370 820 471   19  003 . . . . 020450
       P02 . . 183 19/036 106  . .  01 467 3493 0619  38  . . .. ..

ROBEX  N4506.9 E00635.6 UY11   370 820 471   35  004 . . . . 019990
       P01 . . 183 19/035 130  . .  02 451 3528 0623  38  . . .. ..

BLONA  N4500.5 E00646.6 UY11   370 820 471   10  001 . . . . 019860
       P01 . . 183 18/034 130  . .  02 449 3538 0624  38  . . .. ..

TOSMI  N4459.6 E00658.9 UY11   370 820 471    9  002 . . . . 019750
       P01 . . 183 18/034 096  . .  02 466 3547 0626  38  . . .. ..

TOP30  N4458.8 E00709.6 UY11   370 820 471    8  001 . . . . 019650
       P01 . . 183 18/034 096  . .  02 465 3555 0627  38  . . .. ..

KUMIN  N4458.0 E00720.9 UY11   370 820 471    8  001 . . . . 019550
       P01 . . 159 18/034 096  . .  02 464 3563 0628  39  . . .. ..

KODOK  N4456.6 E00740.2 UY11   370 820 471   14  002 . . . . 019370
       P01 . . 159 18/035 096  . .  02 464 3577 0630  39  . . .. ..

TOP    N4455.5 E00751.7 UY11   370 820 471    8  001 . . . . 019270
114.50 P01 . . 159 18/035 098  . .  02 463 3585 0631  39  . . .. ..

GEN    N4425.5 E00904.9 UB25   370 820 471   60  008 . . . . 018480
112.80 P01 . . 159 17/035 120  . .  02 448 3645 0639  40  . . .. ..

BEROK  N4409.9 E01021.1 UB25   370 820 471   57  007 . . . . 017740
       P02 . .  96 16/036 105  . .  02 451 3702 0646  40  . . .. ..

RUXOL  N4406.9 E01035.6 UB25   370 820 471   11  002 . . . . 017600
       P02 . .  96 16/037 105  . .  03 448 3713 0648  40  . . .. ..

FRZ    N4401.6 E01100.2 UB25   370 820 471   19  002 . . . . 017350
115.20 P02 . .  96 16/037 106  . .  03 446 3732 0650  40  . . .. ..
```

```
VALEN  N4356.2 E01132.0 UB25    370 820 471   24  003 .  .  .  . 017040
       P02 . .  96 15/037 102   . .  03 447 3756 0653  40  .   . ..  ..

BAGNO  N4353.4 E01148.1 UB25    370 820 471   12  002 .  .  .  . 016880
       P02 . .  82 15/036 102   . .  03 445 3768 0655  40  .   . ..  ..

URBAN  N4347.6 E01220.9 UB25    370 820 471   24  003 .  .  .  . 016570
       P02 . .  81 15/036 103   . .  03 444 3792 0658  41  .   . ..  ..

ANC    N4335.2 E01328.3 UB25    370 820 472   51  007 .  .  .  . 015900
110.65 P02 . .  81 14/034 103   . .  03 444 3843 0705  41  .   . ..  ..

FIR    N4330.8 E01335.3 UL612   370 820 472    7  001 .  .  .  . 015820
       P02 . . 120 13/032 129   . .     440 3850 0706  41  .   . ..  ..

NUTRO  N4309.6 E01408.9 UL612   370 820 472   32  005 .  .  .  . 015390
       P02 . . 120 13/032 129   . .  03 440 3882 0711  41  .   . ..  ..

ARPIK  N4244.8 E01447.5 UL612   370 820 472   38  005 .  .  .  . 014900
       P03 . . 120 12/030 130   . .  03 443 3920 0716  41  .   . ..  ..

POLYP  N4228.7 E01512.1 UL612   370 820 473   24  003 .  .  .  . 014580
       P03 . . 120 12/028 130   . .  03 445 3944 0719  41  .   . ..  ..

VIE    N4154.7 E01603.0 UL612   370 820 473   51  007 .  .  .  . 013930
112.60 P03 . . 116 11/026 130   . .  03 449 3995 0726  41  .   . ..  ..

UVOKA  N4122.8 E01651.8 UL612   370 820 474   49  006 .  .  .  . 013310
       P04 . .  91 10/023 129   . .  03 454 4044 0732  41  .   . ..  ..

BRD    N4036.7 E01800.2 UL612   370 820 475   69  009 .  .  .  . 012450
113.20 P05 . .  43 09/017 130   . .  03 461 4113 0741  43  .   . ..  ..

NOSTO  N3949.0 E01900.0 UL612   370 820 476   66  009 .  .  .  . 011640
       P06 . .  45 08/009 134   . .  03 470 4179 0750  46  .   . ..  ..

ARA    N3806.5 E02125.4 UL612   370 820 477  153  019 .  .  .  . 009840
112.70 P07 . . 104 30/008 130   . .  03 485 4332 0809  50  .   . ..  ..

NEMES  N3742.1 E02234.7 UB34    370 820 479   60  007 .  .  .  . 009150
       P09 . . 105 29/023 111   . .  04 502 4392 0816  50  .   . ..  ..

TOD                      NEME1A 370 820 479   18  002 .  .  .  . 008950
       P09 . . 104 29/029 111   . .  00 508 4410 0818  50  .   . ..  ..

DDM    N3728.7 E02313.0 NEME1A DES      475   15  002 .  .  .  . 008900
117.20       . . 102 30/019 111 . .     493 4425 0820  50  .   . ..  ..

KEA    N3733.4 E02417.9 NEME1A DES      411   52  008 .  .  .  . 008660
115.00       . . 102 02/030 082 . .     396 4477 0828  50  .   . ..  ..

KRO    N3759.6 E02429.7 NEME1A DES      347   28  005 .  .  .  . 008510
```

```
112.20      . .  50 03/027 017  . .     320 4505 0833  50  .  . ..  ..

LGAV    N3756.2 E02356.7 NEMElA DES     198   31  009 .   .  .   . 008240
           . .     03/020 260         00 211 4536 0842  50  .  . ..  ..

 LGAV   LNDG     R/W .. .. .. WIND .. .. .. .. R/W CONDITION .. .. ..
```

ALTERNATE A/Ps DATA

MACH Nbr — WIND COMPONENT

```
                              TIME    FL    DIST    MCH    WC       FUEL
ALTERNATE - 1 LGTS            0040   280    0212    703   M016      4440
ALTERNATE - 2 LGRP            0042   350    0244    774   P007      4740
```

NAUTICAL AIR MILES — AVERAGE TEMPERATURE

```
TO  DEST LGAV  NGM 4536  NAM 4024  AV  WC  P59  AV  TEMP  P04  AV  OAT  M51
```

NAUTICAL GROUND MILES — AVERAGE WIND COMPONENT — AVERAGE OUTSIDE AIR TEMPERATURE

```
RP BEROK TO PRELIM DEST LFML         EXIT 184779
```

Re-release procedure to Preliminary Destination from BEROK

```
POSN     LAT      LONG     AWY   FL   MN  TAS    SD   ST   ETO   RTO  FREM/K
 FREQ  ISA/     MORA  WIND   MTR  AFL  SR  GS    TD   TT    TH   ATO  AFREM

BEROK  N4409.9 E01021.1 UB25   370 820 471    57   007 .   .  .   . 017740
       P02 . .   96 16/036 105  . .  02 451 3702 0646  40  .  . ..  ..

GEN    N4425.5 E00904.9 UB25   360 820 474    57   007 .   .  .   . 017010
112.80 P03 . .   96 16/035 285  . .  01 492 3759 0653  40  .  . ..  ..


 LAGEN  N4423.6 E00829.9 UW709  370 820 471    25   003 .   .  .   . 016700
        P01 . . 151 17/034 265  . .  01 474 3784 0656  39  .  . ..  ..

 ENOBA  N4418.0 E00818.4 UW712  370 820 471    10   002 .   .  .   . 016580
        P01 . .  81 17/033 236  . .  00 457 3794 0658  39  .  . ..  ..

 KEPPO  N4355.4 E00746.2 UW707  370 820 471    32   004 .   .  .   . 016170
        P02 . . 151 17/031 226  . .  00 453 3826 0702  39  .  . ..  ..

 FIR    N4350.6 E00729.9 G7     370 820 471    13   002 .   .  .   . 016010
        P02 . . 151 17/028 248  . .     464 3839 0704  38  .  . ..  ..

 NIZ    N4346.2 E00715.3 G7     370 820 471    11   001 .   .  .   . 015870
 112.40 P02 . . 151 17/028 247  . .  01 464 3850 0705  38  .  . ..  ..

 TOD                     G7     340 820 478    10   001 .   .  .   . 015740
        P02 . .  93 17/033 221  . .  00 456 3860 0706  38  .  . ..  ..

 STP    N4313.2 E00636.1 G7     DES     446    34   005 .   .  .   . 015590
 116.50     . .  93 18/021 221  . .  00 431 3894 0711  37  .  . ..  ..

 FIR    N4313.5 E00613.7 G7     DES     389    16   002 .   .  .   . 015510
            . .  88 20/008 271  . .  00 386 3910 0713  38  .  . ..  ..

 CUERS  N4313.6 E00608.1 G7     DES     389     5   001 .   .  .   . 015490
            . .  88 20/008 271  . .  00 386 3915 0714  38  .  . ..  ..

 OB     N4313.8 E00539.9 G7     DES     360    21   004 .   .  .   . 015380
```

```
395.00        . .  88 20/005 271  . .  00 358 3936 0718  38  .  . ..  ..

POMEG  N4317.7 E00519.7 G7      DES      328   15   003 .  . .  . 015300
              . .  56 18/005 285  . .  00 329 3951 0721  38  .  . ..  ..

MTG    N4323.2 E00505.2 G7      DES      241   12   002 .  . .  . 015210
117.30        . .  56 18/008 298  . .  00 245 3963 0723  38  .  . ..  ..

LFML   N4326.2 E00512.9 DCT     DES      171   16   006 .  . .  . 015040
              . .  56 18/003 062  . .  00 172 3979 0729  38  .  . ..  ..
```

PRELIMINARY ALTERNATE A/P DATA

	TIME	FL	DIST	MCH	WC	FUEL
PREL ALTN - 1 LIRF	0102	370	0379	786	M009	6520

```
PREL DEST LFML NGM 3979  NAM 3449  AV WC P71  AV TEMP P04  AV OAT M51
```

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APPENDIX N - Abbreviations

ACC	Area Control Centre
ADC	Air Data Computer
ADF	Automatic Direction Finding
AFTN	Aeronautical Fixed Telecommunication Network
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Service
ARINC	ARINC - formerly Aeronautical Radio Incorporated
ASR	Aviation Safety Report
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
AWPR	Automatic Waypoint Position Reporting
BOTA	Brest Oceanic Transition Area
BRNAV	Basic Area Navigation
CAR	Caribbean
CAT	Clear Air Turbulence
CDU	Control Display Unit
CMA	Central Monitoring Agency
CTA	Control Area
DCPC	Direct Controller/Pilot Communications
DME	Distance Measuring Equipment
DR	Dead Reckoning
ELT	Emergency Locator Transmitter
ETA	Estimated Time of Arrival
ETOPS	Extended Range Twin-engine Aircraft Operations
EUR	Europe
FAA	Federal Aviation Administration
FDE	Fault Detection and Exclusion
FIR	Flight Information Region
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FMC	Flight Management Computer
FMS	Flight Management System
GLONASS	Global Orbiting Navigation Satellite System
GMU	GPS (Height) Monitoring Unit
GNE	Gross Navigation Error
GNSS	Global Navigation Satellite System
GP	General Purpose
GPS	Global Positioning System
HF	High Frequency
HMU	Height Monitoring Unit
HSI	Horizontal Situation Indicator
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
INS	Inertial Navigation System
IRS	Inertial Reference System
JAA	Joint Aviation Authorities
kHz	Kilohertz
LAT	Latitude
LONG	Longitude
LRNS	Long Range Navigation System
MASPS	Minimum Aircraft System Performance Specification

MEL	Minimum Equipment List
MET	Meteorological
MHz	Megahertz
MNPS	Minimum Navigation Performance Specification
MTT	Minimum Time Track
NAM	North America
NAR	North American Route
NAT	North Atlantic
NAT SPG	North Atlantic Systems Planning Group
NDB	Non Directional Beacon
nm	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
OAC	Oceanic Area Control Centre
OCA	Oceanic Control Area
OTS	Organized Track System
PRM	Preferred Route Message
PTS	Polar Track Structure
RA	Resolution Advisory
RAIM	Receiver-Autonomous Integrity Monitoring
RMI	Remote Magnetic Indicator
RNP	Required Navigation Performance
R/T	Radio Telephony
RVSM	Reduced Vertical Separation Minimum
SAM	South America
SELCAL	Selective Calling
SID	Standard Instrument Departure
SOTA	Shannon Oceanic Transition Area
SSB	Single Sideband
SSR	Secondary Surveillance Radar
SST	Supersonic Transport
TA	Traffic Advisory
TAS	True Airspeed
TCAS	Traffic (Alert and) Collision Avoidance System
TLS	Target Level of Safety
TMI	Track Message Identification
UTC	Co-ordinated Universal Time
VHF	Very High Frequency
VOR	VHF Omni-directional Range
WAH	When Able Higher
WATRS	West Atlantic Route System

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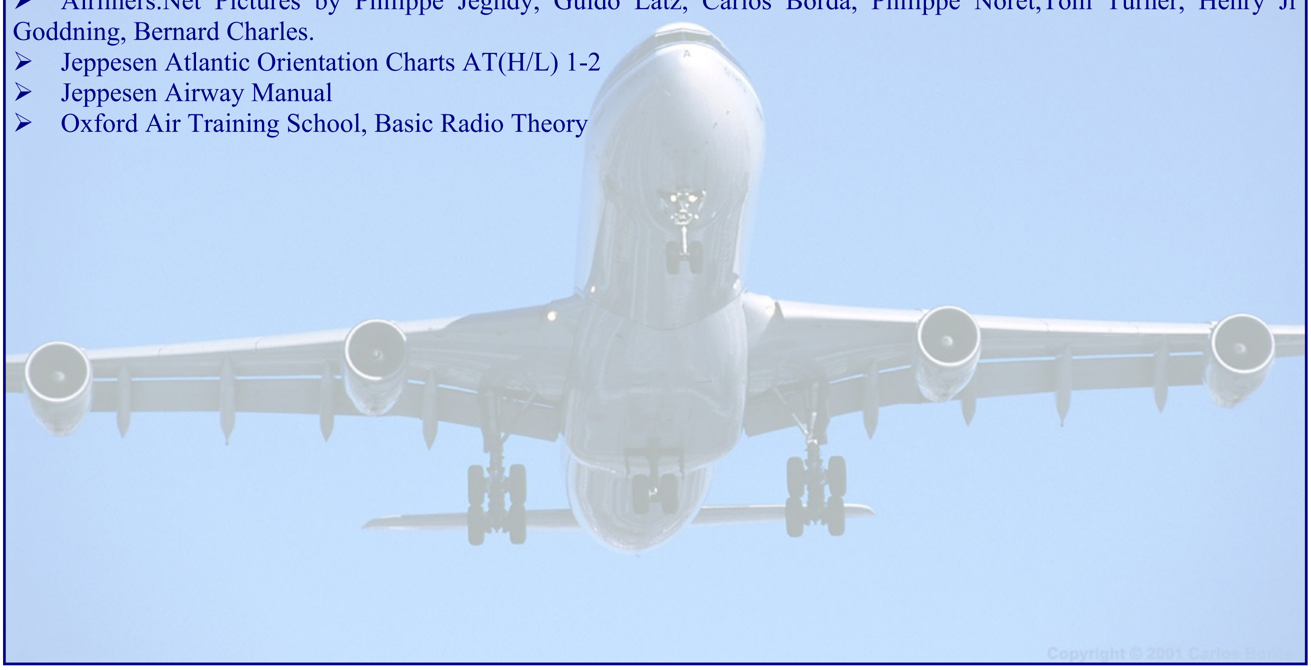

Useful Links

Homepage

- Hellenic (Greek) vACC : Hellenic virtual Area Control Centre responsible for Online Flights in Greece and also homepage of this document (Tutorials Section).

Online-Flightsim Related Links

- VATSIM : Virtual Air Traffic Simulation Network (central website)
- VATSIM-EUR : VATSIM's European Region
- VATSIM-UK : UK Division of VATSIM-EUR Region
- VATUSA : USA Division of VATSIM's North America Region
- NY ARTCC : New York ARTCC of VATUSA
- VATCAN : Canada Divison of VATSIM North America Region
- GlideSlope : A PS1.3 Simulator site with useful/current information about NAT Tracks

Real Life Aviation Links

- Aviation Weather Center : An excellent source for current High SIGWX Charts
- National Weather Service : An excellent source for current METARs and TAFs
- US NOTAM Office : An excellent source for current NOTAMs, RVSMs, Track Systems etc.
- NAT PCO - M.N.P.S.A. : Homepage of North Atlantic Programme Coordination Office (incl. M.N.P.S.A)
- EuroControl : Official Eurocontrol Site (Check also the RVSM Entry-Exit points Section)
- R.V.S.M. : Reduced Vertical Separation Minima Site
- EUR RVSM : Official European RVSM Site
- NAT RVSM : North Atlantic RVSM Site (with many useful links)

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