EN-ROUTE MANAGEMENT

1. Introduction

The purpose of this document is to give some information for en-route controllers in the areas of traffic handling according to aircraft performances.

With reading this article, controllers shall be already familiar with the concepts of indicated speed, true speed and ground speed (IAS, TAS, GS), top of descent (TOD), radar vectoring, Flight level, RVSM and airways.

2. Air traffic service provided

Air traffic control service (ATS) is a service provided for the purpose of:

- Preventing collision between aircraft and on the manoeuvring area between aircraft and obstructions
- Expediting and maintaining an orderly flow of air traffic.

The other objectives of area controllers are:

- Providing aircraft with advice and information required for the safe and efficient conduct of flights.
- Notifying those involved in search and rescue of aircraft in need of this service and assist them in tasks.

It should be clearly understood that provision of alerting service is not an isolated function but is rather incorporated in the provision of flight information and ATC service.

From these objectives, it follows that the emphasis of the air traffic service is placed on the word "service".

This emphasis means that air traffic service should be at the disposition of its users and that any action on its part, which is likely to interfere with the intention of any of its individual users, will only be justified if the results in improving services apply to the majority of users of the services there.

In no case the action of ATS affecting its users will be motivated by the convenience of ATS only.

2.1. Radar services

The radar systems used by ATC units are employed to provide three “radar services”:

- Radar assistance, meant to provide information to the aircraft about their position and any deviation from their route
- Radar surveillance, meant to provide information to ATC about position, velocity and altitude of all aircraft in order to ensure their separation
- Radar vectoring, meant to issue headings in order to provide navigation guidance to the aircraft

These services can only be provided to aircraft which are “**radar identified**”. Moreover, some ATC units can only provide part of these services depending on the radar performances and on the configuration of their airspace.

All approach controllers on IVAO have a radar system with the use of the IvAc software.

2.2. Radar assistance

Radar assistance provides information to the aircraft about any deviation from the clearances they have received and to assist all aircraft under pan or distress conditions (emergencies).

A radar-identified aircraft which is noticeably deviating from its cleared route or holding circuit has to be informed by the ATC.
A radar controller must take all suitable actions as soon as he thinks that such a deviation may influence the flight safety or his traffic management.

2.3. Radar surveillance

Radar surveillance verifies that:

- Radar separation are above minima or operational separation
- The position of aircraft are compatible when any traffic is flying close to other aircraft
- Information about non-controlled traffic is given
- There is no deviation from issued clearances within the tolerance.

2.4. Radar vectoring

Radar vectoring is used to:

- Provide safety to all aircraft and minimum flight separation
- Optimize flight trajectories
- Ensure efficient traffic management

3. En-route regulation parameters

3.1. Purpose of the en-route regulation

After safety, the en-route regulation is the main task of the en-route controller.

The regulation mainly consists of:

- Ensuring traffic safety at all times
- Maintaining optimal separation between all aircraft
- Creating and optimizing traffic flows

The en-route regulation implies the following actions:

- Ensure safety by maintaining adequate separation above the minimum (see below)
- Shorten aircraft routes to the destination airport in order to reduce the time of flight by maintaining an efficient traffic flow
- Regulate the speed of all aircraft on the same traffic flow
- Organize traffic flows to avoid airport congestion
- Handle overtaking, descending, climbing and crossing aircraft around same levels.

The en-route regulation shall solve all potential conflict situations prior to the establishment of a loss of separation.

Some of the conflict situation can be:

- Aircraft crossing another aircraft route at same level and getting closer
- Aircraft getting closer or overtaking another aircraft on same route and same level
- Aircraft joining the same route or crossing from a different route on one specific point
- Aircraft climbing or descending across another aircraft level and route and getting closer

3.2. Capacity Management

The capacity of an air traffic controller depends on many factors including:

- ATS route structure (structural complexity of the control area)
- Navigation accuracy of the aircraft using the airspace
- Weather factors
- Controller workload including control and coordination tasks
- Level and type of air traffic services provided
- Type of communication, navigation and surveillance system used
- Availability of support system, support controller an alert functions

Every effort should be made to provide sufficient capacity to cater for both normal and peak traffic.

In implementing measures to increase the capacity, the controller shall ensure that safety is not jeopardized

3.3. Cruise flight level management

The CTR controller is responsible for all aircraft flight levels under his control.

Every aircraft shall be able to perform its cruise at his Requested Flight Level (RFL) whenever possible. However, when unable to assign the requested flight level, the controller should:

- Assign a cruise level as close as possible to the requested one
- Negotiate a new flight level in function of aircraft performances.

3.3.1. Route parity

For security reasons, the CTR controller has to guarantee the respect of the flight level parity according to the semi-circular rules or the constraints published on en-route charts (which have priority over the semi-circular rules).

Whenever an aircraft enters a controlled zone at a wrong flight level according to the route parity, a flight level change must be cleared, although the pilot has not asked for it.

A correct management of flight level parities in the en-route phase is the most efficient way to avoid potential conflicts. If the route parity is not published or the route is outside published airways, the parity must be assigned according to the standard semi-circular rules, based on East/West track split.

The semi-circular rules are established to assign a given flight level parity (even or odd) to an aircraft according to its magnetic track (check the corresponding documentation).

3.3.2. Identification and solving of cruise level conflicts

The most difficult task of the **CTR** controller is the identification of potential flight levels conflicts between several aircraft before a separation loss takes place.

The detection of a flight level conflict shall be normally anticipated at least 20 minutes before a potential separation loss. This implies a careful analysis of the impact of an aircraft on the traffic flow already at its first contact when entering the controlled airspace.

When two aircraft should potentially cross the same flight level with a horizontal separation smaller than 15 NM within a controlled airspace with radar assistance, (or 15 minutes within a controller airspace without radar assistance), the ATC must assign a new level to one of the two and provide the minimum vertical separation

3.3.3. Conflict detection method

The following empirical method should be employed to prevent a sudden detection of potential level conflicts.

The best method is “Do you ask yourself the right questions?”

1. **Is there any aircraft under my controlled zone which is supposed to fly at the same cruise level as the flight entering my airspace?** If the answer is no, there is no potential conflict between all aircraft flying within the zone. If the answer is yes, read point 2 and 5.

2. **Among all aircraft at the same cruise level, is there any of them flying along a conflicting track with respect to the concerned aircraft?** If the answer is no, there is no potential conflict between all aircraft flying within the zone. If the answer is yes, read point 3.

3. **Among these aircraft, is there any of them having an estimated time of passing over the supposed conflict point which is the same as the concerned aircraft?** If the answer is no, there is no potential conflict between all aircraft flying within the zone. If the answer is yes, read point 4.

4. The evident **conclusion** is that some flight levels among the concerned aircraft have to be reassigned. In certain cases, a direct route may be granted when the separation is surely obtained by assigning diverging tracks. Then, the choice of new cruise levels shall be made according to the same logic presented here (non-observance of parity can be tolerated when it is used during a short period of time and justified). Finally, check point 5.

5. **Among these aircraft at the same cruise level, is there any of them flying along a conflicting track or same track with respect to the concerned aircraft?** If the answer is no, there is no potential conflict between all aircraft flying within the zone. If the answer is yes, read point 6.

6. **Are the speeds of all concerned aircraft suitable to maintain a minimum separation of 15NM?** If the answer is yes (the speed of the following flight is lower than or equal to the first along the same route), there is no potential conflict between all aircraft flying within the zone. If the answer is no, read point 7.

7. The controller must issue a speed clearance to maintain a minimum separation of 15NM, assign a new flight level to one of the aircraft to facilitate overtaking if speeds are not compatible, provide vectoring to one of the aircraft, or put the aircraft into a parallel route with an offset of 10 NM or more.

3.3.4. Management of level change demands from pilots

As in real aviation, a pilot may ask for a flight level change to avoid weather disturbances or to optimize aircraft performances (step climb).

The **CTR** controller shall try to satisfy the pilot demand after a careful analysis of the impact of the level change on the traffic flow under its controller airspace (see the previous section).

During a level change, the aircraft can cross several flight levels. The impact on the traffic flow must be analyzed for each crossed level as well as for the new cruise level.

Some rules to be used:

- In principle, an aircraft flying at a given level has right of way with respect to any other aircraft wishing to fly at the same level.
- If several aircraft fly at the same level, the leading one has right of way.

Moreover, when a pilot asks for a specific level (for example FL340), the chosen level can be his **optimal cruise level**. This means that the pilot would not climb to FL360 because of the reduced performances of his aircraft in higher flight level.

During the flight, the cruise performances (like climb rate, maximum flight level, and optimal flight level) are more limited than at the end of cruise since the airplane is lighter because of the fuel consumption.

3.4. Cruise speed

Speed is a very important parameter in en-route regulation.

An aircraft higher than FL260 should be regulated using MACH speed (the limit can actually vary between FL245 and FL325 depending on the meteorological conditions).

As an area air traffic controller, it is important to note that an aircraft climbing with a constant indicated air speed (**IAS**) reaches its maximum true air speed (**TAS**) at a given altitude. Above this altitude the aircraft will continue climbing with a constant TAS and its IAS will drop in function of its performances.

During this phase, the ATC shall regulate the aircraft speed in **MACH**.
If two aircraft fly using:

- Same **IAS**: the aircraft flying at the **highest level** will fly **faster** than the other.
- Same **MACH**: the aircraft flying at the **lowest level** will fly **faster** than the other.

3.5. Aircraft constraints

After taking off, pilots have operational constraints to follow:

- Pilots want to avoid flight level steps as much as possible and reach their initial optimal cruise flight level directly at optimal climb.
- Pilots want to obtain from ATC their optimal cruise flight level when needed
- Pilots do not want to descend before their optimal top of descent

In addition, on the IVAO network as there are many beginner pilots with low practical knowledge, an air traffic controller can face unusual conditions like:

- A pilot who selects a very low flight level
- A pilot who selects a too high flight level
- A pilot who climbs or descends with a too slow rating feet/min
- A pilot who wants to descend too late or too soon (TOD is not known!)

On the IVAO network, air traffic controllers shall be trained to handle these types of situations.

3.6. En-route separation minima using radar

The respect of separation minima is mandatory.
The en-route separation minima when ATC is using radar are:

- 5 NM horizontally or,
- 1000ft vertically below FL290 or,
- 1000ft vertically in RVSM airspace between FL290 and FL410 or,
- 2000ft vertically in non-RVSM airspace between FL290 and FL410 or,
- 2000ft vertically at and above FL410

Most en-route positions in IVAO can be considered as radar covered positions (except oceanic areas and some other areas with no or few radar coverage – consult your division air traffic control documentation).

The suggested minimum operational separation during cruise between two aircraft flying at the same level and along the same route or parallel routes closer than 10NM is 15NM with the use of radar system (IvAc).

The suggested minimum operational separation between two aircraft in an approach pre-sequencing regulation inside the area controller zone of responsibility to the same IAF is 10NM.

Note that these operational separations have been determined from the **analysis of real practices** by en-route controllers in some countries.
The 10NM operational separation has been established in order to be adapted to the most general case and then avoid all kind of specific practices which do not provide a better ATC quality.

Unless the flight is going to be transferred, air traffic assistance must be ensured so as to maintain aircraft at a distance from the controlled airspace at least equal to half the radar separation minimum.
For non-radar areas, the horizontally separation is not 5NM.

Please consult radar and non-radar separation minima documentation if you want more information.

3.7. Aircraft subject to en-route separation rules

As established by ICAO regulation, horizontal and vertical separation must be provided:

- to all flights in class A and B airspaces
- to IFR and SVFR from each other and from VFR in class C airspace
- to all IFR and SVFR from other IFR/SVFR in class D and E airspaces
- to all IFR and SVFR from other IFR/SVFR as far as practical in class F airspace

The separation conditions applied to night VFR (NVFR) depend on the country. NVFR might be treated as special VFR (SVFR) or normal VFR depending on the local regulations.
On IVAO, a VFR flight can be performed at any time of the day in daylight conditions. In case of doubt the controller shall ask the pilot in which conditions he is flying.

3.8. Loss of separation

Whenever the minimum separation is infringed, two aircraft are considered as they have lost their separation (this situation is called “near miss”).

The controller will take his part of the responsibility for a separation loss between two aircraft if only one of which is under his control and he has not issued any clearance to avoid the near miss situation.
The controller is not supposed to issue any clearance implying a separation reduction below regulatory minima.

On IVAO the generic term of “**AIRPROX**” is used. While ICAO defines a series of classifications for AIRPROX events, the use of this expression on IVAO is kept general since it is easily understood and employed by most controllers and pilots.

A clearance presenting a potential risk of separation loss is considered as an ATC fault.

4. Coordination with other controllers

4.1. Coordination and transfer of arrivals

A suitable coordination with the **APP** controller is necessary to ensure efficient pre-sequencing according to the following parameters:

- In the case of a published arrival procedure, **CTR** and **APP** controllers shall coordinate a **transfer level and point**
- In the case of unpublished arrival (radar vectoring), **CTR** and **APP** controllers shall coordinate a **transfer point or zone,** with an associate altitude if needed**.**
- The **CTR** controller can grant **direct routes towards characteristic points** to prepare the approach sequence
- The **CTR** controller may give a **holding procedure** in order to reduce the flow of traffic inbound the overcrowded TMA

Flights must be transferred before reaching the lateral limits of the TMA controlled by the APP. This generally corresponds about 2 minutes from the TMA boundaries, checking that the aircraft altitude is not too high.

Sometimes the transfer to the **APP** controller may be performed at a level higher than the TMA ceiling. This is coordinated among the two controllers.

The CTR controller could anticipate descent clearances to allow the aircraft reaching the IAF at the coordinated altitude.

4.2. Coordination and transfer of departures

A suitable coordination with the **DEP** (or **APP**) controller is necessary to ensure efficient integration of departing flights through the en-route traffic according to the following parameters:

- In the case of a published departure procedure, **CTR** and **DEP** controllers shall coordinate a **transfer level**
- In the case of omnidirectional departure or radar vectoring, **CTR** and **DEP** controllers shall coordinate a **transfer point or zone,** with an associate altitude if needed
- The **CTR** controller can grant **direct routes towards characteristic points** to prepare the integration of departures through the en-route traffic
- The **CTR** controller may grant a **radar vectoring** to ensure operational and minimum separation during the climb
- The **CTR** controller may change the climb rate and speed of departing aircraft to ensure operational separation during the climb
- The **CTR** controller may coordinate with the **DEP** an **increased transfer level** to help him handling the departing flow

Flights must be transferred to the CTR as soon as possible before reaching the boundaries of the TMA, either its lateral or vertical limits (in any case before the closest one).

5. Management of unstaffed lower zones

The **CTR** controlled zone does not include the TMA/CTR zone below his area of responsibility.
He is supposed to provide ATC service only within en-route areas and airways.

5.1. Continuity of air traffic control and quality of service

At IVAO, most of the approach and tower positions are not open all the time.
The positions are then not controlled.

In order to provide the continuity of the air traffic control and safety,at IVAO it is admitted that an en-route controller can take under his control the unstaffed controlled zones in class A, B, C, D and E airspaces below his own area of responsibility according to his ATC skills and effective traffic load.

Although the CTR controller is taking more controlled airspace, the quality of service in his zone of responsibility shall not be deteriorated.
If the quality of control is deteriorated, the CTR controller shall stop controlling additional unstaffed controlled zones and shall keep only his area of responsibility.

An IVAO staff member or supervisor may ask the en-route controller to immediately disconnect whenever it is evident that he has totally lost control of the situation by cumulating separation loss and discarding several pilots. In the absence of a fruitful collaboration, the controller is subject to disconnection.

Depending on the actual workload, it may only be possible to offer a limited service at certain airports. The service provided could be degraded in the following steps:

1. Full service (approach, tower, ground) is provided
2. Full service is provided, except standard routes (SID/STAR) not given; only omnidirectional departure given, and radar vectors will be used for arriving traffic.
3. Partial service is provided, only for landing and take-off, omnidirectional departure given and radar vectors will be used for arriving traffic.
4. Partial service is provided at the same level as previous point but only on main airport of the area. Other airports, only approach until final axis provided and departure shall be taken only above a certain level.
5. Only approach service provided on airfields above a certain altitude for departing aircraft and arriving aircraft.
6. Only service when separation is needed on approach areas until final axis is reached and above a certain altitude for departure
7. No service is provided

In case of degraded service at an airport, this must be clearly communicated to concerned pilots.

5.2. Management of unstaffed TMA/CTR

If a controlled TMA is not staffed, the area controller may take charge of the approach control totally or partially according to the following criteria:

- Number of en-route flights to be managed
- Specific IVAO event
- Complexity of the approach for the pilot
- Heavy load on approach requiring traffic separation

The en-route controller must manage his control zone as a priority.

An en-route controller may take charge of an unstaffed CTR – tower control zone – only if he has already taken under his responsibility the corresponding associated TMA if existing.

5.3. IFR departures from TMA/CTR

The minimum required ATC service consists of issuing the IFR departure clearance to aircraft on ground (IFR departure procedure, active runway, initial flight level, transponder code) and providing the starting point of the control service:

- Passing a specific point (at a given flight level)
- Passing a specific flight level (at a given point)
- At the holding point of the active runway

Remember that the **CTR controller does not have a complete ATIS**. The controller shall provide any useful information to the pilot to make him reaching the starting point of the control service (wind, QNH, transition altitude and level, specific restrictions).

Example of phraseology: “KLM623, Omnidirectional departure runway 32L then direct SONEB, report at SONEB at flight level 80, squawk 3441”.

Although it is possible to handle traffic on the ground, this practice is rather discouraged since it takes time and effort while the CTR is supposed to control airborne flights. On the contrary, runway management, together with take-off and landing clearances, shall be granted to ensure safe operations.

5.4. IFR arrivals from TMA/CTR

It is recommended to manage only approach and landing on active runways, releasing the pilot to UNICOM once the runway has been vacated. Therefore the pilot will handle the separation on the ground by himself. It is advised to restrict the control service to this minimum level.

5.5. IFR management in uncontrolled zones

5.5.1. Departing from an uncontrolled zone:

The minimum required ATC service consists of providing the starting point of the control service (point and/or flight level).

If the pilot gets in contact already on the ground, the controller may issue an IFR departure clearance (IFR departure procedure, active runway, initial flight level, transponder code) together with the starting point of the control service.

Example of phraseology:
"KLM623, Omnidirectional departure runway 23, then direct GOBOT, report at GOBOT at flight level 70, squawk 3155".

The pilot must perform his flight on air-to-air communication under UNICOM until the reporting point.

5.5.2. Arriving to an uncontrolled zone:

The minimum required ATC service consists of assisting the aircraft descend to the lowest level within the controlled zone, i.e. the first flight level above the LTA base limit or the MEA.

Example of phraseology:
ATC: "KLM623, descend level 70, you are going to leave controlled airspace below, report leaving level 70"
Pilot: "Descending level 70, will report leaving level 70, KLM623"
Pilot: "Leaving level 70, descending, KLM623"
ATC: "KLM623, control service terminated, switch to air-to-air frequency on 122.8, good bye"

In this example the pilot must perform the rest of his flight in class G airspace under UNICOM without any further clearance from the controller.

5.6. VFR traffic management

The CTR controller is not supposed to provide ATC service to VFR flights outside his controlled zone.

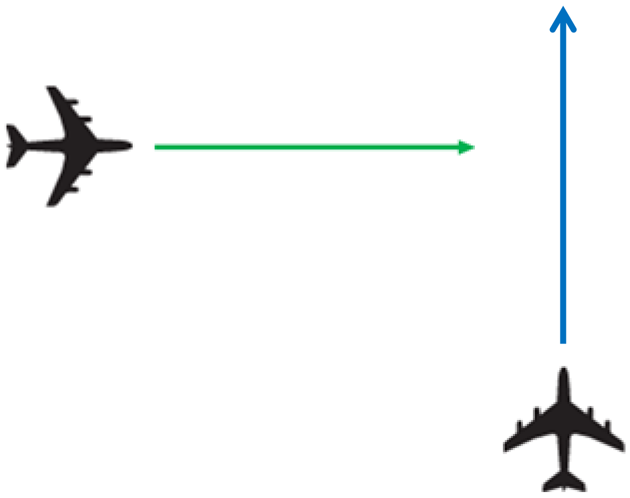
In the absence of IFR flights, it is advised not to control VFR flights below the LTA (or the MEA).
In the presence of IFR flights, the controller shall consider whether the contact with VFR flights is necessary to ensure a suitable management of IFR surrounding traffic. If no potential conflict is identified, the VFR flights can be left uncontrolled.

If the pilot asks for ATC service, the en-route controller may decide to ensure flight information and alert services, together with take-off and landing clearances within the area under his responsibility.

6. Methodology based on situation

6.1. Aircraft crossing at same level but not using same route

When two or more aircraft should potentially cross the same flight level with a horizontal separation smaller than 15 NM within a controlled airspace with radar assistance, the ATC shall assign a new level to one of the two and shall provide the minimum vertical separation between those aircraft.



Cleared flight level shall be issued and reached 15NM minimum before the crossing time at the latest.

The minimum separation is 15 minutes within controller airspace without radar assistance. Consult the adequate documentation for non-radar separation minima.

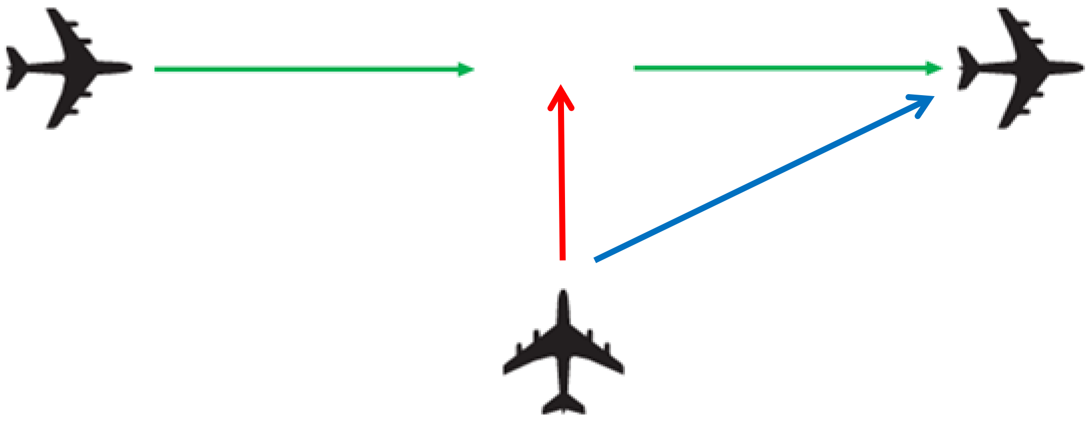
6.2. Aircraft joining the same route at same level

When an aircraft is in progress to join a route where other traffic is flying at the same level, the ATC work is to keep all the time the minimum separation and try to maintain optimal regulation separation.

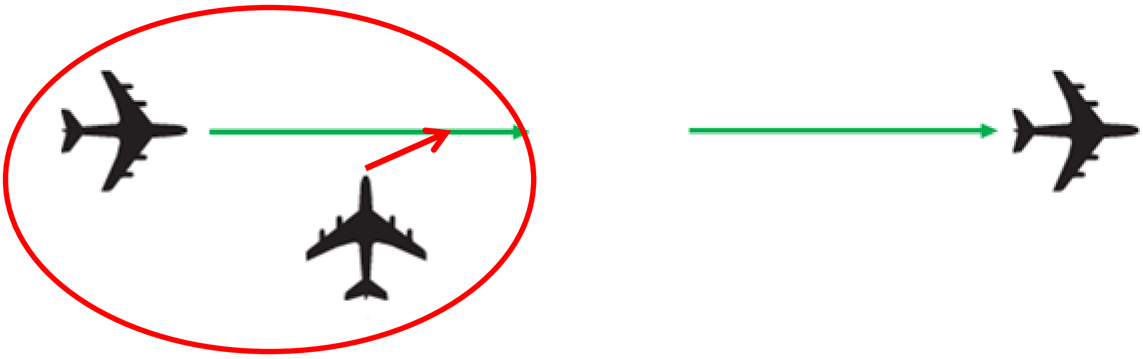
Air traffic controller should anticipate the insertion of the traffic in the sequence.
ATC have the following possibilities:

- ATC will do nothing as the aircraft will maintain minimum of 15NM (optimal regulation separation distance) between all traffic on this airway at the same level.
- ATC will give to aircraft direct to fix or radio navigation beacons in order to include the traffic on a sequence and/or reduce his route to optimize his flight time
- ATC will give to aircraft vectors in order to include the traffic on a sequence as this sequence does not let much space to ATC to include more aircraft. After vectoring this aircraft, ATC will let aircraft continue his normal flight along his planned route.

In all cases, the ATC shall anticipate the aircraft insertion taking into account his flight time to join the free space.
The horizontal separation between aircraft at the same level sharing the same route should be kept greater or equal to 15 NM over the whole en-route phase under radar control.



In the example above, if ATC gives to the aircraft the instruction to join the route with a clearance like the red arrow, the situation will be problematic as there is a flight time to join the route and the final result can be a possible loss of separation or a bad regulation on route (see figure below).



In the first example, if ATC gives to the aircraft the instruction to join the route with a clearance like the blue arrow, as ATC anticipates the flight time of the aircraft, he could join in a better way the flow of traffic on the new route like the figure below.

Consult the next chapter "Traffic flow handling using same route and direction' to have the traffic management after the aircraft is inserted in the regulation flow.
The value of 15NM is a recommended value. In some areas, the horizontal separation for regulation can be increased or decreased but not below 5NM. Consult your national or divisional publication in order to get the exact value. If this value is not published, you shall take 15NM by default.

The minimum separation is 15 minutes within controller airspace without radar assistance. Consult the adequate documentation for non-radar separation minima.

At any time, ATC can change the level of one or several aircraft if there is not enough free space to include one more aircraft.

6.3. Traffic flow handling using same route and direction

The traffic flow on a route can be problematic when there are too many aircraft:

- Flying this route at different speeds and same level.
- Crossing this route at same level
- Crossing this level with same or different route

As an air traffic controller when you manage a traffic flow on the same route, other aircraft outside this route can create loss of separation. Air traffic controller shall pay attention about safety

6.3.1. Creating traffic flow on same route

The best en-route regulation is first obtained by shortening trajectories in function of the surrounding aircraft and also traffic flying the same route at the same flight level.

The traffic flow shall be set up by using the en-route points which are shared by the largest number or airways.

In this situation, the parameters to be analysed to ensure the best regulation are:

- The difference in cruise speed
- The choice of the optimal direct fix
- Presence of other aircraft flying close to the traffic flow

Moreover, the speed of all aircraft must be regulated to avoid separation loss.

6.3.2. Maintaining a traffic flow on a route

Once a traffic flow is set up, the en-route controller shall maintain the situation over the whole route.

He has to constantly monitor all aircraft's positions flying at the same altitude and over the same routes. He shall monitor their speed. The speed regulation is provided by reducing or increasing the aircraft speeds so as their speeds are as close as possible.

In particular, the ATC may ask the first aircraft to increase its speed (if it is able to comply) and/or the second to decrease in order to make its GS (which is the one measured by the radar) lower or equal to the one of the first.

To maintain the required separation, speed clearances shall be issued in order to reach the following hierarchy: $V1 \geq V2 \geq V3$

The horizontal separation between two consecutive aircraft should be kept greater or equal to 15 NM over the whole en-route phase under radar control (optimal regulation distance).

The value of 15NM is a recommended value. In some areas, the horizontal separation for regulation can be increased or decreased but not below 5NM. Consult your national or divisional publication in order to get the exact value. If this value is not published, you shall take 15NM by default.

The minimum separation is 15 minutes within controller airspace without radar assistance. Consult the adequate documentation for non-radar separation minima.

The ATC shall assign the requested cruise altitude (which is the optimum choice according to the aircraft performances and payload) and make it compatible with the regulation altitude to avoid the aircraft to change level too many times during its route. The optimization of the number of clearances allows a better anticipation and radar assistance.

When using the regulation techniques presented here, pay attention not to ask any speed variation greater than 0.02 Mach to avoid degrading aircraft cruise performances.
The same techniques can be easily extended to more than three aircraft, provided that the distance between each pair of aircraft is large enough.

The main goal of regulation is to set up a traffic flow of aircraft flying at a constant and stable distance from one to the following.
If one of the aircraft of the sequence cannot maintain the requested speed, his level shall be changed when possible.

6.4. Climbing, descending and crossing cruise flight levels

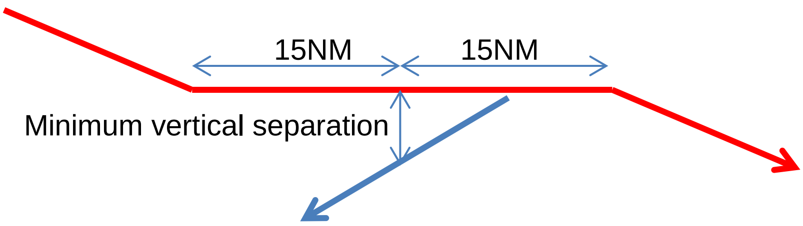
Before reaching their cruise altitude, aircraft perform a climb phase until reaching their first assigned flight level. After the cruise phase, aircraft perform a descent phase to the destination airfield.

During this climb or descent phase, aircraft can cross several flight levels which can be used for another aircraft cruise flight level.

6.4.1. Management by flight level steps

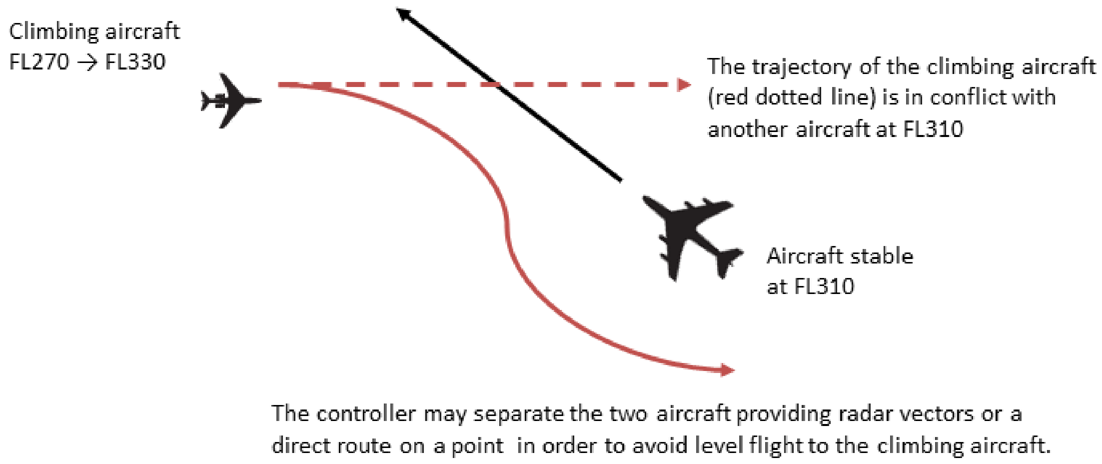
The simplest method is the management by flight level steps.

When two or more aircraft should potentially cross the same flight level with a horizontal regulation separation smaller than 15 NM within a controlled airspace with radar assistance, the ATC shall stop the descent or the climb of the aircraft and provide the minimum vertical separation between those aircraft until the horizontal separation is above the requested regulation separation of 15NM.



6.4.2. Management by heading modification

In order to make an aircraft reach its cruise level, the controller shall provide radar vectors to the detriment of the trajectory (climb or descent has priority on the trajectory to avoid conflicts with other aircraft on converging trajectories).



In almost all cases, the aircraft climbing <u>without level flight steps</u> will gain with respect to a low level flight step, even though its trajectory is longer.

The minimum lateral or vertical separation between the two aircraft shall be respected in all cases.

This example is also applicable for descending operation. Descending steps are acceptable for a pilot point of view but ATC shall take care about the need of descent optimization requested by pilots (not too late and not too soon!).

6.4.3. Management using offset parallel route

Let's consider the case of a climbing or descending aircraft having another aircraft in front of it on the same trajectory , at a higher level and much lower speed. A possible method is the use of offset parallel route.

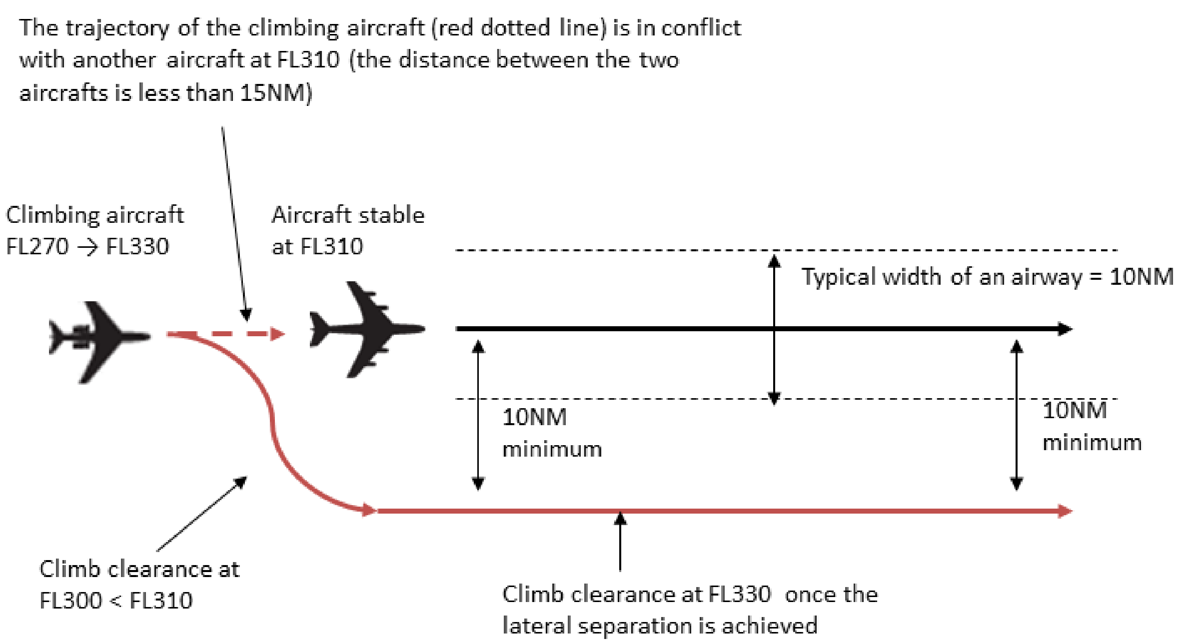
Offset parallel route is a procedure used for aircraft navigating an assigned route along an airway or between published navigational fixes by adjusting their course to parallel the assigned route either minimum 10NM to the right or to the left of the airway centreline or current aircraft track.

In order to respect horizontal separation in all cases and to be in accordance with the rules of the air, the air traffic controller should use a right offset parallel route, except if a left side has more advantages for the air traffic controller to ensure traffic separation and/or to create optimal flow of traffic.

This method offers several advantages:

- It allows aircraft to overtake another by following the same route sharing the same flight level whilst ensuring the needs of lateral separation
- It allows aircraft to overtake another when climbing or descending through a conflicting flight level with another levelled aircraft whilst ensuring the needs of lateral separation

The disadvantage of this method is the pilot capacity to perform this type of operation. The pilot shall have a flight management computer with this function implemented and RNAV capacity.



This method is particularly effective for an aircraft to overtake another aircraft on the same route with a lower speed when crossing a conflicting level.

If the pilot cannot comply with the parallel route offset clearance, ATC can use the vectors methodology until separation has been established.