CENTER AIR TRAFFIC CONTROL

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Chapter 1 – An Introduction Center control

1-1. This Thailand Center Control Study Guide is designed to build on knowledge you have already gained in the Basic, Ground Tower and Approach Study Guides. Center Control is one of the more complex control positions on VATSIM. As the Center controller you are responsible for the separation of aircraft while in the En-Route phase of flight. You will be receiving departures from the Approach/Departure controller and issuing them climb instructions and providing assistance on getting then on their route. You will be issuing descent instructions and clearances to fly STAR's "Standard Arrival Routes". When Clearance Delivery, Ground, Tower and Approach/Departure are offline you will perform their duties as well. All Center controllers must demonstrate the highest skill level and knowledge of ATC to perform their duties.

Chapter 2 – Altimeter Settings

2-1. Altimeter settings in the Thailand Division will be read in QNH format.

2-2. When you issue a QNH setting in a Center you must always identify its source.

2-3. Center controllers must issue QNH settings to aircraft descending into TMA "Terminal Control Areas" prior to reaching the Transition Level.

2-3. Center controllers must issue QNH settings to aircraft climbing out of TMA "Terminal Control Areas" prior to reaching the Transition Altitude.

2-4. All aircraft in the En-Route phase of flight above the Transition Level will fly at Flight Level.

2.5 All aircraft in the En-Route phase of flight below the Transition Altitude will fly at altitudes based on the closest QNH reading to their position on their route.

2-6. Definition of Transition Level: This is the lowest level/altitude a pilot should be operating on standard pressure. The Transition Level for the ENTIRE Bangkok FIR (Thailand vACC) shall be FL130. This includes all TMA's and ATS Routes (Airways).

2-7. Definition of Transition Altitude: This is the highest level/altitude that pilots should be operating on local altimeter/QNH settings. The Transition Altitude for the ENTIRE Bangkok FIR (Thailand vACC) shall be 11,000. This includes all TMA's and ATS Routes (Airways).

2-8 Definition of Transition Layer: The Transition Layer is located between the Transition Altitude and the Transition Level. Cruse flight should NOT be conducted in the Transition Layer. Pilots wishing to cruise in the transition MUST obtain an ATC Clearance to do so.

Chapter 3 – Altitude Assignments

3-1. Thailand shall use the NEODD-SWEVEN rule. Basically aircraft flying on “TRACKS” not headings will fly ODD altitudes (3000, 5000, FL330) on Tracks 000° to 179° and EVEN altitudes (2000, 4000, FL280) on Tracks 180° to 359°. RVSM ends at FL410 and the spacing increases to 2,000 between altitudes. FL430 going SWEVEN, FL450 going NEODD, FL470 going SWEVEN and so on. VFR aircraft are to use the same rules and add 500 feet to their altitudes.

3-2. When traffic, weather or other aircraft performance limits prevent the following of these rules you may assign and altitude so long as the aircraft remains within your airspace. If the aircraft will enter another controller’s airspace, the Wrong Altitude For Direction Of Flight (WAFDOF) must be coordinated with and approved by the receiving controller.

3-3 Several airways in the Thailand FIR have altitude restrictions. Airways in Thailand that have restrictions are listed in the operations SOP and can also be found in the Airway cheat sheet.

3-4. NO VFR aircraft are permitted to fly above FL200.

3-5. Regardless of the direction of flight any altitude you assign must be at or above the Minimum Enroute Altitude for the airway being used or the Minimum Instrument Altitude. Minimum Enroute Altitude (Minimum Flight Altitudes can be found in Thailand AIP ENR 3.1, ENR 3.3 and on Thailand Enroute charts.

3-6. Flight Levels vs Altitudes. If you remember back from our previous training we discussed Transition Altitude and Transition Level. The standard Transition Altitude in Thailand is 6000 and the Transition Level is set by ATC unless stated on a chart. All of Thailand airways use a Transition Altitude of 6000. That means when we issue any altitude adjustments below 6000 we say “six thousand”. Any altitude adjustment above 6000 we use Flight Level and say “climb/descend/maintain to flight level zero seven zero ”. Also if you remember most TMA’s have higher Transition altitudes and Transition Levels. If we have an aircraft enroute that will be flying through a TMA that has a Transition Altitude/Transition Level higher than which that aircraft is at you will need to issue an altitude assignment and the local QNH. Example: Your aircraft is at FL070 and approaching the Phitsanulok TMA. The Phitsanulok Transition Altitude is 11,000 and Transition Level is FL130). This means that you must issue the aircraft the QNH for Phitsanulok and have him maintain 7000. “THA100, Phitsanulok QNH 1015, Maintain 7000.” Now on VATSIM if there is NO Approach controller and NO other aircraft that would pose a issue you may keep the aircraft at a Flight Level.

Chapter 4 – Center Radar Separation

4-1. Controllers controlling the center position have the option of controlling center by means of radar or procedural separation. Procedural separation will be covered in chapter 5.

4-2. Centers are responsible for much more airspace and use a different radar system then Approach Controllers. Therefore, the separation standards they apply are slightly different as well.

4-3. Standard vertical separation between IFR aircraft in Bangkok vACC is 1,000 feet. Certain Airways in Bangkok vACC have altitude restrictions. Refer to Thailand Operations SOP Chapter 1 "Airspace section - e.

4-4. Standard horizontal and longitudinal separation between aircraft will be 5 NM.

4-5. When accepting a handoff on a departure 3 NM increasing to 5 NM if the aircraft are on diverging courses or the first aircraft is and will remain faster.

4-6. Centers may also use visual separation except in class A airspace.

Chapter 5 – Center Procedural Separation

5-1. Procedural Separation is separating aircraft by means of time using pilot position reports.

5-2. Procedural Separation is much harder than separating by means of radar. When controlling by means of radar you can see the aircraft on your radar scope. Procedural separation is accomplished by listening to pilot position reports, plotting their position on a chart and determining if the aircraft's paths will cross and providing the proper separation with that information.

5-3. If you choose to control by means of procedural separation you MUST tell the pilot to make position reports. Most pilots on VATSIM do not know that procedural control is. If a pilot appears to be unsure or advise he does not know how to make position reports you will advise him of the following format:

1. Aircraft position

2. Time over position in four digits

3. Flight level

4. Speed (Mach)

5. Next fix and estimated time over fix

6. Name of subsequent fix

5-4. On VATSIM you can only really simulate Procedural Control. All of the ATC programs will give you the position of aircraft, so you can cheat a little. Also since many pilots don't know when they are crossing vACC

boundaries, you need to be able to see them so you can send them a “Contact Me” message. On some control programs you can use the “filters” feature to block out aircraft at various altitudes.

5-5. If you are going to control via procedural control it is very important to notify bordering vACC and all TMA controllers. If you fail to do this and the other position is controlling with radar the aircraft will be handed off to you too close together.

5-6. There are many rules for controlling by means of procedural control. Some routes require 15 minute separation, some routes require 10 minute separation, and some routes separation is altered based on what equipment the aircraft has onboard and or the type of navaids on the route. To make things simple Thailand shall use 10 minute separation by Mach number for all enroute traffic. Slower air traffic shall use the 10 minute rule. This 10 minute rule applies to aircraft on the same route at the same altitude. It also applies to aircraft at the same altitude in which airways cross. You must separate the aircraft laterally, longitudinally and vertically. Refer to the rules below.

5-7. Means by which lateral separation may be applied include the following:

5-7-1. *By reference to the same or different geographic locations.* By position reports which positively indicate the aircraft are over different geographic locations as determined visually or by reference to a navigation aid. Refer to figure 5.1

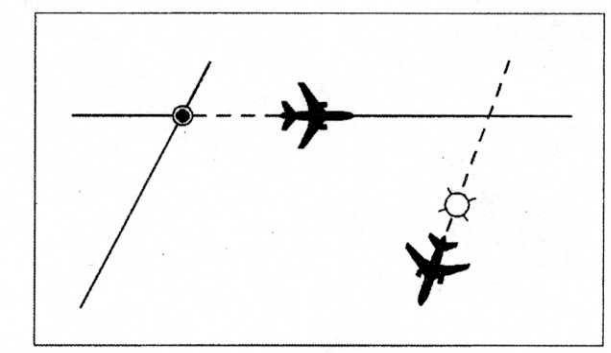

Figure 5.1

5-7-2. *By use of the same navigation aid or method.* By requiring aircraft to fly on specific tracks which are separated by a minimum amount appropriate to the navigation aid or method employed. Lateral separation between two aircraft exists when:

5-7-2-a. VOR: both aircraft are established on radials diverging by at least 15 degrees and at least one aircraft is at a distance of 15 NM or more from the facility. Refer to Figure 5.2

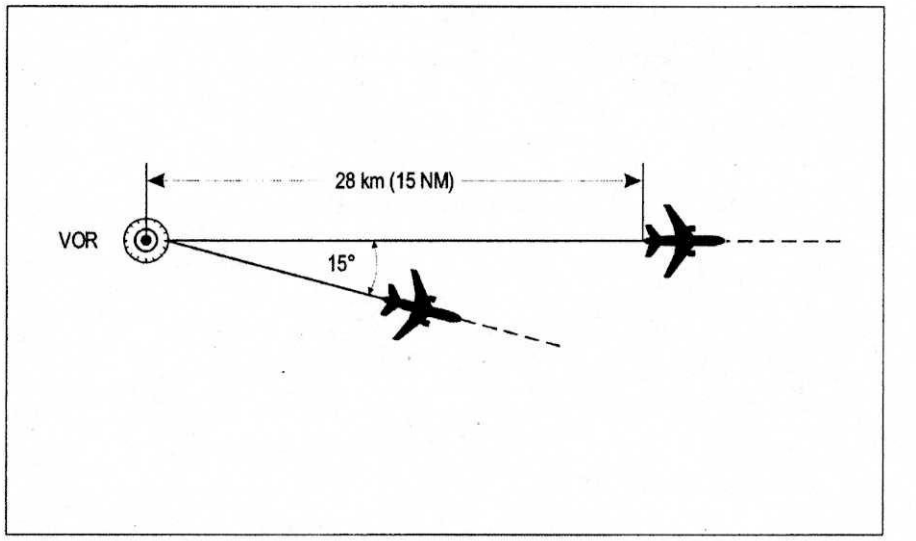

Figure 5.2

5-7-2-b. NDB: both aircraft are established on tracks to or from the NDB which are diverging by at least 30 degrees and at least one aircraft at a distance of 15 NM or more from the facility. Refer to figure 5.3

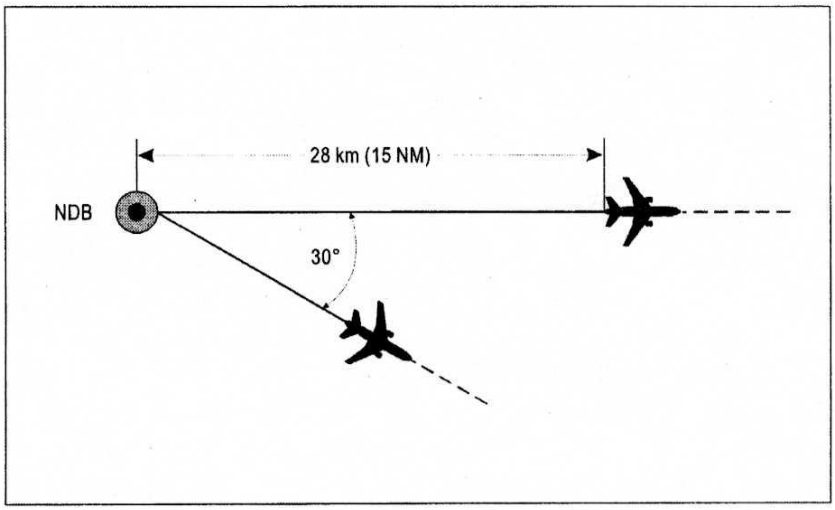

Figure 5.3

5-7-2-c. Dead reckoning (DR): both aircraft established on tracks diverging by at least 45 degrees and at least one aircraft is at a distance of 15 NM or more from the point of intersection of the tracks, this point being determined either visually or by reference to a navigation aid and both aircraft are established outbound from the intersection refer to figure 5.4

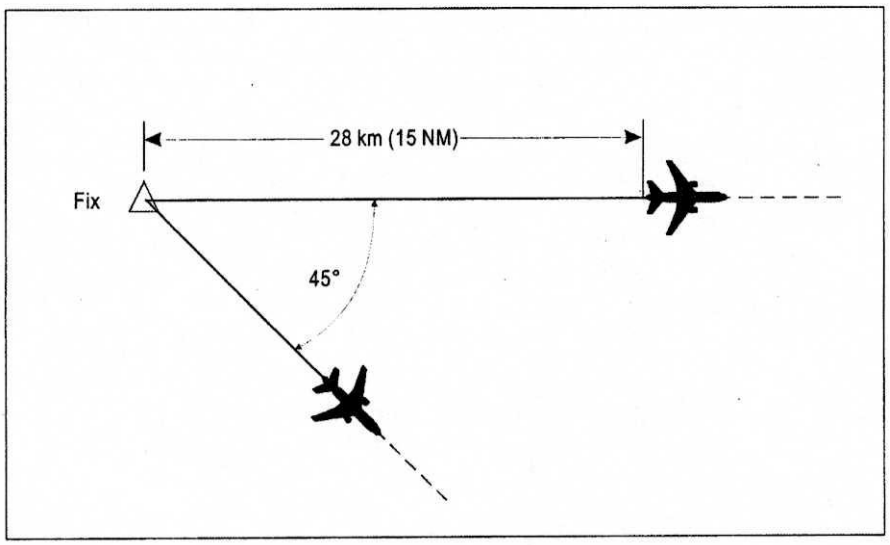

Figure 5.4

5-7-3. Additional information pertaining to Lateral separation can be found in ICAO document 4444 Chapter 5

5-8. Longitudinal separation shall be applied so that the spacing between the estimated positions of the aircraft being separated in never less than a prescribed minimum. Longitudinal separation between aircraft following the same or diverging tracks may be maintained by application of speed control, including Mach number technique. When applicable, use of the Mach number technique shall be prescribed on the basis of a regional agreement.

5-8-1. In applying a time or distance based longitudinal separation minimum between aircraft following the same track, care shall be exercised to ensure that the separation minimum will not be infringed whenever the following aircraft is maintaining a higher speed than the preceding aircraft. When aircraft are expected to reach minimum separation, speed control shall be applied to ensure that the required separation minimum is maintained.

5-8-2. Longitudinal separation may be established by requiring aircraft to depart at a specific time, to arrive over a geographical location at a specific time or to hold over a geographical location until a specified time.

5-8-3. For the purpose of application of longitudinal separation, the terms *same track, reciprocal tracks and crossing tracks* shall have the following meanings:

5-8-2-a. Same Track: same direction tracks and intersecting tracks or portions thereof, the angular difference of which is less than 45 degrees or more than 315 degrees, and whose protected airspaces overlap. Refer to figure 5.5

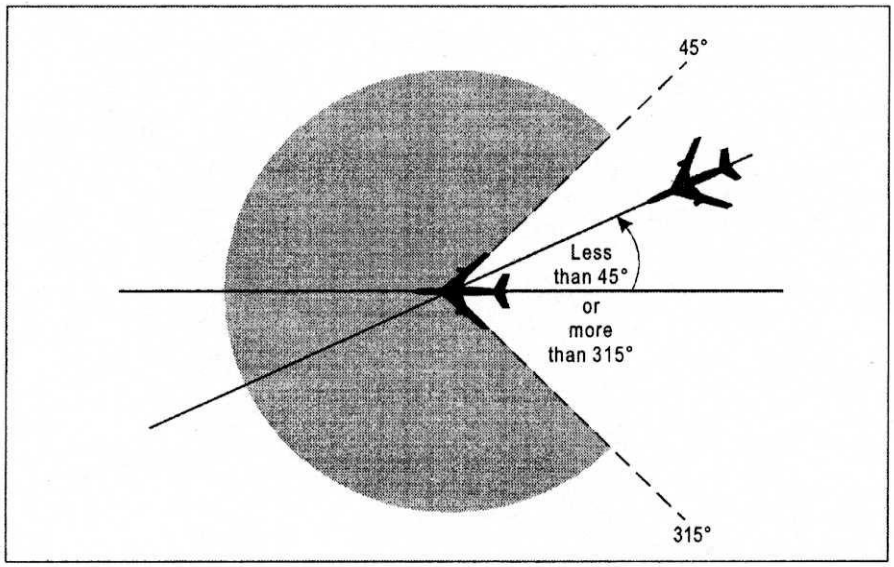

Figure 5.5

5-8-2-b. Reciprocal Tracks: opposite tracks and intersecting tracks or portions thereof, the angular difference of which is more than 135 degrees but less than 225 degrees, and whose protected airspaces overlap. Refer to Figure 5.6

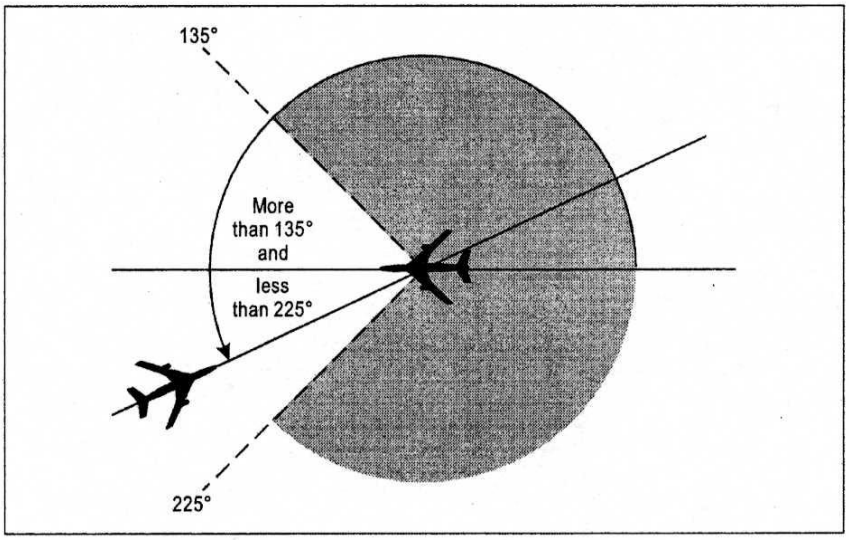

Figure 5.6

5-8-2-c. Crossing Tracks: intersecting tracks or portions thereof other than those specified in 5-8-2-a and 5-8-2-b above. Refer to Figure 5.7

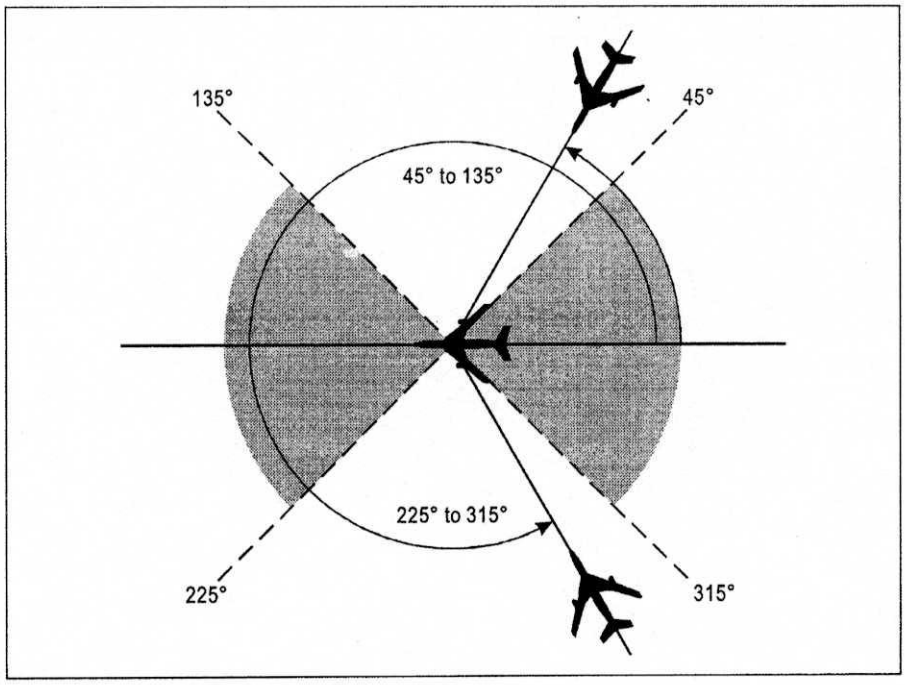

Figure 5.7

5-8-3. Thailand shall apply the following rules to aircraft flying the same altitude and track.

5-8-3-1. 10 minute separation, if navigational aids permit frequent determination of position and speed when aircraft are not using the Mach number method (slower aircraft). Refer to figure 5.8

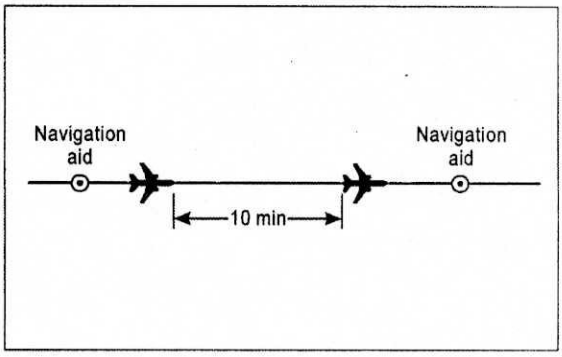

Figure 5.8

5-8-3-1-a 5 minute separation in the following cases provided that in each case the preceding aircraft is maintaining a true airspeed of 20 kt or more faster than the succeeding aircraft: Refer to figure 5.9

1. Between aircraft departing from the same aerodrome;

2. Between en-route aircraft that have reported over the same exact significant point;

3. Between departing and en-route aircraft after the en-route aircraft has reported over a fix that is so located in relation to the departure point as to ensure that five minute separation can be established at the point the departing aircraft will join the air route ; or

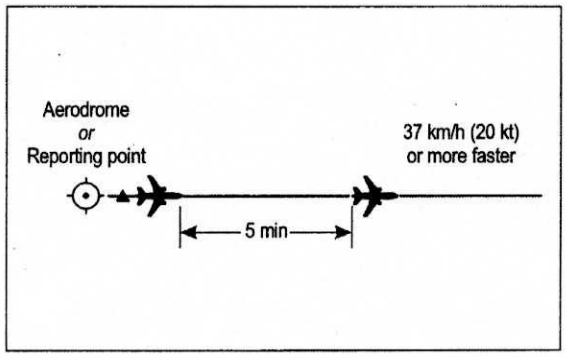

Figure 5.9

4. 3 minutes in the cases listed under “3.” provided the each case the preceding aircraft is maintaining a true airspeed of 40 kt or more faster than the succeeding aircraft. Refer to figure 5.10

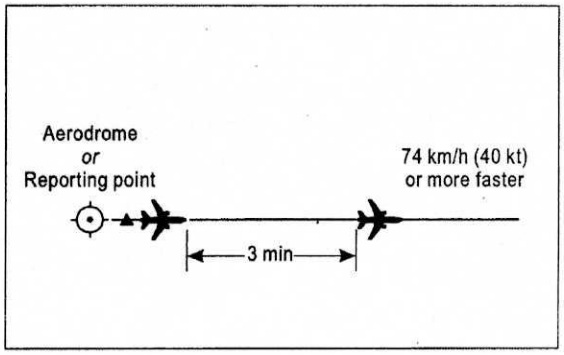

Figure 5.10

5-8-3-2. 10 minute separation by Mach number rule shall be applied to aircraft capable of flying at Mach speeds.

5-8-3-2-a. Turbojet aircraft shall adhere to the true Mach number approved by ATC and shall request ATC approval before making and changes thereto. If it is essential to make an immediate temporary change in Mach number (e.g. due to turbulence), ATC shall be notified as soon as possible that such a change has been made.

5-8-3-2-b. If it is not feasible, due to aircraft performance, to maintain the last assigned Mach number during en-route climbs and descents, pilots of aircraft concerned shall advise ATC at the time of the climb/descent request.

5-8-3-3. When the Mach number technique is applied and provided that:

1. The aircraft concerned have reported over the same common point and follow the same track continuously diverging tracks until some other form of separation (lateral) is provided; or
2. if the aircraft have not reported over the same common point and it is possible to ensure, by radar, ADS-B or other means, that the appropriate time interval will exist at the common point from which they either follow the same track or continuously diverging tracks

minimum longitudinal separation between turbojet aircraft on the same track, weather in level, climbing or descending flight shall be: (refer to figures 5.11, 5.12, 5.13, 5.14, 5.15)

a. Separated by 10 minutes; or
b. between 9 and 5 minutes inclusive, provided that the proceeding aircraft is maintaining a true Mach number greater that the following aircraft in accordance with the following:
   i. 9 minutes, if the preceding aircraft is Mach 0.02 faster than the following aircraft
   ii. 8 minutes, if the preceding aircraft is Mach 0.03 faster than the following aircraft
   iii. 7 minutes, if the preceding aircraft is Mach 0.04 faster than the following aircraft
   iv. 6 minutes, if the preceding aircraft is Mach 0.05 faster than the following aircraft
   v. 5 minutes, if the preceding aircraft is Mach 0.06 faster than the following aircraft

5-8-3-4 When 10 minute longitudinal separation minimum with Mach number technique is applied, the preceding aircraft shall maintain a true Mach number equal to or greater than that maintained by the following aircraft.

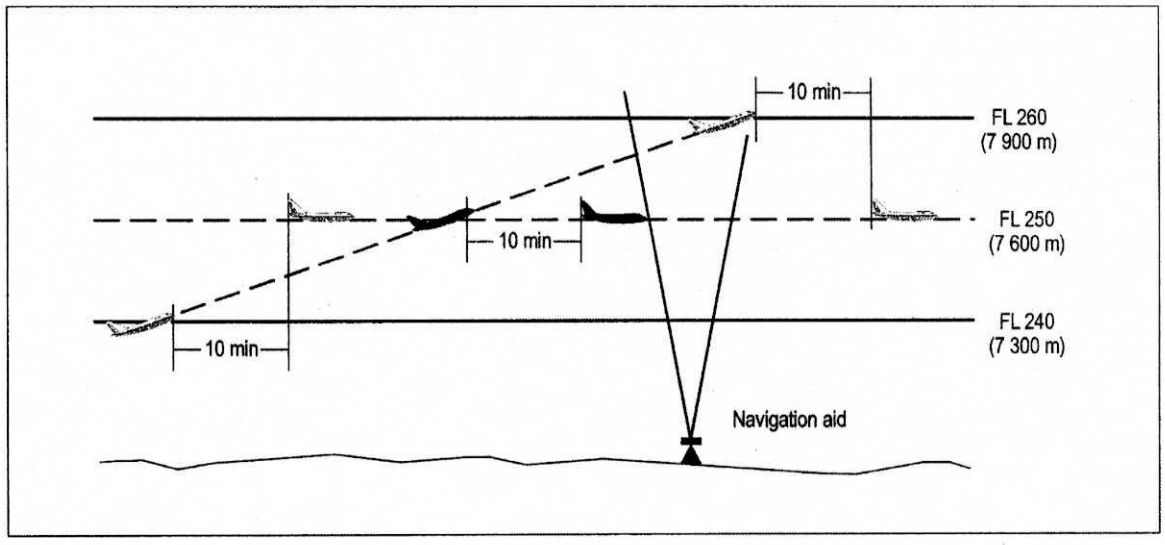

Figure 5.11 Ten-minute separation between aircraft climbing and on same track

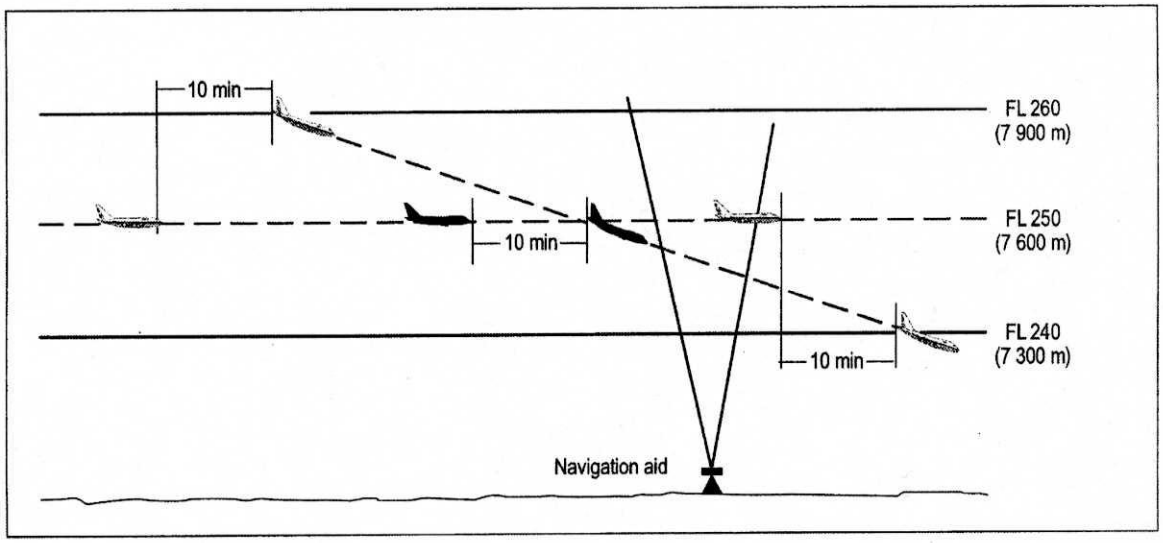

Figure 5.12 Ten-minute separation between aircraft descending and on same track

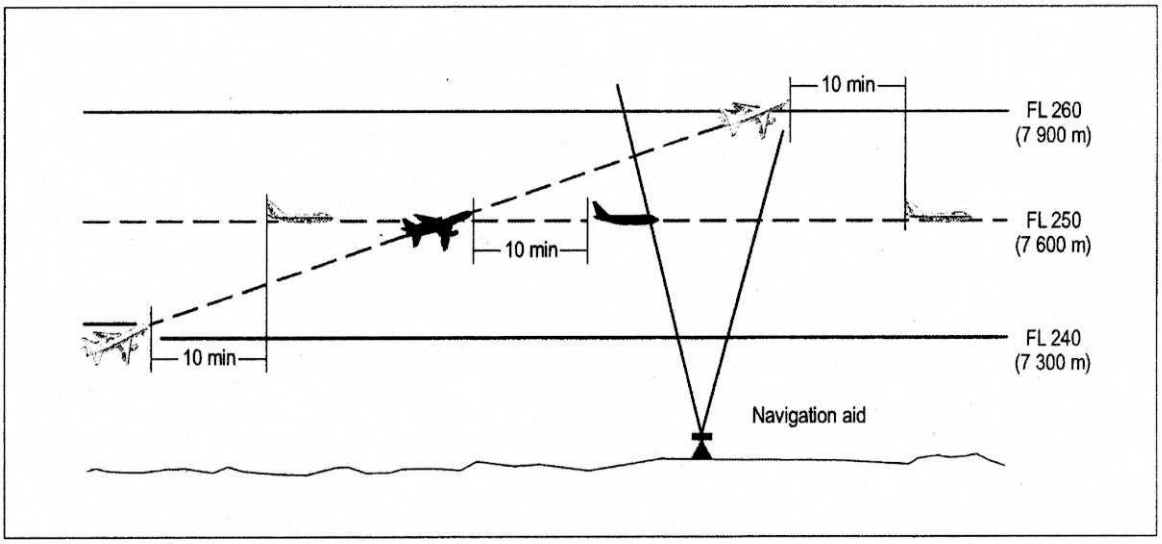

Figure 5.13 Ten-minute separation between aircraft climbing and on crossing tracks

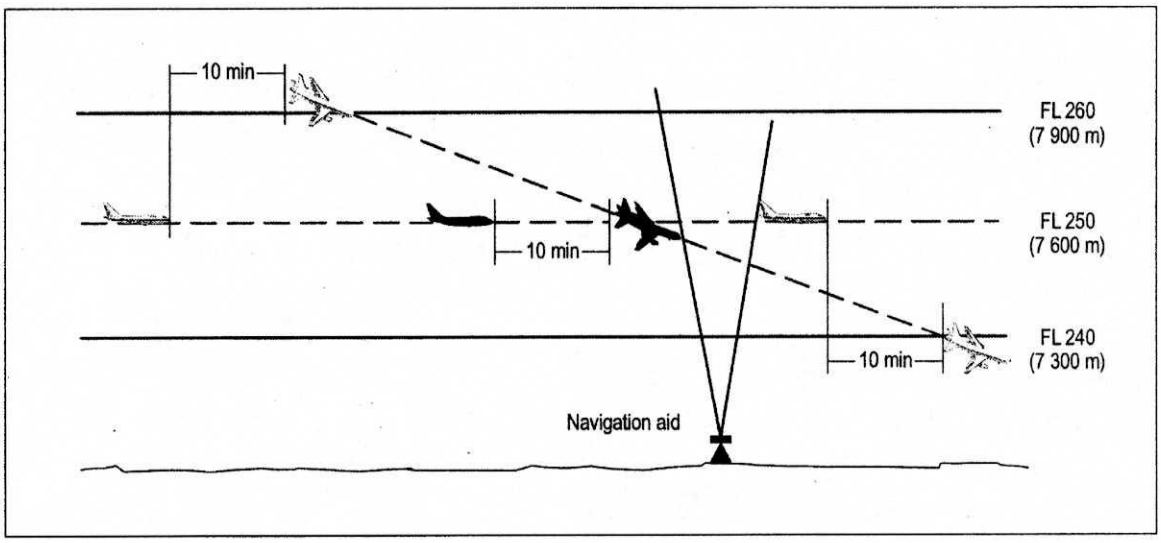

Figure 5.14 Ten minute separation between aircraft descending and on crossing tracks

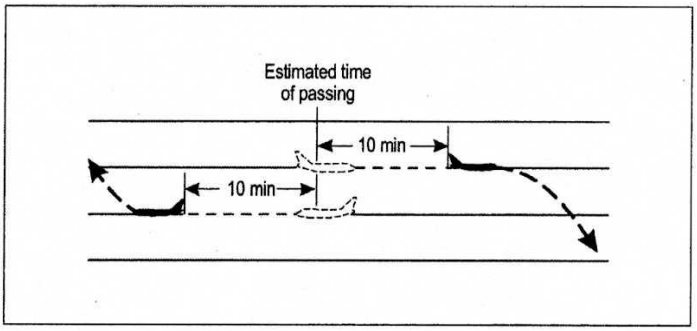

Figure 5.15 Ten minute separation between aircraft on reciprocal tracks

Chapter 6 – Descent Procedures

6-1 Once the aircraft is at its cruising altitude the next thing is to determine is when to start its descent. The actual point can be affected by terrain, traffic and adjacent airspace.

6-2 Here is a simple formula to give you a general idea of when to start a typical aircraft down.

6-2-1 Subtract the destination airport elevation (round to the nearest 1000 feet) from the aircraft's current altitude (in thousands of feet).

6-2-2 Simplify by dropping the thousands

6-2-3 Multiply the resulting number by 4.

6-2-4 The product is the number of flying miles from the destination were the aircraft should start its descent.

Example: Using an aircraft flying at FL320 with a destination of VTCH (Mae Hong Son).

Airport elevation – 929 (rounded up to 1,000)

Aircraft altitude – FL320 (32,000 feet)

32,000 – 1,000 = 31,000

Simplify to 31

31 x 4 = 124

The aircraft should start the descent approximately 124 flying miles from the airport. The calculations are for calm winds. You must subtract for tail wind or add for head winds.

6-3 Military jet aircraft descend even faster than civilian aircraft (4,000-6,000 fpm vs 800-2000 fpm). The formula for figuring there starting point is even easier.

6-4 Add 10 to the first two digits of the flight level. FL370 = 37+10 = 47 miles.

6-5 Another handy tool for determining when to start an aircraft's descent is to use the term "Descend pilots discretion". You must still assign an appropriate IFR altitude to maintain but shifts the burden of choosing the right point to start descent from you over to the pilot.

6-6 If necessary to have the aircraft at a certain altitude by a certain point you may include a restriction, e.g. "Descend at pilots discretion, cross 40 DME east of MHS VOR at and maintain 10,000." In this case the pilot can start whenever and descend at any rate he wants as long as he crosses 40 DME East of MHS at 10,000.

6-7 "Descend at pilots discretion" does not relieve you of your responsibility to assign an altitude which ensures separation from terrain, obstructions, or other traffic. If and aircraft calls outside of your airspace requesting descent, inform the aircraft of the altitude to enter your airspace and advise the pilot to "Outside controlled airspace, descend at own risk, cross 50 DME at or above [altitude] FL170, maintain FL170.

Chapter 7 – Navaid use limitations and GPS

7-1 When assigned routes based on VOR's or NDBs remember:

7-1-1 Typical range of an FlightSim VOR above FL180 is 130 NM. Below FL180 it can be as low as 40 NM depending on terrain and the aircrafts altitude.

7-1-2 The range of most NDBs is approximately 50 NM but this also varies with terrain and altitude.

7-1-3 Unless the aircraft is on an airway you must constantly watch the aircraft on the radar and provide course corrections as necessary.

7-2 With the advances in Flight simulator (GPS) and 3rd party add on aircraft (FMC) it is possible to clear aircraft direct to Navaids, Intersections, DME Fixes and airports.

7-2-1 Two things you should be careful of when using GPS:

7-2-2 Not all pilots are proficient or even familiar with operating the FMS. A direct routing in the flight plan does not necessarily mean the pilot really wants it. They just may not know how to plan a route. Unless the aircraft equipment suffix indicates GPS/FMS use direct routings to other than VORs and NDBs with caution.

Chapter 8 – Uncontrolled Airport Operations

8-1 Airports in Thailand become uncontrolled when the tower is closed during the hours listed in the Thailand Airport AIP. *** Controllers wishing to man a Tower during the times listed as closed is permitted.***

8-2 When the tower is closed during the hours listed in the Thailand AIP, the Approach and Center controllers have the option of treating the airport as controlled but should treat the airport as uncontrolled. ** Unless a Tower controller has logged on and opened the position.**

8-3 When the airport becomes uncontrolled all IFR aircraft will be handled one in and one out. Only one IFR aircraft is permitted in the TMA. Departures will be issued Clearance valid and void times and Arrivals will be issued instructions/times to carry out an instrument approach.

8-4 VFR Aircraft are permitted in the uncontrolled airspace but must contact the controlling facility and follow all VFR regulations.

8-5 We will apply some of the same rules that are in Chapter 10 of the Tower Training Module. The difference is we have no controller in the tower to provide the runway separation needed.

8-6 Successive departures you will issue clearance Valid and clearance void times. You want the first departure to be airborne and in contact with you prior to releasing the second departure. So am a minimum the second departures clearance valid time should be the first aircrafts clearance void time but preferably later.

8-6-a Valid time: is the start time for the departure. Pilots may not depart prior to that time.

8-6-b Void time: is the end time for the departure. Pilots should be airborne by this time.

8-7 When we mix arrivals and departures we follow these rules:

8-7-1 No Take-offs are permitted in the direction of an arriving aircraft or less than 45 degree of the final approach course for that procedure being flown when the arriving aircraft has started the procedure turn nor within the last 5 minutes of a straight-in approach. Refer to Figure 8.1

8-7-2 No Take-offs permitted between 315 degrees clock wise to 135 degrees from the final approach course of an approach up to 3 minutes before the estimated arrival of a aircraft performing straight-in approach, crosses a designated fix (usually the Outer marker or final approach fix) on the approach track. No Take-offs permitted between 315 degrees clock wise to 135 degrees from the final approach course of an approach up to 3 minutes before the estimated arrival of an aircraft performing a full procedure approach. Refer to figure 8.1

8-7-3 We need to allow the arriving aircraft time to land and cancel his IFR clearance before the departures take the active runway and departs. It is very important the issue the correct valid and void times to both aircraft so that we create the proper runway separation.

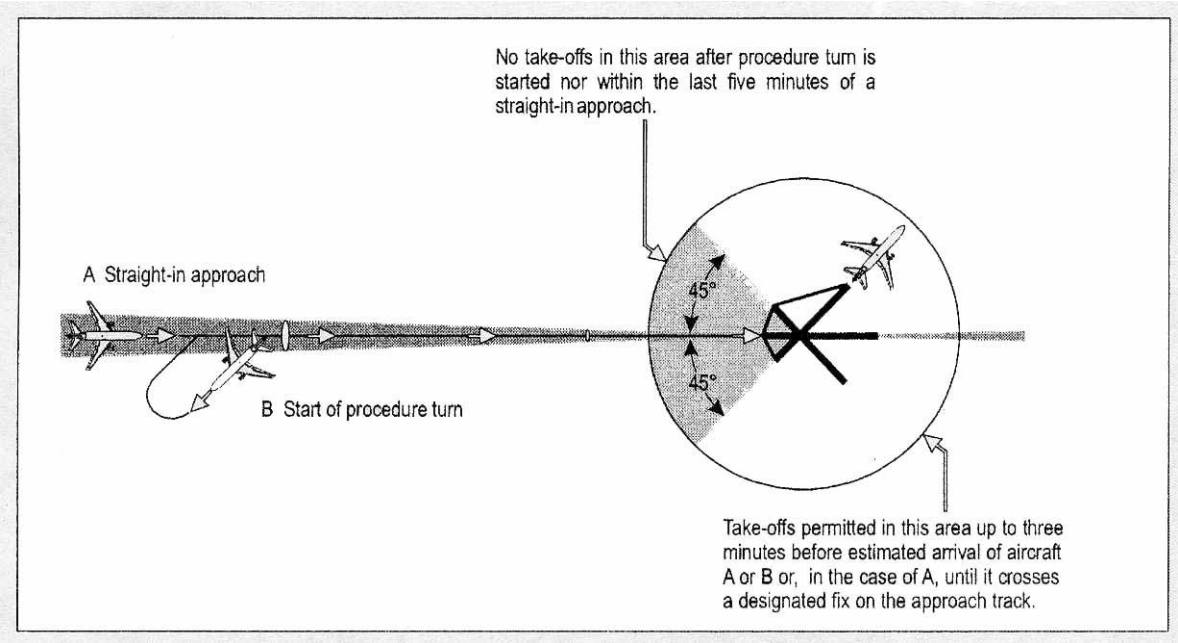

Figure 8.1

8-8 uncontrolled airport Phraseology

8-8-1 Clearance:

THA975 Cleared to Suvarnabhumi aerodrome via A464 airway flight plan route. Maintain (xxx). Squawk (xxxx)

After readback is correct. THA975 read back correct, clearance valid at (xxxx) Zulu, void if not off by (xxxx) Zulu, time now (xxxx) Zulu

Written by John Holt

Updated by John Holt 2-25-13 (change Altimeter settings)