vACC Slovenia Approach Study Guide

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1. Introduction

This manual will show you the basic skills that you will need to work as a departure/approach controller. It will help you to get prepared for the next upgrade of your rating to level the way to the higher positions. This manual is meant to support your training, but it cannot replace an approach lesson held by an authorized vACC Slovenia mentor.

A manual like this can only show you the techniques, but it cannot provide you with full information coverage about how specific situations are handled in your local area.

As a departure/approach controller within VATSIM you must be familiar with the tower control procedures, because in regular duty you must be able to serve these positions at unstaffed airports as well.

There are some communication examples in this manual. Those of the pilots are marked in blue and those of the controllers are marked in green.

2. Training aims for this study guide

We will cover every duty that a departure/approach controller must be able to perform. Beginning with correct radar identification up to sequencing on final approach. At some points there are cross references to some later chapters, but do not start to jump through the document. I divided some topics into different parts, but you will only need the information given so far to complete the next step. Do not get yourself confused or overloaded with information.

3. Basic theory

3.1 Radar controllers

To understand your particular position as a departure/approach controller in the ATC system we will have to talk about some ‘dry’ stuff first.

As a controller covering ground positions you had always a direct look at the aircraft you were responsible for. A tower controller for example can always take his binoculars and watch the aircrafts and their manoeuvres directly with his own eyes (at least in reality). Departure and approach controllers are both radar controllers. The only things they have as reference is the picture on their scope, usually with the data read out from the secondary surveillance radar (SSR) and the radio transmissions made by the pilots. We will get back to that in the paragraphs about radar identification.

3.2 Airspace classifications

3.21 General introduction

Another aspect you have to be aware of is the classification of airspaces. Every airspace class has its specific rules. The Slovenian airspace structure looks as follows:

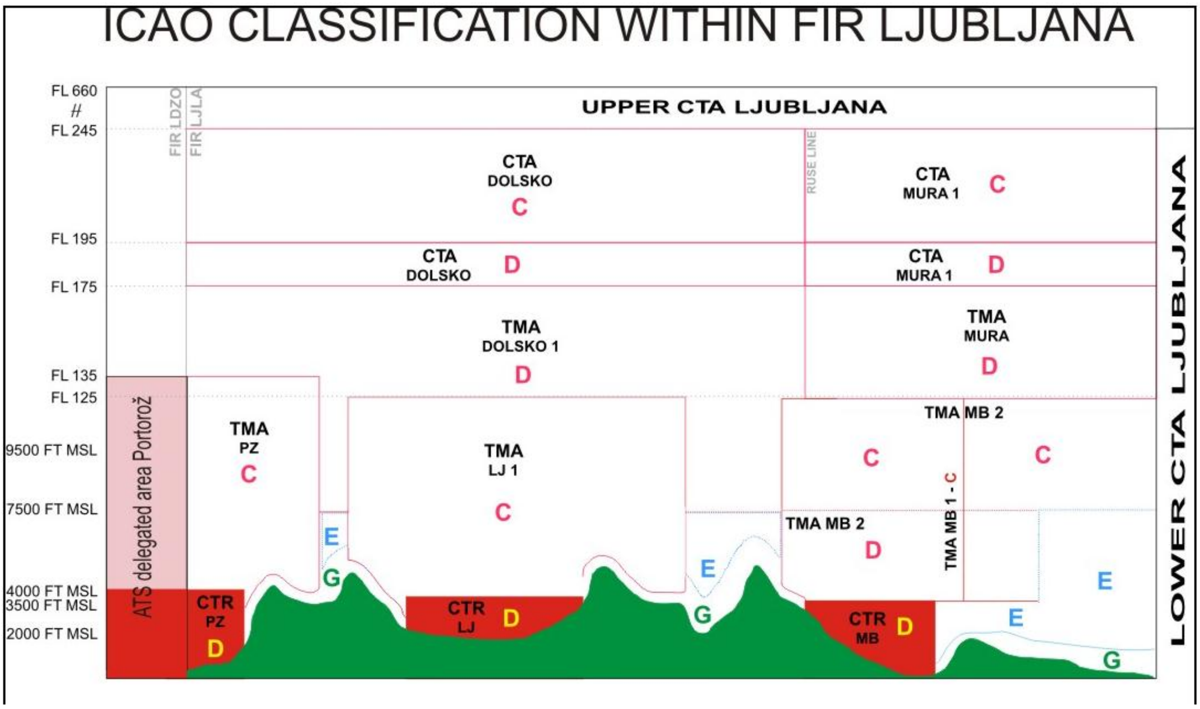


Fig. 3-21-1

The first impression is almost always: why must they do things so complicated and why is it important at all?

To answer this we must take a look at the sky as a whole. We have many different flying machinery in the air today. Some fly under VFR and others under IFR. IFR and VFR both have different limitations and expectations to the area they are flying in, but at least it is all about separation, collision avoidance and finding a way to make them all play together in the same sandbox.

3.22 IFR pilot's point of view

The IFR pilot's flight is more related on the information that they get from ATC in order to maintain separation from other aircraft. That's in the nature of these flight rules taking place in high altitudes with high speeds. That's why he usually does not want any VFR aircraft in the airspace he is flying through. In the lower airspace this is of course not always possible and so the IFR pilot wants at least that the VFR pilot stays away from him.

3.23 VFR pilot's point of view

The VFR Pilot is more related to what he can actually see, rather than to information provided by ATC. There are some aircrafts that are not equipped with a com radio at all, so they have not even the chance to get in contact with ATC. By definition of VFR, aircrafts flying under these rules usually stay in the lower altitudes. It is unavoidable that VFR and IFR meet in certain altitudes in some areas, like aerodromes. So the VFR pilot wants at least that the IFR pilot looks out for him there. VFR can only maintain separation as far as he can see and so he wants the IFR pilot to take this into account, because the VFR has also a right to fly in 'his' domain.

3.26 ATC's point of view

Even if it is not such a problem to separate both types of flight rules from each other, because usually IFR is flying at much higher altitudes than VFR, there are some zones around airports where both types of flight rules meet each other. So the ATC wishes at least that in these zones no one may fly without staying in contact with him and has an SSR enabled transponder.

3.27 Expectations to airspaces

To meet those very different expectations from all parties as close as possible, the sky has been divided into blocks that are mainly aligned vertical and more or less lateral. These blocks are called airspace classes and in every one of them a set of rules apply that are defined by one or more of the following items:

- Meteorological requirements
- Flight rules restrictions (VFR or IFR)
- Instrumentation and equipment requirements (transponder, com radio, nav)
- Contact with ATC and clearance requirements
- Separation

3.28 Implementation of airspaces

Originally there are seven airspace classes (A-G), but in our area only five of them are in place. Just for completion airspace class A is in the US all above 18000ft and airspace class B is reserved for the real large airports like KJFK or EHAM.

In our area airspace class G is VFR only; all others allow both flight rules under certain circumstances.

Let's start from the Top with airspace class C. This airspace reaches from unlimited down to FL195

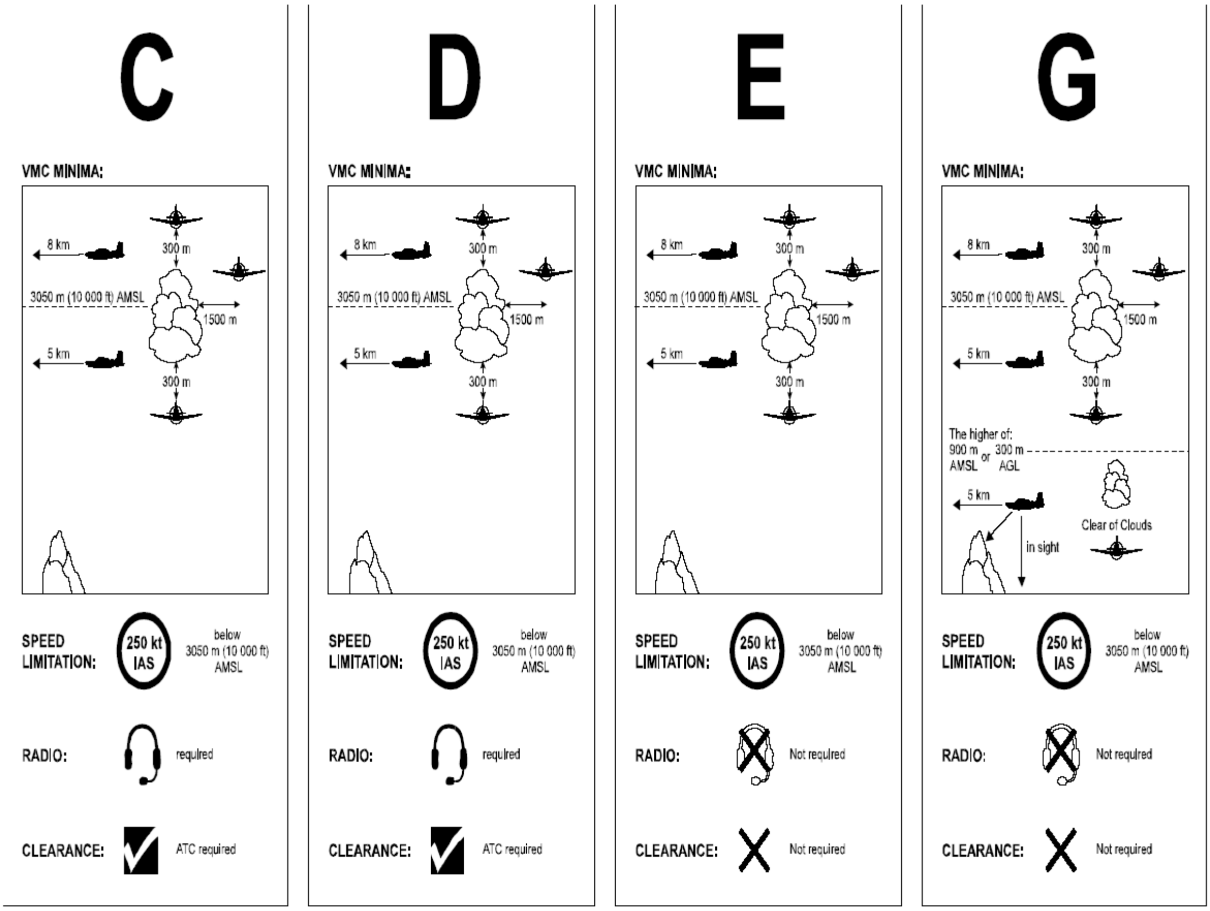
Below class C airspace there is in principle airspace class E everywhere. The bottom level of class E airspace is 2500ft, 1700ft or 1000ft above ground level. You can get information about the exact airspace structure for your local area from your local area charts.

In the case of Slovenia, an Airspace D has been added below FL195 up to FL135 or FL125. VFR traffic requires a permission to enter class D airspace.

Below class E airspace is class G airspace. It reaches from ground level to max. 2500ft. In some remote areas airspace class G can reach as high as 14500ft above ground level. Class G airspace is VFR only and uncontrolled.

That leaves us with airspace class D. Towered airports are embedded in control zones (CTR). These CTRs are class D, which means that also VFR needs a clearance to enter the CTR that they will not need if it would be class E. Some MET conditions are also a bit stricter than in class E or C. Most larger airports have a class C airspace above their CTR. Check your local charts for the lateral extension of the CTR and class C airspace above the CTR for the airports in your area.

With a bit training you will get used to this. For further clarification of the differences between airspace classes take a look at the following two tables. This should resolve most of your questions:



3.3 Providing radar service

3.31 Radar identification

„Identified“ or „Radar contact“ is not a greeting to the pilots. Even if we can take some things in our simulated environment for granted, the process of radar identification is very important for your further work with the aircraft. In the early days of ATC the controller just saw a bright dot on his screen without anything else that represented an aircraft. This was (and is) called a primary target. The process of identification is just to verify, that the pilot who called you recently is really the pilot of the aircraft represented by that radar signal. Later then you could manually add some extra data that was also displayed on the scope and even later this whole process is now semi-automated. With the help of SSR you get today the targets on the scope as you know it. But the process of identification has never changed. You still have to verify if the pilot who is calling you is the pilot of a specific aircraft. Just imagine what could happen if you issue a wrong instruction to the wrong aircraft.

For positive radar identification you will need at least two information: Callsign, transponder code (and the present altitude). Then you verify the reported Callsign with one of the Callsigns on your scope. If you found an appropriate primary target you verify the transmitted transponder code with the one that has been assigned in the flight plan. Now you can issue the positive radar identification. The SSR altitude readout is the third information. You need this to verify if the pilot's flight instruments correspond with the SSR transmissions in order to use them as a reference for altitude assignments.

Never give an instruction to an unidentified aircraft!

3.32 Methods of control

As a radar controller you have a lot of different ways to change an aircraft's flight behaviour. Basically there are three groups of changes that can be made:

- Lateral (changes in heading)
- Vertical (changes in altitude)
- Speed

Those methods can be combined if it is for sure that the aircraft and the flight crew can follow the instructions. You must always take into account the physical limitations of aviation equipment in general and the aircraft's and flight crew's performance before issuing any instruction. If the pilot will object when he is unable to follow a certain instruction it will cost you at least some time and departure/approach can be a very busy environment.

Try to avoid combinations of descent and decelerate, climb and accelerate, narrow turns at high speeds and other illogical constructions.

3.33 Handoff

To get an aircraft from one radar controller to another you have to make a so called transfer of identification, better known as handoff. This procedure is necessary to ensure the flawless and permanent control by ATC. This topic is explained in detail in 5.22.

3.34 Coordination

Coordination with neighbouring sectors is very important for every radar controller.

Most FIRs have so called standard operating procedures (SOP) and letters of agreement (LoA). Common practices are formally written down and every controller can rely on them while providing ATC service. A simple example could be that your airspace has a vertical limit up to FL140, but by SOP you are just allowed to issue climb instructions up to FL130. So make yourself familiar with your local SOPs and if you do not understand certain things just ask your mentor or FIR chief for clarification.

In addition to that there is also no need to keep an aircraft under your control until it reaches your sector's boundaries. As a rule of thumb you can say that you should try to get rid of an aircraft as soon as possible to get yourself some time, but always remember not to deviate from SOP without prior coordination with your adjacent sectors. Such coordination can be done in general for a whole session or individually for a single or a group of aircrafts. You can also do this with certain restrictions.

But whatever you do, you must make sure, that safety is always given. As a short example for that: Let's say your sector's vertical limit is FL140 and you made a general arrangement with your center controller that all aircraft handed over to him that are still in your sector are released for climb instructions. You now have an aircraft departed from your airport, flying a SID. If safety permits you can identify him, issue a climb instruction to your vertical clearance limit (FL140) and hand him directly over to center, no matter if he is still at FL80 or so. You can be sure that the aircraft will follow the SID at least until it leaves your sector and center can clear him in the best case to his requested flight level without delay. As you can see a simple coordination can expedite the flow of traffic and reduce your workload, but there is a catch, which is explained in 5.22.

3.4 ATC Positions in the lower airspace

There are three different positions to cover in lower airspace. Not all of them are existent in every area. First we have the departure controller (DEP). DEP handles all departing IFR traffic from the aerodrome(s) in his sector. He is responsible for the safety and guidance of this traffic on its way through the arriving and surrounding traffic. On the other hand there is the approach controller (APP) who is responsible for all the arriving traffic to the aerodrome(s) in his sector. Even if there usually are defined routes for departing and arriving traffic which keeps them both separated, sometimes it could happen that two routes share some points in the air where the aircrafts could come close together to each other. In this case coordination is the answer again. The third position is the director (DIR). Basically the director is an approach controller with special duties. We'll get back to that later and concentrate first on the duties of DEP and APP.

3.5 Separation minima

This topic will return to you over and over again through all radar positions. The whole concept of separation is to maintain enough room for every single aircraft to manoeuvre. In RVSM airspace, which is used in most regions of Europe, the vertical separation is 1000ft at all times and for all positions. The lateral separation depends on the position. Center control uses 5NM, departure/approach uses 3NM. You only have to apply either one of them. So you can have two aircrafts separated 1000ft vertical with no lateral separation or 3NM lateral on the same altitude. Departure/approach has a more tight separation minima than center. That's because the traffic is not that fast in these sectors than it is in the upper areas and in the terminal area there are usually more aircrafts within there. In the early days of radar service the equipment, namely the antennas, was more precise in the vicinity of the antennas. Also approach antennas have a faster turn rate that leads to a shorter update interval.

4. Definitions and Essential knowledge

4.1 MSA & MRVA

We talked about vectoring techniques so far, but there is another aspect to consider. The world is not flat, but spherical and the surface is full of obstacles like mountains or just tall man-made structures like buildings. It should be clear that an aircraft has to fly in an altitude that is clear of terrain and free of any obstacles, including danger areas with an additional buffer. This altitude is defined on the charts and called minimum sector altitude (MSA). To provide vectors to IFR traffic we must make sure, that the aircraft is at least 500ft in controlled airspace, 1000ft above the highest obstacle within a 5NM diameter area. This altitude is called minimum radar vectoring altitude (MRVA). Below MRVA you just can issue instructions to IFR aircrafts that will make them follow published procedures. An ILS approach procedure for example will lead the aircraft far below the MRVA, but as a published procedure it is known to be safe.

4.2 The nature of IFR procedures

You as a controller just see your radar echoes on your flat scope. It is a clean environment and you probably are not familiar with the area you are controlling as it looks in real. As long as an aircraft is cruising along the airways in high altitudes, everything is fine, but as soon as he gets closer to the ground everything changes. Clouds everywhere, you can barely see your wipers. There is traffic all around you and the terrain with trees, buildings, masts and towers below you and you do not see a thing. You just rely on your instruments and your charts, flying an approach procedure to intercept the localizer. Finally you see the runway lights and seconds later your wheels touch the ground. Following the procedures exactly is the only thing that is between safety and hitting some obstacle. The procedures are safe; every deviation from them can turn out very badly for the people on board. Right down to the ILS approach. If the localizer needle will reach full deflection the aircraft is not safe anymore. The pilot cannot see anything outside, so all he can do is to climb above the MSA and execute the missed approach manoeuvre.

4.21 Responsibility of the controller

Once you as a controller deviate an aircraft from published procedures you are fully responsible to keep the aircraft clear of terrain and obstacles in addition to your duty of conflict avoidance. The pilot trusts you and you should never forget that, whenever you take an aircraft on vectors. Your responsibility ends, except for conflict avoidance, when the pilot can actually see where he is flying or is back on a published procedure.

4.22 Handoff / Release

In real controlling everything usually happens in one room. Controllers of adjacent sectors can talk to each other directly, because they sit side to side to each other. There are also people who do all the coordination work. In our simulation we must compromise and compensate for the lack of those services. As a result our handoff and release procedures are done a little bit different.

This section here is about areas of responsibility, coordination and delegation of control and even if this is some dry stuff again it is very important that you fully understand the concept.

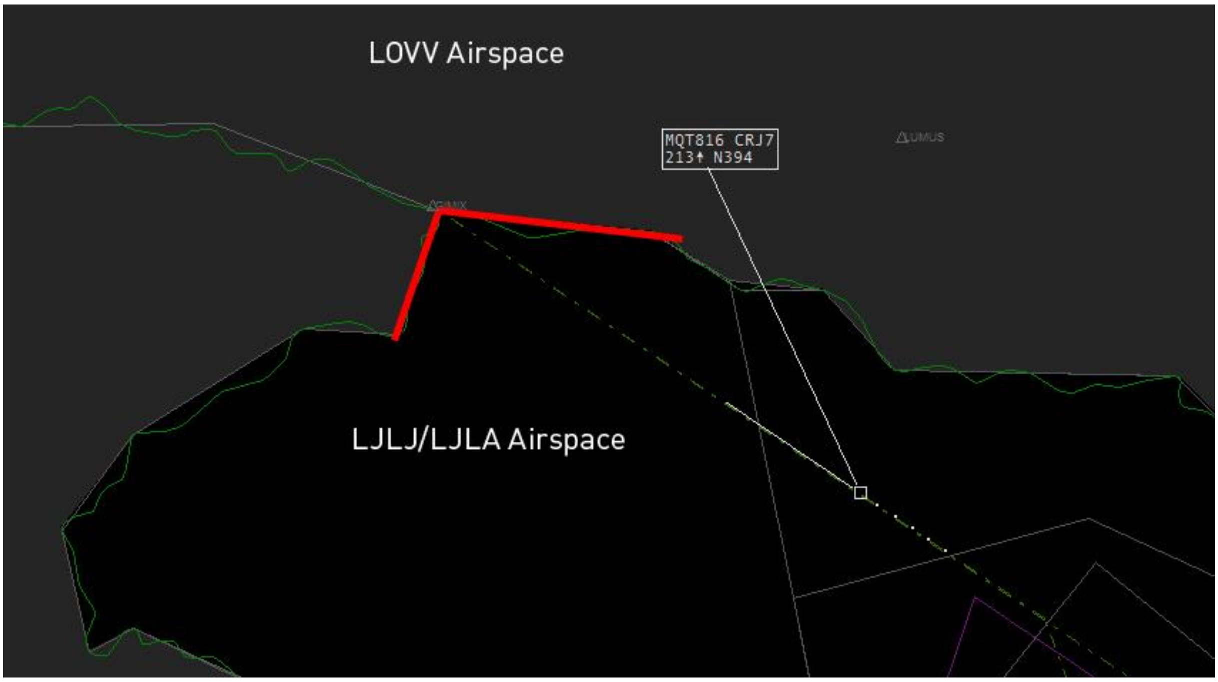


Fig. 4-22-1

Let’s have a closer look on the term handoff. At some point the control over a flight has to be transferred from one controller to another. Usually the transfer of control point is located at the sector border. In Fig. 4-22-1 the LJLJ controller must transfer control of MQT816 to the LOVV controller at the red line. This is the general rule, but the transfer of control point can be specified somewhere else. Either by definition in a letter of agreement between two sectors or by individual coordination between two control units. Usually the TOC point is defined lateral and vertical in some way. For example:

“LOVV inbounds from LJLJ: handoff latest over GIMIX at FL220 or above.

To make this work the transferring controller (the one who initiates the handoff) is responsible for the coordination with the other unit and the accepting controller states the conditions. Also a simple example for that:

Controller A has an aircraft on a non-standard route that must be handed over to another control unit. Controller A must now ask permission from Controller B for handing him over the aircraft on a non-standard TOC point. Controller B may accept this, but only under the condition that the aircraft is not lower than FL200 for example.

A handoff can be divided into two independent steps. One is the transfer of control and the other is the transfer of communications. The situation in Fig. 4-22-1 will make the LJLJ controller initiate the handoff by triggering a handoff request (F4 sectorID <ASEL>). The accepting controller at LOVV accepts the handoff request and the transfer of control is completed.

Now the LJLJ controller tells the aircraft to contact the LOVV controller. As soon as the pilot confirms the new frequency in his read back the transfer of communication and thereby the whole handoff is completed.

Besides the handoff there is another thing called release. Here it comes to responsibility. Imagine the situation in Fig. 4-22-1 again and let’s say that the LJLJ controller just completed the handoff and the LOVV controller has control over the aircraft and is in radio contact with it. The question raises who is responsible for that aircraft and is the LOVV controller allowed to issue instructions to that aircraft while it is not yet in his own airspace?

There is a simple answer. The LJLJ controller is still responsible for the aircraft, because it is still in his airspace. A controller is always responsible for everything that happens in his airspace. Also a controller is not allowed to instruct aircraft that are not in his airspace. Always keep that in mind.

The LJLJ controller could give the LOVV Controller permission for certain operations while the aircraft is still in his airspace and that is called a release. The release can be restricted to certain operations only. MQT816 could be released for turns only by LJLJ. That means the LOVV controller is allowed to turn the aircraft into another direction, but not change its altitude or anything else until the aircraft enters his own airspace.

Also releases can be coordinated individually each time between controllers, but they also may be defined generally in a letter of agreement or in the sector's standard operations procedures.

Remember, even if you give a release for whatever to another controller you are still responsible for the aircraft as long as it is in your airspace. So there are two simple things that you should keep in mind:

Never hand off an aircraft that is in or can become into a conflicting situation while it is still in your own airspace.

5. Departure control

5.1 General introduction

At some point a departed aircraft will call in at departure control with the necessary information for the controller to positively identify him. We talked about radar identification before and you know that this is the first thing to do, so I will spare the procedure in the following examples.

The pilot has some basic information, based on the aeronautical charts, what to do after he is airborne. The easiest thing is if he is on a standard instrument departure route (SID). The SID describes the lateral flight path the aircraft has to follow, including additional restrictions like crossing a specific point at a minimum altitude. He also gets the so called initial climb altitude from the charts or ATC. This is the altitude to which an aircraft may climb without further instructions from ATC. The third important thing he can get from the charts is your frequency, even if he will get the explicit instruction from the local controller who to call next. There is no special handoff procedure from tower to departure, so be prepared to be called by a departing aircraft without prior notice.

Your job is now to separate this aircraft from other traffic, bring it as close as possible to its requested cruise flight level and hand it over to center.

Departure control has the lowest priority among the three lower airspace controllers and is usually the easiest position to serve on.

There is currently no dedicated departure control position in Slovenian airspace.

5.2 Working as a departure controller

A typical call in from a pilot on departure's frequency:

"Ljubljana Radar, ADR4711, 2400ft climbing FL120"

You know now the present altitude of the aircraft, which is 2400ft. You know that you need this for the SSR readout verification. You also know his vertical clearance limit, which is FL120. Usually the aircraft will tell you on initial call the initial climb altitude, that the pilot has found in his charts. However, listen closely to the pilot's report and intervene immediately if something is out of the ordinary from what you expect. Assumed the aircraft is on a SID, you can get information about the SID from your local charts. Which SID the pilot actually will fly you can get out of the flight strip or from the local controller or ask the pilot himself if it is not in the flight plan. All you will have to do now is to assign the aircraft a higher altitude if practicable and watch the aircraft's flight path if it matches with the SID given the required separation in your sector. At some point you will hand the aircraft over to center control. This can be either at your sector border or at any defined point that is usually used in your specific local area. The conclusion is, if there is no thread by other traffic, this is the simplest instruction you can issue:

"ADR4711, identified"

You could also raise or lower his vertical limit below the initial climb if you need to separate from arriving traffic or above the initial climb if you coordinate with the air traffic control above your position.

Sometimes even that is not enough and you will be forced to deviate the aircraft from its planned route in order to maintain separation.

5.3 Basic vectoring

By issuing vector instructions you simply change the aircraft's lateral flight path. This sounds easy at a first look, but you have to keep several things in mind.

The most important rule is that vectors are meant for separation, not to assist the pilot in flying his aircraft or to follow his route.

Basic vectoring is done by issuing a new heading to fly including the direction of the turn:

"ADR4711, turn left heading 200"

In this case the pilot will initiate a turn to the left until he is on his new heading 200 and he will fly just that heading. We'll get to some disadvantages from this technique at a later point in this study guide.

If the new heading will just be a few degrees from the aircraft's present heading you can also instruct the aircraft to 'fly' a heading without the directional instruction:

"ADR4711, fly heading 200"

Sometimes you just want the aircraft to stay on its present heading. In that case a

"ADR4711, maintain present heading"

will do the trick, but you do not know the exact heading the aircraft is flying with this instruction.

No matter the method used to pull an aircraft out of its planned route and put it on vectors, you as a controller are responsible for the aircraft's navigation from that point on. Once set on a heading, the pilot will follow that heading until he's getting new instructions. So better never forget someone you have put on a vector.

After you re-established the desired separation, you have to take the aircraft back to its original course and leave the navigation to the pilot again, who will then resume on his planned route.

To do this you need a fix or navaid on the planned route of the aircraft, send him there and hand over the navigation responsibility to the pilot again. Assuming the closest fix on the aircraft's route would be RADLY:

"ADR4711, resume own navigation, direct RADLY"

Given this instruction the pilot will turn into a direction which is most aligned with the given fix and flies there on a direct path. For example if the aircraft can be aligned inbound RADLY on a 30° left turn, the pilot will turn left. If it would need a 200° turn to the left to do the same he will turn right instead. If you want him to turn into a specific direction you have to tell him that, otherwise he will use the shortest turn possible:

"ADR4711, resume own navigation, turn right direct RADLY"

This will force the pilot to turn right, no matter how many degrees to turn.

6. Approach Control

6.1 General introduction

At some point an IFR aircraft will leave the airway system, starts to descent, decelerates and follows a published procedure in order to land on one of your airport's runways. Nice and for what reason do we need controllers anyway ? The area around an airport can be a very busy environment. Many aircrafts come real close to each other and all of them want to land on that runway. Regarding the statements made at 5.2. it should be clear what we need controllers for. They must make sure that safety is always provided and they have to expedite the flow of traffic. Each runway has a specific capacity, which cannot be exceeded. It may happen from time to time that there are more aircraft arriving at the same time, than the runway can take. This is also a job for the controller to manage the traffic. This can only work if you have a concept. You must plan ahead, so that you know which aircraft is going to land at a certain position in the queue. Even if you should work based on "first come first serve", which is not always possible.

6.2 Anatomy of an approach

6.21 Scenario

If an aircraft leaves the airway system it is supposed to follow a certain procedure that is called approach. The approach procedure can be divided into five segments. Let's say we have an aircraft whose flight plan ends with:

VALLU VALLU2L

We will follow the aircraft through the five segments on that approach by looking at the approach charts:

6.22 Arrival segment

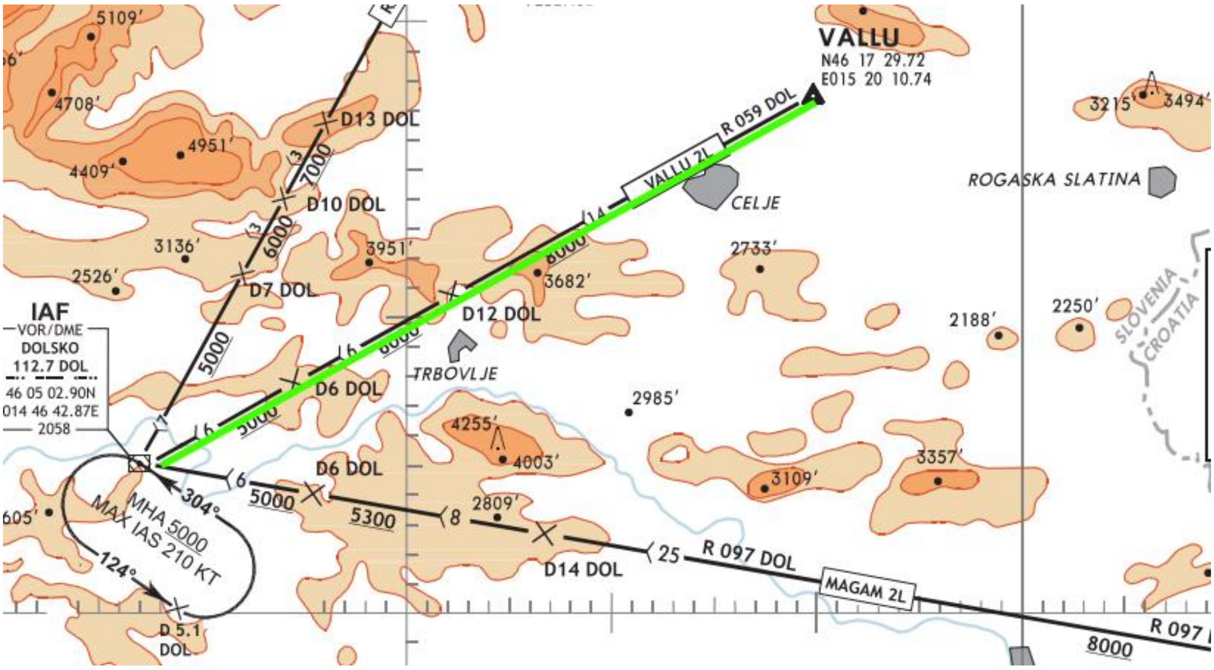


Fig. 6-22-1

The green line marks the arrival segment. This will lead the aircraft from the airway system to the initial approach fix (IAF), DOL (Dolsko) VOR in this case. The IAF is always marked as IAF on the charts and usually there is more than one of it.

6.23 Initial approach segment

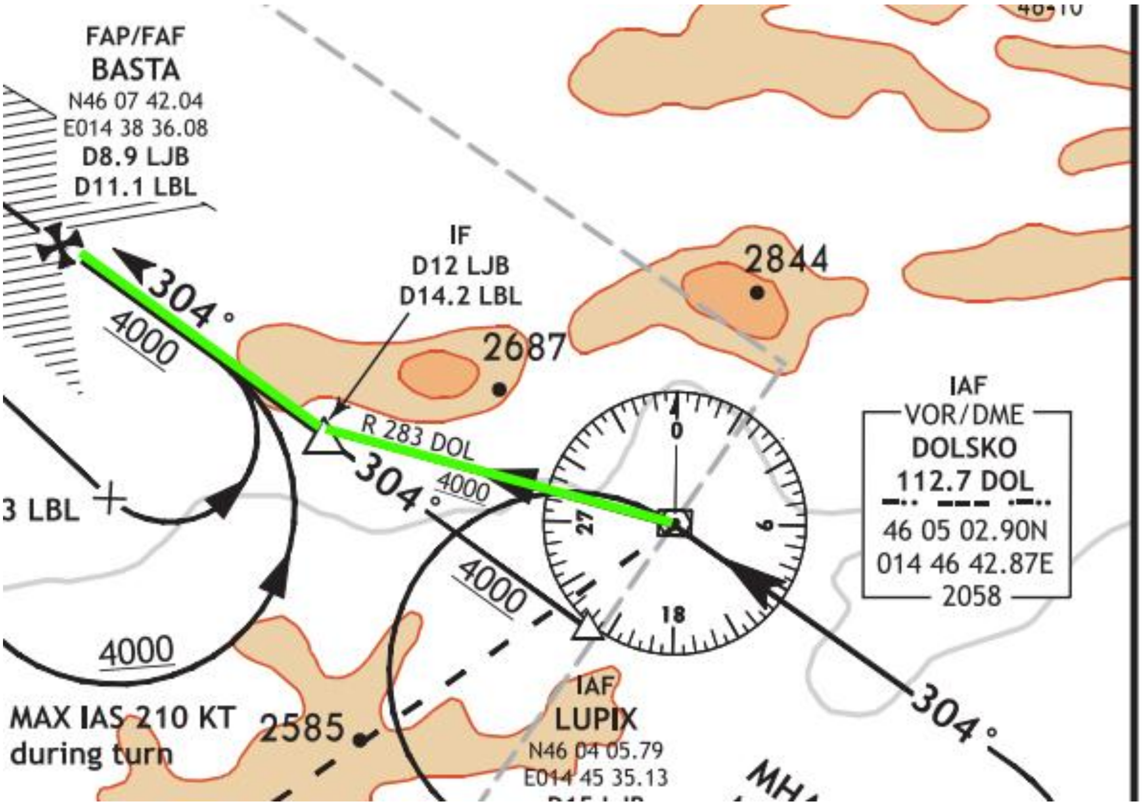


Fig. 6-23-1

Again marked with the green line is the initial approach segment. This will align the aircraft's course with the final approach course. In our example here you have a straight course, but it can consist of anything from a simple radar vector to DME arcs or even holding patterns. Sometimes it will lead through an intermediate approach fix (IF).

6.24 Intermediate approach segment

Marked with a yellow line in Fig. 6-23-1. This course will lead you to the final approach point (FAP). The FAP may be a navaid, but can also be an RNAV waypoint like it is here. The FAP marks also the beginning of the glide slope of an ILS approach.

6.25 Final approach segment

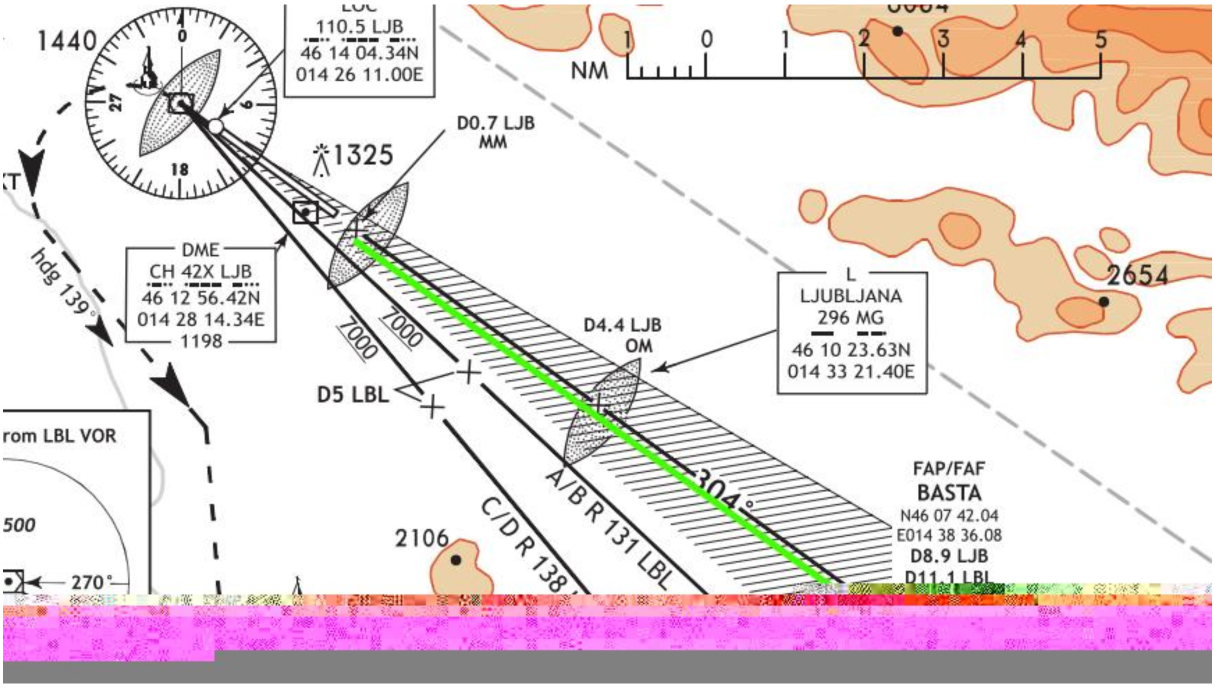


Fig. 6-25-1

Marked with a green line here. The final approach segment leads from the FAP to the missed approach point (MAP). The MAP is the latest point for the pilot to make his decision to land or not. Basically if he has not the runway in sight at the MAP he must go around. The MAP is here exactly at the middle marker (MM), 0.7 DME from LJB, but can be defined elsewhere depending on the airport and is then usually marked as MAP.

6.26 Missed approach segment

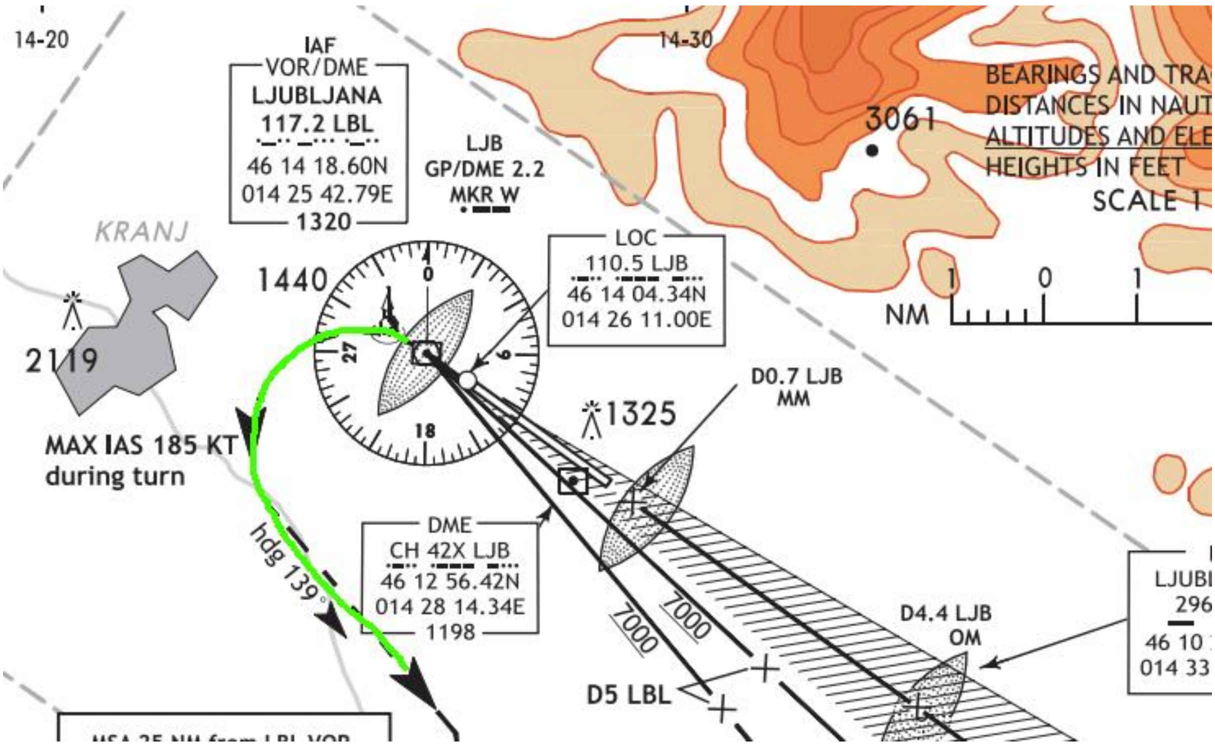


Fig. 6-26-1

In case of a go around you will have to follow the missed approach procedure, which is also explained on the charts. In our example the pilot as to climb straight on runway heading until MKR W and then turn left onto HDG 139, before establishing on radial R173 from LBL VOR.

6.27 Summary

We have learned so far, that the IFR pilot can rely on his instruments until reaching the MAP. Generally this is true, but under certain circumstances and with the necessary equipment on the aircraft and on the ground it is possible and allowed to land without seeing a thing outside. We will get back to that later, after we learned the basics.

6.28 Reason

The reason for the implementation of such tight procedures should be obvious. Always keep in mind that all our aviation participants are depended on technical equipment. Every single part of this equipment can fail. This occurs mostly if you do not need it. A simple communications failure on board of the aircraft would get you as ATC and the pilot within the system into serious trouble if there were not these procedures. In case of such a com failure the pilot needs something that he can safely do with all that other traffic around him, possibly surrounded by bad weather. On the other hand even the controller needs something he can be sure about that a pilot will do in such a case. That will provide the controller with the ability to do his conflict avoidance duties.

6.3 Types of instrument approaches

6.31 Common types

There are lots of different types of instrument approaches. All of them provide you with at least one electronic means of bearing or distance measuring. Common types are:

ILS, ILS/DME, VOR, VOR/DME, LOC, LOC/DME, NDB, NDB/DME, RNAV (GPS)

Most of the approach types above indicate what equipment is necessary to execute it. For an NDB approach you will need a NDB receiver, for NDB/DME a DME device is additionally needed.

You can categorize these approach types into precision and non-precision approaches. Precision approaches are all types of approaches where you have both lateral and vertical guidance. Everything else is a non-precision approach.

6.32 Precision approaches

We will focus on an ILS approach here, because this is the most common approach type. An ILS approach is easy to perform for both the pilot and the controller.

Your primary goal is to guide the aircraft on a course where it can intercept the localizer (lateral guidance) within a 30° angle at a defined altitude. At the same time you also have to make sure that the aircraft is able to intercept the glide path (vertical guidance) from below. The reason for that is simply because some aircraft's systems are unable to intercept a glide path from above due to antenna configuration. And if that would not be enough the aircraft has to fly straight at level for one mile between localizer and glide slope interception. Let's go for it step by step.

Depending on local procedures the aircraft will follow some route to get near the final approach path and descents to the defined altitude as we talked about before. This could be straight in or from the downwind or any kind of angle to the final approach course. Your first job is now to move the aircraft into a position where it can intercept the localizer. To accomplish that you must know where your final approach point is located, because the aircraft has to over fly this point. The FAP is also the point where the aircraft will start its descent. So why is that so important?

Earlier we talked about MSA und MRVA. At some point on final approach the aircraft will descent below your MRVA and the MSA. In our simulated environment you have the advantage that you see the aircraft on your radar scope all the time even if it is on the ground. In reality depending on antenna positions at some point below the MRVA the aircraft might disappear from your scope, because the antenna will simply not get back an echo. Providing service to such an aircraft is impossible for safety reasons. The ILS system, which is providing lateral and vertical guidance, has been invented to compensate for these technical limitations.

Remember that you must make sure that an aircraft is established on the localizer before it descents below MRVA or MSA. Consider an aircraft established if the indicator for the localizer is within its scale limits. Everything else is an unsafe situation.

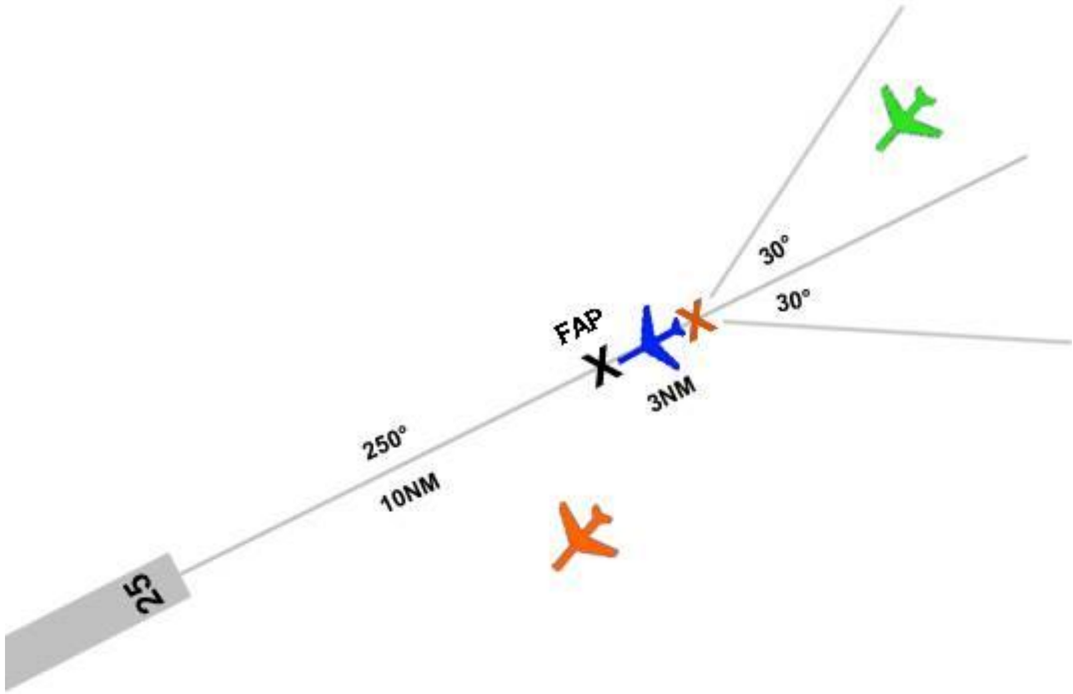


Fig 6.32-1

Back to our FAP. It is not a good idea to point the localizer (LLZ) intercept vector exactly to the FAP, because the aircraft has to fly at least one mile at level before it is about to commence descent on the glide slope. So you'll make out a point some three miles in front of the FAP and guide the aircraft to that point for LLZ interception. The idea behind that is to give the instruments enough time to align to the LLZ signal and for reducing speed. The system of navigation instruments and pilot depend on each other. The navigation instruments plot the course and the pilot as the helm's man has to follow it. So it is better to do this one at a time. We leave speed control aside for now, because we will go back to that in advanced vectoring and refer back to the ILS procedure affection there.

If you have a look at fig 6.32-1 you will see the green aircraft is on its intercept course for the LLZ runway 25. But the intercept course for the LLZ is only a vector and if we would let it go with that, the aircraft would end up somewhere the red aircraft is right now.

The pilot needs a clearance to intercept the LLZ and follow the glide slope (GS). This is simply done by this instruction:

"ADR4711, cleared ILS approach runway 25"

Usually you issue that instruction together with the final turn. If we turned the green aircraft to a heading of 230° it would be something like that:

“ADR4711, turn left HDG 230, cleared ILS approach runway 25”

What can we expect now from the pilot? He is allowed to leave the vectored heading to intercept the LLZ. In fact it will be a turn to the right by 20° at some point. The blue aircraft represents a localizer established aircraft. It is laterally aligned, but does not follow the GS yet.

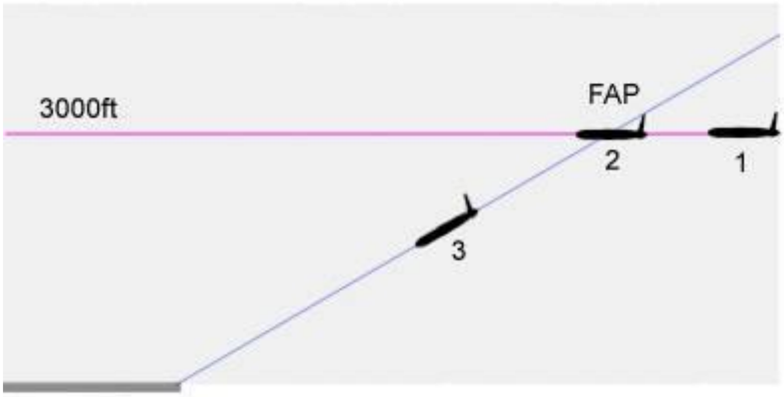


Fig. 6.32-2

We are looking at the same situation from the side now. The blue aircraft from fig. 6.32-1 is indicated here in position 1. As we can see it is flying straight ahead towards the center of the runway indicated by the magenta line. The blue line is our GS that is intercepted by the aircraft from below. At position 2 the aircraft becomes established on the ILS:

Fig. 6.32-3

Both indicators are perfectly aligned to their centers and the aircraft is ready to follow the GS. From now on the aircraft is allowed to descent below the MRVA, because the pilot is able to maintain a safe track without assistance of ATC all the way down to the runway without seeing a thing outside. He is also allowed to descent below the MSA, because the ILS path is designed in a way that provides sufficient distance to any obstacle in the flight path.

Once the aircraft is established on the ILS you can safely hand him over to tower. You could do so also if the aircraft is just established on the LLZ if the situation and local procedures permit.

One point left open from fig. 6.32-1. Why is the distance from FAP to touchdown 10NM?

Well, a glideslope has always an angle of 3°. We could do some complicated maths here, but we can simply go by this:

You need the difference between the airport elevation and the altitude where your aircraft shall intercept the glideslope. Let's say our airport here is exactly at sea level, which means 3000 – 0 is still 3000. Divide this by 1000 and multiply with 3. You'll get (3000 – 0) / 1000 * 3 = 9 . 9NM plus the one mile flight at level leads to the 10NM. If you need the aircraft to intercept at 4000ft it would come out to 12NM.

Usually the intercept altitude for the glideslope increases with airport elevation.

6.33 Advanced ILS procedures

Most major airports have more than one runway to increase its capacity.

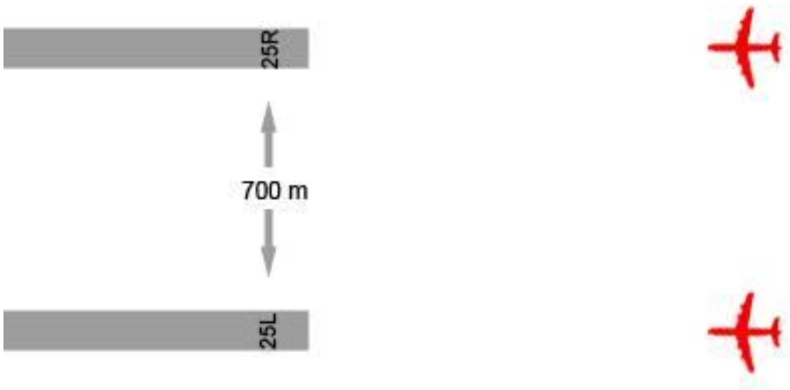


Fig. 6.33-1

This would probably the first idea that comes into your mind. Nothing to say against the concept, but if we strictly use the technique from 6.32 we will run into some trouble here. Remember the chapter about separation minima? Let's step back in time a bit on this scenario:

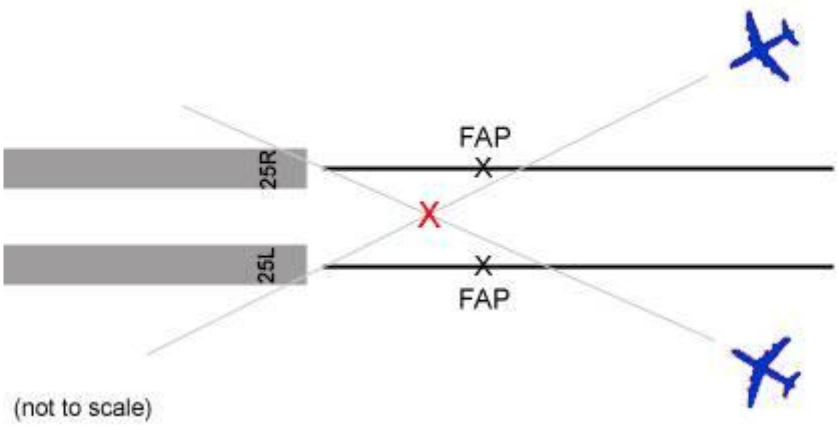


Fig. 6.33-2

In air traffic control you must always consider what might happen under certain conditions. To be on the safe side expect the unexpected. Modern jet aircraft move at high speeds and every reaction to an instruction takes time to be executed. Also technical equipment might fail in situations where you hardly need it. Remember: You cannot stop the aircrafts in the air to analyse and resolve a situation, so you have to create failsafe scenarios.

If we would have both aircraft on the same altitude we will run into a problem here. We have to maintain a lateral separation of at least 3NM for the aircrafts to each other. So the above scenario would not work out anyway. Not to mention what might happen in a sudden communication failure and both or maybe just one aircraft proceeds on its assigned heading.

Maintaining lateral separation is impossible here, so the only way is vertical separation. We simply let one of the aircrafts intercept the LLZ 1000ft higher than the other. At the same time we must extend the distance to localizer interception also by another 3NM. So we end up in a situation like in fig. 6.33-3.

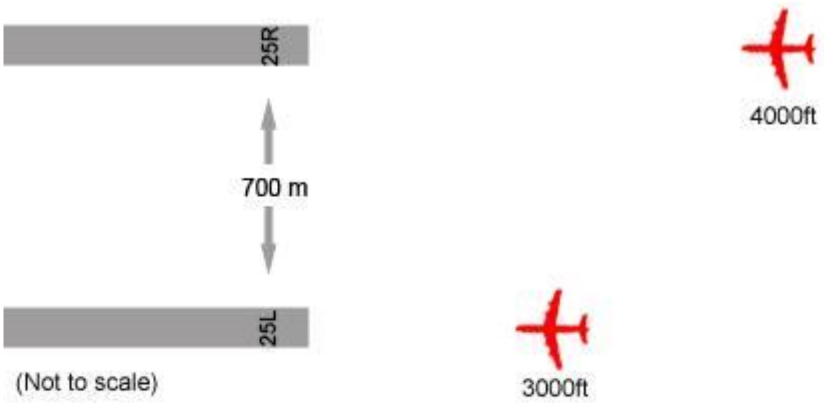


Fig. 6.33-3

Fig. 6.33-4

Putting this into relation to the situation in fig. 6.33-2, we are on the safe side now. Both aircraft could overshoot the LLZ or lose communication with us without violating separation minima. Using a technique like this will not allow you to clear both aircraft simultaneously for the ILS approach, because the higher aircraft will descent through the altitude of the lower aircraft sooner or later and if this happens before both aircraft are safely established on the localizer you will have a separation conflict.

Remember:
Separation minima will apply until both aircraft are established on the localizer.

To avoid the reduction of your 1000ft vertical separation you clear the upper aircraft just for the localizer:

"ADR4711, turn right heading 230 to intercept localizer RWY 25R, report established on localizer"

This will not allow the pilot to leave his altitude as a clearance for the ILS approach would do.

As soon as both aircraft are established at least on the localizer you may descent the upper aircraft to its normal approach altitude:

“ADR4711, descent altitude 3000ft, cleared ILS approach RWY 25R”

As an alternative descending the aircraft with the glide slope:

“ADR4711, descent with the glide slope, cleared ILS approach RWY 25R”

This will keep the aircraft at the higher altitude, until it is also established on the glide slope to start its descent.

6.4 Using Speed control

Until now you have just provided guidance to your traffic. In order to take control of the traffic you will need to know about speeds and how it affects the aircraft’s manoeuvring.

Generally choosing speeds is up to the pilot who is only limited by airspace- and procedural restrictions. On the other hand you as a controller are responsible for separation. So it cannot be in your interest if every single pilot in a well-planned sequence is maintaining a speed of his own choice.

An aircraft’s speed affects its manoeuvrability and certain conditions such as altitude or winds affect the aircraft’s speed vice versa. And if that would not be enough variables all aircraft are limited somehow in their speed through design. A piston engine aircraft is usually not as fast as a jet engine aircraft, but the jet usually must maintain a higher speed to prevent falling out of the sky.

So the first rule of speed control in approach airspace is to find a suitable speed for all kinds of aircraft. Not too slow and not too fast. This becomes even more important if we get closer to the runway and tighten the sequence to increase efficiency.

Remember that your indication on the radarscope is the groundspeed. The groundspeed depends on the aircraft’s altitude. You could have two aircraft on 3000ft and FL100, both flying 200kt indicated airspeed and the higher aircraft will have a significant higher groundspeed than the lower aircraft.

The speed of an aircraft has a direct impact to its turn radius. The faster the aircraft the greater is its turn radius.

Normally an aircraft turns at a rate of 3° per second. That means it will take 2 minutes for a full circle [360 / (3 x 60)]. If you want to separate two aircraft by two minutes just let the succeeding aircraft fly a full circle.

Let’s get into some deep stuff here. As a radar controller you should be able to do quick calculations, because the more advanced techniques depend on that. But do not be afraid that you have to become a math genius before getting better at radar. Most of that stuff can be put aside with experience, because the numbers do not change that much as long as you do not invent a new wheel every day.

You can use speed to achieve these things:

- Take influence on the turn radius of an aircraft sequencing
- adjust spacing

6.41 Turn radius

You want to put an aircraft on downwind to give him one turn to intercept the localizer. Let’s say the aircraft moves at 180kts/IAS, which is a common speed used in approach airspace. The question here is to find out the distance between downwind and the extended runway centerline to make this technique work.

Using standard turns the aircraft needs exactly two minutes for a full circle. That means for a 180° turn it will need exactly one minute. With a speed of 180 knots it will move 3NM in one minute (180 / 60). The circle has a circumference of 6NM (easy to calculate, because the aircraft moves with 3NM per minute and would need two minutes to prescribe a full circle.). All we need to do now is to double the 6NM (we want the diameter of the circle) and divide this by PI. 12 / 3.14 is very approximately 4NM distance between downwind and the extended runway centerline.

Unfortunately this one turn technique just works up to speeds of 220kts, because above this speed an aircraft would be unable to fly standard turns with a bank angle below 30°. Even if the aircraft would probably take bank angles above 30° the passengers most certainly would not.

6.5 Transition

6.51 Definition

The segment between leaving the airway system and final approach is called transition. This is not the same as an RNAV transition. Do not mix up these two terms even if they fulfil the same purpose. Basically the aircraft looses some altitude in the transition segment. At most airports the transition segment is somehow defined and charted. A well-known an commonly used method is the standard terminal arrival route (STAR) that is sometimes combined with a RNAV transition as well.

6.52 RNAV Transition

The RNAV transition is just a defined route with more or less turns, a descent profile and speed restrictions in it. The idea behind this is to ‘widen’ the tight approach airspace a bit to keep more aircraft at one time within approach airspace. An RNAV transition may contain some tight turns and utilization of the same lateral route on different altitudes. So an RNAV transition can usually not be flown without assistance from ATC. Most of the time you will not use these procedures in order to increase the efficiency of traffic flow. You are always encouraged and requested to provide the shortest possible way to final approach.

6.53 Standard procedures

You may ask yourself for what all the STARs and charted procedures are good for if no one uses them anyway most of the time. The answer is really simple: Loss of communication with ATC. A pilot cannot just park in an instance to check his radios. Every minute the aircraft is burning fuel until it runs dry and then the pilot will have a serious problem. So he has to land anyway and to provide safety for all others involved he will follow the standard procedures to do so. Your task as ATC in that case is of course trying to re-establish radio contact and to make the necessary room for the aircraft that will now follow a predefined procedure:

6.54 Radio failure procedure

In case of a radio failure the pilot will follow exactly defined procedures. There are different procedures for IFR and VFR. For the last one it is also of interest if this occurs in airspace C or somewhere else. At least for the IFR flights this is not a condition that requires immediate landing as long as the rest of the aircraft’s systems work within defined parameters. Your task as a controller is to create a safe passage for the manoeuvres the pilot will execute in case of a com failure. Also you have to try to re-establish communications. Starting with the last one there are several ways to accomplish that. Even if the pilot cannot answer you there is a pretty good chance that he can at least receive your transmissions.

First thing to do is to call the aircraft several times. If he does not answer you can be sure, that he cannot answer. To find out if he can receive you there are some possible ways:

"ADR4711, if you receive this transmission squawk ident"

If you see an ident firing up on this datatag you can be sure that the pilot at least receives your transmission. That's the first step. You know that he can receive you, but you do not know if he understands you correctly. He cannot make a read back to you, so consider it as a simple "roger" and keep your instructions simple and brief. If you find it necessary repeat everything twice. To get a clue of the signal quality you can issue a more complicated instruction. The pilot will only follow this if he is absolutely sure that he has understood you:

"ADR4711, if you receive this transmission turn left HDG 270 for one minute, then resume own navigation direct DOL VOR"

Whatever you do, consider this one way communication as unsafe and better keep with the brief instructions. If everything fails here is what the IFR pilot will do:

First he will set his transponder to 7600 and you will get an indication on your scope with a flashing datatag and the words RDOF (radio failure) in it. He will follow his flight plan exactly to the IAF of his destination airport. If he is on an intermediate flight level he will remain on this flight level for 7 minutes before he starts to climb (descent) to his requested cruise flight level on his own. If he has been diverted from his filed route (e.g.: he is on a radar vector) he is supposed to return to his route on a direct way to the next applicable waypoint. Your job (and the job of all other controllers involved) is to clear the projected flight path from other traffic.

Remember that radio failure squawk 7600 is a distress call and has to be dealt with accordingly.

Once he has arrived at the IAF (that may be in flight level 350 according to his requested cruise flight level) he will hold there until his expected approach time or at least for five minutes if no EAT has been issued or calculated.

He then will start to descent in the holding to the minimum approach altitude (mostly the minimum holding altitude as published in the charts).

After that he will start the published approach procedure on his own. He is supposed to land within 30 minutes. If he cannot accomplish that he must divert to his alternate destination airport.

A VFR pilot in airspace C will do the following:

He will also set his transponder to 7600 and will follow his last issued clearance. If he is unable to so anymore (clearance limit reached or due to weather) he has to leave airspace C under VMC (Visual Meteorological Conditions). If he is in airspace C above FL100 he has to leave airspace C immediately.

The VFR pilot, if in airspace C or not is supposed to land on the nearest available airfield in case of radio failure. If he has not received a clearance to enter a controlzone before the radio failure he has to stay away from it. Within the controlzone he has to follow tower's instructions given to him using light signals.

6.6 Advanced vectoring

You already know about separation. We will now talk about how to create and maintain separation as we need it.

6.61 Vertical movement

This is maybe the easier variant, because you do not have to consider very much here. Two aircraft at different altitudes cannot produce any conflicts regardless what lateral path they follow. In order to maintain vertical separation in case of altitude changes you just have to make sure that they do not cross each other's altitude at any time. Climb- or descent rates are the means to achieve that. You must control their rates of altitude change if you want to be on the safe side.

ADR4711 is on FL140 and UKV123 is on FL160. You want the ADR on 6000ft and the UKV on 7000ft. The first descent instruction will be issued to the lower aircraft, which is ADR4711. UKV123 gets his instruction after ADR4711:

"ADR4711, descent altitude 6000ft, QNH 1012, rate of descent 2000ft per minute"

"UKV123, descent altitude 7000ft, QNH 1012, rate of descent 2000ft per minute"

With the addition 'or greater' or 'or less' you will give the pilot some freedom. He will help you if he can, but only if he knows what you are trying to achieve ADR4711 could descent with 2500ft/m to reach 600ft a bit faster than you expect for example.

Issue rates only if absolutely necessary for maintaining separation. Try to avoid any restrictions for the pilots whenever possible.

As already stated in 6.4 you will have to make sure that the aircraft is able to execute your instruction. A Cessna 172 will not be able to climb with 2500ft/m .

Whatever you do remember that this will only work safely as long as no aircraft involved climbs or descents through another's aircraft altitude.

Another interesting question is the lateral distance needed to reach a certain altitude with a given rate of descent. Maybe you have to keep an aircraft on approach at a certain altitude because of a departing aircraft that is crossing below. You already know that you can apply 2000ft/m as a maximum rate of descent for your arriving aircraft. You need to know when you must issue the descent instruction to make sure that the aircraft can perform its approach without delay. Let's say our ADR4711 is at FL110 with 330kts ground speed and you want him at 5000ft:

Altitude difference is 6000ft here and the aircraft moves with 5.5NM per minute (330 / 60). At 2000ft per minute rate of descent he will need 2.75NM for 1000ft . Round this up to 3NM for safety reasons and for compensation of time loss from communication and reaction by the pilot. 3NM x 6(000)ft is 18NM.

Which rate of descent must be applied if the aircraft is 15NM away from the point where it should reach its target altitude? 5.5NM per minute and 15NM to go means 2.5 minutes to fly. 6000ft in 2.5 minutes is 2400ft/m with some safety added you should give 2500ft/m. Just play a bit with rates of descent to develop a feel for it.

6.62 Groundspeed affection

We talked about rates of descent and speeds so far. Those where instructions given by us as a controller. We left out the dependence between altitude and groundspeed so far. This is a physical effect that we cannot avoid, but we may use it for our own purposes.

Let's say you took two aircraft as a package from center. Both of them are on the same STAR on different altitudes. You have not got enough space to separate them laterally in order to get them in sequence. So what do we do?

Our scenario is as follows: ADR123 on FL150 / 300KIAS – UKV999 on FL160 / 300 KIAS, same lateral position, same direction. We need them now both at 5000ft and 3NM laterally separated within 30NM using only vertical techniques.

But before we will solve this situation we have to take a look at the different speeds. The pilot has his indicated airspeed (IAS). The Controller has the groundspeed (GS). The connecting element is the true airspeed (TAS). Since we want to learn how to control here and not how to fly an airplane I will keep this as brief as possible. Just enough to clarify the dependencies.

The IAS is just an indicator how fast the aircraft travels through the air at the moment.

The GS is an indicator how fast the aircraft moves relative to the ground. Everything is corrected here. Air density, wind and so on. This speed is exactly the same a car would have driving on the ground. The TAS is a bit tricky. It indicates the speed a solid body has in a desired media. If we leave the wind aside we only have to deal with the solid body (our aircraft) and the medium (air) in which it moves. Air gets thinner in high altitudes. That means less resistance by the medium resulting in higher speed of the solid body. The conclusion: The higher the aircraft, the greater the speed.

Those speeds are all interconnected. With a simple formula you can determine them. You already have your groundspeed. The indicated airspeed can be obtained from the pilot:

“ADR123, report indicated airspeed.”
“ADR123, indicated airspeed 300kts.”

In our airspace we can use this formula to calculate the TAS:

TAS = IAS + FL/2

In case of the ADR123 this would be

300kt + 150/2 = 375kt

UKV999 would have

300kt + 160/2 = 380kt

If we leave the wind aside we can say that GS=TAS.

We need them both at 5000ft. At 5000ft ADR123 will have

300kt + 50/2 = 325kt

That will provide a speed difference of 55kt leading to an increasing lateral separation of approximately 1NM per minute.

So we need three minutes to separate them by 3NM. We have to descent both aircraft at the same time and one has to reach our destination fix three minutes before the other. So what are the rates of descent?

First, we calculate the rate of the higher aircraft. He is moving with 380kts GS. He’ll need approximately 6 minutes for the 30NM and has to loose 11000ft, so a rate of descent would be 1800ft/m .

The ADR123 needs on its current altitude and speed also 6 minutes, but has to be there 3 minutes after the higher UKV999. So it has to loose the 11000ft in 3 minutes (6 minutes flying time in total and the 3 minutes needed to increase lateral separation leaves 3 minutes for the descent). That indicates a rate of descent of 3500ft/m. Just give it a try. It’ll work.

6.63 Lateral movement

Very often you will get your aircraft from center as a vertical separated package.

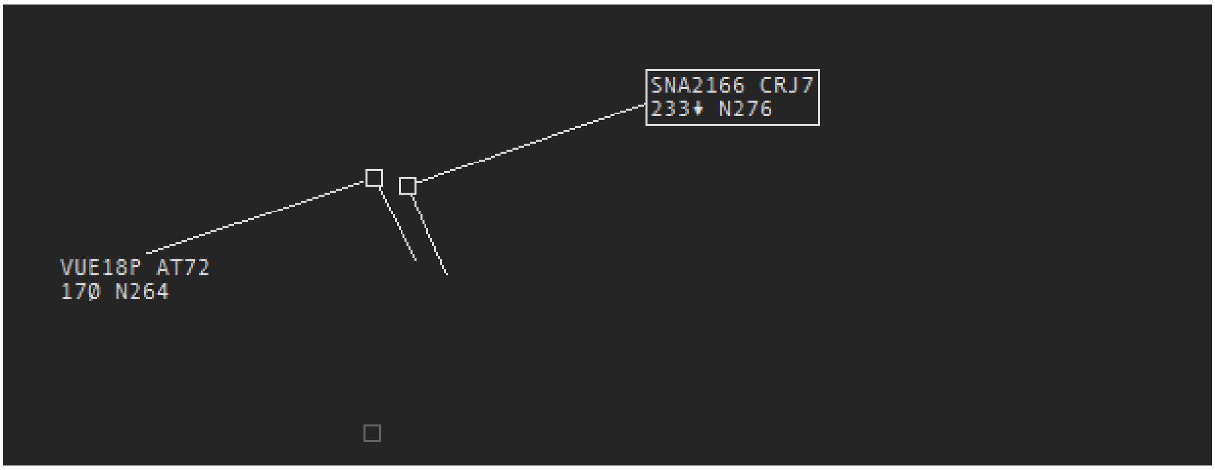


Fig. 6-62-1

We just got these two aircraft from center. Both are following the route to LUMUS, expected to reach LUMUS at FL170 and we want them laterally separated there by at least 3 NM. So one of them has to fly a 3 NM longer track to LUMUS than the other. This will work, because they have the same speed here. We will divert the SNA a bit to the southeast, but how much is a bit in this situation? I could bore you now with some simple trigonometry, but we will keep it as simple as possible. A divert by 30° usually does the trick on these distances. Let’s see what happens:

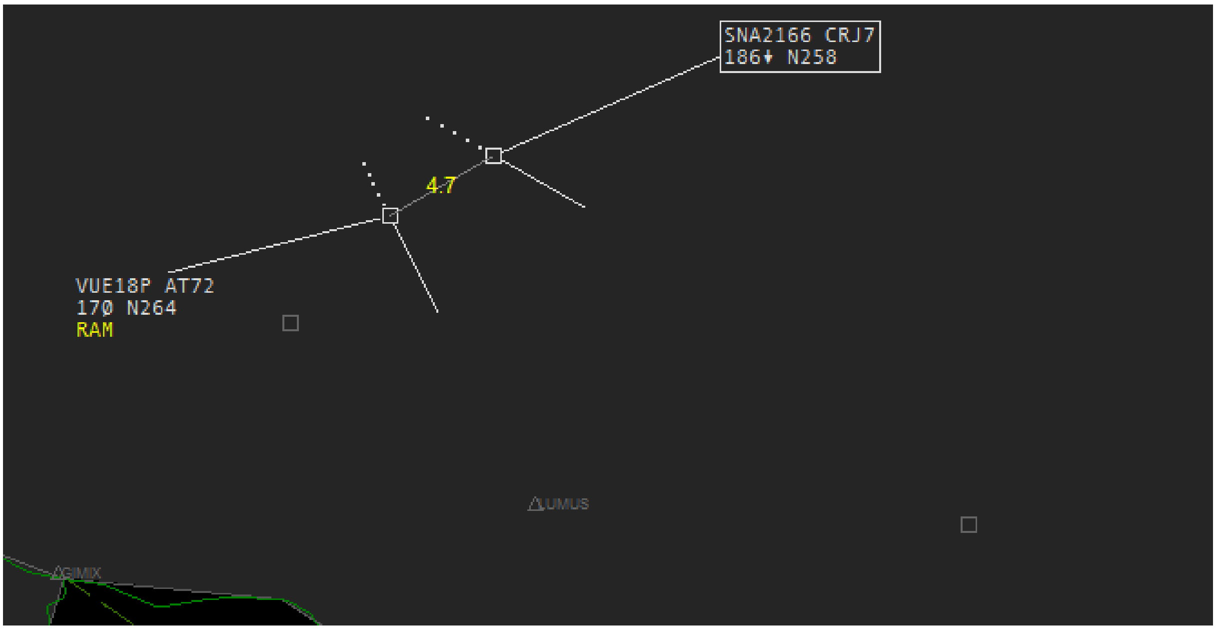


Fig. 6-62-2

After 13.5 NM (half of 27) we must turn the SNA back to a heading to LUMUS. Consider the time you need to give the instruction and the time the pilot needs to execute it.

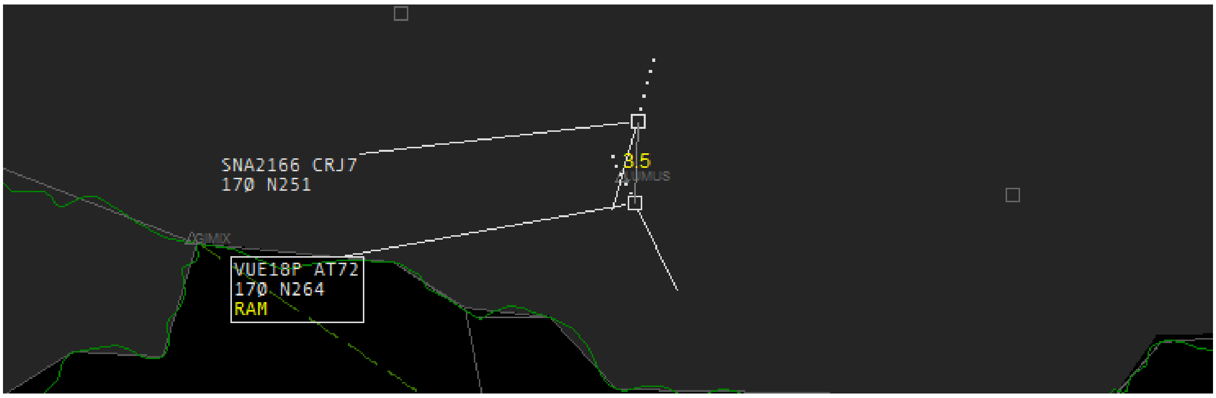


Fig. 6-62-3

So we end up at a lateral separation of 3.5NM. To spare you the work to calculate all your turns everytime you can use the following table. It shows the direct distances from one fix to another and the adjacent angle needed for turning one aircraft away to create at least 3NM lateral separation. The angles are already adjusted for safety and time compensation.

	10NM	15NM	20NM	25NM	30NM
Angle	**50°**	**40°**	**35°**	**30°**	**30°**

Tab. 6-62-1

6.7 Sequencing and spacing

6.71 Introduction

You will probably find building a proper sequence regarding safety and efficient traffic flow a bit difficult in the beginning. One difficulty is about technique, which can be teached by demonstrating it on certain situations. The other thing is to tighten the sequence for a better efficiency, but that requires experience, which you have to collect by constant training.

In fact almost anything will become easier with growing experience, because you do not have to think about it very much anymore.

You may have the feeling that the traffic runs faster in approach airspace, than it does in center airspace. Subjectively this is correct and caused by your limited sector size and maybe mistakes made by your center controller. You do not have much space to get arriving aircraft into sequence. If we take the approach airspace of LJLJ for example it has only a radius of 30NM (more or less) with a ceiling of FL145. Effectively you can use only 20NM lateral for your sequencing when working on a direct approach. If we take the minimum of 20NM with an aircraft moving with 180kts it will have crossed our entire airspace in seven minutes. The same aircraft at 330kts will cross our airspace in four minutes. In our simulation you can cut at least one minute for establishing communications and that is very optimistic.

Those are of course extremes and with the help of releases you can extend your available space a bit, so that you will have some more time to work with. This time may vary from airport to airport. There are airports in our area where you have 10-15 minutes, but there are also airports where it tightens up to five minutes.

6.72 Airport capacity

One thing you should be absolutely clear about is the maximum capacity one airport's runways have. You can calculate that yourself for your airport. Our minimum lateral separation is 3NM. You need now your longest possible final approach. In LJLJ you can use 20NM from airspace border to the outer marker. With 3NM spacing you can have 6 aircraft simultaneously on final. We get more capacity from working with vectors, but that does not increase the capacity a lot. We can use 2 aircrafts for calculation. So our runway capacity is 8 aircraft. Note that this has nothing to do with the landings per hour, because this would have something to do with speeds. The number just tells something about how much aircraft can be handled at once (theoretically). I can have 8 aircraft at once in my queue. If the first one on final has landed, I can add another one at the end of the queue. If they move all with 180kts with a 3NM spacing on final I could do this every minute. If I would get two new aircraft every minute with 8 in the queue already I would overload my capacity and I would have to do something about that before it actually happens.

Of course this is just a mathematical example. If you just take half of your calculated capacity you will get the numbers with what you can safely work in our simulation. Also this number just tells you something about how many aircraft you can keep in the queue from IAF to the runway. It says nothing about how much traffic can be in your airspace at all.

6.8 Holding procedures

Holding procedures may be issued for different reasons:

- The sector has exceeded its capacity
- The destination airport is temporarily not available
- On pilot's request (e.g.: waiting for weather improvement)

A holding procedure is basically flying circles in a defined area. Whenever possible you should only use published holding procedures:

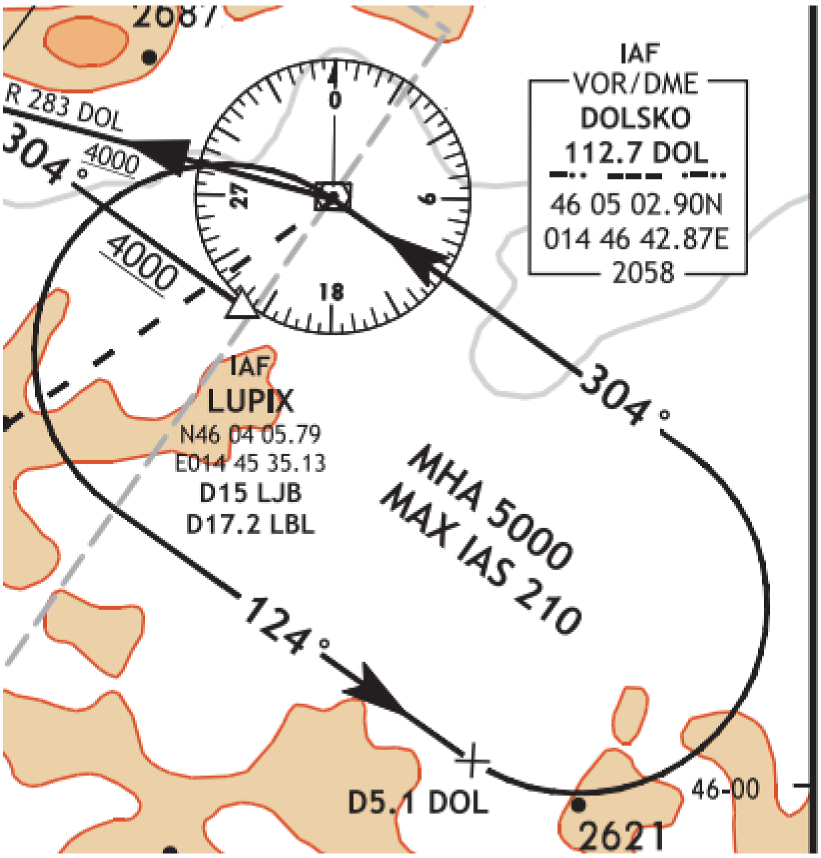


Fig. 6-8-1

Holding procedures can be established almost everywhere. Usually over a waypoint, navaid or fix. It is also possible to hold an aircraft at its present position. The one in fig. 6-8-1 is established over a VORTAC.

Since this is published on the charts a holding instruction here is very simple:

"ADR4711, hold at DOL"

This will instruct the pilot to hold over the DOL VOR at his last cleared flight level and this is also the shortest possible hold instruction.

But you will not use that short form very often. You had a certain reason to build up a holding in the first place and if it comes to that you usually have more than one aircraft in your sector. So you want them in certain levels in the holding. Getting additional aircraft from center you instruct them to descent to their holding level. This descent instruction should be given with the holding clearance. You usually start from bottom to top. The lowest available level here is 5000ft.

Let's say you receive ADR4711 at FL130 and UKV999 at FL140:

"UKV999, identified, hold at DOL, descent A5000ft, QNH1029"
"ADR4711, identified, hold at DOL, descent A6000ft, QNH1029"

Issue rates of descent if necessary to avoid any conflict.

Another point is that you should inform the pilot of the expected approach time (EAT)he has to wait. Everything less than 20 minutes is considered as no delay and is said so.

"ADR4711, hold at DOL, no delay expected"

If a delay of more than 20 minutes is expected you should inform the pilot accordingly:

"ADR4711, hold at DOL, expected approach time 1230 UTC"

Together this will become:

"ADR4711, identified, hold at DOL, descent A6000ft, QNH1029, expected approach time 1230 UTC"

In case the expected approach time has changed you also have to inform the pilot:

"ADR4711, revised expected approach time 1240 UTC"

This is important, because in case of a radio failure the pilot will continue his approach at 1240 UTC. So you have to keep track of your issued EATs at any time.

Sometime the best holding is not needed anymore. To cancel a holding you just have to issue a new clearance. That could either be a vector, a direct or even a clearance for an arrival route or transition:

"ADR4711, turn left heading 120"
"UKV999 proceed direct BASTA"

You can also make use of the navaid:

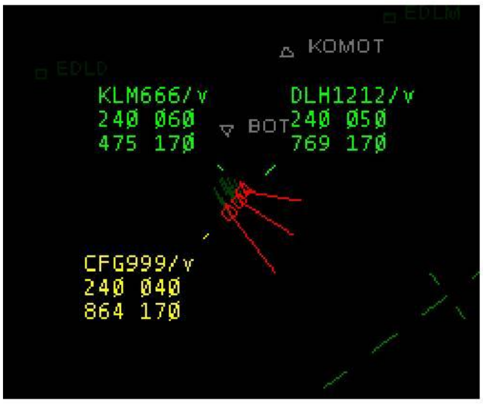
"ADR4711, leave DOL on radial 160"

But how to disassemble a holding? You could say, it's easy. You get one out, let the others descent with certain rates and so on. It would work and would also be pretty safe, but how long would this take?

Well if it is applicable you could clear them on a transition and let them descent there or you could use a fan technique:

Fig. 6-8-2

This is your situation. Three aircraft in the holding all vertical separated. The extended runway centerline is located to the south-east. We'll take them out of there all at once and sequence them for the ILS approach. This is accomplished with different headings. I will not even have to let them descent, because I simply extend the ILS a bit and let them descent with the glideslope.



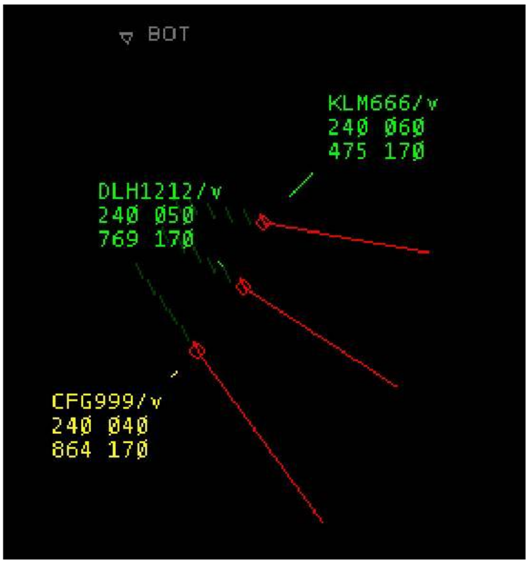


Fig. 6-8-3

Fig. 6-8-4

Turning them out of the holding with a 10° offset to each other. I just set the lowest on a 90° angle to the extended runway centerline. In this case 140° for CFG999. DLH1212 is at 130° and KLM666 on 120° as you can see in fig. 6-8-4.

Fig. 6-8-5

At the right moment I just turn them, clear them for the ILS and let them descent with the glideslope.

6.9 Director

The approach airspace can be (and is usually in the real world) divided into several sectors. Those sectors can be defined either lateral or vertical or both. This has to be done, because the real world's traffic amount is much higher than that in our simulation. But even here you have some divided approach airspaces. Usually you'll find a north and south sector on airports with parallel runways. However, regardless how many approach controllers share one area their common task is to guide the aircrafts from the airway system to a point where they can initiate their final approach to land. And that's the point where a director is sometimes needed.

Simply said the director is the boss of the final approach. Many aircrafts approaching an airport from different directions at the same time. If we take a look at the concept of dividing the approach airspace in a north and south area with one controller in charge of each sectors, we will have two independent downwinds. It would be very complicated for two independent approach controllers to coordinate themselves who turns which aircraft into final approach at a given point and time. This is where the director comes in. If we stick to the most common type of final approach, the ILS, the primary task of the director is to "feed" that ILS with the aircrafts coming from the several downwinds. Sounds easy? But it is a challenging position if you do the job right. The director has to make sure that he uses the ILS most efficiently without violating any aspects of security, regulations and procedures, including wake turbulence separation on final approach, that apply for all approach controllers. That means he has to ensure separation and considering different aircraft types and their performance to plan the sequence on the ILS.As an approach controller working together with a director you'll have to make sure that everything runs within defined parameters. Recalling chapter 6.33 from this study guide, the approach controllers have to make sure that their aircraft are on a defined altitude and speed before they are handed over to the director. On an airport with parallel runways and a north and south approach the definitions could be as follows:

Glideslope is intercepted at 3000ft, 10NM out. The north sector, with a shorter downwind, sets his aircrafts on 4000ft on downwind. South sector does the same at 5000ft. Speed for all aircrafts on downwind is 220kts and lateral separation is 5NM. This will give the director an excellent start to work with the aircrafts. They are all vertical separated from each other and from those on final approach, so he can turn them immediately. He has also some room to move them vertically.

This strict pre-sequencing explains it also why a pilot is supposed to report his call sign only on first contact with the director. Since they are all on the same heading, altitude and speed there is nothing more to report than "Hello, here I am and waiting for instructions". Another reason is that the director's frequency is usually the most busy one in the whole system.

Just a few advices for working as a director:

- Concentrate on the final approach segment. The director position is probably the only one that does not require to scan the scope. Your area of responsibility fits usually on your scope.
- Make sure that you stay in control. You will have new pilot's calling in all the time, but you will recognize that it is not possible to answer all these initial calls in an instance. So do not try. Instead find yourself some way to keep track of the calls. So you cannot forget anyone.
- Always remember that you will have constant incoming traffic. This is not like ordinary approach control where you will get 4-5 aircraft at the same time and then there is nothing new for the next 6 minutes. All your instructions have to be well planned ahead. There is no "break" on the director's position to cover (self-made) mistakes.
- If you miss a turn or something that makes it impossible to get an aircraft into the final approach sequence, do not try to mess around with that aircraft. Do not try to do wild vectoring stuff. You do not have the time and the room for that. Instead coordinate with your fellow approach controllers to hand those aircraft over again and let the approach controllers put them back for another approach.

- Hand all aircraft over to tower as soon as it is practicable. This can usually be done if the situation is safe. Establish the aircrafts on the ILS, give your final speed instructions if necessary and get them off your frequency.

7. Traffic Management

7.1 General Introduction

Until now you should have learned the necessary techniques a radar controller needs in the lower airspace. But that is only half the skills you need to become a good approach controller.

Traffic management consumes half your resources on an approach position. Besides the fact that you have to be totally aware of the situation in your own sector, you also have to get a picture of what is going on at the airports you are serving and also how is the situation above and on your neighbouring sectors. That's what makes the approach control position that challenging.

7.2 The big picture

Under normal circumstances everything should run like a clockwork. You are working in a team together with other controllers. It is a bit like “assembly line working” . The only problem is that you as an approach controller are neither the head nor the tail of the line. You are right in the middle. That's a difficult position in the line if you imagine that your particular line runs bi-directional. You can say that the approach controller is the pacemaker of the whole team. Everything depends on him and his skills.

You have to be aware of all those things:

Keep an eye on center's airspace. How many aircraft arrive from and how many will leave to your own center controller and when will they do that.

Keep an eye on neighbouring center sectors for the same reason if you have to deal with them directly.

Keep track of the departures of your airport(s). Can your airspace handle that amount of traffic, considering the arrivals according to the timeframe a departing aircraft needs to leave your sector?

Oversee the total capacity of your sector and react in time.

At the same time you have to do all of the following:

Coordinate the traffic flow with both ground and adjacent radar controllers. Maintain separation.

Plan ahead like a chess player. How will the sector look in the next 10 Minutes?

Plan approach sequences so far ahead that you consider also aircraft that are about to reach your sector within the next 5 Minutes.

All this together can become impossible if you do not know how to set priorities and filter out information that is important.

7.3 Often made mistakes

Most situations where a controller looses control of the situation can be avoided. There are some simple conditions that can trigger a chain reaction.

As long as there is not much to do the concentration is focussed on the own sector, providing excellent service and perfect procedures for every single pilot. The danger is that the inbound wave that is already coming will be recognized too late. If you put too much attention on providing a perfect intercept course for example, you have to zoom in so much that you can barely see your own sector at all, rather than the surrounding area. Faster than you are aware your airspace is full of aircraft and you have nothing prepared so far. The short reaction is to deal with the traffic as it comes without a plan just focussing on separation. If the inbound wave continues and more and more aircraft arrive you will have your total chaos.

7.4 How to maintain control?

It is really simple. The top rule is:

- Under all circumstances keep scanning the scope!

In addition to that keep the following hints in mind:

- Do not let single situations distract you too much, keep scanning.
- Create failsafe scenarios, which do not need your immediate attention regardless what happens, keep scanning.
- Build yourself “bridges” to remember certain things or let the pilots do the job for you and of course keep scanning.

7.41 A situation from a psychological point of view

It is in the human nature to focus on dangerous situations and to forget the whole world around you. The brain switches to a very simple mode if it comes to close situations. The whole decision making process is narrowed down to “fight or retreat”. Now that we know that we just have to find a way to prevent this. A good point to start is to analyse this switching process. A very simple example:

You have two aircraft on final approach, your scope is zoomed out to fit the whole sector in. The two planes are 7NM separated and seven others are on their way to the airport. Everything runs smooth. The second plane on your final approach catches up now and the separation is melting down to 5NM. Your brain takes a notice of that, but does not consider it as threat, yet. So you continue doing your job, ignoring the developing situation. At the same time you’ll have those two planes in mind and your brain starts to think if this can still work out that way. You start to zoom in (even if you do not realize this !). The separation is down to 4NM. For your brain this is becoming a threat and at the lowest level everything is considered a life threat what your brain has been conditioned for earlier. This happened already during your training where your mentor told you more than once that everything below 3NM is a conflict situation. That’s the point where it gets out of your hands if you do nothing to prevent it.

You already zoomed in and you have almost forgotten the aircraft in your sector that you actually cannot see anymore. Now you zoom further in while your brain has already begun to think in simpler terms. It thinks, that the second plane catches up, so it must be too fast. You have to slow it down. Meanwhile your adrenaline rises and you build up fear. That will start the rest of the process. You forget everything, but this single situation. You recognize the calls of other aircraft, but you are unable to let go of the situation, because you are still in the “fight or retreat” process. All you do now is watching if your countermeasures solve the problem. It certainly does not, because it is impossible to regain separation with speed alone here and that’s it. You lost control of this situation and of your whole sector. That’s because meanwhile all other traffic keeps moving. In the end your brain concludes that it cannot win this fight what leaves it with the retreat. You turn the second aircraft out. The threat is over, you calm down, zoom out again and suddenly you realize that your sector is out of control. Everything starts over, but this time you have not just two aircraft to deal with. And now you do not only have to fight the chaos, but also your own disappointment. This is also eating up your resources. You’ll start vectoring with just one priority: Separate the aircraft at all cost, which makes the chaos even worse, leaving you almost no time to think, plan, coordinate. In simple terms: You lost control and in the worst case you are unable to regain it.

7.42 Prevention of loosing control

First of all: Do not let fear take control over your judgement. You have to be totally aware of yourself. Avoid zooming in too much. Even if you do, you have to force yourself back to a zoom level where you can oversee your whole sector.

Fear is caused by being unsure. If you are unsure what to do or which effect has a certain action you will raise fear. So be sure that you do the right thing in a certain situation. You can test those actions during your training. That's what training is all about. If you do not know the limits, you cannot expect from yourself to stay within them in a close call.

Of course you should recognize close situations long before they are established. Action is always better than reaction. If you just react you have no control. You are being controlled then.

If you have a close look into your body functions you will recognize when your instincts will take over and that is exactly the point where to pull the emergency brake:

- Keep your scope at a zoom level where you can oversee your whole sector.
- Everytime before you are going to zoom in make a quick scan of the whole sector. This picture will be imprinted in your brain and with a little training you will be able to remember the situation like it was and with some additional training you will also know how it will look after 2,3 or 4 Minutes.
- You can also trigger the 2 or 3 Minute reminder in your controller client before zooming in as a reminder bell.

8. VFR traffic

8.1 When to encounter VFR traffic

Due to our airspace structure you will barely have any contact with VFR traffic. There are two possible reasons why a VFR flight will require your services. One is that he is suddenly out of VMC conditions. This may happen due to weather or simply disorientation of the pilot. The other reason is a planned flight through airspace C or D.

8.2 IFR pickup

We'll start with a change from VFR to IFR first. If a VFR pilot loses or is unable to return to VMC conditions and due to that he is unable to land his only chance for safety is to contact ATC and request an IFR pickup. Basically the pilot requests to start an IFR flight from his present position:

"Ljubljana Radar, S5-ABC"

"S5-ABC, Ljubljana Radar"

"S5-ABC, C172, 5NM inbound DOL VOR R180, altitude 2500ft, VFR to Ljubljana, request IFR pickup due to weather"

This would be a typical request in such a case. Remember that this is all about responsibility and airspaces. As long as he is VFR he is VFR. He has no permission to enter airspace C and has to maintain own separation. He is simply self-responsible for his actions.

Ok, for every IFR flight a flight plan is needed and we need to issue a squawk code in order to identify the aircraft. If the pilot has filed a flight plan that does not totally mess up our operations we should simply use that plan. If he has not filed a flight plan we have to make one up.

One could ask why we do not provide him with vectors? Ok, to answer that for yourself you should take into account why we do not provide a flight from KBOS to LJLJ a simple vector for the whole route. It is plain simple. Since he will become a regular IFR flight we have to separate him from other traffic even if his communication is failing. In that case it is better to know where the pilot will fly.

First we should ensure a positive radar identification. This can (in real life) be difficult regarding our MRVA and therefore the technical limitations of the radar system depending on the aircraft's altitude and the surrounding terrain. Here we have always at least a primary target even if the aircraft is still on the ground.

We'll first issue a squawk to the aircraft and then we'll try to identify him. If that fails look for alternate ways of radar identification at 9.1.

I'll show you the necessary steps one at a time. At the end of this chapter is a combined sequence as you would normally do for an IFR pickup.

"S5-ABC, squawk 5301"
"S5-ABC, squawk 5301"
"S5-ABC, identified, indicated altitude 2500ft"

All we have done here is a positive radar identification of the aircraft and a verification of his altitude. Nothing more, nothing less. The pilot is still bound to VFR with all the restrictions mentioned above.

So what is still needed to switch the aircraft to IFR? We need to let the Pilot know, when IFR will start.

„S5-ABC, cleared to Ljubljana via DOL VOR, climb altitude 5000ft, IFR starts when passing 4000ft / at DOL VOR / now[1].“

8.21 IFR pickup in sequence

As promised the communication as you would normally do it:

"Ljubljana Radar, S5-ABC"
"S5-ABC, Ljubljana Radar"
"S5-ABC, C172, 5NM inbound DOL VOR R180, altitude 2500ft, VFR to Ljubljana, request IFR pickup due to weather"
"S5-ABC, squawk 2210, cleared to Ljubljana via DOL VOR, 5000ft"
S5-ABC, squawk 2210, cleared to Ljubljana via DOL VOR, 5000ft"
"S5-ABC, readback correct, identified, indicated altitude 2500ft, climb 5000ft, IFR starts when passing 4000ft"

8.3 Clearance for airspace C

Another possible reason to deal with VFR flights in your sector is a VFR flight who wants to fly under VFR rules in airspace Charly.

Every aircraft entering airspace Charly needs a clearance to do so and even if he stays within VFR he needs a route. The reasons for that are already explained in 8.2 . After the initial call a typical request for that could be as follows:

E: "S5-ABC, C172, VFR to Portoroz 10NM south DOL VFR, 2500ft, request crossing airspace Charlie of Ljubljana via DOL VOR R270"

Remember that the aircraft will fly under VFR even if you clear him to enter airspace charly. So we do not issue instructions to that aircraft unless it is absolutely necessary to avoid imminent danger.

---

[1] „now" is only valid if the aircraft is above the Minimum Radar Vectoring Altitude (MRVA)

What a controller can do here is assigning a squawk code to make the tracking a bit easier especially if you have more than one VFR aircraft in airspace charly. This is done as usual and also the radar identification is done as you would do with an IFR flight.

Ok, next thing to do is to issue a clearance for entering airspace Charly. If we are satisfied with the route the pilot suggested, we can use it. Otherwise we can also divert from it, if we need to, but you should try to respect the pilot's requests if possible:

E: "S5-ABC, crossing approved via DOL VOR, Altitude between 6500ft and 8500ft "

VFR is supposed to fly on these "odd" flight levels or altitudes. While IFR will use 9000ft, 10000ft or FL130 for instance the VFR pilot will use 9500ft, 10500ft or FL135.

From the time where he enters airspace charly, which is 5000ft on this route, he has to maintain radio contact with ATC and is not allowed to leave the frequency without permission. He does not need any climb instructions. We simply lifted his vertical limit, in this case 5000ft, which is the lower border to airspace Charlie in this sector, up to 8500ft where he can move. At the same time we restricted his lateral movement freedom to the route for which the clearance is valid.

After he has received and read back the clearance he will climb on his own to an altitude between 6500ft and 8500ft and will follow the assigned route.

We can alert him when he is entering airspace Charlie by the following phrase:

"S5-ABC, you are entering airspace Charlie"

His clearance for airspace Charlie is valid only via DOL VOR. That means he has to leave airspace Charlie after passing DOL VOR on his own and via the shortest way possible. Alternatively, ATC could have assigned exit instructions, such as:

"S5-ABC, crossing approved via DOL VOR, leave DOL VOR R270 outbound, Altitude between 6500ft and 8500ft."

Or

"S5-ABC, crossing approved via DOL VOR direct ILB VOR, Altitude between 6500ft and 8500ft."

You have to separate IFR to VFR, but not vice versa. You cannot expect a B744 to divert from his route just because a C172 pilot wants to sniff some thin air. To do that you can issue just normal climb/descent or turn instructions to the VFR pilot, but that would not be what VFR is all about. The better way is to plan ahead and give the VFR pilot traffic advisories far ahead, so he can react on his own:

"S5-ABC, traffic, 9 o'clock, 8NM, heading 180, B737 suggest left turn heading 230"

The suggestion is just as it tells, a suggestion. The pilot is not bound to that, but he will inform you about his intentions:

"S5-ABC, traffic in sight, making left 230, then resume own navigation R270 DOL"

At some point, the pilot will have left the Airspace Charly of Ljubljana and we can release him from our frequency:

"S5-ABC, you are leaving airspace Charlie, approved to leave"

8.4 Change from IFR to VFR

Also this can happen. Let's assume an aircraft, maybe a business charter jet, has filed an IFR flight plan from Munich (EDDM) to Celje. Celje has no control zone, so it is an uncontrolled airport without any instrument approach facilities. So an IFR flight to that airport is not possible. The pilot has to cancel his IFR flight plan at some time in order to approach this airport VFR. In order to do that the pilot will report as follows:

"S5-ABC, cancel IFR"

If you receive such a request there are basically two possible reactions to this. One is to comply with the request and one is not to do so (what a surprise). Ok, if you comply with that you'll answer:

"S5-ABC, IFR cancelled at 1240 UTC"

The time is important here, because of two reasons. One is to keep record of the change of flight rules, the other is important to real life only. Only the IFR part of the flight plan will be cancelled. The flight plan itself remains active until landing. So the pilot has to inform ATC about the landing. If the calculated flight time is exceeded to much there would be some research conducted.

If it is necessary to get him out of airspace charly you can add this instruction (as any other needed instruction) after the cancel instruction:

"S5-ABC, IFR cancelled at 1240 UTC, descent below 5000ft QNH1023"

If you are not able to comply with the request you have to issue the following instruction:

"S5-ABC, unable to accept cancellation, due to converging traffic"

If you cannot follow a pilot's request always try to provide a reason for the pilot if time permits. Even it is not necessary it is always good service for the pilot and if he knows the reasons for specific actions you'll give him a chance to support you as good as he can.

9. Special procedures

9.1 Alternate methods of radar identification

Sometimes you have to identify an aircraft without SSR, means you'll get no telemetry data read outs like squawk code or altitudes. VFR aircraft are often not equipped with a transponder with mode C. All you'll get is a primary target. What is radar identification? We remember that radar identification is just to make sure that the primary target you are looking at is the aircraft you are looking for. Usually you would get the squawk code you have assigned to the aircraft shown in the data block as soon as the pilot dials it into his transponder. But you have only a simple dot marking a primary target.

So what do we do? There are several methods. In case you just have to deal with a transponder secondary radar readout failure you can do the following:

"ADR1234, squawk ident for identification"

If you get the ident indication on your scope on the aircraft of interest, you can be sure that it is the aircraft you are looking at is the same as the aircraft you are talking to.

We talked earlier about not providing any instructions to unidentified aircrafts. But there is one exception and that is for identification purposes. You can instruct an aircraft as follows:

"S5-ABC, turn left heading 120 for 1 minute, then resume own navigation direct DOL for identification"

If you monitor the aircraft of interest closely and you watch how he is following your instructions you can also pretty sure that it is the aircraft you are talking to and you can identify him.

But always remember if you have no SSR you have no information about altitudes. You'll have the pilot report those information to you:

"ADR1234, report altitude"
"**ADR1234, 5000ft"**
"ADR1234, roger, climb FL110, report passing 8000ft"

You'll have also keep track of altitudes and if it is necessary you'll need to do the same with the speed.

9.2 Emergencies / aircraft in distress

In real life those are the most difficult situations to master. If it comes to this point the aircraft, the pilot(s) and the passengers are in real danger and it is the top priority to get this aircraft back on the ground as fast as safety permits.

9.21 Definition

You will encounter an emergency from time to time in our simulated environment. Most of them are set up in a way and some of them are real (simulated). Sometimes you will experience an abuse of an emergency just to catch some attention or to speed up the flight in busy airspaces.

Basically you can say that an emergency is a situation where the pilot cannot guarantee a safe and secure handling of the aircraft anymore or vice versa (also pilots may fail).

At this point you have to remember more than usually that your job as a controller is not to instruct a pilot how to fly or how to operate his aircraft. Your job is to maintain air traffic safety, uphold an efficient traffic flow and assist the flight crews.

9.22 Emergency set-up

Most of you know the squawk 7700. That is a clear indicator of an aircraft in distress, but it is not mandatory to dial in this squawk for an aircraft in distress. The code is meant to use in situations where this is the only chance for the pilot to communicate with you, similar to the 7600 code. As long as the pilot is able to communicate with you he will just declare that emergency to you and not every emergency actually is one in the first place. Usually it is a developing situation for example: A pilot reports you some power loss in an engine. On a multi-engine aircraft this is not an immediate danger and at this point just an information. It should put you into a low alert state, but nothing else. You have to treat the aircraft as usual. If the problem cannot be solved by the flight crew or if it gets worse the pilot may declare an emergency some time later.

As already said, an emergency is not usually declared by setting the transponder to 7700. The pilot may just report:

"ADR4711, declaring emergency. Engine no.1 failed. Engine no.2 power at 70%"

If it is urgent or may be the frequency is overloaded the pilot will force your attention to him:

"MAYDAY, MAYDAY, MAYDAY. ADR4711, engine no.1 on fire."

This is some kind of an override on the frequency. The word mayday is recognized even if there is an overlay of two transmissions at a time and should cause an instant release of the PTT key of all other stations.

9.23 Duties of ATC during an emergency situation

As already said the top priority is to get this aircraft as fast as safety permits to the ground. There are some basic rules that apply to all aircraft in distress. You have to give that aircraft the right of way over all other traffic even if that means that other aircraft have to enter a holding or to discontinue an approach.

As we are in approach area here it is much likely that the aircraft is already close to his destination airport, so use diversion only if it is unavoidable for safety reasons or on pilot's request.

Rule no.1 is always to let the pilot make the decisions. He is in control and he is responsible for all the lifes on board. Just give him some room to execute whatever he is about to do as long as safety permits. Try to assist, but not to instruct. Try to help, but not to dictate. Listen closely to his requests and make possible whatever is possible for you to make.

Remember that this is a stress situation even for experienced pilots.

Keep your frequency clear. Issue brief instructions to other aircraft that might be in the distressed aircraft's flight path and let some room is the aircraft in distress tries to contact you. You can also push other aircraft's into adjacent sectors or divert them if needed.

Coordinate with other sectors and especially the tower controller of the airport where our emergency is about to land, because he must also take some precautions.

A word on the head count. You may know this from some movies and it also exists in the real world. The only purpose to request a head count, which will be reported as passengers + crew (e.g.: 102+3), is in a situation where it is most likely that the aircraft will not be able to land safely. It just assists the investigators of the potential crash site with the body count of survivors and casualties. This might be gross, but this is reality. However, since here in the simulation no lifes are at stage we should handle emergencies without asking for the head count.

It really depends on the situations which course of action to take. You as ATC can provide a pilot with a lot of freedom what to do. You could offer free turns, climbs and descents to any directions and altitudes. Also most pilots would / must prefer visual approaches on a runway of their choice. You can accomplish that by keeping other traffic away and by coordinating with other sectors and the destination airport's tower controller.

Try to avoid unnecessary frequency changes. You can obtain a landing clearance from the tower and issue it to the pilot keeping him on your frequency all the time. Once he is on the ground it is still early enough to approve him to leave your frequency.

Assist the pilot on his request. Do not issue information that he did not request unless it is a vital information. However it may never hurt to verify essential things like gear down or airport in sight.

9.24 Planning ahead

It is also a good idea to think ahead. If a pilot reports electrical problems it is much likely that his radios are going to fail. In that case you can issue instructions what to do in order to prevent him executing the radio failure procedures:

"ADR4711, if radio contact lost, wind 220 degrees, 5kts, runway 30, cleared to land"

or to spare communications in the hot phase of flight:

"ADR4711, if no transmission received for 5 minutes, wind 220 degrees, 5kts, runway 30, cleared to land"

9.25 Special procedures

Imagine what to do if the gyroscope failed. The pilot will only have his compass left and no proper indication of his heading, but he still has his turn indicator. You can issue "no gyro vectors" here, just instructing the pilot when to start and stop his turns with a given rate. We remember that an aircraft needs 2 minutes to prescribe a full circle on standard turn rates and 4 minutes if you do half the rate. We can work with that:

"ADR4711, this will be a no gyro vector for ILS to runway 23L. Make all turns one (half). Start and stop all turns on the command now."

And then you go:

"ADR4711, turn left now"

and to stop:

"ADR4711, stop turn now"

9.3 Coordination

Coordination is one the most important things for any (radar) controller. Everything out of the ordinary has to be coordinated in some way. In reality there are standalone units that do most of this job. You will know at which time a specific aircraft will be at a given fix in your sector. With some simple calculus you could do the same here, but that leaves the question if it would help you doing your job. So better go without that.

On the other hand a good method of coordination is essential for maintaining an efficient flow of traffic. Most sectors have their standard operation procedures. They work out well most of the time, but you could squeeze it a bit more, if you coordinate certain actions at the right time.

9.31 What has to be coordinated?

As I said, everything out of the ordinary, meaning not within the limits of the standard operation procedures. This can be simple things. Imagine that it is stated in SOP that center will hand over all approaches at RADLY fix at 10.000ft. Now he has an aircraft that comes in a bit high and it will not make it to 10.000ft in time. The SOP says clearly 10.000ft. Center has now two ways to handle the situation. One is delaying actions, like some vectors or may be an enroute holding to loose some altitude or he will simply coordinate with approach a hand over at RADLY at FL130 for example. Another example would be the type of approach. If your SOP states that the standard is an ILS approach you will have to coordinate any visual, LOC/DME or any other kind of approach.

9.32 How is coordination not done?

Remember chapter 3.33, 3.34, 4.21 and 4.22? We talked about responsibilities and the technical aspect there. We will now evaluate the coordination procedure itself. Often coordination is mixed up with indication. You will hear a center saying something like:

"ADR4711 comes at FL150 at RADLY and I set CFG123 right behind at FL160"

and the approach controller:

"ADR4711, CFG123, um, ahhh, ok"

This is not coordination this is just indication and you could go a step further and call it dictation.

In coordination you will always have two units involved. An initiator and a receiver. You can imagine this as some sort of question and answer game.

If I would be a center controller who wants to divert from the standard procedures, I have to ask you as my adjacent approach controller for permission to do so. I cannot just force you to take a decision for granted that I already made. Basically it runs like this:

Center: **“Hello approach. I got aircraft xxxx and want to do this and that with it”**

Approach: **“Ok, you can do so.”**

or

Approach: **“No, you cannot do that”**

And that is obvious, because the center controller has no idea what approach has been planning to manage the traffic in his sector. May be center’s idea works out well for himself, but it could destroy a well laid plan of the approach unit.

9.33 How to do it the right way?

First of all keep the talking brief as you would do with the aircraft under your control. It does not help to tell center, tower or neighbouring approach units a book with 1000 pages. Even if it sounds kind of abstract to you, just stay with the brief phraseology. It will safe precious time and covers for misunderstanding as well.

As I said earlier forget the time based coordination, because it is rather unimportant for our simulation, so the phraseology used here is slightly different from the original, but it will serve our needs.

The “Approval request” is one of the most needed coordination procedures for the approach controller. It is used for a short cut request or a diversion from standard flight levels.

Our example is you as an approach controller want to issue a direct for ADR4711, which is over MOGUL fix, to TARGA fix. The aircraft will leave your sector and enter center sector 10NM to the north east as where center would expect him. So you start coordination by calling center on your preferred method of communication (Teamspeak, intercom, text, etc.):

Approach: **“center, approach”**

Center: **“center”**

This is just like an initial call with an aircraft. The initiating station states the call sign of the station to be called first, followed by his own call sign. The called station answers with his own call sign only to signal he is ready for communication.

Approach: **“approach, approval request, MOGUL, ADR4711 request direct TARGA.”**

First state your own call sign. This is important, because you could also make a coordination for another unit. The tower for example. The next thing is to indicate the type of coordination, which is approval request here. Next is the fix where the aircraft is right now. You could do also a point out instead or additionally. Followed by the call sign of the aircraft and the request itself.

Center has now some alternatives to answer. If he agrees with your request he will answer as follows:

Center: **“center, direct TARGA approved”**

Now a read back of yours is required:

Approach: **“direct TARGA approved”**

and center will confirm the correct read back:

Center: **“correct”**

And that’s it.

If he disagrees with your request he will answer this:

Center: **“center, unable to approve”**

He can also offer you an alternate for your request:

Center **“center, unable to approve, proceed ADR4711 direct OLGUR”**

A read back is also required here as demonstrated above.

Remember the alternative radar identification from 9.1? If you have ADR4711 identified that way, may be because it is simply not equipped with a mode C transponder, you will have to hand over this aircraft to another sector. This is called transfer of radar identification and, as it is out of the ordinary, it has to be coordinated:

Approach: **“Center, approach”**

Center: **“Center”**

Approach: **“Approach, radar handover ADR4711”**

Center: **“ADR4711, go ahead”**

Pass all relevant information to the accepting station that he will need to make sure that you both talk about the same aircraft. Also include information about clearances as well, because you both will only have this aircraft as primary target without any information displayed.

ADR4711 is at DOL VOR at 4000ft and you cleared him for FL140. Present heading is 090:

Approach: **“ADR4711, DOL VOR, 4000ft, cleared FL140, heading 090”**

If center is pleased with that he will answer:

Center: **“ADR4711, accepted”**

Or if he is not:

Center: **“unable to accept”**

He may also state some conditions under which he would accept.

9.4 Radio discipline

Even if it is fun to have some nice words with the pilots you should not make this a regular behaviour. It can cost you the control you need if the traffic gets heavier. Remember that your radio frequency has been assigned to the position for professional service. Therefore it is kept as brief as possible with a clear message at all times. Train yourself on the official phraseology. It has been designed to avoid misunderstandings and to be brief and efficient at all times. You will find yourself in situations where you think you must say something, even if there is no need to do so. Blowing up the radar identification is a common mistake for example:

“Radar, good evening, ADR4711, FL160”

The controller answers accordingly:

“ADR4711, radar, good evening, identified, continue as filed”

And the pilot’s read back (He has to do a read back, because you issued an instruction):

“ADR4711, will continue to FILED”

now he got it wrong, we have to correct:

“ADR4711, negative, continue as filed”

And again the read back:

“ADR4711, roger, continue as filed”

Now imagine how much time this would cost if you get 3, 5, 7 hand overs at a time. You will talk yourself out of control doing this.

If we reduce this dialogue to the absolutely necessary we will end up with this:

“Radar, ADR4711, FL160”
“ADR4711, radar, identified”

And that’s it. No small talk, no unnecessary instructions, no misunderstandings and no read back required.

Good evening is just polite and if time permits you can do this. The continue as filed instruction is obvious. What else should he do if he did not get a diverting instruction, so forget it.