

Establishing approach sequences

This guide is intended to provide new approach controllers with an easy introduction to the subject. It contains the basic principles and important tips for establishing sequences on the final approach. Detailed knowledge of the articles "Radar vectors" and "Speeds" is assumed.

General

Terms

"Separation" refers to the minimum distance that two aircraft must have to each other vertically and/or laterally. Radar separation and wake turbulence separation are particularly important in this guide.

"Spacing" refers to the distance that you want to achieve between two aircraft on the final approach. This depends on many factors such as the weather, the current traffic situation, the airfield and the quality of the pilot.

In an approach sequence, we always work towards achieving the desired spacing while maintaining separation.

"Compression": As a controller, we always plan in such a way that separation is maintained until touchdown. So if we tell the pilot in front to maintain 170 kts until 5 NM before the runway, they will reduce to their final speed from this point on. In the meantime, however, the aircraft following them continues to fly at 170 kts and consequently will start to catch up. We refer to this phenomenon as "compression" or "catch-up". In most cases, it is sufficient to add one mile to the required separation to counter compression.

An example: due to the aircraft types, we need 5 NM wake turbulence separation between two approaches. We therefore add 1 NM and arrive at our spacing of 6 NM, which we maintain until 5 NM before the runway.

Finding the correct spacing

In addition to the criteria mentioned above, there is a lot more to consider in order to find the correct final approach spacing.

This includes, for example

- The layout of the airport and runway(s) - How many runways does the airport have? Are they used for landings only or for take-offs as well? Does the runway have "high-speed exits" that allow pilots to quickly leave the runway?
- The current traffic volume - are there currently more inbounds or outbounds?
Communication with the tower is required here!
- The weather - Are LVP in effect?
- Pilots - If, based on your experience, you don't trust a pilot to leave the runway quickly enough, give the following pilot an extra mile. A go-around is always more inefficient than an extra mile.
- Experience - Keep a constant eye on the situation on the ground. If the tower repeatedly fails to use a gap of 5.5 NM for a departure, give the next aircraft an extra mile.

As a general rule, a gap of 6 NM (+1 NM compression = 7 NM final approach spacing) is sufficient at most airports to allow a departure to take off.

Practical implementation

Now we have to put all this into practice.

Speed Control

Especially while starting out, it is generally advisable to set all aircraft in your TMA to a uniform speed as the work/traffic load increases. 220 kts is a good speed for this, because almost all aircraft can fly this "clean" (without flaps/slats). If all pilots are flying at the same speed, it is much easier for you to develop a plan because you can recognize the gaps laterally on the scope.

In order to allow the pilot a reasonable speed reduction, the pilots should preferably not be faster than 200kts when they reach the glideslope. Important: The approach clearance does not cancel the speed reduction. However, this is not the case everywhere. So if you are unsure whether the pilot knows this, it may be better to give them the speed again instead of finding out later that the pilot has already reduced their speed.

On final, the most commonly used values are **180 kts to 6 NM / 170 kts to 5 NM / 160 kts to 4 NM**. Note: 180 kts to 6 NM in particular can lead to a less precise final approach, as pilots with different types of aircraft reduce to their final approach speed at different speeds. They will then fly even longer at different speeds than at 170 kts to 5 NM or 160 kts to 4 NM and in the end, this can lead to a difference of 0.3 - 0.4 NM

So remember: As soon as you realize your airspace filling up and you can no longer get all the planes onto the approach directly, reduce all planes to one speed early on. Try to stick to the "standard speeds", especially at the beginning, and only reduce them as you gain experience (if at all).

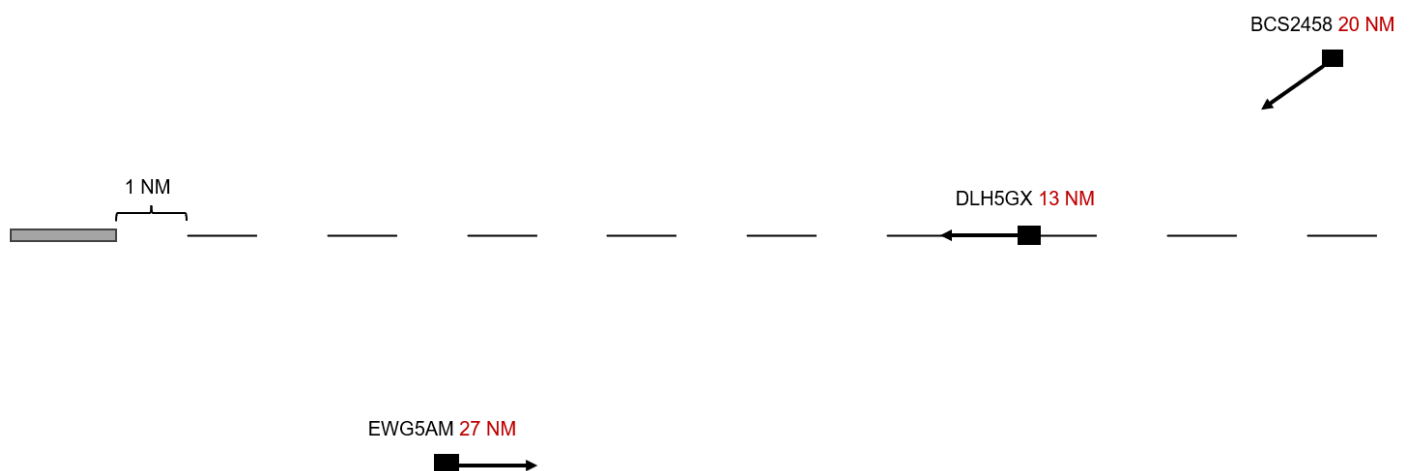
The correct altitude

It is also very important to descend in time. You should calculate that an airplane can descend 300 ft per NM (~1000 ft per 3 NM). As a rule of thumb, if the airplane is guided over the downwind, it should not be higher than 8000 ft abeam of the field, otherwise it is clearly too high to turn it to a 10 NM final. If you realize that the pilot is too high for your further planning, there are several ways to counteract this. You could tell the pilot the rough distance they still have to fly (see also the next chapter) so they can then descend faster or slower at their own discretion. Otherwise, you can also assign the pilot a certain descent rate. But don't wait too long, because even with speedbrakes, aircrafts' descent rates are not limitless.

With the clearance for the approach, pilots may descend to the published altitude for the approach. If the controller wants the pilot to fly at a different altitude for the approach, this must be explicitly stated.

Achieving the desired spacing

To estimate the distance of the aircraft until touchdown, observe a plane that is already on the ILS. Then, you need to determine the spacing you currently need. If, as in the above example, you need a final approach spacing of 7 NM, start with the first aircraft and count backwards in increments of 7. So, if the first aircraft is at 13 NM, the next one, at the same speed, must fly exactly 7 NM more (i.e., 20 NM). The ones behind will need to fly 27, 34, 41 NM, etc.



There are various ways, procedures, and tips to achieve this:

Downwind

The downwind leg runs parallel, in the opposite direction to the final approach, and should be about 5 NM away from it. Many airports already have arrivals or transitions set up like this. The planes should not exceed 220 KIAS to avoid overshooting when turning onto the final approach.

If you turn the following aircraft when the preceding one (already established on the LOC) is abeam, this will result in a spacing of 5.5 to 6 NM between the two aircraft on the ILS (Figure 1), assuming both aircraft have the same speed. This refers to the moment when the aircraft turns,

not when you as the controller start speaking – you need to issue the instruction a bit earlier. If you turn the aircraft when it's 0.5 NM past abeam, you will gain an extra NM of spacing because the aircraft must "fly back" that 0.5 NM (Figure 2). Each additional NM of downwind results in 2 NM more flying distance. Turning the aircraft when it's 0.5 NM before abeam will result in 1 NM less spacing. With this rule of thumb, you can calculate any desired spacing. Experiment a little and fine-tune with earlier or later speed reductions.



Figure 1

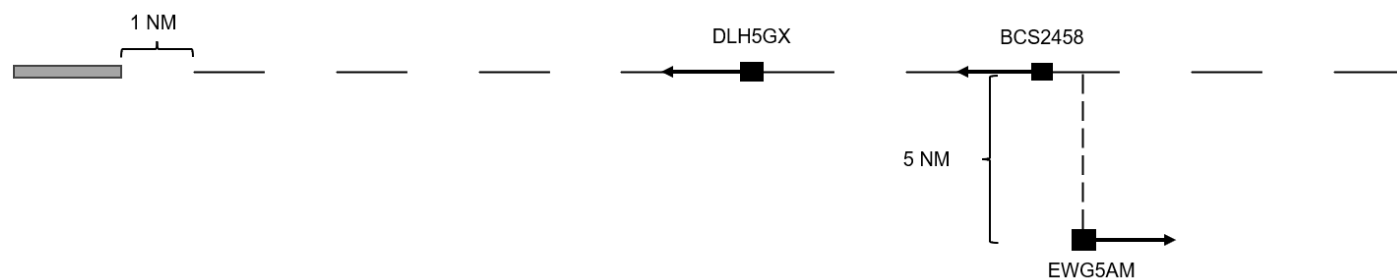


Figure 2

If the aircraft is turned onto the final approach just two radar updates (10 seconds) later than planned, it will have already covered 1 NM in that time. This means it will need to fly 2 NM more, which is rarely corrected with speed adjustments. Over 30 seconds, this results in 6 NM more flying distance and reduces the runway capacity by 50%. This example clearly shows why your **priority should always be the final approach!**

Base

You can use the base leg depending on local conditions and traffic to turn aircraft from the downwind onto the final approach (Figure 1) or to allow aircraft to fly more or less "directly" onto the final approach (Figure 2).



Figure 3

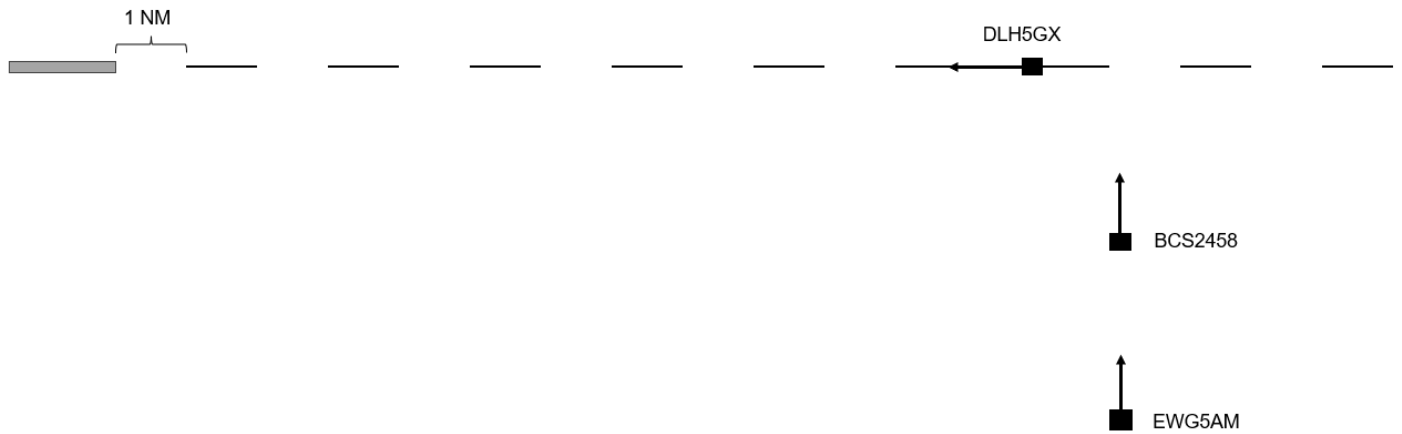


Figure 4

If you look closely at the figures, you'll see that the distance of BCS2458 (and EWG5AM in Figure 2) relative to the final approach remains constant. The only variable distance is that of the Lufthansa moving westward toward the runway. Therefore, the base leg should ideally be at an angle of 90° or more to the final approach in both cases. Otherwise, situations like in Figure 5 can occur. Here, the distance from DLH5GX to the runway decreases, while the distances of BCS2458 and EWG5AM increase. With each radar update, the spacing relative to the approach changes. This makes it much harder to accurately turn the aircraft one after the other onto the final approach.

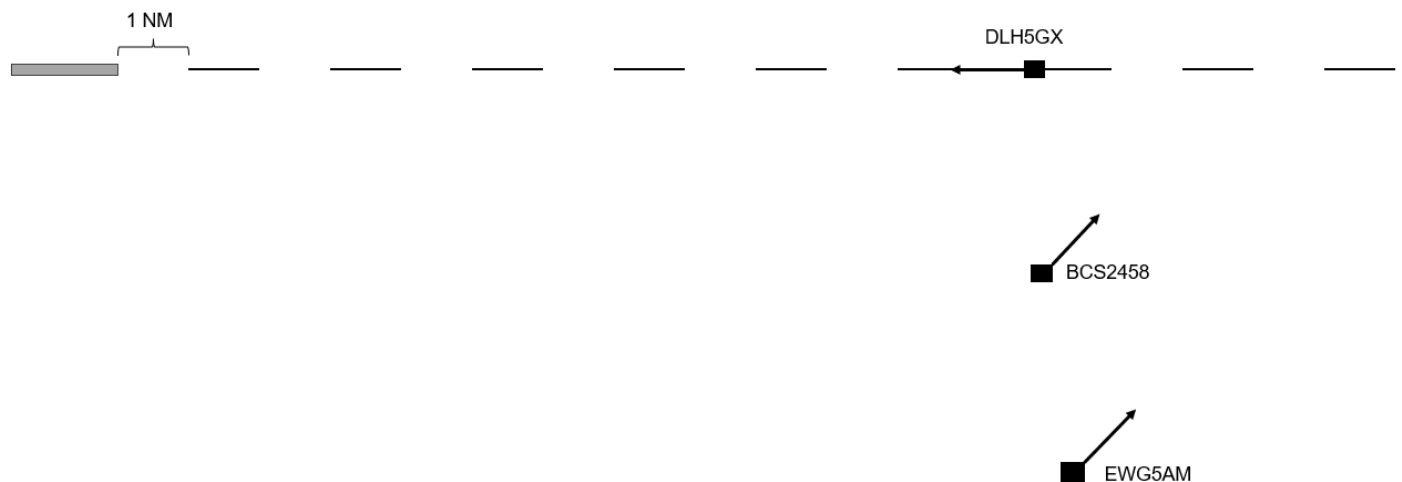


Figure 5

Final Approach

The goal of the approach controller should be to guide all aircraft onto the final approach at more or less the same point. To achieve this, it's important that the director receives neither too few nor too many aircraft. In the first case, the intercept point shifts closer to the airport; in the second case, it shifts farther away.

Of course, you won't always manage to have every plane intercept at exactly the same point. However, at most German airports, 10-15 NM is a good guideline. Generally, on Vatsim, the goal should be to have as short a final approach as possible, as this minimizes the effects of technical differences, such as wind or speed variations.

Adjustments

Slow aircraft

One of the more challenging situations is when you need to integrate an aircraft into the sequence that will fly the final approach significantly slower than the others. Here, too, you should try to let the plane fly **as short a final approach as possible**. Over 20 NM, a speed difference of 60 or more knots will waste much more space than over 8-10 NM. Therefore, the aircraft should always be kept near the ~10 NM final, for example, by having it fly circles. When the opportunity arises, you can then slot it in. How many miles do you need to the next aircraft? You can calculate this again using the formula:

$$\text{Speed difference} / 60 = \text{loss of spacing per minute}$$

For example, if the slow type is flying the ILS at 120 KTS and cleared for an 8 NM final, it will take about 4 minutes to reach touchdown. If the following traffic is flying at an average of 180 KTS, it gains 1 NM per minute on the slow type. Therefore, the following plane needs at least 4 NM more than the required separation to avoid catching up to the slow aircraft. In such a scenario, it's always better to err on the side of caution and give one or two miles more rather than too few.

A further video with an interesting approach can be found here:

<https://youtu.be/VNcSB-c6atU?si=Wo2vHTW9Dgm0zHE6>

Wind

Wind can also affect the headings used for downwind or base legs. For an east-west runway with a west wind pushing aircraft eastward, a heading of 360° for the base leg may need to be corrected 5 or even 10 degrees to the left. A heading of 180° may need to be corrected to the right. Tools like windy.com, which show the wind at altitude, can help assess the potential effects.

In cases of strong headwind on the final approach, it's important that aircraft are not turned too early or too late onto the final. As soon as the aircraft turns onto the intercept heading, its ground speed begins to decrease. If the trailing aircraft is turned too early, speed control will be less effective than in calm wind conditions. If the aircraft is turned too late, it becomes much harder to make up the gap with a headwind, and the aircraft will fly more distance in the final turn.

Think about the effects of wind when it's perpendicular to the approach (e.g., from the north or south on an east-west runway). What difference does it make on the base leg when aircraft from one direction have a tailwind and others a headwind, even if all are flying at 220 kts?

Consider, before logging in, what adjustments might be sensible and observe how it works with the first few aircraft.

Pilots

With some experience, you can usually gauge whether a pilot is new and/or unfamiliar with their aircraft from the first contact. Keep this in mind when planning and issuing instructions.

Give a new pilot an extra mile or two on the final, keep in mind that their instructions may be carried out with some delay, and don't waste time scolding them for mistakes. Focus instead on resolving the situation.

Not everything is lost because of one pilot!

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