Change of runway configuration at Stockholm Arlanda Airport

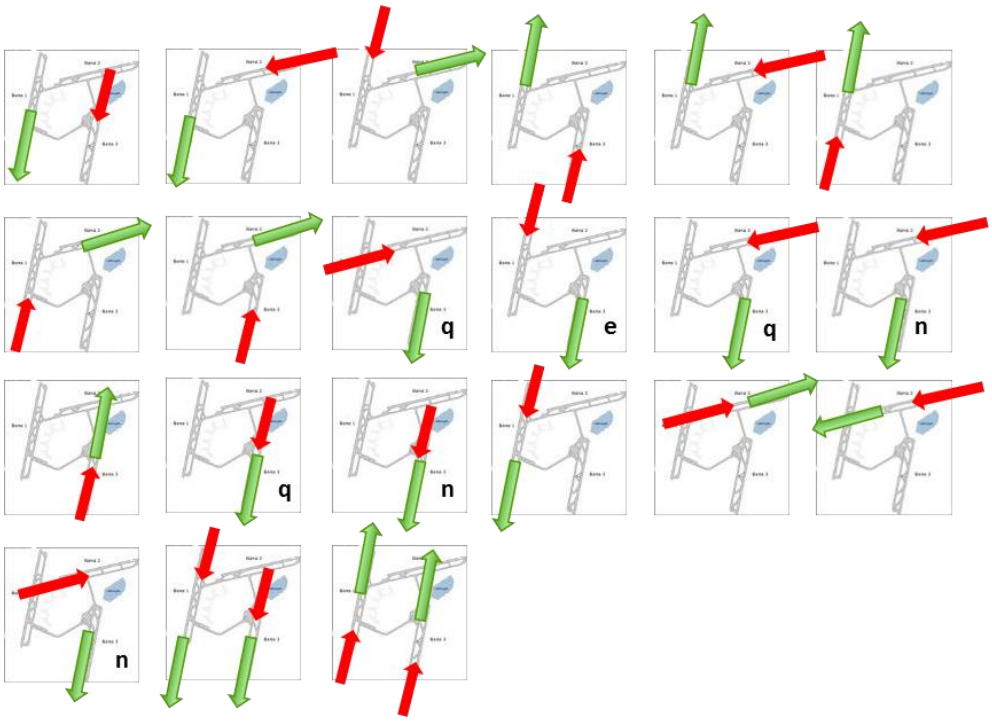
Changing the "runway configuration", the combination of runways that are active, involves two different processes: the decision process and the execution process. The text below describes the procedure and the processes.

The decision processes

The decision to change runway configuration is taken by the watch supervisor (WS) at the control tower after consultations with the terminal control.

Many parameters need to be considered in the decision:

- **Environmental permit:** Arlanda's environmental permit contains 21 approved runway configurations with different capacity levels that are used in different wind direction intervals due to noise considerations. Mixed parallel operations are not in use:



- **Winds:** For safety reasons aircraft land and take off into the wind direction. The wind speed and direction at ground and at 1 000 ft altitude determines which runways are suitable for landing and take-off.
- **Adverse weather conditions:** For example, CB activity near the airport, snow or fog.
- **Technical equipment:** Status of technical equipment, e.g. if the approach lighting system is out of service (U/S).
- **Traffic forecast:** The forecasted traffic intensity per 20-minute intervals.

- **Capacity:** Different runway configurations have different capacity ceilings. The chosen configuration should have enough capacity to handle the forecasted traffic during a certain period, without delays.
- **Maintenance:** The airport occasionally must close runways and taxiways for air traffic in order to perform maintenance.
- **External factors:** External factors such as flight inspection or activities in the airport vicinity involving the Swedish armed forces.

The execution processes

When a decision has been made, the execution process begins. This process can be seen from three different perspectives: the control tower, the terminal control and the pilot, see **Fel! Hittar inte referenskälla.** below. All three perspectives need to be considered in order to make sure that change of runway configuration is carried out safely.

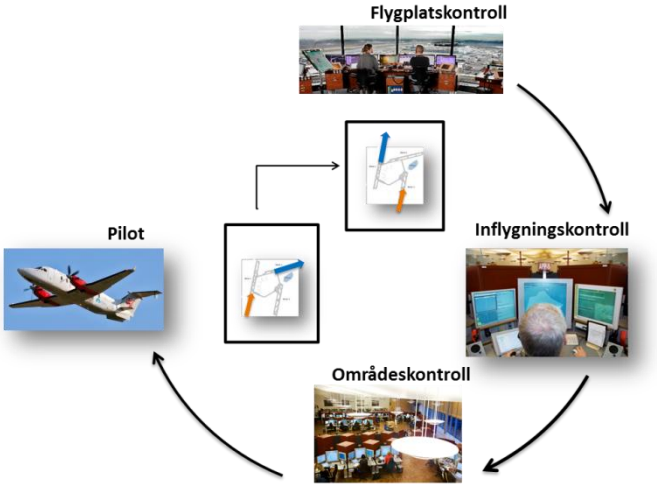


Figure 1 Change of runway configuration – the execution process.

Figure 2 below illustrates a transition from the runway configuration ARR 01L/DEP 08 to ARR 01R/DEP 01L at northeasterly winds, transitioning from a low traffic intensity configuration to a high traffic intensity configuration. The runway change in this example was initiated based on a forecasted traffic increase.

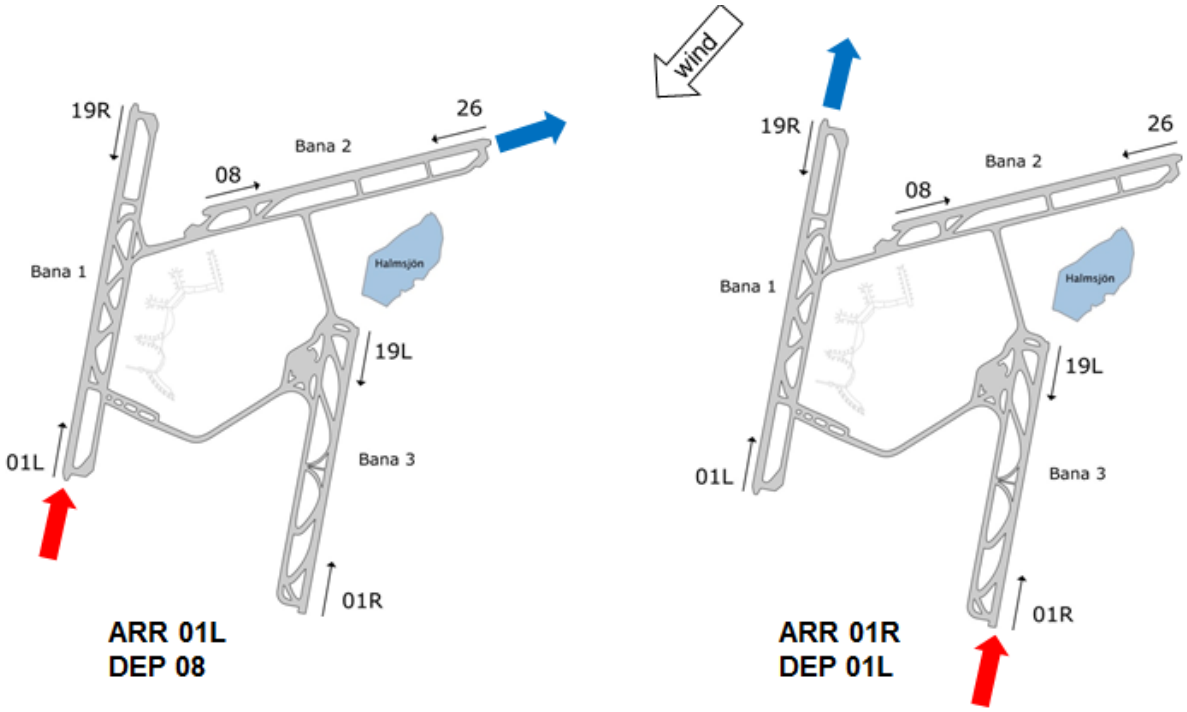


Figure 2 Change of runway configuration from ARR 01L/DEP 08 to ARR 01R/DEP 01L.

Using the example in Figure 2 above the execution of a runway configuration change can be described as follows.

The control tower regularly receives traffic forecasts from NMOC (Network Manager Operational Center) at Eurocontrol in Brussels.

Based on the parameters described above, the control tower decides to change the current runway configuration to one that provides a capacity increase, minimizing the risk of delays. Usually a combination of runway 1 (01L/19R) and runway 2 (08/26) is used in lower traffic intensity, while the parallel runways 1 and 3 are used in higher traffic intensity. In this case, the low traffic configuration ARR 01L/DEP 08 is changed to the parallel runways (high traffic configuration) ARR 01R/DEP 01L.

The exact time for the change has to be decided by the control tower in consultation with the terminal control.

For the control tower, the runway changes in the example above results in new taxi flow patterns on the ground. The controller responsible for arrivals will now be responsible for departures and the other way around.

Technical systems such as approach lights, navigational aids, and systems for handling the aircraft on ground must be checked and their settings adapted to the new runway configuration.

Departing aircraft get new departure procedure clearances (SID or heading).

During these changes, the control tower coordinates with terminal control to make sure that everyone involved get access to updated and correct information. The process of changing runway configuration is described in checklists.

For the terminal control, a runway configuration change requires adaptation of working method and configuration of technical systems. All systems must provide correct information on SIDs and STARs for the air traffic during the whole process.

The area control, which is the function responsible for giving inbound clearance to arriving aircraft, needs to receive the right information about which aircraft will use the old runway and which aircraft will be the first to land on the new runway in use.

The procedure for terminal control is also described in checklists.

In this example, it is mainly the departure flow that must be adapted since new SIDs are being used for departures. However, the arrival flow also has to be adapted since the approach altitude to RWY 01R is higher than to RWY 01L due to environmental restrictions, which results in longer finals, see Figure 3 and Figure 4 below.

Figure 3 **Arrivals to RWY 01L (orange) and departures from RWY 08 (blue).**

Figure 4 Arrivals to RWY 01R (orange) and departures from RWY 01L (blue).

It should be noted that some runway configuration changes are more complex than the one illustrated in Figure 3 and Figure 4 above. For example, a runway change initiated by a change of wind direction can result in changing from ARR 19R/DEP 08 to ARR 26/DEP 19R, which is a more complex change in both arrival and departure flows.

The area control handles flights in a very large area, see Figure 5 below, and therefore needs information well in advance about which flights will need new clearances (STAR and runway for landing) due to the runway configuration change. In this process, the area control needs to consider other traffic under their responsibility, such as overflying traffic.

Due to the extensive coordination between different control functions and pilots, ATC normally expects at least 30 minutes for a runway configuration change.

The terminal control, in dialogue with tower control, determines in a nominal situation from what approximate time the runway change will take place. Terminal control then makes a judgement analyzing the inbound flow and then notifies the control tower about which flight will be the last one to arrive at the old runway and which will be the first to arrive at the new runway. The terminal control then informs area control about the runway change and which runway each involved aircraft is to land on.

The tower control then notifies terminal control which flight will be the last to depart from the old runway and which will be the first to depart from the new runway.

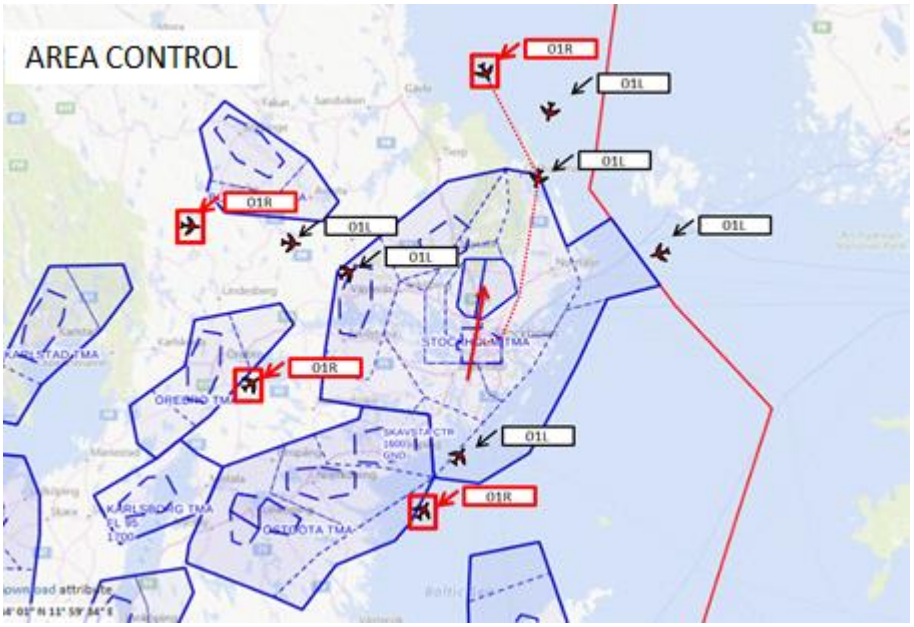


Figure 5 During the execution process, some pilots will plan to land at the current runway in use (RWY 01L) and some will plan to land on the new runway in use. Checklists and technical support will make sure that the controllers and pilots concerned have the correct information on which runway that is in use for landing for which aircraft.

Much of the cockpit preparation for the approach phase takes place before top of descent. Therefore, the pilot will need information about which STAR and runway to expect as early as possible. Depending on the change of runway for landing, a late change could lead to the aircraft being too high relative to the distance to the runway, which makes it difficult for the pilot to perform continuous decent operation.

Runways changes with short notice increase the workload of both pilots and controllers and are due to safety reasons avoided as far as possible.