

HOW TO USE THE RUNWAY

1. Introduction

A runway is a rectangular area of an aerodrome prepared for the landing and take-off of the aircrafts.

The runway is the most critical part of an airfield. An accident on runway will affect the airport availability and any accident on a runway generally causes several reasons of damage and injuries in the real life.

As a pilot or active ATC (air traffic controller), you must respect elementary security rules presented in this document.

2. Runway construction

A runway shall be characterized by the following parameters:

- Runway length and width
- Runway Surface type
- Runway sections
- Runway Strength

2.1. Runway sections

A runway can have different section that can be use or not by aircraft for taxi, landing or taking-off operation.

The normal used portion of the runway is from threshold to opposite threshold, but do not include overrun, blast pad or stop way areas at both ends.



Example of a runway with number 09 R

2.1.1. Stop way or blast pad

Blast pad, overrun areas or stop ways are often constructed just before the start of a runway where jet blast produced by large planes during the takeoff roll could otherwise erode the ground and eventually damage the runway. Overrun areas are also constructed at the end of runways as emergency space to slowly stop planes that overrun the runway on a landing gone wrong, or to slowly stop a plane on a rejected takeoff or a takeoff gone wrong. Blast pads are often not as strong as the main paved surface of the runway and are marked with yellow chevrons.

Planes are not allowed to taxi, take-off or land on blast pads, except in an emergency.



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2.1.2. Displaced threshold

A displaced threshold exists because obstacles just before the runway, runway strength, or noise restrictions may make the beginning section of runway unsuitable for landings. It is marked with white paint arrows that lead up to the beginning of the landing portion of the runway.

Displaced thresholds may be used for taxiing, take-off, and landing rollout, but not for touchdown and landing operations.



2.1.3. Runway closed

When a runway is closed, there is a permanent or temporary cross on the runway.

If you see a cross on the runway or in the charts, this runway is closed and it is forbidden to land on a closed runway (except for emergency purpose).



2.2. Surface types

The choice of material used to construct the runway depends on the use and the local ground conditions. In the biggest airport, you will find long hard surface type runways (asphalt and concrete). In the smallest airport, you can find only a soft surface type runway (grass and gravel).

The most common surface types are.

- ASP Asphalt
- BIT Bituminous Asphalt or Tarmac
- BRI Bricks (no longer in use, covered with Asphalt or Concrete now)
- CLA Clay
- COM Composite
- CON Concrete
- COP Composite
- COR Coral (Coral reef structures)
- GRE Graded or rolled earth, Grass on graded earth
- GRS Grass or earth not graded or rolled
- GVL Gravel
- ICE Ice
- LAT Laterite
- MAC Macadam
- PEM Partially Concrete, Asphalt or Bitumen-bound Macadam
- PER Permanent Surface, Details unknown
- PSP Marsden Matting (Derived from Pierced/Perforated Steel Planking)
- SAN Sand
- SMT Summerfield Tracking
- SNO Snow
- U Unknown surface

Water runways do not have a type code as they don't have physical markings, and are thus not registered as specific runways.

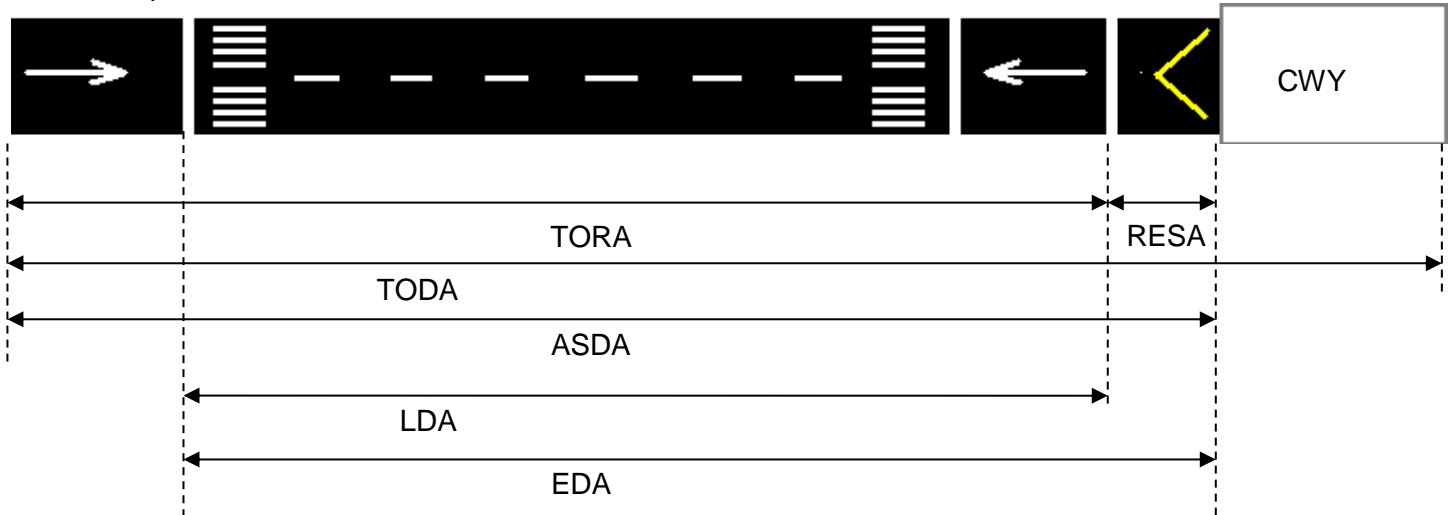
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2.3. Runway length

The runway length is generally:

- 500 to 1000 meters long and 25-45 meters wide for small airfields
- 2000 to 4200 meters long and 45-60 meters wide for the larger airfields

On charts, you can find normalized distance



2.3.1. TORA = Take Off Runway Available

TORA is the length of runway declared available and suitable for the ground run of an airplane taking off. This means the maximum run distance for an aircraft during a take-off.

2.3.2. RESA = Runway End Safety Area

RESA is the length of the stop way.

2.3.3. TODA = Take Off Distance Available

TODA is the length of the take-off run available plus the length of the clearway and stop band, if clearway or stop band is provided.

This distance is the take-off distance for an aircraft to reach the minimum 50ft.

Clearway is an area beyond the paved runway, free of obstructions. Clearway allows large airplanes to take off at a heavier weight than would be allowed if only the length of the paved runway is taken into account.

$$\text{TODA} = \text{TORA} + \text{RESA} + \text{CWY}$$

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2.3.4. ASDA = Accelerate-Stop Distance Available

ASDA is the length of the take-off run available plus the length of the stop way, if stop way is provided

ASDA = TORA + RESA

ASDA is the maximum run distance for an aircraft when performing a rejected take-off.

2.3.5. LDA = Landing Distance Available

LDA is the length of runway that is declared available and suitable for the ground run of an airplane landing.

LDA never include runway section before displaced threshold before touchdown point.

2.3.6. EDA = Emergency Distance Available

EDA is the maximum length of runway available for an emergency landing.

EDA=LDA+RESA

3. Mandatory rules to know as a pilot

3.1.A clearance is mandatory

In a controlled airfield and for a pilot, a clearance from the air traffic controller is mandatory to enter, back-track, cross, land and take-off on the runway.
With no clearance in a controlled air field, the pilot shall not enter and land on any runway.

Pilots must read back all these clearances.

Examples:

ATC: Speedbird 5 4 6, line up runway 13 and wait.

Pilot: line-up runway 13 and wait, Speedbird 5 4 6

ATC: Alitalia 1 4 4 5, runway 15, cleared to land, wind 100 degrees 6 knots

Pilot: cleared to land runway 15, Alitalia 1 4 4 5.

A pilot doesn't usually read back the winds given as information.

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3.2.Runway using condition for landing and taking-off procedure

A landing procedure cannot be performed when the runway is occupied.

A taking-off procedure cannot be performed when the runway is occupied.

In controlled area, a pilot on short final shall make a go around procedure before the runway threshold if he doesn't receive any landing clearance.

3.3.Go around when runway is occupied

The pilot in command shall initiate a go around procedure if he can see any aircraft, vehicle or obstacle on the runway even he had received from ATC a landing clearance. He must inform immediately the ATC about the go around.

3.4.Runway use in non-controlled areas

When there is no ATC available in an airfield, you must give your intension using self-announcement procedure on UNICOM 122.800 MHz frequency.

The first pilot announcing a landing (if he has the runway in sight) or take-off maneuvers takes the runway for him and obtains the priority.

Then, if a second aircraft wants to land, he has to wait or negotiate with this pilot a new priority in function of the current position of all aircrafts.

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4. Mandatory rules to know as an air traffic controller

4.1.A clearance is mandatory

In a controlled airfield, as an air traffic controller, it is mandatory to give a clearance to a pilot in order let him enter, back-track, cross, land and take-off on the runway.

With no clearance, the pilot shall not enter and land on any runway.

Pilots must read back all these clearances.

4.2.Runway using condition for landing and taking-off procedure

After given a landing or taking off clearance, the runway available in front of the aircraft cannot be used until the aircraft has vacated the runway nor has making a go-around procedure.

After given a landing or take off clearance, all the runway cannot be use any more for a landing or a take-off before the aircraft has not vacate the runway nor has not making a go around.

An air traffic controller shall manage all runways with the best rate of usability. He must follow the basic rule described below:

When an ATC delivers a line up and take-off clearance, he has to make sure that the taking-off aircraft has enough time to free the runway before the following aircraft on final is landing.

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5. Runway occupied or runway free

5.1. Definition

Whatever the aircraft is controlled or not, a runway is considered occupied when:

- An aircraft or a vehicle is on the runway whatever rolling, taxiing or waiting.
- An aircraft is landing on the runway from runway threshold until the touchdown
- An aircraft is taking-off until the runway limits are left
- An aircraft is making a touch and go or a low pass until the runway limits are left
- An aircraft or a vehicle are between the runway and the holding point bar

The runway is considered occupied if the different cases above will be effective with a clearance already given (taking off, landing, crossing, taxiing ...).

For example, a runway is considered occupied if:

- A landing clearance is already given to an aircraft whatever if the aircraft overflies the runway or not.
- A taking-off clearance is already given to an aircraft on the runway or at the holding point.
- A runway crossing clearance is already given to an aircraft until he vacates the runway.

Touch and Go, Stop and Go, Low Pass clearances are considered as landing and taking/off clearances.

For airports which have multiple runways, the bare basic of the security is the same, but some rules must be added. These special rules will be part of another document.

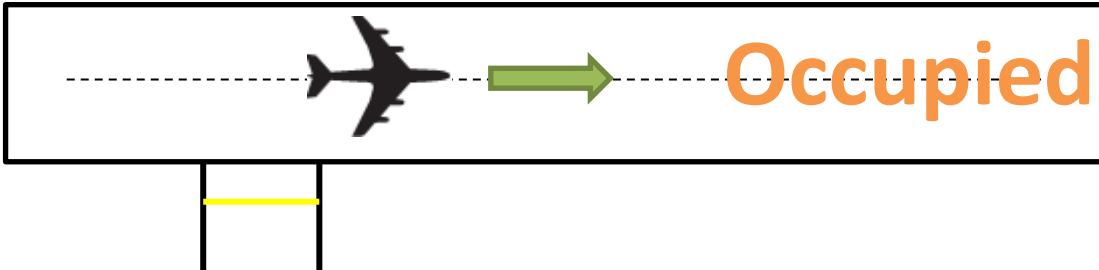
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5.2.Examples

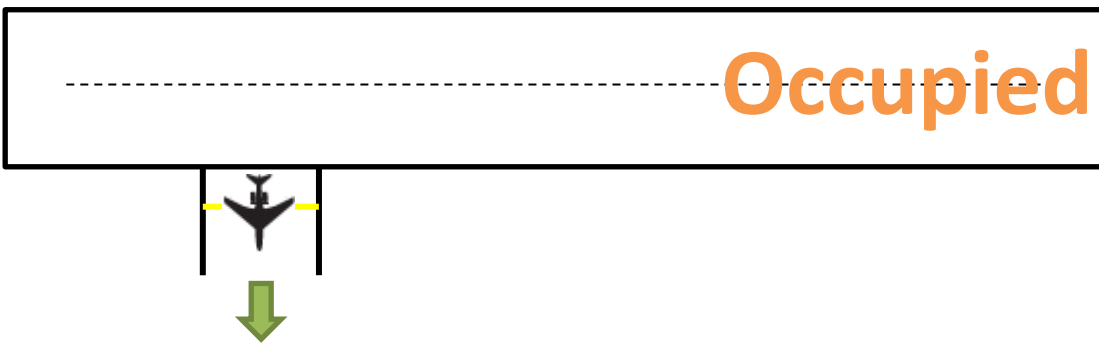
Below, an example of an aircraft on runway taxiing, crossing, back-tracking, taking-off or landing:

Runway is occupied



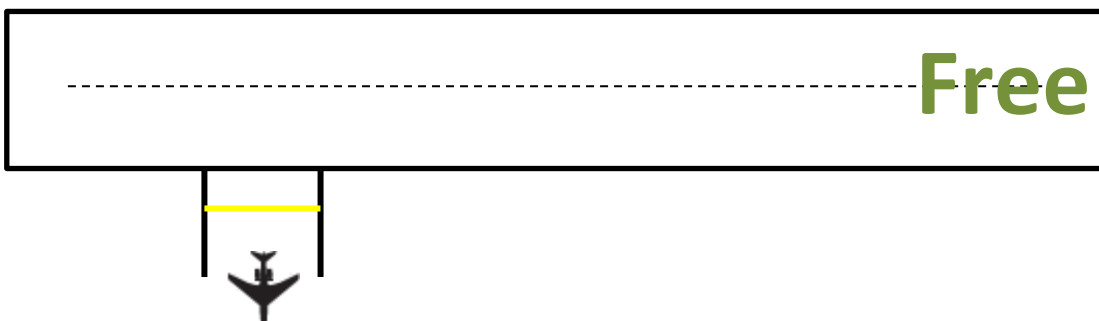
Below, an example of an aircraft in progress of a runway vacating but the holding point bar is not behind the aircraft:

Runway is occupied.



Below, an example of an aircraft which has vacated the runway:

Runway is free.

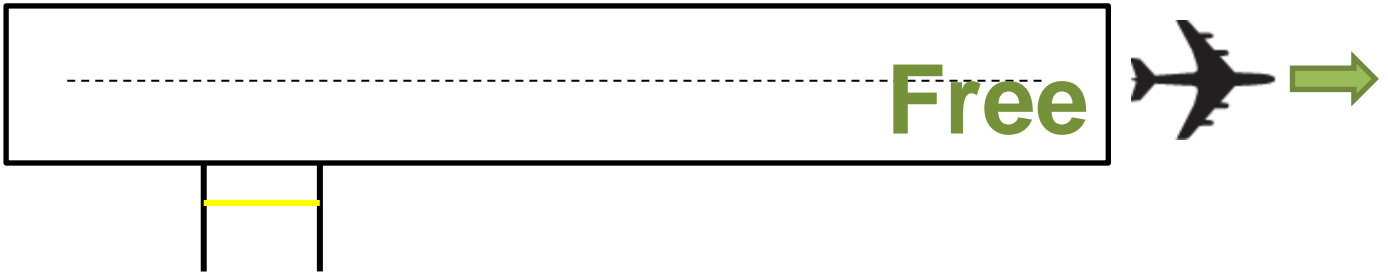


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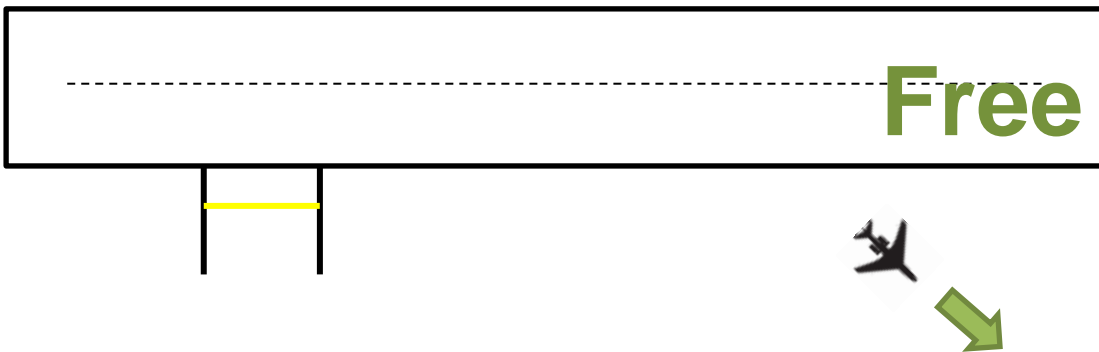
Below, an example of an aircraft which has performed his taking off and has vacated the runway after the opposite threshold:

Runway is free.



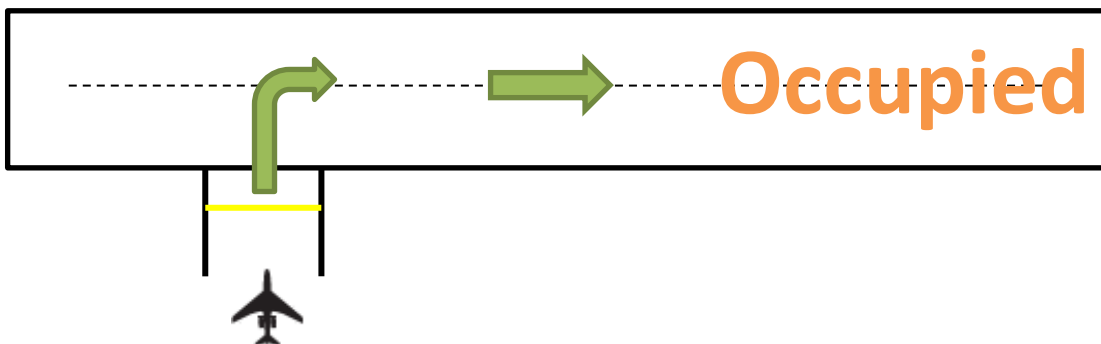
Below, an example of an aircraft which has performed his taking off and has vacated the runway with an initial turn before the opposite threshold:

Runway is free.



Below, an example of an aircraft behind the holding point which has received a take-off clearance or a line-up clearance:

Runway is considered as occupied.



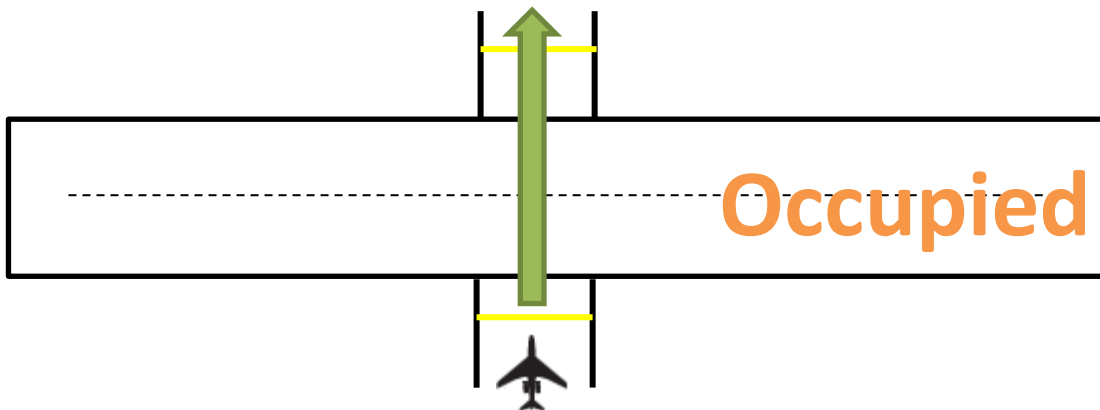
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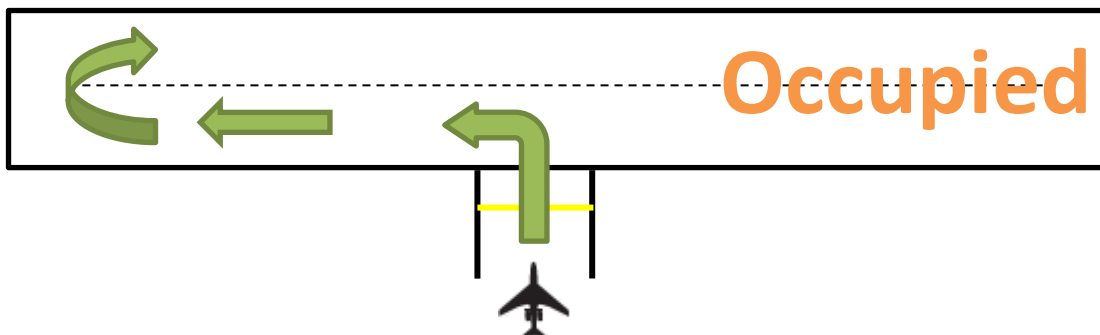
Below, an example of an aircraft flying on final, which has received a landing clearance:
Runway is considered as occupied.



Below, an example of an aircraft which has received a crossing clearance:
Runway is considered as occupied.




Below, an example of an aircraft which has received a back track (back taxi) clearance:
Runway is considered as occupied.




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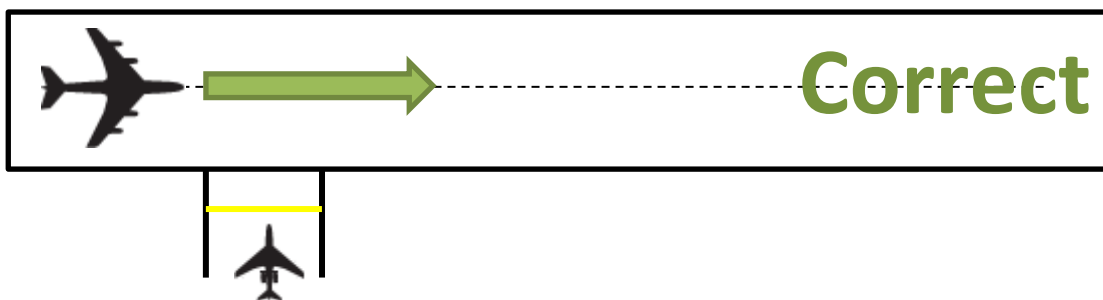
6. Situation with two aircraft in one runway

Definition: Heavy aircraft image = 

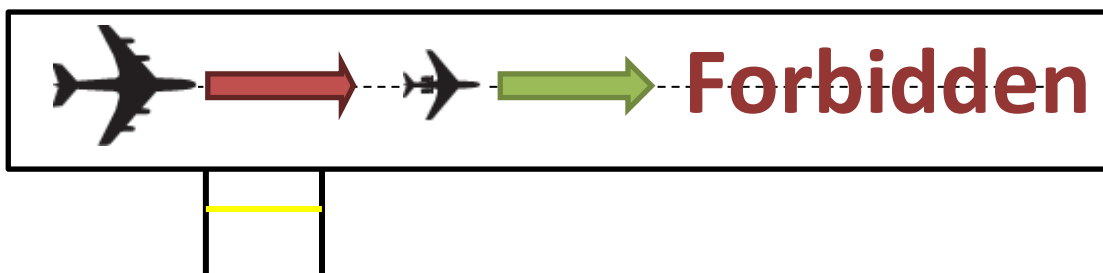
Medium aircraft image = 

6.1. Basic situation with a line-up, taking off or landing aircraft

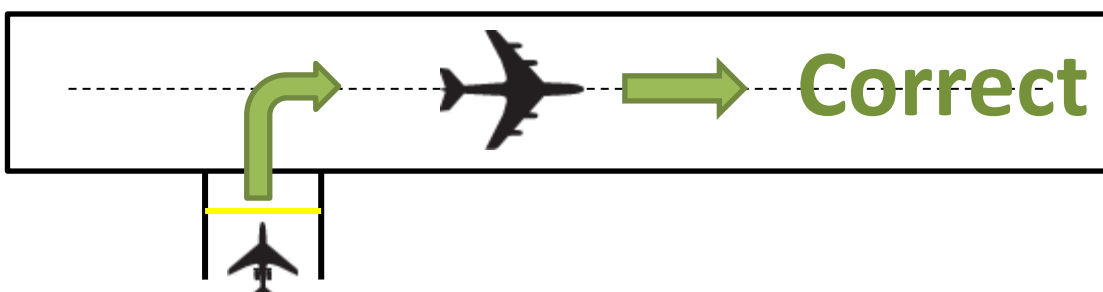
Below, the medium aircraft is maintaining on holding point, ATC can give the take-off clearance to heavy aircraft and this aircraft can perform the taking-off.



Below, the medium aircraft is on the runway or overflying the runway, ATC cannot give any take-off clearance to heavy aircraft and this aircraft cannot perform the taking-off.



Below, the heavy aircraft is landing or taking off and has crossed the position next to the holding point occupied by the medium aircraft, ATC can give the line-up clearance to medium aircraft and this aircraft can enter into the runway only for line up operation or taxiing operation via the runway.



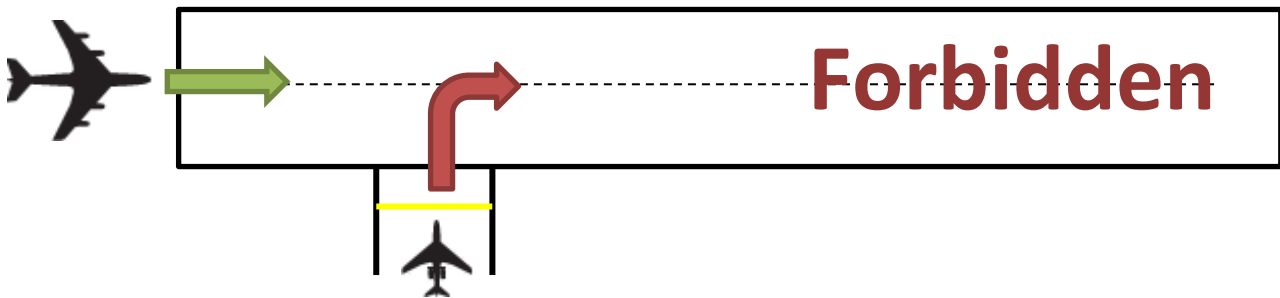
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In the situation above, if the heavy aircraft is landing, there must be another free taxiway in order to vacate the runway without any backtrack.

See backtrack operation at the end of document to study one holding point operations.

Below, the heavy aircraft is on final before runway threshold, ATC cannot give the line-up clearance to medium aircraft and this aircraft cannot enter into the runway.



In the case above, the air traffic controller can use a conditional line-up clearance to speed up the management of the runway (only possible if country and airport regulation permits conditional clearance). The controller must verify that the pilot in the aircraft at the holding point can see the incoming traffic.

6.2. Go around operation

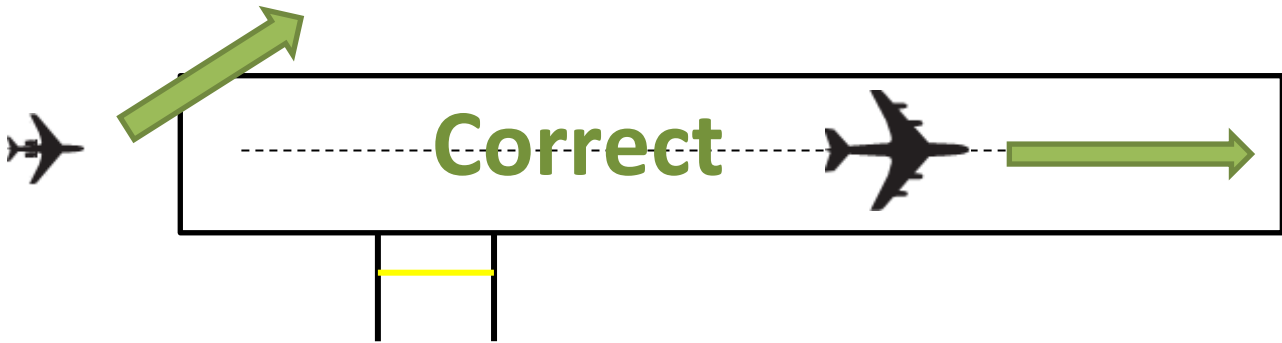
Below, the medium aircraft is on final before runway threshold and a heavy aircraft is on the runway taxiing, landing or overflying, ATC cannot give the landing clearance to medium aircraft and this aircraft cannot land on the runway until the heavy aircraft has vacated the runway.



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As the pilot in command of your aircraft, if the runway is not free and your aircraft is on short final (<2NM), you must go around with no delay even if you have received a landing clearance. As an air traffic controller, if the runway is not free and there is a traffic on short final (<2NM), you must order a go around clearance with no delay. Be aware of air traffic separation if the first aircraft will not land!



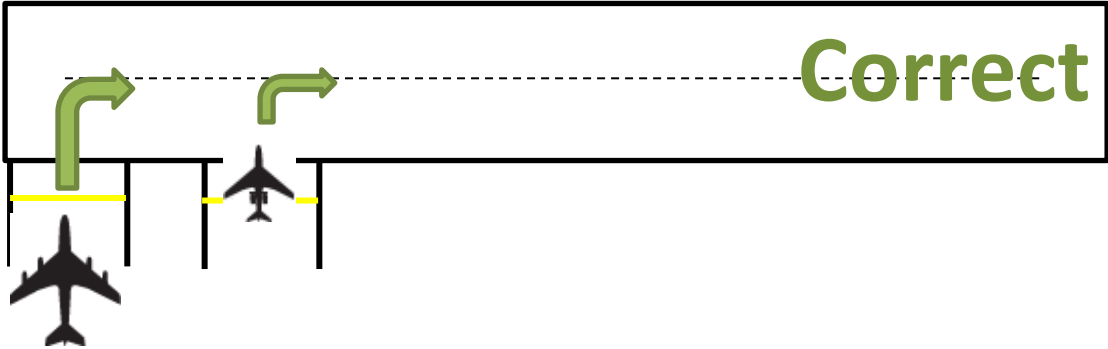
6.3. Multi alignment operation

In the largest airport, many holding points and vacating taxiways are available for each runway. These numerous holding points and taxiways are sometimes necessary to provide enough opportunities to the pilots to choose the best and quickest taxiway to vacate the runway.

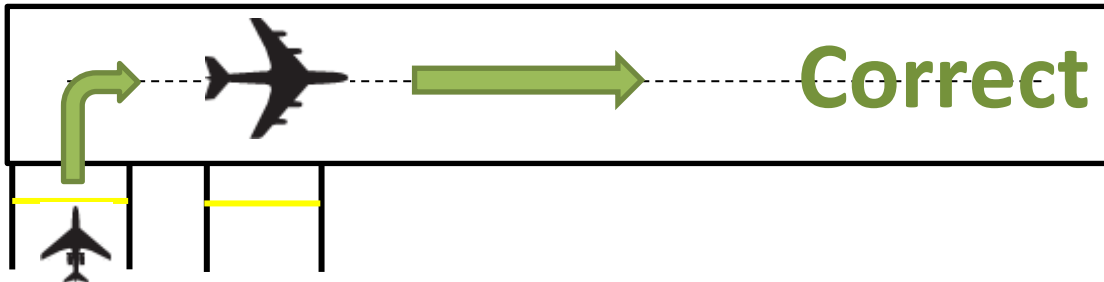
As an air traffic controller, you can use these numerous taxiways and holding point for:

- Making homogenous departure sequence
- Using multi alignment procedure
- Expediting light aircraft departure

Below, this is an example of multi-alignment operation. Both aircrafts have received a line-up procedure. As air traffic controller advise the aircraft behind (here the heavy one) about traffic in front of him from another taxiway.

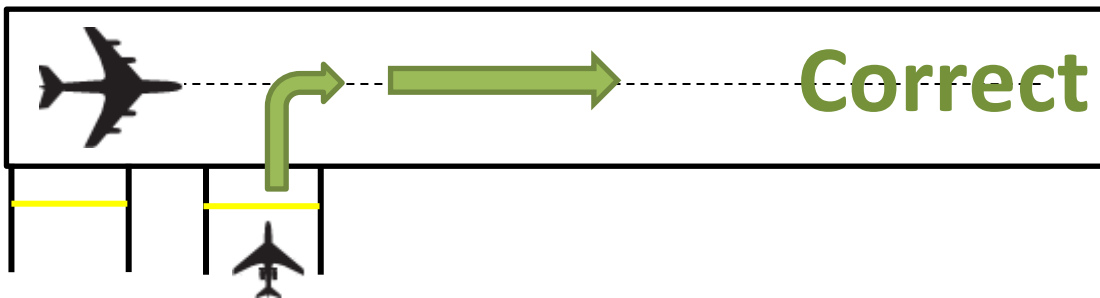


Below, the medium aircraft is holding the position on runway behind the heavy aircraft, ATC can give the take-off clearance to heavy aircraft and this aircraft can perform the taking-off. The medium aircraft shall maintain his position until the heavy aircraft has vacated the runway.



Note that multi-alignment from different taxiway behind a taking off aircraft is authorized in order to optimize the taking off sequence.

Below, the heavy aircraft is holding the position on runway behind the medium aircraft lining up, ATC can give the take-off clearance to medium aircraft and this aircraft can perform the taking-off. This situation can be used by air traffic controller to expedite a light aircraft departure before a take-off of an heavier aircraft.



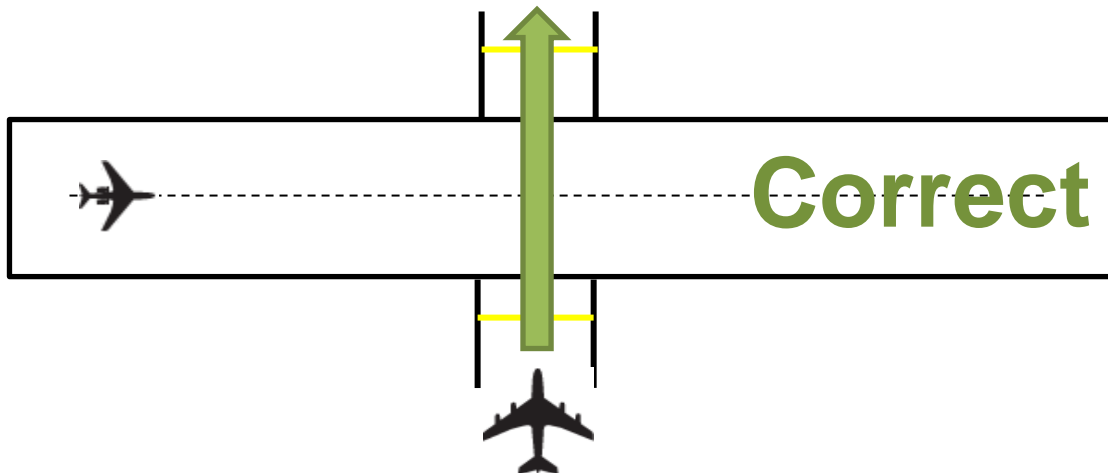
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6.4. Runway crossing operation

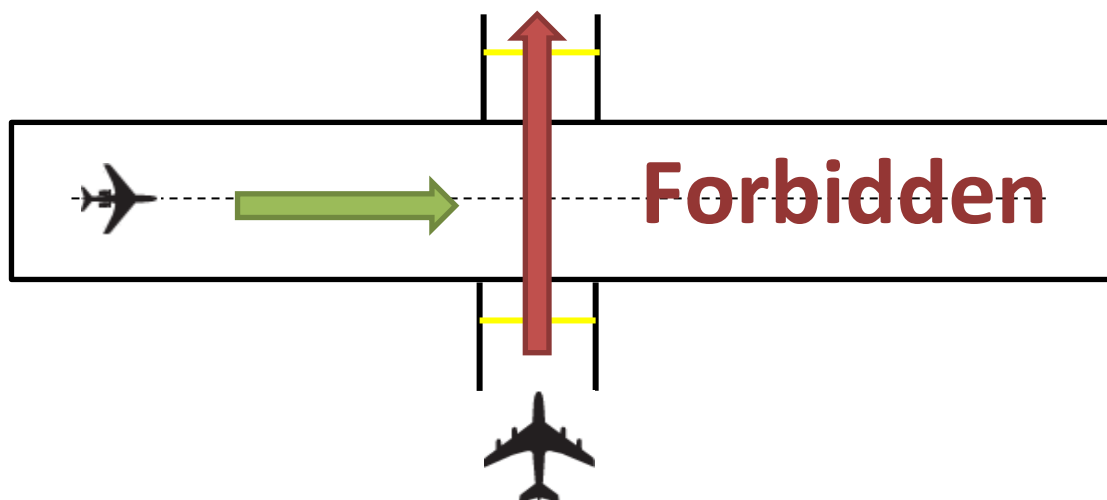
In some airfield, a runway crossing clearance is needed in order to let aircrafts joining an apron area, or a holding point. The runway crossing operation can be used in the same way like multi alignment operation.

Below, the medium aircraft is holding the position on runway and the heavy aircraft need to cross the runway, ATC can give the crossing clearance to heavy aircraft and this aircraft can perform the taxi. The medium aircraft shall maintain the position and must not perform any take-off operation.



A runway can be used as taxiway when needed if the runway is free to use for this type of operation.

Below, the medium aircraft is moving on the runway (taxiing, landing, taking off or overflying) and the heavy aircraft need to cross the runway, ATC cannot give the crossing clearance to heavy aircraft and this aircraft must maintain the holding point. The medium aircraft shall finish his.

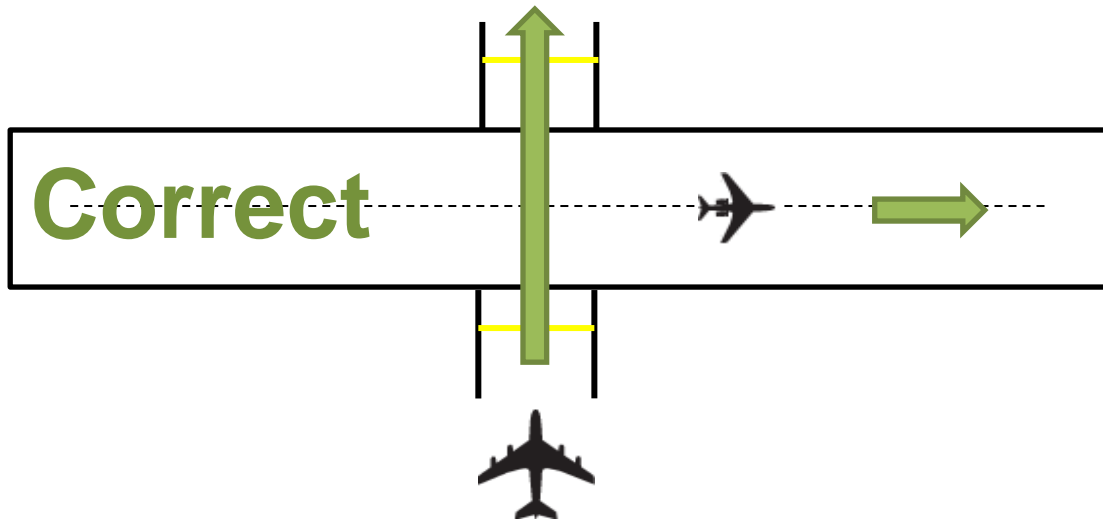


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Note that a conditional crossing clearance behind a taking off or a landing traffic is not allowed indue to safety reasons.

Below, the medium aircraft has vacated the crossing taxiways after a landing, taking off or taxiing operation and the heavy aircraft need to cross the runway, ATC can give the crossing clearance to heavy aircraft and this aircraft can perform the taxi.

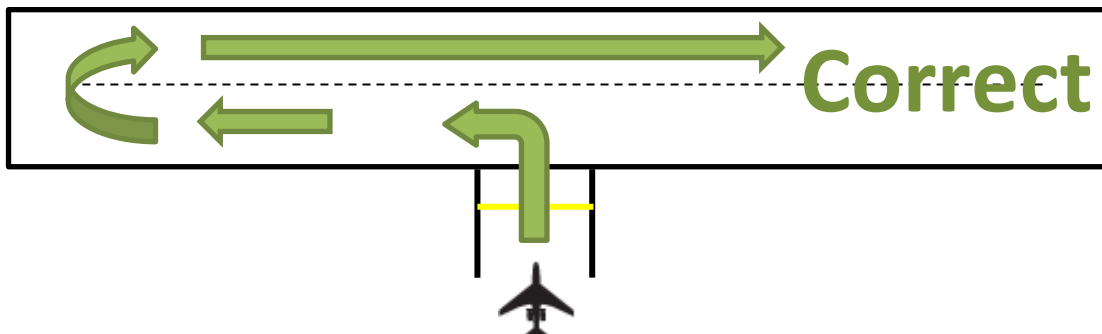


The medium aircraft shall maintain the position and wait the runway vacation after a half turn if he wants to make a back track operation and exit the runway via the same taxiways used by heavy aircraft.

6.5.Runway back-track operation

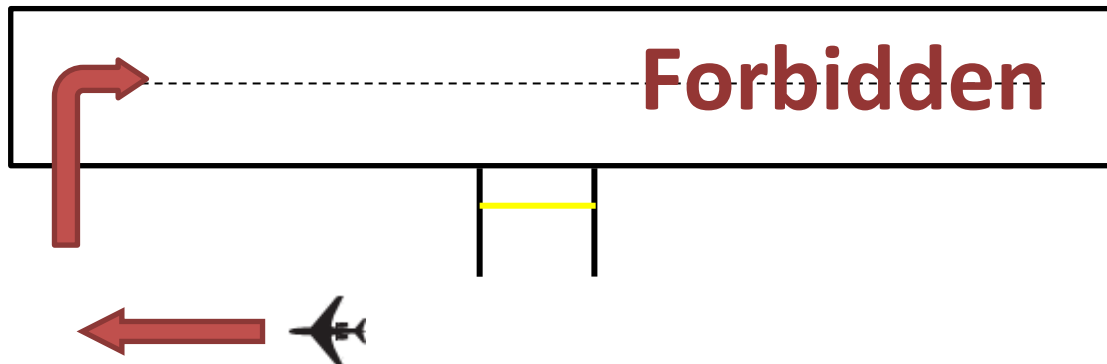
Some small airfields have few hold point and taxiway to exit and enter the runway. Sometimes the holding point is not located at runway threshold. In that case, you must use the runway as taxiway in order to line up at the beginning of the runway. This taxi operation is named “back-track” (or back taxi in some countries).

Below, the medium aircraft is at the unique holding point of the runway, and the air traffic controller gives the take-off clearance but the aircraft need the whole runway to take off, then ATC shall give a back-track clearance to the aircraft, followed by the take-off clearance.



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Some IVAO beginners take sometimes the opportunity to taxi via the grass outside any taxiway and apron: this is a wrong operation if one taxiway exists.

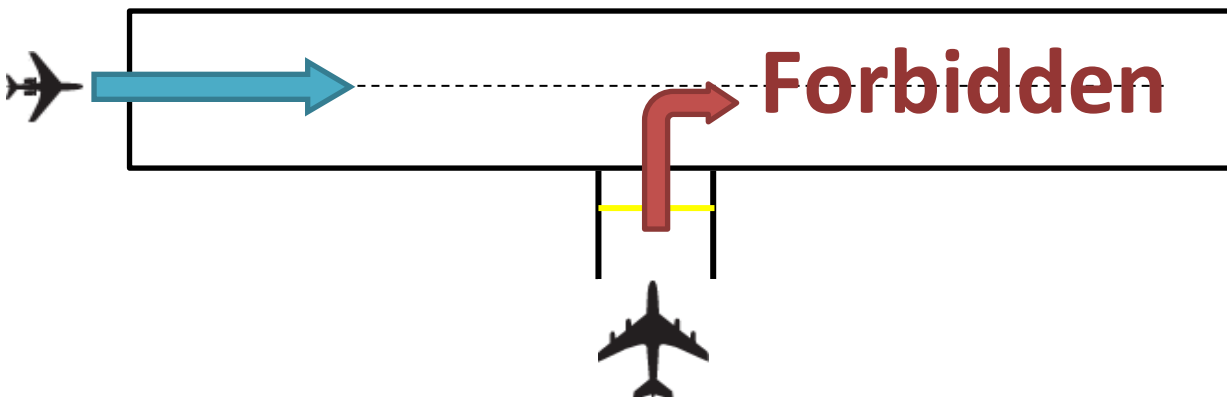


The aircraft shall not leave taxiway or runway in order to join the runway threshold.

For an airfield with only one taxiway at the middle, and with two traffics involved with the situation. The air traffic controller has already given a taxi clearance to a heavy aircraft to the unique holding point.

Below, the heavy aircraft is at the unique holding point of the runway, and the air traffic controller need to give the take-off clearance but there is a medium aircraft on final which is currently landing.

The problem is that the heavy aircraft occupied the unique vacating taxiway and the landing medium aircraft will occupied the runway and cancel the take-off.



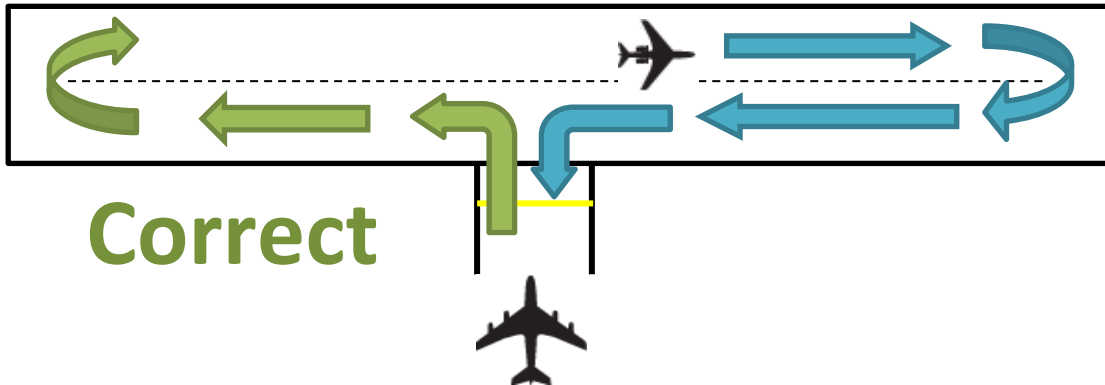
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A simple solution is to use double back-track operation in order to avoid a go-around procedure of the medium aircraft.

The solution is to give a clearance to the medium aircraft to continue to the end of the runway after landing, in order to let the heavy aircraft back-track to the beginning of the runway. Continuing this back-tracking procedure, the heavy aircraft will let the holding point free to use by the medium aircraft.

The medium aircraft will perform a back-track operation after a half turn and vacate the runway using the unique taxiway while the heavy aircraft will wait at the runway threshold. Then, the heavy aircraft can initiate the taking off without risks.



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