



PERFORM A CIRCLING APPROACH [B737]

1. Introduction

This documentation will illustrate how to perform a circling / circle-to-land approach with a Boeing B737NG.

The theoretical part about circling approach is available in another documentation.
Also, basic knowledge on how to operate the Boeing 737 is required.

Refer to ILS or VOR approach documentation for proper use of a Boeing 737 during approach phase.

2. Theoretical aspects

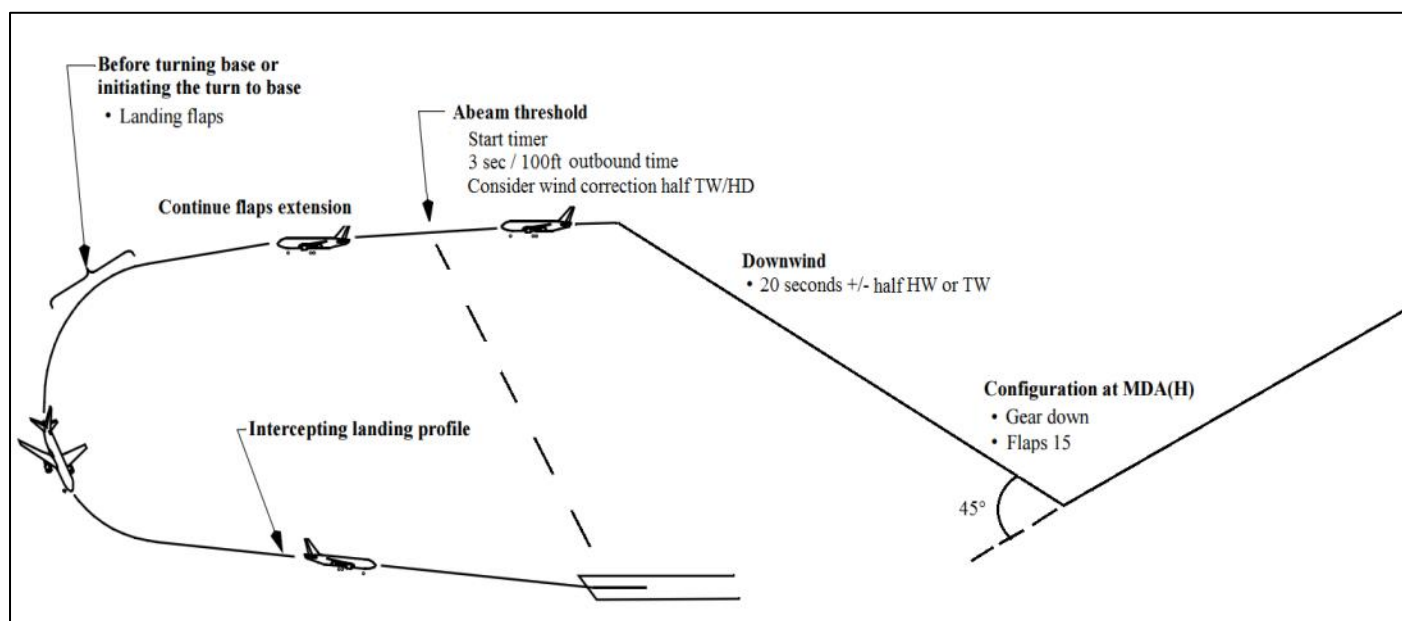
2.1. Scenario

This documentation will be about performing a circling approach using various techniques such as visual references, aircraft manual extract and rules of thumb.

We will be established on final instrument approach at FTTJ on ILS Y RWY05

2.2. Aircraft manual standard operating procedures

Modified extract from the B737 FCOM



2.3. Lateral flightpath

First we need to be established on the instrument approach you have chosen to acquire visual references.

In this case we have chosen a precision ILS CAT I approach. We could have chosen a non-precision approach such as VOR or NDB approach.

High precision ILS CAT II and CAT III approaches are not eligible for circle-to-land manoeuvres and subsequently, CAT I approach must be selected.

Circling minima should normally be the same for all the approach procedures of an airport.

We will find our aircraft established on the localizer a few moments before reaching our MDA. Upon reaching our MDA or the MAPt, we will **open** by performing a 45-degree turn either to the left or to the right and remain on this new course for 20 seconds corrected for wind. Then we will turn toward downwind and we will continue like any visual pattern (start timer across threshold, base turn and final).

The **opening** can only be made given the pilot has acquired runway visual references and estimates he can maintain visual contact during the whole manoeuvring. Otherwise a go-around must be initiated.

If there is no restriction on the chart prohibiting a direction to perform the circle-to-land, try as much as possible to select the direction using this list of priority:

- If landing is intended on a runway which is not the reciprocal QFU, the shortest way to achieve final.
- The downwind leg which is not the published one for VFR flights
- Turn as to keep the runway on your left side (captain) / right side (FO) for better visibility

2.4. Vertical flightpath

Our aircraft will be descending, established on the final approach course and the pilot flying should level his aircraft when clear of clouds, at the latest reaching the MDA.

The instrument approach final descent shall not be continued below MDA, even with visual references.

Since a circle-to-land is generally at low height (typically 700ft AGL) compared to visual traffic patterns (standard on B737 is 1500ft AAL), final descent should be initiated on final leg.

Remember, you may accept a positive deviation but you must never descend below MDA unless you are in position to perform final descent (normally not before entering base turn).

2.5. Speed management

As the aircraft is performing an indirect approach, the pilot flying should operate a stabilized approach. However, since we need to manoeuvre the aircraft, we will not prepare our aircraft in the landing configuration.

For the Boeing B737, we will maintain:

- Vref+15, meaning about 160 IAS, and allowing a standard 25° bank angle.
- Final approach speed Vref when established on final.

Speed is critical, in particular when auto thrust is not used. Attention to aircraft energy is important!

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3. Preliminary work

3.1. Main parameters

Approach will be FTTJ ILS Y RWY05 Circling RWY23

- Minima for CAT C: DA - 1570' (DH - 602')
- Required visibility for CAT C: 2400m
- Missed Approach Point: 0.5NM IFL DME
- Prohibited Sector: Yes, southeast
- Opening Turn: 45° Left (Toward Northwest)
- Maximum IAS: 180 kts

3.2. Lateral path calculations

Remain in the **4.5NM-protected circling area (CAT C)** independently of your calculations.

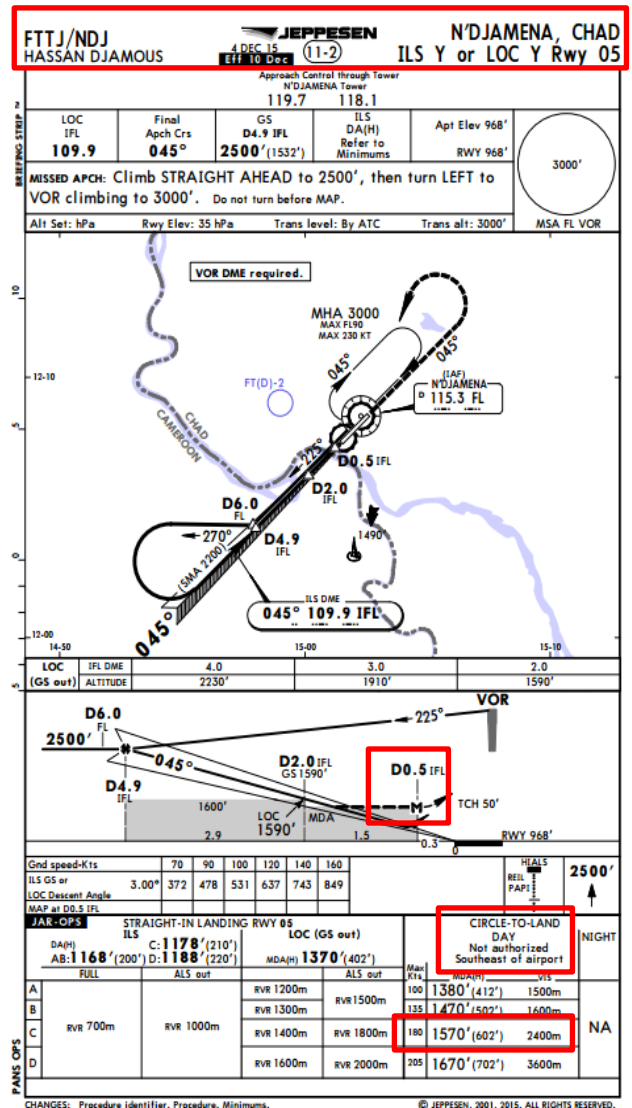
The opening leg is always **20 seconds**

The **outbound time** requires an easy calculation:

$$\text{Outbound Time (sec)} = \frac{\text{MDH (ft)}}{100} * 3$$

Abeam threshold, we will start the timer for a duration of **18 seconds** = 602/100*3

Both durations need to be corrected by **adding or subtracting half of the headwind or tailwind component in seconds** (not considered in this example)



Review appropriate documentation to determine headwind/tailwind component calculations.

3.3. Vertical flightpath

Using the previous method to determine the lateral flightpath, you do not need to perform calculations regarding your descent.

At the end of the final turn, you should be in position for a **3-degree** standard descent. In addition, most runways are equipped with visual guidance systems such as **PAPI**.

Remember: the final descent should be initiated only when in position to do so at a correct sink rate and established on the runway axis.

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4. Flying the circle-to-land

Even though we rely on instruments, you must acquire, maintain and use visual references!

4.1. End of ILS approach

At this point, the following aircraft configuration has to be set while descending established on the ILS:

- Aircraft is at $V_{ref}+15$ (approx. 160kts)
- Aircraft is Flaps 15 and Gear is down.
- Minima are identified: 1570 feet in this case.



When reaching MDA, level off the aircraft.

You see the runway and consider the whole circling achievable in regard to visual flight. In that case you may enter into the opening leg. Check every circling steps (downwind, base and final).

Use the FPV (Flightpath Vector) also named "The Bird" if available for enhanced flight accuracy.



If you do not see the runway, you may proceed until the MAPt at MDA before initiating a go-around.

You may also stop the descent at a higher altitude than the MDA (Recommended on unmanned facilities)

4.2. Opening leg

When you are confident about performing the circling, perform the opening by turning to the **left** (in this case) by **45 degrees**.

We were established on course 046°.
Our new course will be 001°.

As soon as wings are leveled, **start timer**.
As briefed, leg time is **20 seconds** (no wind).

Do mind the wind to not get pushed onto the runway because of the drift. It will result in an overshoot when performing the last turn to final.

Aircraft remains in the same configuration.



4.3. Downwind leg



At the end of timer, perform a 45 degree turn toward the runway to enter downwind.

We were established on course 001°.
Our new course will be 046°.

When flying **abeam** threshold (confirm visually), **start timer**

Leg time using previous formula is **18 seconds**.
There is no wind so no correction.

Optimum lateral distance with runway is **2.2NM**. Adjust!

Continue flaps extension; before base turn, set landing flaps.

If you are flying an advanced depiction of this aircraft, change arrival runway (if able).

4.4. Base and final leg

At the end of timer, perform base turn starting with a 20-degree bank angle.

At half of the turn but not before:

- Reduce speed to approach speed

You may check at half turn that your distance to runway centerline is good: at 140kts, optimum value is 0.7NM.



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Adjust turn speed by modifying the bank angle (max value is 30°).

At the end of the turn, visually adjust your position with the runway.
Normally you should be a bit below the normal descent path.

Do not initiate descent below MDA if not established on final leg or if position is uncertain.

Use any means to confirm your descent:

- Visual guidance such as PAPI
- Instrumental references

Do not forget your landing checklist!



4.5. In case of aborted approach and go-around

In case of aborted approach (which can be due to loss of visual references), the situation is critical!

Your reaction is subsequent to your position in the circling:

- Before being abeam the runway threshold, turn toward the airfield and rejoin the original instrument approach published missed approach path.
- If you are at a later stage, turn toward the airfield, climbing in circles while remaining in the protected area and rejoin as soon as possible a suitable course toward the missed approach path.

In case of go-around on final, perform a standard visual traffic pattern.

If unable, climb using maximum rate of climb to safe altitude, in circles to remain in the protected area.

5. Conclusion

Circle-to-land procedures remain one of the most complex IFR procedures due to its visual part which is not particularly adapted to airliners.

However, based on a solid method, it is no longer too difficult to perform.

See the final trajectory of our flight.



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