Příloha 1

Standardní provozní postupy pro výcvik přiblížení RNP v letecké škole F AIR

1 PROCEDURES FOR RNP APPROACH – LNAV

1.1 General

This chapter describes approach using **RNAV(GNSS) RWY XY** chart. This procedure is based on GNSS (GPS) area navigation and specified as RNP approach. The F AIR fleet avionics suitable for this type of approach is:

- GNS Garmin G430 (OK-AKA, OK-IFR, OK-FZZ)
- Garmin G1000/G950 (OK-UTC, OK-MEP)

Note: FNPT II OK-MEX is suitable for RNP approach training

All approaches must be flown as NON Precision using LNAV minima from minima box published on the approach chart.

Note: The only aircraft equipped for vertical guidance (EGNOS) is P2006T OK-MEP, but EGNOS VNAV and LPV approaches are out of scope of this chapter.

For all aircraft – CDI indication is sufficient for manual flight, nevertheless autoflight is available (if installed)

1.2 Pre-flight Procedures

Flight planning

1) ATC flight plan must contain:
   - Filed 10 – **G** (GNSS)**, R** (PBN approved)
   - Field 18 – **PBN/S1** (RNP Approach), **NAV/SBAS** (only OK-MEP)
2) Conventional navigation approach (NON-RNAV) must be available at the alternate airport or at the destination if an alternate is not required.
3) Check RAIM availability at the time of arrival (ETA ± 15min). Use Augur prediction tool:

   http://augur.ecacnav.com/augur/app/npa

4) Check RNAV(GNSS) LNAV approach availability by NOTAM.
5) Ensure that all navigation onboard equipment including GNSS sensor is operative (aircraft documentation) and all required conventional radionavigation facilities are usable (NOTAM)

In the Aircraft – Before Taxi

1) Ensure that the navigation database is valid.
2) Check GPS CDI setting – **AUTO** (OK-MEP – Check EGNOS updates – **ON**)
3) Check that navigation database contains intended procedures which correlates witch valid Jeppesen documentation.

1.3 Preparation for the Approach – RNP Approach Specifics

Before TOD – complete all steps described in the general flight procedures together with RNP approach specifics described here.

The RNAV GNSS procedure must be loaded from navigation database. These formats of database procedures could be used using G1000:

- **RNAV __GPS LNAV**
- **RNAV __GPS LNAV+V**
- **RNAV __GPS L/VNAV**
- **RNAV __GPS LPV**
- Using GPS overlay of conventional approach is also acceptable. Procedure name format is than e.g. **NDB__GPS LNAV** (where **GPS LNAV** indicates that using of GPS sensor is acceptable to fly the procedure)

Corresponding approach mode (**LNAV**, **LNAV+V**, **L/VNAV**, **LPV**) will be displayed when activated for final approach in upper right corner of HSI.

G430 (without SBAS) database procedures formats:

- **RNAV __ ^{GPS}**
- **GPS__ ^{GPS}**
- Using GPS overlay of conventional approach is also acceptable. Procedure name format is than e.g. **NDB__ ^{GPS}** (where ^{GPS} indicates, that using of GPS sensor is acceptable to fly the procedure)

Procedures LNAV+V, L/VNAV and LPV (available for SBAS sensors) have similar or more precise horizontal guidance, but glide path indication on the final approach is also given. This vertical guidance could be used to fly CDFA approach easily and more precisely.

Warning: LNAV minima shall be used in all cases

Approach briefing for an RNP approach should generally consist of:

1) STAR:
    - ROUTING and ALTITUDE RESTRICTIONS
    - TAA procedure could be used
2) APPROACH PLATE:
    - BRIEFING STRIP
        - Check for important notes
    - MSA
    - HORIZONTAL PLAN
        - Check correct sequence of waypoints and tracks.
        - Check for important notes
    - VERTICAL PROFILE
        - Angle/expected vertical speed
        - Altitude restrictions (SDFs)
    - MISSED APPROACH
        - Charted procedure – crosscheck with navigation database procedure
        - Fuel remaining (time available for next approach, holding or diversion)
3) AIRPORT DIAGRAM
    - LAYOUT AND TAXI PROCEDURE
4) CONTINGENCY PROCEDURES
    - LOSS OF RNP CAPABILITY
        - Alternative (NON RNAV) missed approach procedure

If ETA differs more then ±15min from original ETA new RAIM prediction check is required – Use onboard RAIM prediction tool.

1.4 Arrival and Initial Approach

30NM before reaching destination airport check that the system transits from en-route mode to arrival mode (FSD = 1NM)

Note: When navigating with an active arrival route, the flight phase and CDI scale will not change until the aircraft arrives at the first waypoint in the arrival route (if within 31 nm from the destination airport).

Use the avionics according to arrival procedure (RNAV 1, DIRECT TO, TAA procedures, holdings, reversal procedures etc.) as described in other chapters of SOP, Avionics Pilot Guides and AFM.

Use GPS distance to next waypoint for orientation.

1.5 Interception of the Final Approach Track

Aircraft should be established on the final approach track at least 2NM before FAF. Only than automatic transition to approach is assured.

If vectors to final are provided use VTF function. It will automatically activate the approach mode.

Warning: ***Do not accept:***

- ***"DIRECT TO FAF"***
- ***"DIRECT TO IF" with intercept angles exceeding 45deg***

Do not make changes in final approach segment in GNS flight plan

When established on final approach track set the navigation system display to the default navigation page (long push of CLR pushbutton) or MAP page with WPT, DTK and DIS fields. For G1000 only – Switch the PFD FPL inset on.

Use GPS distance to next waypoint (IF, FAF) for orientation.

Warning: DME distances are not usually collocated witch charted RNAV waypoints mostly defined from RWY threshold

1.6 Deceleration and Landing Configuration

Approximately 5NM before FAF – commence deceleration to be able to configure the aircraft according to following schedule (GPS distance is used):

1) 2NM to FAF – Check transition of the navigation system to **APCH MODE** G430 (W/O SBAS) **–** **APCH**, G1000 – **LNAV**, **LNAV+V**, **L/VNAV**, **LPV** and then set flaps 10 deg (or T/O for Tecnam) and gear down
2) 0.2NM to FAF – Flaps for approach

Continuously decelerate to flaps speed and extend flaps on schedule to reach target approach speed on FAF. Watch altitude, loosing altitude is common mistake. It is necessary to increase pitch with speed reduction and trim the

aircraft continuously. Before selecting next flap position check that speed is below flaps extension speed, then select flaps. Standard call outs are:

- "**SPEED CHECK - FLAPS 10**"
- "**SPEED CHECK - FLAPS 25**"

With first flaps selection – switch FUEL PUMPS and check LDG LT ON.

Before landing gear extension check current airspeed is below the LDG gear operation/extension speed and call "**SPEED CHECK** - **GEAR DOWN**" and extend the landing gear (if applicable).

	FNPT II	P2006T	PA 34	PA 28 Archer/ Warrior	C172
DECELERATE	15 MP	18 MP	15 MP	2000 RPM	2000 RPM
FLAPS 10DEG OR T/O	< 140 kt	< 119 kt	< 140 kt	< 102 kt	< 110 kt
V_{LO} GEAR DN	< 130 kt	< 93 kt	< 128 kt	--------	--------
FLAPS FOR STANDARD APPROACH	25deg < 120 kt	Full < 93 kt	25deg < 120 kt	25deg < 102 kt	20deg < 85 kt
FINAL APPROACH SPEED	90-100 kt	80kt	90-100 kt	80kt	75kt
FINAL APPROACH POWER	18 MP	20 MP	18 MP	1800 RPM	1800 RPM

1.7 Final Approach General

There are two types of descend on final approach of non precision approach. These are:

- **CDFA** – Continuous Descend Final Approach
- "**Dive and drive**" - old method of step down flight

CDFA is compulsory (with exceptions) procedure for all commercial operators. Step down procedure is not recommended, but has one single advantage for light aircraft as described below.

1.8 CDFA Approach General

The approach is flown on constant descend angle without any step down level off. Instead of MDA the DA is used and there is no level flight at this altitude. When DA is reached and decision to land is made, the aircraft continues on constant angle descend to flare. If go around is to be executed it is initiated immediately when reaching the DA (without any level off segment).

To be able to follow continuous descend angle, correct rate of descend must be briefed and flown. This value could be calculated or given from Jeppesen chart using expected ground speed on the final approach.

Gnd speed-Kts	70	90	100	120	140	160
Descent Angle 3.01°	373	479	532	639	745	852
MAP at D1.8						

Figure 1.1 Jeppesen Approach Chart Descend Rate Box

Since aircraft must not descend even 1 ft below MDA, if visual reference is not established, correct DA must be used. MDA is depicted as DA on Jeppesen charts nowadays, but this altitude is still the "old" MDA with no margin for height loss during initiation of go around. Thus higher DA must be briefed and used. F AIR SOP set this add on to be 50ft:

DA = published MDA/DA + 50ft

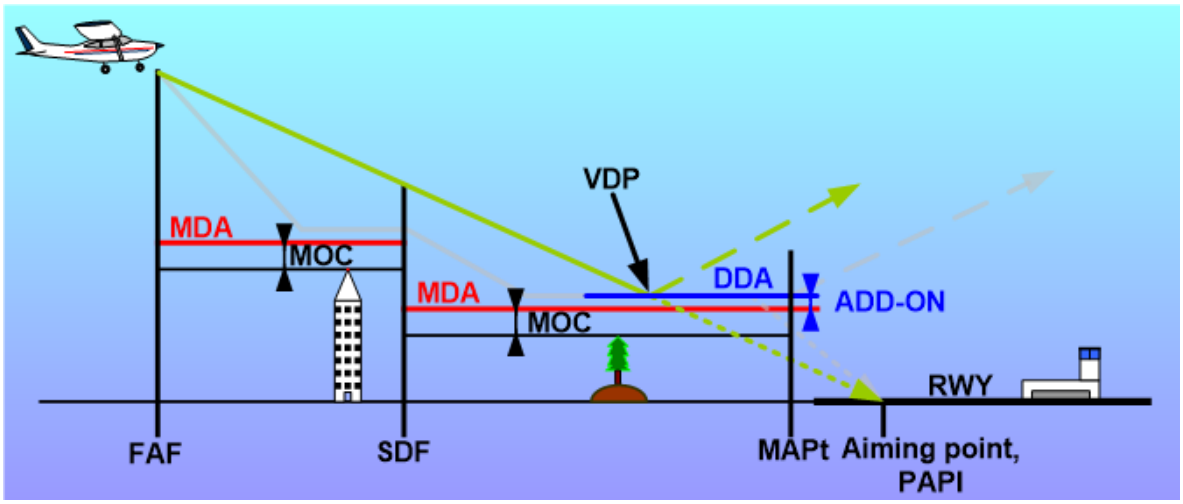

Figure 1.2 CDFA Final Approach

With respect to construction of final segment of non precision approach all minimum altitudes and corresponding fixes must be taken into account. Pilot must be sure that SDF and its minimum altitudes are adhered and that go around is initiated not later then at MAPt. This is specially important in single pilot operation, where pilot errors could be extensive during high workload periods.

RNAV systems could provide also vertical guidance (e.g. LNAV+V). SBAS G1000 displays magenta glide path slope indication similar to green ILS glide slope indication. This indication will help you to fly CDFA approach.

Note: If missed approach procedure contains a turn, this turn must not be initiated before MAPt.

1.9 CDFA – FAF

1) With flaps selected for final approach position pitch down to target APPROACH PITCH
2) Reduce power to FINAL APPROACH POWER
3) Check target VERTICAL SPEED – it is really essential for non precision approach
4) TRIM the aircraft
5) Call briefed decision altitude from APCH chart

"**FINAL APPROACH FIX, DECISION ALTITUDE 1210**"

Warning: Final descend could be initiated only if APCH MODE is active.

Navigation system will now display distance to MAPt, mostly RWY threshold (**RW**XY)

1.10 CDFA – Final Approach

When the aircraft is stabilized on the approach set propellers full forward and perform BEFORE LANDING CHECK LIST – **GUMPS** CHECK.

Note: Because final approach is quite busy time for the pilot, GUMPS check could be easily forgotten. If not performed before, use 4 NM as a reminder to complete the GUMPS.

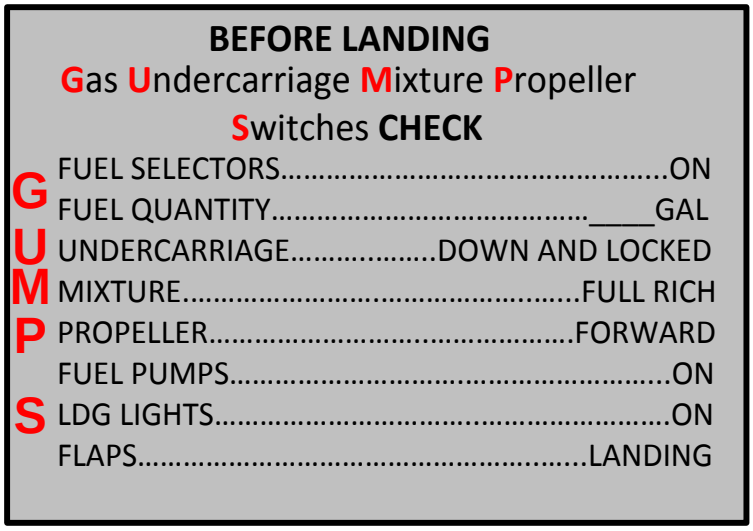

Figure 1.3 Before Landing Check List – GUMPS Check Example

Continuously check altitudes at GPS distances from chart on the approach plate. Try to stay one to half mile ahead of the aircraft, e.g.:

Passing 5.5 NM call: "**5 NM GPS 2190**"
Passing 5 NM call: "**CHECKED**" or "**PLUS** or **MINUS** __ (difference)"

Be aware of minimum altitudes over SDFs and MAPt position.

DIST to RW10	6.0	5.0	4.0	3.0	2.0	1.0
ALTITUDE	2720′	2410′	2090′	1770′	1450′	1130′

Figure 1.4 Jeppesen Approach Chart Distance Crossing Altitudes

Pay attention to possible navigation system messages/alerts. Good practice is to check for possible alert together with checking crossing altitude every mile. These alerts which require execution of missed approach are described in chapter Missed Approach for RNP Approach. If landing runway is in sight the approach could be continued even if navigation system is not capable of navigation on final approach.

1.11 CDFA – 1000ft AAL

First gate for stabilization – if all stabilization criteria are not met consider go around.

This point also serves as a gate for continue or go around based on WX reports.

1.12 CDFA – 500ft AAL

500 ft AAL is the gate for fully stabilized approach. Passing 500 ft AAL check stabilized approach criteria and:

- If stabilized criteria are met call "**500, STABILIZED**" and continue in approach to DA
- If one or more stabilized criteria are not met call "**500, GO AROUND, FLAPS 10**" and initiate go around procedure as described in paragraph Go Around for RNP Approach.

Stabilized approach criteria
Lateral flight path ±½ scale
Glide path ±100ft
VS ≤ 1000ft/min if not briefed accordingly
Bank≤15°
Approach speed -10kt, +20kt
Gear + Flaps down
Throttle not idle
GUMPS check completed

1.13 CDFA – Approaching DA

1) Until DA + 100 ft keep "head down" and fly according to the instruments
2) DA + 100ft call "**APPROACHING MINIMUM**"
3) From this moment distribute attention to instruments and to the outside view. Continue flying by the instruments if still in IMC. If visual reference is established distribute attention evenly between the instruments the outside view, instruments will help you maintain vertical and horizontal path more precisely, especially in bad visibility.

1.14 CDFA – Reaching DA

When reaching DA the final decision to land or go around must be made.

A pilot may not continue an approach below the decision altitude of non precision approach, unless at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

- Elements of the approach light system
- The threshold
- The threshold markings
- The threshold lights
- The threshold identification lights
- The visual glide slope indicator
- The touchdown zone or touchdown zone markings
- The touchdown zone lights
- Runway edge lights

If visual reference is established call: "**MINIMUM, LANDING**" and continue in approach for landing. Avoid changes in pitch and power setting.

Go around may still be executed below minimums even if LANDING was called out – the reasons could be: blocked RWY, loss of visual references, ATC request, aircraft not stabilised etc.

Note: Pilots have tendency to pitch down when the visibility is poor

If visual reference is not established call: "**MINIMUM, GO AROUND, FLAPS 10**" and execute go around procedure as described in paragraph Go Around for RNP Approach.

1.15 CDFA – Landing

If the decision is to land, keep in mind that the aircraft is at least 250 ft above the runway:

- Do not change engine power significantly until FLARE
- Do not change PITCH significantly until FLARE
- Concentrate most of your attention outside
- Use PAPI or VASI to maintain correct vertical path
- Reduce power smoothly in flare
- Perform normal touchdown and ground roll

1.16 Non CDFA General

This method of non precision was used prior to the implementation of CDFA approach. Non CDFA final approach is normally not used in commercial air transportation, but could be still used in light aircraft training and could have advantages for light aircraft.

Final approach is flown by "dive and drive" technique. This means, that passing FAF pilot sets descend rate greater than necessary for continuous descend. This steeper descend brings the aircraft to MDA before SDF and thus level flight is required till passing this fix. After positive identification of SDF, descend to next MDA could be initiated – again steeper with level flight in MDA to next SDF or MAPt.

The level flight in MDA could be continued to MAPt and if no visual references are established, go around must be initiated not later than in MAPt. Pilot can leave MDA when visual references are established and descend for landing to aiming point using standard approach angle.

Visual descend point is determined by intersection of standard approach descend path and MDA.

Non CDFA technique is more demanding and is more susceptible to error (reading of MDAs, SDF positions, pilot technique errors – undershooting of MDA, low speed – throttle control etc.) The only advantage is that the aircraft could get closer to the RWY and this increases chances to establish visual references in low visibilities. But this is advantage only for light aircraft where late descend (after VDP) and landing beyond aiming point is not a performance concern.

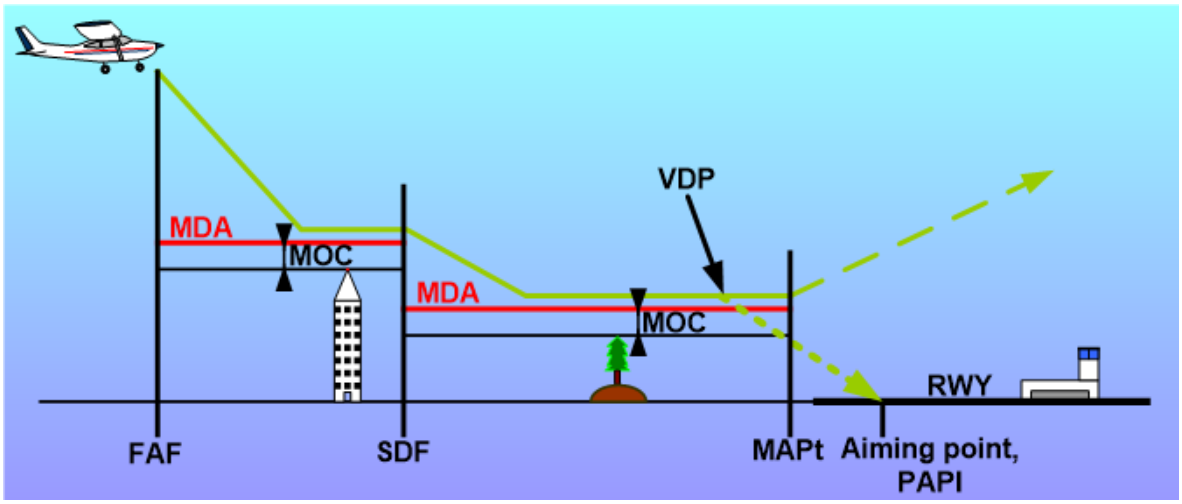

Figure 1.5 Non CDFA Final Approach

RNP approach step down fixes could be coded as a waypoint in navigation database or could be derived by GPS distance from MAPt, mostly RWY threshold.

1.17 Non CDFA – FAF

1) With flaps selected for final approach position pitch down to target DESCEND PITCH
2) Reduce power to slightly lower than FINAL APPROACH POWER (2000 RPM or 2inHg MP lower)
3) Check target VERTICAL SPEED – this speed will be greater than the one calculated for continuous approach depicted on approach plate
4) TRIM the aircraft
5) Call next MDA and SDF:
   "**FINAL APCH FIX, DESCENDING 2830 TO 4NM GPS**"
   OR if SDF is not published:
   "**FINAL APCH FIX, DESCENDING DESCENDING 2510, MAPt AT RWY THRESHOLD**"

Warning: Final descend could be initiated only if APCH MODE is active.

Navigation system will now display distance to MAPt, mostly RWY threshold (**RW**XY)

1.18 Non CDFA – Final Approach

When the aircraft is stabilized in the descend set propellers full forward and perform BEFORE LANDING CHECK LIST – **GUMPS** CHECK.

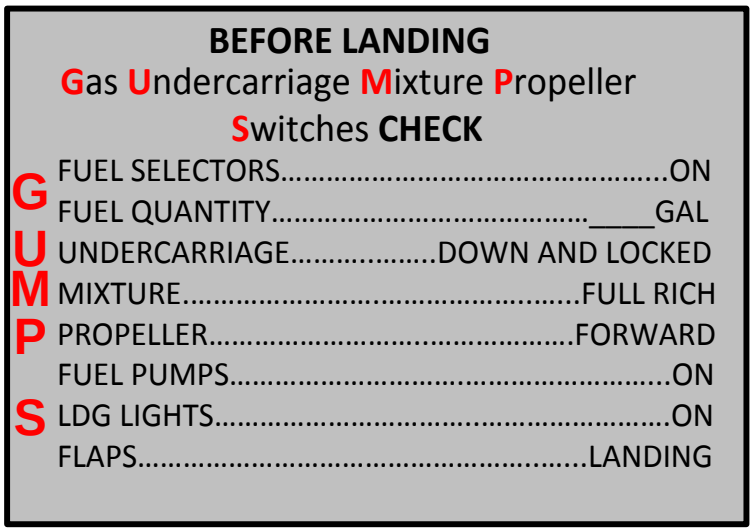

Figure 1.6 Before Landing Check List – GUMPS Check Example

Continuously check navigation system for messages/alerts. These alerts which require execution of missed approach are described in chapter Missed Approach for RNP Approach. If landing runway is in sight the approach could be continued even if navigation system is not capable of navigation on final approach.

1.19 Non CDFA – Reaching SDF MDA

1) 100ft above SDF MDA call **"APPROACHING 2830"**
2) Smoothly level the aircraft off to stay above MDA. Pitch up and add appropriate power to maintain speed. It is strongly recommended to fly at MDA + margin for unforeseen turbulence, gusts etc. This margin is preferably 50ft.
3) TRIM the aircraft

Note: Power changes during "dive and drive" are significant due to drag caused by landing configuration.

1.20 Non CDFA – Passing SDF

1) Pitch down to target DESCEND PITCH
2) Reduce power to slightly lower than FINAL APPROACH POWER (2000 RPM or 2inHg MP lower)
3) Check target VERTICAL SPEED – this speed will be greater then the one calculated for continuous approach depicted on approach plate
4) TRIM the aircraft
5) Call next MDA and SDF:
   "**PASSING STEP DOWN FIX, DESCENDING 2280 TO 2NM GPS**"

   OR if next SDF is not published:
   "**PASSING STEP DOWN FIX, DESCENDING 1420, MAPt AT RWY THRESHOLD**"

1.21 Non CDFA – 1000ft AAL

First gate for stabilization – even though non CDFA approach is not stabilized approach from its basics, some stabilized criteria like maximum lateral deviation,

speed deviation etc, could be taken into account and if not met go around should be considered.

This point also serves as a gate for continue or go around based on WX reports.

1.22 Non CDFA – 500ft AAL

500 ft AAL is the gate for fully stabilized approach for continuous descend approaches. Nevertheless passing 500 ft AAL stabilized approach criteria should be checked even for non CDFA approach and:

- If stabilized criteria are met call "**500, STABILIZED**" and continue in approach
- If one or more stabilized criteria are not met call "**500, GO AROUND, FLAPS 10**" and initiate go around procedure as described in paragraph Go Around for RNP Approach.

Stabilized approach criteria
Lateral flight path ±½ scale
VS ≤ 1000ft/min if not briefed accordingly
Bank≤15°
Approach speed -10kt, +20kt
Gear + Flaps down
Throttle not idle
GUMPS check completed

1.23 Non CDFA – Reaching MDA

1) 100ft above SDF MDA call **"APPROACHING MINIMUM"**
2) Smoothly level the aircraft off to stay above MDA. Pitch up a add appropriate power to maintain speed. It is strongly recommended to fly at MDA + margin for unforeseen turbulence, gust etc. This margin is preferably 50ft.
3) TRIM the aircraft

1.24 Non CDFA – MDA

When stable level off flight is achieved call: **"MINIMUM"**

From this moment distribute attention between the instruments and the outside view. Search for visual references and keep in mind MAPt position. Continue flying by the instruments if still in IMC.

A pilot may not continue an approach below the MDA of non precision approach, unless at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

- Elements of the approach light system
- The threshold
- The threshold markings
- The threshold lights
- The threshold identification lights
- The visual glide slope indicator
- The touchdown zone or touchdown zone markings
- The touchdown zone lights
- Runway edge lights

If visual reference is established:

1) Call **"LANDING"**
2) Distribute attention evenly between the instruments and the outside view, instruments will help you maintain vertical and horizontal path more precisely, especially in bad visibility.
3) When reaching descend path (final approach descend angle, on PAPI or VASI): Reduce power to approximately FINAL APPROACH POWER and initiate descend for landing.

Go around may still be executed below minimums even if LANDING was called out – the reasons could be: blocked RWY, loss of visual references, ATC request, aircraft not stabilised etc.

Reaching MAPt and visual references were not established:

Call: "**GO AROUND, FLAPS 10**" and execute go around procedure as described in paragraph Go Around for RNP Approach.

1.25 Non CDFA – Landing

If the decision is to land, keep in mind that the aircraft is at least 250 ft above the runway:

- Maintain approximately FINAL APPROACH POWER until FLARE
- Maintain APPROACH PITCH until FLARE
- Concentrate most of your attention outside
- Use PAPI or VASI to maintain correct vertical path
- Reduce power smoothly in flare
- Perform normal touchdown and ground roll

1.26 Reportable Events

Technical defects and the exceeding of technical limitations, including:

- Significant navigation errors attributed to incorrect data or a data base coding error.
- Unexpected deviations in lateral/vertical flight path not caused by pilot input or erroneous operation of equipment.
- Significant misleading information without a failure warning.
- Total loss or multiple navigation equipment failure.
- Loss of integrity (e.g. RAIM) function whereas integrity was predicted to be available during the pre-flight planning.

2 GO AROUND FOR RNP APPROACH

2.1 Go around must be initiated immediately in following cases:

- No visual reference is established at DA
- No visual reference is established at MDA and MAPt was reached
- Approach is not stable
- Extensive lateral deviation
- The aircraft is not in position from which it could continue to safe landing after reaching visual contact
- Traffic or obstacle on the landing RWY
- On ATC request

RNP approach specific:

- RNAV equipment failure
- Loss of integrity
- Loss of system integrity monitoring

G1000 alerts:

LOI in lower left part of HSI – Loss of integrity **–** loss of RAIM or navigation capability – GPS could not be used as primary navigation

ABORT APR – Loss of GPS navigation. Abort approach.

LOI – GPS integrity lost. Crosscheck with other NAVS.

GPS NAV LOST – Loss of GPS navigation. Insufficient satellites.

GPS NAV LOST – Loss of GPS navigation. Position error.

GPS NAV LOST – Loss of GPS navigation. GPS fail.

Note: **APR DWNGRADE – Approach downgraded** Alert message appears only if LNAV/VNAV or LPV approach is selected – approach to LNAV minimums could be still continued

G430 (without SBAS) alerts:

INTEG in lower left corner of the display – loss of RAIM or navigation capability – GPS could not be used as primary navigation

MSG – Approach is not active

MSG – RAIM is not available

MSG – RAIM not available from FAF to MAP waypoints

MSG – RAIM position warning

MSG – Degraded accuracy

MSG – Poor GPS coverage

2.2 Go Around Procedure

Go around procedure is initiated by call out "**GO AROUND, FLAPS 10**" (this call out could be adjusted for Tecnam aircraft as "**GO AROUND, FLAPS TAKE OFF**" due to different flaps position indication)

1) Set climb PITCH V_y + max (take-off) power

Note: The aim is to climb out from the obstacles, not to accelerate. Control the pitch precisely for smooth transition into climb without acceleration or undershooting V_Y.

2) Reduce flaps to 10deg or T/O position
3) when VSI + altimeter show climb call "**POSITIVE RATE - GEAR UP"** and retract landing gear (if applicable)
4) Maintain V_y (blue line)

	FNPT II	P2006T	PA 34	PA 28 Archer	PA 28 Warior	C172
GEAR RETRACTION	107 kt	93 kt	107 kt	---	---	---
Vy	**88 kt** (blue line)	**80 kt** (blue line)	**88 kt** (blue line)	**76 kt**	**79 kt**	**74 kt**

5) Immediately after selecting the gear lever up (or for fixed undercarriage aircraft after selecting flaps to 10deg or T/O position) – **activate missed approach** procedure in navigation system.

   OR

   If the go around was initiated due to loss of RNAV capability select primary indicator (CDI) to guide the aircraft by conventional navigation where possible

6) Retract the flaps in sequence at safe altitude (200ft above MINIMUMS): Call "**FLAPS UP**" and set flaps up.

   Inform ATC, if go around was initiated due to loss of RNAV capability. Continue in using conventional navigation or request alternative procedure or radar vectors.

7) At MINIMUMS + 500ft call "**ACCELERATION ALTITUDE**"
8) Reduce PITCH and accelerate to $v_{cruise\ climb}$
9) Set climb power

	FNPT II	P2006T	PA-34	PA 28 Archer/ Warrior	C172
$V_{cruise\ clb}$	105 kt	90-100 kt	105 kt	87 kt	85 kt
CLIMB POWER	30 MP 2500 RPM	27 MP 2265 RPM	32 MP 2500 RPM	FULL PWR reduced by 30-50 RPM	FULL PWR reduced by 30-50 RPM

10) Perform AFTER TAKE OFF CHECKLIST/UPS CHECK (see picture bellow)
11) Communicate

Note: Always keep in mind NAP

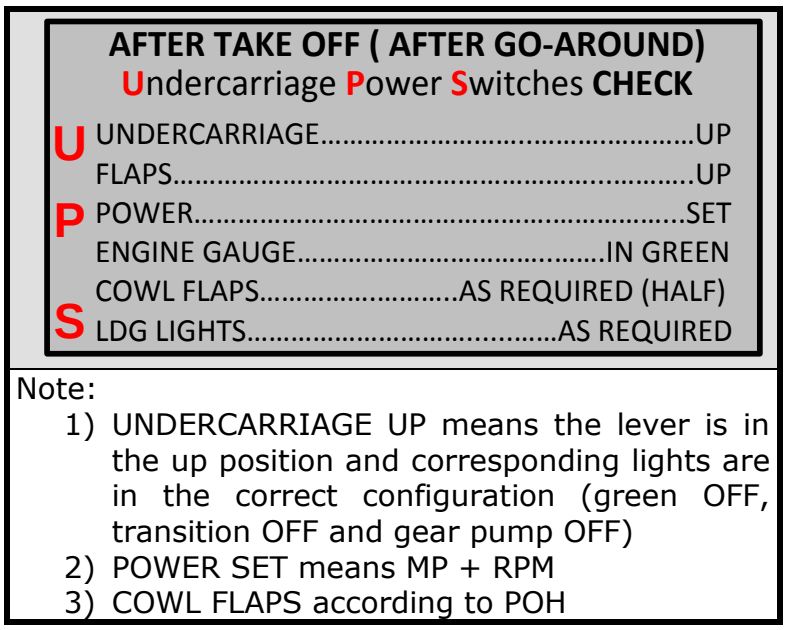

Figure 2.1 Ups Check Example