NAV CANADA ▸ PROPRIETARY

PBN Considerations for Air Traffic Controllers (ATC)

ICAO APAC

PBNICG/10, April 20th 2023

Serving a world in motion
navcanada.ca

NAV CANADA

In 1996, NAV CANADA became the world's first fully privatized ANS

Facts and Figures

We are a private, non-share capital company, managing one of the largest regions of airspace in the world.

ACC Traffic

2.9 million flights

Total IFR Flight Hours: 3.2 million

FY22

Tower, FSS and RAAS Traffic

5.6 million movements

FY22

18 M

square kilometres of airspace managed by NAV CANADA

100+

staffed sites

4,500+

employees across the country

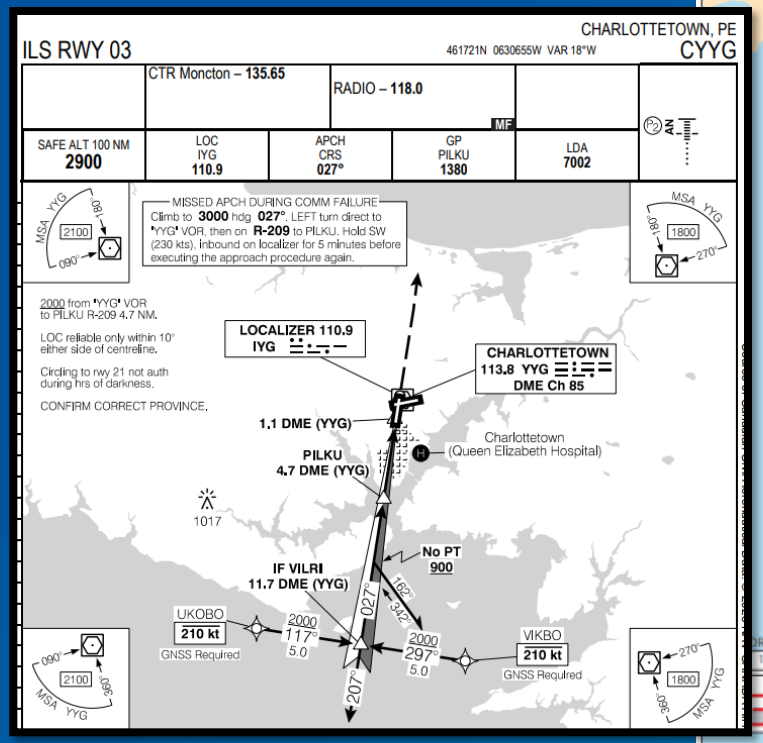
50,000+

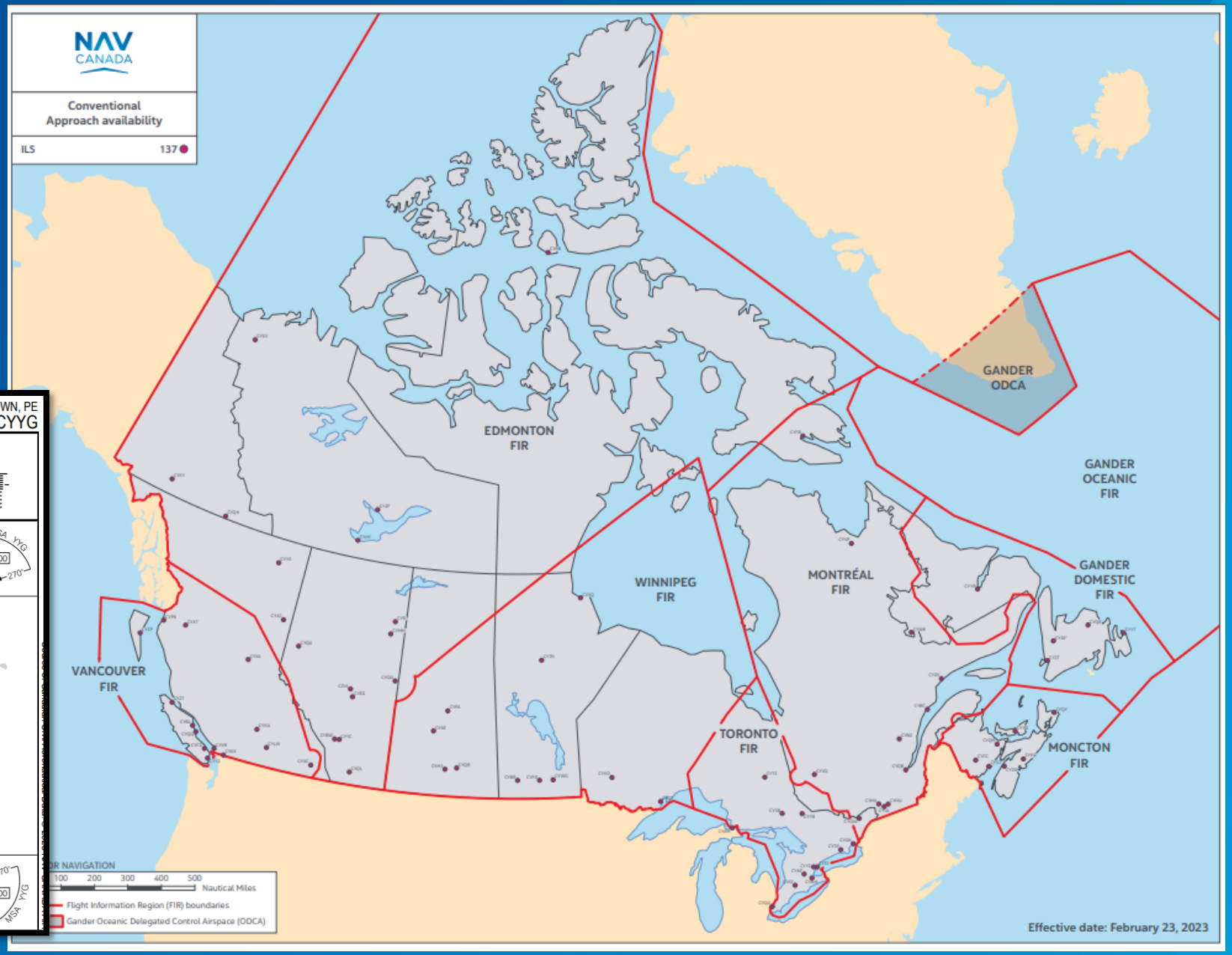
customer accounts

The facts and figures presented here were accurate as of 2022.

ILS

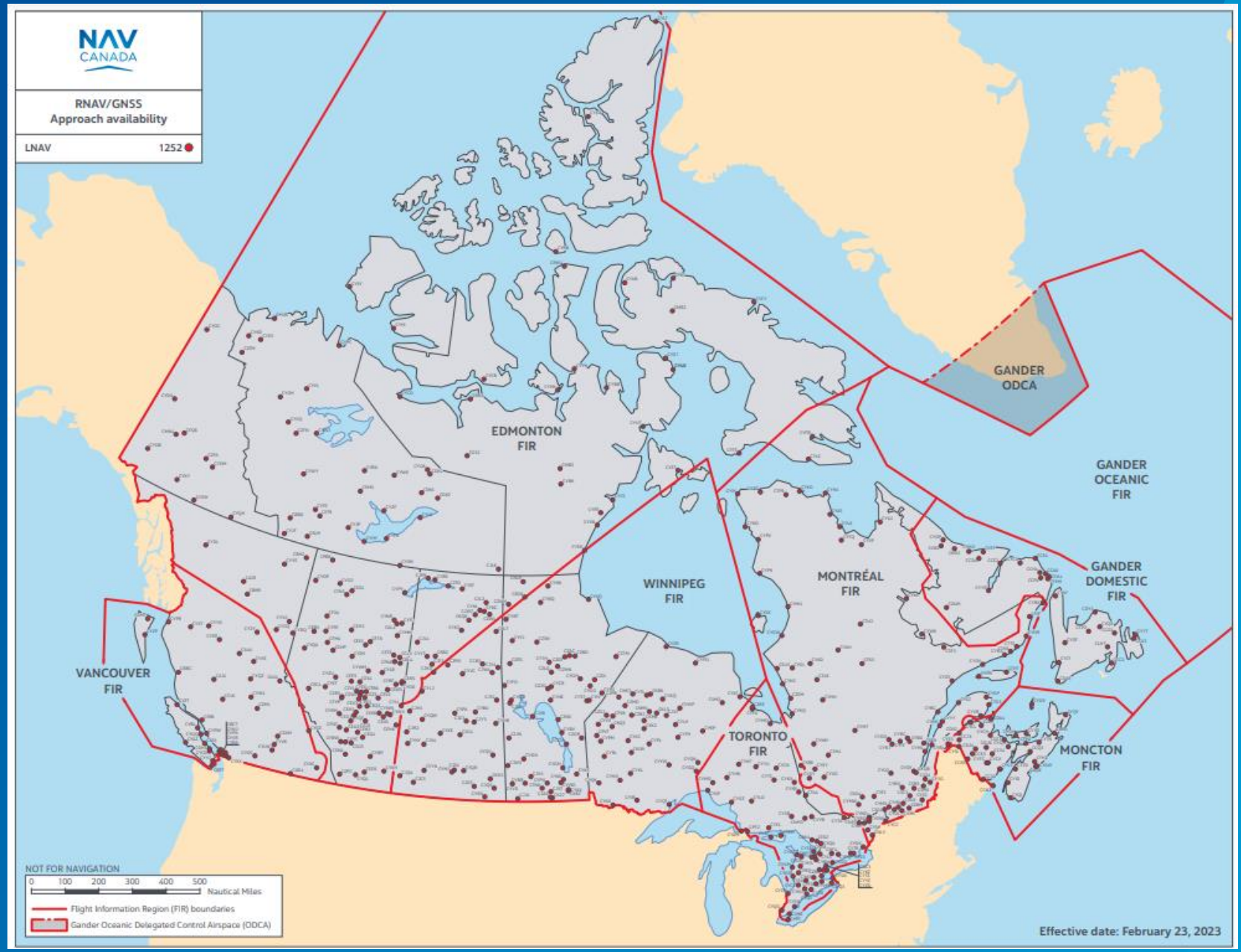
137


ILS RWY 03
CHARLOTTETOWN, PE
CYYG
461721N 0630655W VAR 18°W
CTR Moncton – 135.65
RADIO – 118.0
MF
SAFE ALT 100 NM
2900
LOC
IYG
110.9
APCH
CRS
027°
GP
PILKU
1380
LDA
7002
AN
MISSED APCH DURING COMM FAILURE
Climb to 3000 hdg 027°. LEFT turn direct to 'YYG' VOR, then on R-209 to PILKU. Hold SW (230 kts), inbound on localizer for 5 minutes before executing the approach procedure again.
2000 from 'YYG' VOR to PILKU R-209 4.7 NM.
LOC reliable only within 10° either side of centreline.
Circling to rwy 21 not auth during hrs of darkness.
CONFIRM CORRECT PROVINCE.
LOCALIZER 110.9
IYG
CHARLOTTETOWN
113.8 YYG
DME Ch 85
1.1 DME (YYG)
PILKU
4.7 DME (YYG)
Charlottetown
(Queen Elizabeth Hospital)
1017
No PT
900
IF VILRI
11.7 DME (YYG)
UKOBO
210 kt
GNSS Required
2000
117°
5.0
027°
162°
342°
207°
2000
297°
5.0
VIKBO
210 kt
GNSS Required
MSA YYG
2100
1800


NAV CANADA
Conventional Approach availability
ILS 137
EDMONTON FIR
WINNIPEG FIR
VANCOUVER FIR
MONTRÉAL FIR
TORONTO FIR
GANDER ODCA
GANDER OCEANIC FIR
GANDER DOMESTIC FIR
MONCTON FIR
Nautical Miles
Flight Information Region (FIR) boundaries
Gander Oceanic Delegated Control Airspace (ODCA)
Effective date: February 23, 2023

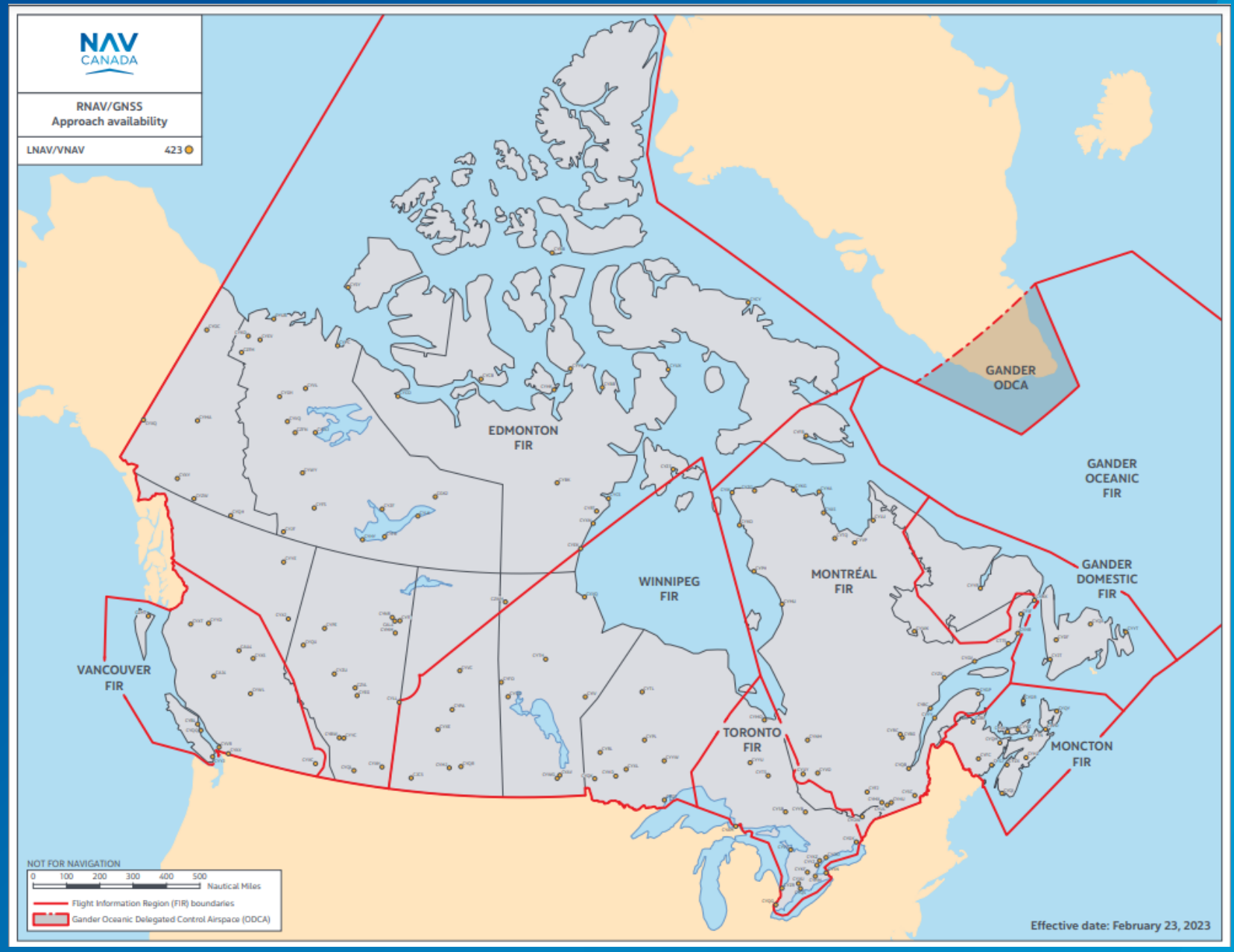
LNAV

1252


NAV CANADA
RNAV/GNSS
Approach availability
LNAV 1252
EDMONTON FIR
WINNIPEG FIR
VANCOUVER FIR
TORONTO FIR
MONTRÉAL FIR
GANDER ODCA
GANDER OCEANIC FIR
GANDER DOMESTIC FIR
MONCTON FIR
NOT FOR NAVIGATION
0 100 200 300 400 500 Nautical Miles
Flight Information Region (FIR) boundaries
Gander Oceanic Delegated Control Airspace (ODCA)
Effective date: February 23, 2023

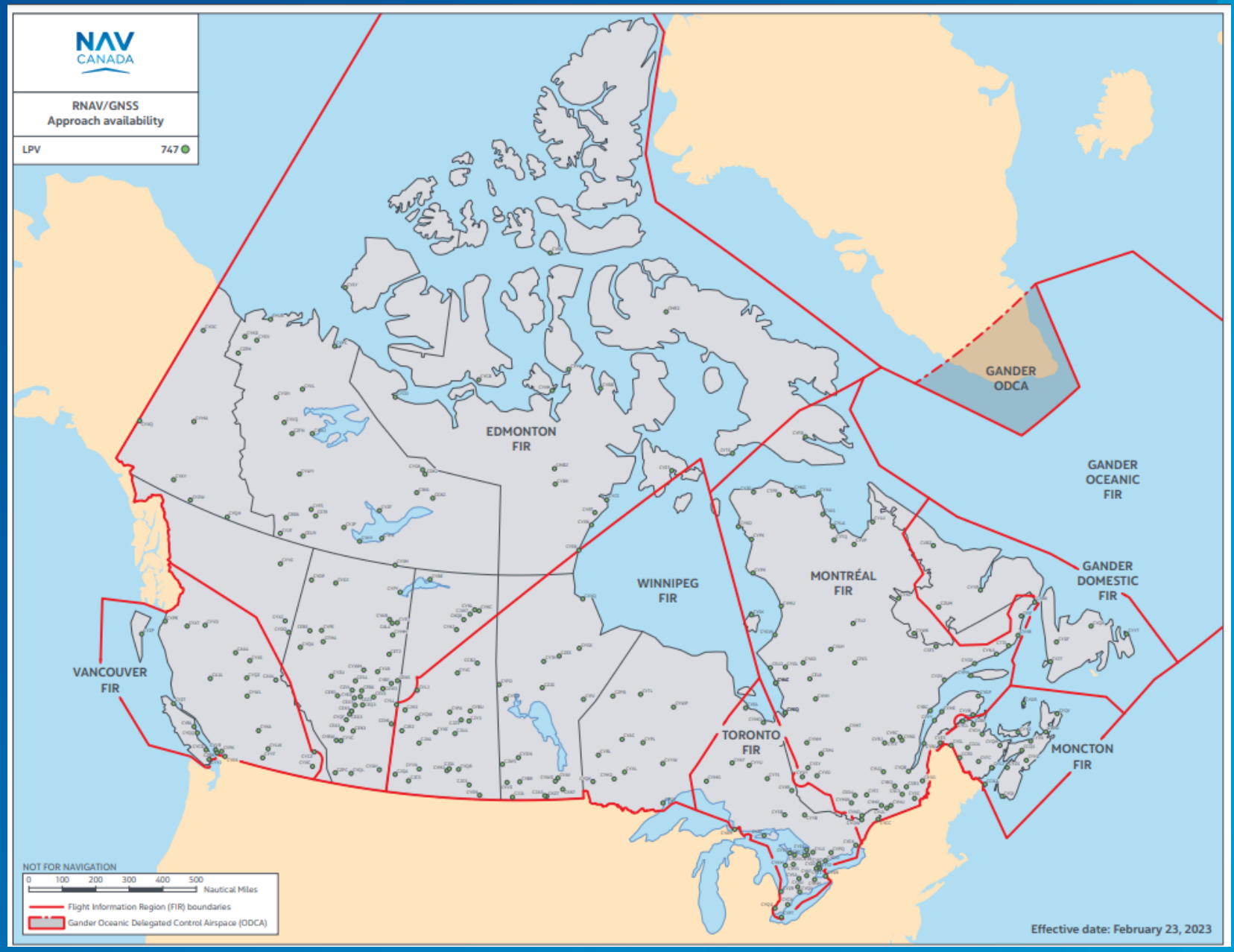
LNAV/VNAV

423



LPV

747


NAV CANADA
RNAV/GNSS
Approach availability
LPV 747
EDMONTON FIR
WINNIPEG FIR
VANCOUVER FIR
MONTRÉAL FIR
TORONTO FIR
GANDER ODCA
GANDER OCEANIC FIR
GANDER DOMESTIC FIR
MONCTON FIR
NOT FOR NAVIGATION
0 100 200 300 400 500
Nautical Miles
Flight Information Region (FIR) boundaries
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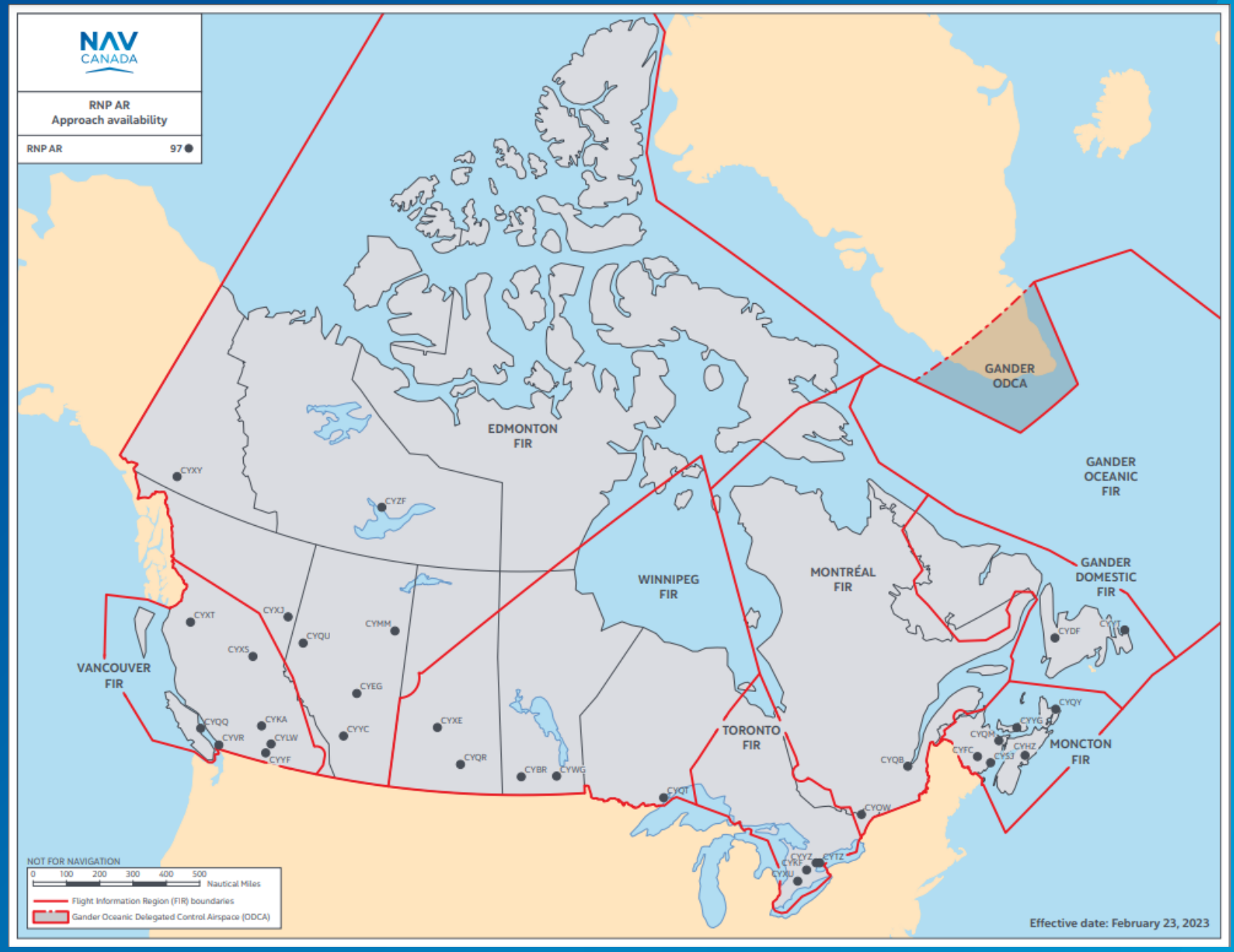
RNP AR APCH

97



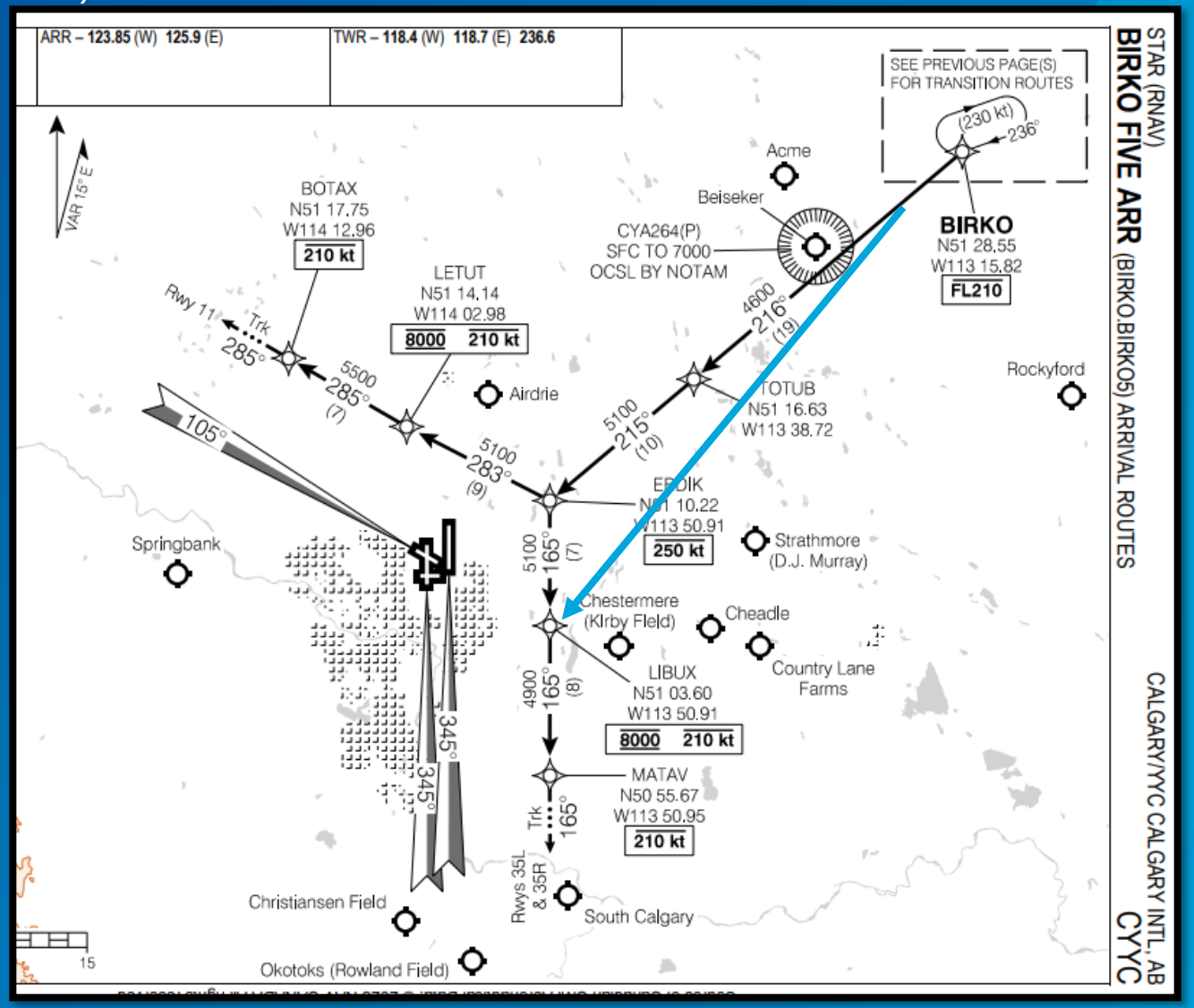
PBN Considerations for ATC

- STAR Design
- Phraseology
- Barometric VNAV
- Limitations
- VNAV
- EoR Training

Standard Arrival Routes (STARs)

Descent Management

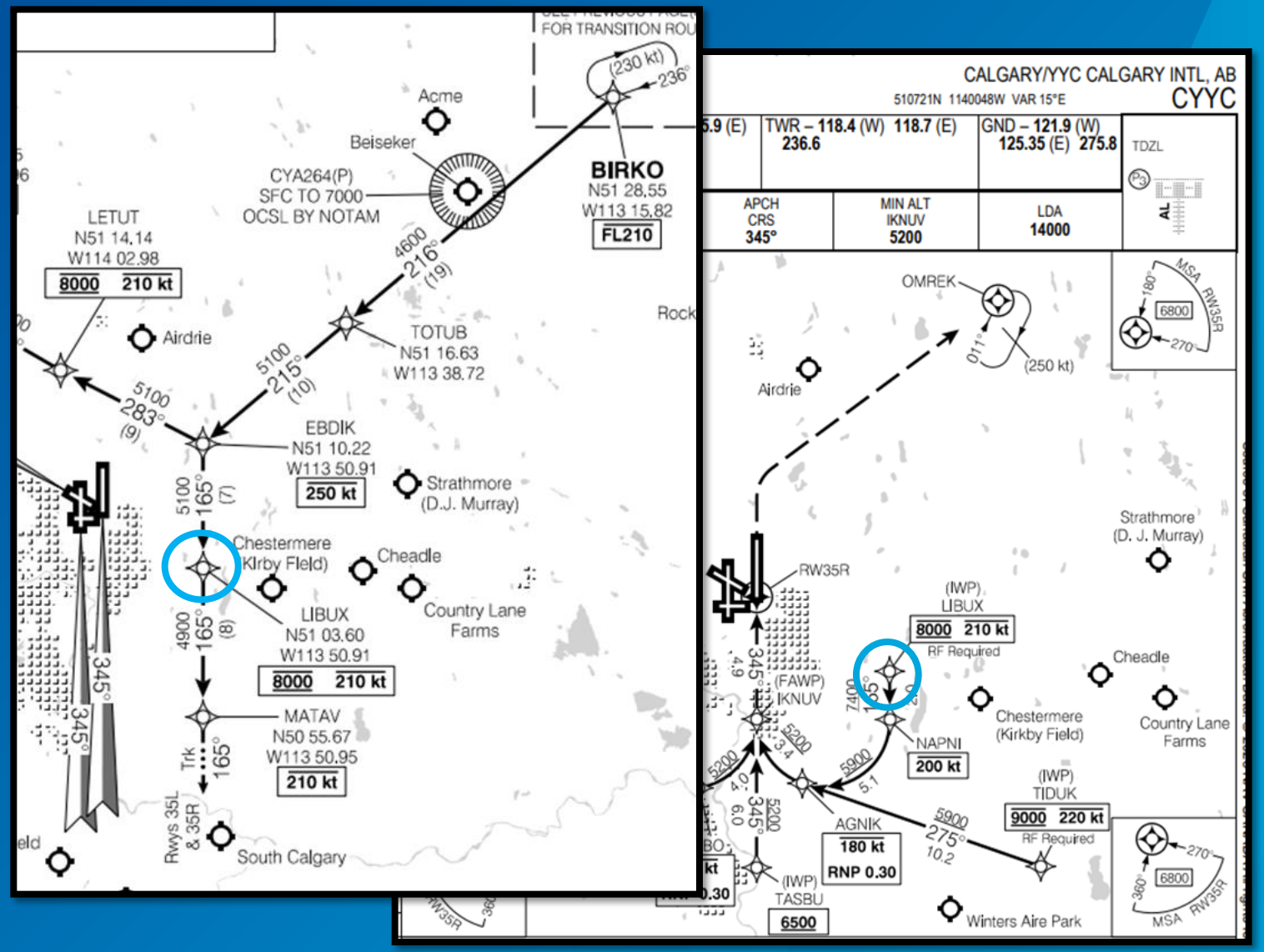
- STAR design allow for FMS to calculate descent profile
- ATC “short-cuts” could require adjustments to descent rates
- Purpose of a "short-cut"
  - Separation or Sequencing



Phraseology

REJOIN STAR

The STAR may include an approach interface waypoint common to the STAR and the approach procedure.



RNAV Phraseology Guide

REJOIN STAR

The STAR may include an approach interface waypoint common to the STAR and the approach procedure. In such cases, the navigation system displays the waypoint twice: in the STAR waypoint list and in the approach waypoint list. If the controller instructs the pilot to proceed direct the approach interface waypoint, the pilot is expected to select it from the STAR waypoint list to prevent the aircraft from flying the lateral profile of the approach without clearance.

Phraseology

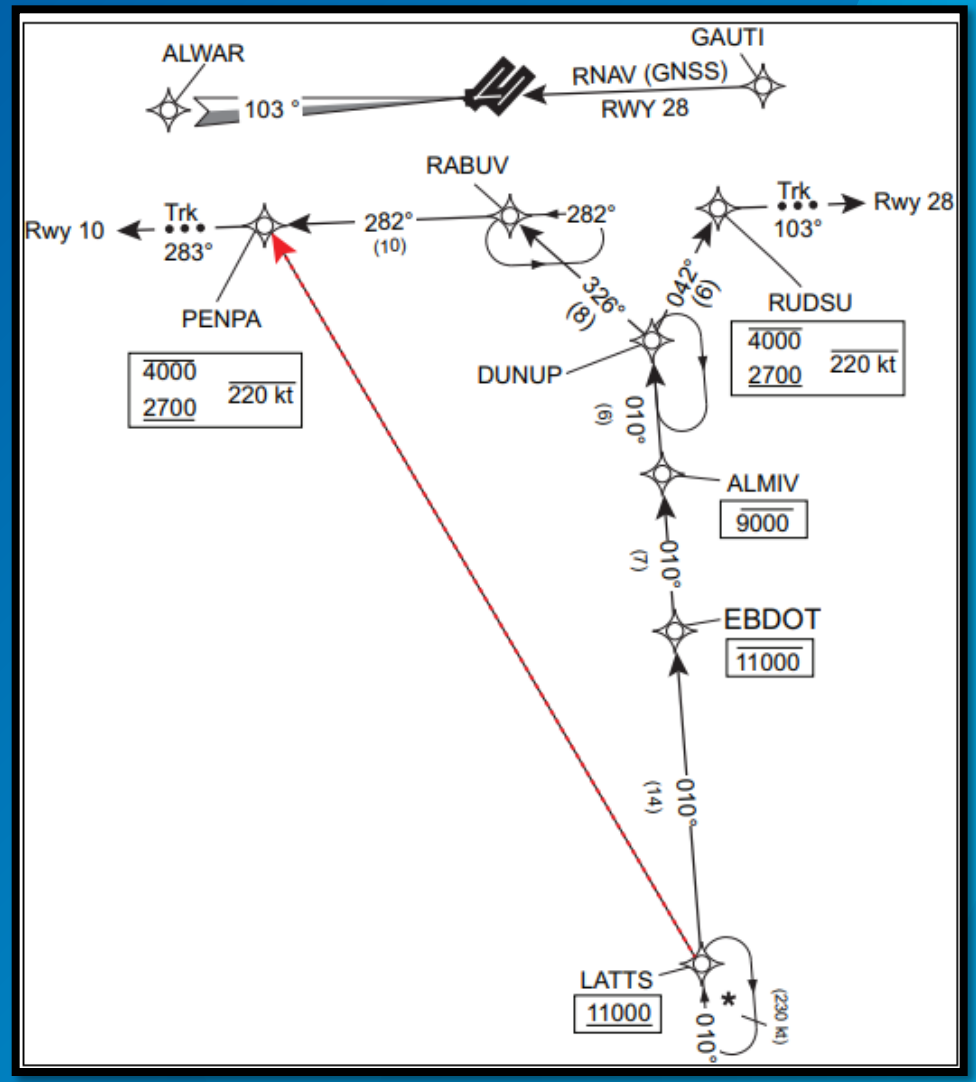
(aircraft id) PROCEED DIRECT (waypoint name) REJOIN STAR

Example

AIR CANADA ONE-TWO-THREE PROCEED DIRECT DUTIR REJOIN STAR.

Pilot Actions

- Proceed direct to DUTIR, selected from the STAR waypoint list
- Comply with all charted altitude and speed restrictions at and after DUTIR

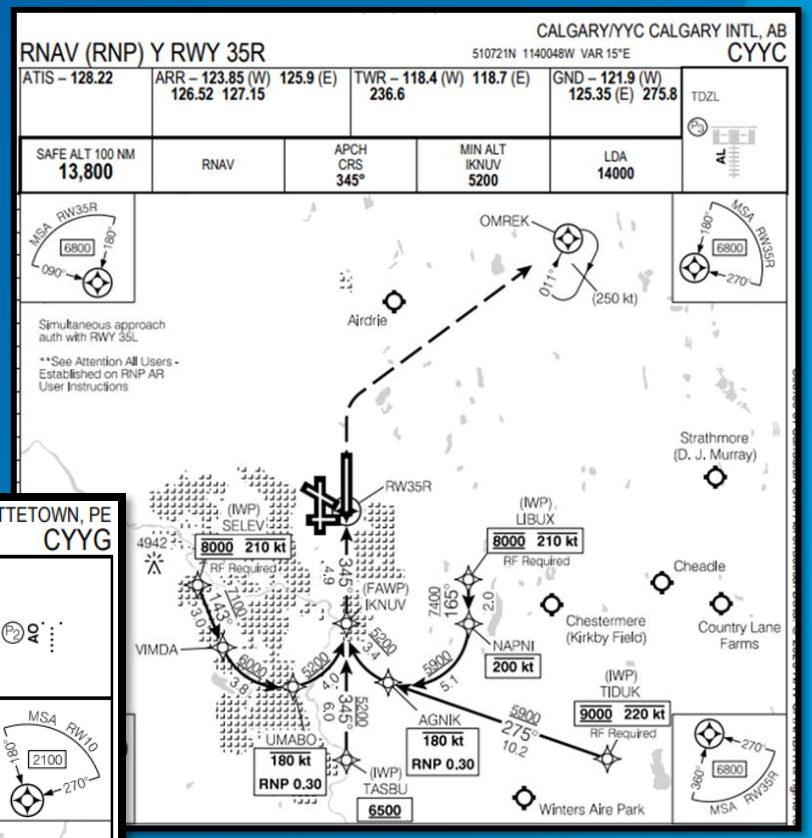


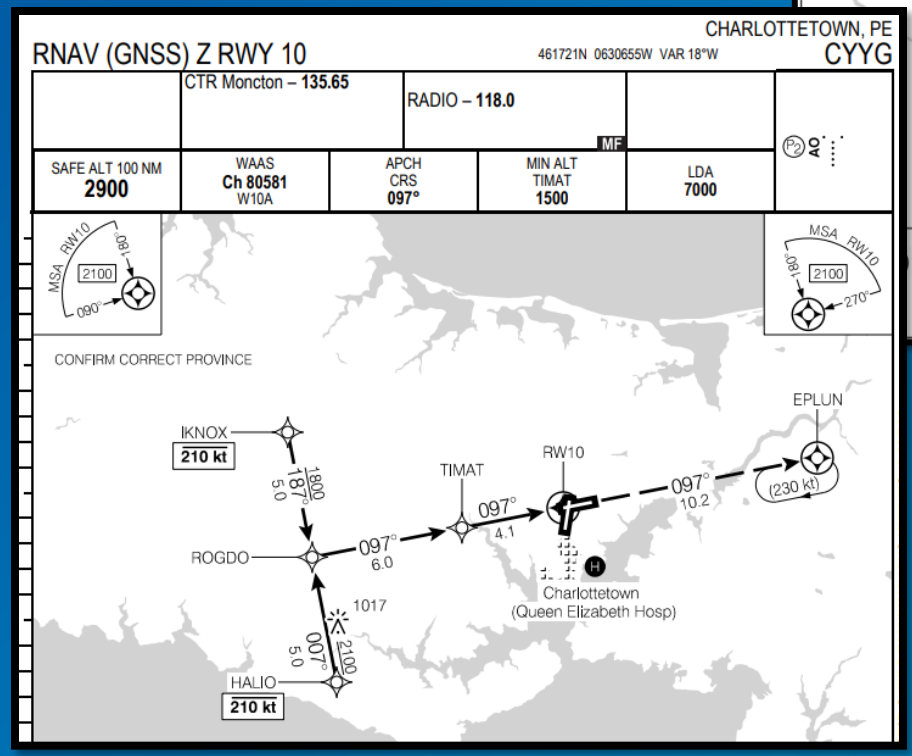
RNAV Phraseology Guide

Multiple Approach Transitions

Approach Clearance Phraseology

- ATC will specify required transition as part of approach clearance





RNAV Phraseology Guide

Multiple Approach Transitions

Phraseology

STAR to approach

(aircraft id) CLEARED (RNAV approach name) APPROACH (runway id) (approach transition name) TRANSITION

Example

STAR to approach
JAZZ ONE-TWO-THREE CLEARED RNAV ZULU RUNWAY ONE-EIGHT APPROACH, NAGEK TRANSITION.

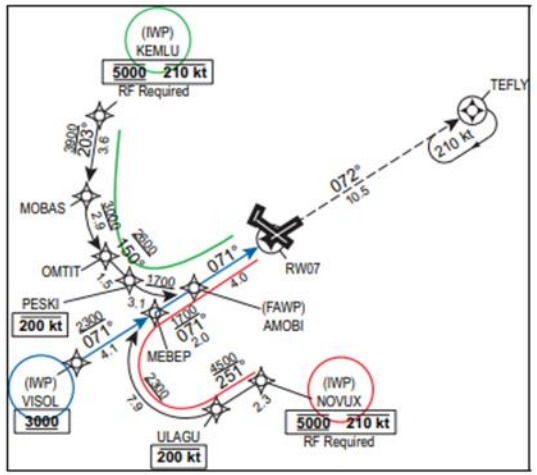


Figure 10 RNAV RNP Approach: NOVUX, VISOL, KEMLU

Features

- IAWP: initial approach waypoint
- IWP: intermediate waypoint
- FAWP: final approach waypoint
- MAWP: missed approach waypoint

The final approach course can be intercepted through three different "transitions": NOVUX, VISOL, or KEMLU. All three are listed separately in GPS/FMC and defined as follows:

NOVUX Transition	VISOL Transition	KEMLU Transition
NOVUX	VISOL	KEMLU
ILAGU	MEBEP	MOBAS
MEBEP	AMOBI	OMTIT
AMOBI	RWY07	PESKI
RWY07		AMOBI
		RWY07

Pilot Action

Fly the RNAV RNP approach fix sequence of the transition name included in the approach clearance.

Barometric-VNAV

Altimeter Setting

The vertical path defined by baro-VNAV is affected by altimeter setting errors. For this reason, baro-VNAV is not authorized unless a local field altimeter setting is available.

Flight crew members must use a current altimeter setting, particularly at times when pressure is reported or is expected to be rapidly decreasing

- ATC will issue a revised altimeter setting if the setting changes by 0.02 or more
- If the setting is more than one hour old, ATC will provide time of report.

Barometric-VNAV

Altimeter Setting

- The flight crew must ensure that the current local altimeter setting (QNH) is set prior to the FAF/FAP

Altimeter cross-check.

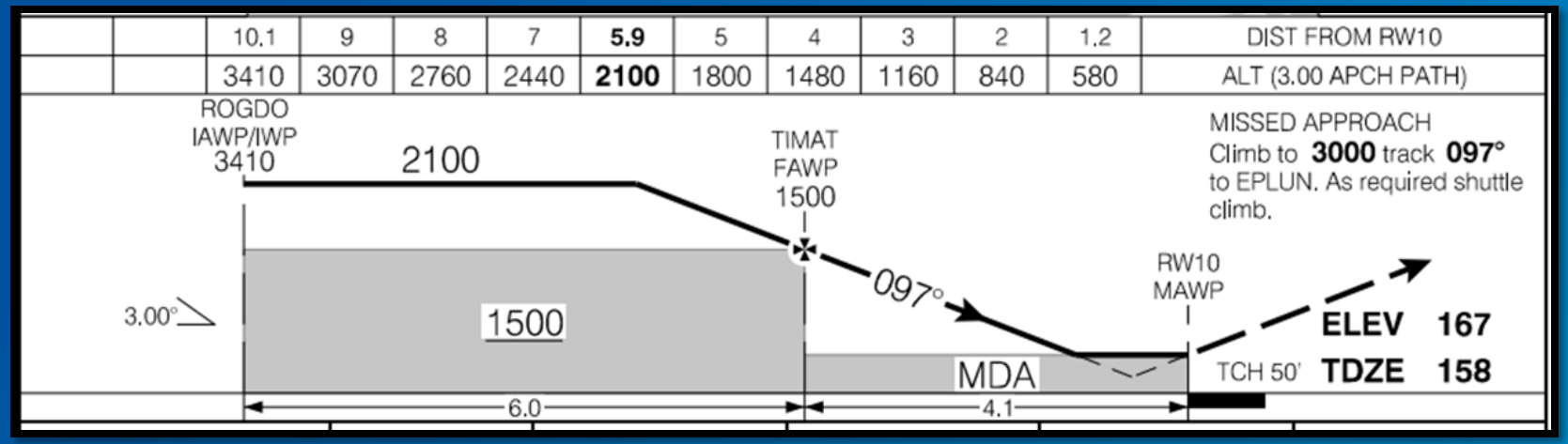
- The intent of this check is to detect a gross error or a bias error in an altimeter system.

- The flight crew members must complete an altimetry cross-check ensuring both pilots' altimeters agree within 100 ft (±30 m) not later than the FAF/FAP after receiving the current local altimeter setting at the airport of intended landing.

- If the altimetry cross-check fails, then the procedure must not be conducted.

RNP AR APCH and RNP APCH Temperature Limitations

When temperature compensation is not, or cannot be, applied through the FMS, pilots shall refer to a temperature limit, published on the approach chart.



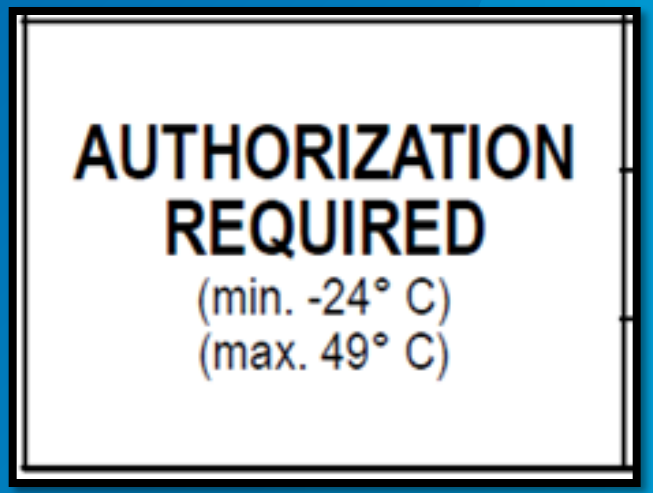
AUTHORIZATION REQUIRED
(min. -24° C)
(max. 49° C)

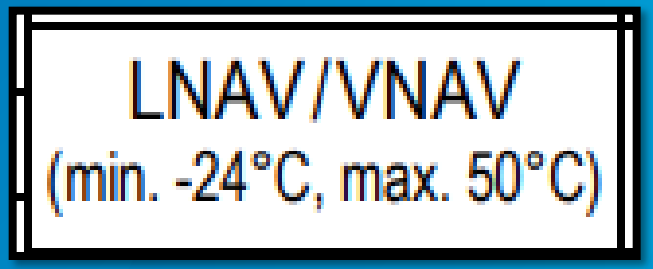
LNAV/VNAV
(min. -24°C, max. 50°C)

RNP AR APCH and RNP APCH Temperature Limitations

For aircraft with temperature compensation capabilities, approved operating procedures may allow flight crew members to disregard the temperature limits on RNAV approach.

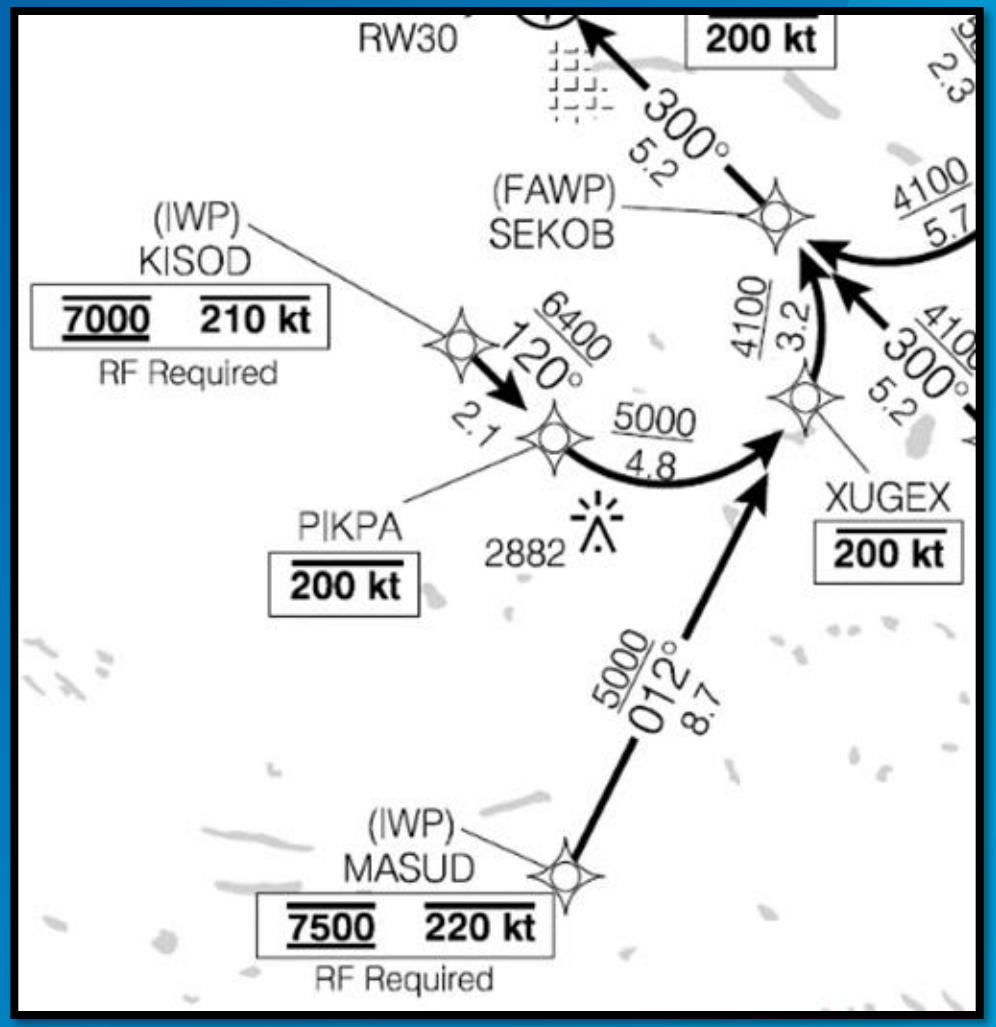
For aircraft without temperature compensation capabilities, the operation must occur within the temperature limits published on the approach chart.





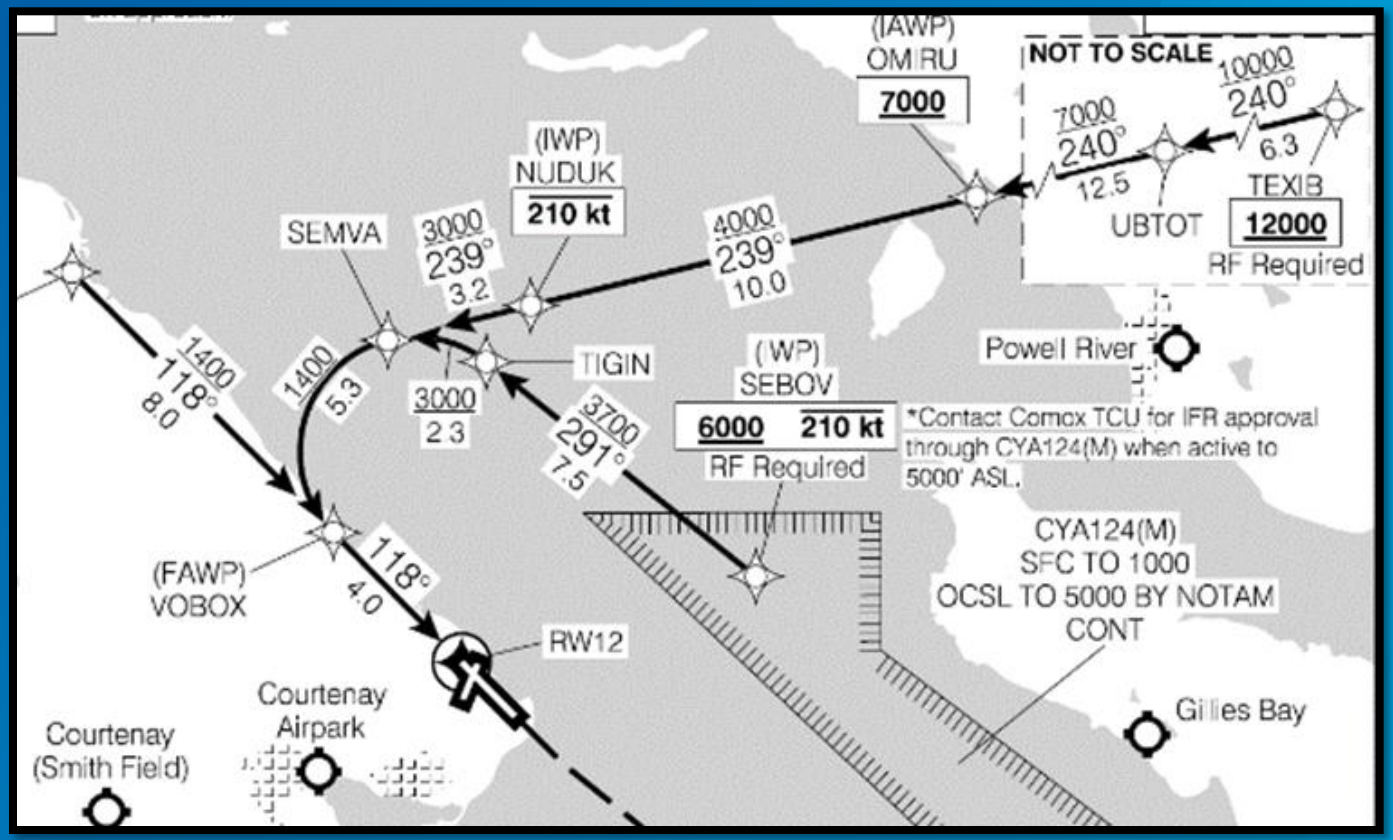
RNP AR APCH Airspeed Limitations

ATC may assign speeds, at or below, the charted speed in accordance with established procedures.



RNP AR APCH Routing Limitations

To ensure proper RF leg behaviour, ATC should not provide aircraft clearance to any waypoint after the IWP



ATC Sequencing

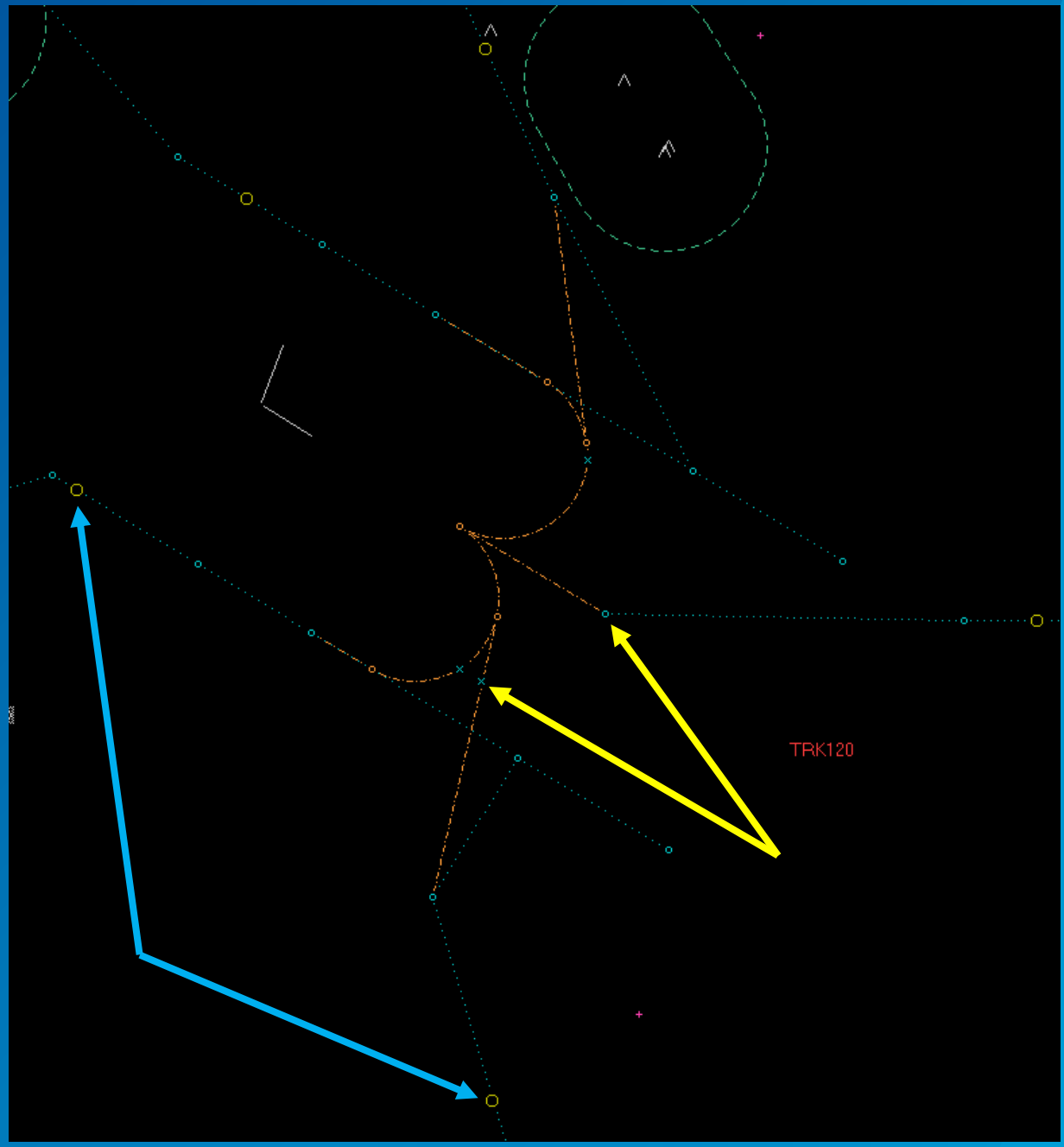
Speed Control

ATC speed control more practical than vectors to achieve in-trail spacing

ATC Sequencing

Vectors

Manual spacing tools to help manage multiple transitions and the ability to vector aircraft to final



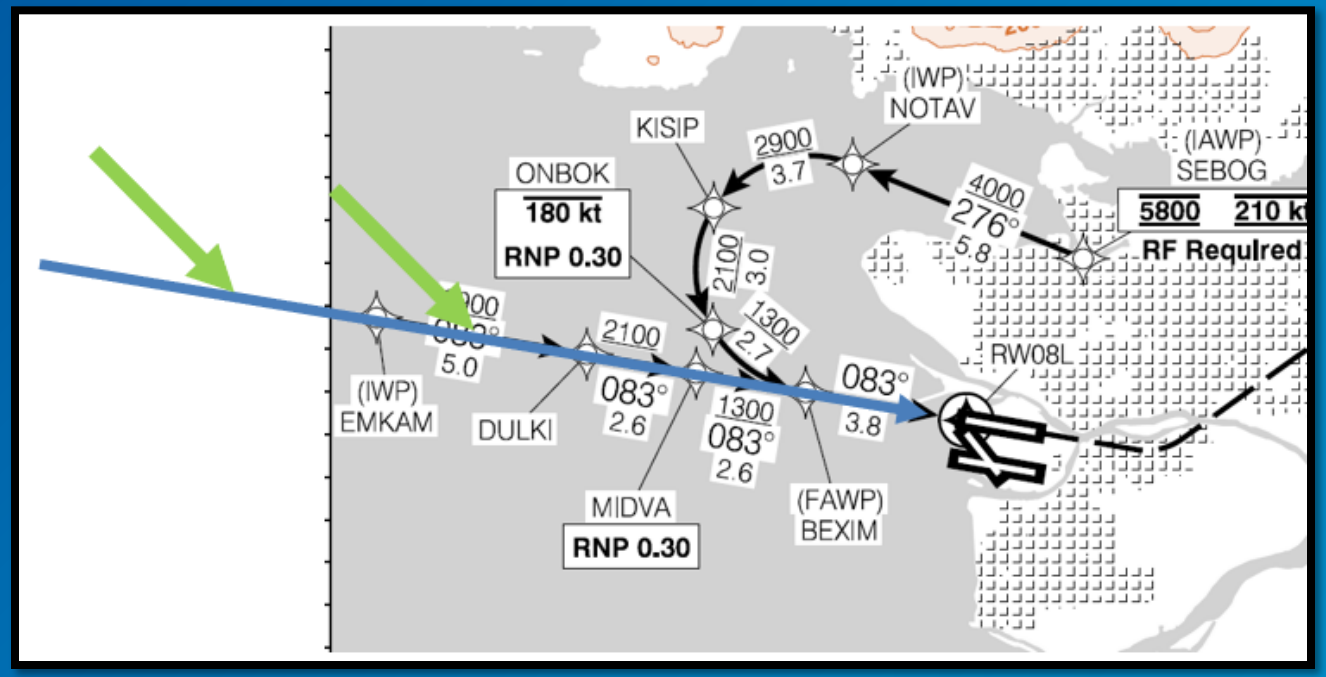
ATC Sequencing

Vectors to the Final Approach Course

Air Traffic Control (ATC) tactical interventions in the terminal area may include radar headings,

ATC will:

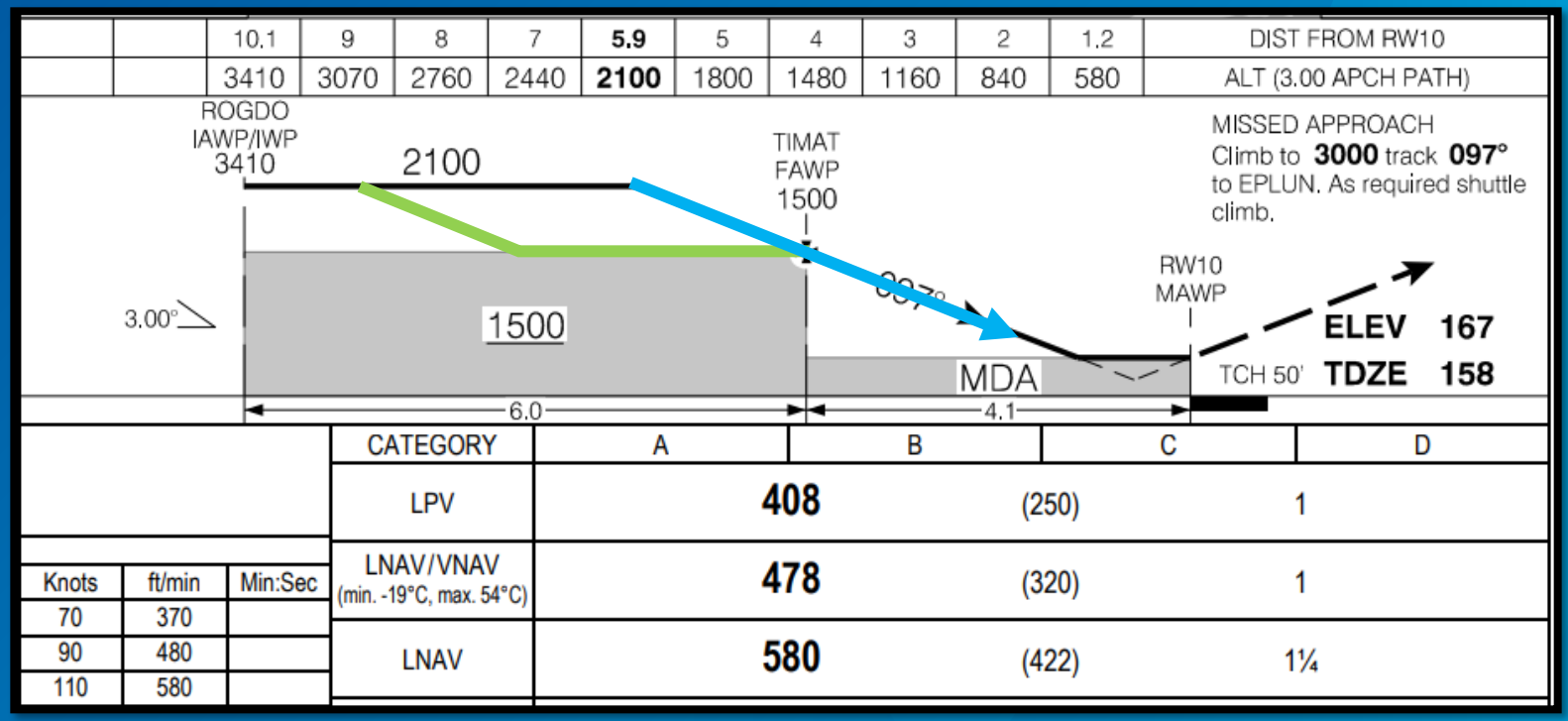
- Normally vector an aircraft to intercept the final approach course at an angle of 30 degrees or less, 2nm or more from the point at which final descent will begin.
- Specify altitude restrictions to ensure that the aircraft does not descend until on the final approach course



Where does final descent begin?

VNAV outside the FAF/FAWP

- LPV
- LNAV/VNAV
- LNAV
- RNP AR APCH

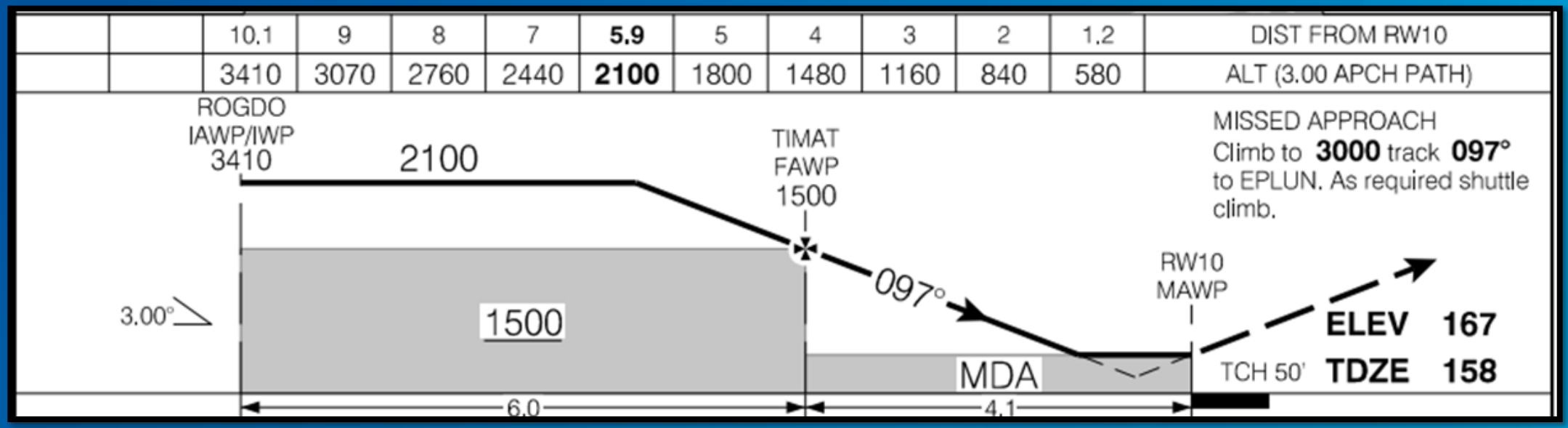


Where does final descent begin?

ATC Phraseology

- “NOT BELOW 3000 UNTIL 8 MILE FINAL….”

- “NOT BELOW 3000 UNTIL ROGDO….”



Inability to conduct an RNAV Approach

If, at any stage of conducting an approach procedure, a flight is unable to comply with an ATC approach clearance, crews must immediately advise ATC and request an alternate clearance or course of action.

“WESTJET 124 UNABLE MUPUV TRANSITION, REQUEST VECTORS TO FINAL”

ATC will also advise the flight crews if intended transition is not available, due to sequencing or other reasons, along with the expectations.

“WESTJET 124, UNABLE MUPUV TRANSITION, EXPECT VECTORS TO FINAL”

EoR Training for ATC

EoR

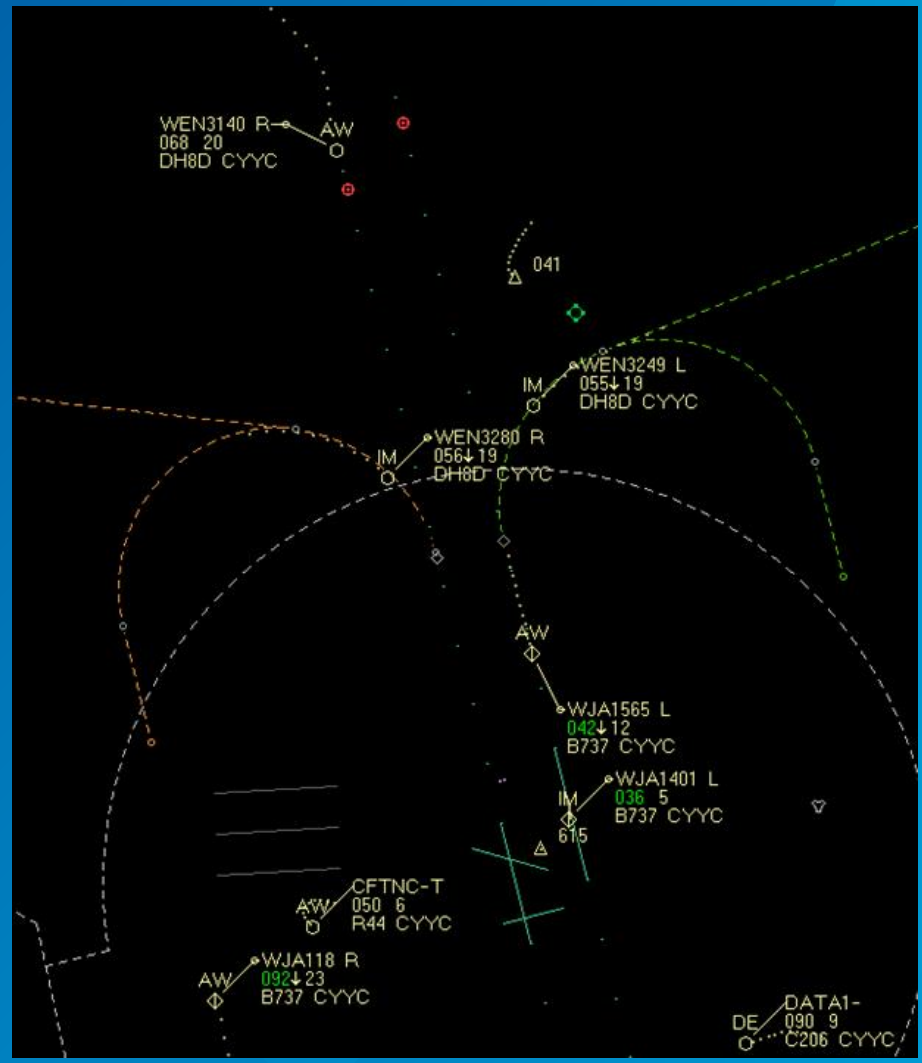
- Phraseology
- Control Transfer

In-trail spacing

- Speed control vs vectoring
- Tangent and RF Leg
- Vector to final in front and behind aircraft on RNP AR APCH
- Mixed mode operation

Breakout procedures

- Wrong runway identification
- Phraseology
- Issues with non-RNP AR aircraft



THANK YOU

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Manager, Airspace Modernization

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