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Cold Temperature Restricted Airports

Procedures and Best Practices

+ CTRA Presentation Topics

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DO NOT USE CHARTS PROVIDED FOR NAVIGATION

Cold Temperature Restricted Airports

Cold Temperature Altitude Corrections

November 12, 2015

Subject: Cold temperature altitude corrections at airports with a published cold temperature restriction.

Purpose: To provide a list of 14 CFR Part 97 "Cold Temperature Restricted Airports" designated with a temperature restriction and guidance on when and how to calculate and apply altitude corrections to affected approach segment(s) during cold temperature operations. This list may also be found at the bottom of the, "Terminal Procedures Basic Search" page:

http://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dtpp/search/

Background: In response to aviation industry concerns over cold weather altimetry errors, the FAA conducted a risk analysis to determine if current 14 CFR Part 97 instrument approach procedures, in the United States National Airspace System, place aircraft at risk during cold temperature operations. This study applied the coldest recorded temperature at the given airports in the last five years and specifically determined if there was a probability that during these non-standard day operations, anticipated altitude errors in a barometric altimetry system could exceed the Required Obstacle Clearance (ROC) used on procedure segment altitudes. If a probability, of the ROC being exceeded, went above one percent on a segment of the approach, a temperature restriction was applied to that segment. In addition to the low probability that these procedures will be required, the probability of the ROC being exceeded precisely at an obstacle position is extremely low, providing an even greater safety margin.

Introduction

- This presentation is designed to provide an overview of how to apply the Cold Temperature Restricted Airport (CTRA) procedure and why it is important. It is focused on the procedures for manual calculation.

- The actual application of the correction procedure should be infrequent but it is important for pilots to understand it should it be necessary.

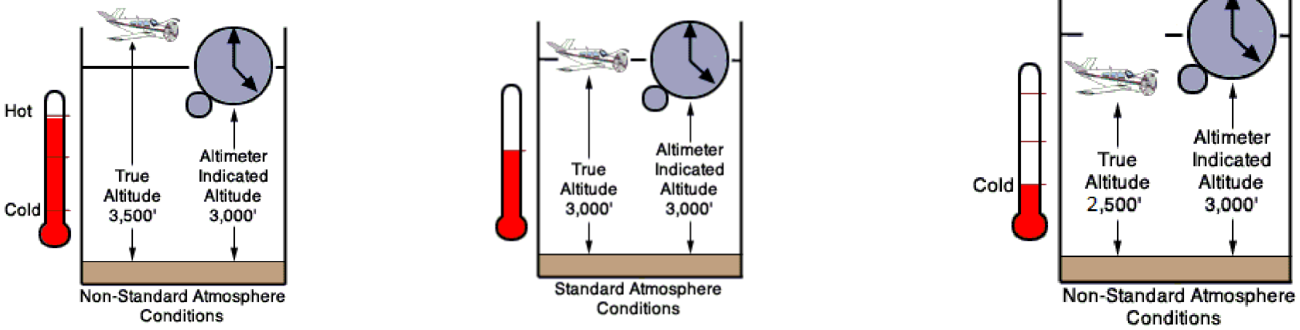
- Failure to apply the procedure when required could result in the aircraft being dangerously close to obstacles and terrain.

Please provide feedback so that the presentation can be improved, contact info is at the end.

ALTIMETER ERRORS EXPLAINED

Altimeter Error due to Cold Temperature

Barometric altimeters are inherently susceptible to errors when exposed to non-standard temperatures due to their being solely a pressure instrument.



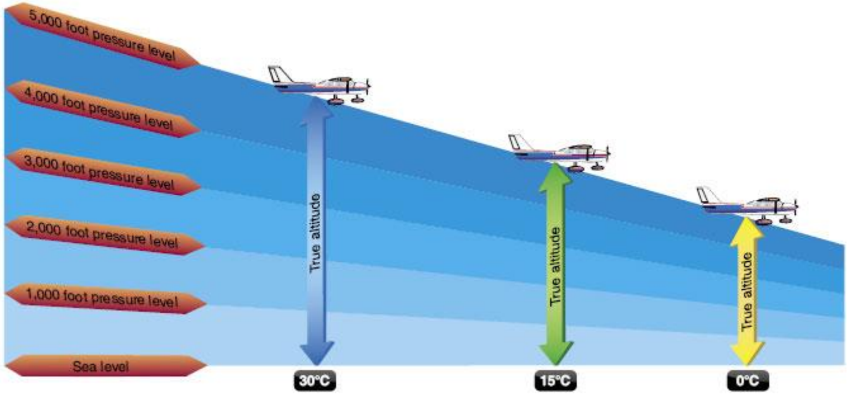
Source: NASA

When the temperature is warmer than standard, your altimeter will indicate you are lower than you actually are. This means you are at a higher altitude than your altimeter shows.

The inverse is more dangerous, when it is colder than standard your altimeter will erroneously indicate you are higher than you actually are, possibly putting you *dangerously close to obstacles or terrain*.

How Big is the Error

The altimeter error becomes more pronounced the colder the temperature and the higher your true altitude. Cold air is denser than warm air so the altimeter will indicate a higher altitude than the aircraft's true altitude. The FAA publishes in several documents the ICAO Cold Temperature Error Table to allow pilots to make corrections.



Source: FAA

ICAO COLD TEMPERATURE ERROR TABLE
HEIGHT ABOVE AIRPORT IN FEET

REPORTED TEMP °C	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	420	570	710
-30	40	60	80	100	120	140	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
-50	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

Source: FAA

Remember the saying: *From Hot to Cold, Look Out Below*

HOW THE CTRA LIST CAME TO BE

FAA and Industry Respond to Safety Implications of Altimeter Error

The United States Air Force, Canadian pilots, and several operators have had altimeter correction procedures for cold temperature in place for decades. It is only recently that the FAA mandated all civil pilots carry out the altimeter correction technique when flying an instrument approach procedure at airports designated as being at higher risk for losing obstacle clearance.

1992

The Air Line Pilots Association submit a request at the Aeronautical Charting Forum that the FAA investigate a cold weather procedure for instrument procedures near areas of high terrain or higher true altitudes.

2005

The FAA continues to investigate an appropriate solution and determine airport selection criteria. Several examples of near misses with terrain due to cold temperature error are provided by industry as further need for a standard correction procedure.

2010

A MITRE study shows the impact of cold temperatures on obstacle clearance and a standardized process for identifying impacted procedures is put into place. Soon after consensus is found at the Aeronautical Charting Forum for how pilots should make any correction.

2015

After several years of the cold temperature correction procedure being published and recommended, the FAA makes altimeter corrections mandatory for several hundred instrument approach procedures in the lower 48 and Alaska.

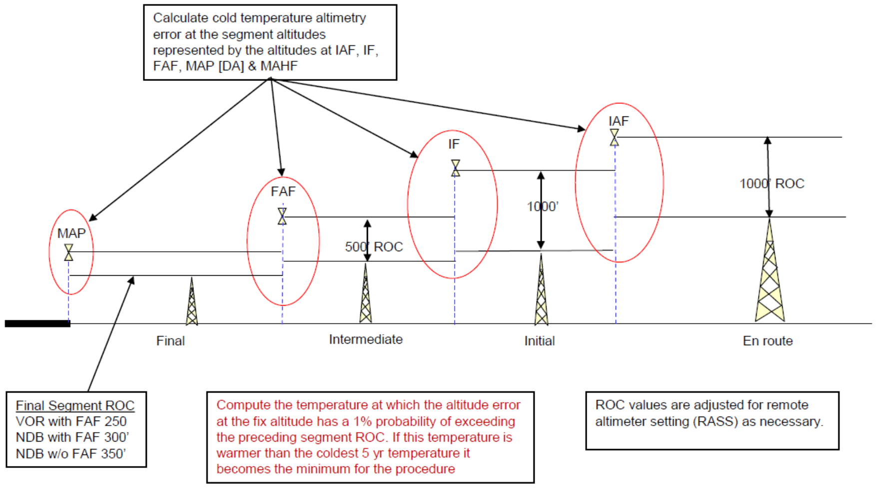
How and Why Airports are Selected

Loss of Required Obstacle Clearance (ROC)

Each segment (i.e., intermediate, final) of an instrument approach procedure is designed to have a minimum amount of ROC above obstacles and terrain. Cold temperatures can lead to pilots unknowingly losing their ROC.

Determining the Risk of Losing ROC

Risk was defined as the probability that total altitude error may exceed the ROC for the segment of a procedure at a given temperature. Risk was calculated for a segment after identifying the coldest recorded temperature for that airport in the last five years. A consensus of industry and government experts determined that if the risk exceeds 1% for that segment of the procedure, it should require a correction when the threshold temperature is reached. The risk analysis was only carried out for civil airports with runways at least 2,500 feet in length due to database constraints.



Source: [MITRE]

Impacted Instrument Approach Procedures

Governing List

After the segment(s) of a procedure are determined to require cold temperature correction they are added to the master list published in the *Notices to Airmen Publication* (NTAP) which is published on a 28 day cycle. The NTAP includes all information pertaining to the procedure for applying the correction and is the source for all CTRA information. Airports may be listed more than once (italicized entries) as temperature thresholds may be different for different segments.

The *Aeronautical Information Manual* contains additional information on altimeter errors but does not provide information on CTRA procedures.

Temperature restriction in Celsius/Fahrenheit

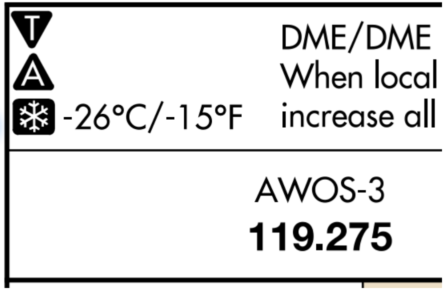
			SEGMENTS		
Identifier	Airport Name	Temperature	Intermediate	Final	Missed Appr
Alaska					
PABL	Buckland	-36C/-33F	X		
PABR	Wiley Post-Will Rogers	-41C/-42F	X		
PABT	Bettles	-37C/-35F	X	X	

Affected segment of the procedure

Terminal Procedure Publication

In order to alert a pilot of what procedures require correction, a new “snowflake” symbol was added to the Notes box of the impacted procedure. The temperature at which correction is required is shown as −XX°C/XX°F. If the airport’s temperature is reported at or below this value then a correction to the segment, as shown for that airport in the NTAP, is required.

Symbol indicates procedure requires cold temperature correction on the segments listed in the NTAP when at or below −26°C/−15°F



HOW TO APPLY THE CORRECTION

When and Where to Apply

This section highlights the different requirements and procedures to apply the cold temperature correction. Pilots normally determine the destination airport's surface temperature, compare that to the temperature restriction to determine if correction is required, and if so, calculate the new altitude(s) to be flown. The procedures for alerting air traffic control is the next section.

Reported Surface Temperature

In order to determine if an airport surface temperature is at or below the published cold temperature restriction, pilots normally listen to the weather provided over a system like an ASOS, AWOS, or ATIS. Alternatively, pilots may use Real Time Mesocscale Analysis (RTMA).

Segments of an Approach Procedure

Pilots must make an altitude correction to the published, "at", "at or above", and "at or below" altitudes on all designated segment(s) for all published procedures when the reported airport temperature is at or below the published airport cold temperature restriction.

Temperature Compensating Equipment

Pilots with temperature compensating aircraft, and choosing to use this system, must ensure the system is on and operating for each segment requiring an altitude correction. Pilots may use the system for the entire approach if desired. Those without the equipment must make the manual calculation described later on.

Baro-VNAV

The CTRA procedure and temperatures are mutually exclusive from the charted temperature restriction published for uncompensated baro-VNAV systems. Pilots must follow those additional requirements if it is applicable.

Segments of the Approach - Planview

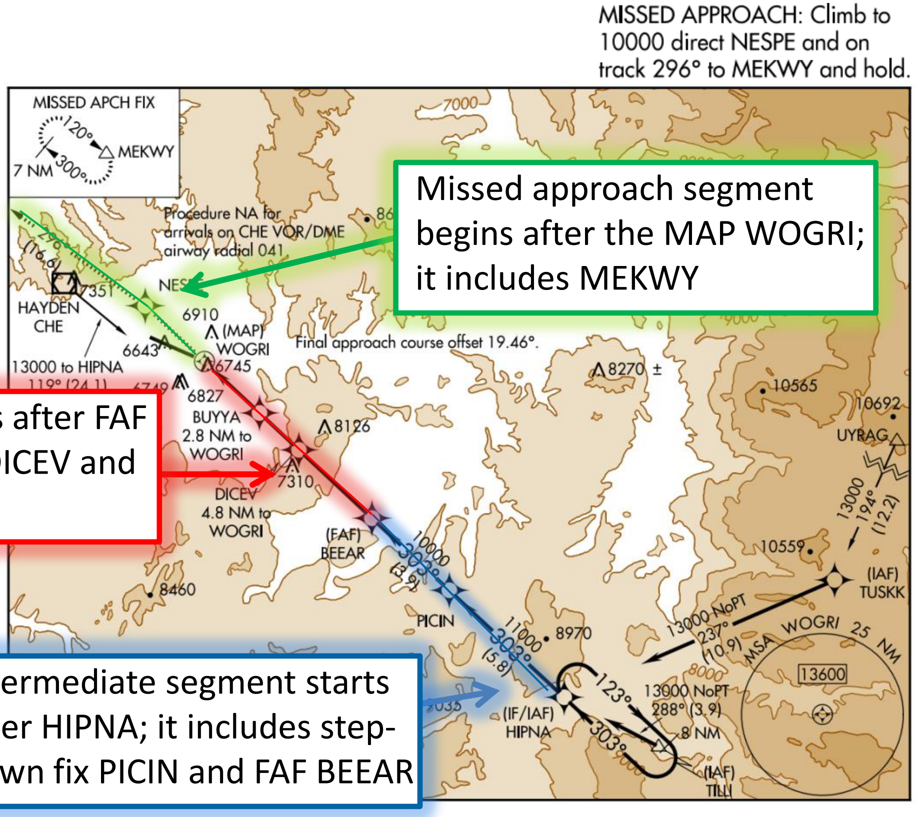
Segments of an Instrument Approach Procedure

It is important to remember that any cold temperature correction applies to a segment of a procedure and not the fix. In other words, the corrected altitude is applied after the applicable fix. There are three segments of a procedure that may require correction: intermediate, final, or missed approach.

The intermediate segment begins after the Intermediate Fix (IF); if no IF is shown, this segment begins at a point where you are proceeding inbound to the final approach fix and are properly aligned with the Final Approach Course (FAC).

The final approach segment begins after the Final Approach Fix (FAF) or Final Approach Point (FAP).

The missed approach segment begins after the Missed Approach Point (MAP). You can ignore intermediate fixes on the missed approach segment when making a correction as only the final fix had the ROC analysed.



Segments of the Approach – Profile

Segments of an Instrument Approach Procedure

Remember, any cold temperature correction applies to a *segment* of a procedure and not the *fix*. In other words, the corrected altitude is applied after the applicable fix.

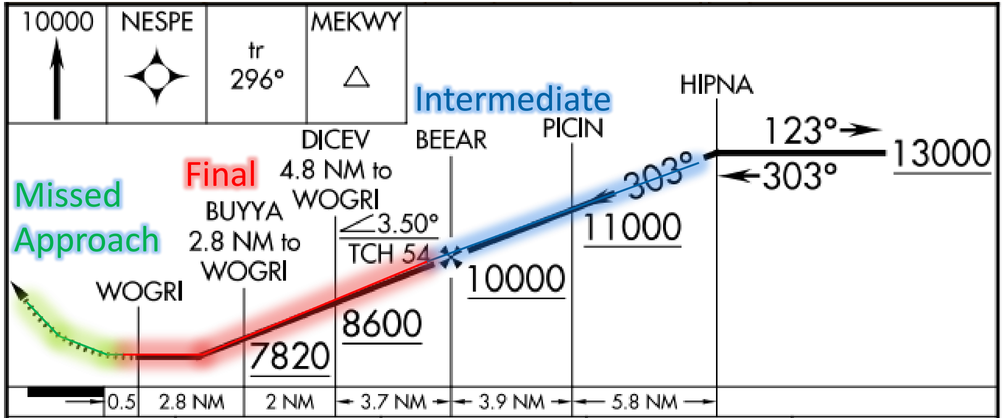
Make things easy: You may compute the correction for the lowest fix in a segment (BEEAR – 10,000') and apply that same amount of correction to any higher fixes in that segment (PICIN – 11,000').

Intermediate segment starts after HIPNA; it includes step-down fix PICIN and FAF BEEAR. *Hint: FAA policy is to chart in the profile view the IF (HIPNA is the IF) if there is one*.

Final approach segment starts after FAF BEEAR; it includes DICEV and BUYYA. Compute MDA or DA/DH, as applicable.

Missed approach segment begins after the MAP WOGRI; it includes MEKWY. Any intermediate fix on the missed approach segment (such as NESPE) can be ignored as only the final fix's altitude needs to be corrected.

MISSED APPROACH: Climb to 10000 direct NESPE and on track 296° to MEKWY and hold.



CATEGORY	A	B	C	D
LP MDA	7000-1	394 (400-1)	7000-1⅛	394 (400-1⅛)
LNAV MDA	7080-1	474 (500-1)	7080-1⅜	474 (500-1⅜)
C CIRCLING	7220-1	614 (700-1)	7660-3 1054 (1100-3)	8180-3 1574 (1600-3)

HOW TO APPLY THE CORRECTION

Using the ICAO Cold Temperature Error Table

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Where to Find the Table

Pilots can find the ICAO Cold Temperature Error Table at the beginning (legend section) of the Terminal Procedure Publication (TPP), in the NTAP, or in the AIM. If you are using an Electronic Flight Bag, like an iPad, be sure the table is saved and accessible or available in hard copy.

Using the Table

In increments of 10 degrees Celsius, the table gives the altimeter correction for a given altitude above the airport. Pilots add that correction to the appropriate altitude for that segment of the approach. Pilots must add correction(s) from the table to the segment altitude(s) and fly at the new corrected altitude. No extrapolation above the 5000 feet column is required. Pilots may use the 5000 feet column for calculating corrections to segments greater than 5000 feet above airport elevation.

ICAO COLD TEMPERATURE ERROR TABLE
HEIGHT ABOVE AIRPORT IN FEET

REPORTED TEMP °C	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	420	570	710
-30	40	60	80	100	120	140	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
-50	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

For example, if the temperature is −20°C, and the published altitude for the segment is 3,000 feet above the airport, pilots would add 420 feet to the segment altitude and fly the sum altitude. Remember, you must subtract airport elevation from the segment altitude to determine height above airport.

Using the Temperature Correction Procedure Properly

Vertically Guided Procedures

Some procedures with vertical guidance (ILS, LPV, LNAV/VNAV) may require a cold temperature altitude correction on the intermediate segment. Fly the corrected intermediate altitude until intercepting glideslope. Follow the glideslope as published as it is unaffected by cold temperatures and will be providing reliable guidance.

Final Segment Corrections: DA/DH, MDA

For all procedures requiring a final approach segment correction, including those with vertical guidance, pilots must use the corrected DA/DH or MDA. Pilots would be dangerously close to terrain or obstacles if a final approach segment correction is required and is not used.

Do Not Change Your Altimeter Setting

Pilots are not to adjust their altimeter setting, also known as the Kollsman window, when applying the altitude correction. The calculated correction is added to the original altitude and is flown using the current altimeter setting.

INTERACTING WITH AIR TRAFFIC CONTROL

Reporting Requirements

After a pilot determines a cold temperature correction is required, they must report to Air Traffic Control (ATC) when they are required to apply the correction to either the intermediate or missed approach segment. ATC must be told as loss of separation could result if another aircraft in the vicinity is not applying the correction. It is not necessary to report a final approach segment correction. ATC will not inform pilots when a correction may be required and will not be able to make the calculation for the pilot, nor will they deny the pilot the ability to make a correction. If you decide to correct another segment of the procedure, such as the initial segment, tell ATC.

Initial Check-in with ATC who will Provide Approach Clearance

Inform ATC on initial contact, or as soon as practical, should an altitude correction be required for the intermediate or missed approach segment.

- Intermediate segment: “Require 10600 ft. for cold temperature operations until BEEAR”
- Missed approach segment: “Require final holding altitude, 10600 ft. on missed approach for cold temperature operations”

When Cleared for the Approach

Pilots should state the corrected altitude they will be flying on the intermediate segment when cleared for the approach.

- Intermediate Segment: “Level 10600 ft. for cold temperature operations inside HIPNA to BEEAR”

Radar Vectors

Pilots should query ATC when vectored altitudes to an intermediate segment are lower than the requested intermediate segment altitude, corrected for temperature, on initial contact with ATC. Pilots must not make an altitude correction to a radar vectored altitude unless approved by ATC.

Communication at Uncontrolled Airports

Pilots are encouraged to self-announce corrected altitude when flying into non-towered airfields.

ATC will not apply a cold temperature correction to Minimum Vectoring Altitudes (MVA)

EXAMPLES

EXAMPLES

Fairbanks, AK (PAFA)

Procedure requires cold temperature correction when at or below −20°C/−4°F for the intermediate and final approach segments.
Scenario: Airport reported temperature is −20°C/−4°F, flying published S-ILS 2L procedure arriving over GLOWS

Calculating Intermediate Segment

1. Determine airport elevation: 439’
2. Locate intermediate segment altitude (after IF): 2,100’
3. Subtract airport elev. from segment: 1,661’ ≈ 1,700’
4. Use the error table to find correction: 240’ (must interpolate between 1,500’ and 2,000’ for -20 °)
5. Add correction to intermediate segment: 2,100’+240’= ≈2,300’

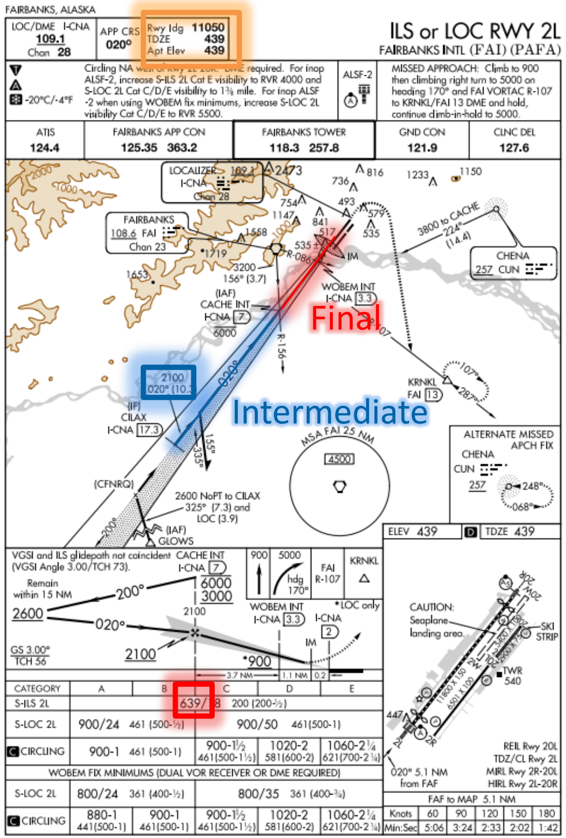
Fly at 2,400’ after the IF CILAX until intercepting the glideslope, descend normally

Calculating Final Segment

1. Determine airport elevation: 439’
2. Locate final segment altitude (DA): 639’
3. Subtract airport elev. from segment: 200’
4. Use the error table to find correction: 30’ (200’ and -20 °)
5. Add correction to final segment (DA): 639’+30’= 669’

After glideslope intercept, fly the glideslope to the new DA of 669’

Inform ATC that you will be applying a correction between CILAX and CACHE:
“Require 2,400 feet for cold temperature operations from CILAX to CACHE”



Jackson Hole, WY (KJAC) – Slide 1

Procedure requires cold temperature correction when at or below −26°C/−15°F for the intermediate, final, and missed approach segments.

Scenario: Airport reported temperature is −28°C/−18°F, flying published S-19 procedure arriving over NECIT

Calculating Intermediate Segment

1. Determine airport elevation: 6,451’
2. Locate intermediate segment altitude (aligned with FAC; after LAGIC): 8,500’
3. Subtract airport elev. from segment: 2,049’ ≈ 2,000’
4. Use the error table to find correction: 360’ (interpolate for temperature)
5. Add correction to intermediate segment: 8,500’+360’= ≈8,900’

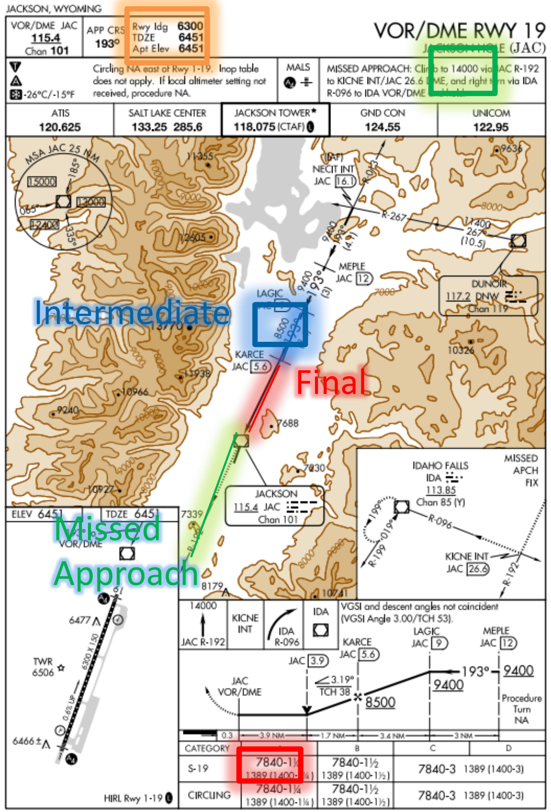
After aligned with FAC and after LAGIC, fly at 8,900’ until FAF

Calculating Final Segment

1. Determine airport elevation: 6,451’
2. Locate final segment altitude (MDA): 7,840’
3. Subtract airport elev. from segment: 1,389’ ≈ 1,400’
4. Use the error table to find correction: 250’ (interpolate temperature and elevation)
5. Add correction to final segment (MDA): 7,840’+250’= ≈8,090’

After the FAF KARCE descend to the new MDA of 8,090’

See next slide for missed approach segment calculation



Jackson Hole, WY (KJAC) – Slide 2

Calculating Missed Approach Segment

1. Determine airport elevation: 6,451’
2. Locate missed approach segment altitude: 14,000’
3. Subtract airport elev. from segment: 7,549’ ≈ 7,600’
4. Use the error table to find correction: 900’ (interpolate temperature and use 5,000’ elevation)
5. Add correction to missed approach segment: 14,000’+900’= 14,900’

After the MAP climb to 14,900’

Inform ATC that you will be applying a correction between LAGIC and KARCE:
“Require 8,900 feet from LAGIC to KARCE for cold temperature operations ”

Inform ATC of your new missed approach altitude:
“Require final holding altitude 14,900 feet on missed approach for cold temperature operations”

Pellston Regional, MI (KPLN)

Procedure requires cold temperature correction when at or below −30°C/−22°F for the intermediate and final approach segment.
Scenario: Airport reported temperature is −30°C/−22°F, you are being provided radar vectors for S-ILS 32

Calculating Intermediate Segment

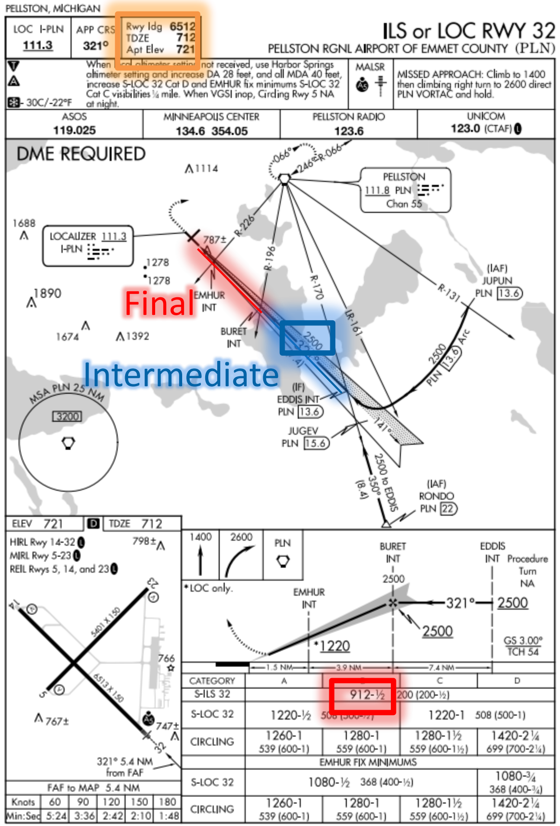
1. Determine airport elevation: 721'
2. Locate intermediate segment altitude (after IF): 2,500'
3. Subtract airport elev. from segment: 1,779' ≈ 1,800'
4. Use the error table to find correction: 340' (interpolate for elevation)
5. Add correction to intermediate segment (round up or down): 2,500'+340'= ≈2,800'

As you are being provided radar vectors, alert ATC of your cold temperature operation altitude and ensure you do not fly below it until intercepting the glideslope

Calculating Final Segment

1. Determine airport elevation: 721'
2. Locate final segment altitude (DA): 912'
3. Subtract airport elev. from segment: 191' ≈ 200'
4. Use the error table to find correction: 40'
5. Add correction to final segment (DA): 912'+40'= ≈952'

After glideslope intercept, descend via the glideslope to the new DA of 952'



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Tok Junction, AK (PFTO)

Procedure requires cold temperature correction when at or below −19°C/−2°F for the intermediate segment.
Scenario: Airport reported temperature is −25°C/−13°F, you are flying the published procedure arriving via CIMGO

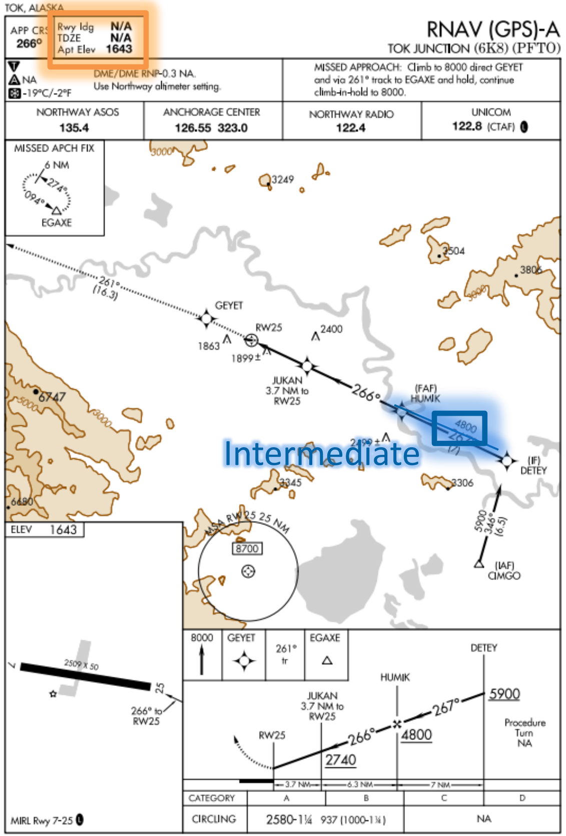
Calculating Intermediate Segment

1. Determine airport elevation: 1,643’
2. Locate intermediate segment altitude (after IF): 4,800’
3. Subtract airport elev. from segment: 3,157’ ≈ 3,200’
4. Use the error table to find correction: 525’ (interpolate for elevation and temperature)
5. Add correction to intermediate segment: 4,800’+525’= ≈5,300’

Fly at 5,300’ after the IF DETEY until the FAF HUMIK

Note: Tok Junction does not have temperature reporting on the airport, Northway ASOS is 35 NMs southeast and is acceptable for use; however, RTMA is available for Tok

Inform ATC that you will be applying a correction between DETEY and HUMIK:
“Require 5,300 feet for cold temperature operations from DETEY to HUMIK”



BEST PRACTICES

Be Prepared

Thankfully CTRA procedures should not be very common for most pilots but being prepared is important. Below are some best practices from pilots with experience utilizing the CTRA procedures.

1. If flying IFR in areas of cold temperature, be sure to look at forecasted temperatures and to be prepared to utilize cold temperature correction procedures, make it part of your flight planning process.
2. Have the latest CTRA section of the NTAP in the aircraft either electronically or hard copy.
3. Listen to the destination weather, utilize FIS-B, or Flight Service well in advance of your arrival
4. Practice several CTRA scenarios for your destination airport ahead of time. You can round up or down when making your calculations.
5. Don’t forget to calculate the missed approach altitude when it is required.
6. Check your avionics: some can make the calculation for you.
7. Remember, vertical guidance takes precedent and altitude corrections apply to segments.
8. Know what you must report to ATC and how you want to say it, plain English is always appropriate.
9. Be prepared for vectors to final, know your intermediate altitudes if required, inform ATC.
10. The correction amount calculated for the lowest step-down fix in a segment can be applied to all higher altitude fixes along that segment, this can save time and reduce workload.

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Please provide feedback so this presentation and the CTRA procedure can be improved!