On Track

Articles Of Interest for the Professional Aviator
ICP Flight - Central Flying School

Terminal Arrival Areas (TAAs)

By: Kevin McGowan, Maj, USAF, ICP Flight

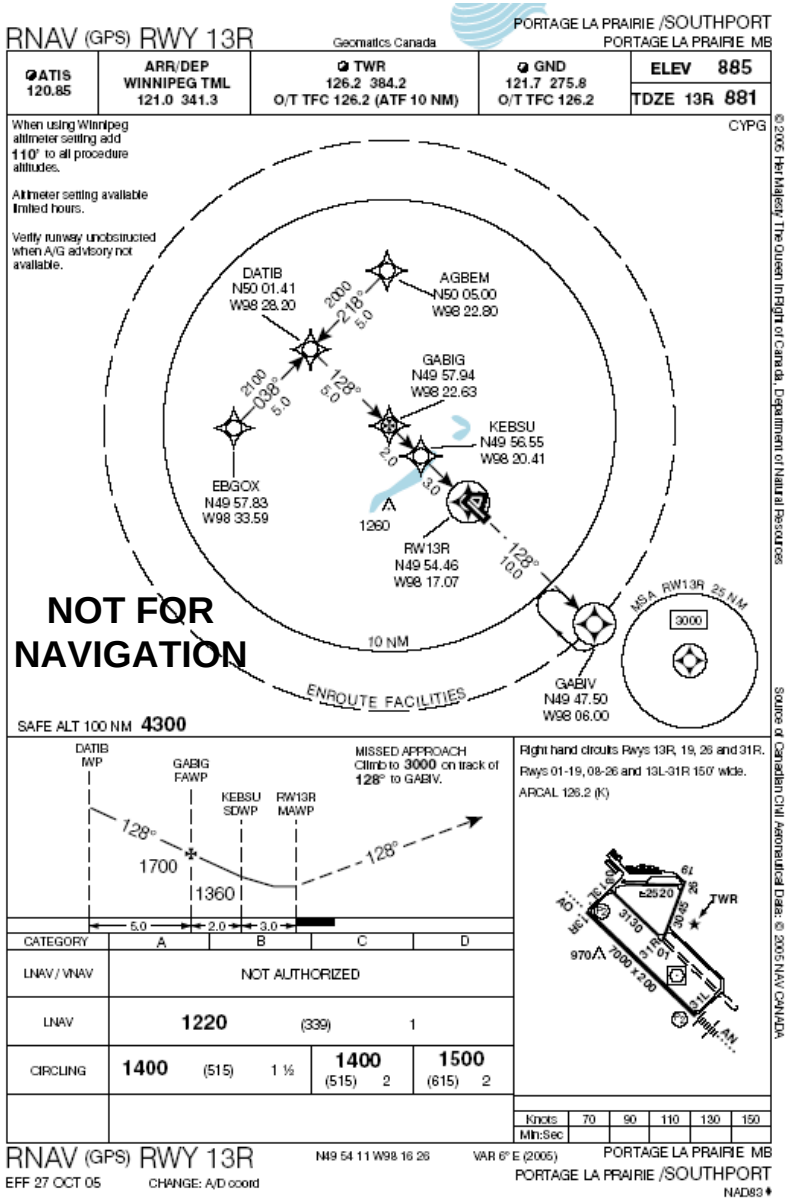
24 May, 2006

Like many other industries, the aviation industry is in a state of perpetual change and over the course of the last 102 years we've progressed from the invention of powered flight to supersonic travel. Furthermore, navigation techniques and tools have evolved from dead reckoning with a stop watch and map reading to laser ring gyros and Global Navigation Satellite System (GNSS) systems capable of flying approaches down narrow, curving mountain canyons in IMC to 250' AGL. To help take advantage of this new technology, effective 27 October, 2005, Canada has adopted the Terminal Arrival Area (TAA) procedures that have been widely used in the U.S. for several years now and they will be slowly integrated into the NavCanada approach inventory.

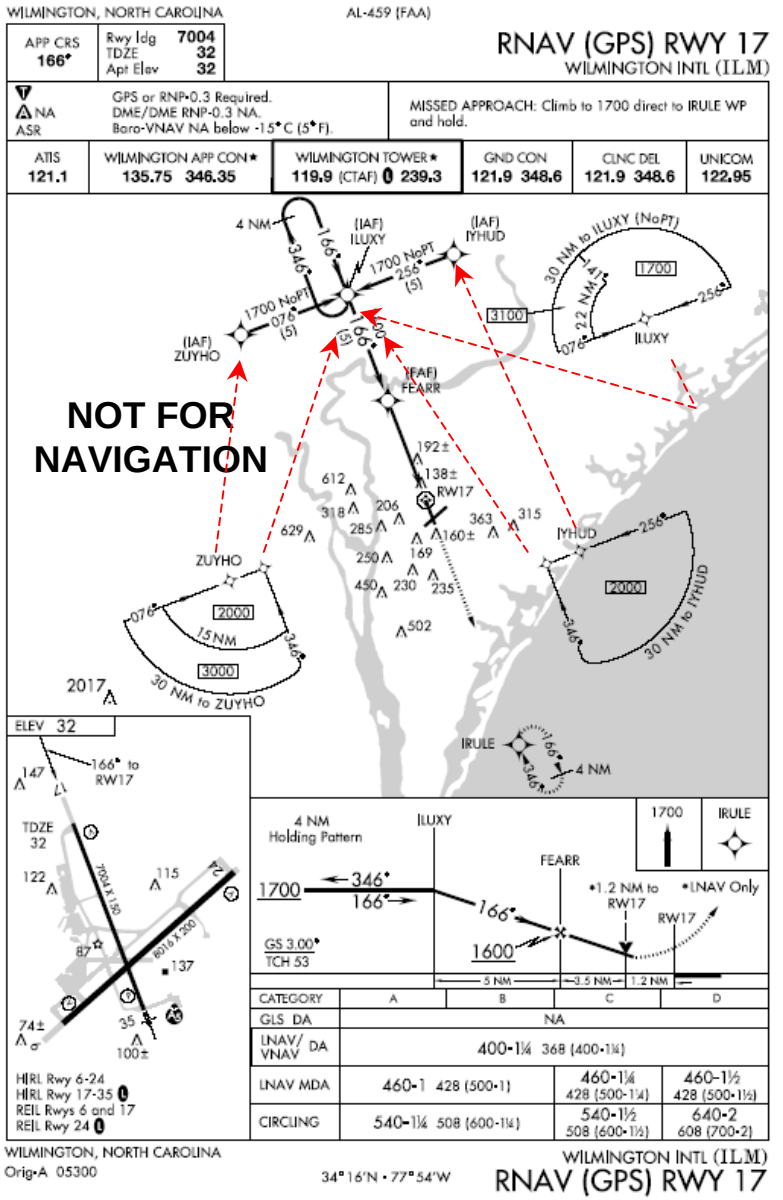
So, what are TAAs anyway? Simply put, TAAs are efficient arrival procedures that are designed to get the pilot down from the enroute structure to the underlying RNAV approach procedure with very little ATC interaction. Although TAAs are not present on all RNAV approaches, especially in heavy traffic areas, they do provide progressive step down altitudes for the pilot to fly based upon the aircraft's relative position to the respective sector's IAF (not a navigational facility).

Identifying A TAA:

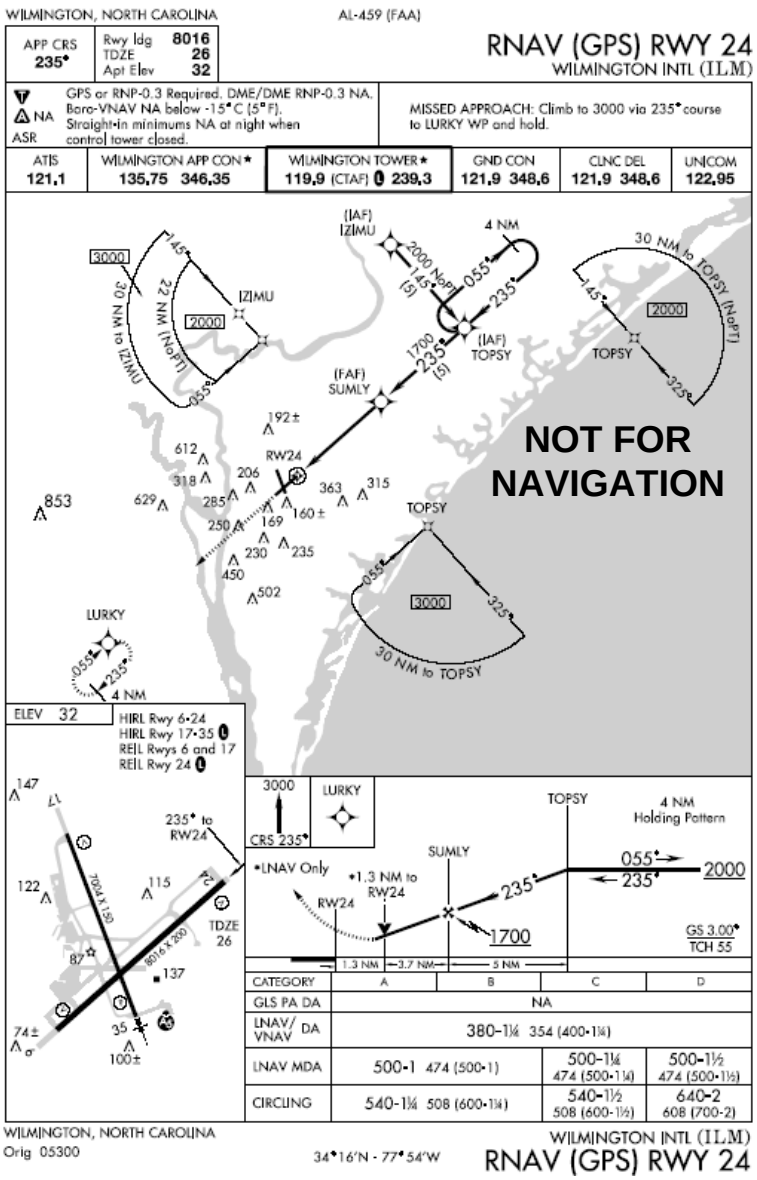
Although more critical in the U.S. due to different terminal arrival procedures, identifying what RNAV approaches have TAAs and which do not is absolutely critical. Luckily, identifying the difference between the two has been made remarkably easy through a slight variance in Minimum Safe Altitude (MSA) depictions. While traditional Instrument Approach Procedures (IAPs) have 360° MSA circles depicted in the IAP's plan view that extend out 25 nm from the approach facility (or Missed Approach Waypoints on RNAV approaches) and may be divided into sectors of no less than 90° (see Figure 1), the MSA circles on TAAs are broken into multiple pie shaped wedges that extend 30 nm from the Initial Approach Fix (IAF) (not an aerodrome facility) for the respective sector on the underlying RNAV approach. Each wedge is separated from the other and is placed in the corresponding sector of the IAP's plan view (see Figure 2).



(Figure 1)



(Figure 2)



(Figure 3)

RNAV IAP Layout:

The RNAV procedure underlying the TAA will normally be in a standard "T" design (also called the "Basic T") (see Figure 2). If required for terrain clearance or air traffic control considerations, the procedure may also assume a "Y", "L" or "I" shape (see Figure 3). The approach will typically have one to three IAFs, an Intermediate Fix (IF) which will also serve as one of the IAFs, a Final Approach Fix (FAF), a Missed Approach Waypoint (MAWP), which will be typically located at the runway threshold, and a Missed Approach Holding Point (MAHP). All the waypoints on the approach, except the MAWP, if collocated with the runway threshold, will be given a "pronounceable" 5-letter name which will be in your FMS database. The IAFs are typically aligned in a straight line, perpendicular to the final approach course, thus

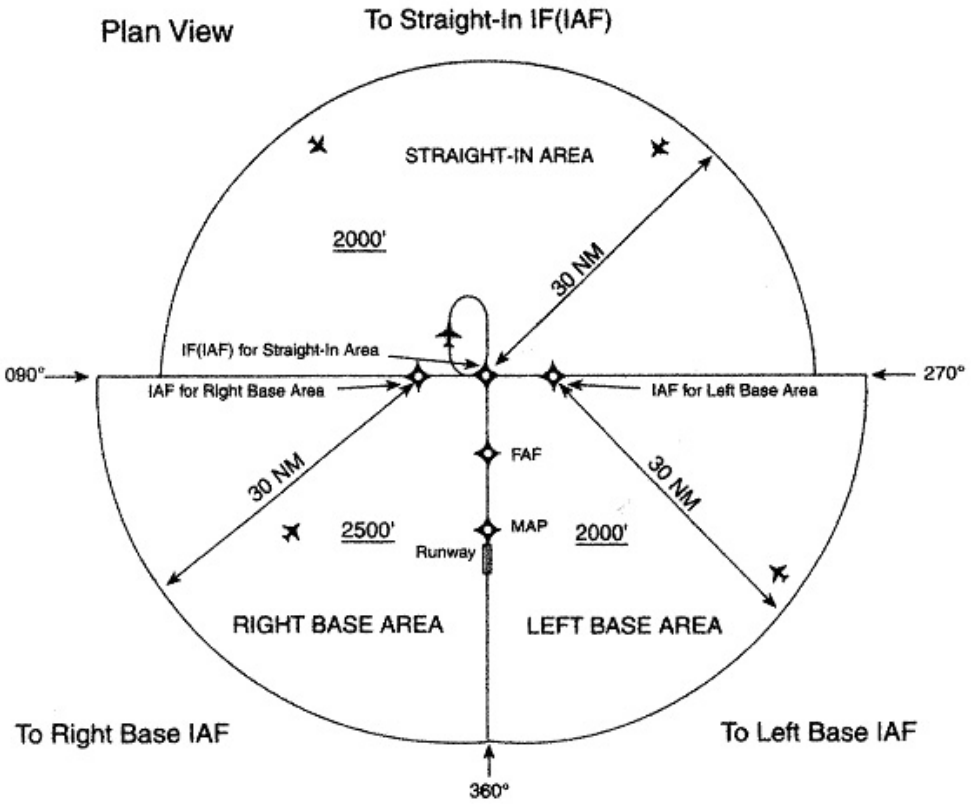
forming a "T". The initial segment is normally 3 – 6 nm in length; the intermediate segment is typically 5 – 7 nm long; and the final segment is typically 5 nm long with the actual lengths of each segment being dependant upon the surrounding obstacles / restrictions and the highest category of aircraft normally expected to use the procedure.

Although RNAV approaches are typically designed to eliminate the need to perform a Procedure Turn, this isn't always possible. When required for altitude loss (usually due to excessively steep descent gradients on the approach) or alignment purposes, the TAAs may include a holding pattern co-located with the IF (known as a Holding-In-Lieu-Of (HILO) Procedure Turn when flying in the U.S. or a Racetrack procedure when flying overseas) (see Figure 2). This mandatory holding pattern will be depicted with a dark, solid line similar to the actual approach routing. If so included, the arrival routing will be annotated with "NoPT" (No Procedure Turn) on the TAA entry sector wedges or the approach routing itself to identify when the holding pattern is not required. If arriving from a sector or routing that does not have "NoPT" depicted on it, the pilot is expected to execute one turn in the depicted holding pattern followed by the remainder of the approach. Now, if the holding procedure is not required (i.e. you are entering from a "NoPT" sector or routing, or you've been vectored to final and "cleared for the straight-in approach" by ATC) but you choose to execute the depicted holding pattern anyway, you must inform ATC and receive clearance to do so beforehand.

Arrival Routing:

The standard "T" design RNAV approaches are broken down into 3 areas, the left base, right base, and straight-in sectors. These areas are defined by the extension of the IAF legs and the intermediate segment course and extend out to 30 nm from the defining IAF appropriate for that sector (see Figure 4). The TAA's lateral boundaries are defined by magnetic courses to the IAF appropriate for that sector. The straight-in area can be further broken down by magnetic courses to the IF (IAF) and arcs based upon the RNAV distances from the IF (IAF). The left and right base areas, on the other hand, can only be further subdivided by arcs defined by the RNAV distance to the respective IAFs (see Figure 2). As of 23 February 2006, all sector altitudes provide 1,000' obstacle clearance and 2,000' in all mountainous areas.

OK, so how do you fly this thing? Once you're cleared for the RNAV approach, and prior to reaching the TAA, you'll need to determine which sector you'll be approaching from. You can do this by determining the magnetic bearing from your present position to the IF and comparing this to the bearings that are published on the TAA that define each sector (see Figure 4). It is essential that you use the bearing to the central IF and not the IAF for the left or right base areas. Using the incorrect IAF as a reference point may provide a false position which could result in you descending prematurely or to an incorrect altitude, flying incorrect routing, and/or incorrectly applying the IF holding alignment procedure if so annotated (i.e. flying it when you shouldn't or visa versa).



(Figure 4)

OK, so how do you get to the TAA in the first place? Luckily, TAAs typically overlay one or more airways from the enroute system. In this case, fly the airway routing until established within a segment of the TAA and then proceed direct to your respective IAF. In the event that the TAA does not overlie the airway, there will typically be a transition route published from the airway structure to the TAA. In the rare instances where there is no airway or transition route passing through the TAA, fly direct to your respective IAF and maintain the last assigned altitude (except in Canada where, unless told otherwise, you can descend to the lowest published IFR altitude for your position) until such time as you are established within the TAA boundaries.

Now once established within the TAA boundaries, you'll be expected to proceed directly to the IAF for your sector at the altitude(s) depicted on the TAA. This means that if you're in the left or right base areas, you will then proceed to the respective IAF for those areas. While if you're in the straight-in sector, then you will proceed directly to the IF (IAF).

As you're considered established on the approach once you enter the TAA area (or you're established on the Transition Route that will ultimately enter the TAA in the U.S.), you're expected commence a descent to the respective step down altitudes. That means that if your respective entry sector contains step down altitudes (such as those depicted in Figures 2 and 3) and you're within the applicable subsection of the sector, you're

expected to descend to, but no lower than, the step down altitudes depicted on the TAA
xpected to descend to, but no lower than, the step down altitudes depicted on the TAA
pected to descend to, but no lower than, the step down altitudes depicted on the TAA
ected to descend to, but no lower than, the step down altitudes depicted on the TAA
cted to descend to, but no lower than, the step down altitudes depicted on the TAA
ted to descend to, but no lower than, the step down altitudes depicted on the TAA (unless
ed to descend to, but no lower than, the step down altitudes depicted on the TAA (unless
d to descend to, but no lower than, the step down altitudes depicted on the TAA (unless
 to descend to, but no lower than, the step down altitudes depicted on the TAA (unless
to descend to, but no lower than, the step down altitudes depicted on the TAA (unless
o descend to, but no lower than, the step down altitudes depicted on the TAA (unless
 descend to, but no lower than, the step down altitudes depicted on the TAA (unless
descend to, but no lower than, the step down altitudes depicted on the TAA (unless
escend to, but no lower than, the step down altitudes depicted on the TAA (unless
scend to, but no lower than, the step down altitudes depicted on the TAA (unless
cend to, but no lower than, the step down altitudes depicted on the TAA (unless
end to, but no lower than, the step down altitudes depicted on the TAA (unless instructed
nd to, but no lower than, the step down altitudes depicted on the TAA (unless instructed
d to, but no lower than, the step down altitudes depicted on the TAA (unless instructed
 to, but no lower than, the step down altitudes depicted on the TAA (unless instructed
to, but no lower than, the step down altitudes depicted on the TAA (unless instructed
he step down altitudes depicted on the TAA (unless instructed otherwise by ATC). This
e step down altitudes depicted on the TAA (unless instructed otherwise by ATC). This
 step down altitudes depicted on the TAA (unless instructed otherwise by ATC). This
step down altitudes depicted on the TAA (unless instructed otherwise by ATC). This
tep down altitudes depicted on the TAA (unless instructed otherwise by ATC). This step
ep down altitudes depicted on the TAA (unless instructed otherwise by ATC). This step
p down altitudes depicted on the TAA (unless instructed otherwise by ATC). This step
 down altitudes depicted on the TAA (unless instructed otherwise by ATC). This step
down altitudes depicted on the TAA (unless instructed otherwise by ATC). This step
own altitudes depicted on the TAA (unless instructed otherwise by ATC). This step
wn altitudes depicted on the TAA (unless instructed otherwise by ATC). This step down
n altitudes depicted on the TAA (unless instructed otherwise by ATC). This step down
 altitudes depicted on the TAA (unless instructed otherwise by ATC). This step down
altitudes depicted on the TAA (unless instructed otherwise by ATC). This step down rule
ltitudes depicted on the TAA (unless instructed otherwise by ATC). This step down rule
titudes depicted on the TAA (unless instructed otherwise by ATC). This step down rule
itudes depicted on the TAA (unless instructed otherwise by ATC). This step down rule
tudes depicted on the TAA (unless instructed otherwise by ATC). This step down rule
udes depicted on the TAA (unless instructed otherwise by ATC). This step down rule
des depicted on the TAA (unless instructed otherwise by ATC). This step down rule
es depicted on the TAA (unless instructed otherwise by ATC). This step down rule holds
s depicted on the TAA (unless instructed otherwise by ATC). This step down rule holds
 depicted on the TAA (unless instructed otherwise by ATC). This step down rule holds
depicted on the TAA (unless instructed otherwise by ATC). This step down rule holds
epicted on the TAA (unless instructed otherwise by ATC). This step down rule holds

picted on the TAA (unless instructed otherwise by ATC). This step down rule holds true icted on the TAA (unless instructed otherwise by ATC). This step down rule holds true in Canada as well as in the U.S. Be advised, however, failure to reach the TAA altitude prescribed for your sector by the time you cross your respective IAF could result in a descent gradient for the remainder of the RNAV IAP that is in excess of an acceptable descent gradient (as prescribed by aircraft limits and/or TERPS criteria).

Approach Routing:

Upon passing the IAF for your respective sector at the altitude identified on the TAA, you'll be expected to complete the approach as depicted. Although your FMS/GPS should know what to do and fly it appropriately, it is important to understand what it *should* do so that you're not along for the ride to somewhere you shouldn't be. With this in mind, ensure that the RNAV approach is flown as depicted. Consider the approach routing a mandatory track that you must not deviate from. This includes all depicted courses and altitudes.

Once you're established on the initial and subsequent intermediate approach segment, then the remainder of the approach will be flown in accordance with established RNAV approach procedures.

Route Verification:

Despite how wonderful technology is and how much we would like to trust it, it is critical that we not trust it 100%. The FMS/GPS database that contains the data for your route or approach was created by someone converting a textual version of the approach or routing into an apparently random string of letters and numbers that your FMS/GPS then interprets to be an specific route with specific altitudes or holding patterns. The process from conception to programming is an involved process that includes many individuals who are all susceptible to error. The only problem is that if an error is induced, that particular approach could become unsafe and/or ineffective. The catch is that you've got to catch it before it's too late.

To assist with this process, your FMS database supplier (DoD or Jeppesen) will publish NOTAMs for their respective products which will alert you to known errors in their products. You can obtain the DoD DAFIF NOTAMs by clicking on the "DAFIF NOTAMs" button on the DoD NOTAM website (https://www.notams.jcs.mil) and the Jeppesen NavData FMS database NOTAMs by visiting the Jeppesen NOTAM website (http://www.jeppesen.com/wlcs/index.jsp?section=resources&content=publications_notam.html).

Furthermore, IAW GPH 204A, before flying a GPS or RNAV IAP, you must verify the accuracy and integrity of the FMS database. This should be done by comparing the FMS version to a NOTAM verified, current paper product. If any discrepancy is found, the

paper product will be considered correct. It is also a good idea, although not required, to compare the FMS database to a paper product from another agency. For example, if you are using the Jeppesen NavData database, then compare the IAP to a DoD or DND paper version of the IAP. And while you can correct routing errors on preloaded SIDs and STARs, you are not authorized to change waypoint attributes (location, altitudes, etc.) on IAPs. This includes adding and/or removing waypoints from a preloaded IAP. You are, however, authorized to modify the attributes for the MAHP (such as defining a holding pattern) based upon clearances received from ATC.

Conclusion:

So, there you have it. In a nutshell, TAAs are nothing more than a means by which ATC can get an aircraft down from the enroute system onto an approach with minimal communication. Do a careful analysis of your present position before commencing the approach and then comply with the progressive step down altitudes outlined in your applicable TAA sector. Then, once you pass the appropriate IAF for the underlying RNAV approach, fly the remainder of the approach as depicted in accordance with established RNAV procedures.

Related Materials:

At the time that this article was written, TAA criteria and procedures had not been included in the Transport Canada regulations. However, Transport Canada has adopted the FAA's regulations on TAAs by exemption as outlined in Transport Canada TP 308/GPH 209 Advisory Circular 1/04. This exemption will remain in effect until November 30th, 2006, 23:59 UTC, or such time as they are incorporated into the CARs and related standards, technical specifications and criteria publications, the expiration dates outlined in TC Advisory Circular 1/04 are breached, or the Minister cancels the Advisory Circular, whichever happens first.

If you're interested in reading more about Terminal Arrival Areas (TAAs) and RNAV approaches in general, I would recommend reading Section 5-4-5 of the U.S. Federal Aviation Administration (FAA) Aeronautical Information Manual (AIM) which is available online (http://www.faa.gov/atpubs/AIM/Chap5/aim0504.html#5-4-5) and in print. If you're interested in the criteria for these procedures, I would recommend reading the following:

U.S. DoT FAA Orders:

- 8260.3B Vol. 3, Change 19 - Precision Approach (PA) and Barometric Vertical Navigation (Baro VNAV) Approach Procedures
- 8260.40B - Flight Management System (FMS) Instrument Procedures
- 8260.42A - Heliport Global Positioning System (GPS) Non-precision Approach Criteria
- 8260.45A - Terminal Arrival Area (TAA) Design Criteria

8260.47 - Barometric Vertical Navigation (VNAV) Instrument Procedures Development
8260.48 - Area Navigation (RNAV) Approach Construction Criteria
8260.50 - Wide Area Augmentation System (WAAS) Instrument Procedures
8260.51 - Required Navigation Performance (RNP) Instrument Procedures

The aforementioned U.S. DoT FAA Orders can be found online at http://www.faa.gov/asd/international/tso.htm

TP 308/GPH 209 Advisory Circular 1/04 can be found online at http://www.tc.gc.ca/civilaviation/ansanda/aarna/tp308/ac2004-1att1.htm

References:

1. *Department of Defense, "General Planning", chapter 3.*
2. *Department of National Defense, "Flight Planning and Procedures Canada and North Atlantic", chapter 4.*
3. *Department of National Defense, "GPH 209 – Criteria For The Development Of Instrument Approaches".*
4. *Department of Transportation Federal Aviation Administration Order 8260.45A.*
5. *Federal Aviation Administration (FAA), phone and personal interviews.*
6. *Federal Aviation Administration, "Federal Aviation Regulations / Aeronautical Information Manual (FAR/AIM)", AIM chapter 5.*
7. *Jeppesen, phone interviews.*
8. *Transport Canada, TP 308/GPH 209 Advisory Circular 1/04.*

Note: Graphics obtained from the FAA FAR/AIM, and the DND and DoD FLIP.