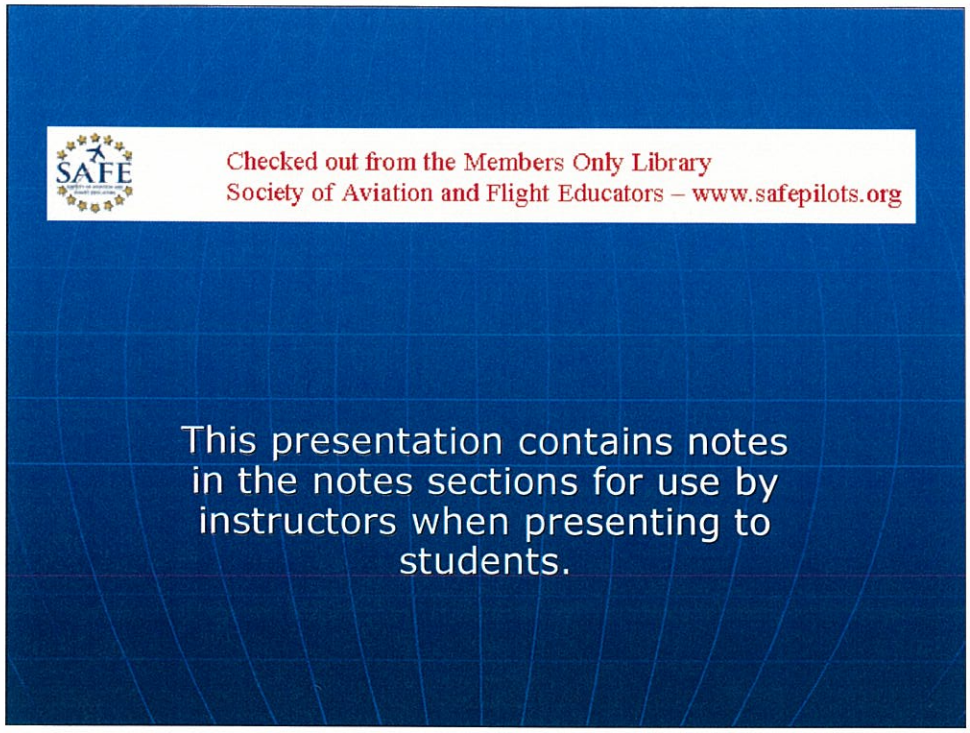
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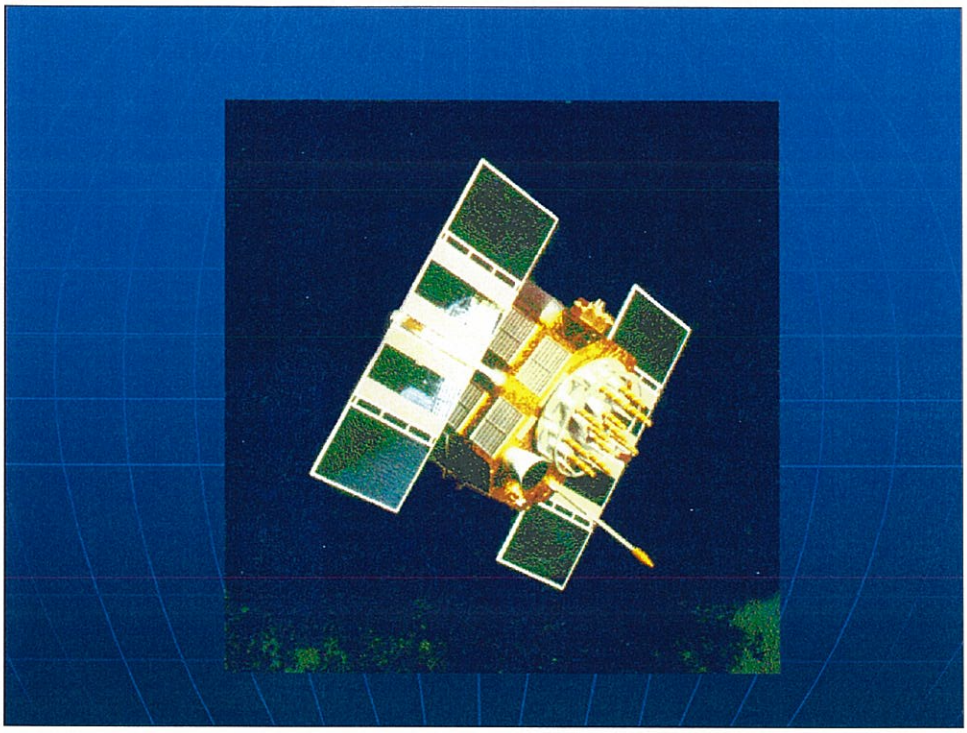
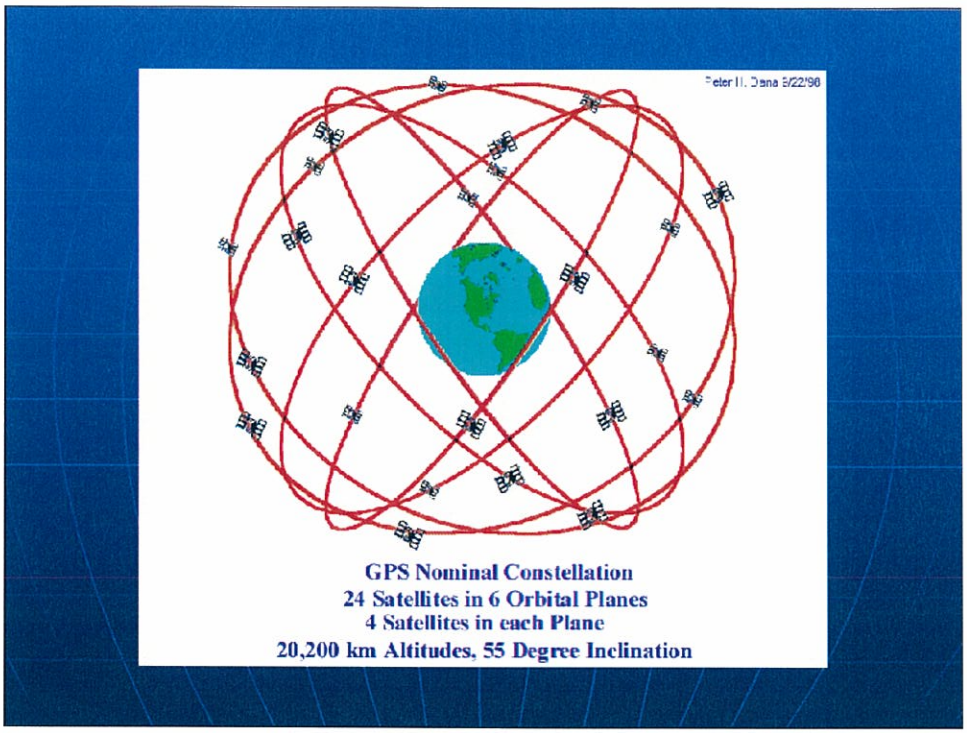
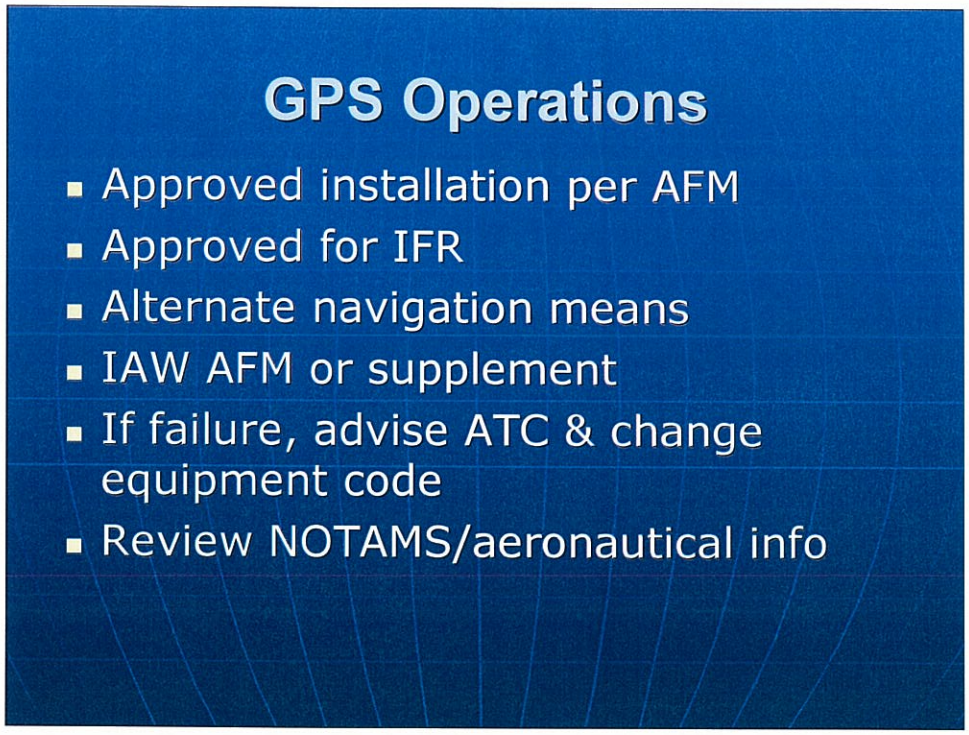
Society of Aviation and Flight Educators – www.safepilots.org
This presentation contains notes in the notes sections for use by instructors when presenting to students.

GPS Approaches

by
Patricia Knight
Master CFI & Pilot Examiner




Peter H. Dana 8/22/96
GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination



(a) GPS navigation equipment used must be approved and the installation IAW FAA guidance.

Visual flight rules (VFR) and hand-held GPS systems are not authorized for IFR navigation, instrument approaches, or as a principal instrument flight reference. During IFR operations they may be considered only an aid to situational awareness.

(b) Aircraft using GPS navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight. Active monitoring of alternative navigation equipment is not required if the GPS receiver uses RAIM for integrity monitoring. Active monitoring of an alternate means of navigation is required when the RAIM capability of the GPS equipment is lost.

(c) Procedures must be established for use in the event that the loss of RAIM capability is predicted to occur. In situations where this is encountered, the flight must rely on other approved equipment, delay departure, or cancel the flight.

(d) The GPS operation must be conducted in accordance with the FAA-approved aircraft flight manual (AFM) or flight manual supplement.

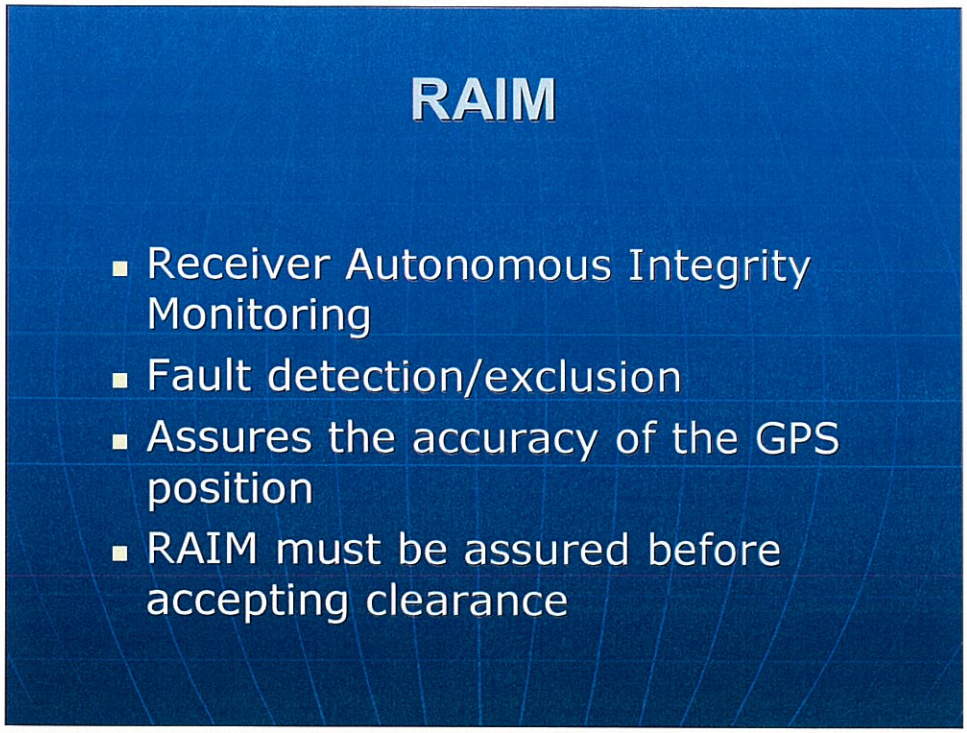
Flight crew members must be thoroughly familiar with the particular GPS equipment installed in the aircraft, the receiver operation manual, and the AFM or flight manual supplement. The basic operation, receiver presentation to the pilot, and some capabilities of the equipment can vary greatly. Using the equipment in flight under VFR conditions prior to attempting IFR operation will allow further familiarization.

(e) Aircraft navigating by IFR approved GPS are considered to be area navigation (RNAV) aircraft and have special equipment suffixes. File the appropriate equipment suffix in accordance with TBL 5-1-2, on the ATC flight plan. If GPS avionics become inoperative, the pilot should advise ATC and amend the equipment suffix.

(f) Prior to any GPS IFR operation, the pilot must review appropriate NOTAMs and aeronautical information. (See GPS NOTAMs/Aeronautical Information.)

(g) GPS domestic en route and terminal IFR operations can be conducted as soon as proper avionics systems are installed, provided all general requirements are met. The avionics necessary to receive all of the ground-based facilities appropriate for the route to the destination airport and any required alternate airport must be installed and operational. Ground-based facilities necessary for these routes must also be operational.

(h) To determine equipment approvals and limitations, refer to the AFM, AFM supplements, or pilot guides.



•RAIM is necessary since delays of up to two hours can occur before an erroneous satellite transmission can be detected and corrected by the satellite control segment.

•fault detection

•fault exclusion, refers to the ability of the receiver to exclude a failed satellite from the position solution and is provided by some GPS receivers

•RAIM messages two types.

- •not enough satellites available to provide RAIM integrity monitoring
- •RAIM integrity monitor has detected a potential error that exceeds the limit for the current phase of flight. Without RAIM capability, the pilot has no assurance of the accuracy of the GPS position.

•RAIM outages may occur due to an insufficient number of satellites or due to unsuitable satellite geometry which causes the error in the position solution to become too large. Loss of satellite reception and RAIM warnings may occur due to aircraft dynamics (changes in pitch or bank angle). Antenna location on the aircraft, satellite position relative to the horizon, and aircraft attitude may affect reception of one or more satellites. Since the relative positions of the satellites are constantly changing, prior experience with the airport does not guarantee reception at all times, and RAIM availability should always be checked.

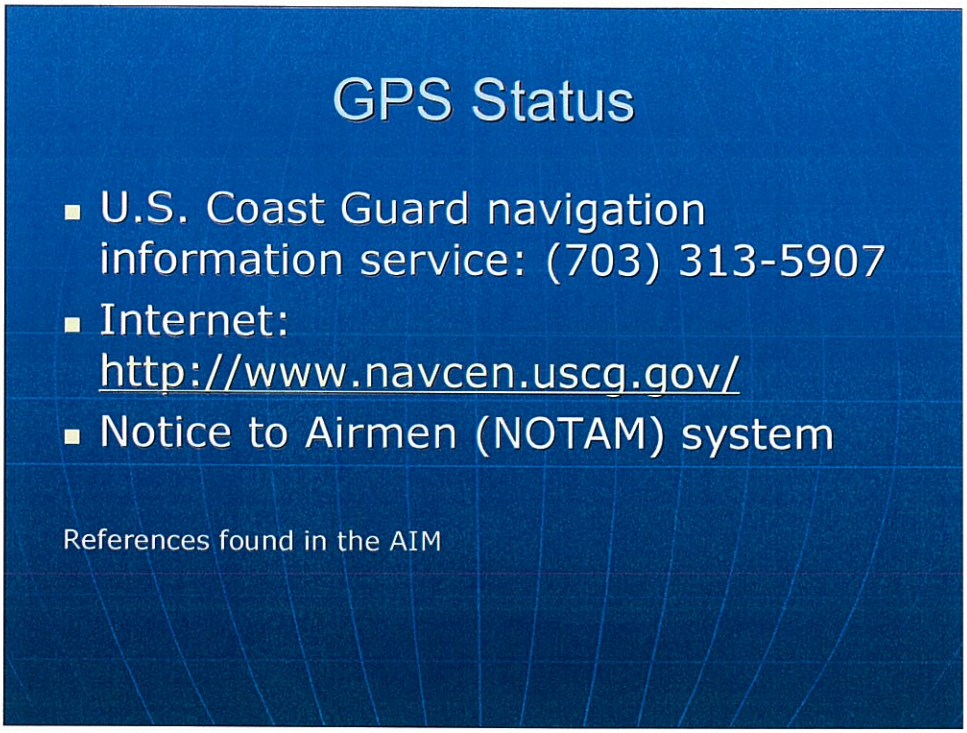
•If RAIM is not available, another type of navigation and approach system must be used, another destination selected, or the trip delayed until RAIM is predicted to be available on arrival.

•On longer flights, pilots should consider rechecking the RAIM prediction for the destination during the flight. This may provide early indications that an unscheduled satellite outage has occurred since takeoff.

•Prior to the final approach waypoint (FAWP), the approach should not be completed since GPS may no longer provide the required accuracy. The receiver performs a RAIM prediction by 2 NM prior to the FAWP to ensure that RAIM is available at the FAWP as a condition for entering the approach mode. The pilot should ensure that the receiver has sequenced from "Armed" to "Approach" prior to the FAWP (normally occurs 2 NM prior). Failure to sequence may be an indication of the detection of a satellite anomaly, failure to arm the receiver (if required), or other problems which preclude completing the approach.

•If the receiver does not sequence into the approach mode or a RAIM failure/status annunciation occurs prior to the FAWP, the pilot should not descend to Minimum Descent Altitude (MDA), but should proceed to the missed approach waypoint (MAWP) via the FAWP, perform a missed approach, and contact ATC as soon as practical. Refer to the receiver operating manual for specific indications and instructions associated with loss of RAIM prior to the FAF.

•If a RAIM failure occurs after the FAWP, the receiver is allowed to continue operating without an annunciation for up to 5 minutes to allow completion of the approach. If the RAIM flag/status annunciation appears after the FAWP, the missed approach should be executed immediately.



GPS Status

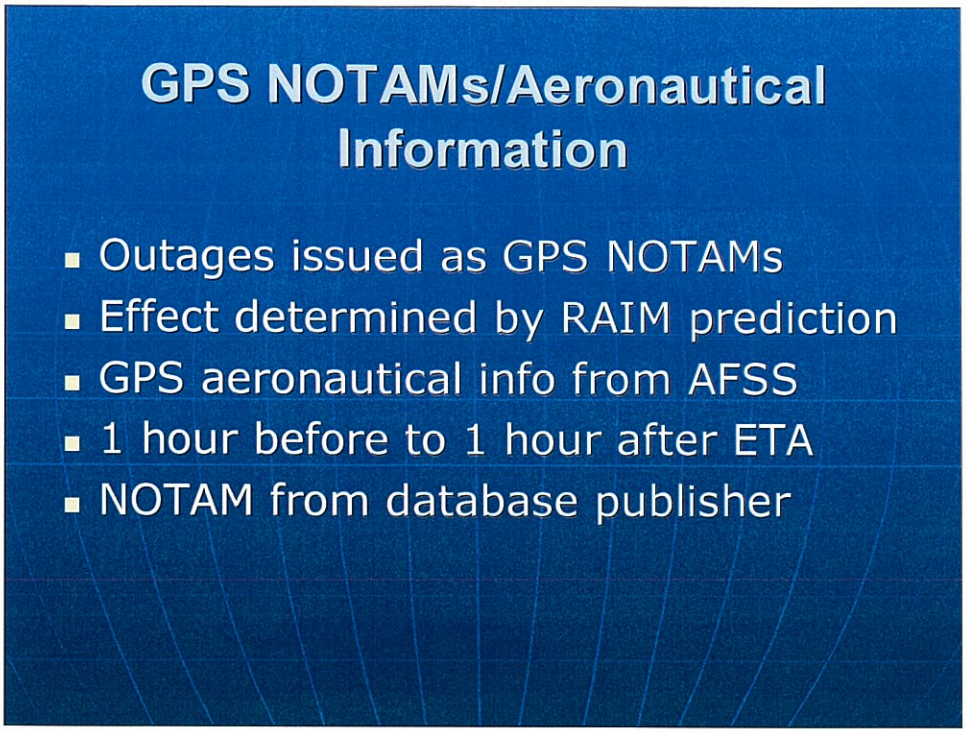
The status of GPS satellites is broadcast as part of the data message transmitted by the GPS satellites. GPS status information is also available by means of the, Internet: http://www.navcen.uscg.gov/. Additionally, satellite status is available through the Notice to Airmen (NOTAM) system.

GPS Handhelds

Not authorized for IFR! Why?

RAIM, antenna location, power source, unapproved installation, view, AFM supplement, limitations

Situational awareness only



1. GPS satellite outages are issued as GPS NOTAMs both domestically and internationally. However, the effect of an outage on the intended operation cannot be determined unless the pilot has a RAIM availability prediction program which allows excluding a satellite which is predicted to be out of service based on the NOTAM information.

2. The term UNRELIABLE is used in conjunction with GPS NOTAMs. The term UNRELIABLE is an advisory to pilots indicating the expected level of service may not be available. GPS operation may be NOTAMed UNRELIABLE due to testing or anomalies. Air Traffic Control will advise pilots requesting a GPS or RNAV (GPS) approach of GPS UNRELIABLE for:

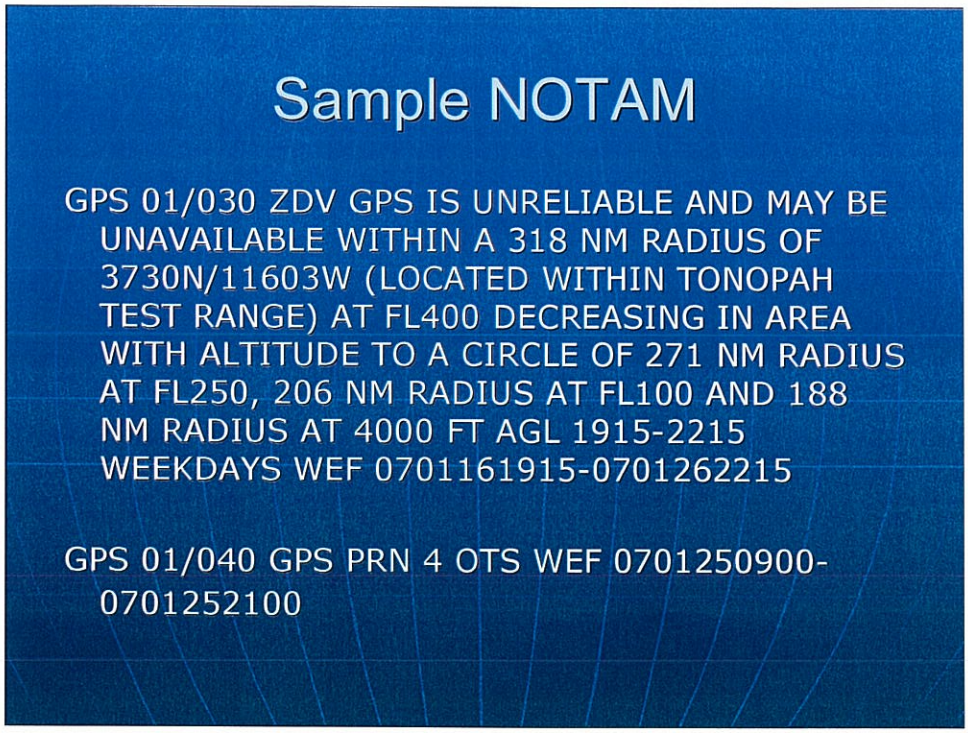
(a) NOTAMs not contained in the ATIS broadcast.

(b) Pilot reports of GPS anomalies received within the preceding 15 minutes.

3. Civilian pilots may obtain GPS RAIM availability information for nonprecision approach procedures by specifically requesting GPS aeronautical information from an Automated Flight Service Station during preflight briefings. GPS RAIM aeronautical information can be obtained for a period of 3 hours (ETA hour and 1 hour before to 1 hour after the ETA hour) or a 24 hour time frame at a particular airport. FAA briefers will provide RAIM information for a period of 1 hour before to 1 hour after the ETA, unless a specific time frame is requested by the pilot. If flying a published GPS departure, a RAIM prediction should also be requested for the departure airport.

4. The military provides airfield specific GPS RAIM NOTAMs for nonprecision approach procedures at military airfields. The RAIM outages are issued as M-series NOTAMs and may be obtained for up to 24 hours from the time of request.

5. Receiver manufacturers and/or database suppliers may supply "NOTAM" type information concerning database errors. Pilots should check these sources, when available, to ensure that they have the most current information concerning their electronic database.



GPS 01/030 ZDV GPS IS UNRELIABLE AND MAY BE UNAVAILABLE WITHIN A 318 NM RADIUS OF 3730N/11603W (LOCATED WITHIN TONOPAH TEST RANGE) AT FL400 DECREASING IN AREA WITH ALTITUDE TO A CIRCLE OF 271 NM RADIUS AT FL250, 206 NM RADIUS AT FL100 AND 188 NM RADIUS AT 4000 FT AGL 1915-2215 WEEKDAYS WEF 0701161915-0701262215

GPS 01/031 ZDV GPS IS UNRELIABLE AND MAY BE UNAVAILABLE WITHIN A 318 NM RADIUS OF 3730N/11603W (LOCATED WITHIN TONOPAH TEST RANGE) AT FL400 DECREASING IN AREA WITH ALTITUDE TO A CIRCLE OF 271 NM RADIUS AT FL250, 206 NM RADIUS AT FL100 AND 188 NM RADIUS AT 4000 FT AGL 0130-0530 WEEKDAYS WEF 0701170130-0701260530

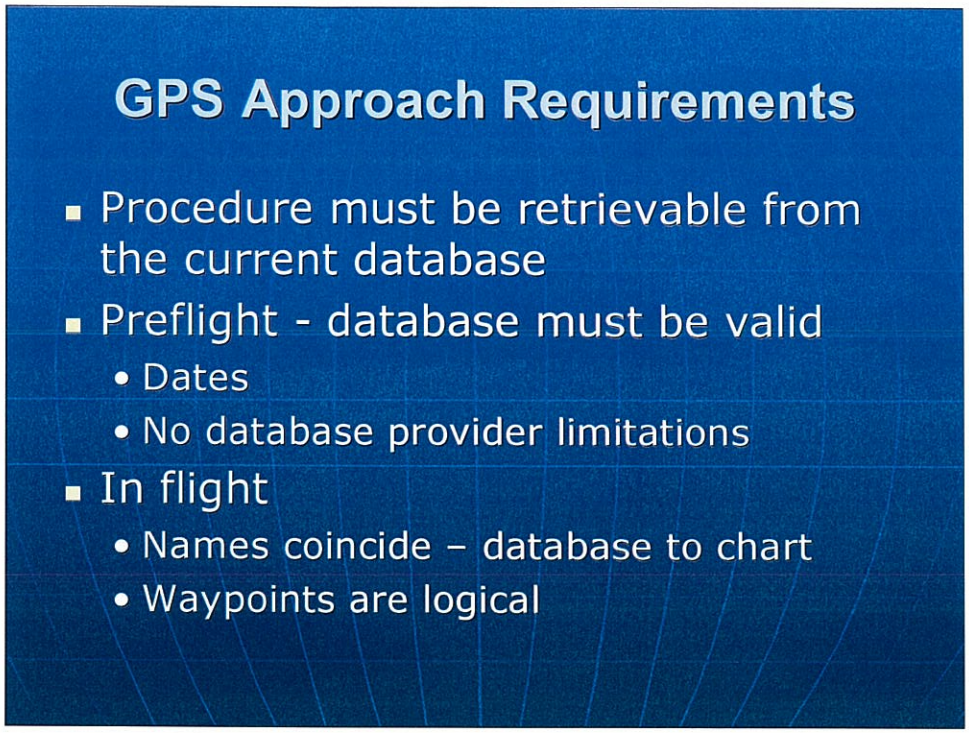
GPS 01/044 ZDV GPS IS UNRELIABLE AND MAY BE UNAVAILABLE WITHIN A 350 NM RADIUS OF THE HOLLOMAN TACAN /HMN/ OR 325144N/1060633W AT FL400 DECREASING IN AREA WITH DECREASE IN ALTITUDE TO 301 NM RADIUS AT FL250, 216 NM RADIUS AT 10000 FT MSL, AND 227 NM RADIUS AT 4,000 FT AGL. THE IMPACT AREA ALSO EXTENDS APPROXIMATELY 240 NM INTO THE MEXICAN FIR AT FL400 AT THE FURTHEST POINT TO THE SOUTH, DECREASING TO 150 NM AT 4000 FT AGL 0000-1000 DLY WEF 0701250000-0701271000

GPS 01/040 GPS PRN 4 OTS WEF 0701250900-0701252100

GPS 08/045 GPS PRN 15 OTS WEF 0608211425

Pseudo-Random Noise (PRN)

A binary signal with random noise-like properties. It is generated by mathematical algorithm or "code", and consists of repeated pattern of 1's and 0's. This binary code can be modulated on the GPS carrier waves using Binary Shift-Key (BSK) modulation. The C/A-Code and the P-Code are examples of PRN codes. Each satellite transmits a unique C/A-Code and P-Code sequence (on the same L1 and L2 frequencies), and **hence a satellite may be identified according to its "PRN number", e.g. PRN2 or PRN14 are particular GPS satellites.**



1. Authorization to fly approaches under IFR using GPS avionics systems requires that:

(a) A pilot use GPS avionics with TSO- C129, or equivalent, authorization in class A1, B1, B3, C1, or C3; and

(b) All approach procedures to be flown must be retrievable from the current airborne navigation database supplied by the TSO-C129 equipment manufacturer or other FAA approved source.

(c) Prior to using a procedure or waypoint retrieved from the airborne navigation database, the pilot should verify the validity of the database. This verification should include the following preflight and in-flight steps:

(1) Preflight:

[a] Determine the date of database issuance, and verify that the date/time of proposed use is before the expiration date/time.

[b] Verify that the database provider has not published a notice limiting the use of the specific waypoint or procedure.

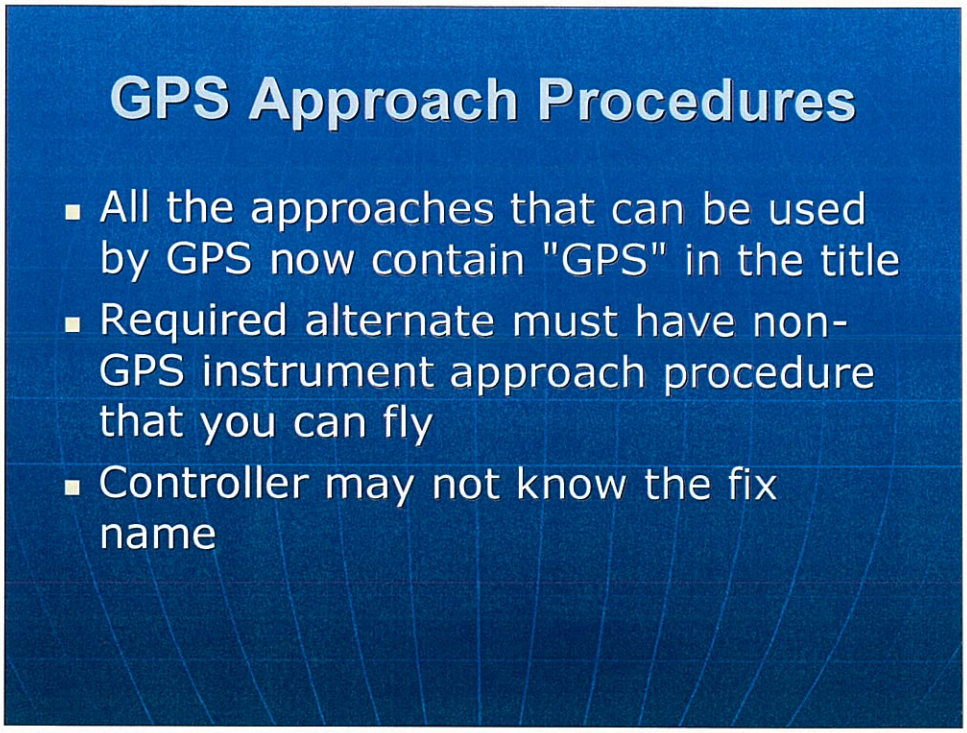
(2) Inflight:

[a] Determine that the waypoints and transition names coincide with names found on the procedure chart. Do not use waypoints, which do not exactly match the spelling shown on published procedure charts.

[b] Determine that the waypoints are generally ***logical in location, in the correct order, and that their orientation to each other is as found on the procedure chart, both laterally and vertically.***

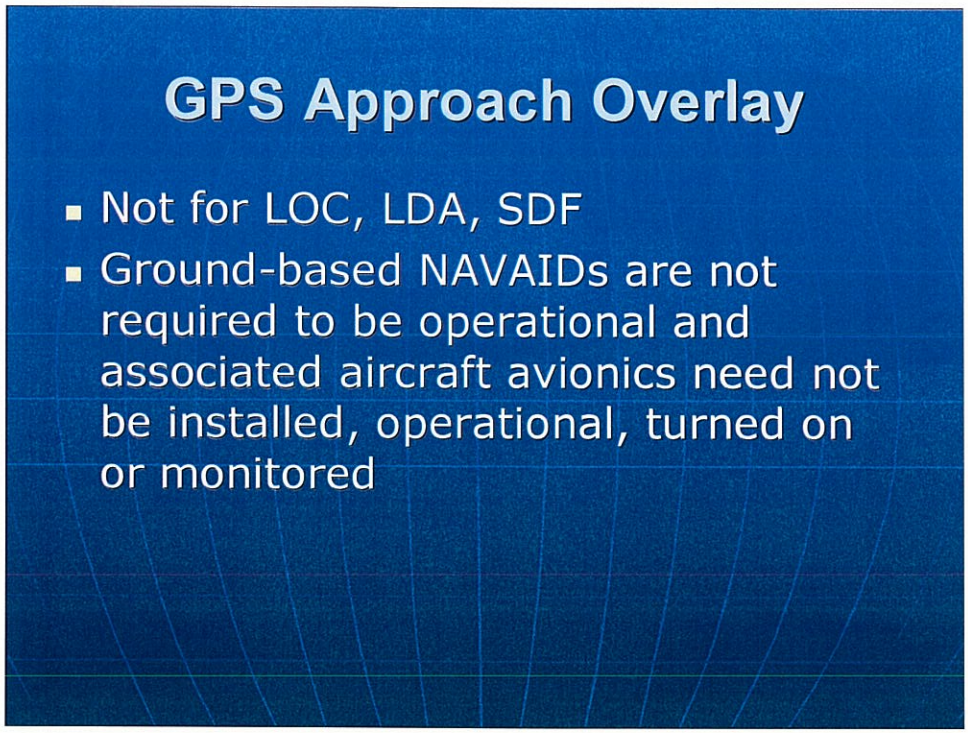
NOTE- *There is no specific requirement to check each waypoint latitude and longitude, type of waypoint and/or altitude constraint, only the general relationship of waypoints in the procedure, or the logic of an individual waypoint's location.*

[c] If the cursory check of procedure logic or individual waypoint location, specified in [b] above, indicates a potential error, do not use the retrieved procedure or waypoint until a verification of latitude and longitude, waypoint type, and altitude constraints indicate full conformity with the published data.



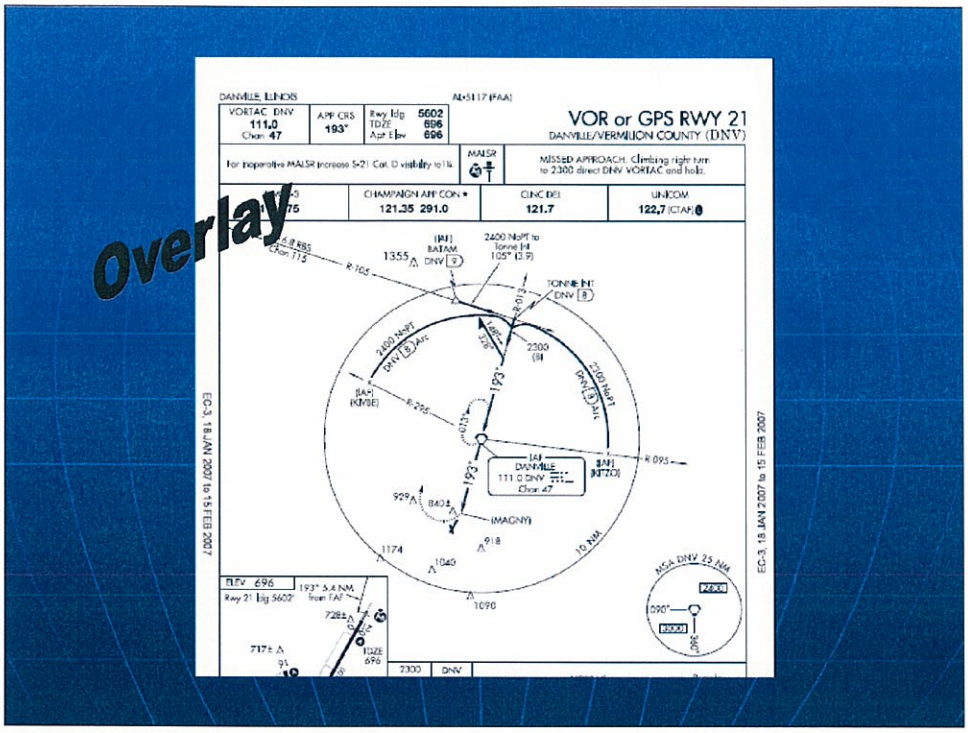
As the production of stand-alone GPS approaches has progressed, many of the original overlay approaches have been replaced with stand-alone procedures specifically designed for use by GPS systems. The title of the remaining GPS overlay procedures has been revised on the approach chart to "or GPS" (e.g., VOR or GPS RWY 24). Therefore, all the approaches that can be used by GPS now contain "GPS" in the title (e.g., "VOR or GPS RWY 24," "GPS RWY 24," or "RNAV (GPS) RWY 24"). During these GPS approaches, underlying ground-based NAVAIDs are not required to be operational and associated aircraft avionics need not be installed, operational, turned on or monitored (monitoring of the underlying approach is suggested when equipment is available and functional). Existing overlay approaches may be requested using the GPS title, such as "GPS RWY 24" for the VOR or GPS RWY 24.

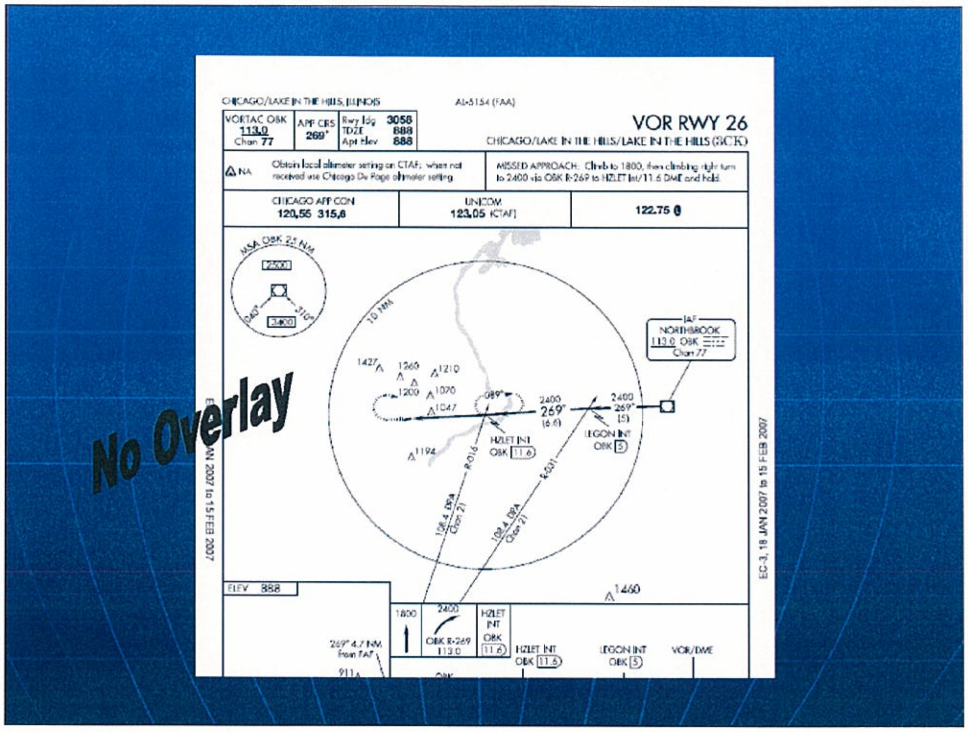
NOTE- *Any required alternate airport must have an approved instrument approach procedure other than GPS that is anticipated to be operational and available at the estimated time of arrival, and which the aircraft is equipped to fly.*

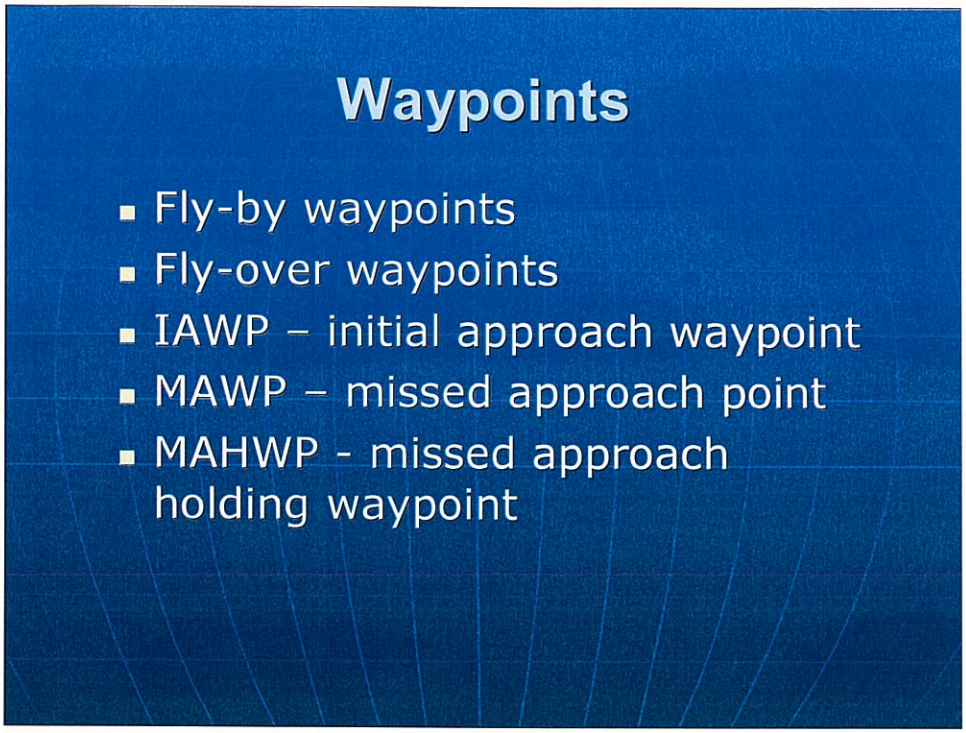


The GPS Approach Overlay Program is an authorization for pilots to use GPS avionics under IFR for flying designated nonprecision instrument approach procedures, except LOC, LDA, and simplified directional facility (SDF) procedures. These procedures are now identified by the name of the procedure and "or GPS" (e.g., VOR/DME or GPS RWY 15). Other previous types of overlays have either been converted to this format or replaced with stand-alone procedures. Only approaches contained in the current onboard navigation database are authorized. The navigation database may contain information about nonoverlay approach procedures that is intended to be used to enhance position orientation, generally by providing a map, while flying these approaches using conventional NAVAIDs. This approach information should not be confused with a GPS overlay approach (see the receiver operating manual, AFM, or AFM Supplement for details on how to identify these approaches in the navigation database).

NOTE- Overlay approaches are predicated upon the design criteria of the ground-based NAVAID used as the basis of the approach. As such, they do not adhere to the design criteria described in paragraph 5-4-5j, Area Navigation (RNAV) Instrument Approach Charts, for stand-alone GPS approaches.


Overlay
DANVILLE, ILLINOIS
VOR or GPS RWY 21
DANVILLE/VERMILION COUNTY (DNV)
VORTAC DNV 111.0 Chan 47
APP CRS 193°
Rwy Idg 5602
TDZE 696
Apt Elev 696
MISSED APPROACH: Climbing right turn to 2300 direct DNV VORTAC and hold.
CHAMPAIGN APP CON
121.35 291.0
CLNC DEL 121.7
UNICOM 122.7
2400 NoPT to Tonne [H] 105° (2.9)
TONNE INT
DNV
2400 NoPT DNV 9 Arc
2300 (H)
2100 NoPT DNV 9 Arc
R-105
R-295
R-093
193°
(MAGNY)
10 NM
MSA DNV 25 NM
EC-3, 18 JAN 2007 to 15 FEB 2007


CHICAGO/LAKE IN THE HILLS, ILLINOIS
AL-5154 (FAA)
VORTAC OBK
113.0
Chan 77
APP CRS
269°
Rwy ldg 3058
TDZE 888
Apt Elev 888
VOR RWY 26
CHICAGO/LAKE IN THE HILLS/LAKE IN THE HILLS (3CK)
Obtain local altimeter setting on CTAF; when not received use Chicago De Page altimeter setting.
MISSED APPROACH: Climb to 1800, then climbing right turn to 2400 via OBK R-269 to HZLET Int/11.6 DME and hold.
CHICAGO APP CON
120.55 315.6
UNICOM
123.05 (CTAF)
122.75
MSA OBK 25 NM
2500
3400
10 NM
IAF
NORTHBROOK
113.0 OBK
Chan 77
No Overlay
2400
269°
(6.6)
HZLET INT
OBK 11.6
LEGON INT
OBK 5
1427
1260
1210
1200
1070
1047
1194
1460
ELEV 888
1800
2400
HZLET INT
OBK 11.6
OBK R-269
113.0
LEGON INT
OBK 5
VOR/DME
269° 4.7 NM from FAF
911
EC-3, 18 JAN 2007 to 15 FEB 2007

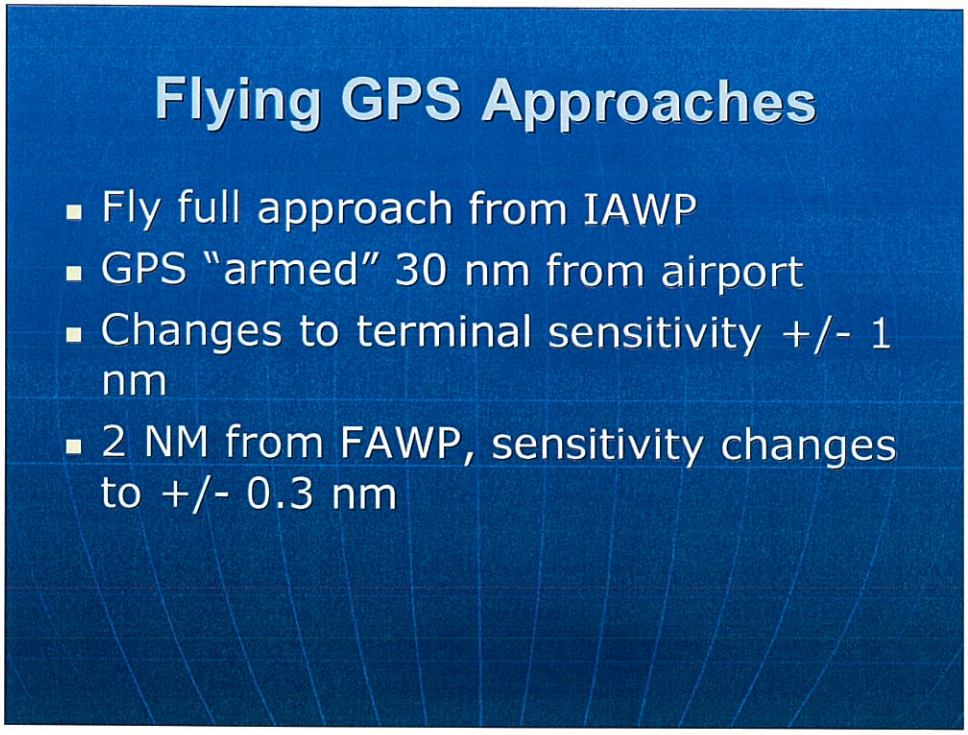


1. GPS approaches make use of both fly-over and fly-by waypoints. Fly-by waypoints are used when an aircraft should begin a turn to the next course prior to reaching the waypoint separating the two route segments. This is known as turn anticipation and is compensated for in the airspace and terrain clearances. Approach waypoints, except for the MAWP and the missed approach holding waypoint (MAHWP), are normally fly-by waypoints. Fly-over waypoints are used when the aircraft must fly over the point prior to starting a turn. New approach charts depict fly-over waypoints as a circled waypoint symbol. Overlay approach charts and some early stand alone GPS approach charts may not reflect this convention.

2. Since GPS receivers are basically "To-To" navigators, they must always be navigating to a defined point. On overlay approaches, if no pronounceable five-character name is published for an approach waypoint or fix, it was given a database identifier consisting of letters and numbers. These points will appear in the list of waypoints in the approach procedure database, but may not appear on the approach chart. A point used for the purpose of defining the navigation track for an airborne computer system (i.e., GPS or FMS) is called a Computer Navigation Fix (CNF). CNFs include unnamed DME fixes, beginning and ending points of DME arcs and sensor final approach fixes (FAFs) on some GPS overlay approaches. To aid in the approach chart/database correlation process, the FAA has begun a program to assign five-letter names to CNFs and to chart CNFs on various National Oceanic Service aeronautical products. These CNFs are not to be used for any air traffic control (ATC) application, such as holding for which the fix has not already been assessed. CNFs will be charted to distinguish them from conventional reporting points, fixes, intersections, and waypoints. The CNF name will be enclosed in parenthesis, e.g., (MABEE), and the name will be placed next to the CNF it defines. If the CNF is not at an existing point defined by means such as crossing radials or radial/DME, the point will be indicated by an "X." The CNF name will not be used in filing a flight plan or in aircraft/ATC communications. Use current phraseology, e.g., facility name, radial, distance, to describe these fixes.

3. Unnamed waypoints in the database will be uniquely identified for each airport but may be repeated for another airport (e.g., RW36 will be used at each airport with a runway 36 but will be at the same location for all approaches at a given airport).

4. The runway threshold waypoint, which is normally the MAWP, may have a five letter identifier (e.g., SNEEZ) or be coded as RW## (e.g., RW36, RW36L). Those thresholds which are coded as five letter identifiers are being changed to the RW## designation. This may cause the approach chart and database to differ until all changes are complete. The runway threshold waypoint is also used as the center of the Minimum Safe Altitude (MSA) on most GPS approaches. MAWPs not located at the threshold will have a five letter identifier.



1. Determining which area of the TAA the aircraft will enter when flying a "T" with a TAA must be accomplished using the bearing and distance to the IF(IAF). This is most critical when entering the TAA in the vicinity of the extended runway centerline and determining whether you will be entering the right or left base area. Once inside the TAA, all sectors and stepdowns are based on the bearing and distance to the IAF for that area, which the aircraft should be proceeding direct to at that time, unless on vectors. (See FIG 5-4-3 and FIG 5-4-4.)

2. Pilots should fly the full approach from an Initial Approach Waypoint (IAWP) or feeder fix unless specifically cleared otherwise. Randomly joining an approach at an intermediate fix does not assure terrain clearance.

3. When an approach has been loaded in the flight plan, GPS receivers will give an "arm" annunciation 30 NM straight line distance from the airport/heliport reference point. Pilots should arm the approach mode at this time, if it has not already been armed (some receivers arm automatically). Without arming, the receiver will not change from en route CDI and RAIM sensitivity of ±5 NM either side of centerline to ±1 NM terminal sensitivity. Where the IAWP is inside this 30 mile point, a CDI sensitivity change will occur once the approach mode is armed and the aircraft is inside 30 NM. Where the IAWP is beyond 30 NM from the airport/heliport reference point, CDI sensitivity will not change until the aircraft is within 30 miles of the airport/heliport reference point even if the approach is armed earlier. Feeder route obstacle clearance is predicated on the receiver being in terminal (±1 NM) CDI sensitivity and RAIM within 30 NM of the airport/heliport reference point, therefore, the receiver should always be armed (if required) not later than the 30 NM annunciation.

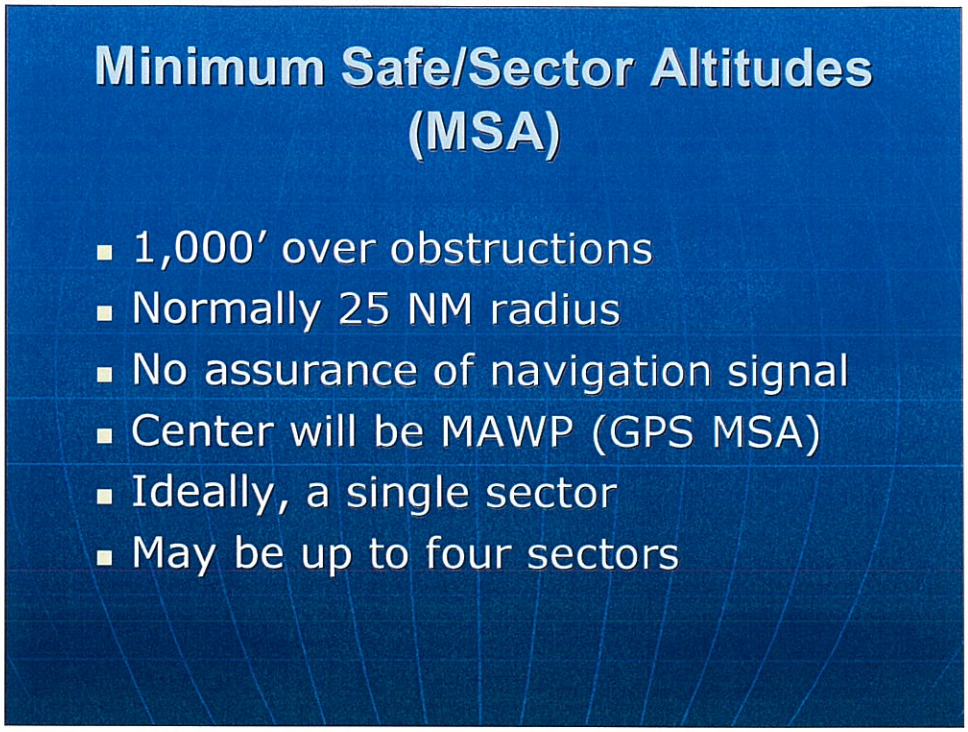
4. The pilot must be aware of what bank angle/turn rate the particular receiver uses to compute turn anticipation, and whether wind and airspeed are included in the receiver's calculations. This information should be in the receiver operating manual. Over or under banking the turn onto the final approach course may significantly delay getting on course and may result in high descent rates to achieve the next segment altitude.

5. When within 2 NM of the FAWP with the approach mode armed, the approach mode will switch to active, which results in RAIM changing to approach sensitivity and a change in CDI sensitivity. Beginning 2 NM prior to the FAWP, the full scale CDI sensitivity will smoothly change from ±1 NM to ±0.3 NM at the FAWP. As sensitivity changes from ±1 NM to ±0.3 NM approaching the FAWP, with the CDI not centered, the corresponding increase in CDI displacement may give the impression that the aircraft is moving further away from the intended course even though it is on an acceptable intercept heading. Referencing the digital track displacement information (cross track error), if it is available in the approach mode, may help the pilot remain position oriented in this situation. Being established on the final approach course prior to the beginning of the sensitivity change at 2 NM will help prevent problems in interpreting the CDI display during ramp down. Therefore, requesting or accepting vectors which will cause the aircraft to intercept the final approach course within 2 NM of the FAWP is not recommended.

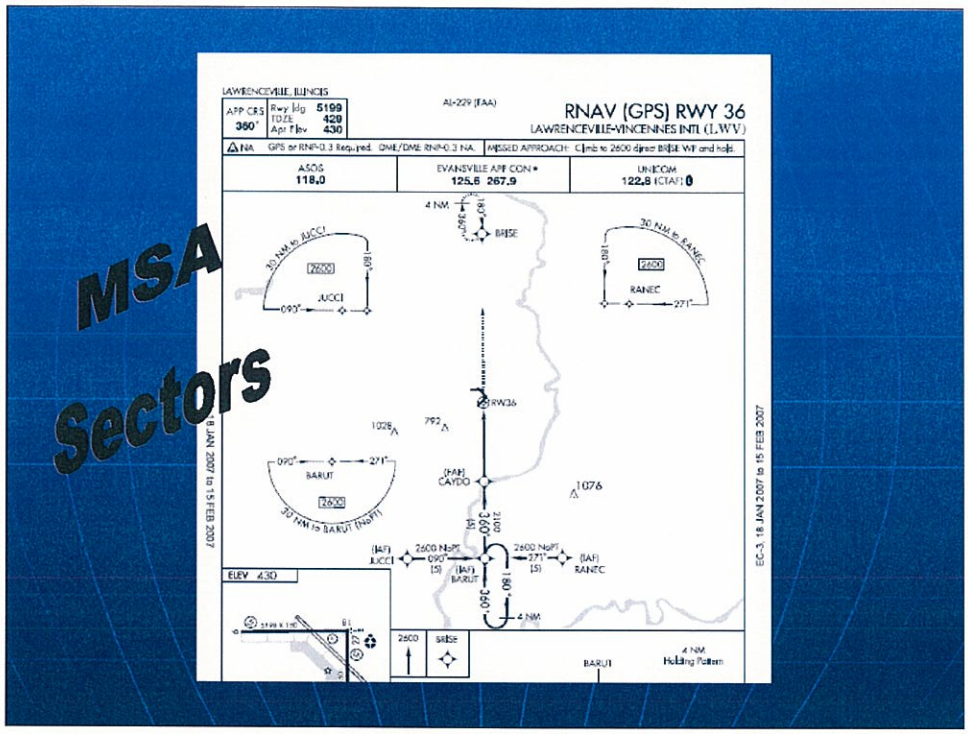
6. When receiving vectors to final, most receiver operating manuals suggest placing the receiver in the nonsequencing mode on the FAWP and manually setting the course. This provides an extended final approach course in cases where the aircraft is vectored onto the final approach course outside of any existing segment which is aligned with the runway. Assigned altitudes must be maintained until established on a published segment of the approach. Required altitudes at waypoints outside the FAWP or stepdown fixes must be considered. Calculating the distance to the FAWP may be required in order to descend at the proper location.

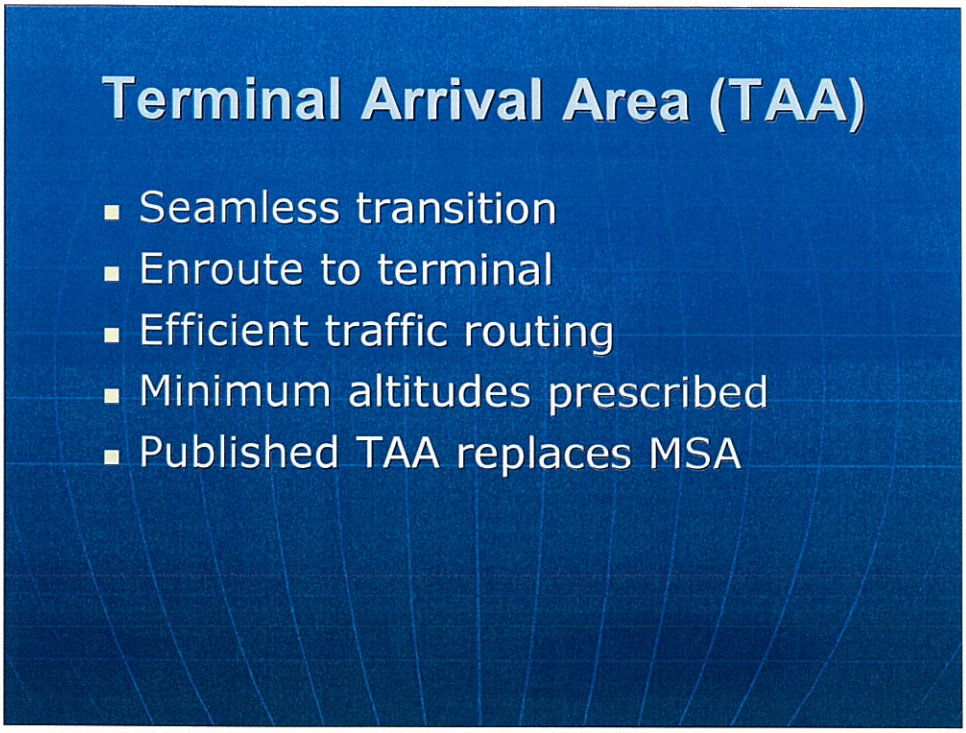
7. Overriding an automatically selected sensitivity during an approach will cancel the approach mode annunciation. If the approach mode is not armed by 2 NM prior to the FAWP, the approach mode will not become active at 2 NM prior to the FAWP, and the equipment will flag. In these conditions, the RAIM and CDI sensitivity will not ramp down, and the pilot should not descend to MDA, but fly to the MAWP and execute a missed approach. The approach active annunciator and/or the receiver should be checked to ensure the approach mode is active prior to the FAWP.

8. Do not attempt to fly an approach unless the procedure is contained in the current, on-board navigation database and identified as "GPS" on the approach chart. The navigation database may contain information about nonoverlay approach procedures that is intended to be used to enhance position orientation, generally by providing a map, while flying these approaches using conventional NAVAIDs. This approach information should not be confused with a GPS

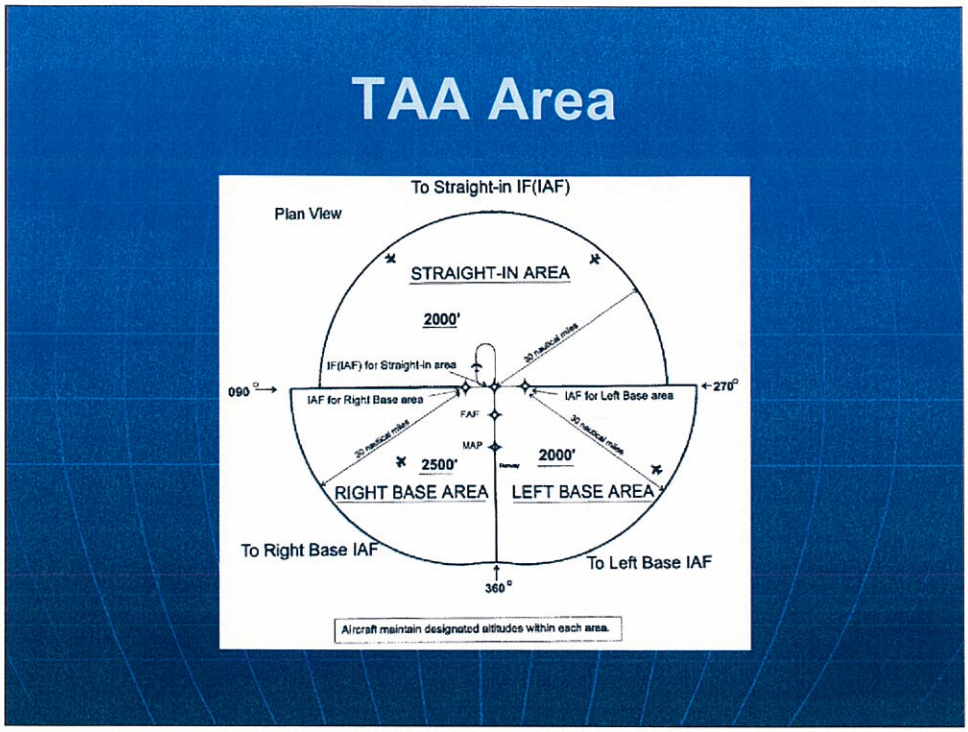


MSA's are published for emergency use on IAP charts. For conventional navigation systems, the MSA is normally based on the primary omnidirectional facility on which the IAP is predicated. The MSA depiction on the approach chart contains the facility identifier of the NAVAID used to determine the MSA altitudes. For RNAV approaches, the MSA is based on the runway waypoint (RWY WP) for straight-in approaches, or the airport waypoint (APT WP) for circling approaches. For GPS approaches, the MSA center will be the missed approach waypoint (MAWP). MSAs are expressed in feet above mean sea level and normally have a 25 NM radius; however, this radius may be expanded to 30 NM if necessary to encompass the airport landing surfaces. Ideally, a single sector altitude is established and depicted on the plan view of approach charts; however, when necessary to obtain relief from obstructions, the area may be further sectored and as many as four MSAs established. When established, sectors may be no less than 90° in spread. MSAs provide 1,000 feet clearance over all obstructions but do not necessarily assure acceptable navigation signal coverage.


MSA
Sectors
LAWRENCEVILLE, ILLINOIS
APP CRS 360°
Rwy Idg 5199
TDZE 429
Apt Elev 430
AI-229 (FAA)
RNAV (GPS) RWY 36
LAWRENCEVILLE-VINCENNES INTL (LWV)
NA. GPS or RNP-0.3 Required. DME/DME RNP-0.3 NA.
MISSED APPROACH: Climb to 2600 direct BRISE WP and hold.
ASOS 118.0
EVANSVILLE APP CON 125.6 267.9
UNICOM 122.8 (CTAF) 0
4 NM
360°
180°
BRISE
30 NM to JUCCI
2600
JUCCI
090°
180°
30 NM to RANEC
2600
RANEC
271°
RW36
1028
792
090°
271°
BARUT
2600
30 NM to BARUT (NoPT)
(FAF)
CAYDO
1076
2600
181°
(IAF)
JUCCI
2600 NoPT
090°
15
(IAF)
BARUT
2600 NoPT
271°
15
(IAF)
RANEC
360°
180°
4 NM
ELEV 430
2600
BRISE
BARUT
4 NM
Holding Pattern
18 JAN 2007 to 15 FEB 2007
EC-3, 18 JAN 2007 to 15 FEB 2007



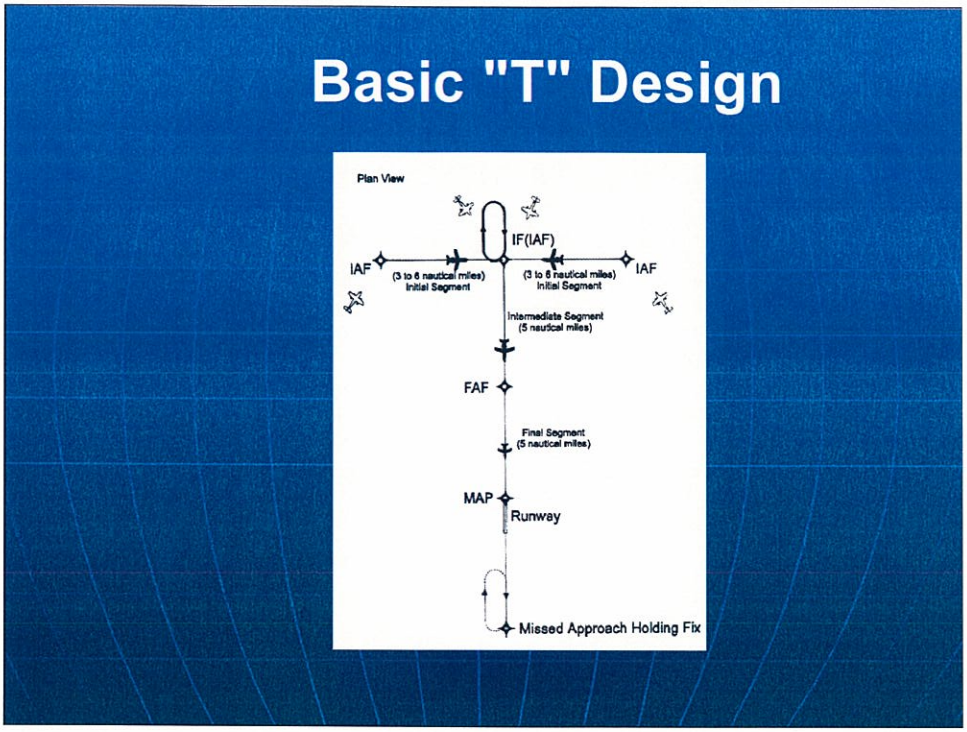
The objective of the TAA is to provide a seamless transition from the en route structure to the terminal environment for arriving aircraft equipped with Flight Management System (FMS) and/or Global Positioning System (GPS) navigational equipment. The underlying instrument approach procedure is an area navigation (RNAV) procedure described in this section. The TAA provides the pilot and air traffic controller with a very efficient method for routing traffic into the terminal environment with little required air traffic control interface, and with minimum altitudes depicted that provide standard obstacle clearance compatible with the instrument procedure associated with it. The TAA will not be found on all RNAV procedures, particularly in areas of heavy concentration of air traffic. When the TAA is published, it replaces the MSA for that approach procedure. See FIG 5-4-9 for a depiction of a RNAV approach chart with a TAA.



5. The standard TAA consists of three areas defined by the extension of the IAF legs and the intermediate segment course. These areas are called the straight-in, left-base, and right-base areas. (See FIG 5-4-7). TAA area lateral boundaries are identified by magnetic courses TO the IF (IAF). The straight-in area can be further divided into pie-shaped sectors with the boundaries identified by magnetic courses TO the IF (IAF), and may contain stepdown sections defined by arcs based on RNAV distances (DME or ATD) from the IF (IAF). The right/left-base areas can only be subdivided using arcs based on RNAV distances from the IAFs for those areas. Minimum MSL altitudes are charted within each of these defined areas/subdivisions that provide at least 1,000 feet of obstacle clearance, or more as necessary in mountainous areas.

(a) Prior to arriving at the TAA boundary, the pilot can determine which area of the TAA the aircraft will enter by selecting the IF (IAF) to determine the magnetic bearing TO the center IF (IAF). That bearing should then be compared with the published bearings that define the lateral boundaries of the TAA areas. Using the end IAFs may give a false indication of which area the aircraft will enter. This is critical when approaching the TAA near the extended boundary between the left and right-base areas, especially where these areas contain different minimum altitude requirements.

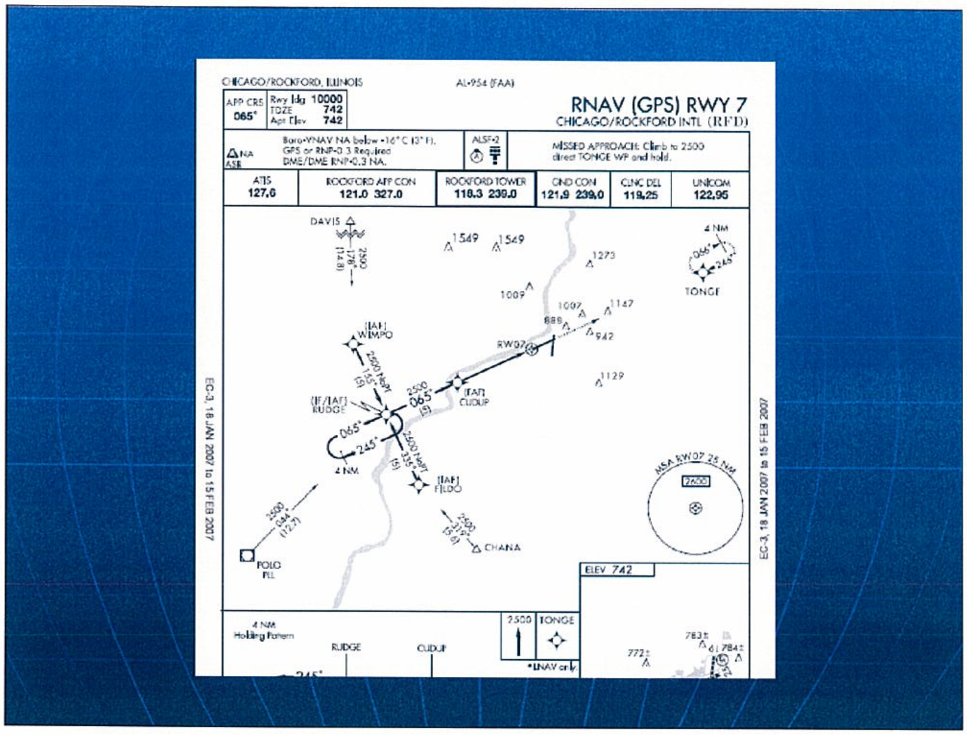
(b) Pilots entering the TAA and cleared by air traffic control, are expected to proceed directly to the IAF associated with that area of the TAA at the altitude depicted, unless otherwise cleared by air traffic control. Pilots entering the TAA with two-way radio communications failure (14 CFR Section 91.185, IFR Operations: Two-way Radio Communications Failure), must maintain the highest altitude prescribed by Section 91.185(c)(2) until arriving at the appropriate IAF.

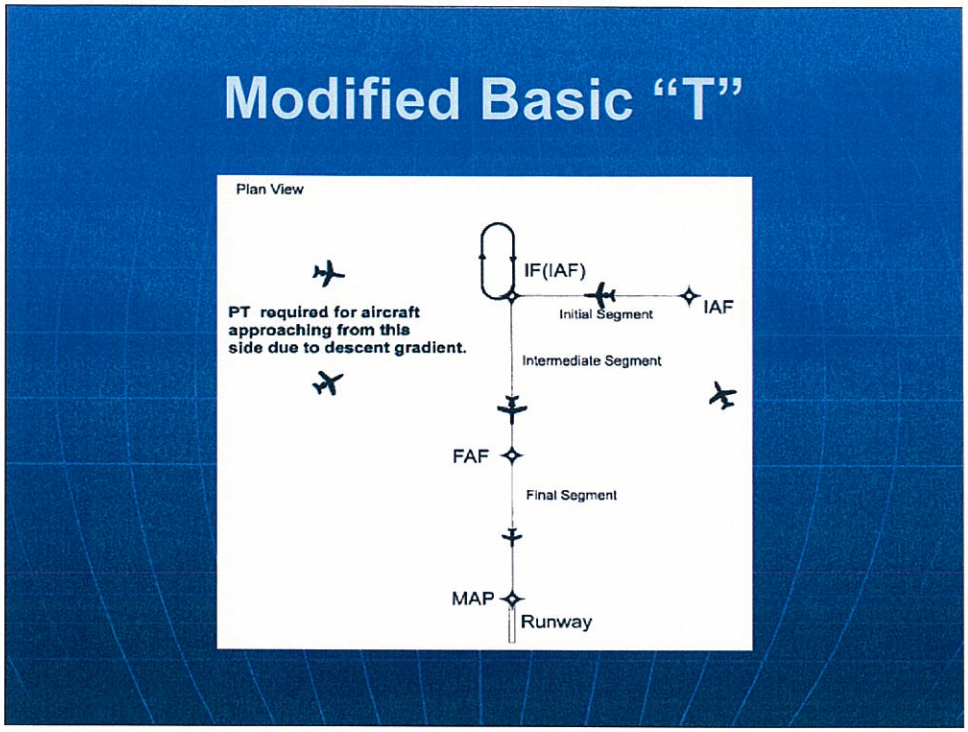


2. The RNAV procedure underlying the TAA will be the "T" design (also called the "Basic T"), or a modification of the "T." The "T" design incorporates from one to three IAFs; an intermediate fix (IF) that serves as a dual purpose IF (IAF); a final approach fix (FAF), and a missed approach point (MAP) usually located at the runway threshold. The three IAFs are normally aligned in a straight line perpendicular to the intermediate course, which is an extension of the final course leading to the runway, forming a "T." The initial segment is normally from 3-6 NM in length; the intermediate 5-7 NM, and the final segment 5 NM. Specific segment length may be varied to accommodate specific aircraft categories for which the procedure is designed. However, the published segment lengths will reflect the highest category of aircraft normally expected to use the procedure.

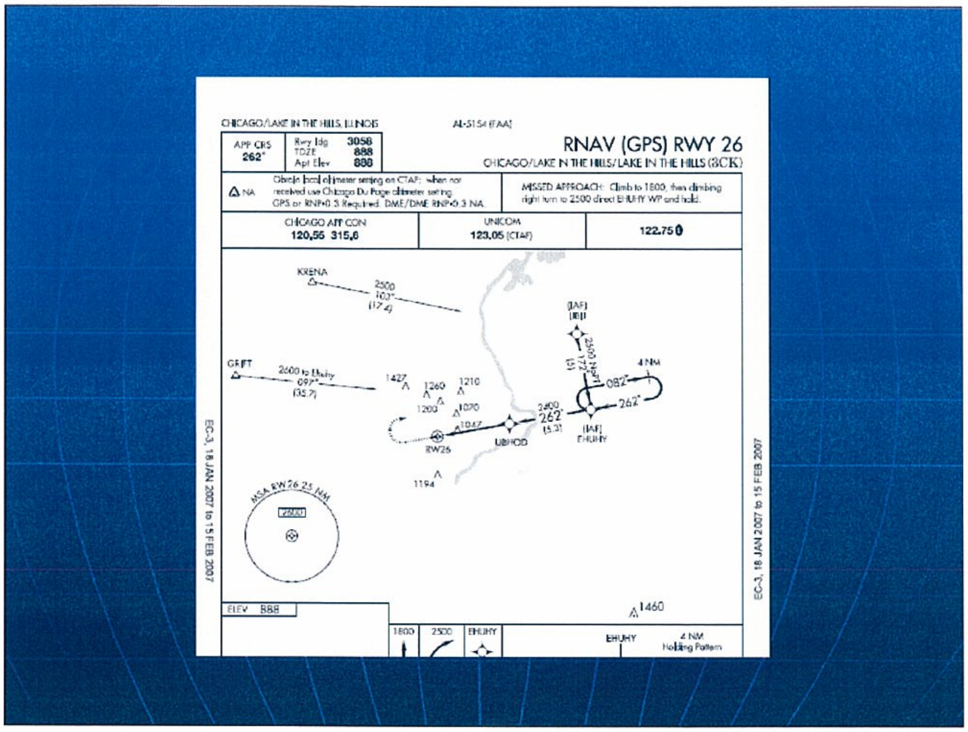
(a) A standard racetrack holding pattern may be provided at the center IAF, and if present may be necessary for course reversal and for altitude adjustment for entry into the procedure. In the latter case, the pattern provides an extended distance for the descent required by the procedure. Depiction of this pattern in U.S. Government publications will utilize the "hold-in-lieu-of-PT" holding pattern symbol.

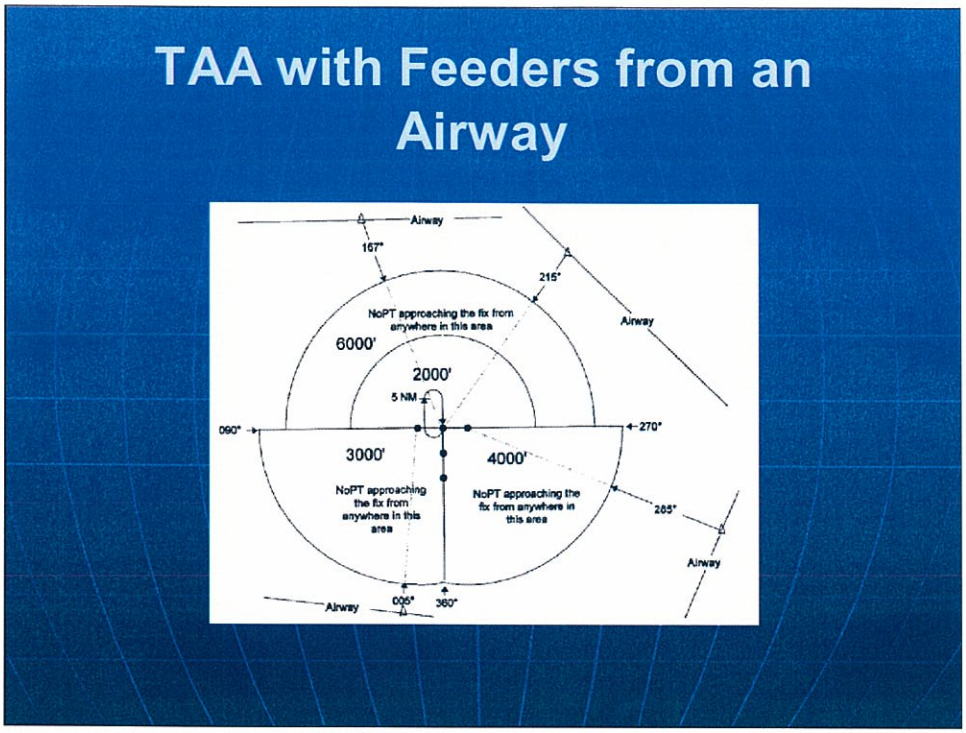
(b) The published procedure will be annotated to indicate when the course reversal is not necessary when flying within a particular TAA area; e.g., "NoPT." Otherwise, the pilot is expected to execute the course reversal under the provisions of 14 CFR Section 91.175. The pilot may elect to use the course reversal pattern when it is not required by the procedure, but must inform air traffic control and receive clearance to do so. (See FIG 5-4-1 and FIG 5-4-2).


CHICAGO/ROCKFORD, ILLINOIS
AL-954 (FAA)
APP CRS 065°
Rwy ldg 10000
TDZE 742
Apt Elev 742
RNAV (GPS) RWY 7
CHICAGO/ROCKFORD INTL (RFD)
NA ASR
Baro-VNAV NA below -16° C (3° F).
GPS or RNP-0.3 Required
DME/DME RNP-0.3 NA.
ALSF-2
MISSED APPROACH: Climb to 2500 direct TONGE WP and hold.
ATIS 127.6
ROCKFORD APP CON 121.0 327.0
ROCKFORD TOWER 118.3 239.0
GND CON 121.9 239.0
CLNC DEL 119.25
UNICOM 122.95
DAVIS
TONGE
(IAF) WIMPO
(IF/IAF) RUDGE
(IAF) CUDUP
(IAF) FILDO
CHANA
POLO
RW07
MSA RW07 25 NM
ELEV 742
EC-3, 18 JAN 2007 to 15 FEB 2007
4 NM Holding Pattern
RUDGE
CUDUP
LNAV only

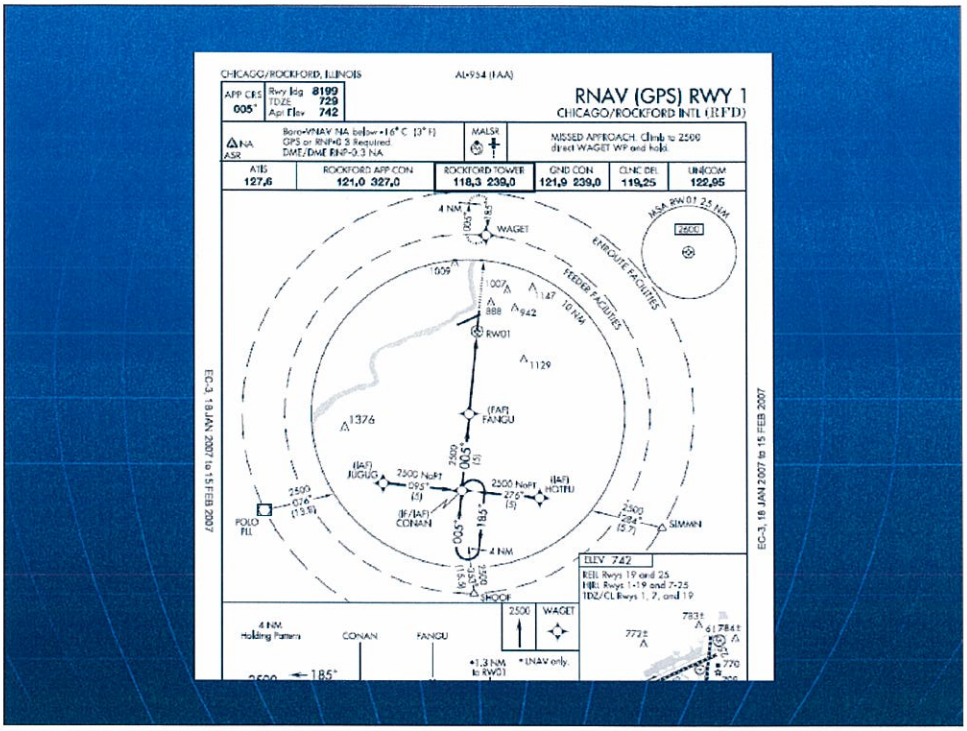


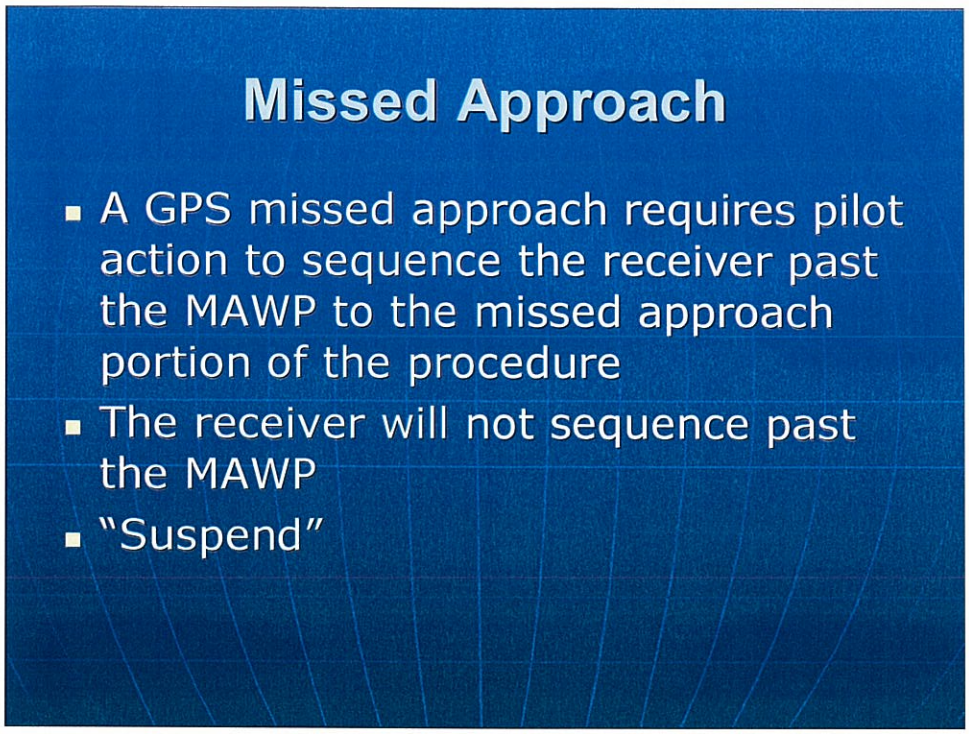
3. The "T" design may be modified by the procedure designers where required by terrain or air traffic control considerations. For instance, the "T" design may appear more like a regularly or irregularly shaped "Y", or may even have one or both outboard IAFs eliminated resulting in an upside down "L" or an "I" configuration. (See FIG 5-4-3 and FIG 5-4-10). Further, the leg lengths associated with the outboard IAFs may differ. (See FIG 5-4-5 and FIG 5-4-6).


CHICAGO/LAKE IN THE HILLS, ILLINOIS
AL-5154 (FAA)
APP CRS 262°
Rwy Idg 3058
TDZE 888
Apt Elev 888
RNAV (GPS) RWY 26
CHICAGO/LAKE IN THE HILLS/LAKE IN THE HILLS (3CK)
NA
Obtain local altimeter setting on CTAF; when not received use Chicago Du Page altimeter setting.
GPS or RNP-0.3 Required. DME/DME RNP-0.3 NA.
MISSED APPROACH: Climb to 1800, then climbing right turn to 2500 direct EHUHY WP and hold.
CHICAGO APP CON
120.55 315.6
UNICOM
123.05 (CTAF)
122.75
KRENA
2500
103°
(17.4)
GRIFT
2600 to Ehuhy
097°
(35.7)
(IAF)
4 NM
082°
262°
UBHOD
RW26
(IAF)
EHUHY
MSA RW26 25 NM
2800
ELEV 888
1460
1800
2500
EHUHY
EHUHY
4 NM
Holding Pattern
EC-3, 18 JAN 2007 to 15 FEB 2007
EC-3, 18 JAN 2007 to 15 FEB 2007



9. When an airway does not cross the lateral TAA boundaries, a feeder route will be established to provide a transition from the en route structure to the appropriate IAF. Each feeder route will terminate at the TAA boundary, and will be aligned along a path pointing to the associated IAF. Pilots should descend to the TAA altitude after crossing the TAA boundary and cleared by air traffic control. (See FIG 5-4-12).

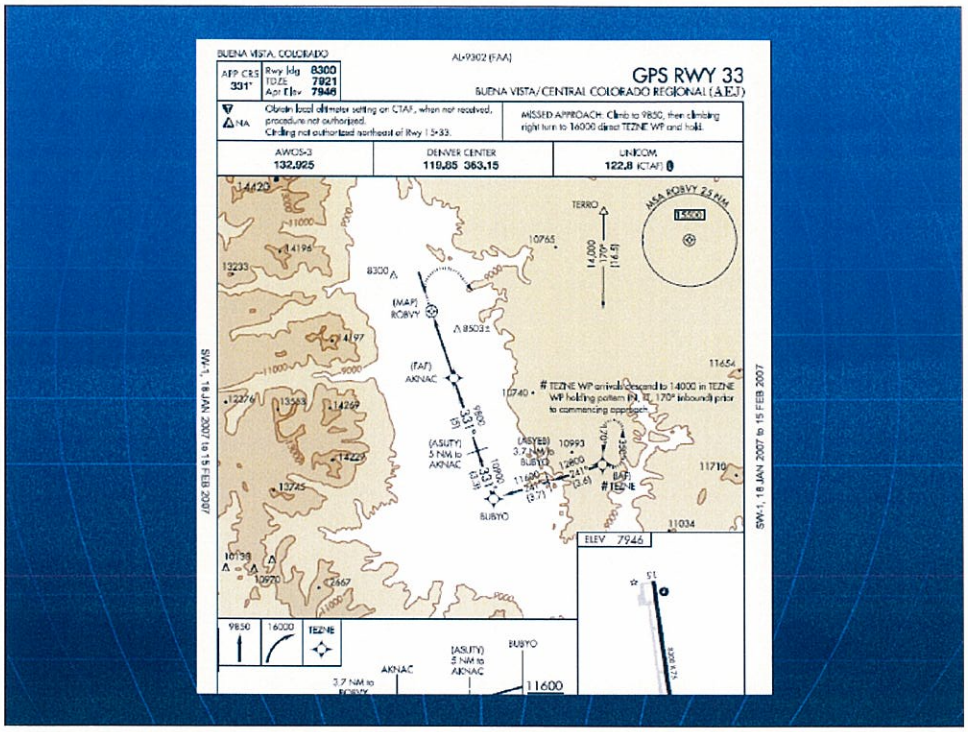

CHICAGO/ROCKFORD, ILLINOIS
AL-954 (FAA)
RNAV (GPS) RWY 1
CHICAGO/ROCKFORD INTL (RFD)
APP CRS 005°
Rwy Idg 8199
TDZE 729
Apt Elev 742
NA
ASR
Baro-VNAV NA below -16° C (3° F)
GPS or RNP-0.3 Required
DME/DME RNP-0.3 NA
MALSR
MISSED APPROACH: Climb to 2500 direct WAGET WP and hold.
ATIS 127.6
ROCKFORD APP CON 121.0 327.0
ROCKFORD TOWER 118.3 239.0
GND CON 121.9 239.0
CLNC DEL 119.25
UNICOM 122.95
WAGET
4 NM
ENROUTE FACILITIES
10 NM
RW01
(FAF) FANGU
(IAF) JUGUG
(IAF) HOTPU
(IF/IAF) CONAN
POLO FLL
SIMMN
SHOOF
ELEV 742
REIL Rwys 19 and 25
HIRL Rwys 1-19 and 7-25
TDZ/CL Rwys 1, 7, and 19
ASR RW 01 25 NM
2500
4 NM Holding Pattern
185°
*1.3 NM to RW01
* LNAV only.
EC-3, 18 JAN 2007 to 15 FEB 2007
EC-3, 18 JAN 2007 to 15 FEB 2007

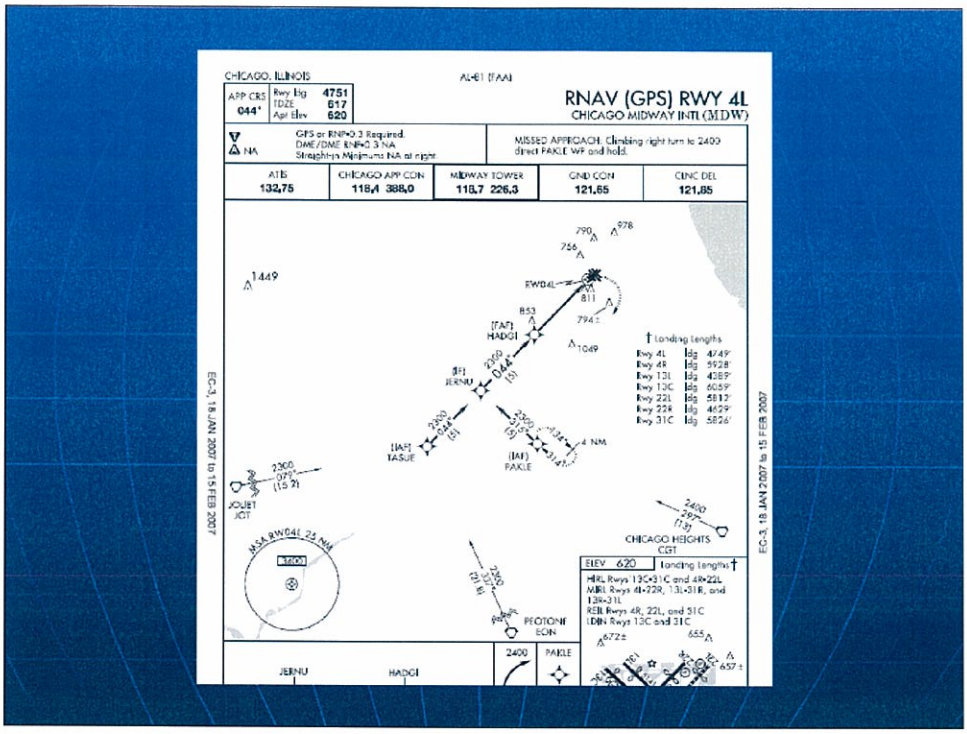


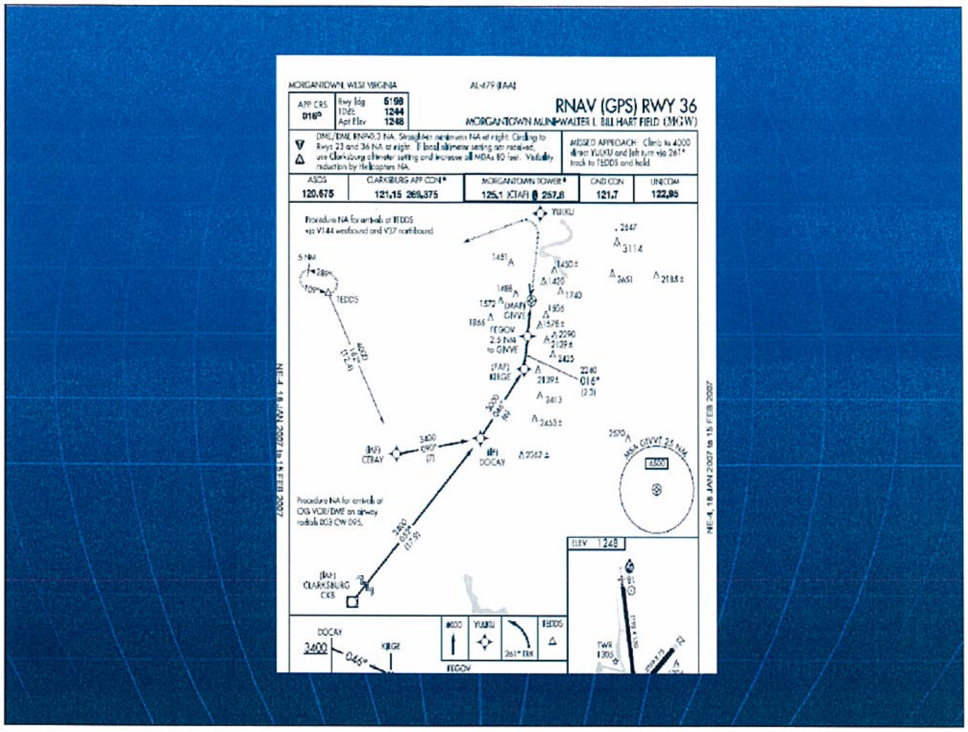
1. A GPS missed approach requires pilot action to sequence the receiver past the MAWP to the missed approach portion of the procedure. The pilot must be thoroughly familiar with the activation procedure for the particular GPS receiver installed in the aircraft and must initiate appropriate action after the MAWP. Activating the missed approach prior to the MAWP will cause CDI sensitivity to immediately change to terminal (±1NM) sensitivity and the receiver will continue to navigate to the MAWP. The receiver will not sequence past the MAWP. Turns should not begin prior to the MAWP. If the missed approach is not activated, the GPS receiver will display an extension of the inbound final approach course and the ATD will increase from the MAWP until it is manually sequenced after crossing the MAWP.

2. Missed approach routings in which the first track is via a course rather than direct to the next waypoint require additional action by the pilot to set the course. Being familiar with all of the inputs required is especially critical during this phase of flight.

Examples

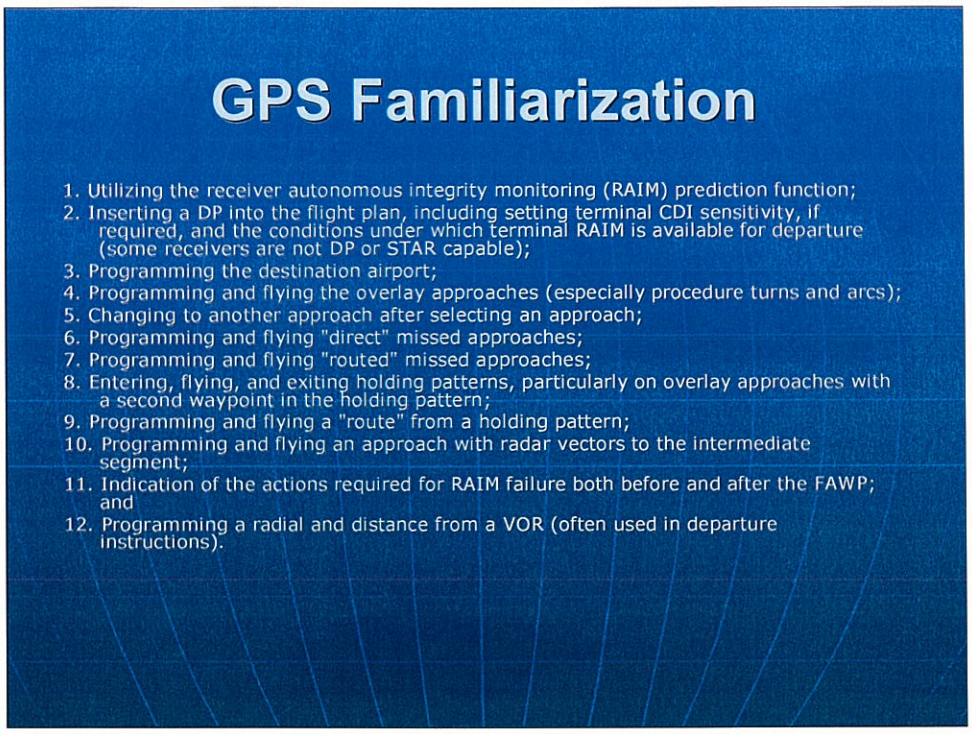

BUENA VISTA, COLORADO
AL-9302 (FAA)
GPS RWY 33
BUENA VISTA/CENTRAL COLORADO REGIONAL (AEJ)
APP CRS 331°
Rwy Idg 8300
TDZE 7921
Apt Elev 7946
Obtain local altimeter setting on CTAF, when not received, procedure not authorized.
Circling not authorized northeast of Rwy 15-33.
MISSED APPROACH: Climb to 9850, then climbing right turn to 16000 direct TEZNE WP and hold.
AWOS-3
132.925
DENVER CENTER
119.85 363.15
UNICOM
122.8 (CTAF)
MSA ROBVY 25 NM
TERRO
(MAP)
ROBVY
(FAF)
AKNAC
(ASUTY)
5 NM to
AKNAC
BUBYO
TEZNE WP arrivals descend to 14000 in TEZNE WP holding pattern (N, IT, 170° inbound) prior to commencing approach.
ELEV 7946
SW-1, 18 JAN 2007 to 15 FEB 2007
9850
16000
TEZNE
11600


CHICAGO, ILLINOIS
AL-61 (FAA)
RNAV (GPS) RWY 4L
CHICAGO MIDWAY INTL (MDW)
APP CRS 044°
Rwy Elg 4751
TDZE 617
Apt Elev 620
GPS or RNP-0.3 Required.
DME/DME RNP-0.3 NA.
Straight-in Minimums NA at night.
MISSED APPROACH: Climbing right turn to 2400 direct PAKLE WP and hold.
ATIS 132.75
CHICAGO APP CON 118.4 388.0
MIDWAY TOWER 118.7 226.3
GND CON 121.65
CLNC DEL 121.85
RWY4L
[FAF] HADGI
JERNU
[IAF] TASUE
[IAF] PAKLE
JOLIET JCT
CHICAGO HEIGHTS CGT
PEOTONE EON
MSA RWY04L 25 NM
† Landing Lengths
Rwy 4L ldg 4749'
Rwy 4R ldg 5928'
Rwy 13L ldg 4089'
Rwy 13C ldg 6059'
Rwy 22L ldg 5812'
Rwy 22R ldg 4629'
Rwy 31C ldg 5826'
ELEV 620
HIRL Rwys 13C-31C and 4R-22L
MIRL Rwys 4L-22R, 13L-31R, and 13R-31L
REIL Rwys 4R, 22L, and 31C
LDIN Rwys 13C and 31C
EC-3, 18 JAN 2007 to 15 FEB 2007
EC-3, 18 JAN 2007 to 15 FEB 2007


MORGANTOWN, WEST VIRGINIA
AL-479 (FAA)
RNAV (GPS) RWY 36
MORGANTOWN MUNI-WALTER L. BILL HART FIELD (MGW)
APP CRS 016°
Rwy Idg 5198
TDZE 1244
Apt Elev 1248
MISSED APPROACH: Climb to 4000 direct YUUKU and left turn via 261° track to TEDDS and hold.
ASOS 120.675
CLARKSBURG APP CON 121.15 269.375
MORGANTOWN TOWER 125.1 (CTAF) 257.8
GND CON 121.7
UNICOM 122.95
YUUKU
TEDDS
Procedure NA for arrivals at TEDDS via V144 westbound and V37 northbound
CEBAY
DOCAY
KBIGE
GIVYE
FEGOV
(IAF) CLARKSBURG CKB
ELEV 1248
NE-4, 18 JAN 2007 to 15 FEB 2007

Summary

- Know your GPS
- Do not use handheld for approaches
- Check GPS NOTAMs
- Fly the entire procedure



Pilots should practice GPS approaches under visual meteorological conditions (VMC) until thoroughly proficient with all aspects of their equipment (receiver and installation) prior to attempting flight by IFR in instrument meteorological conditions (IMC). Some of the areas which the pilot should practice are:

1. Utilizing the receiver autonomous integrity monitoring (RAIM) prediction function;

2. Inserting a DP into the flight plan, including setting terminal CDI sensitivity, if required, and the conditions under which terminal RAIM is available for departure (some receivers are not DP or STAR capable);

3. Programming the destination airport;

4. Programming and flying the overlay approaches (especially procedure turns and arcs);

5. Changing to another approach after selecting an approach;

6. Programming and flying "direct" missed approaches;

7. Programming and flying "routed" missed approaches;

8. Entering, flying, and exiting holding patterns, particularly on overlay approaches with a second waypoint in the holding pattern;

9. Programming and flying a "route" from a holding pattern;

10. Programming and flying an approach with radar vectors to the intermediate segment;

11. Indication of the actions required for RAIM failure both before and after the FAWP; and

12. Programming a radial and distance from a VOR (often used in departure instructions).

It Is All About Safety

For further information, contact:
Patricia Knight, MCFI & Pilot Examiner
at
pknight@earthlink.net