GPS FAMILIARIZATION / CHECKOUT

BASIC OPERATION:
Turn unit on.
Describe basic system architecture (major functional units, interconnections, and possible failure modes).

COM FUNCTIONS:
Adjust volume.
Manually enter a com frequency.
Enter a frequency from the database.
Swap active and standby com frequencies (soft key & yoke button).
Monitor a 2nd com frequency.
Quickly enter emergency frequ cy (121.5)
Explain meaning of "Tx" indicator.
Discuss the Com Audio Panel.

NAV FUNCTIONS:
Adjust volume.
Manually enter a nav frequency.
Enter a frequency from the database
Set CDI selector to the proper setting.
Listen to navaid audio.
Explain how "auto ident" function works.
Select To or From display mode.

TRANSPONDER FUNCTIONS (IF EQUIPPED WITH SLAVED TRANSPONDER):
Enter code (Mode-A) using soft keys
Enter code using cursor/edit function.
Squawk Ident.
Explain how automatic active/standby function works.
Turn Auto mode on and off.
Verify transponder has gone active.
Explain how auto mode might malfunction while practicing slow flight.
Manually stop altitude squawk.
Manually turn transponder off.
Quickly squawk VFR (1200).
Quickly squawk emergency (7700)
Explain emergency transponder turn-off procedure.

DATABASE FUNCTIONS.
Verify database currency [IFR].
Explain legal use of database info if the database is out of date [IFR].
Find nearest airport, intersection, or navaid.
Find nearest ATC or FSS com frequency.

Retrieve information about an airport.
Find the nearest airport with an instrument approach and fly it [IFR].

BASIC GPS FUNCTIONS.
Navigate direct to a waypoint.
Select waypoint from database.
Select waypoint from flight plan [IFR].
Explain the difference between "-D->/Direct" and "-D->/Dest" [IFR].

FLIGHT PLAN FUNCTIONS.
Program a full Origin to Destination flight plan [IFR].
Program a departure procedure [IFR].
Program a departure approach [IFR].
Program an arrival procedure [IRF].
Program a destination approach [IFR].
Program an alternate [IFR].
Explain the difference between the "Save" and "Exec" functions [IFR].
Load and execute a saved flight plan [IFR].
Accept direct to a pre-loaded waypoint in flight [IFR].
Accept a full re-route in flight [IFR].
Hold at a waypoint [IFR]
Enter a GPS approach and fly it [IFR].
Fly a missed approach [IFR].
Explain what happens on a GPS approach if you don't cross directly over the FAF [IFR].
Explain the difference between "fly over" and "fly by" waypoints [IFR].
Explain use of the GPS while flying an ILS approach [IFR].
Describe several situations where the unit will go into suspend mode [IFR].

MAP FUNCTIONS.
Activate map mode.
Explain how map page 1 differs from the other pages.
Demonstrate use of various declutter controls
Adjust map scale.
Turn auto-scaling on and off.
Explain the difference between magenta and white course lines [IFR].
Explain the meaning of a dashed course line [IFR].

TIMERS/NRST/FLTPLAN (PFD).
Set and run a count-down timer [IFR].
Display NRST airfields.
Display Current Flt Plan [IFR].

MESSAGES.
Explain what the "Messages available" indicator looks like.
Demonstrate how to retrieve current or old messages.

Explain the meaning and proper action for the following common messages:
* WARNING Communications lost with [Com Radio, Nav Radio, etc].
* WARNING Altitude Encoder Communications Failure.
* WARNING Fuel Data Communications Failure.
* Countdown timer 1/2 expired [IFR].
* Steep turn ahead [IFR].
* Hold Parallel/Teardrop/Direct [IFR]
* WARNING Loss of Integrity Cross-Check NAV
* Integrity Restored Normal Ops.
* WARNING Loss of Navigation
* CDI Selection should be set to (Localizer/ILS/VOR) [IFR].
* VOR Receiver Should Be Tuned to xxx.xx for (approach) [IFR].
* Database expired on (date) [IFR].
* Baro Correction xx.yy CRSR to Change ENTER to Accept [IFR]
* Warning Loss of Navigation LOI On Approach [IFR].
* TILT Game Over

Discuss KAP 140 basic functions.
* Preselect Altiutde and Set Barometer.
***** On / Off button and start up cycle
* Roll/Hdg/Nav functions
* Heading marker or Roll Knob use and limitations.

See Whittsflying.com for a lot more information.

Discuss the following only if there is time and student is not already seeing stars:

ADVANCED GPS FUNCTIONS.
Intercept a given course TO a waypoint [IFR].
Intercept a given course FROM a waypoint [IFR].
Select and track a course using OBS mode [IFR].
Describe what "station declination" is [IFR].
Describe how station declination affects CrsTo, CrsFr, and OBS modes [IFR]
Describe the SUSP function w/r/t CrsTo, CrsFr, and OBS modes [IFR].
Describe the differences between En-Route, Terminal, and Approach modes [IFR].

HOLDING.
Create and fly a hold at a random waypoint [IFR].
Fly a charted hold [IFR].
Resume flight plan after holding [IFR].

GPS Technology - INFORMATIONAL

---GPS approaches will gradually be renamed as **RNAV** approaches.
---No handheld is approved for IFR
---Make and model of GPS determines what is possible
---The pilot is the weak link in full GPS utilization
---GPS does not give you cross radials for location
---GPS sequences waypoints as they occur in order.
---GPS requires manual suspension of sequence if interrupted
---GPS use magnetic course adjusted from true course to give great circle track
---Distance from station affects the sensitivity of the course deviation needle in VOR or LOC
---GPS fakes this sensitivity this an en route mode -+5nm; at 30 miles terminal +1nm ; at 2 miles .3nm
---The WAAS system may be used as primary means of navigation

Differential Correction

---GPS can be easily jammed but WAAS and LAAS offers some protection over 25-mile areas of airports
---Ground stations monitor satellites and correct errors with differential information
---Third generation WAAS systems and receivers use embedded signals to create a local satellite signal
---Older GPS will work but WAAS capable will have reliability and six-second warning of lost signal
---No other equipment is required for a WAAS approach

IFR En Route GPS

---Requires radar contact if IFR but not as sole means of navigation IFR Approach GPS
---En route plus GPS approaches connected to basic navs via switch confusing annunciation lights
---GPS will arm approach capability when within 30 miles of airport using terminal scale
---Two miles outside the FAF the scale changes to the approach-active mode
---New GPS have VTF feature to allow vector to final before activating autosequencing
---The approach GPS will not function if a satellite is disabled
---Approaches can be added on to a route or STAR IFR Databases
---28-day cycle where receiver will not lock out out-of-date approaches
---Cost up to $700 annually, failure to have charts and plates could violate FARs

Flying the GPS

---Waypoints must be flown exactly as sequenced in database
---Land or circle to land are options to failure execute missed approach procedure
---The “hold” function stops autosequencing until restarted on intercepting final approach course
---Recommended on overlay approaches to use the GPS only as a backup
---Block autosequencing when a procedure turn is required
---NoPT approaches can be flown directly with GPS autosequencing
---2nd Generation approaches use the T-shape arrivals without course reversal
---GPS approaches use holding patterns rather than procedure turns for course reversal
---IFR GPS can substitute for VOR, ADF and DME if fix is in database
---You cannot use the GPS for ADF substitute unless you also have an ADF
---Using GPS as DME may confuse countup/countdown depending on waypoint selection RAIM

---IFR GPS have RAIM with a different level for all three regions of IFR flight
---RAIM gives integrity warnings within 30-seconds, 10 seconds
---On approach and RAIM occurs fly missed approach procedure
---RAIM for an approach cannot be activated without the local altimeter setting

HAZARDS
---Selecting wrong IAF
---Selecting wrong approach function
---Beginning descent at approach active annunciator light
---Confusion in activating autosequencing outside FAF
---Confusion when GPS changes scale outside the FAF

IFR GPS
Modes are APCH,OBS, CURSOR, and LEG ++
---OBS is for the missed, procedure turns and holding
---GPS starts in LEG mode such as Direct to ..
---IFR GPS allows sequencing of waypoints as required for IFR procedures
---Waypoint inserts and cancellations are an additional IFR procedure requirement s met in the cursor mode
---The cursor mode allows you to scroll through the flight plan to make deletions and inserts
---Moving map displays can be North-up (like charts) or course-up

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AREA NAVIGATION (RNAV)

---Provide more direct routing
---Provides more separation
---Segregates arrival/departing traffic
---Increases air space capacity
---No need for existing routes or NAVAIDS
---Reduces lateral track separations
---Works around NAVAID altitude limitations
---Allows airway use where NAVAIDS DO NOT
---Route structures can be modified
---Minimizes environmental impact
---Higher accuracy in navigation
---Reduced fuel usage
---Center for Aircraft Systems Development (CAASD) computerizes solutions to problems

FAA RADAR SYSTEMS

---Give speed and altitude throughout along with prediction
---Airport Surveillance Radar (ASR) terminal area arrivals and departures
---Air Route Surveillance Radar (ARSR) beacon only and remote sites
---Precision Runway Monitoring (PRM) with one-second position updates and target trails more personnel
---Effort to maintain compatibility with existing equipment and fill in primary target gaps
---Air Traffic Control Radar Beacon System (ATCRBS) gives one of 4096 codes and information on aircraft
---Automated Radar Terminal System (ARTS) Flight data soon to be Commercial Off The Shelf (COTS)
---Standard Terminal Automation Replacement System (STARS) key to future
---Digital color display to track 435 aircraft,16 radar feeds and six levels of weather information
---20-minute look ahead capability
---Precision Approach Radar (PAR) Guidance to ground with two controllers and radars (Navy only?)
---Bright Radar Indicator Terminal Equipment (BRITE) limited radar capability to ATC towers
---DBRITE is digital that used alphanumeric to give picture and information in TV format
---Radar Coverage practically eliminates the Approach by use of vectors
---Automatic Dependent Surveillance (ADS) and ADS-Broadcast gives ATC and planes position data.
---**ADS and ADS-B** works without radar through use of GPS
---A Controller-Pilot Data Link Communicator (CPDLC) is in the works to replace the radio communications
---CPDLC expect to reduce a 20-second radio call to only 2-seconds.

---The **Traffic Alert and Collision Avoidance System (TCAS**) using Mode A and C began in 1987
---Mode-S transponders have made datalink capability to GA aircraft for a price
---Traffic Alert and Collision Avoidance System (TCAS) has three systems that work together
---First, is a directional antenna with Mode S to get a bearing
---Second, Mode C is used to plot altitude
---Third, Mode S uses timing of signals for distance.
---TCAS I provides information needed for pilot to begin evasion
---TCAS II provides surveillance, tracking, detection and avoidance maneuver to use
---TCAS II will tell other additional aircraft likewise equipped to use coordinated maneuvers to avoid
---TCAS II operates independently of ATC and make possible reduced vertical separation on air routes

---Traffic Information Service (TIS) is ground based use of Mode S to display avoidance information
---Terrain Awareness and Warning System (TAWS) has digital terrain data base to warn against CFIT
---TAWS by its Ground Proximity Warning System (GPWS) in GA aircraft will dramatically reduce accidents
---Graphical Weather Service (GWS) will give in cockpit display using ground based sensors to Mode S

Flight Management System (FMS**)**
---Computer updated by navaids, inertial system and global positioning system (GPS)
---Continuously updated automatic navigation and aircraft performance using Control Display Unit (CDU)
---Electronic Flight Information System (EFIS) glass cockpit display of flight, navigation and engine data.

Navigation Systems
---High maintenance ground based navaids since 1930 require flying greater distances to fly place to place.
---Since 1980s the SATNAV system using GPS provides better information than ground based systems
---GPS is available everywhere but integrity and availability can be a problem
---Center for Advanced Aviation Systems Development (CAASD) is moving toward satellite system
---Satellite systems are opening up fle flight routes recognizin
---Satellite powered ADS-B may replace radar for surveillance

How GPS Came to Be
---In 1970s U.S. Military developed this all purpose navigational system
---First satellite launch in 1978 fully operational in 1995 with 24 satellites
---It is the antenna system of the handheld GPS that affects its reliability
---GPS satellite outages are NOTAMed on DUAT using GPS
---Minimum of four satellites are required for three-dimensional position including your altitude
---A GPS measures the time it takes a specific located satellite signal to get to your receiver
---Accuracy of GPS is based on probability down to 99.99 percent within 300 meters, 95-percent for 100m
---Comparative accuracy, ILS 15-30 WAAS20 , VOR/DME 200/600
---GPS is least accurate in altitude but biggest problem is the integrity of the system itself.
---Latest GPS models are not required to follow any standard of procedure or terminology to operate.