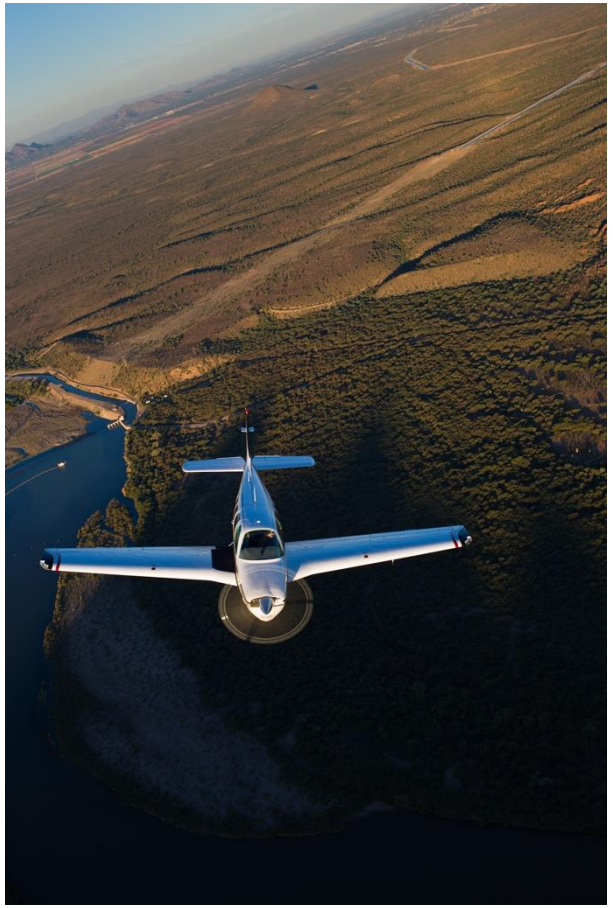
Introduction

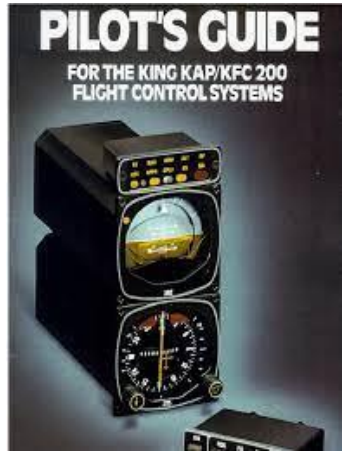
- Caretaker of 1981 Turbo-Normalized A36
  - 1700 hours in TN'd A36s
- Owner of Ktronics Aero Services
- CFI / CFII / BPPP Instructor
  - Over 400 hours of dual given in Bonanzas
- American Bonanza Society Life Member
- Software DER – Part 25 / Part 23 DAL A
- Live near Austin, TX with my wife and twin boys



KTRONICS AERO

Disclaimer

- This presentation is general advice.
- Every airplane and installation is unique.
- Consult the POH and AFMS for YOUR airplane for specific guidance.
- This presentation is not a substitute for training from a qualified CFI.



Agenda

- Introduction
- Autopilot Components
- Autopilot Operation
- Autopilot Modes
- What is GPSS Roll Steering
- When and how to use GPSS Roll Steering

Introduction

- Companion to my article in the April ABS Magazine
- Widespread lack of understanding about how autopilots work and specifically how GPSS/Roll Steering works with legacy APs.
- Autopilots are a key workload reducing tool, but they can be dangerous
- Training and practice are required to safely operate ”Uncle Otto”

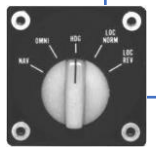
Autopilot Components

Orientation Source

- Attitude Indicator – Attitude Based Autopilots (BendixKing, Century)
- Turn Coordinator – Rate Based Autopilots (STEC, some BK - KAP 140)
- EFIS Adapter (i.e., Aspen EA-100, Garmin GAD43/E)

Servos

- Connected the AP to the control surfaces with cables and clutches
- 1,2,3 or 4 Servos – Roll, Pitch, Pitch Trim, and Yaw



Controller

- Mode controller, Go Around Switch, CWS, Trim, Disconnect

Flight Computer

- Brains of the Autopilot
- Located in the panel or in the avionics bay

Autopilot Operation

- How to Engage the Autopilot?
  - Press the desired mode on the mode controller
  - May have another switch engage the AP
- How to Disengage the AP?
  - Press the disconnect button
  - Activate the electric trim
  - Turn off the Avionics Master
  - Pull the AP circuit breaker

- Preflight Checks – DO them per the AFMS
- Know where the AP and Trim circuit breakers are located
  - Be able to find them by “Feel”

Lateral Navigation Modes

- Roll Mode
  - Not all APs support this mode
  - If supported - default lateral mode
  - Holds the wings level or constant bank angle
  - May or may not have a dedicated button
- Heading Mode
  - Engaged with the HDG button
  - Follows the heading bug
  - ”Sync” bug before engaging
- NAVigation Mode
  - Engaged with the NAV button
  - Follows the deviations from HSI, CDI
- APPRoach Mode
  - Engaged with the APPR button
  - Follows the deviations from HSI, CDI
  - AP gains are increased which leads to more aggressive corrections
  - Required for GS capture

Vertical Navigation Modes

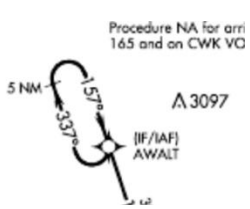
- Pitch Attitude Hold Mode
  - Typically, the default vertical mode when AP engaged.
  - AP holds the pitch attitude of the aircraft when the mode was engaged
  - Pitch attitude can be adjusted with a rocker switch or the CWS button
- ALTitude Hold Mode
  - Press the ALT button at the desired altitude
  - Aircraft will maintain the pressure ALT at the time the button is pressed
  - The AP overshoot 50 to 100 ft after the button is pressed
  - A rocker switch or CWS can be used to make small altitude adjustment
- Vertical Speed Mode / Altitude Preselect
  - Dial in a VS and ALT then press the VS button
  - Aircraft will climb or descend at a selected vertical speed
  - Aircraft will level off at the pre-selected altitude

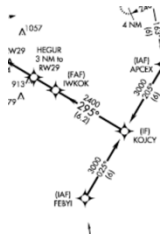
GPSS and Roll Steering

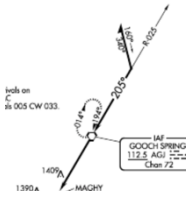
- Early Roll Steering Boxes were built by DAC and Icarus consisted of a converter box and selector switch.

- Most Retro fit EFISs have GPSS built in (Aspen, Garmin G5, Garmin G500)
- Converter is connected between a WAAS Navigator and the autopilot heading bug input.

- WAAS GPS is able to provide precise steering commands because it has accurate position, ground speed, track and desired track
- Roll steering can fly complex flight paths including sharp turns, procedure turns, and holds

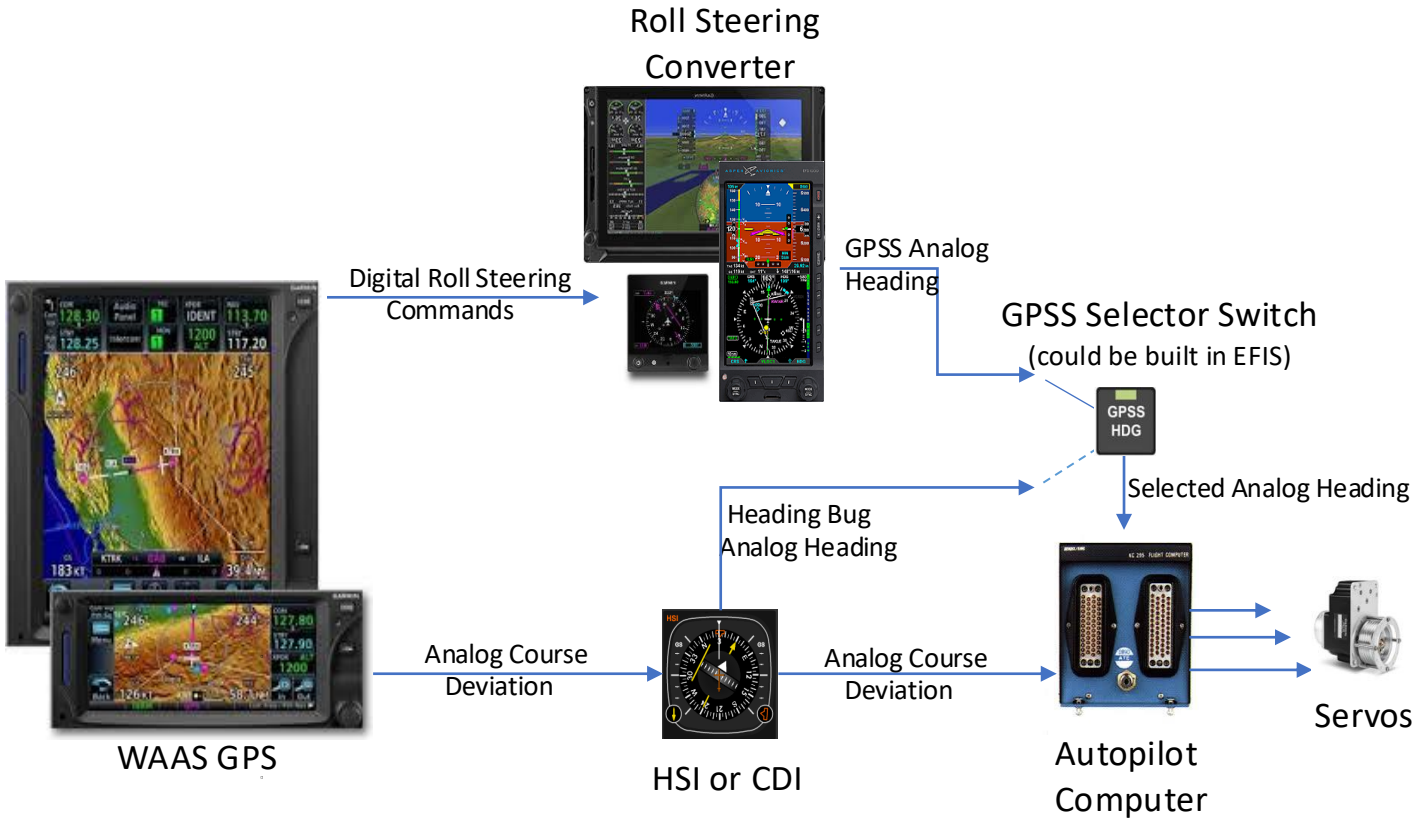






GPSS Roll Steering Operation

- Autopilot must be in heading mode
- GPSS selector switch - GPSS enabled
  - Most EFIS now have a built in softkey for enabling GPSS



Enroute Navigation

- No More NAV Mode – Always use GPSS
- Smooth turns at waypoints – no more “S-turns” as the AP chases the deviation indicator
- For enroute the autopilot should be in HDG mode and GPSS Enabled

Non-Precision Approaches

Approaches without Glideslope

- GPS LNAV and LP approaches without advisory glideslope
- LOC, LOC BC, VOR and NDB approaches WITH GPS overlays
- You MUST be able to load the approach in your GPS
- For non-GPS approaches You MUST monitor the primary NAV aid (VOR, LOC, etc) with HSI/CDI
  - GPSS data is still being sent to the roll steering converter even when the GPS is VLOC mode.
- Autopilot in HDG mode and GPSS Enabled
- Manage vertical navigation with Pitch Hold and ALT modes

Precision Approaches

Approaches with Glideslope

- GPS Approaches with Glideslope – LPV, LP+V, LNAV+V, etc.
- ILS
- You MUST be able to load the approach in your GPS
- Use HDG mode GPSS enabled until established on the final approach course
- If your AP supports glideslope tracking, then select APPR mode.
- If your AP doesn’t not support glideslope tracking then use Pitch Mode to manage the vertical portion of the approach.

Missed Approach

- Get the aircraft safely away from the ground, cleaned up, climbing, stable and established on the missed approach procedure
- Precision Approach
  - If you switched to APPR mode for GS tracking – you must switch back to HDG mode and ensure GPSS is still engaged
- Non-Precision Approach
  - Nothing to do – Already in HDG mode with GPSS
- Re-engage the AP and evaluate your situation.

Training and Practice

- Schedule an IPC or flight review to practice using the AP
- Before the flight review the AFMS and Pilot's Guide for your AP
- Contact a BPPP instructor or your favorite CFI and put together a flight plan that will allow to you use ALL the modes of your AP
- Training and practice are necessary to use safely and effectively use autopilots

Questions??

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  - kevin@ktronicsaero.com
- Lets go flying!