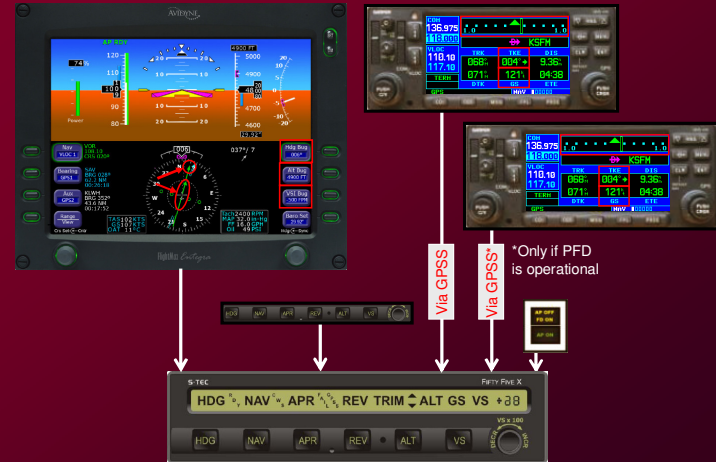
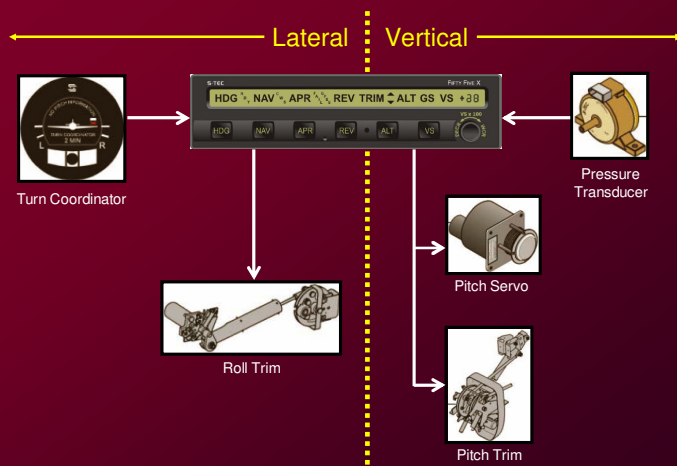


# S-TEC 55X Two Axis Autopilot

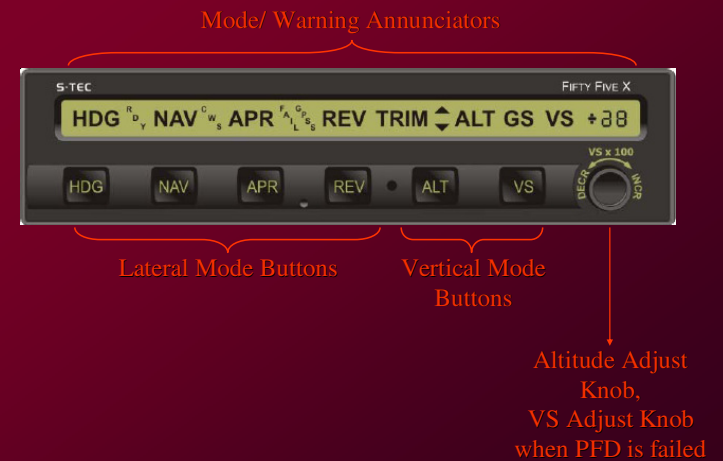
## Autopilot Control- Inputs



## Aircraft Control



## Flight Guidance Programmer/ Computer (AP Head)



## AP annunciations on PFD

- Selected modes annunciate across top of PFD, "AP" on right indicates AP on:

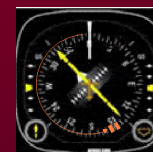


- HDG, ALT, and VS bugs turn solid when respective mode is active:



## Heading Mode Traps

- If HDG bug is turned more than 180 degrees, AP will reverse direction of turn:

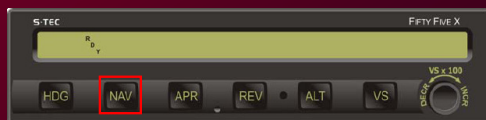


(Aircraft will initially turn left, then turn to right)

- If HDG bug is turned exactly 180 degrees, the AP doesn't know which way to turn, so it won't.
- If HDG bug is turned slightly *less* or *more* than 180 degrees, the AP will command a very slow turn until the bug has moved from the bottom of the HIS.
- Not ensuring HDG bug is set to desired heading or current heading before engaging HDG mode

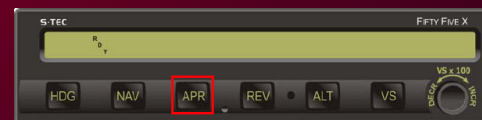
## NAV Mode

- Will track GPS or VOR signal, adjust for wind to keep needle centered.
- Uses selected HSI course as starting point for tracking and wind bracketing.
- If needle is deflected more than 50%, or if Nav flag appears, annunciator will flash "NAV".



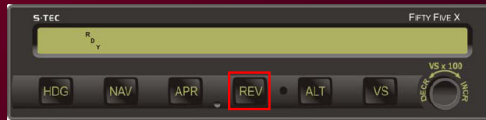
## APR Mode

- More aggressive (re: tracking) NAV mode:
  - Manually select when tracking a VOR course, or
  - Automatically activated from NAV mode if Localizer is tuned
- NAV and APR annunciated



## REV Mode

- Select when flying backcourse approach, or when flying front course outbound (procedure turn ILS)
- Tells AP to fly the *tail* of the needle, rather than head, as initial heading
- Still set head of HSI needle to front course

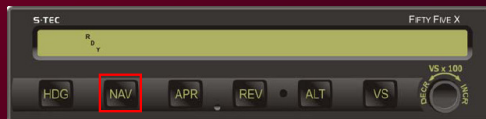


## NAV/ APR/ REV Mode Traps

- Uses tip (tail in REV) of HSI as starting point for tracking, so-
  - If HSI is set wrong, AP will have harder time finding wind correction and staying on course
  - On PT or backcourses, AP will turn to *inbound* heading (where tip of HSI is) if REV is not selected

## GPS Steering Mode (GPSS)

- GPSS bypasses HSI/ PFD; AP talks directly to GPS unit
- Setting HSI course has no effect, selecting VLOC on PFD as no effect
- AP will fly active flight plan and/ or approach, smoothly transitioning from leg to leg
- GPSS mode will still work with PFD failure
- To engage GPSS, select NAV twice



## GPSS Traps

- AP will follow whatever guidance is active in GPS, not necessarily what is monitored on HSI
- If GPSS is commanded, but VLOC is displayed on HSI, annunciation turns yellow:



## Nav Modes Intercept

- If CDI is full scale, AP will set up 45 degree intercept (from tip/ tail of HSI):



(Note that HDG bug is hollow, and has no effect on AP)

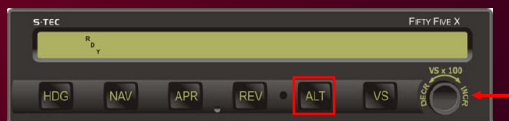
## Nav Modes Intercept

- For manual intercept angle, i.e. "heading to intercept" press and hold HDG, then desired NAV mode (NAV, APR, REV, or GPSS)
- HDG and selected Nav mode will annunciate until course is active, then HDG will extinguish:



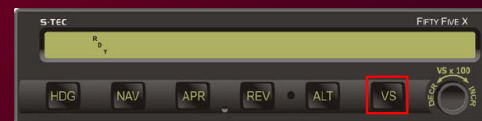
## ALT Mode

- Holds pressure altitude present at time of selection
- Altimeter setting changes will require adjustment of AP
- Small corrections (< 200 feet) to captured altitude may be made with knob on AP Head, one click will change altitude 20 feet



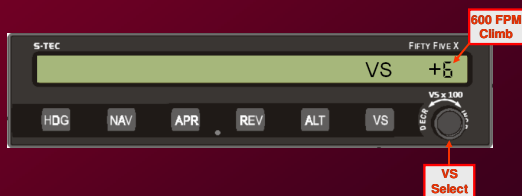
## VS Mode

- Will attempt to maintain selected vertical speed.
- CAUTION! AP will fly the aircraft into a stall if VS selected which is greater than aircraft is capable of maintaining.
- CAUTION! AP may exceed Vne in descent if power is not reduced.
- PIC must monitor power and airspeed, and adjust selected VS if aircraft unable to safely perform climb or descent.



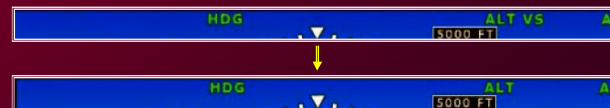
## VS Mode

- If PFD fails, and is depowered, VS control reverts to FGP
- Selected VS annunciated on FGP (in hundreds of feet per minute)



## Altitude Preselect and Capture

- Select desired level-off altitude and VS on PFD
- Press and hold VS, then press ALT
- If no VS, or mismatched VS, is selected, VS will default to 500 FPM in proper direction
- VS will taper to zero as target altitude is approached
- VS and ALT annunciate until altitude is captured, then only ALT



## Glide Slope Mode

- GS Mode will automatically arm if, for more than one second:
  - AP in APR and ALT modes
  - Localizer deflection <50%
  - Glideslope deflection >10% UP
- GS and ALT annunciated
- Once glideslope needle centers, ALT annunciation extinguishes and AP tracks GS



## Disabling GS Mode

- To disable GS auto-capture press APR when in *active* APR mode:
  - Holding at OM, ILS approach with GS OTS
- To enable press APR again
- When GS capture is disabled, GS annunciation flashes:



## Manual GS Arming

- If vector to final is tight, and localizer is intercepted close to OM, glideslope deflection may not be >20% when APR mode is activated
- Manually arm GS mode by pressing ALT while in ALT mode
- Annunciations are the same as with auto GS arming

## Autopilot Limitations

- AP must be off for go-around, missed approach, takeoff, and landing
- AP may not be engaged before 400' AGL
- AP may not be used:
  - Above 185 KIAS
  - With Flaps 100%
  - In ALT mode below 95 KIAS unless flaps are 50%
  - In moderate or severe turbulence
  - At less than 1.2 Vs

## Autopilot Limitations- Approaches

- AP must be disengaged:
  - On precision IAP, at DA
  - On non-precision IAP, at MDA-100'
  - If CDI deviation exceeds 50%
- Max intercept angle 45 degrees

## Autopilot Limitations- ILS

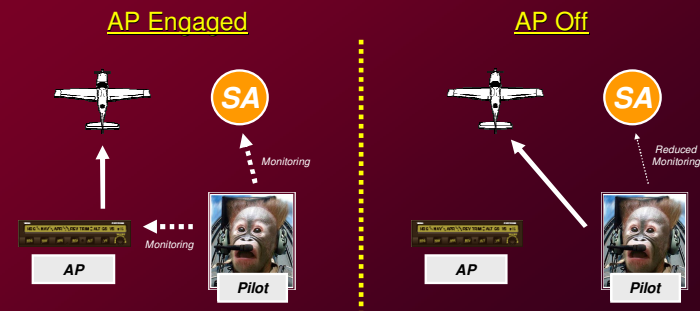
- Localizer:
  - Must intercept at least 5 miles from OM
  - If crosswind component is greater than 12 knots, must intercept at least 10 miles from OM
  - Max crosswind component from OM inbound to MAP is 12 knots
- Glideslope:
  - Flaps must be set and left at 50% prior to OM
  - May not manually arm GS mode if more than 1/3<sup>rd</sup> dot high on glideslope

## Autopilot Disengagement

- Press down on side yoke trim switch
- Pull autopilot circuit breaker
- Turn off both batteries and alternators

## AP usage strategy

- AP can function as a second pilot, but only when it's on!
  - Flying with AP on is like having a two pilot crew, flying with AP off is a single pilot crew.
- You can monitor the AP, the AP can not monitor you:



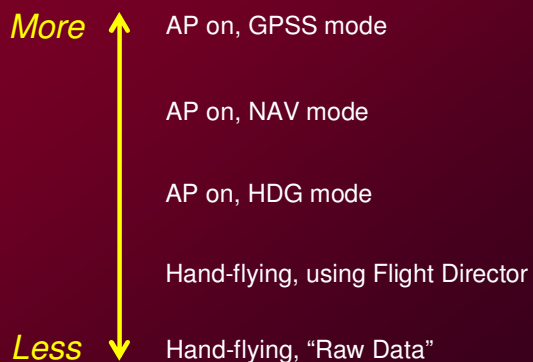
## AP usage strategy

- Use AP at times when your workload is highest:
  - IMC, particularly departure (>1000' AFL) and approach
  - Night
  - In busy airspace
  - Copying/ inputting clearances/ clearance changes
  - Looking for traffic
  - Dealing with abnormal/ emergency situation
- Handfly for proficiency when workload is light:
  - Approaches in VMC
  - Straight and level in IMC
  - Or with a second, *rated and trained*, pilot aboard

## AP usage strategy

- AP usage doesn't have to be "all or nothing"
- Scenarios may require higher or lower levels of automation
  - It's not always appropriate to turn off the AP completely if it's not doing what you want
  - If you do, you're now behind the airplane and hand-flying, with less ability to catch up mentally, as you must dedicate mental cycles to aircraft control.

## Levels of Automation



## AP Tips

- Always verify mode annunciated is what you have selected, and expect to see.
- Always verify "AP" annunciated before releasing controls- easy to switch to FD mode and forget AP is not engaged.
- Always have hand on yoke when within 1000' AGL if quick AP override is needed.

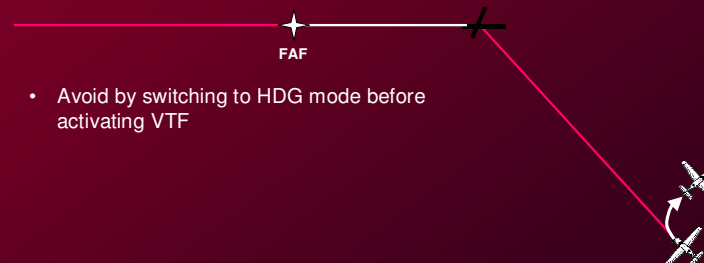
## PFD Failure; PFD/ AP Communication Failure

- If PFD fails, AP loses several pieces of information
- Only AP modes which will function are:
  - GPSS (L/R command comes directly from #1 GPS)
  - Altitude Hold
  - VS Hold (If PFD is de-powered)
- No ability to use:
  - HDG
  - NAV/ APR/ REV
  - GS
  - Altitude Pre-select and capture
- Occasionally, PFD to AP communication does not initialize properly during aircraft startup
  - Diagnosed by absence of AP RDY on PFD, even if present on FGP
  - AP will function as if the PFD has failed, except VS mode will be unavailable, as the PFD is still powered
  - GPSS and ALT hold will still be available



## Common Traps

- Flying direct-to airport, in GPSS mode
- "Fly present heading, vectors for --- approach"
- Activate approach without first switching to HDG mode
- CDI is full scale deflection; aircraft turns to heading which would give 45 intercept:



## Common Traps

- Proceeding direct-to IAF in GPSS mode, for full IAP
- Do not notice impending station passage in time:
  - Active course becomes course inbound to IAF.
  - Aircraft turns to intercept, does not proceed outbound.
- Avoid by switching to HDG mode when close to IAF

