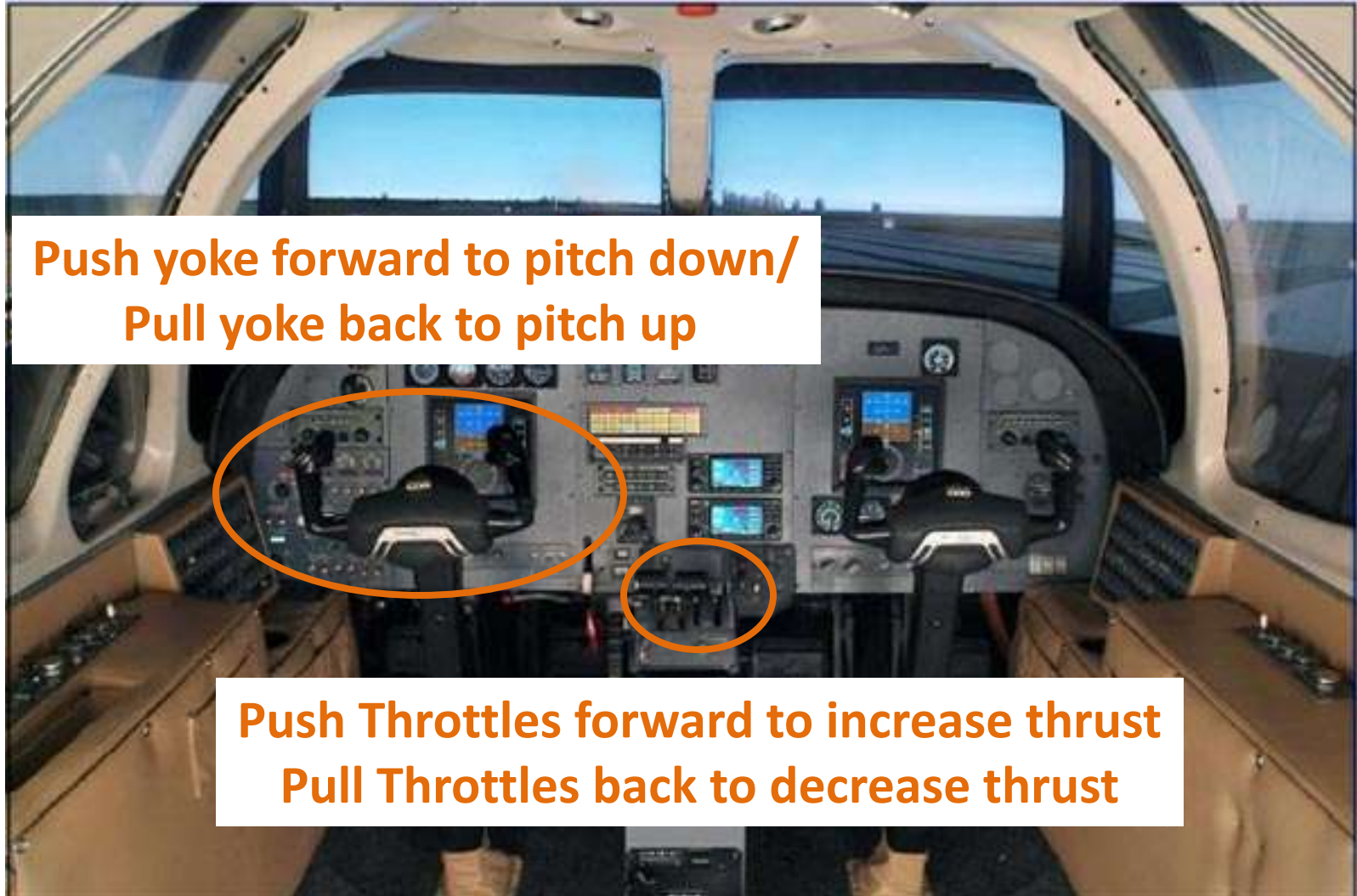


Flight Controls

SYST 560/460

Lance Sherry

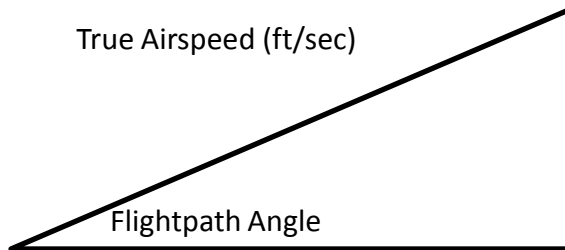
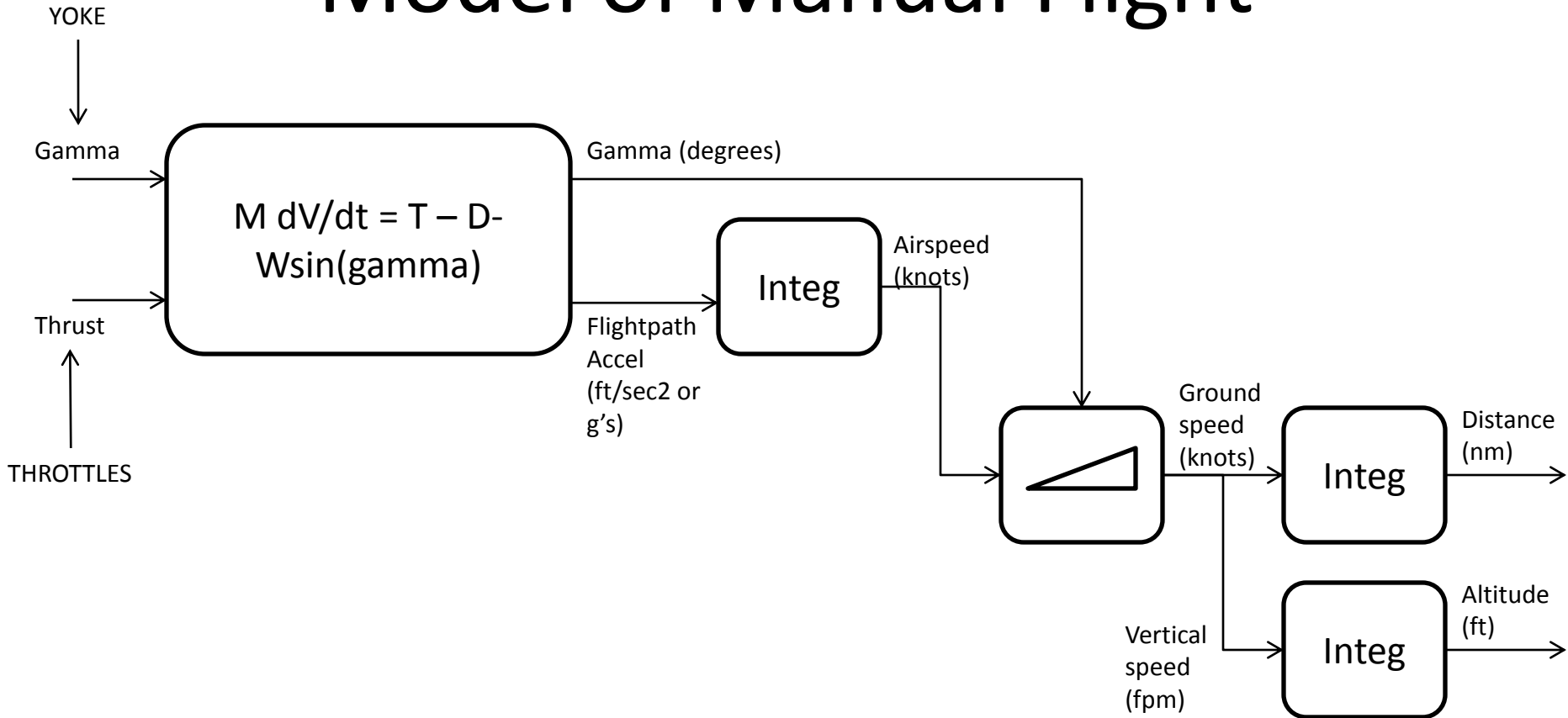
Model of Manual Flight



**Push yoke forward to pitch down/
Pull yoke back to pitch up**

**Push Throttles forward to increase thrust
Pull Throttles back to decrease thrust**

Model of Manual Flight



Altitude Rate = Vertical Speed (ft/sec)

$$\sin(\text{Flightpath Angle}) = \frac{\text{Vertical Speed (ft/sec)}}{\text{True Airspeed (ft/sec)}}$$

Model of Manual Flight

Time (secs)	T	FlightpathAngle	sin (FPA)	Weight	Drag
0	22461	17			
=A2+1	=25000-B2	=(C2*0.5)-10	=SIN(C3*57.3)	100000	=0.5*0.0212*0.0017*1000*(L2)*(L2)

T-D/M	Inertia	FlightpathAccel (ft/sec ²)	FlightpathAccel (g's)	Excess Thrust for Constant Speed	Airspeed (ft/sec)	Airspeed (knots)
					=M2*6076/3600	140
=(B3-F3)/(E3/32.2)	=(E3*SIN(C3*57.3))/(E3/32.2)	=(B3-F3-(E3*SIN(C3*57.3)))/(E3/32.2)	=I3/32.2	=B3-F3	=L2+I3	=L3*(3600/6076)

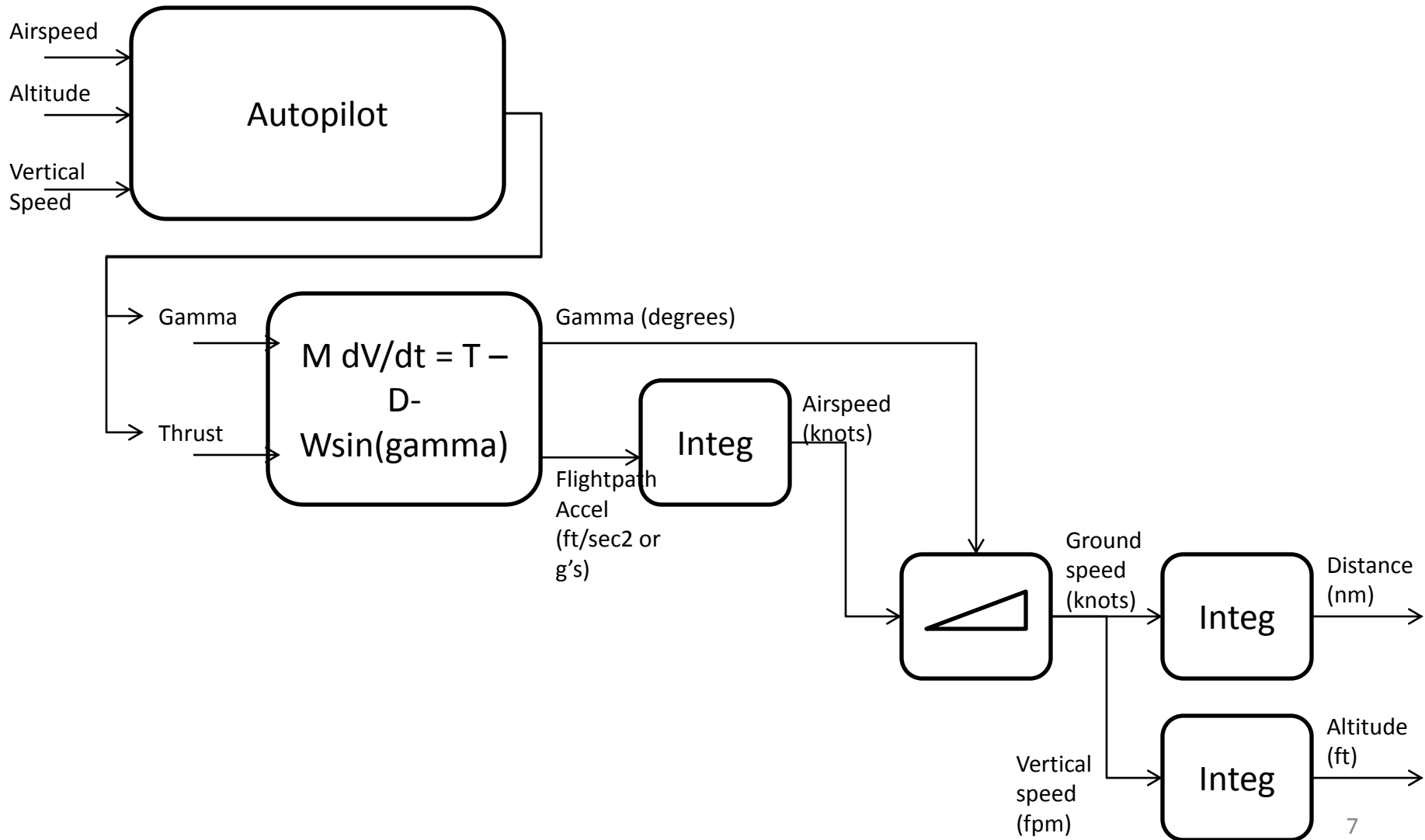
Groundspeed (ft/sec)	Groundspeed (knots)	Distance (ft)	Distance (nm)
		-36456	=P2/6076
=L3*COS(C3/57.3)	=N3*(3600/6076)	=P2+N3	=P3/6076

VerticalSpeed (ft/s)	Vertical Speed (fpm)	Altitude	Alt for 3 Deg Glideslope at 140 knots	Vertical Deviation (+ High)
		2500	=2000	=T2-U2
=L3*SIN(C3/57.3)	=R3*60	=T2+R3	=U2-16.66667	=T3-U3

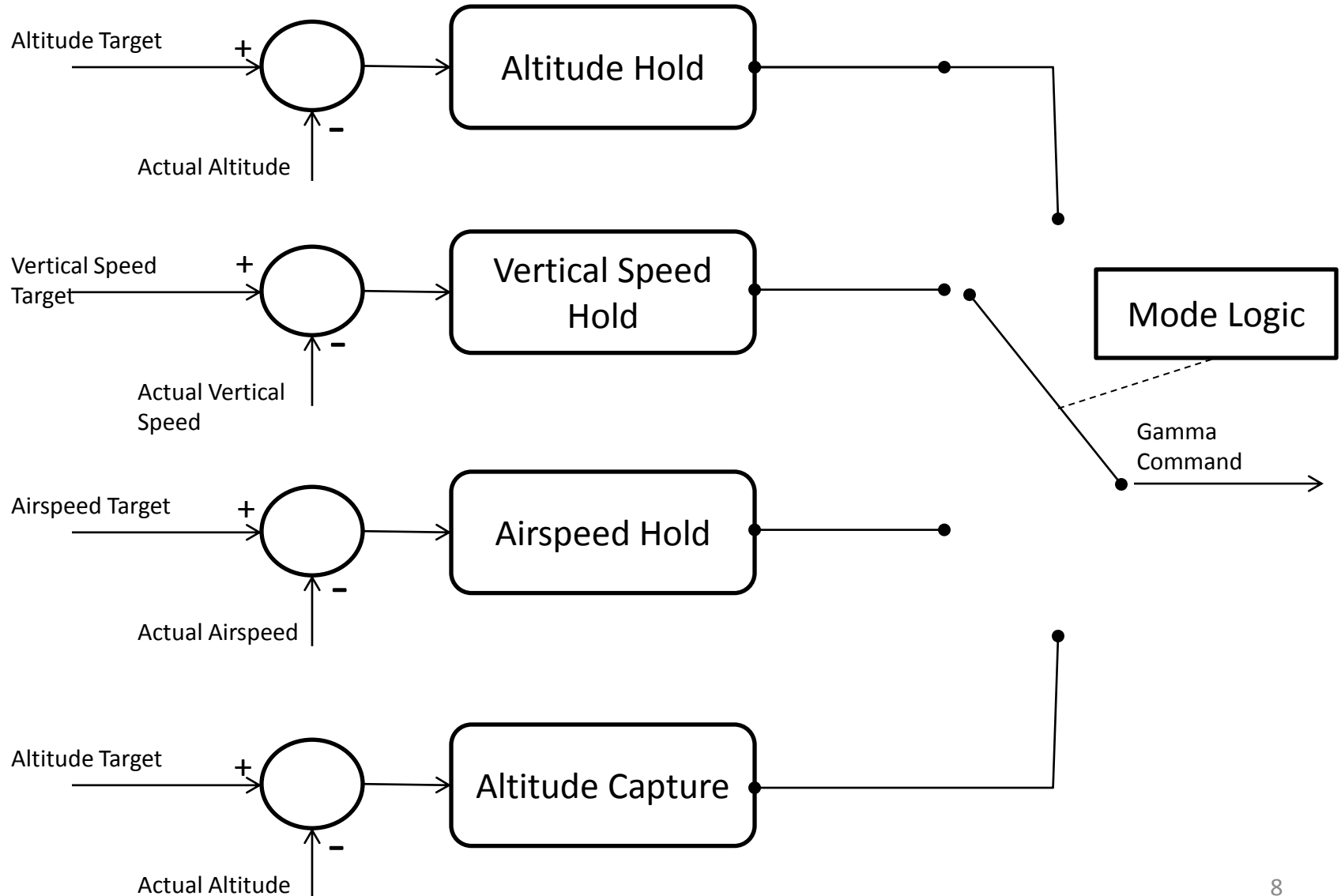
Homework

- Build Aircraft simulation model using equations for Flightpath Axis
 - Plot:
 - T on x axis, Airspeed and Ground Speed (primary y axis), FP Accel (secondary y)
 - T on x axis, Altitude (primary y axis), Vertical speed (secondary y)
 - T on x axis, Airspeed and Ground Speed (primary y axis), Thrust (secondary y)
- 1. Initialize to 5000 ft at 250 knots. Fly for 60 seconds then climb at 2000 fpm, to 7000'. Increase speed to 260 knots. (Adjust FPAng and Thrust)
- 2. Fly a glideslope of -3° from -6nm from 2000' at 160 knots. (Adjust FPAng and Thrust)

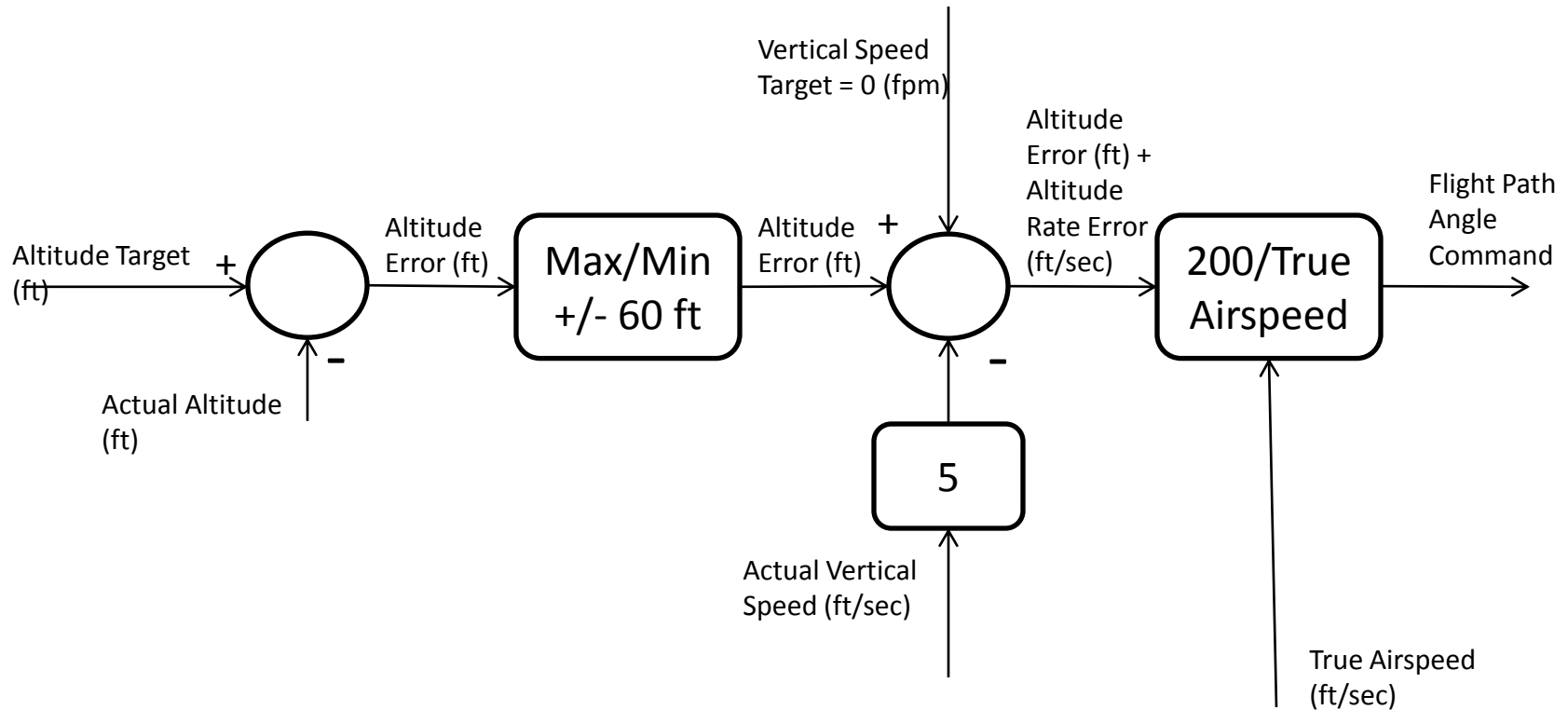
Model of Autopilot Flight



Autopilot – Control Laws



Altitude Hold



$$\sin(\text{Flightpath Angle}) = \frac{\text{Vertical Speed (ft/sec)}}{\text{True Airspeed (ft/sec)}}$$

Mode Logic – Switches Control Laws

