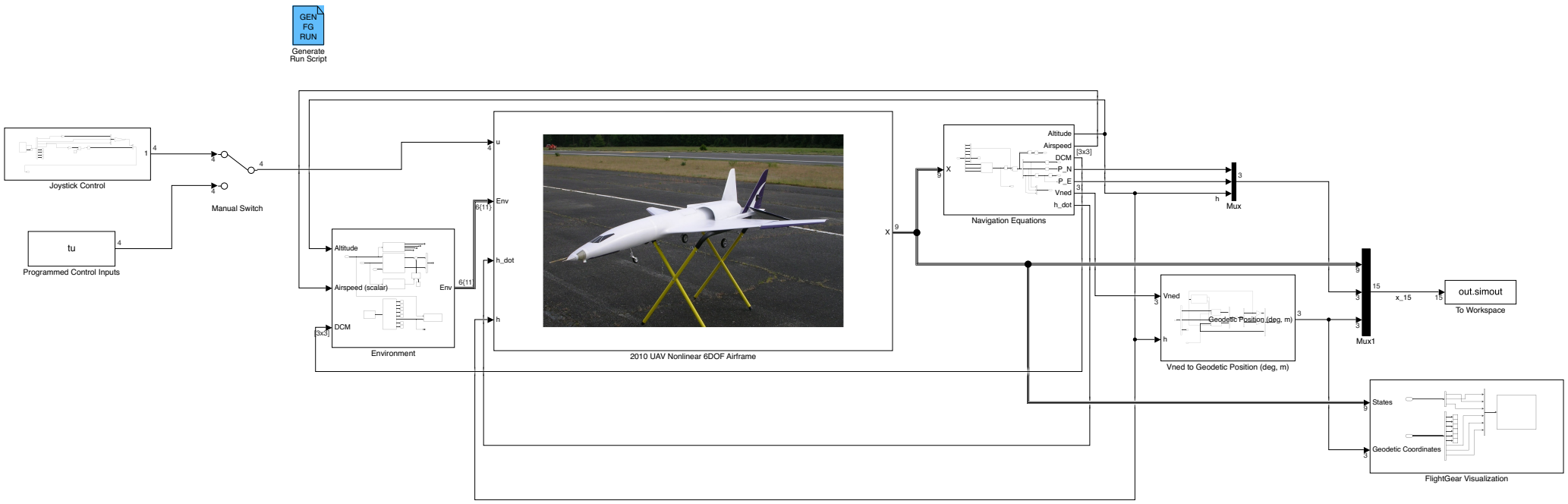
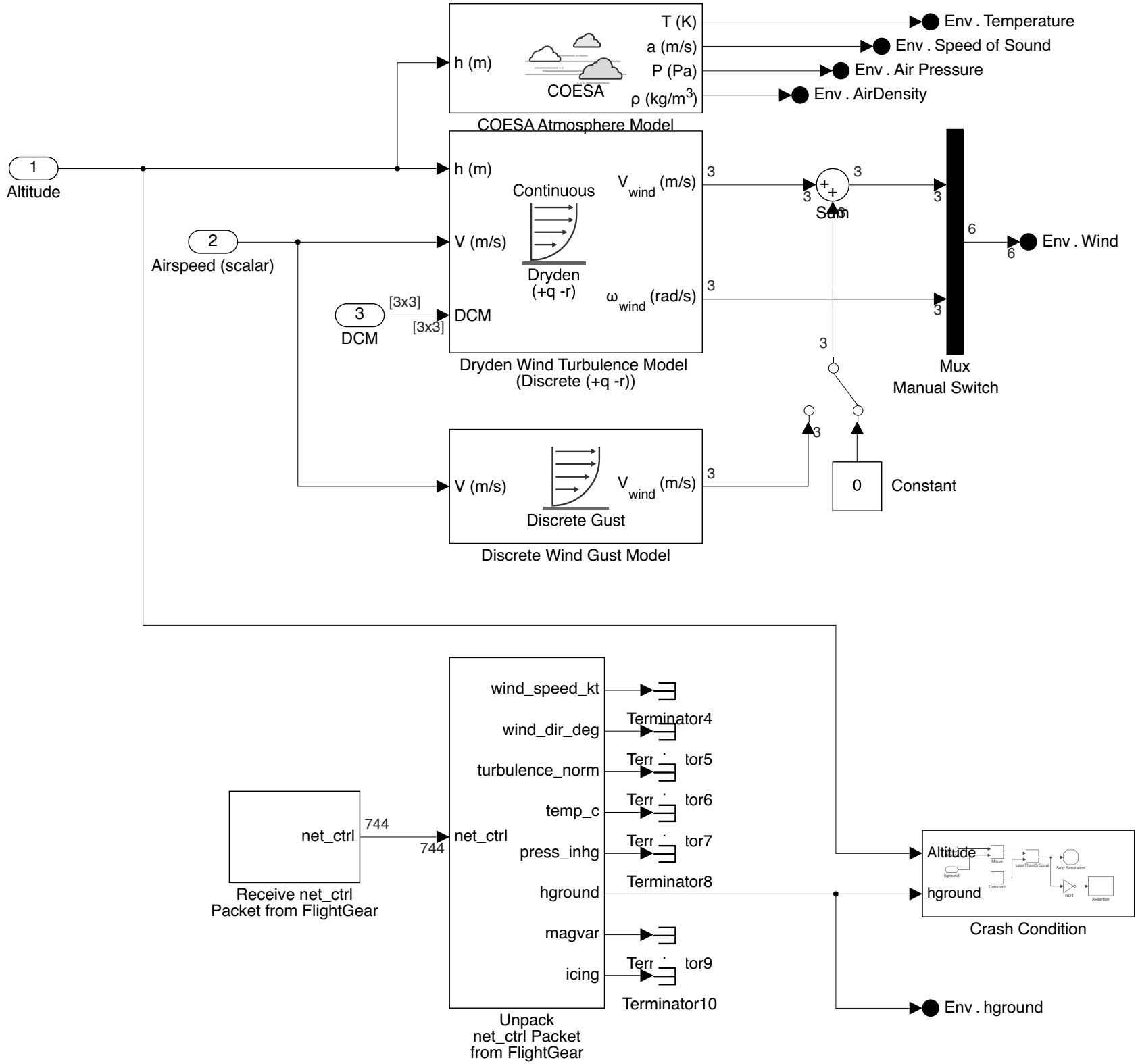
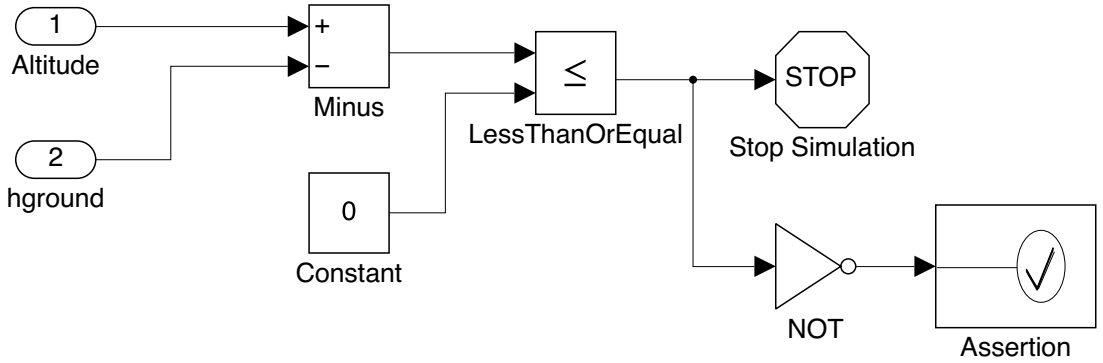
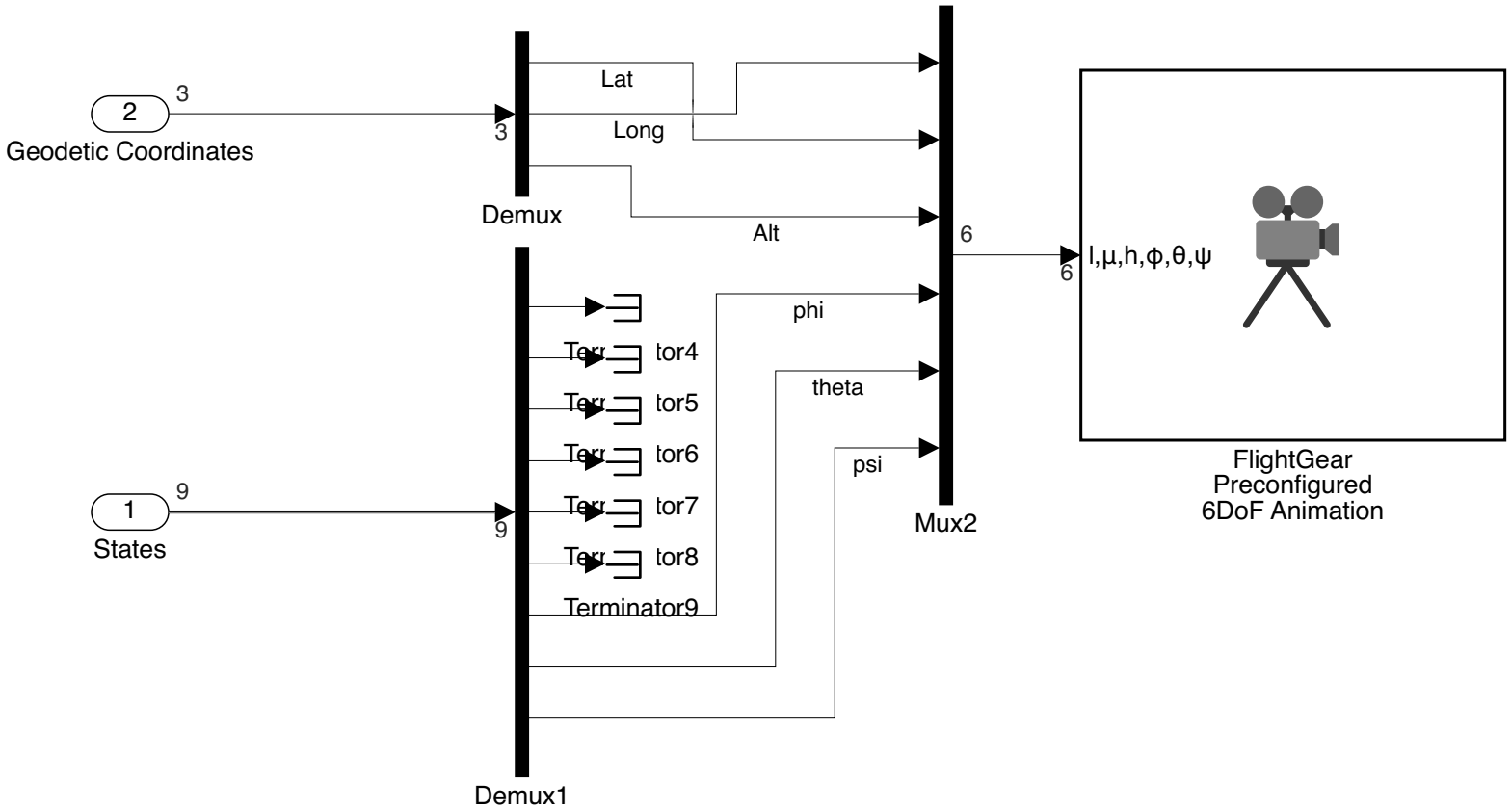
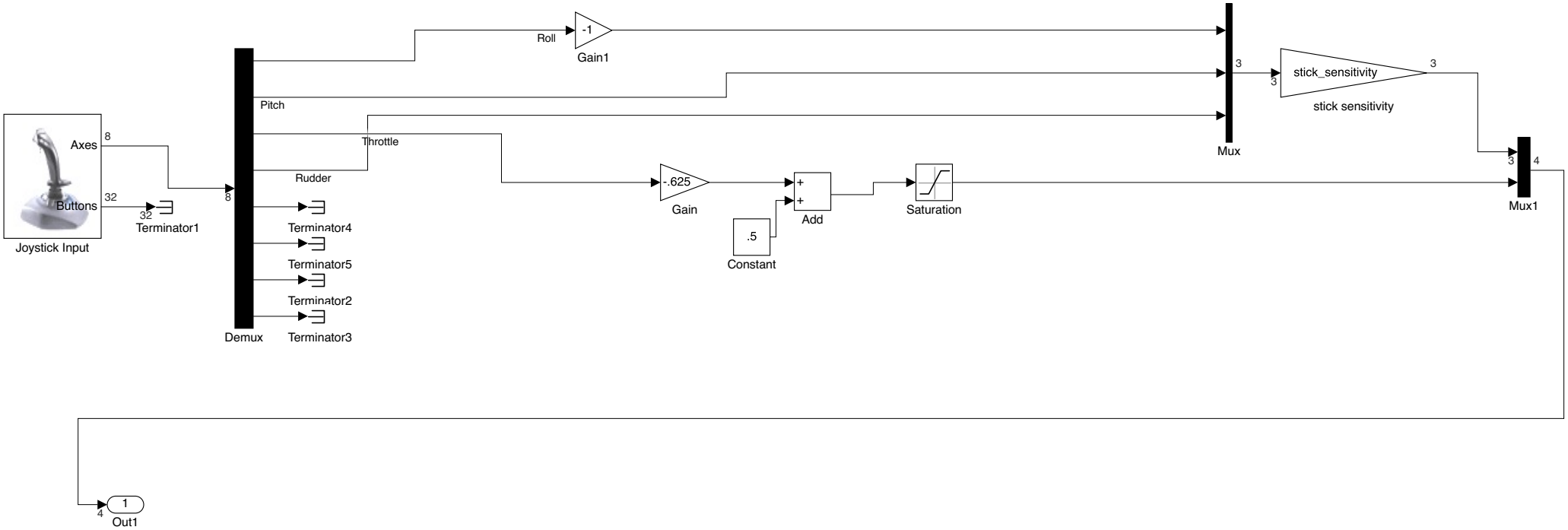
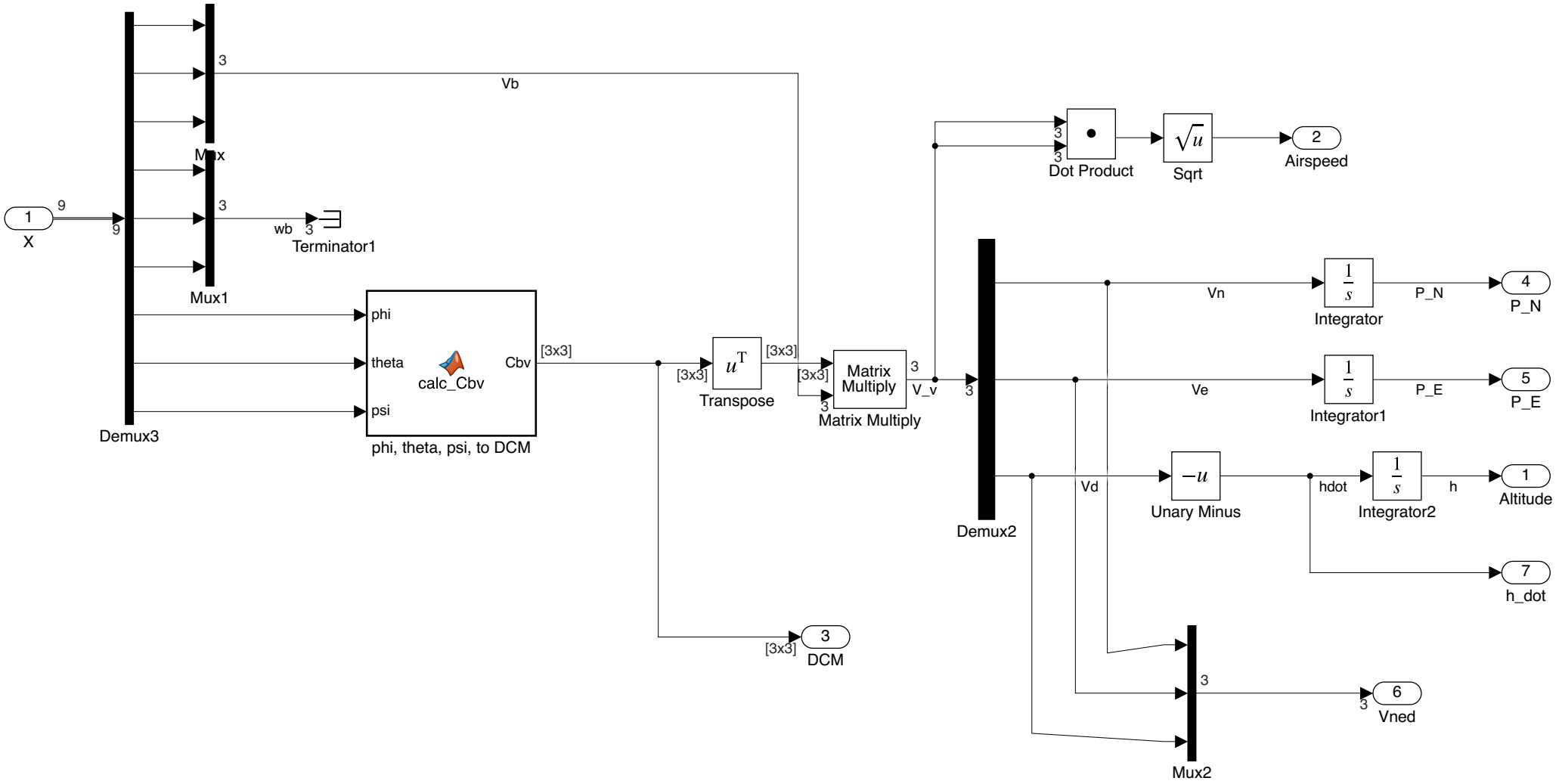

GEN
FG
RUN
Generate
Run Script
Joystick Control
Manual Switch
tu
Programmed Control Inputs
Altitude
Airspeed (scalar)
DCM
Env
Environment
u
Env
h_dot
h
2010 UAV Nonlinear 6DOF Airframe
Altitude
Airspeed
DCM
P_N
P_E
Vned
h_dot
Navigation Equations
Mux
Vned
h
Geodetic Position (deg, m)
Vned to Geodetic Position (deg, m)
Mux1
x_15
out.simout
To Workspace
States
Geodetic Coordinates
FlightGear Visualization


T (K)
a (m/s)
P (Pa)
ρ (kg/m3)
h (m)
COESA
Env . Temperature
Env . Speed of Sound
Env . Air Pressure
Env . AirDensity
COESA Atmosphere Model
1
Altitude
2
Airspeed (scalar)
3
DCM
[3x3]
[3x3]
h (m)
V (m/s)
DCM
Continuous
Dryden
(+q -r)
V wind (m/s)
ω wind (rad/s)
Sum
Mux
6
Env . Wind
Dryden Wind Turbulence Model
(Discrete (+q -r))
Manual Switch
0
Constant
V (m/s)
Discrete Gust
V wind (m/s)
Discrete Wind Gust Model
net_ctrl
744
Receive net_ctrl
Packet from FlightGear
wind_speed_kt
wind_dir_deg
turbulence_norm
temp_c
press_inhg
hground
magvar
icing
Terminator4
Terminator8
Terminator10
Unpack
net_ctrl Packet
from FlightGear
Altitude
hground
Crash Condition
Env . hground


1
Altitude
2
hground
+
−
Minus
0
Constant
≤
LessThanOrEqual
STOP
Stop Simulation
NOT
Assertion


2
3
Geodetic Coordinates
3
Demux
Lat
Long
Alt
6
6
l,μ,h,ϕ,θ,ψ
FlightGear
Preconfigured
6DoF Animation
Mux2
phi
theta
psi
Terr tor4
Terr tor5
Terr tor6
Terr tor7
Terr tor8
Terminator9
1
9
States
9
Demux1


Axes
8
Buttons
32
Joystick Input
32
Terminator1
6
Demux
Roll
-1
Gain1
Pitch
Throttle
Rudder
Terminator4
Terminator5
Terminator2
Terminator3
-.625
Gain
.5
Constant
+
+
Add
Saturation
3
3
Mux
stick_sensitivity
stick sensitivity
3
3
3
4
Mux1
4
1
Out1


1
X
9
9
Demux3
3
Mux
3
Mux1
wb
3
Terminator1
Vb
phi
theta
psi
calc_Cbv
Cbv
[3x3]
phi, theta, psi, to DCM
[3x3]
u^T
Transpose
[3x3]
[3x3]
Matrix Multiply
3
3
V_v
Dot Product
Sqrt
2
Airspeed
Demux2
Vn
Integrator
P_N
4
P_N
Ve
Integrator1
P_E
5
P_E
Vd
$-u$
Unary Minus
hdot
Integrator2
h
1
Altitude
7
h_dot
3
[3x3]
3
DCM
3
3
6
Vned
Mux2

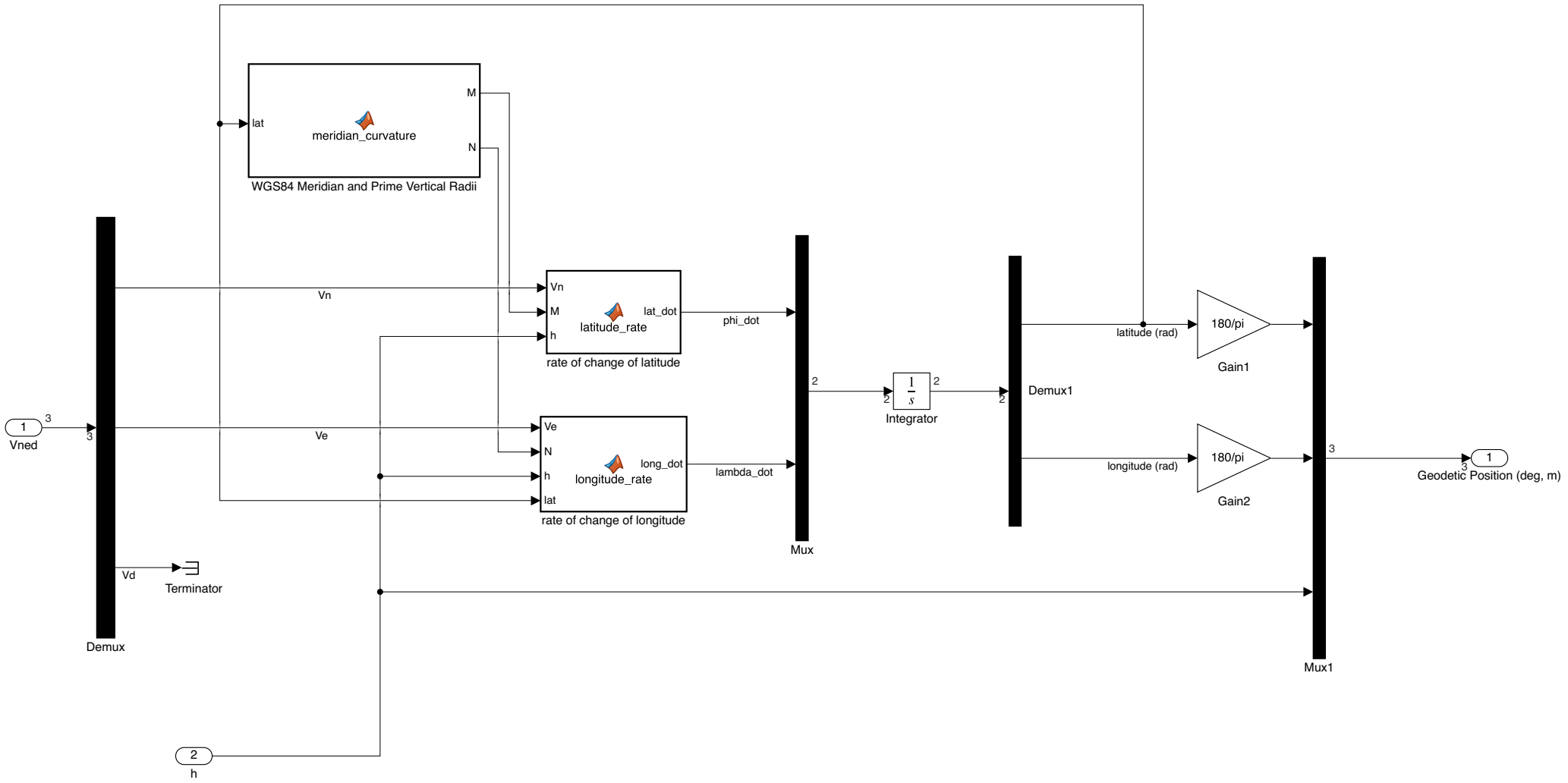
```
function Cbv = calc_Cbv(phi, theta, psi)

C1v = [ cos(psi) sin(psi)  0
       -sin(psi) cos(psi)  0
        0        0         1];

C21 = [cos(theta)  0  -sin(theta)
       0           1   0
       sin(theta)  0   cos(theta)];

Cb2 = [1  0        0
       0  cos(phi) sin(phi)
       0 -sin(phi) cos(phi)];

Cbv = Cb2*C21*C1v;
```


lat
meridian_curvature
M
N
WGS84 Meridian and Prime Vertical Radii
1
Vned
3
Demux
Vn
Ve
Vd
Terminator
Vn
M
h
latitude_rate
lat_dot
rate of change of latitude
Ve
N
h
lat
longitude_rate
long_dot
rate of change of longitude
phi_dot
lambda_dot
2
Mux
1/s
Integrator
Demux1
latitude (rad)
longitude (rad)
180/pi
Gain1
180/pi
Gain2
3
Mux1
1
Geodetic Position (deg, m)
2
h

```
function [M, N] = meridian_curvature(lat)

a = 6378137.0;
e = 0.081819190842622;

M = a*(1-e^2)/(1 - e^2*sin(lat)^2)^(3/2);
N = a/(1 - e^2*sin(lat)^2)^(1/2);
```

```
function lat_dot = latitude_rate(Vn, M, h)
lat_dot = Vn/(M+h);
```

```
function long_dot = longitude_rate(Ve, N, h, lat)
long_dot = Ve/((N+h)*cos(lat));
```