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function [Alon, Blon, Alat, Blat] = AircraftLinearModel(trim_definition,
    trim_variables, aircraft_parameters)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
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% Inputs: trim_definition          = [V0; h0]
%          trim_variables          = [alpha0; de0; dt0]
%          aircraft_parameters    = structure with A/C parameters
%
%
% Outputs: Alon [6x6]
%          Blon [6x2]
%          Alat [6x6]
%          Blat [6x2]
%
%
% Develop Longitudinal and Lateral A and B matrices.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
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%
% STUDENT COMPLETE

u0 = trim_definition(1);
h0 = trim_definition(2);

alpha0 = trim_variables(1);
de0 = trim_variables(2);
dt0 = trim_variables(3);

theta0 = alpha0;

ap = aircraft_parameters;
rho = stdatmo(h0);

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Longitudinal

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%%% Trim values
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CW0 = ap.W/((1/2)*rho*u0^2*ap.S);
CL0 = CW0*cos(theta0);
CD0 = ap.CDmin + ap.K*(CL0-ap.CLmin)^2;
CT0 = CD0 + CW0*sin(theta0);

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%%% Nondimensional stability derivatives in body coordinates
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%%% This is provided since we never discussed propulsion - Prof. Frew
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dTdu = dt0*ap.Cprop*ap.Sprop*(ap.kmotor-2*u0+dt0*(-2*ap.kmotor+2*u0));
CXu = dTdu/(.5*rho*u0*ap.S)-2*CT0;

CDu = 0;%CDM*Ma;    % Compressibility only.  Ignore aeroelasticity and other
    effects (dynamic pressure and thrust).
CLu = 0;%CLM*Ma;
Cmu = 0;%CmM*Ma;

CZu = 0;

CZalpha = -CD0 - ap.CLalpha;
CXalpha = CL0*(1-2*ap.K*ap.CLalpha);

CZalphadot = -ap.CLalphadot;

CZq = -ap.CLq;

% Longitudinal dimensional stability derivatives (from Etkin and Reid)
Xu = rho*u0*ap.S*CW0*sin(theta0) + 0.5*rho*u0*ap.S*CXu;
Zu = -rho*u0*ap.S*CW0*cos(theta0) + 0.5*rho*u0*ap.S*CZu;
Mu = 0.5*rho*u0*ap.S*ap.c*Cmu;

Xw = 0.5*rho*u0*ap.S*CXalpha;
Zw = 0.5*rho*u0*ap.S*CZalpha;
Mw = 0.5*rho*u0*ap.S*ap.c*ap.Cmalpha;

Xq = 0;
Zq = 0.25*rho*u0*ap.c*ap.S*CZq;
Mq = 0.25*rho*u0*ap.c^2*ap.S*ap.Cmq;

Xwdot = 0;
Zwdot = 0.25*rho*ap.c*ap.S*CZalphadot;
Mwdot = 0.25*rho*ap.c^2*ap.S*ap.Cmalphadot;

% Matrices
m = ap.m;
g = ap.g;
Iy = ap.Iy;

Alon = [
            Xu/m,                Xw/m,
            0,                    -g*cos(theta0),
            0, 0;                Zw/(m-Zwdot),
            Zu/(m-Zwdot),        (-m*g*sin(theta0))/(m-Zwdot),
            (Zq + m*u0)/(m-Zwdot),
            0, 0;                (1/Iy)*(Mu+(Mwdot*Zu)/(m-Zwdot)), (1/Iy)*(Mw + (Mwdot*Zw)/
            (m-Zwdot)), (1/Iy)*(Mq + (Mwdot*(Zq + m*u0)/(m-Zwdot))), (-
            Mwdot*m*g*sin(theta0))/(Iy*(m-Zwdot)), 0, 0;

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```

        0,
1,      0, 0;
        1,
0,      0, 0;
        0,
0,      0, 0;
        0, 0
];

```

```
Blon = zeros(6,2);
```

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Lateral

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% Lateral-directional dimensional stability derivatives
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Yv = 0.5*rho*u0*ap.S*ap.CYbeta;
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```
Yp = 0.25*rho*u0*ap.b*ap.S*ap.CYp;
```

```
Yr = 0.25*rho*u0*ap.b*ap.S*ap.CYr;
```

```
Lv = 0.5*rho*u0*ap.S*ap.b*ap.Clbeta;
```

```
Lp = 0.25*rho*u0*ap.S*ap.b^2*ap.Clp;
```

```
Lr = 0.25*rho*u0*ap.S*ap.b^2*ap.Clr;
```

```
Nv = 0.5*rho*u0*ap.S*ap.b*ap.Cnbeta;
```

```
Np = 0.25*rho*u0*ap.S*ap.b^2*ap.Cnp;
```

```
Nr = 0.25*rho*u0*ap.S*ap.b^2*ap.Cnr;
```

```
G = ap.Ix*ap.Iz-ap.Ixz^2;
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G3=ap.Iz/G;
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G4=ap.Ixz/G;
```

```
G8=ap.Ix/G;
```

```

Alat = [Yv/m      Yp/m      (Yr/m)-u0
        ap.g*cos(theta0)      0      0;
        G3*Lv + G4*Nv      G3*Lp + G4*Np      G3*Lr + G4*Nr      0
              0              0;
        G4*Lv + G8*Nv      G4*Lp + G8*Np      G4*Lr + G8*Nr      0
              0              0;
        0              1      tan(theta0)      0
              0              0;
        0              0      sec(theta0)      0
              0              0;

```

```
1          0          0          0
          u0*cos(theta0)  0];

Blat = zeros(6,2);
```

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