AAE490A/AT490B
MATLAB Script for Experiment #1
Stall Speed and CLmax determination

The script below can be found on the class web site
http://roger.ecn.purdue.edu/~andrisan/Courses/AAE490A_S2001/Index.html
along with the 5 required supporting functions. Copy the script and 5
functions to your computer account and execute the script. When the
script runs successfully and gives the results indicated following
the script, you can change the data input lines…

```
Hi=[4500,4100,4400]   %indicated geopotential feet at stall
Vi=  [61,60,59]   %stall speed knots.
flap=[ 0, 0, 0] % Flap setting %flap=0 for no flap %flap=0.5 fo
    half flap %flap=1 for full flap
ZeroFuelWeight=4500 % pounds <<<Use the number Professor
    Holleman gave
FuelWeight=[900,800,700]  % pounds (lbf).
Viwarn=[64,66,63]   % indicated stall warning speed knots.
```

to include the data you measured when you flew the experiment in the
Frasca Trainer. The modified script will then give the results you
need for your Experiment #1 write-up.

```
% Experiment #1 Stall Speed and CLmax Determination
% Ref: NTPS, pages D24-D26.
% This MATLAB script computes stall airspeed and CLmax
% given Vindicated, flap setting, indicated geopotential pressure
altitude.
% It assumes standard outside air temperature for the calibrated
pressure altitude.
disp(' ')
disp('Start here')
disp('Experiment 1') %Example 1
disp(' ')
clear all
echo on
% Compute stall speed and Clmax
```

```
% Item 1 Indicated pressure altitude for the flight experiment.
% The following vector must be of the same length as Vi, flap and
FuelWeight.
Hi=[4500,4100,4400]   %indicated geopotential feet at stall. Put your
data in this vector.

% Item 2 Indicated airspeed and flap setting from the experiment.
% The following vectors must be of the same length as Hi and
FuelWeight.
Vi=  [61,60,59]   %stall speed knots. Put your data in this vector
and the one below.
flap=[ 0, 0, 0] % Flap setting %flap=0 for no flap %flap=0.5 for half
flap %flap=1 for full flap

% The following step is not listed in the NTPS Data Reduction
procedure,
% but we will do this in this and other experiments.
% Correct indicated altitude for instrument and position errors.
Hcalibrated=ALTBaron58(Hi,Vi,flap)

% Items 3 and 4 Correct for indicated airspeed for instrument,
position errors.
Vcalibrated=AS1Baron58(Vi,flap) % Airspeed units are KNOTS.

% Items 5 and 6 Compute equivalent airspeed
% Item 6a Get standard pressure (p, lbf/ft^2) for calibrated pressure
altitude.
GeometricFlag=0 %Hvector is Geopotential altitude
[temp,p,rho,Hgeopvector]=
atmosphere4(Hcalibrated,GeometricFlag);
p
% Item 6b Get equivalent airspeed (Vequivalent)
[Vequivalent,qcOverp0,qcOverp]=AS2(Vcalibrated,p); %Knots
Vequivalent

% Item 7 Compute test weights.
ZeroFuelWeight=4500 % pounds <<<Use the number Professor Holleman
gave you.
% The following vector must be of the same length as Hi, Vi, and
flap.
FuelWeight=[900,800,700]  % pounds (lbf). Put your data in this
vector. (6lbf/gal)
```

```
Wt=ZeroFuelWeight+FuelWeight

% Item 8
rho0=0.00237691267925741; % Sea level density, slugs per cubic foot
S=199.2; % ft squared
Vefps=1.687808*Vequivalent % convert knots to ft/sec
Clmax=2*Wt./(rho0*Vefps.*Vefps*S)

% Item 8 done using true airspeed (Vtrue, knots)
% In this calculation we assume standard temperature for the
calibrated pressure altitude.
% It would be better if we had mesured outside air temperature, but
we did not in this experiment.
temp     %degree Rankine
[Vtrue,M,aknots,rho,sigma]=    AS3(Vequivalent,temp,Hcalibrated); %
knots
Vtfps=1.687808*Vtrue % convert knots to ft/sec
Clmax2=2*Wt./(rho.*Vtfps.*Vtfps*S)

% Item 9 Stall speed corrected for weight
Ws=5500 % pounds (lbf), standard weight is maximum takeoff weight
(Baron 58 manual p. 1-12)
Vs1=Vequivalent.*sqrt(Ws./Wt) % knots


% *********
% Compute warning speed

% Item 10 Indicated ressure ltitude for the flight experiment.
% The following vectors must be of the same length as Hi and
FuelWeight.
Viwarn=[64,66,63]   % indicated stall warning speed knots. Put your
data in this vector and the one below.

% The following step is not listed in the NTPS Data Reduction
procedure,
% but we will do this in this and other experiments.
% Correct indicated altitude for instrument and position errors.
Hcalibratedwarn=ALTBaron58(Hi,Viwarn,flap)

% Items 11 and 12 Correct for indicated airspeed for instrument,
position errors.
```

```
Vcalibratedwarn=AS1Baron58(Viwarn,flap) % Airspeed units are KNOTS.

% Items 13 and 14 Compute equivalent airspeed
% Item 14a Get standard pressure (p, lbf/ft^2) for calibrated
pressure altitude.
GeometricFlag=0 %Hcalibratedwarn is Geopotential altitude
[temp,pwarn,rho,Hgeopvector]=
atmosphere4(Hcalibratedwarn,GeometricFlag);
pwarn
% Item 14b Get equivalent airspeed (Vequivalent)
[Vequivalentwarn,qcOverp0,qcOverp]=AS2(Vcalibratedwarn,pwarn); %Knots
Vequivalentwarn

% Item 15 Warning speed corrected for weight
Vwarn=Vequivalentwarn.*sqrt(Ws./Wt) % knots

% Item 16 Stall warning
StallWarning=Vwarn-Vs1 %knots
echo off
```

```
>>>>>>Output of the above script
Start here
Experiment 1
% Compute stall speed and Clmax

% Item 1 Indicated pressure altitude for the flight experiment.
% The following vector must be of the same length as Vi, flap and
FuelWeight.
Hi=[4500,4100,4400]   %indicated geopotential feet at stall. Put your
data in this vector.
Hi =
        4500        4100        4400
% Item 2 Indicated airspeed and flap setting from the experiment.
% The following vectors must be of the same length as Hi and
FuelWeight.
Vi=  [61,60,59]   %stall speed knots. Put your data in this vector
and the one below.
Vi =
    61    60    59
flap=[ 0, 0, 0] % Flap setting %flap=0 for no flap %flap=0.5 for half
flap %flap=1 for full flap
flap =
     0     0     0
% The following step is not listed in the NTPS Data Reduction
procedure,
% but we will do this in this and other experiments.
% Correct indicated altitude for instrument and position errors.
Hcalibrated=ALTBaron58(Hi,Vi,flap)
Hcalibrated =
           4497.5334176209               4097.607365
4397.57666
% Items 3 and 4 Correct for indicated airspeed for instrument,
position errors.
Vcalibrated=AS1Baron58(Vi,flap) % Airspeed units are KNOTS.
Vcalibrated =
    61    60    59
% Items 5 and 6 Compute equivalent airspeed
% Item 6a Get standard pressure (p, lbf/ft^2) for calibrated pressure
altitude.
GeometricFlag=0 %Hvector is Geopotential altitude
GeometricFlag =
     0
```

```
[temp,p,rho,Hgeopvector]=
atmosphere4(Hcalibrated,GeometricFlag);
p
p =
          1794.15802524556          1821.07726301237
1800.85576404759
% Item 6b Get equivalent airspeed (Vequivalent)
[Vequivalent,qcOverp0,qcOverp]=AS2(Vcalibrated,p); %Knots
Vequivalent
Vequivalent =
          60.9883956985937          59.9900282280775
58.9897545503723
% Item 7 Compute test weights.
ZeroFuelWeight=4500 % pounds <<<Use the number Professor Holleman
gave you.
ZeroFuelWeight =
        4500
% The following vector must be of the same length as Hi, Vi, and
flap.
FuelWeight=[900,800,700]  % pounds (lbf). Put your data in this
vector. (6lbf/gal)
FuelWeight =
   900   800   700
Wt=ZeroFuelWeight+FuelWeight
Wt =
        5400        5300        5200
% Item 8
rho0=0.00237691267925741; % Sea level density, slugs per cubic foot
S=199.2; % ft squared
Vefps=1.687808*Vequivalent % convert knots to ft/sec
Vefps =
          102.936702167252          101.251649563575
99.5633796481548
Clmax=2*Wt./(rho0*Vefps.*Vefps*S)
Clmax =
          2.15268603376695          2.18373074765527
2.2158048954023

% Item 8 done using true airspeed (Vtrue, knots)
% In this calculation we assume standard temperature for the
calibrated pressure altitude.
```

```
% It would be better if we had mesured outside air temperature, but
we did not in this experiment.
temp     %degree Rankine
temp =
          502.631076227417          504.057276519232
502.987538018174
[Vtrue,M,aknots,rho,sigma]=    AS3(Vequivalent,temp,Hcalibrated); %
knots
Vtfps=1.687808*Vtrue % convert knots to ft/sec
Vtfps =
          110.052373973644           107.60010827523
106.285402211383
Clmax2=2*Wt./(rho.*Vtfps.*Vtfps*S)
Clmax2 =
          2.15268603376695          2.18373074765527
2.2158048954023

% Item 9 Stall speed corrected for weight
Ws=5500 % pounds (lbf), standard weight is maximum takeoff weight
(Baron 58 manual p. 1-12)
Ws =
        5500
Vs1=Vequivalent.*sqrt(Ws./Wt) % knots
Vs1 =
           61.550512610895          61.1114342162578
60.6675228040291


% *********
% Compute warning speed

% Item 10 Indicated ressure ltitude for the flight experiment.
% The following vectors must be of the same length as Hi and
FuelWeight.
Viwarn=[64,66,63]   % indicated stall warning speed knots. Put your
data in this vector and the one below.
Viwarn =
    64    66    63

% The following step is not listed in the NTPS Data Reduction
procedure,
% but we will do this in this and other experiments.
```

```
% Correct indicated altitude for instrument and position errors.
Hcalibratedwarn=ALTBaron58(Hi,Viwarn,flap)
Hcalibratedwarn =
          4497.43439548361          4097.41522249815
4397.4783755843
% Items 11 and 12 Correct for indicated airspeed for instrument,
position errors.
Vcalibratedwarn=AS1Baron58(Viwarn,flap) % Airspeed units are KNOTS.
Vcalibratedwarn =
    64    66    63
% Items 13 and 14 Compute equivalent airspeed
% Item 14a Get standard pressure (p, lbf/ft^2) for calibrated
pressure altitude.
GeometricFlag=0 %Hcalibratedwarn is Geopotential altitude
GeometricFlag =
     0
[temp,pwarn,rho,Hgeopvector]=
atmosphere4(Hcalibratedwarn,GeometricFlag);
pwarn
pwarn =
          1794.16465036291          1821.09027436524
1800.86235967757
% Item 14b Get equivalent airspeed (Vequivalent)
[Vequivalentwarn,qcOverp0,qcOverp]=AS2(Vcalibratedwarn,pwarn); %Knots
Vequivalentwarn
Vequivalentwarn =
          63.9866024589078           65.986736356799
62.9875315476322

% Item 15 Warning speed corrected for weight
Vwarn=Vequivalentwarn.*sqrt(Ws./Wt) % knots
Vwarn =
          64.5763531974026          67.2202400486068
64.7790033313736
% Item 16 Stall warning
StallWarning=Vwarn-Vs1 %knots
StallWarning =
          3.02584058650753          6.10880583234901
4.11148052734453
echo off
»
```