DATCOM

AND MATLAB PLOTS

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Running DATCOM

Setting Up the "for005.dat" File

Before DATCOM can be run, the for005.dat file must be created. The specifications and syntax for the file are given in the USAF DATCOM Manual Volume I. An example for005.dat file, for the Navion, is shown below:

```
CASEID NAVION WITH NO ELEVATORS, FLAPS OR AILERON DEFLECTIONS
 $FLTCON
  NMACH=10.0,
  MACH(1)=0.05,0.10,0.15,0.20,0.25,0.30,0.35,0.40,0.45,0.50
  NALPHA=20.0,
  ALSCHD(1)=-4.0,-3.0,-2.0,-1.0,0.0,1.0,2.0,3.0,4.0,5.0,
  7.0,8.0,9.0,10.0,11.0,12.0,13.0,14.0,15.0,16.0,
  NALT=10.0,
  ALT(1)=0.0,1000.0,2000.0,3000.0,4000.0,5000.0,
         6000.0,7000.0,8000.0,9000.0,
  GAMMA=0.0,WT=2750.0,LOOP=3$
 $OPTINS SREF=184.0,CBARR=5.7,BLREF=33.4$
 $SYNTHS XCG=7.03,ZCG=-0.47,XW=5.80,ZW=-2.12,ALIW=0.0,XH=21.64,
  ZH=0.78,ALIH=0.0,XV=23.21,ZV=0.0,XVF=19.76,ZVF=1.25,VERTUP=.TRUE.$
 $BODY NX=18.0,ITYPE=1.0,
  ZU(1)=1.019,1.372,1.490,1.764,2.038,2.078,2.509,2.979,3.136,3.215,
   3.136,2.900,2.470,1.686,1.450,1.215,0.862,0.548,
  ZL(1)=-1.019,-1.372,-1.490,-1.764,-2.038,-2.117,-2.156,-2.195,
   -2.195,-2.195,-2.195,-2.156,-2.117,-1.960,-1.568,-1.176,-0.862,
   -0.392,
  X(1)=0.0,0.314,0.666,2.352,4.077,5.449,6.115,6.939,7.644,8.311,
   9.840,11.055,12.505,14.191,17.327,20.503,23.639,27.755,
  S(1)=3.765,6.422,7.433,9.992,12.799,13.815,15.802,17.685,
   18.552,18.823,18.384,17.130,14.969,10.887,6.881,3.904,2.163,0.125,
  P(1)=6.913,8.999,9.668,11.207,12.683,13.176,14.114,15.019,15.399,
   15.533,15.003,14.765,13.749,11.702,9.299,7.039,5.618,2.292,
  R(1)=1.176,1.490,1.568,1.803,1.999,2.097,2.156,2.176,2.215,2.215,
   2.195,2.156,2.078,1.901,1.470,1.039,0.627,0.078$
NACA-W-6-643-618
 $WGPLNF CHRDTP=3.73,SSPNE=14.43,SSPN=16.70,CHRDR=7.29,SAVSI=1.0,CHSTAT=0.25,
  TWISTA=0.0,DHDADI=8.5,DHDADO=0.0,TYPE=1.0$
NACA-H-6-631-012
 $HTPLNF CHRDTP=2.51,SSPNE=6.19,SSPN=6.59,CHRDR=5.02,SAVSI=6.0,CHSTAT=0.25,
  TWISTA=0.0,DHDADI=0.0,DHDADO=0.0,TYPE=1.0$
NACA-V-6-631-012
 $VTPLNF CHRDTP=1.88,SSPNE=4.39,SSPN=5.02,CHRDR=4.47,SAVSI=13.5,
  CHSTAT=.25,TYPE=1.0$
PLOT
SAVE
NEXT CASE
```

Setting Up the Directory

The directory structure for running the DATCOM program must be set up in a specific manner. The basic DATCOM directory will include a top level folder called "datcom" (ex. C:\datcom). Inside that folder should contain an MS-DOS Batch File named "Datcom" and a folder named "Bin". Inside the folder named "Bin" should be three executable files: DATCOM, Datplot and Plotdat.

Alongside the "Bin" folder in the "datcom" directory should be another folder, preferably with the name of the aircraft being analyzed. The "for005.dat" will be saved inside this folder. Later, after DATCOM is run, more output files will appear in this folder.

The example below illustrates the directory structure, starting with the harddisk (C:\) using the Navion as the aircraft being analyzed:

```
C:\
   datcom\
      bin\
         Datcom.exe
         Datplot.exe
         Plotdat.exe
      navion\
         for005.dat
      Datcom.bat
```

Executing DATCOM

This step is the most important one but is also very technical. Knowledge of the MS-DOS prompt would be helpful.

Ensure that the directory is set up as stated above, and that the file paths (ex. C:\datcom\) are easy to navigate to.

Start up the MS-DOS Command Prompt. This is usually located in the "Accessories" section of the "Start" menu. For this example, the top level "datcom" folder is located in the root of the drive (C:\). It is highly recommended that the same is done to minimize error and confusion (the F:\ is also easy and acceptable).

Once the MS-DOS prompt appears, navigate to the folder where "datcom.bat", the "Datcom" MS-DOS batch file, is located. The letters "cd" mean "change directory" – this needs to be used. The path (everything after the "cd") may be different. An example is shown:

```
> cd C:\datcom
```

The prompt should indicate that the directory has been changed. The "Datcom" batch file can now be run simply by typing "datcom".

```
C:\datcom> datcom
```

Once the batch file has been run, navigate to the folder which contains the "for005.dat" file. In this example, the folder is named "navion".

```
C:\datcom> cd navion
```

Once inside the aircraft folder, type "datcom" once again. DATCOM has been executed.

```
C:\datcom\navion> datcom
```

Output Files

After DATCOM has been run, a multitude of output files are created in the aircraft directory. Along with the for005.dat file, the following files are also created:

```
for006.dat
for008.dat
for009.dat
for010.dat
for011.dat
for012.dat
for013.dat
for014.dat
```

The only files of significant purpose are "for006.dat" and "for013.dat". The "for006.dat" file returns the errors associated with the "for005.dat" file and displays useful aerodynamic data. The "for013.dat" file will become the input file for the MATLAB plotting program.

The MATLAB plotDATCOM Program

The Input File: for013.dat

The "for013.dat" file contains thousands of numbers depending on how much output is specified in the "for005.dat" file. The majority of this output is summarized in the "for006.dat" file.

It is a good practice to check the "for013.dat" file to ensure that there are no "NaN" characters. If these characters exist anywhere in the file, the MATLAB program will give an error. These characters usually appear when there is a calculation error in DATCOM – most likely if the Mach numbers defined in the "for005.dat" file are too high. An example of "NaN" characters is shown below:

```
-1.0000E-30  -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30
        NaN -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30
        NaN         NaN         NaN         NaN         NaN         NaN         NaN
        NaN         NaN         NaN         NaN         NaN         NaN         NaN
-1.0000E-30  -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30 -1.0000E-30
```

Running plotDATCOM

The plotDATCOM program is a MATLAB GUI file. Three files should always be in the same directory when executing the program: plotDATCOM.m, plotdatgui.m and plotdatgui.fig. Some computers may not display the ".m" and ".fig" extensions.

Start up MATLAB, since these files need to be run from within it. Once MATLAB has loaded, navigate to the directory where the three files mentioned above are located.

Once the directory are listed, type "plotDATCOM" in the MATLAB command window. The following window should appear. This window will be referred to as the "main screen."
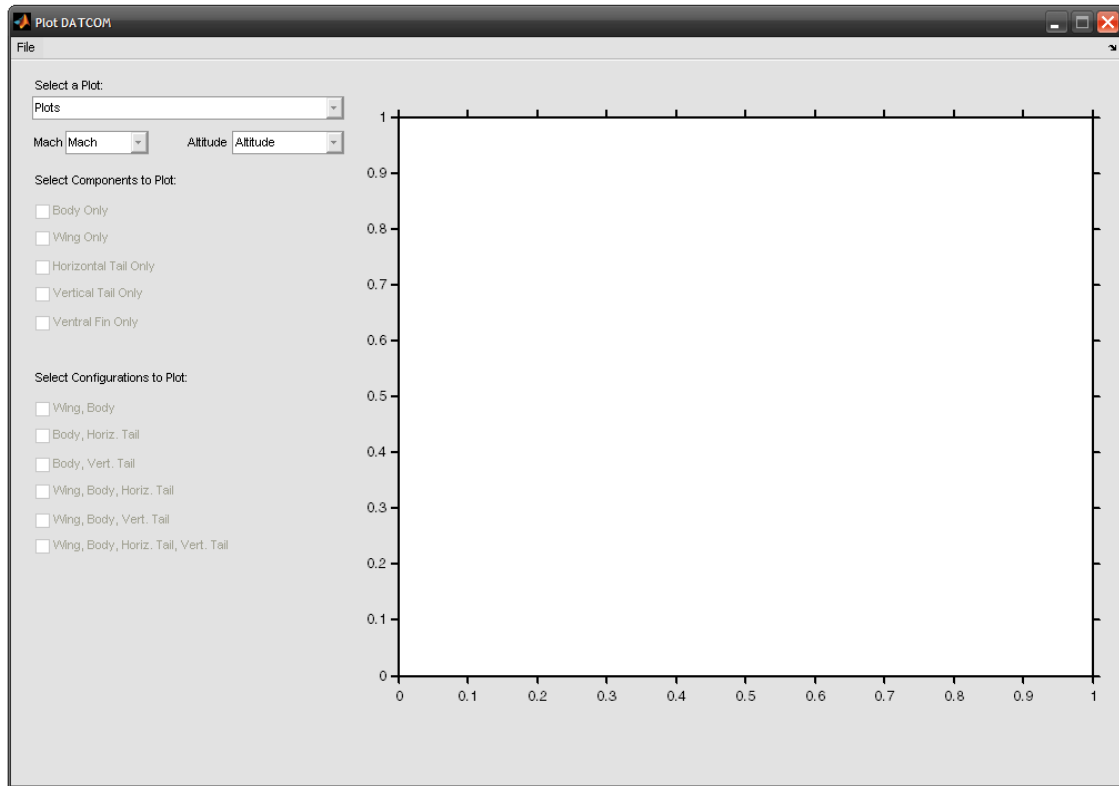
## Loading the "for013.dat" File

The next step after executing the plot program is to load the input file. The input file is the "for013.dat" file that was created earlier.

To load the file, go to the menu bar and click "File". Then select "Load DATCOM file…". An Open Dialog Box appears, as shown on the next page.

Navigate to the aircraft folder which contains the "for013.dat" file. For this example, the path is C:\datcom\navion. Then select the "for013.dat" file, and click "Open".
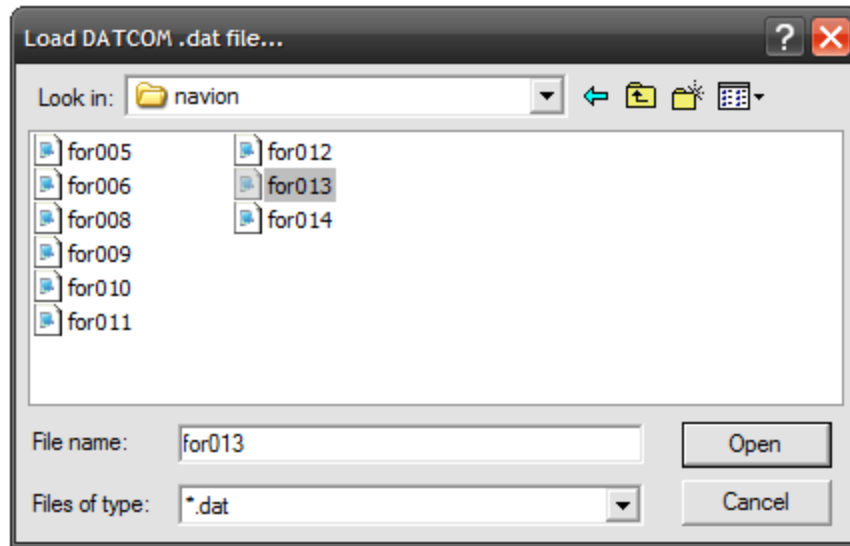
Viewing the Plots of the Components

If the file loaded correctly and no error was given, then the checkboxes on the main screen will become active and the dropdown menus for Plots, Mach, and Altitude will fill with text and numbers.

Presently, the following plots can be chosen:

```
1.  Drag Coef. vs. AOA
2.  Lift Coef. vs. AOA
3.  Pitching Moment Coef. vs. AOA
4.  Normal Force Coef. vs. AOA
5.  Axial Force Coef. vs. AOA
6.  Lift Curve Slope vs. AOA
7.  Pitching Moment Coef. Slope vs. AOA
8.  Side Force Coef. Deriv. vs AOA
9.  Yawing Moment Coef. Deriv. vs. AOA
10. Rolling Moment Coef. Deriv. vs. AOA
11. Pitching Moment Coef. vs. Lift Coef.
12. Lift Coef. vs. Drag Coef.
13. Normal Force Coef. vs. Axial Force Coef.
14. Normal Force Coef. vs. Pitching Moment Coef.
15. Dynamic Pressure Ratio vs. AOA
16. Downwash Angle vs. AOA
17. Downwash Gradient vs. AOA
```

First, a plot should be selected from the drop-down menu. Second, a Mach (if available) and/or altitude should be selected.

Then the component checkboxes can be selected. The program automatically plots the various components as they are selected. However, certain plots limit the components than can be plotted.

The following illustrates a plot:
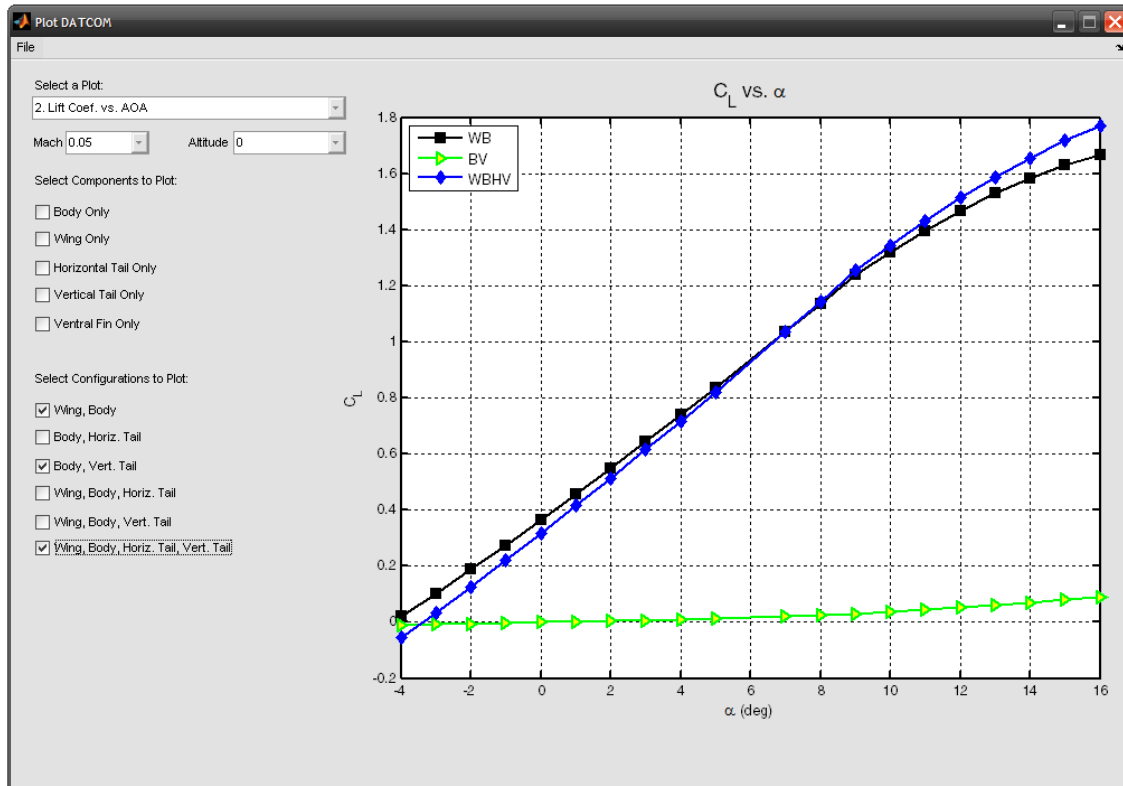
Exporting Plots

Plots can be exported to another MATLAB figure window where they can be copied and printed.

To do this, select the plot, mach, altitude and components that will be plotted. Then go to the menu bar and select "File". Then select "Export Plot..." A traditional MATLAB plot window appears where the figure can be manipulated, annotated, copied and printed. An example window is shown: