

DATCOM+ User's Manual

Windows Version

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Our cows are out standing in their fields!

1. Introduction

This manual will show you how to install and use the Digital Datcom program (and its variant DATCOM+) on your PC. Note that there are two different versions of this manual, one for Windows and one for Cygwin/Linux. Currently, it is designed to operate under following operating systems and variants:

- **Windows XP, 2000 SP4**
- **Windows Vista**
- **Cygwin**, operating under Windows XP or Vista. Cygwin is a free Linux-like environment for Windows XP
- **Linux** – Program is compiled under Debian.

Digital Datcom (or **Datcom**) refers to the original computer program of the United States Air Force. **DATCOM+** refers to the packaging modification to the original Datcom program to make the program more user-friendly (or at least less user-abusive), including a new front end which permits comments in the input file, and various output formats.

Digdat is the name of the actual program that runs to process your data file, and generates the aerodynamic coefficients.

2. Disclaimers

DISCLAIMER REQUIRED BY HQ USAF FOR PUBLIC RELEASE APPROVAL OF DIGITAL DATCOM:

THIS SOFTWARE AND ANY ACCOMPANYING DOCUMENTATION IS RELEASED "AS IS". THE U.S. GOVERNMENT MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THIS SOFTWARE AND ANY ACCOMPANYING DOCUMENTATION, INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL THE U.S. GOVERNMENT BE LIABLE FOR ANY DAMAGES, INCLUDING LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE, OR INABILITY TO USE, THIS SOFTWARE OR ANY ACCOMPANYING DOCUMENTATION, EVEN IF INFORMED IN ADVANCE OF THE POSSIBILITY OF SUCH DAMAGES.

Furthermore:

Holy Cows, Inc. in no way warranties or means to imply that this program is suitable to do anything other than to take up disk space. Reasonable attempts have been made to keep from trashing your system, but that doesn't mean it won't. Any and all actions and results of the program are the responsibility of the user. If you are worried about it, don't use this program at all.

3. Installation

3.1 Notepad++

It is strongly suggested that you install Notepad++ before you install Datcom. Notepad++ is a FREE context-sensitive editor that will highlight keywords, dim comments, etc. It makes for a nice editor for Datcom files.

You can find the installation program at

<http://notepad-plus.sourceforge.net/uk/site.htm>

Note that if you do NOT install Notepad, Datcom will still run, although a couple of the right-click menus will not be very satisfying when you select Edit with Notepad++. This is a minor bug that might get fixed one day.

3.2 Windows XP and Vista

Download the datcom_install_xp.exe or datcom_install_vista.exe program and run it. Currently, the only difference between the two is where it installs the Datcom directory. It will install the Datcom directory under your personal directory (My Documents\datcom on Windows XP, Users\yourname\datcom under Windows Vista). For Vista, do NOT change the installation directory to **Program Files**. It doesn't run under that directory properly, at least not right now.

Once installed, it will place a shortcut to the Datcom directory on your desktop.

4. What does DATCOM+ consist of?

You have installed executable and script files in a directory where they are visible from whatever directory you navigate to, and a directory of Datcom related files.

datcom
 bin
 doc
 examples

Looking at the **examples** directory that was created, you will note several files with the extension “**.dcm**”. That is the extension associated with the DATCOM programs for the input files. The file that is probably the most complete as of this writing is the **citation.dcm**, so it will be used in these examples. A few other files are also included, so that you can see the variations with different aircraft. Try them out for yourself, and look at the AC3D model (**.ac**) that is created.

Look at the **citation.dcm** file in your favorite editor. If you have Notepad++ installed, right-click on the file and select **Edit with Notepad++**. The **citation.dcm** file was designed to allow you to read it and maybe understand it, even though the Datcom notation might be difficult to read and understand. It consists of comment lines, that start with “*”, and there are also Datcom commands, some of which **MUST** start in column 1, and some of which start in column 2 with a \$, followed by a common block name, such as **FLTCN**. If it starts with a \$, it has to end with a \$.

It is **HIGHLY** recommended that you use an existing template such as **citation.dcm** for your work. This template contains some unique structuring in it that is required for DATCOM+ to generate all of the coefficients correctly. It also comes in handy if you have to ask for help, as it is difficult to read just the Datcom input file without any comments. You can just change the values in that file to your aircraft’s value, or copy the line, comment out the value from the Citation, and put your value in.

IMPORTANT NOTE: Significant (non-comment) lines in your Datcom input file **MUST** be shorter than 80 characters.

You will need to look at the **Digital_Datcom_Users_Manual.pdf** file, **AFFDL-TR-79-3032, The USAF Stability and Control DATCOM, Volume 1, User’s manual**, which is the original user’s manual that came with the Digital Datcom, published by McDonnell Douglas Astronautics Company in April 1979, and updated by Public Domain Aeronautical Software in December 1999. It contains pictures to explain some of the values. It’s not worth printing it out, but have the soft copy available. You will find it on the www.holycows.net/datcom web page as a separate download.

To start the processing of an input file, one merely double-clicks on a **.dcm** file in Explorer. In a few moments, that directory will have four files added to it if it was successful, otherwise there will be several.

The first program that is called in the **datcom** script is **predat.exe**. This program reads your input file, a file with the extension “**.dcm**”, such as “**citation.dcm**”, and does several things to it:

1. Strips off all comment lines, likes that start with “*” or “#”
2. Restructures the input file into separate cases for flaps, ailerons, elevators, etc., if necessary. Some simpler models only have the wing, fuselage, and tail defined.
3. Stores all of the significant commands in the file FOR005.DAT, which is the input file to the Datcom program.

The second step sounds simple enough, but really is significant. Datcom allows multiple cases to be built in one file, but has limitations on what processing it can do in each case. You also have to know what items you can SAVE for the next case, and what items that you can't. For example, when one of the flaps type is defined, Datcom places this on the aft-most horizontal surface. So, if you have already defined your elevator, adding flaps to the wing would place them on the horizontal tail, not the wing as desired. **Predat** takes all of the statements in and structures multiple cases to avoid such problems. It will build a case with the fuselage, wing and trailing edge flaps, one with fuselage, wing, and leading edge flaps, one with fuselage, wing, and horizontal stabilizer with elevator, etc., for the surfaces that you have defined as being present. **Predat** allows you to define the configuration once, and it handles breaking the aircraft up into management pieces.

Once the **predat** program has run and has built the FOR005.DAT file, the **digdat.exe** program is called. This is the same name and format as the original Datcom program **digdat.exe**. Because the input name and format have not changed from the original **Datcom** program, you can use an old version of that program if you have one, or use input files originally designed for that program. However, if you use the old program, you won't get the extra output formats like LFI and XML

The DATCOM+ version of Datcom (**digdat.exe**) has modified the back-end of the Datcom program, to provide multiple output formats. The following files are output:

- **{Aircraft}.out** – This is the original output format of the Datcom program. It shows the input lines, and LOTS of output tables. These tables are informative, but are generally in 132-column format, which makes them difficult to read or print. If you have problems with your own Datcom model file, this is a good place to look, as it will list errors that it encounters, and if it aborts, tells you where it aborted.
- **{Aircraft}.xml and {Aircraft}_aero.xml** – These files are in the input format necessary for JSBSim, which is also used by FlightGear. Since the Datcom program only provides stability coefficients, the aerodynamics section in the

{aircraft}_aero.xml file is the only one with significant data in it. There are many lines in the other file that are parameters listed here that might not have values in them that you will have to provide in order to be able to use this file with JSBSim or FlightGear, but it has formatted all of the coefficient data nicely for you. The **_aero.xml** file format is read by **jiff.exe**, a program for plotting coefficient data.

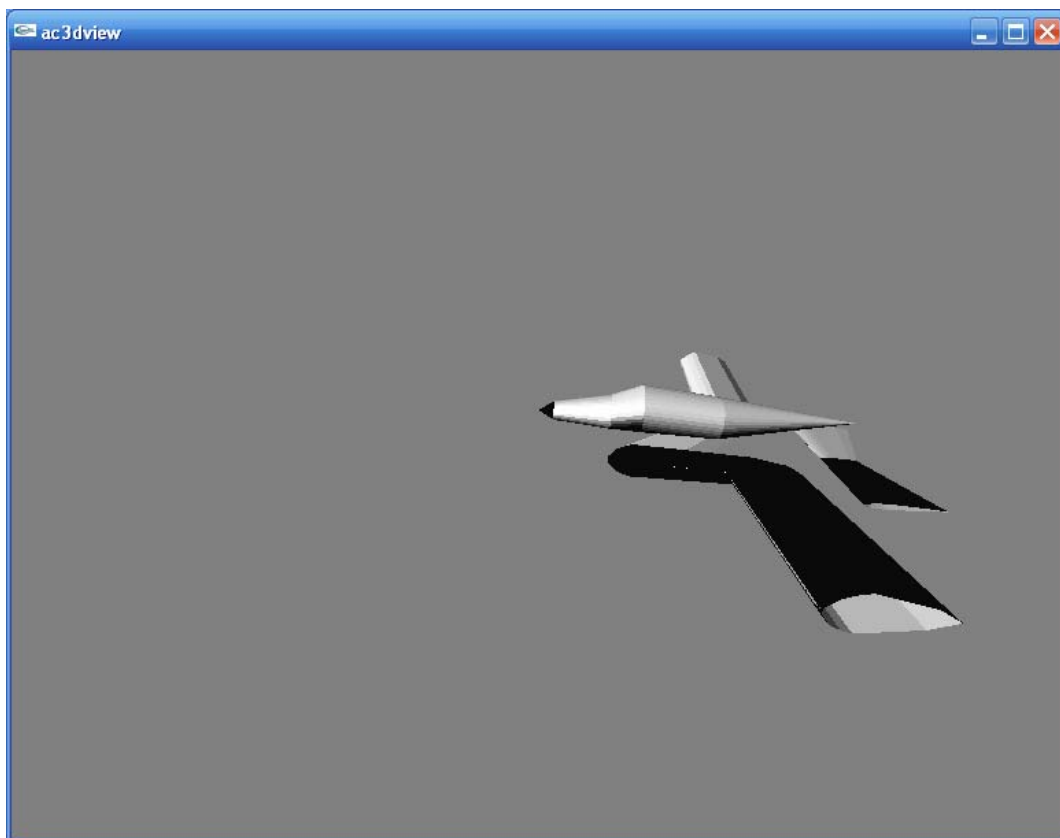
- **{Aircraft}.lfi** –This file format is a Holy Cows Inc. format (which you are free to utilize) called free-format table. In it, the table name, independent variables, and data values are all pretty easy to determine. Many years ago, I used this format for Linear Function Interpolation (LFI) tables in my simulation programs. It hasn't been used much lately, but the format has remained because of a program called **lfipplot.exe**, which will plot these tables. More on that later.
- **{Aircraft}.ac** –This file is in the AC3D format, a graphical format for viewing three dimensional objects. It is used by FlightGear to visualize the aircraft model, and rather than just providing a static view of a three-dimensional object or a 3-view (top, side, and front), it allows you to rotate the model around and look at all angles. If you have a favorite AC3D viewing program, this file should work in it. There is also one that is packaged with Datcom, called AC3Dview. More on that later.

5. When things go wrong

Sometimes, things don't come out right. Yeah, it happens once in a while. The first place that I recommend you checking is the **{aircraft}.out** file. It shows the inputs that it used and the outputs that it generates. If there were a problem with the input file, that would be flagged and execution would stop. The other thing to check in this file is the output tables. You can look at these tables, and although you won't get a complete picture of what the values are, look to see if they make sense. You might see **NaN** in some fields. This stands for **Not A Number**. This is a bad thing. That probably means that it accepted your input file as value, but the values were really wrong. You might have to go back through your input file and make sure that the values are correct. I've seen times when someone new will mix metric and standard (meters and feet) values in the same file. That's not a good thing.

Another thing that you can check is the picture that is generated in the file **{aircraft}.ac** (for example, **citation.ac**). Sometimes the airplane just doesn't look right. For the bad example of mixing feet and meters, the fuselage was **VERY** short, which lead us to the mixing of units. The display might not be perfect, as fuselages don't seem to be coming out correctly right now, especially non-circular cross-sections or ogive tails.

Here is an example of when things go wrong:

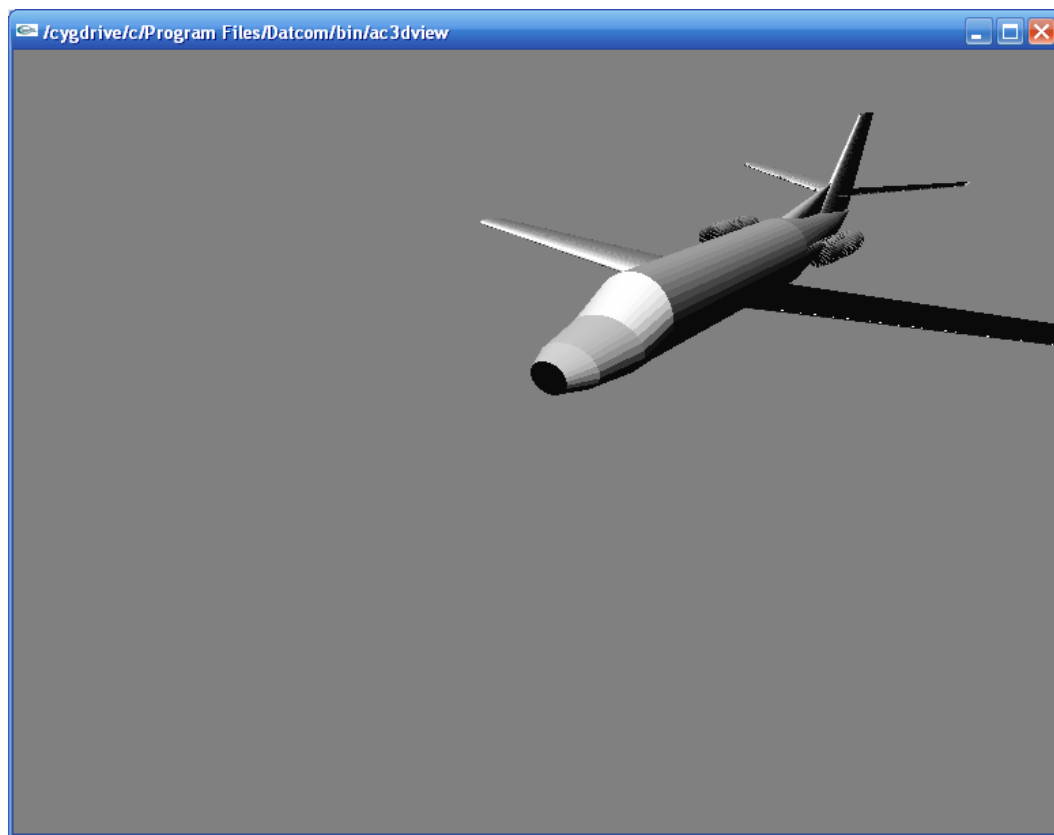


6. Viewing your Output

After you have gone through the long process of inputting all of your model's parameters, you are anxious to see the results of your hard work. Let's look at each one of the outputs to see what they provide:

6.1. AC3D format

One of the files generated is the **{aircraft}.ac**, such as **citation.ac**. There are several AC3D viewing and editing programs, one of which is included with the DATCOM+ distribution package. To use it, from Explorer double-click on the **.AC** file. The output may look something like this.

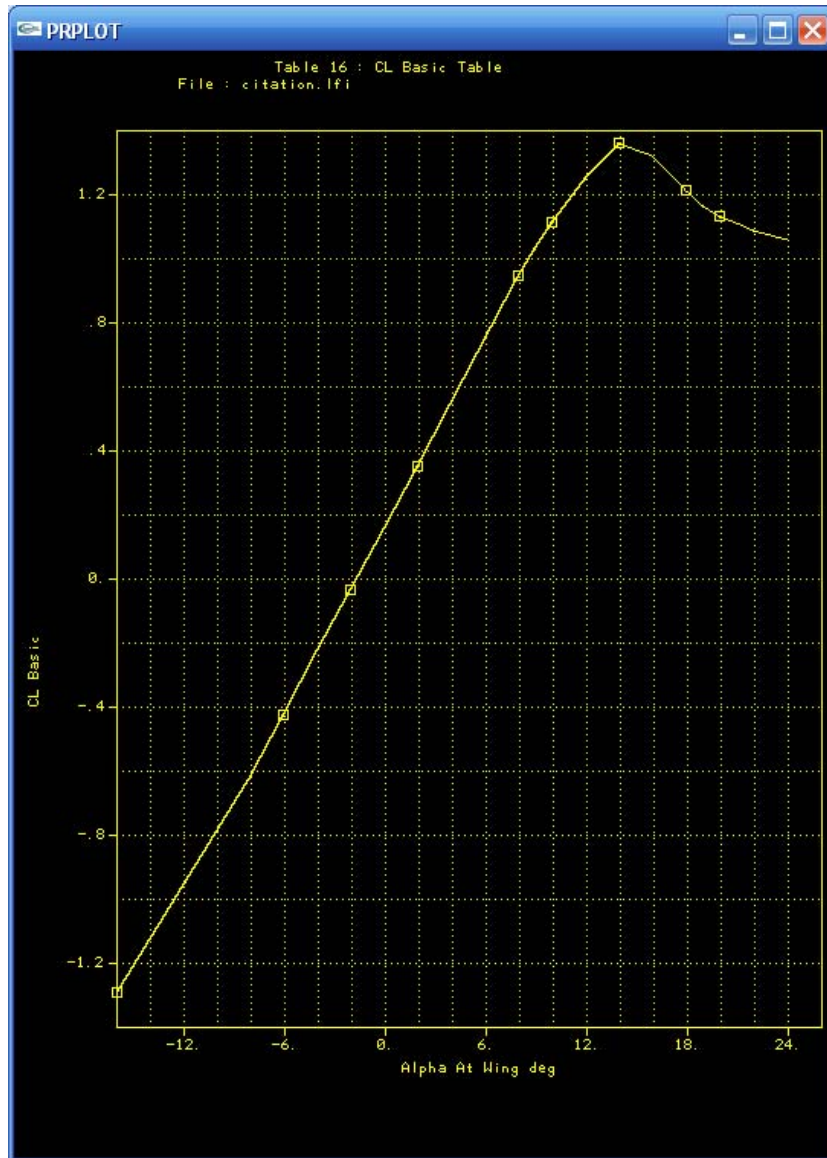


Check the command screen output (which may be hidden) for commands to move about the model. To close this window, press ESC or click on the **X** at the top right corner of the screen.

6.2. LFIPLLOT

LFIPLLOT allows you to plot the dependent and independent variables on nice graphs, to the screen. To view, just double-click on the **.LFI** file.

An example of LFIPLLOT output is shown below. Press **PG DOWN** or **PG UP** to switch between the plots, as there are many of them. Press **ESC** to exit out of this program.

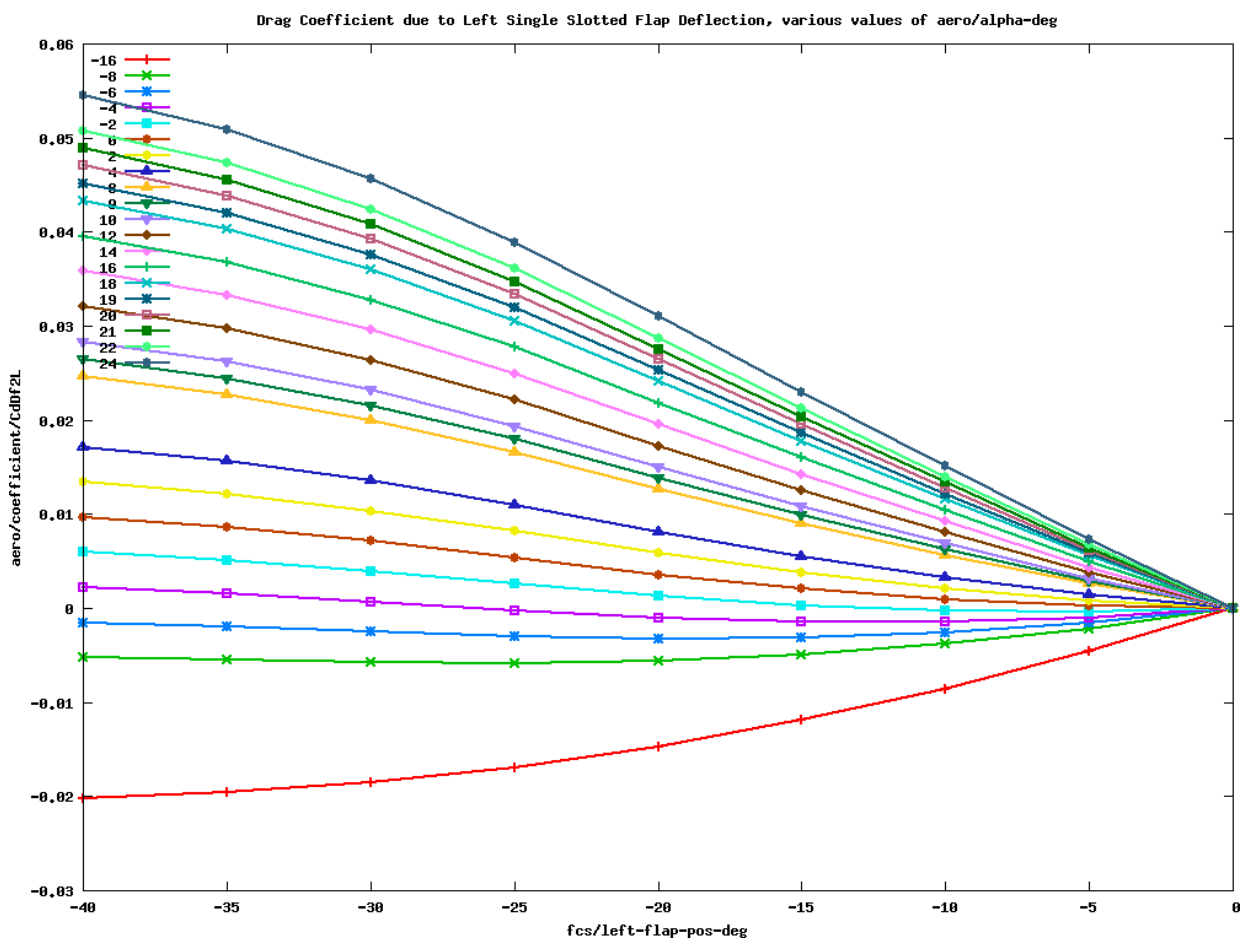


6.3. JIFF

JIFF, or JSBSim Input File Formatter, was written by Agostino De Marco. It reads a JSBSim configuration file **.xml** that Datcom produces and generates commands for the **gnuplot** program. Gnuplot is a non-interactive plotting routine that generates plots in many different formats, one of which is the **png** format.

Again, all you have to do here is double-click the **{aircraft}_aero.xml** file. You can also just double-click the **{aircraft}.xml** file, which should produce the same results.

The plots are generated in the subdirectory **{aircraft}.jiff**. You can view, import them into reports, or print them. This is an example of a plot that is generated by JIFF.



7. Miscellaneous

If you have any problems or suggestions, you can email them to billg@holycows.net. Put the word 'DATCOM' in your subject line so that my spam filter doesn't delete it.

I encourage you to join the Digital Datcom group at Yahoo. There you will find installation packages, more information, and maybe even some help with your problems. The web address is :

http://tech.groups.yahoo.com/group/digital_datcom/

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