# DATCOM+ User's Manual
## Linux 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
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THIS SOFTWARE AND ANY ACCOMPANYING DOCUMENTATION IS RELEASED "AS
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WILL THE U.S. GOVERNMENT BE LIABLE FOR ANY DAMAGES, INCLUDING LOST
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ARISING OUT OF THE USE, OR INABILITY TO USE, THIS SOFTWARE OR ANY
ACCOMPANYING DOCUMENTATION, EVEN IF INFORMED IN ADVANCE OF THE
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```

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

### Cygwin and Linux

**These** installation instructions presuppose that you have already installed Cygwin onto your PC. If you have not, see Appendix A of this manual. It is not difficult package to install, but it does require a decent internet connection.

To install Datcom, download the package datcom_cygwin.tar and store it on under your Cygwin structure. If Cygwin is installed on your C: drive and your name is Bill (mine is), the path to your home directory will be c:\cygwin\home\Bill. Your name may be different. Store the datcom_cygwin.tar file in your home directory, or another similar directory.

Go **out to your** home directory, or wherever you stored the tar file and type:

**tar xvf datcom_cygwin.tar**

This will extract the files stored in the tar file, which include a directory of DATCOM related files, and another tar file (datcom_bin.tz) containing the DATCOM and associated executable programs and processing script. To extract the executables and store them in their proper local (/usr/local/bin), just type:

**tar xvzPf datcom_bin.tz**

If you don't have access to /usr/local/bin or don't have the root password, you will have to extract these files with:

**tar xvzpf datcom_bin.tz**

(note the lower case 'p'), which will extract these files to your local directory, in /usr/local/bin, and you will have to put these files somewhere in your path.

## 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**
- **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. 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 **FLTCON**. 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, from the command prompt one types in:

datcom filename

You can leave off the .dcm extension if you wish, to make it easier. For example, either of these commands is valid and are equivalent:

**datcom citation.dcm**
**datcom citation**

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 **predate** 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 **lfiplot.exe**, which will plot these tables. More on that later.

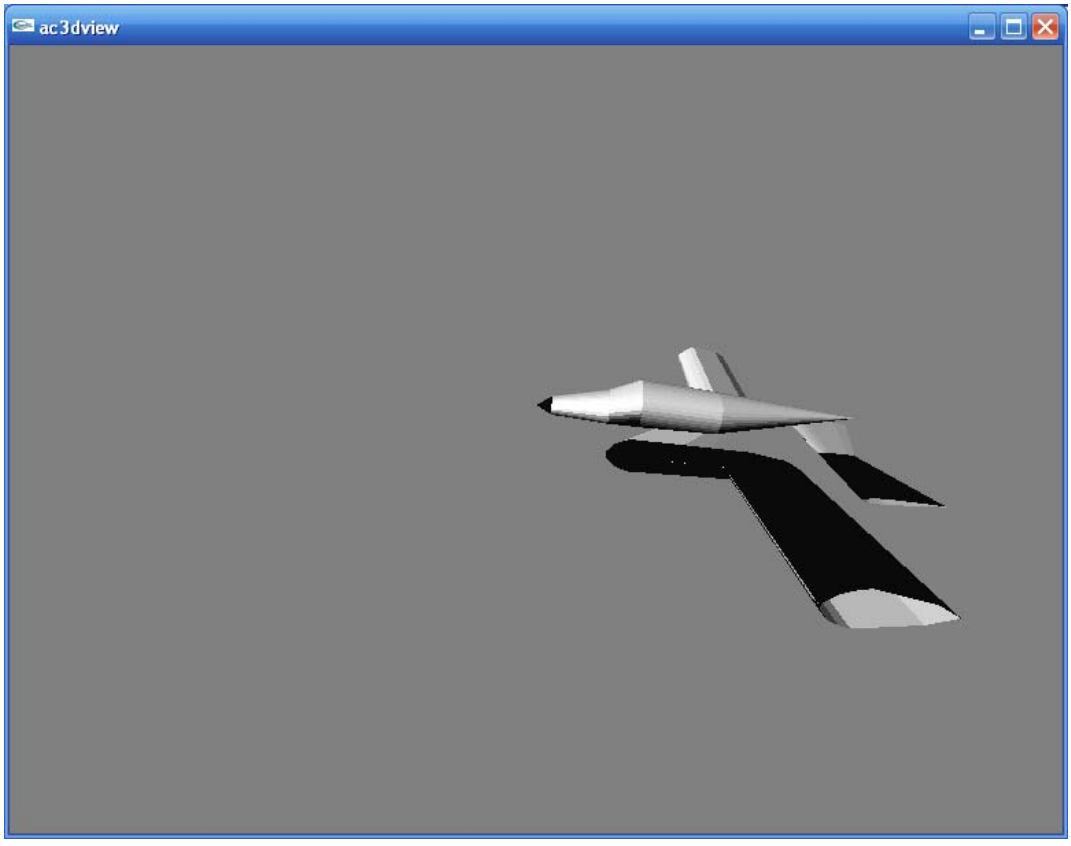
- **{Aircraft}.ac –**This file is in the AC3D format, a graphical format for viewing three dimensional objects. It is used by FlightGear to visualize the aircraft model, and rather than just providing a static view of a three-dimensional object or a 3-view (top, side, and front), it allows you to rotate 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:

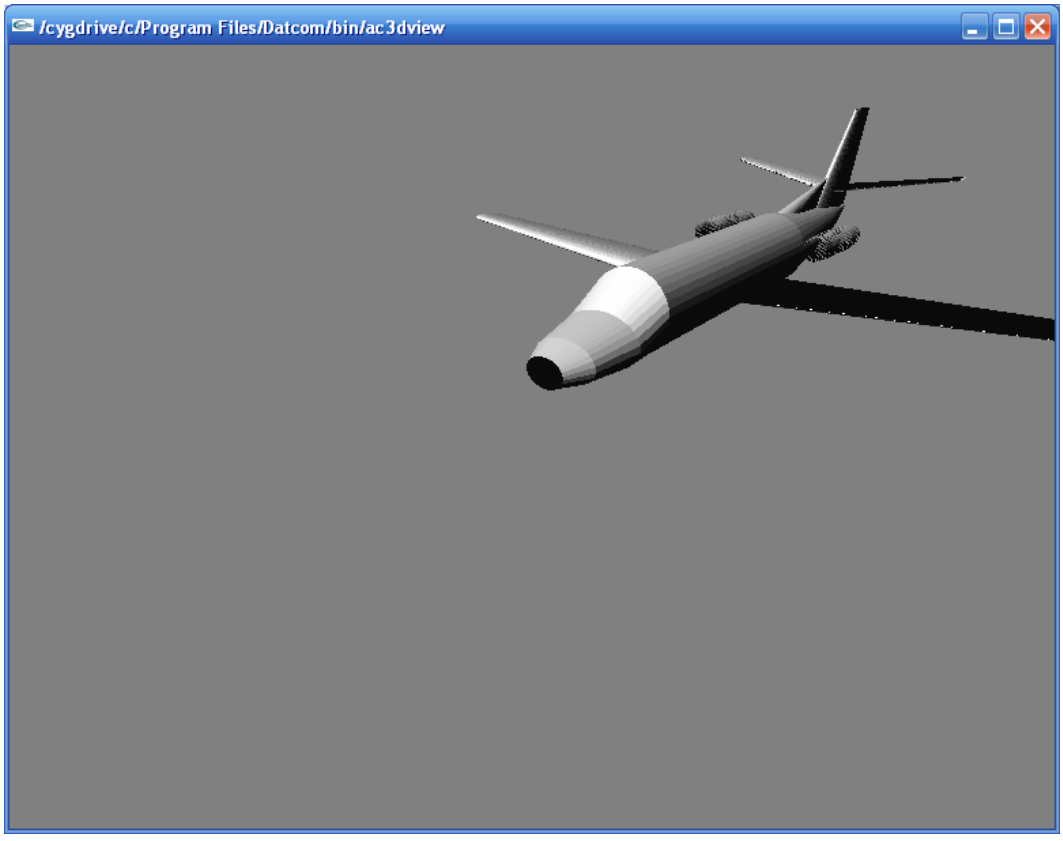
### 6.1. AC3D format

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 the command prompt, simply **type:**

**ac3dview {model}.ac**

example: **ac3dview citation.ac**

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.

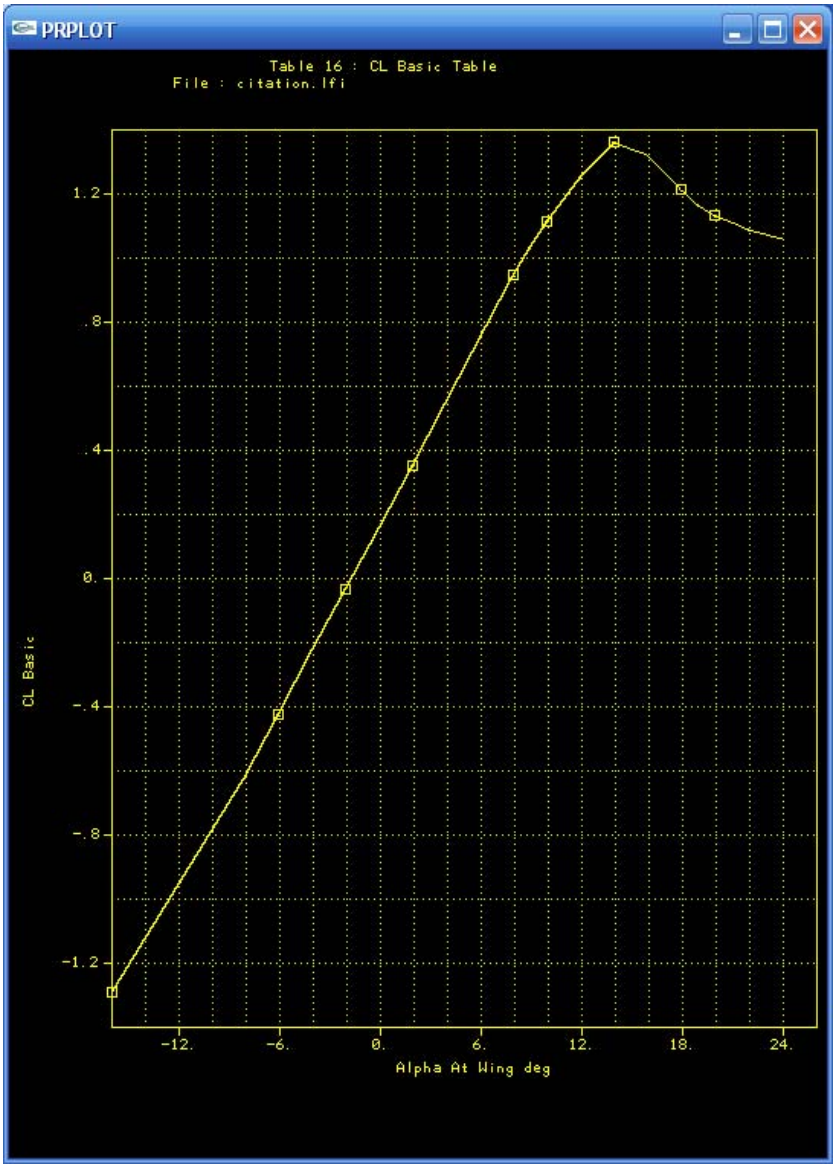
## 6.2. LFIPLOT

LFIPLOT allows you to plot the dependent and independent variables on nice graphs, to the screen. The command is:

Lfiplot {model}.lfi

Example: **lfiplot** citation.lfi

An example of LFIPLOT 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.



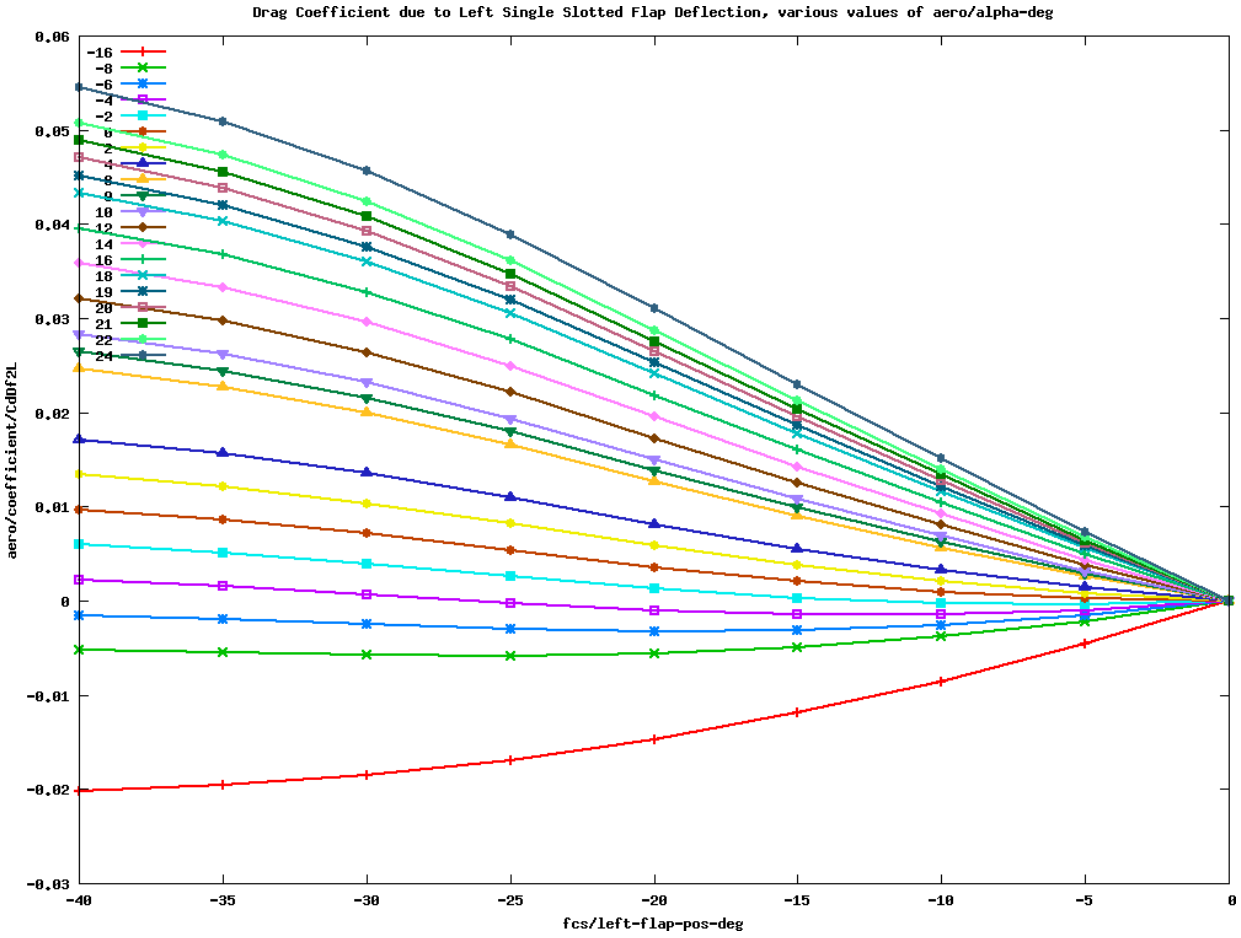
### 6.3. JIFF

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.

Type:

```
jiff  datcom.xml  -g png  -G  c:/cygwin/bin/gnuplot.exe
```

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/

A big thank you goes out to the following people for their help and support:

- Agostino De Marco, for a great JIFF program.
- Dipl.-Ing. Jan Nowack and Dipl.-Ing. Andreas Gäb, Lehrstuhl für Flugdynamik, RWTH Aachen, Wüllnerstr. 7, 52062 Aachen, for their Windows installation program (that I modified), and for identifying bugs and other issues.
- Torsten Dreyer for his work on the Seneca II model, and for identifying problems with DATCOM+
- Of course, all those people that put in THOUSANDS of hours on the original Data Compendium, and the computer program Digital Datcom.

# Appendix A

## Cygwin Download and Installation

### I. Cygwin Download

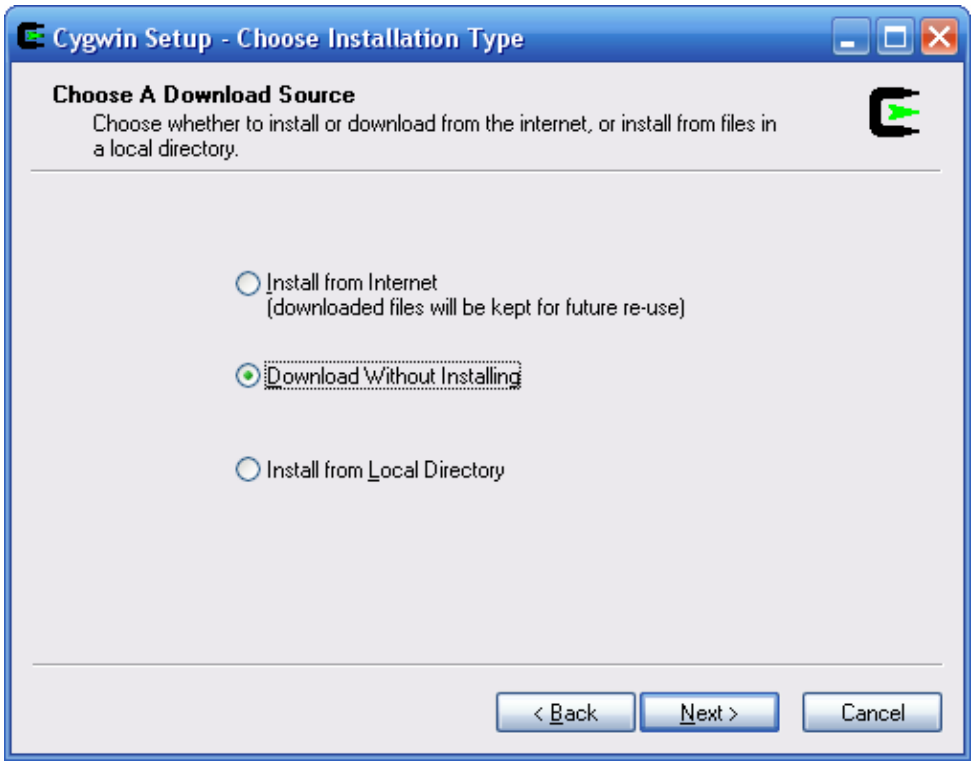
**Purpose:** This document will detail how to download the latest version of Cygwin and build an installation package for use by yourself and others. It's a good idea to install Cygwin in a two-step process like this, so that you have the packages that were used to install your Cygwin, should you ever need to reinstall it. If you don't care about that, you can remove the installation files after Cygwin is installed.

**Introduction**: Cygwin is a linux-type environment for Windows. You should be able to run most or all Linux commands under Cygwin. You cannot run an application that was built under Linux, but if you have the source, you can compile it under Cygwin. There are many books on Linux commands and packages available, for money and for free.

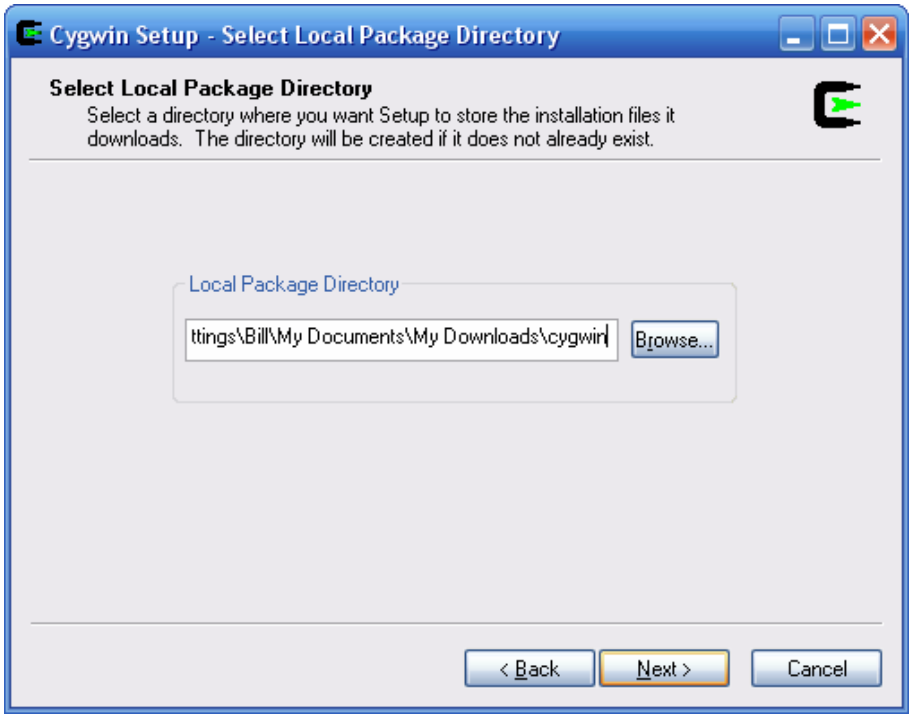
1. Go to www.cygwin.com and download the setup program setup.exe. This file should be saved on your local hard drive, as it will be used later for the student installation package.

2. Start the setup.exe program. Click N**ext**.

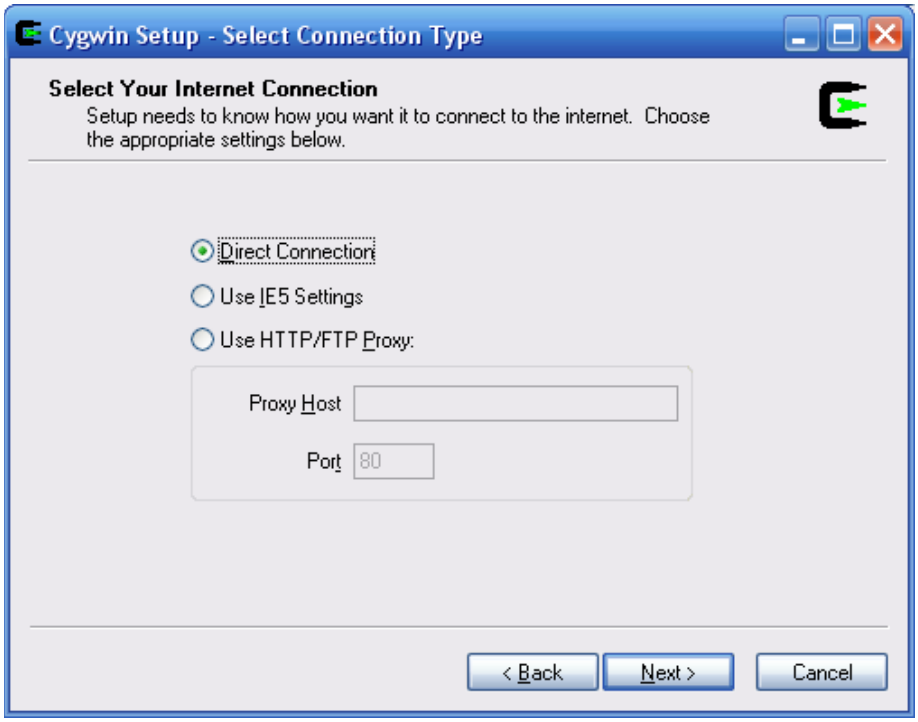
3. At this screen, select the **Download without installing** option and press **Next**.



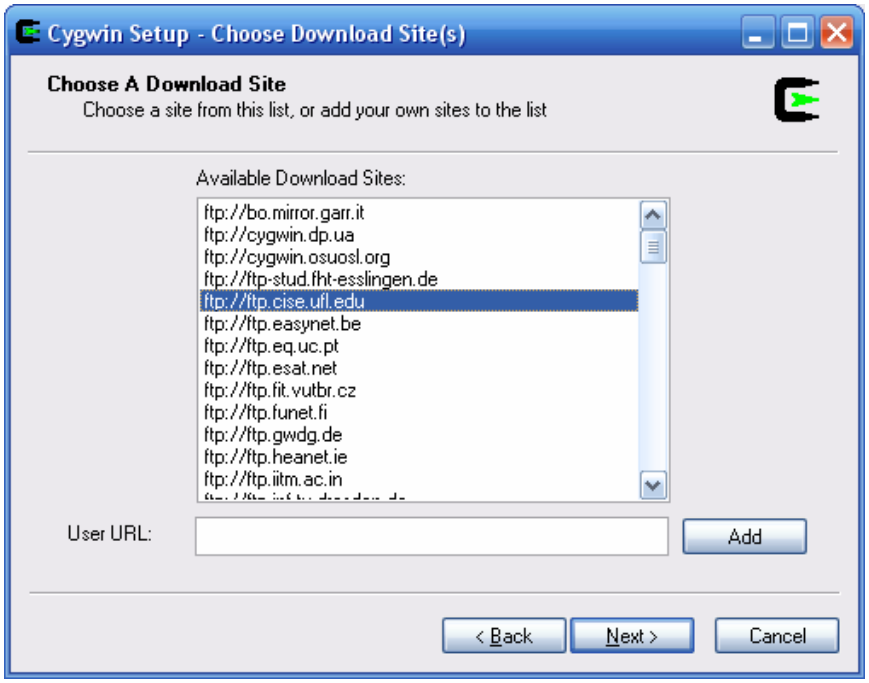
4. At this screen, select where the files will be saved when they are downloaded. I added '**cygwin**' to the end of the default path when I did it.



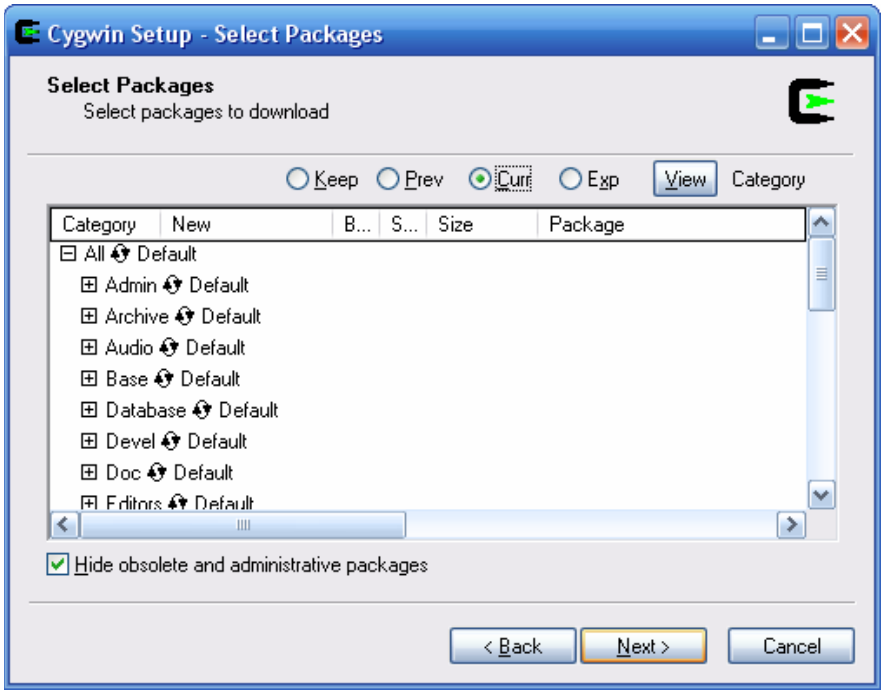

5. At this window, accept the default selection unless you need to make some other selection, and select **Next.**



6. This screen will give you a list of places that have the download packages. I chose the server at University of Florida because it is near me. You might need to chose another server if UFL is down, or have problems with it. Click **Next**.




7. This screen is where we select which packages we want installed or not installed. I have my own suggestions, but you might find that this list needs to be adjusted. The screen looks like this:



You can expand the list of packages within a group by pressing on the boxed PLUS sign. Select or deselect a package by clicking on the icon with the circle and two arrows, or on the package version ('skip' if not installed). The list of package to include above the default include:

**Archive** – unzip, zip
**Devel** – binutils, gcc, gcc-core, gcc-g++, gcc-g77
**Editors** – vim
**Graphics** – ghostscript, ghostscript-base, gnuplot, gv
**System** – util-linux

When you click on a package, it might have dependencies on other packages, which it will include automatically for you. Click **Next** after you have selected all of the appropriate packages. All of your packages will now download to your hard drive. This might take a while. If you took too long to select the packages (I don't know how long the time out is, but it happened when I was building this document, you might have to restart the setup.exe program. Your previously selection path will remain, but you will have to reselect the packages.

8. You have now downloaded all the packages necessary to load Cygwin on a local computer, without requiring a download from the internet.

9. Go out to your local hard drive location where you downloaded the files ('**My documents\my downloads\cygwin**' in my case). Copy the setup.exe program here. You can remove the two setup files '**setup.log**' and '**setup.log.full'**. You will be left with the setup program and a directory that looks like '**ftp%3a%2f%2fftp.cise.ufl.edu%2fpub%2fmirrors%2fcygwin**'

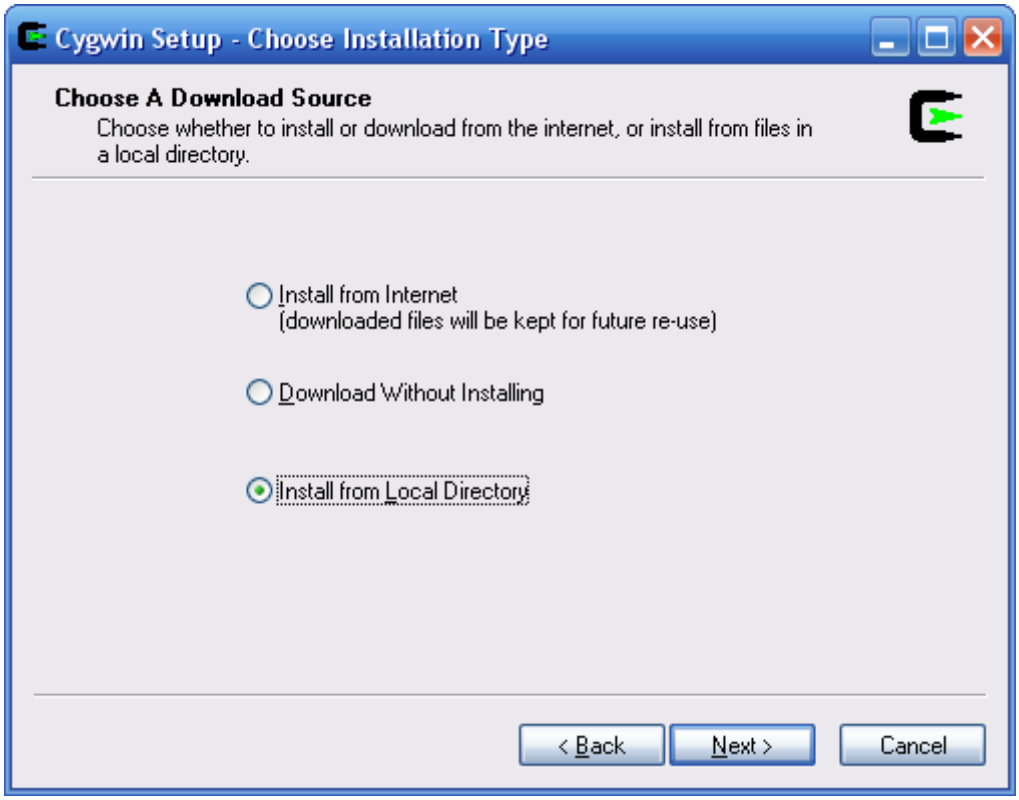
10. Move this entire directory to a place on your network. I might suggest a naming convention like '**Cygwin Installation - current'** or '**Cygwin installation – Fall 2007'**, so that in the future, when you redo this, you can retain the previous installation, which has date stamps on all of the files.

## II. Installing Cygwin

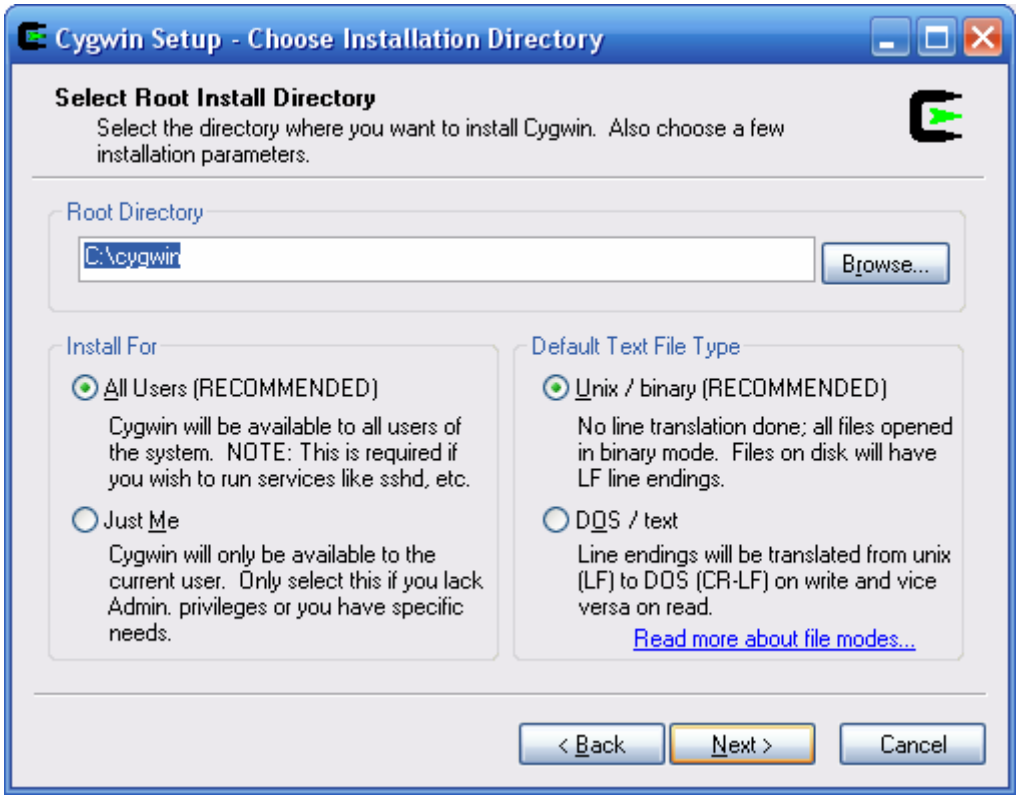
**Purpose:** This document will detail how to install the latest version of Cygwin. This presumes that the Cygwin packages have already been downloaded onto your network.

1. On the network, find the '**cygwin'** directory that contains the setup.exe and installation packages. Start the **setup.exe** program. Click **Next** at the first window.

2. At this window, select '**Install from local directory**' and click **Next**.

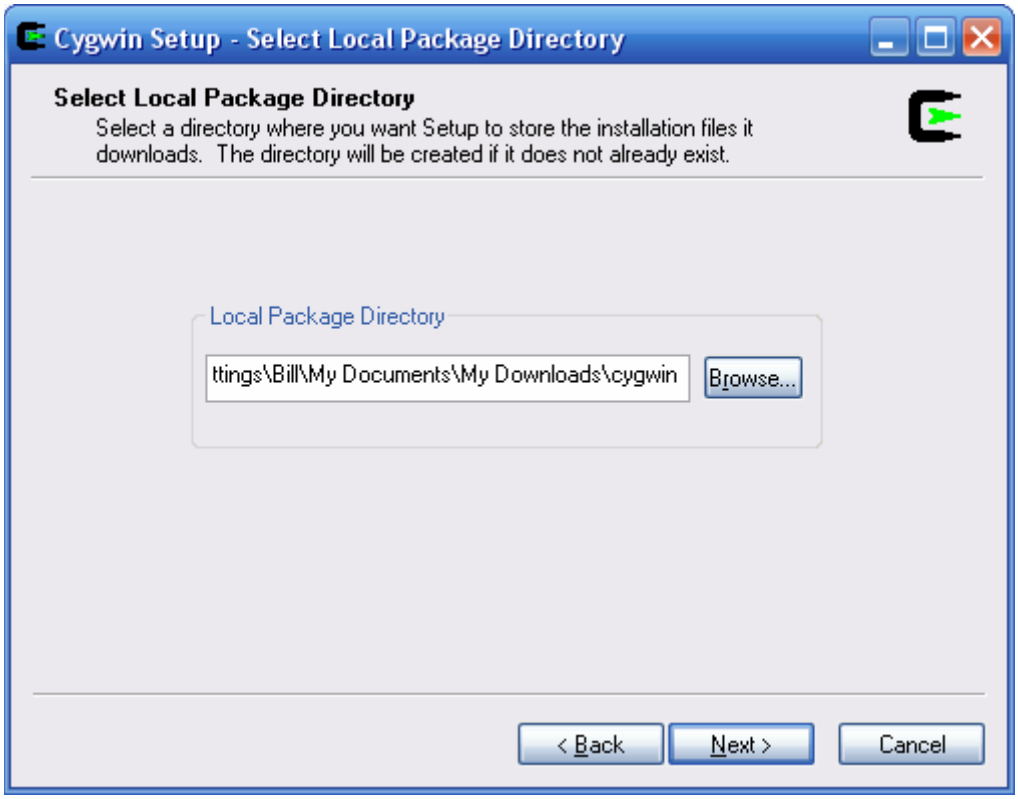



3. At this window, you can use the default values, or change as required for your particular installation. Click **Next**.

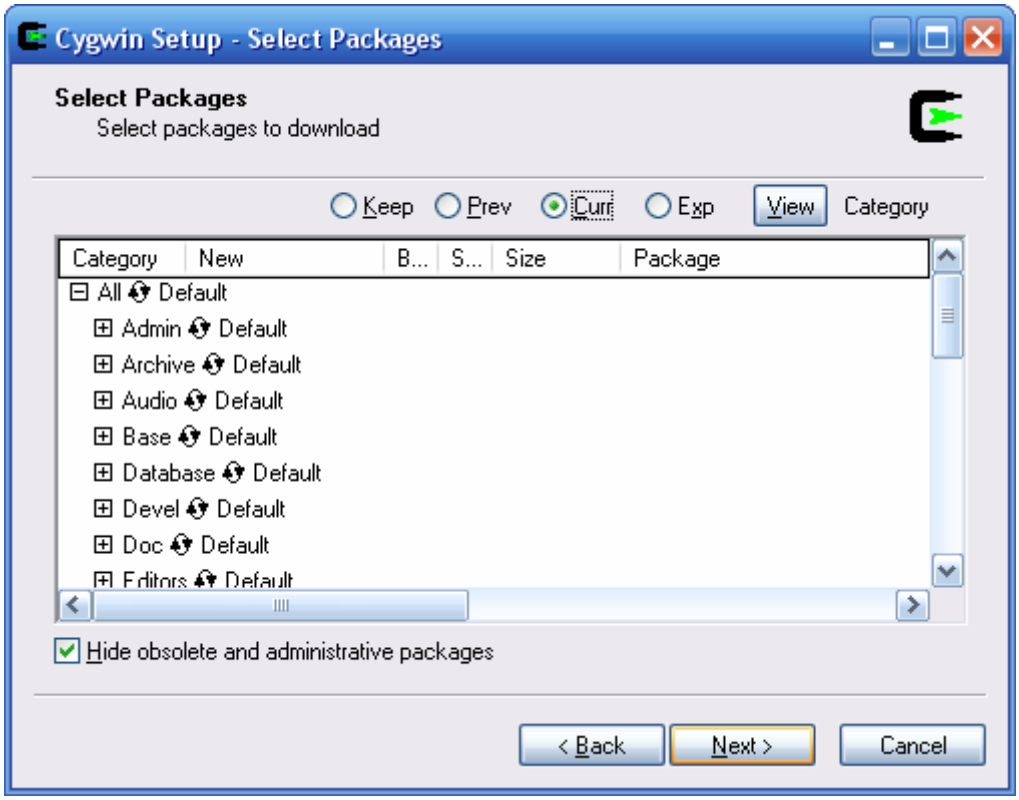


4. The next window is just WRONG. The local package directory that you want to select is where the files are current;ly stored, not where they WILL be stored. Browse out to your network location there the files are stored ('**K:\Installation\Cygwin**' in my case). The SECOND time that someone installs for this location, it should be the correct location, but better safe than sorry.

   **IMPORTANT NOTE:** If you don't go out to the proper location, the setup.exe program hangs up, and is really nasty to kill, and you won't be happy.




5. At this window, select the list of packages to be installed. Just click on the word '**Default**' to the right of '**All**', and it will install all the local packages. This takes a few minutes.




6. At this window, we will use the defaults, and click **Next**. Installation is now complete.

7. Double-click on the Cygwin icon on your desktop. It will open up a text window and execute a few commands automatically. Nothing to be worried about. You now have Cygwin, a powerful Linux-type environment installed on your computer. The following are simple command to help you with this environment:

    a. **ls** – directory listing ('**dir**' also provides the same output). Options include:
        i. –l : long format
        ii. –a: list all files
        iii. –t: sort by date
        iv. –r: reverse the order

        So, the command '**ls –alrt**' will list all files, in a long format, sorted by reverse date order

    b. **cd** – change directory. Directories are separated by '/'. Options include:
        i. ~: return to your home directory
        ii. -: return to the last directory that you were in
        iii. cd /cygdrive/c/windows : Change the c:\windows directory on the hard drive.
        iv.

    c. **mv** file1 file2: Move or rename file1 to file2

**d.** **rm**: remove file or directory. Options include:
    **i.** **–r** : recurse to the directories below this one
    **ii.** **–f** : Don’t give me any lip about it, just do it.