

# Hercules (Hyperion)

The emulator needed to run IBM mainframe bits is called “[Hercules](#)” and has gone through a LOT of evolution through the many years of its existence.

The primary maintainer of the current version is David Trout (a.k.a. “Fish”) of SoftDev Labs.

His code is excellent and he maintains the current version of the emulator on Github under the [SDL-Hercules-390](#) project.

David describes the build process on the SDL web page [Hercules Build Instructions](#) but as easy as it looks, it's not for all the reasons described here. I've annotated his work for clarity (and reality) of what it takes to get this built properly under Windows - and to be clear, the complexity is in getting the LIBRARIES working properly since his instructions point to builds of utility libraries that are over 10 years old.

Because we're not concerned with the older Visual Studio implementations, I'm only concerned with my build environment VS2022.

Also - because the use of the IDE actually gets in the way of a fast build - I am limiting my remediation instructions to the command prompt **makefile.bat** build.

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**SPECIAL NOTE:** The build of Hercules requires **WIN32.MAK** which is a deprecated, but available feature in VS2022

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(for the original Visual Studio 2008 instructions, click [here](#) which will take you to the SoftDevLabs web site.)

## Hercules (Hyperion) Windows Build Instructions

### (Visual Studio 2022)

#### Introduction

EVERYTHING in this document assumes you are running Windows 10 or Windows 11

This document provides instructions on how to build the Windows “MSVC” version of SDL Hercules 4.x Hyperion. It parallels David Trout's version of the document but points out the “reality” of what is needed to setup for an updated build of Hercules.

SDL did a great job of constructing the build process and fully utilizing the MSBUILD machinery - it's *textbook* ... The challenges were in doing a proper **complete** build without the use of libraries which

he provided.

Those libraries were built in 2008 and because I don't want and don't have the sources for any libraries that old (I use the same library builds across all projects), the fun starts when it comes time to update the dependent libraries (as of this writing):

## Dependencies

Significant functionality is provided by these three *optional* libraries. But the majority of the features I will require depend upon them... so for this process, they are *required*.

- [ZLIB](#) (version [1.2.11](#)) is a very lightweight and full-featured compression library created by Greg Roelofs and maintained by Mark Adler
- [PCRE FTP Perl Compatible Regular Expressions](#) is a very sophisticated regular expression library. **PCRE support is required in order to build the Hercules Automated Operator functionality.** The PCRE library is a set of functions that implement regular expression pattern matching using the same syntax and semantics as Perl 5.

There are two major versions of the PCRE library:

- The current version, PCRE2, first released in 2015, is now at version [10.35](#)
- The older, but still widely deployed PCRE library, originally released in 1997, is at version 8.44. Its API and feature set are stable—future releases will be for bugfixes only. Any new features will be added to PCRE2, and not to the PCRE 8.x series. The current version is [8.44](#) This build example uses PCRE 8.44.
- [BZIP2](#) The bzip2 file compression program was developed by Julian Seward and launched on the 18th of July in 1996. It has remained an open source program, available to all for free, for over twenty two years now. The last stable release was seven years ago. The version 1.0.6 was released on the 20th of September in 2010. bzip2 compression program is based on Burrows–Wheeler algorithm. The current version is [1.0.6](#).

THE PCRE MODULE: creates complexity in revising the build because SDL's instruction conveniently include links to binaries which are very old and refer to the *UNIX* names of `pcre3.(lib|dll)` which is confusing to anyone trying to build the libraries today. More on this later ...

To build the Windows MSVC version of Hercules you need to first download and install Microsoft's free (Free, fully-featured IDE for students, open-source and individual developers) [Visual Studio Community 2019](#) product.

To build the DEPENDENCIES you will need to [Download and Install CMAKE](#).

## Summary of Steps Involved

The overall setup of the build environment indicated above is straightforward but incomplete. SDL indicates the 5 steps necessary for Hercules and assumes that you use their pre-built libraries. Before doing anything - it's important to have a proper build structure ready.

Choose your build location and GIT/Clone the working directories:

```
git clone https://github.com/SDL-Hercules-390/hyperion.git
```

The resulting development tree (after following all of the subsequent steps) will look like this:

#### User Terminal

```
+---autoconf +---crypto | +---include | \---lib +---decNumber | +---include | \---lib +---html | +---images
| \---include +---m4 +---man +---msvc.* [SDL Old Library Build Outputs] +---msvc.makefile.includes
[SDL Original Makefile Includes] +---msvc.makefile.sz.includes ["Current" Library Makefile Includes] +
--msvc.sz.* ["Current" Library build outputs] +---readme | \---images +---scripts +---SoftFloat | +---doc
| +---include | \---lib +---telnet | +---include | \---lib +---tests +---util \---winbuild <-- It is highly
recommended that you use this. | It is the default, and makes the build process | less complex to
diagnose and maintain. | +---bzip2 [SDL Libraries] | +---Debug | \---x64 | \---Debug +---bzip2.sz
["Current" Libraries] | +---Debug | +---include | \---x64 | \---Debug +---pcre [SDL Libraries] | +---bin | +
--include | +---lib | \---x64 | +---bin | +---include | \---lib +---pcre.sz ["Current" Libraries] | +---bin | +---
include | +---lib | \---x64 | +---bin | +---include | \---lib +---zlib [SDL Libraries] | +---Debug | | +---include
| | \---lib | +---include | +---lib | \---x64 | +---Debug | | +---include | | \---lib | +---include | \---lib \---zlib.sz
["Current" Libraries] +---Debug | +---include | \---lib +---include +---lib \---x64 +---Debug | +---include |
\---lib +---include \---lib
```

Because we are building not only Hercules, but the dependencies as well the more precise required steps are:

1. Download and install **Visual Studio 2022**.
2. Define the INCLUDE and VS170COMNTOOLS environment variables, and fix Visual Studio's "Default Property Sheets".
3. Download/UnZip/Position the following pre-built libraries from SDL so the original build functionality can be adequately tested using the defaults:
  1. VC2008/SDL ZLIB
  2. VC2008/SDL BZIP2
  3. VC2008/SDL PCRE

If you intend to build the "Current Libraries" - these additional steps will be required:

- Copy the folder structure for all three libraries (*we assume the defaults of winbuild noted above*)
- Copy the makefile structure and give it a proper identifier (*we are using sz in this context*)

#### User Terminal

```
:: Change to the directory root of the GIT cloned repository CD [hyperion_root] :: Copy the STRUCTURE
of the three libraries XCOPY ".\winbuild\bzip2" ".\winbuild\bzip2.sz" /T /E XCOPY ".\winbuild\pcre"
".\winbuild\pcre.sz" /T /E XCOPY ".\winbuild\zlib" ".\winbuild\zlib.sz" /T /E :: Clone the MAKEFILE
structures XCOPY ".\makefile.msvc" ".\makefile.sz.msvc" XCOPY ".\makefile-dllmod.msvc" ".\makefile-
dllmod.sz.msvc" :: EDIT the Cloned MSVC makefiles to reflect the parallel structure NOTEPAD
".\makefile.sz.msvc" > Replace this line: !include makefile-dllmod.msvc > With this line: !include
makefile-dllmod.sz.msvc > Save NOTEPAD ".\makefile-dllmod.sz.msvc" > Replace this line: INCDIR =
msvc.makefile.includes > With this line: INCDIR = msvc.makefile.sz.includes > Save :: CLONE the
original makefiles XCOPY ".\msvc.makefile.includes\*.*" ".\msvc.makefile.sz.includes\*.*"
```

If you decide to locate those packages OUTSIDE of the build tree, you may indicate their proper

location through the use of environment variables:

- SET ZLIB\_DIR=<UnQuotedDirectoryLocation>
- SET BZIP2\_DIR=<UnQuotedDirectoryLocation>
- SET PCRE\_DIR=<UnQuotedDirectoryLocation>

It is **important** to note that the subordinate structures must match the hierarchy indicated above.

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## Detailed Activity Steps

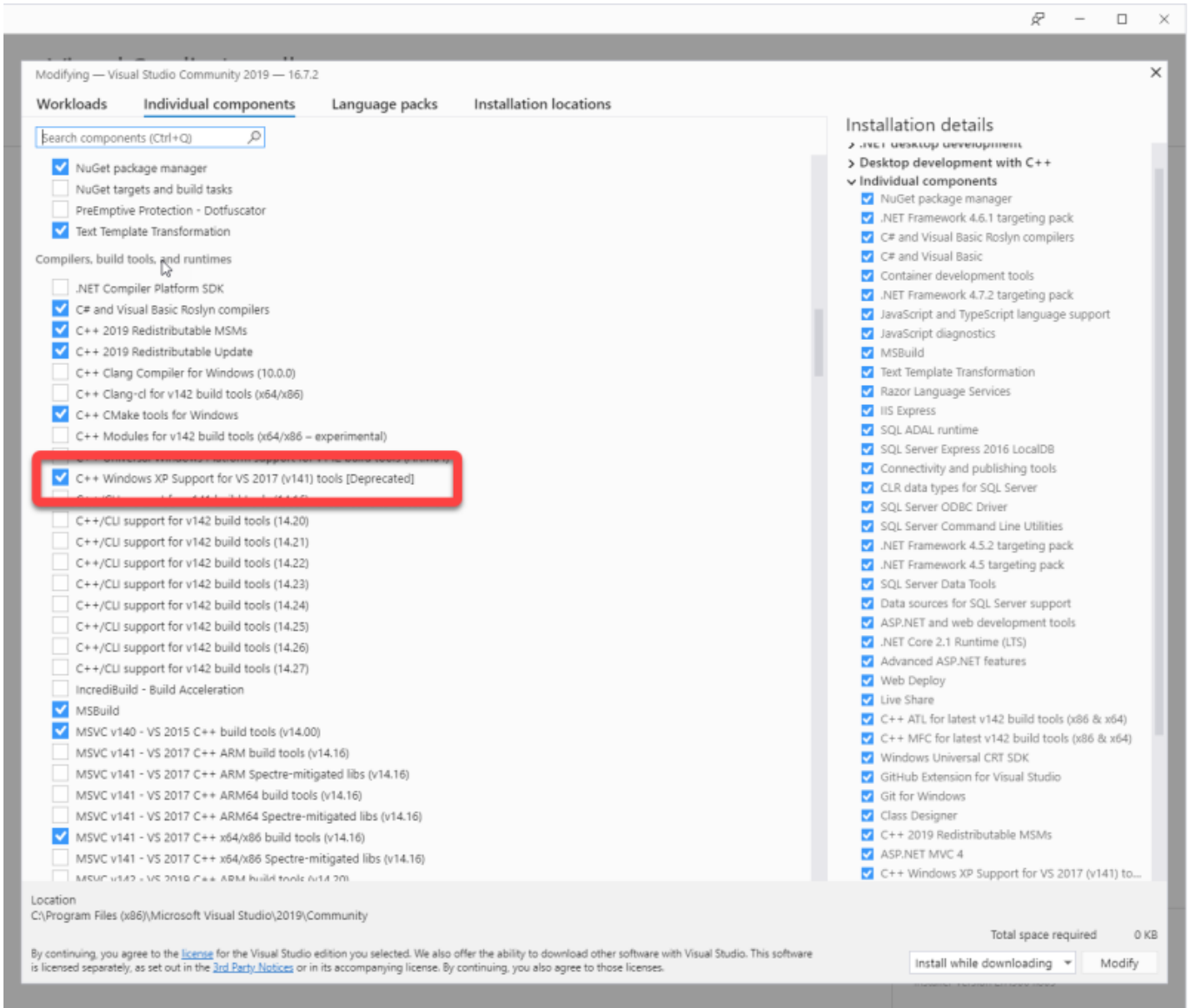
### 1. Download and Install Visual Studio

Click the download button for the “Community” edition from the Visual Studio download web page using the above link to download a small installer stub. Run the installer and select which components you wish to install, and then let the installer install your selected components.

The install takes quite a while to finish, so get yourself a cup of coffee while you wait.

#### **IMPORTANT!**

You must select the “C++ Windows XP Support for VS 2017 (v141) tools [Deprecated]” option!



Once Visual Studio is installed, you will need to do make important configuration changes:

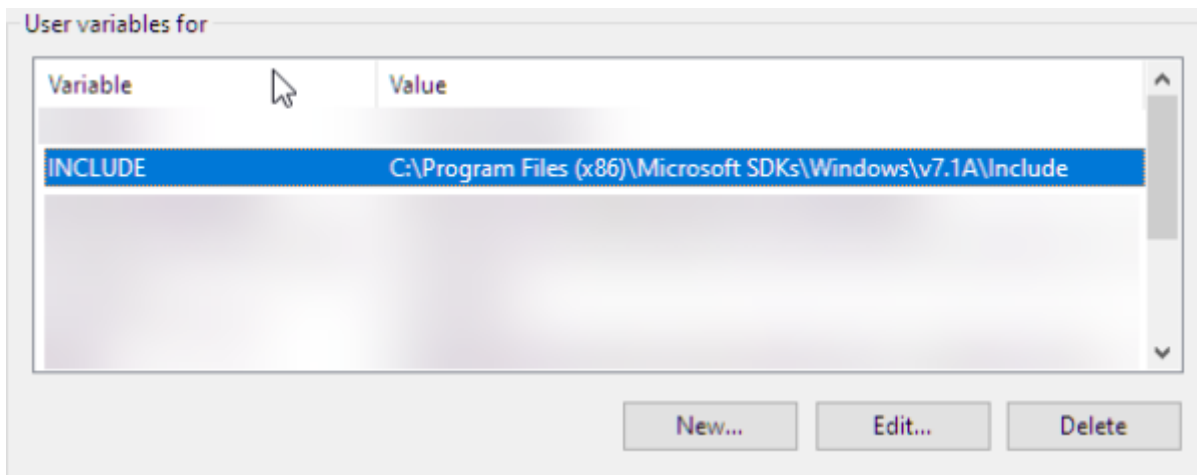
1. You need to manually define very important environment variables
2. Fix Visual Studio's "Default Property Sheets" to add the INCLUDE directories specifying the location of the win32.mak file installed by the above installation option. This will be more clearly explained in the next step.

## 2. Define Environment Variables and Fix Property Sheets

### INCLUDE

The **INCLUDE** environment variable must be defined because it identifies the location of an additional list of compiler search directories. This *must* indicate the directory where the "win32.mak" file was installed. (The "Windows XP support" install option is what provided the "win32.mak".) This directory varies depending on the version of Visual Studio installed and where it was installed, but for most people it will be:

## C:\Program Files (x86)\Microsoft SDKs\Windows\v7.1A\Include

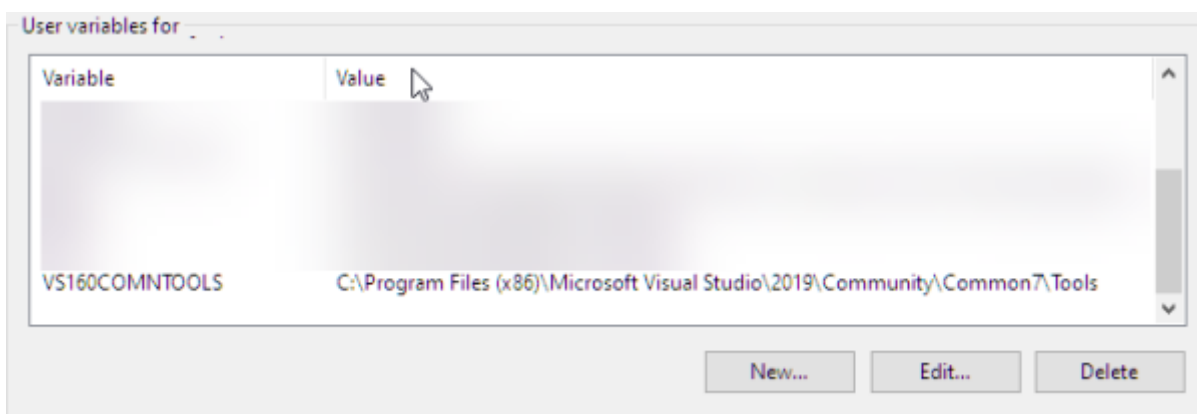


## VSnnnCOMNTOOLS

The **VSnnnCOMNTOOLS** environment variable must also be defined (*where 'nnn' is the internal version number of Visual Studio*)

- '140' for Visual Studio 2015
- '150' for Visual Studio 2017
- '160' for Visual Studio 2019
- **'170'** for Visual Studio 2022

In earlier versions of Visual Studio the installer automatically defined this environment variable for you, but in later versions of Visual Studio the installer no longer provides this. Because we require this variable for the automatic/batch build process, it will need to be defined.



This value identifies the location of the Visual Studio "Common Tools" directory. These tools enable the build routine `makefile.bat` to locate the necessary configuration files which initialize Visual Studio's build environment.

For most people this directory will be:

## C:\Program Files (x86)\Microsoft Visual Studio\yyyy\Community\Common7\Tools

For Visual Studio 2022, the directory is most likely to be:

**C:\Program Files\Microsoft Visual Studio\2022\Community\Common7\Tools**

where 'yyyy' is of course the version of Visual Studio ("2015", "2017", "2019", "2022").

### Option 1: Change Default Property Sheets

Place the following file, or edit its contents, into the file:

**C:\Users\<userProfileName>\AppData\Local\Microsoft\MSBuild\v4.0\Microsoft.Cpp.x64.user.props**

[Microsoft.Cpp.x64.user.props](#)

```
<?xml version="1.0" encoding="utf-8"?>
<Project DefaultTargets="Build" ToolsVersion="4.0"
xmlns="http://schemas.microsoft.com/developer/msbuild/2003">
  <ImportGroup Label="PropertySheets">
  </ImportGroup>
  <PropertyGroup Label="UserMacros" />
  <PropertyGroup>
<IncludePath>$(VC_IncludePath);$(WindowsSDK_IncludePath);$(INCLUDE);</I
ncludePath>
  </PropertyGroup>
  <ItemDefinitionGroup />
  <ItemGroup />
</Project>
```

### Option 2: Change Default Property Sheets

NOTE: This task must be done in ELEVATED mode because it modifies installed Program files.

Finally, we must modify Visual Studio's "Default Property Sheets"; one for 32-bit and another for 64-bit.

These property sheets contain the defaults which are used by MSBUILD and tell Visual Studio how to initialize its various configuration values. Visual Studio does not (by default) include directories identified by the INCLUDE environment variable. These modification enable the capability.

The Default Installation contains the following toolset.props property files:

- C:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v150\Platforms\Win32\PlatformToolsets\v141\Toolset.props

- C:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v150\Platforms\Win32\PlatformToolsets\v141\_xp\Toolset.props
- C:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v150\Platforms\x64\PlatformToolsets\v141\Toolset.props
- C:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v150\Platforms\x64\PlatformToolsets\v141\_xp\Toolset.props
- C:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v160\Platforms\ARM\PlatformToolsets\v142\Toolset.props
- C:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v160\Platforms\Win32\PlatformToolsets\v142\Toolset.props
- CC:\Program Files\Microsoft Visual Studio\2022\Community\MSBuild\Microsoft\VC\v160\Platforms\x64\PlatformToolsets\v142\Toolset.props

If you have other toolchains installed - you may need to locate them:

- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\ARM\PlatformToolsets\v140\Toolset.props
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\Win32\PlatformToolsets\v140\Toolset.props
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\Win32\PlatformToolsets\v140\_xp\Toolset.props
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\x64\PlatformToolsets\v140\Toolset.props
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\x64\PlatformToolsets\v140\_xp\Toolset.props

**We are only concerned with these three:**

- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\ARM\PlatformToolsets\v140\Toolset.props
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\Win32\PlatformToolsets\v140\Toolset.props
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\x64\PlatformToolsets\v140\Toolset.props

Backup/rename the originals to:

- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\ARM\PlatformToolsets\v140\Toolset.props.original
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\Win32\PlatformToolsets\v140\Toolset.props.original
- C:\Program Files (x86)\MSBuild\Microsoft.Cpp\v4.0\v140\Platforms\x64\PlatformToolsets\v140\Toolset.props.original



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Then modify them as illustrated here:

```

28 <Import Project="$ (VCTargetsPath)\Microsoft.Cpp.Common.props" />
29
30 <PropertyGroup>
31 <ExecutablePath Condition="'$(ExecutablePath)' == ''">$(VC_ExecutablePath_ARM);$(WindowsSDK_ExecutablePath);$(VS_Executa
32 <IncludePath Condition="'$(IncludePath)' == ''">$(VC_IncludePath);$(WindowsSDK_IncludePath);</IncludePath>
33 <ReferencePath Condition="'$(ReferencePath)' == ''">$(VC_ReferencesPath_ARM);</ReferencePath>
34 <LibraryPath Condition="'$(LibraryPath)' == ''">$(VC_LibraryPath_ARM);$(WindowsSDK_LibraryPath_ARM);$(NETFXKitsDir)Lib\
35 <LibraryWPath Condition="'$(LibraryWPath)' == ''">$(WindowsSDK_MetadataPath);</LibraryWPath>
28 <Import Project="$ (VCTargetsPath)\Microsoft.Cpp.Common.props" />
29
30 <PropertyGroup>
31 <ExecutablePath Condition="'$(ExecutablePath)' == ''">$(VC_ExecutablePath_ARM);$(WindowsSDK_ExecutablePath);$(VS_Executa
32 <IncludePath Condition="'$(IncludePath)' == ''">$(VC_IncludePath);$(WindowsSDK_IncludePath);$(INCLUDE);</IncludePath>
33 <ReferencePath Condition="'$(ReferencePath)' == ''">$(VC_ReferencesPath_ARM);</ReferencePath>
34 <LibraryPath Condition="'$(LibraryPath)' == ''">$(VC_LibraryPath_ARM);$(WindowsSDK_LibraryPath_ARM);$(NETFXKitsDir)Lib\
35 <LibraryWPath Condition="'$(LibraryWPath)' == ''">$(WindowsSDK_MetadataPath);</LibraryWPath>

```

NOTE: The "INCLUDE" environment variable we defined earlier above is very important in that it defines the location where the "win32.mak" file lives which Hercules needs to initialize its build settings. We place it in its own environment variable because the "INCLUDE" environment variable is defined as a semicolon-delimited list of directories to be searched, and thus can contain other additional directories to be searched. Each development toolchain behaves differently so we have modified Visual Studio's default behavior in such a way that our build work can be more flexible.

As you can see, all we are doing is appending the "\$ (INCLUDE)" directories to the end of Visual Studio's default search directories. This enables Visual Studio to locate the critical "win32.mak" file when the build procedure asks for it.

Once you have Visual Studio installed and have defined the two environment variables and fixed the Property Sheets, then you are finished with the Visual Studio installation portion of the setup.

### **SPECIAL INSTRUCTIONS FOR WINDOWS 10 and 11:**

Before your newly defined environment variables can take effect, you will need to first logoff and then log back on! Earlier versions of Windows are smart enough to dynamically update the environment immediately after being modified, but Windows 10 is different! You have to logoff and logon again (or reboot) before the new environment variables will take effect!

### **3. Setting up ZLIB Support**

ZLIB is a compression algorithm written by Jean Loup Gailly and Mark Adler and *may* be used in the Hercules project pursuant to the ZLIB License (a copy of which may be seen at [http://www.zlib.net/zlib\\_license.html](http://www.zlib.net/zlib_license.html)).

In source form, the Hercules project *does not* contain any ZLIB source code.

In *binary* form however, the Hercules project *may* include an *unmodified* version of the ZLIB runtime DLL in addition to its own distribution binaries.

The 'ZLIB\_DIR' environment variable defines the location of where the required files are for building a version of Hercules that supports ZLIB compression. The `makefile.bat` and related MSBuild files

used by the Hercules build process test whether this environment variable is defined as an indicator to build ZLIB compression support into Hercules.

If 'ZLIB\_DIR' is undefined when you invoke the `makefile` the MSBuild functionality attempts to find the required files in a predefined default directory **winbuild**. If the MSBuild functionality cannot find them, then ZLIB support will not be generated. Otherwise 'ZLIB\_DIR' must point to a valid directory where the ZLIB package is installed and that directory MUST have the following structure:

General User

```
HYPERION\WINBUILD\ZLIB +---Debug | +---include | \---lib +---include +---lib \---x64 +---Debug | +---include | \---lib +---include \---lib
```

ZLIB\_DIR must contain the top path of the ZLIB directory.

When building a 64-bit (x64) version of Hercules the above 'x64' subdirectories are automatically searched. As long as the above directory structure is observed then Hercules ZLIB functionality will be included.

The SDL-provided Library distribution expected within this structure is:

General User

```
HYPERION\WINBUILD\ZLIB | zlib1.dll | zlib1.pdb | +---Debug | | zlib1.dll | | zlib1.pdb | | | +---include | | zconf.h | | zlib.h | | | \---lib | zdll.lib | +---include | zconf.h | zlib.h | +---lib | zdll.lib | \---x64 | zlib1.dll | zlib1.pdb | +---Debug | | zlib1.dll | | zlib1.pdb | | | +---include | | zconf.h | | zlib.h | | | \---lib | zdll.lib | +---include | zconf.h | zlib.h | \---lib zdll.lib
```

### 3.A Setting up ZLIB "Current Library" Support

If your build requires the "Current Version" libraries, the resulting hierarchy will be substantially different than the one required for Hyperion/Hercules. It is for this reason that you should BUILD the libraries separately, and then move them into place using the established hierarchy indicated above.

For ZLIB, the required hierarchy using ZLIB's present-day build mechanism on windows requires that you copy the files from their build directory structure into the following hierarchy:

General User

```
HYPERION\WINBUILD\ZLIB.SZ | zlib.dll | zlib.pdb | zlibstatic.lib | +---Debug | | zlibd.dll | | zlibd.pdb | | | +---include | | zconf.h | | zlib.h | | | \---lib | zlibd.lib | zlibstaticd.lib | +---include | zconf.h | zlib.h | +---lib | zlib.lib | zlibstatic.lib | \---x64 | zlib.dll | zlib.pdb | +---Debug | | zlibd.dll | | zlibd.pdb | | | +---include | | zconf.h | | zlib.h | | | \---lib | zlibd.lib | zlibstaticd.lib | +---include | zconf.h | zlib.h | \---lib zlib.dll zlib.exp zlib.ilc zlib.lib zlib.pdb zlibstatic.lib
```

and you will then need to modify the MSVC files accordingly:

```
hyperion\msvc.makefile.sz.includes\ZLIB_DIR.msvc
```

```

25#
26# ZLIB_DIR = E:\MyProjects\zlib and bris2 dlls\zlib latest\zlib122-dll
27# ZLIB_DIR = C:\winbuild\zlib\win32_32
28# -----
29
30 !IFDEF ZLIB_DIR
31# Undefined: use default value, if it exists.
32# ZLIB_DIR defaults to winbuild\zlib relative to current directory
33 !IF "$(CPU)" == "i386" && EXIST(winbuild\zlib\win32_32)
34# Avoid breaking existing builds, use win32_32 subdir if it exists
35 ZLIB_DIR = winbuild\zlib\win32_32
36 !ELSEIF "$(CPU)" == "i386" && EXIST(winbuild\zlib)
37 ZLIB_DIR = winbuild\zlib
38 !ELSEIF "$(CPU)" == "AMD64" && EXIST(winbuild\zlib\x64)
39 ZLIB_DIR = winbuild\zlib\x64
40 !ENDIF
41 !ELSE
42# Defined: use explicit directory or subdirectory
43# unless "NONE" is specified or it doesn't exist.
44 !IF "$(ZLIB_DIR)" == "NONE"
45 !UNDEF ZLIB_DIR
46 !ELSE
47 !IF "$(CPU)" == "i386"
48 !IF EXIST($(ZLIB_DIR))
49 !UNDEF ZLIB_DIR
50 !ENDIF
51 !ELSEIF "$(CPU)" == "AMD64"
52 !IF EXIST($(ZLIB_DIR)\x64)
53 ZLIB_DIR = $(ZLIB_DIR)\x64
54 !ENDIF
55 !ENDIF
56 !ENDIF
57 !ENDIF
58
59 !IFDEF ZLIB_DIR
60 !IF EXIST("$(ZLIB_DIR)\include\zlib.h")
61 !ERROR ZLIB_DIR "$(ZLIB_DIR)\include\zlib.h" does not exist. Check ZLIB_DIR
62 !ELSEIF EXIST("$(ZLIB_DIR)\lib\zdll.lib")
63 !ERROR ZLIB_DIR "$(ZLIB_DIR)\lib\zdll.lib" does not exist. Check ZLIB_DIR
64 !ELSEIF EXIST("$(ZLIB_DIR)\lib\zlibstatic.lib")
65 !ERROR ZLIB_DIR "$(ZLIB_DIR)\lib\zlibstatic.lib" does not exist. Check ZLIB_DIR
66 !ELSEIF EXIST("$(ZLIB_DIR)\zlib.dll")
67 !ERROR ZLIB_DIR "$(ZLIB_DIR)\zlib.dll" does not exist. Check ZLIB_DIR
68 !ENDIF

```

### hyperion\msvc.makefile.sz.includes\ZLIB\_FLAGS.msvc

```

1# -----
2# ZLIB_FLAGS.msvc (INCLUDE ed by "makefile-dlmod.msvc")
3# -----
4# (C) Copyright Roger Bowler, 2005-2007
5# -----
6#
7# Sets ZLIB-compression-related compiler/linker flags & #defines...
8#
9# -----
10
11 !IFDEF ZLIB_DIR
12 ZLIB_DLL = $(ZLIB_DIR)\zlib.dll
13 ZLIB_LIB = $(ZLIB_DIR)/lib/zlib.lib
14 ZLIB_INC = $(ZLIB_DIR)/include
15 LIBS = $(LIBS) "$(ZLIB_LIB)"
16 cflags = $(cflags) /D HAVE_ZLIB /D HAVE_ZLIB_H /I"$(ZLIB_INC)"
17 !ENDIF
18

```

### hyperion\msvc.makefile.sz.includes\ZLIB\_RULES.msvc

```

10
11 !IFDEF ZLIB_DIR
12
13 $(X)zlib.dll:
14     XCOPY "$(ZLIB_DLL)" $(X) /V /C /F /H /R /K /Y
15
16 allzlib: allHercules \
17     $(X)zlib.dll
18
19 !ELSE
20
21 allzlib: allHercules
22
23 !ENDIF
24
25# NOTE: to be safe, since this member contains build rules, we need to
26# make sure there's always a blank line following the last build rule
27# in the member so that mmake doesn't complain or otherwise treat the
28# statements immediately following the original !INCLUDE statement as
29# part of the build rule actions. Thus the purpose of the comments you
30# are now reading as the very last few lines in every build rule member.
31

```

## 4. Setting up BZIP2 Support

BZIP2 is a freely available (open-source (BSD-style) license), patent free (as far as the author knows), high-quality data compressor written by Julian R Seward. It typically compresses files to within 10% to 15% of the best available techniques (the PPM family of statistical compressors), whilst being around twice as fast at compression and six times faster at decompression.

In source form, the Hercules project *does not* contain any BZIP2 source code.

In *binary* form however, the Hercules project *may* include an *unmodified* version of the BZIP2 runtime DLL in addition to its own distribution binaries.

The '**BZIP2\_DIR**' environment variable defines the location of where the required files are for building a version of Hercules that supports BZIP2 compression. The `makefile.bat` and related MSBuild files used by the Hercules build process test whether this environment variable is defined as an indicator to build BZIP2 compression support into Hercules.

If 'BZIP2\_DIR' is undefined when you invoke the `makefile` the MSBuild functionality attempts to find the required files in a predefined default directory **winbuild**. If the MSBuild functionality cannot find them, then BZIP2 support will not be generated. Otherwise 'BZIP2\_DIR' must point to a valid directory where the BZIP2 package is installed and that directory **MUST** have the following structure:

General User

`HYPERION\WINBUILD\BZIP2 +---Debug \---x64 \---Debug`

ZLIB\_DIR must contain the top path of the ZLIB directory.

When building a 64-bit (x64) version of Hercules the above 'x64' subdirectories are automatically searched. As long as the above directory structure is observed then Hercules ZLIB functionality will be included.

The SDL-provided Library distribution expected within this structure is:

General User

`HYPERION\WINBUILD\BZIP2 | bzip2.org.url | bzlib.h | libbz2.dll | libbz2.lib | libbz2.pdb | +---Debug | libbz2.dll | libbz2.lib | libbz2.pdb | \---x64 | bzlib.h | libbz2.dll | libbz2.lib | libbz2.pdb | \---Debug libbz2.dll libbz2.lib libbz2.pdb`

#### 4.A Setting up BZIP2 "Current Library" Support

If your build requires the "Current Version" libraries, the resulting hierarchy will be substantially different than the one required for Hyperion/Hercules. It is for this reason that you should BUILD the libraries separately, and then move them into place using the established hierarchy indicated above.

For ZLIB, the required hierarchy using ZLIB's present-day build mechanism on windows requires that you copy the files from their build directory structure into the following hierarchy:

General User

`HYPERION\WINBUILD\BZIP2.SZ | bzlib.h | libbz2.dll | libbz2.lib | libbz2.pdb | +---Debug | libbz2.dll | libbz2.lib | libbz2.pdb | +---include | bzlib.h | \---x64 | bzlib.h | libbz2.dll | libbz2.lib | libbz2.pdb | \---Debug libbz2.dll libbz2.lib libbz2.pdb`

and you will then need to modify the MSVC files accordingly:

`hyperion\msvc.makefile.sz.includes\BZIP2_DIR.msvc`

```

22 # The makefile will do that if it needs to. Just define the variable
23 # with the path as-is. E.g.:
24 #
25 # BZIP2_DIR = E:\MyProjects\bzip2
26 # -----
27
28 !IFDEF BZIP2_DIR
29 # Undefined: Use default value, if it exists.
30 # BZIP2_DIR defaults to winbuild\bzip2 relative to current directory
31 !IF "$(CPU)" == "i386" && EXIST(winbuild\bzip2)
32 BZIP2_DIR = winbuild\bzip2
33 !ELSEIF "$(CPU)" == "AMD64" && EXIST(winbuild\bzip2\x64)
34 BZIP2_DIR = winbuild\bzip2\x64
35 !ENDIF
36 !ELSE
37 # Defined: use explicit directory or subdirectory
38
22 # The makefile will do that if it needs to. Just define the variable
23 # with the path as-is. E.g.:
24 #
25 # BZIP2_DIR = E:\MyProjects\bzip2
26 # -----
27
28 !IFDEF BZIP2_DIR
29 # Undefined: Use default value, if it exists.
30 # BZIP2_DIR defaults to winbuild\bzip2.sz relative to current directory
31 !IF "$(CPU)" == "i386" && EXIST(winbuild\bzip2.sz)
32 BZIP2_DIR = winbuild\bzip2.sz
33 !ELSEIF "$(CPU)" == "AMD64" && EXIST(winbuild\bzip2.sz\x64)
34 BZIP2_DIR = winbuild\bzip2.sz\x64
35 !ENDIF
36 !ELSE
37 # Defined: use explicit directory or subdirectory
38

```

## 5. Setting up PCRE Support

NOTE: the Perl-Compatible Regular Expressions library is needed only to support the *Hercules Automatic Operator* (HAO) Facility. If you do not plan to ever use the Hercules Automatic Operator facility, then you do not need to install PCRE support and may safely skip this step.

**PCRE (Perl-Compatible Regular Expressions)** is: “a set of functions that implement regular expression pattern matching using the same syntax and semantics as Perl 5. PCRE has its own native API, as well as a set of wrapper functions that correspond to the POSIX regular expression API. The PCRE library is free, even for building commercial software.”

In source form, the Hercules project *does not* contain any PCRE source code.

In *binary* form however, the Hercules project *may* include an *unmodified* version of the PCRE runtime DLL in addition to its own distribution binaries.

The '**PCRE\_DIR**' environment variable defines the location of where the required files are for building a version of Hercules that supports PCRE compression. The `makefile.bat` and related MSBuild files used by the Hercules build process test whether this environment variable is defined as an indicator to build PCRE compression support into Hercules.

If '**PCRE\_DIR**' is undefined when you invoke the `makefile` the MSBuild functionality attempts to find the required files in a predefined default directory **winbuild**. If the MSBuild functionality cannot find them, then PCRE support will not be generated. Otherwise '**PCRE\_DIR**' must point to a valid directory where the PCRE package is installed and that directory **MUST** have the following structure:

General User

```
HYPERION\WINBUILD\PCRE +---bin +---include +---lib \---x64 +---bin +---include \---lib
```

**PCRE\_DIR** must contain the top path of the PCRE directory.

When building a 64-bit (x64) version of Hercules the above 'x64' subdirectories are automatically searched. As long as the above directory structure is observed then Hercules PCRE functionality will be included.



The SDL-provided Library distribution expected within this structure is:

### General User

HYPERION\WINBUILD\PCRE +---bin | pcre3.dll | pcre3.pdb | pcreposix3.dll | pcreposix3.pdb | +---include | pcre.h | pcreposix.h | +---lib | pcre.lib | pcreposix.lib | \---x64 +---bin | pcre3.dll | pcre3.pdb | pcreposix3.dll | pcreposix3.pdb | +---include | pcre.h | pcreposix.h | \---lib pcre.lib pcreposix.lib

### 5.A Setting up PCRE "Current Library" Support

If your build requires the "Current Version" libraries, the resulting hierarchy will be substantially different than the one required for Hyperion/Hercules. It is for this reason that you should BUILD the libraries separately, and then move them into place using the established hierarchy indicated above.

For PCRE, the required hierarchy using PCRE's present-day build mechanism on windows requires that you copy the files from their build directory structure into the following hierarchy:

### General User

HYPERION\WINBUILD\PCRE.SZ +---bin | pcre.dll | pcre.pdb | pcre16.dll | pcre16.pdb | pcre32.dll | pcre32.pdb | pcrecpp.dll | pcrecpp.pdb | pcreposix.dll | pcreposix.pdb | +---include | pcre.h | pcrecpp.h | pcreposix.h | +---lib | pcre.lib | pcre16.lib | pcre32.lib | pcrecpp.lib | pcreposix.lib | \---x64 +---bin | pcre.dll | pcre.pdb | pcre16.dll | pcre16.pdb | pcre32.dll | pcre32.pdb | pcrecpp.dll | pcrecpp.pdb | pcreposix.dll | pcreposix.pdb | +---include | pcre.h | pcrecpp.h | pcreposix.h | \---lib pcre.lib pcre16.lib pcre32.lib pcrecpp.lib pcreposix.lib

and you will then need to modify the MSVC files accordingly:

[hyperion\msvc.makefile.sz.includes\PCRE\\_DIR.msvc](#)

```
1 # .....
2 # PCRE_DIR.msvc [INCLUDE ed by "makefile-dll.msvc"]
3 # .....
4 # (C) Copyright Roger Bowler, 2005-2007
5 # .....
6 # StdS
7 # .....
8 # Handles support for PCRE (Perl Compatible Regular Expressions),
9 # for MSVC, needed by HAO (Hercules Automatic Operator) facility
10 # .....
11 # .....
12 # .....
13 # .....
14 # To enable PCRE (Perl-Compatible Regular Expressions) support, first
15 # download "32 and 64-bit PCRE for Windows" from www.airesoft.co.uk/pcre
16 # file name: http://www.airesoft.co.uk/files/pcre/pcre-8.20.zip
17 # Then create a permanent directory somewhere called whatever you want
18 # and unzip pcre-8.20.zip into that directory. Finally define an
19 # environment variable called "PCRE_DIR" pointing to that directory.
20 # .....
21 # .....
22 #ifndef PCRE_DIR
23 # Undefined: use default value, if it exists.
24 # PCRE_DIR defaults to winbuild\pcre relative to current directory
25 #if "$(CPU)" == "i386" && EXIST(winbuild\pcre)
26 PCRE_DIR = winbuild\pcre
27 #elseif "$(CPU)" == "AMD64" && EXIST(winbuild\pcre\x64)
28 #elseif "$(CPU)" == "IA64" && EXIST(winbuild\pcre\ia64)
29 PCRE_DIR = winbuild\pcre\ia64
30 #elseif EXIST(winbuild\pcre)
31 PCRE_DIR = winbuild\pcre
32 #endif
33 #else
34 # Defined: use explicit directory or subdirectory
35 # unless "NONE" is specified or it doesn't exist.
36 #if "$(PCRE_DIR)" == "NONE"
37 #undef PCRE_DIR
38 #else
39 #if "$(CPU)" == "i386"
40 #if EXIST($(PCRE_DIR))
41 #undef PCRE_DIR
42 #endif
43 #elseif "$(CPU)" == "AMD64"
44 #if EXIST($(PCRE_DIR)\x64)
45 PCRE_DIR = $(PCRE_DIR)\x64
46 #endif
47 #elseif "$(CPU)" == "IA64"
48 #if EXIST($(PCRE_DIR)\ia64)
49 PCRE_DIR = $(PCRE_DIR)\ia64
50 #endif
51 #endif
52 #endif
53 #endif
54 #endif
55 #
```

## (6.A) Modify OUTPUT\_DIRS

To ensure that MSBuild generates outputs to the proper isolated directories - the following modifications MUST be made to the following file:

```

1 # *****
2 #   OUTPUT_DIRS.msvc    (!!INCLUDE ed by "makefile-dllmod.msvc")
3 #   -----
4 #   (C) Copyright Roger Bowler, 2005-2009
5 #   -----
6 #
7 #   Define the build output directories...
8 #
9 #   SET PREFIX=NONE to generate output directories named bin,obj,pdb,map,cod
10 # (this is for nmake version 6 which barfs if the command line is too long)
11 # Otherwise the output directories are named:
12 #
13 #   msvc.[debug].[xxxx].bin/obj/pdb/map/cod
14 #
15 # where xxxx is "dllmod" (for i386) or "AMD64".
16 # (this naming convention is to avoid breaking existing build procedures)
17 # *****
18
19 !IFDEF NODEBUG
20 DEBUG_PREFIX =
21 !ELSE
22 DEBUG_PREFIX = debug.
23 !ENDIF
24
25 !IF "$ (CPU)" == "i386"
26 ARCH_PREFIX = dllmod.
27 !ELSE
28 ARCH_PREFIX = $ (CPU) .
29 !ENDIF
30
31 !IF ("$(PREFIX)" == "NONE") || ("$(PREFIX)" == "none")
32 PREFIX =
33 !ELSE
34 PREFIX = msvc.$(DEBUG_PREFIX)$(ARCH_PREFIX)
35 !ENDIF
36
37 !IF ("$(EXEDIR)" == "") || ("$(OBJDIR)" == "") || ("$(PDBDIR)" == "") || ("$(MAPDIR)" == "")
38 EXEDIR = $(PREFIX)bin
39 OBJDIR = $(PREFIX)obj
40 PDBDIR = $(PREFIX)pdb
41 MAPDIR = $(PREFIX)map
42 !ENDIF
43
44 !IFDEF ASSEMBLY_LISTINGS
45 !ENDIF ASMDIR

```

## Building Hercules using the Visual Studio "makefile.bat"

Once you have installed Microsoft's Visual Studio 2019 Community Edition and have finished setting up the build environment, you can then easily build Hercules via the provided Visual Studio solution and project files included as part of the Hercules source-code distribution.

### General User

[CD \[hercules build directory\] makefile.bat retail makefile.msvc 8 CLEAN makefile.bat retail-x64](#)  
[makefile.msvc 8 CLEAN makefile.bat debug makefile.msvc 8 CLEAN makefile.bat debug-x64](#)  
[makefile.msvc 8 CLEAN makefile.bat retail makefile.msvc 8 makefile.bat retail-x64 makefile.msvc 8](#)  
[makefile.bat debug makefile.msvc 8 makefile.bat debug-x64 makefile.msvc 8 if you built the "Current Libraries" and want to use those: makefile.bat retail makefile.sz.msvc 8 CLEAN makefile.bat retail-x64](#)  
[makefile.sz.msvc 8 CLEAN makefile.bat debug makefile.sz.msvc 8 CLEAN makefile.bat debug-x64](#)  
[makefile.sz.msvc 8 CLEAN makefile.bat retail makefile.sz.msvc 8 makefile.bat retail-x64](#)  
[makefile.sz.msvc 8 makefile.bat debug makefile.sz.msvc 8 makefile.bat debug-x64 makefile.sz.msvc 8](#)

### That's it!

NOTE: When using the IDE, clicking the "Rebuild Solution" button in Visual Studio simply invokes Hercules's "makefile.bat" script, which in turn invokes the nmake command for the make file called makefile.msvc or makefile.sz.msvc (after calling a few helper batch scripts to first define the

Visual Studio build environment).

All of the actual building (compiling and linking) is controlled by the "makefile.msvc" make file (which, as explained, is invoked automatically by Visual Studio when you click the "Rebuild Solution" button).

### General User

```
hyperion>makefile /? makefile.bat begun on Fri 08/28/2020 at 13:10:07.47 cmdline: makefile /?
makefile.bat(1) : error C9999 : Help information is as follows: makefile.bat Initializes the Windows
software development build environment and invokes nmake to build the desired 32 or 64-bit version
of the Hercules emulator. Format: makefile.bat {build-type} {makefile-name} {num-cpu-engines} \ [-
asm] \ [-title "custom build title"] \ [-hqa {directory}] \ [-extpkg {directory}] \ [-a|clean] \ [{nmake-
option}] Where: {build-type} The desired build configuration. Valid values are DEBUG / RETAIL for
building a 32-bit Hercules, or DEBUG-X64 / RETAIL-X64 to build a 64-bit version of Hercules targeting
(favoring) AMD64 processors. DEBUG builds activate/enable UNOPTIMIZED debugging logic and are
thus VERY slow and not recommended for normal use. RETAIL builds on the other hand are highly
optimized and thus the recommended type for normal every day ("production") use. {makefile-name}
The name of our makefile: 'makefile.msvc' (or some other makefile name if you have a customized
one) {num-cpu-engines} The maximum number of emulated CPUs (NUMCPU=) you want this build of
Hercules to support: 1 to 64. -asm To generate assembly (.cod) listings. -title "xxx..." To define a
custom title for this build. -hqa "directory" To define the Hercules Quality Assurance directory
containing your optional "hqa.h" and/or "HQA.msvc" build settings override files. -extpkg "directory"
To define the base directory where the Hercules External Packages are installed. Hercules will use the
'include' and 'lib' subdirectories of this directory to locate External Package header files and lib files
during the build process. If not specified the default is to use the header and lib files that come with
the Hercules repository. [-a|clean] Use '-a' to perform a full rebuild of all Hercules binaries, or 'clean'
to delete all temporary work files from all work/output directories, including any/all previously built
binaries. If not specified then only those modules that need to be rebuilt are actually rebuilt, usually
resulting in much quicker build. However, when doing a 'RETAIL' build it is HIGHLY RECOMMENDED
that you always specify the '-a' option to ensure that a complete rebuild is done. [{nmake-option}]
Extra nmake option(s). (e.g. -k, -g, etc...) makefile.bat ended on Fri 08/28/2020 at 13:10:07.59, rc=1
```

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