CHICAGO BOOTH

**CRSP**<sup>°</sup> Center for Research in Security Prices

# CRSP Utilities & Program Libraries Release Notes

**Tools for CRSPAccess Version 3.86** 

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## **CRSP CONTACT INFORMATION**

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## CHAPTER 1: CUPL 3.86

This release of CRSPAccess Version 3.86 is also known as the CRSP Utilities and Programming Libraries (CUPL). It is intended for subscribers on Linux and Solaris platforms, and Windows subscribers who have specifically requested the command-line CRSPAccess tools.

## 64-Bit Support

CRSP is pleased to announce that we are now providing support on 64-bit platforms:

- Linux Redhat 64-bit
- Solaris- Sun Ultra Sparc and on Intel x86
- Windows XP and Windows 7

Executables and files used in the 64-bit software have the same names as the 32-bit executables and files. When installed, folder names holding the for the 64-bit files are different:

32-BIT FOLDER NAMES	64-BIT FOLDER NAMES	
Accbin	Accbin64	
Acclib	Acclib64	
Include	Include64	
Sample	Sample64	

Support for 32-bit platforms continues.

## CRSPAccess Supported Systems

CRSP has tested programs and libraries on these supported operating systems and compilers. More recent versions of these systems and compilers or others may be compatible, but are not fully supported.

OPERATING SYSTEM	CPU	FORTRAN COMPILER*	C COMPILER	BINARY	CRSPACCESS VERSION
Windows XP	Intel x86 32-bit	Intel Fortran 9.1 and higher with Visual Studio 2005 or 2008	MS Visual Studio C++ 2005 or 2008	IEEE Little Endian	3.14 and higher
Windows 7	Intel x86 32 – or 64-bit	Intel VisualFortran 2011/ ParallelStudio XE	MS Visual Studio C++ 2008	IEEE - Little Endian	3.22
Sun Solaris 10	Sun Sparc	Sun Fortran-95 8.2	Sun C 5.8, part of SunStudio 11	IEEE – Big Endian	3.14 and higher
	Intel X86	Sun Fortran-95 8.2	Sun C 5.8, part of SunStudio 11	IEEE - Little Endian	3.22
Red Hat Enterprise Linux	Linux x86 32-bit	Lahey/Fujitsu Fortran-95 6.20 g95 0.91	gcc3.2.3	IEEE - Little Endian	3.14 and higher
5.0	Linux x86 64-bit	g95 0.91	gcc 4.1.2	IEEE - Little Endian	3.22

\*Refer to Chapter 4 for more specifics related to compilers and compatibility.

## **CRSPAccess Supported Versions**

Official Support for CRSPAccess versions 2.97, 3.10 – 3.12 is now discontinued.

CRSPAccess Versions 3.14 and 3.19 will continue to be supported through June 2012.

CRSPACCESS			CRSP UTILITIES (TS_PRINT, STK_PRINT,	CRSP LEGACY UTILITY SUPPORT
(CUPL) VERSION	FORTRAN-95	C PROGRAMS	CCM_PRINT, IND_PRINT)	CST_PRINT
3.14	Supported	Supported	Supported	Supported
3.19	Supported	Supported	Supported	Supported
3.22	Supported	Supported	Supported	Not Supported

## Attention SASECRSP Engine Users

Compatibility between SAS versions and CRSPAccess Verion 2.97 and higher follows:

- SAS Version 9.1.3 Service Pack 3, SAS Version 9.2, or the recently released SAS Version 9.3 is required for the SASECRSP engine to work at its best. Functionality includes access to Indexes data and to the old format Compustat (CPZ) for those who subscribe to those products
- SAS Version 9.3 includes a new SASEXCCM engine that includes support for the new format Compustat (CMZ) Databases. In this release, the SASEXCCM engine is still marked as experimental.

## Programmers

Programming libraries have been compiled for support on 64-bit computers for C and FORTRAN.

CRSP continues to provide support for set-based data access through programming libraries, but encourages subscribers to transition to the item-based access that was first introduced in 2008. *CRSP Programming Guides* available on our website provide instructions for both methods.

The CRSP software includes one CRSP library for each supported language: C, F95 and G95 (for Fortran on Linux) Each library includes both set-based and item-based access.

CRSPAccess DLL is included in both 32-bit and 64-bit CRSP-supported Windows platforms.

## **Command Line Tools**

Ts\_print sample program, ts\_samp8.rqt requests data from both the stock and CRSP/Compustat Merged Databases. Detailed in the June 2011 CCM release notes, beginning with the June data cut of the CCM database, keysets for Banks were changed from 2-digit numbers to 4-digit numbers. Ts\_samp8.rqt reflects this keyset change. If using this sample program with a database prior to June 2011, this sample program will need to be edited to replace keyset 2100 with keyset 44.

## Known Issues

## Large Volumes

There are four dates where the daily trading volume for Citigroup, PERMNO 70519, Ticker C, exceed our database's maximum value (2147483648). Instead of inserting a false value into the database, CRSP has listed the volumes for these dates as -99 (missing). The true trading volume values for those dates:

DATE	VOLUME
20090805	2674463281
20091217	3772638437
20091218	2813697156
20101207	3267829406

We expect a future release of CRSPAccess to be able to handle these large values properly at which time they will replace the missing values.

## **CRSP** Guides

All CRSP User Guides and Manuals are available on our website at: <u>www.crsp.ChicagoBooth.edu/documentation</u>

## **CHAPTER 2: INSTALLATION**

The following installations are now available:

## Windows

Windows has a single executable, setupwin.exe. It automatically detects the operating system (32- or 64-bit).

## 64-bit Installation

When installing on a 64-bit Windows workstation, there will be a pop-up window that allows the choice of either the 32-bit or 64-bit version of the software. By default, the 64-bit will be chosen. CRSP recommends the 64-bit version of the tools.

CUPL CRSPAccess Utilities and F	Programming Library 3.86
	CUPL 32-bit or 64-bit
Introduction	
License Agreement	Which Version of CUPL Software would you like to install?
Choose Install Folder	
Pre-Installation Summary	
O Installing	
Install Complete	
	O CUPL 32-Bit
	CUPL 64-bit
(a) prof of a)	
I HACK P	
CLAREL	
InstallAnywhere	
Cancel	Previous
	. Telloud

#### 32-bit Installation

Click on the 32-bit button to change to that installation. If you are installing the 32-bit software on a 64-bit machine, as it completes the following message will be displayed. Click **OK** and the 32-bit version of the software is installed:

CRSPAccess	x
A 32-bit version of CRSPAc	cess software found.
	ОК

On a 32-bit workstation, it will automatically install the 32-bit version of the software.

## Linux

- Setuplinux.bin
  - 32-bit installation will work on either 32- or 64-bit machines.
  - 32-bit CRSPAccess command-line utilities will work on either 32- or 64-bit machines
- Setuplinux64.bin
  - + 64-bit installation will work only on 64-bit machine
  - Error message will return during the initialization phase of the installation when trying to install on 32-bit computer:

Launching installer ...

./setuplinux64.bin: Line 2471: /space/temp/install.dir.4493/Linux/resource/ jre/bin/java: cannot execute binary file

./setuplinux64.bin: line 2471: /space/temp/install.dir.4493/Linux/resource/ jre/bin/java: Success

[root@localhost CUPL1\_VER386\_SRD]#

## Preparing for installation

CRSP continues to utilize the InstallAnywhere<sup>©</sup> wizard-driven installation process for CRSP software. Files are compressed and are not directly accessible until installed.

## Please Note:

- Installation over a previous version of CRSPAccess software: CRSP strongly recommends executing one of the following two actions before installing CRSPAccess 3.86 directly into a location that contains a prior version of the software. This will insure a clean installation. Either:
  - 1. Uninstall the older version before installing CRSPAccess 3.86, using either the uninstall command from the CRSPAccess menu, or using Add/Remove programs through the Control Panel, or
  - First rename the old folder containing the CRSPAccess software then install CRSPAccess 3.86 into a folder with the name you wish to use. For example, if you have CRSPAccess 3.22 on your computer in a folder named CRSP, first rename this folder to something such as CRSP322 or CRSP\_old. When installing CRSPAccess 3.86, it may now be installed into a new folder named CRSP.
- *Windows Command Prompt:* InstallAnywhere bypasses the need for users to set path variables. A shortcut labeled CRSP Command Prompt is available in CRSPAccess from the start menu. To run the command line utilities, this shortcut will set the environment variables and open a window. To use the command prompt from Accessories or by running cmd.exe, you will need to manually set your path in the command window with the following:

set path=%crsp\_bin%;%path%

- *Uninstall for Windows:* To comply with recommended Windows procedures, use the Control Panel > Add/Remove Programs.
- *Client Environment for Windows:* The client\_environment.exe is used to set the environment variables needed to run CRSPAccess for multiple or single users. This can set variables at either the user or system level. A client\_environment.

exe is included in the 3.86 release of CRSPAccess. Stock or Stock & Index-only subscribers should leave the area for the CRSP/Compustat Merged Database blank. Client\_environment.exe is located in the accbin\* folder of CRSPAccess or can be accessed from the CRSPAccess menu under Start, if installed on the local machine.

## Installation steps

The following screen shots and instructions were written from the InstallAnywhere procedures for Windows systems. The installation is very similar for all supported operating systems, so these systems are all served by this one set of instructions. Differences between platforms are clearly noted.

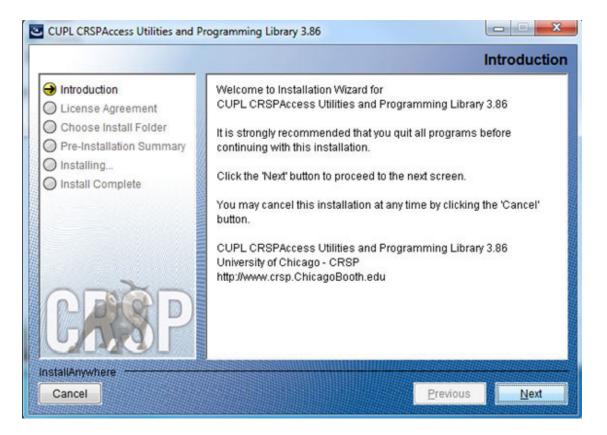
To install the CRSP Access software, download it from the MoveIT Cloud (https://crsp.moveitcloud.com/). Select the file for the platform you are using, as detailed below. The Install Splash screen will pop up on your screen and disappear. A few moments may follow before the install process begins. Once the installation initiates, you will be guided by the InstallAnywhere Wizard.

### Windows:

Double click on setupwin\*.exe.

### Linux:

Double click on setuplinux\*.bin to begin the installation process.



After you have clicked **Next** on the Welcome screen, scroll through and read the CRSP Software Media Agreement. Click to accept the terms of the license agreement, and assuming you do, click **Next**.



The default directory for the software installation is c:\crsp. You may accept or modify it. We recommend creating a folder that reflects the version of the software. Click **Next**.

CUPL CRSPAccess Utilities and Proceed and Proceeding CUPL CRSPAccess Utilities CUPL CRSPAccess Utilities and Proceeding CUPL CRSPAccess Utilities CUPL CRSPACCESS Utilitis CUPL CRSPACCESS Utilities	rogramming Library 3.86 Choose Install Folder
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Choose Install Folder</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Install Complete</li> </ul>	Click Next to install "CUPL CRSPAccess Utilities and Programming Library 3.86" to the following directory, or click CHOOSE to install to a different directory.
	Directory Name C:\crsp386 Restore Default Folder Choose
InstallAnywhere	Previous <u>N</u> ext

The installer will detect the appropriate software for your computer and set it as the default.

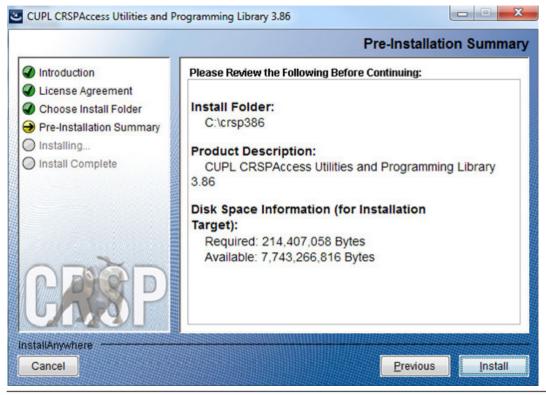
CUPL CRSPAccess Utilities and Pr	ogramming Library 3.86	X
		CUPL 32-bit or 64-bit
<ul> <li>Introduction</li> <li>License Agreement</li> <li>Choose Install Folder</li> <li>Pre-Installation Summary</li> <li>Installing</li> <li>Install Complete</li> </ul>	Which Version of CUPL Software	would you like to install?
<u>ARRE</u> P	<ul> <li>CUPL 32-Bit</li> <li>CUPL 64-bit</li> </ul>	
InstallAnywhere Cancel		Previous

#### Windows:

Summary information is displayed: Location, software features, and the amount of space that will be used. Click Install.

#### Linux:

The root directory that will appear on the screen, based on the previous suggestion would read /home/username/ crsp. Click on **Install** to proceed.

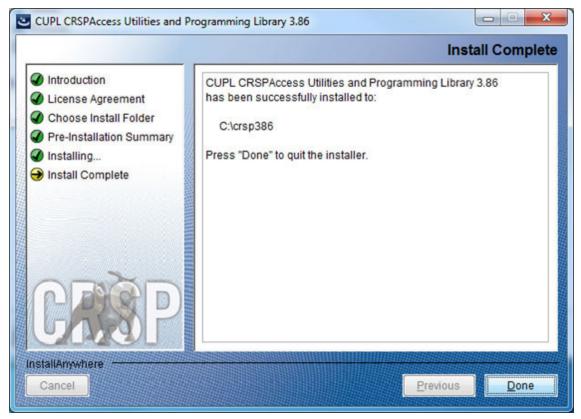


### Windows:

The status of your installation will appear.

## Linux:

The root folder that will appear will be /home/username/crsp/accbin\*. A message indicating the success of the installation appears when the process is complete. Click **Done**.



#### Linux:

After clicking Done, a file, crsp.kshrc can be run to set software alias names at the prompt, type:

>. ./crsp.kshrc <enter>

## **CRSPAccess Environment Variables**

ENVIRONMENT VARIABLE	USAGE
CRSP_ROOT	Top level program directory. Most other CRSP environment variables are set based on CRSP_ROOT
CRSP_LOG	Log directory used for user
CRSP_MSTK	CRSP Monthly Database directory
CRSP_DSTK	CRSP Daily Database directory
CRSP_CCM	CRSP/Compustat Merged Database directory (if available) - Xpressfeed CCM version
CRSP_INCLUDE	Programming header files; include subfolder of root
CRSP_SAMPLE	Sample programs; sample subfolder of root
CRSP_LIB	Object libraries; acclib subfolder of root (control files)
CRSP_BIN	Executables and scripts; accbin* subfolder of root
CRSP_ENV_ULOG	Usage logs produced by users; =CRSP_LOG

ENVIRONMENT VARIABLE	USAGE
CRSP_ENV_ELOG	Error logs produced by users; =CRSP_LOG
CRSP_ENV_ROOT	Variable must point to the most recent CRSPAccess database installed on your system
CRSP_WORK	Directory used to store user-generated files

## **Linux Environment Variables**

## Important Change for Linux Installations:

Following previous installs, the crsp.kshrc file was run upon completion to set both environment variables and software alias values. This new version of InstallAnywhere sets the environment variables directly on the system when the software is installed. The crsp.kshrc file must still be run to set the aliases.

A user may wish to revert back to a previous cut of data or a previous version of the software. In order to do so, CRSP provides shell scripts for users to run that will create a custom-named kshrc file that the user may run to set environment variables at the session level. This process also provides a way for a system administrator to create a script that can be put into the system login process so that the environment variables are seen by all users.

To use a shell script for generating an initialization script file, follow these steps:

1.	cd to the root directory where program files have been loaded	cd accbin*
2.	If you are running csh shell, enter	source crsp_setup.csh
	If you are running ksh or bash shell, enter	./ crsp_setup.sh

3. The script will prompt for data, root, and log directories. Follow the instructions on the prompts in terms of trailing slashes in directory names.

The script will create new scripts, mycrsp.cshrc in csh or mycrsp.kshrc in ksh.mycrsp is the default that may be changed.

Note: When creating a custom kshrc file, be aware that it will overwrite a like-named file if one exists rather than create a new version. The kshrc file will overwrite all environment variables, so must be completely filled in.

env | grep CRSP can be used to check the CRSP environment variables set.

## PC Network Installation of cRSPAccess

CRSPAccess can be installed on a Windows network with Windows 8 clients. Data, programs and libraries are loaded to a server machine that can be accessed by clients with access to the data. A separate client installation program is provided to configure the clients. Configuring a client involves installing program shortcuts to CRSP programs and setting environment variables on the client workstation. The executable, client\_environment.exe is located in the crsproot\accbin\* folder and may be set to run on the user or system level.

- client environment.exe run on the user level sets the environment variables on a computer for the current user.
- client\_environment.exe on the system level sets the environment variables on a computer for all users of that machine and requires administrator privileges to run.
- The environment variable CRSP\_WORK is defined. The directory defined by CRSP\_WORK must have write permission established for the intended users. This directory is used as storage for temporary files, log files and is a recommended location for user created folders and files.

#### The following steps will configure a client:

- 1. Run software and data installs first on the server machine. The program and data disks must be accessible and mapped on the client workstation. The client installer must know the path of the CRSP root folder and monthly and/or daily data folders in terms of the client disk mappings.
- 2. From the client workstation, execute the desired client install. client\_environment.exe is located in the crsproot\ accbin\* folder and should be run from this location.
- 3. Select whether the environment variables are to be set at the user or system level. Identify file locations for the programs and databases.
- 4. File locations will default to what is currently set on the system. If new databases or software are replacing existing
- versions and if the same data locations are used, it is not necessary to reset the environment variables.
- 5. Once locations are defined, click DO. DONE will appear in the lower left hand corner of the screen once the environment variables and shortcuts are set. The client\_environment tool will be included with the Start Menu shortcuts in case future changes are needed.
- 6. The Remove option is useful for moving settings from user to system or vice versa. The Remove option erases all CRSP environment variables and shortcuts, thus should be used with caution. CRSP recommends making note of the variables and locations before running this option.

CRSP Client Environment: (CUPL_ver386 64-bit)	
CRSP Root	
CRSP Root Directory This folder/directory contains the CRSP root subfolders that will allow the CRSP utilities to function properly.	
C:\crsp386	Browse
CRSP Work	
CRSP Work Directory This folder/directory is used for storage of temporary files, log files and contains subfolders that may hold user created files	
C:\crsp386\work\	Browse
CRSP Daily Stock	
CRSP Daily Stock Database Directory	
e:\crspdata\diz201403\	Browse
CRSP Monthly Stock	
CRSP Monthly Stock Database Directory	
e:\crspdata\miz201403\	Browse
CRSP Compustat CCM	
CRSP Compustat CCM Database Directory	
	Browse
Administrator privileges are required to set system level environment variables.	Exit

## **CHAPTER 3: USING C WITH CUPL**

## Windows Systems

CRSP software is tested and fully supported on Windows 8. All C libraries and sample programs were compiled and tested using the Microsoft Visual Studio 2008 and 2010.

CRSP access relies on environment variables set during installation. The environment variables can also be set through the client\_environment tool or with administrator privileges, through the Control Panel/System/Advanced/Environment menu on Windows 8. Environment variables can be used in command prompt windows with the name enclosed in percent (%) characters. The set command can be used in a command prompt window to show available environment variables. (e.g. >set crsp). See Installation Procedures (Page 9) for information on installing the CRSPAccess data and programs.

Important CRSP files and directories have the following names.

%crsp_bin%	folder containing executable sample programs and batch files. This folder should be in the <code>PATH</code> so programs can be run from any folder
%crsp_lib%	folder containing CRSP object library and internal files
%crsp_lib%\crsp_dll.lib	CRSP dynamic link library
%crsp_lib%\crsp_lib.lib	CRSP object library
%crsp_include%	location of CRSP C Header Files referred to by INCLUDE statements
%crsp_sample%	folder containing CRSP sample programs
%crsp_mstk%	folder containing monthly CRSP stock and index databases
%crsp_dstk%	folder containing daily CRSP stock and index databases
%crsp_ccm%	folder containing CCM database
%crsp_work%	folder identified for user containing log, temporary and other user-generated files

## Using the crsp\_dll.lib

CRSP\_dll.lib is included in both 32-bit and 64-bit CRSP-supported Windows platforms.

If you are using the CRSP dynamic link library, crsp\_dll.lib, make note of the following:

- 1. Your program must be modified if it uses the global CRSP err-msg string to report CRSP error messages, or if it uses the crsp\_file\_fopen function. The stk\_samp1.c sample program shows proper use of the crsp\_errprintf function to print CRSP error messages and can be used directly with the CRSP DLL.
- To compile a program with the CRSP DLL, the library file crsp\_dll.lib must be used instead of crsp\_lib.lib. This can be done by simply switching the file names when adding the library file to your project, in the library definition in an NMAKE file, or on the command line.
- 3. The %crsp\_bin% folder must be in the PATH at run-time. CRSP installs do not set the PATH automatically unless running in a CRSP Command Prompt window. The user must set PATH directly under Control Panel/System/Advanced/ Environment Variables, or with a SET command in the shortcut or Window prior to running the program.

## Visual Studio 2010 - C Compiler Instructions

CRSP supports compiling C programs in Windows 32-bit and 64-bit environments. The following example compiles a sample C program provided with the CUPL tools using Microsoft Visual Studio 2010. Use 64-bit options in Visual Studio with a 64-bit install of CUPL, 32-bit options with a 32-bit install.

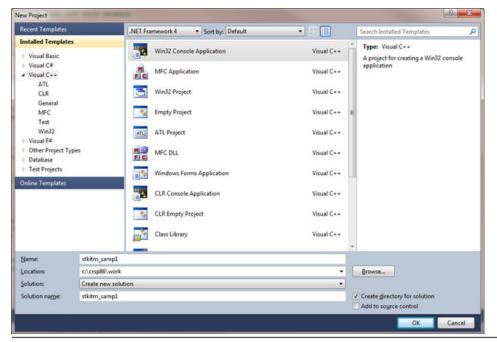
## Step 1:

To begin, open Visual Studio 2010. Click on New Project.



## Step 2:

Select Visual C++ and highlight Win32 Console Application. Give the project a name, specify a location, and provide a solution name. Click **OK**.



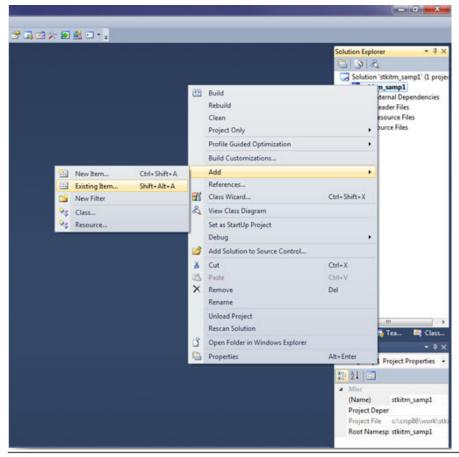
## Step 3:

On the Application Settings screen, click on Console application, and check Empty project, then click on Finish.

Win32 Application Wizard - st	Vin32 Application Wizard - stkitm_samp1								
C:\_	ation Settings								
Overview	Application type:	Add common header files for:							
Application Settings	<ul> <li>Windows application</li> <li>Console application</li> <li>DLL</li> <li>Static library</li> <li>Additional options:</li> <li>Empty project</li> <li>Export symbols</li> <li>Precompiled header</li> </ul>	□ ΔTL □ MFC							
	< Previous	Next > Finish Cancel							

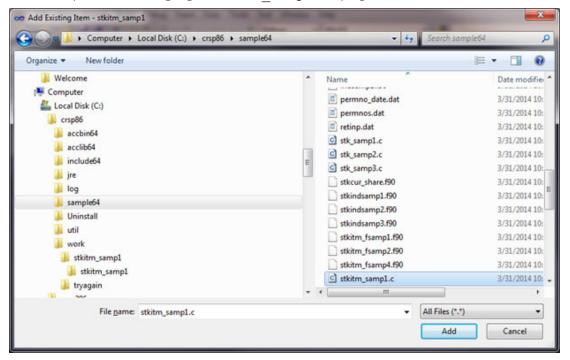
#### Step 4:

You are ready to add information to the project that you are building. To do so, right click on the project, in this example, stkitm sampl (in bold). On the pop-up screen, select **Add > Existing Item**.



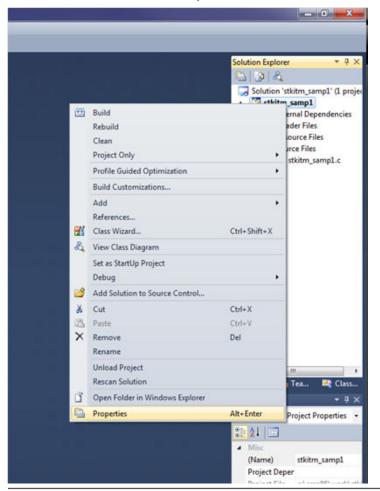
### Step 5:

Browse for the program that you would like to add. In the CUPL Version 3.86 – 64-bit tools, sample programs are located in the Sample64 folder. Highlight stkitm sampl.c program and **Add**.



#### Step 6:

The program will display in the Source folder of the project. Right click on the stkitm\_samp1 project again, and at the very bottom of the window, select **Properties**.



## Step 7:

At this point, there are several actions to take and there is no specific order necessary. First, in the **Configuration** options in the upper left corner of the screen, click on the dropdown and select **Release**.

tkitm_samp1 Prop	perty Pages					? ×
<u>Configuration</u> :	Release	•	Platform:	Active(Win32)	•	Configuration Manager
<ul> <li>C/C++</li> <li>Linker</li> <li>Gen</li> <li>Inpu</li> <li>Mar</li> <li>Deb</li> <li>Syst</li> <li>Opti</li> <li>Emb</li> <li>Adv.</li> <li>Con</li> <li>Manifes</li> <li>XML Do</li> </ul>	ion Properties ing birectories eral ut infest File ugging em imization bedded IDL anced hmand Line	"gdi32.lb" "\ "odbccp32.l /MANIFEST \stkitm_samp	winspool.lb" b" /MANIFE UAC:"level=" p1.pdb" /SU	kitm_samp1\Release\stkitm_samp1.exe" /INC 'comdig32.lb' "advapi32.lb" "shell32.lb" "ole ST /ManifestFile:"Release\stkitm_samp1.exe ir ssinvoker uAccess=false" /DEBUG /PDB:'c SSYSTEM.CONSOLE /OPT.REF./OPT.ICF /P IG /TLBID:1 /DYNAMICBASE /NXCOMPAT /	32.lib" "oleaut 32.lib" "uu ntermediate.manifest" /A ::\crsp86\work\stkitm_sz GD:"c:\crsp86\work\stk	id.lb" "odbc32.lb" LLOWISOLATION imp1\Release itm_samp1\Release
<ul> <li>Build Ev</li> <li>Custom</li> </ul>	Build Step	Additional Op	ptions		Inhert f	rom parent or project defaults 📝
•					ОК	Cancel Apply

#### Step 8:

On the top right corner of the same screen (see above), click on the **Configuration Manager**. From the Active solution platform dropdown, select x64 and click **OK**. If x64 doesn't exist as an option, from this same dropdown click on New and add x64 as an option, click **OK**, and then **Close**.

ctive solution <u>c</u> onfiguration:		Active solu	Active solution glatform:				
Debug		Win32 deploy):					
Project contexts (check the pro	eject configurations to build or						
Project		Platform	1	Build			
stkitm_samp1	Debug		Win32				
w Project Platform New glatform: x64	<u>२</u>						
New <u>p</u> latform:	? ×						
New platform: x64 x64	₹ 						
New <u>p</u> latform: x64 x69 <u>settings from:</u>	•						

#### Step 9:

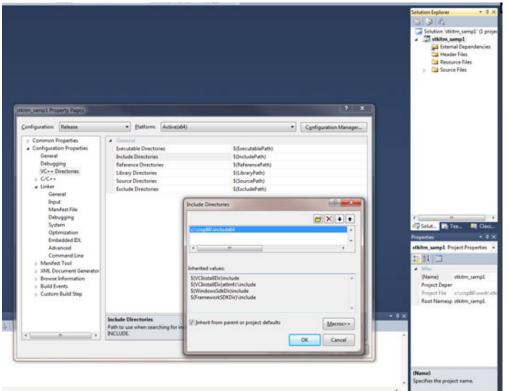
Back to the Property Pages, under **Configuration Properties**, click on **Debugging**. In the **Command** Arguments line, define the database that you will use, and enter a name for the output file. In this example, <code>%crsp\_dstk%</code> is using environment variables that are pointing to the CRSP daily stock database. "10" is the daily stock setid. <code>stksampl.out</code> is the file that will be generated once the project is built and run.

tkitm_samp1 Proper	rty Pages elease	- Dist	form:	Active(x64)		-	? ×
Common Pro	Common Properties     Configuration Properties	Debugger to laur		Active(x04)		- C	onfiguration Manager
Configuration     General	Properties	Local Windows D	Debugg	er			•
Debuggin VC++ Dire C/C++ Linker Genera Input Manife Debug System Optimi Embed Advan Comm Manifest T S XML Docu	ctories st File ging b tizztion Ided IDL ced and Line 'ool iment Generator 'ormation	Local Windows Debugger Command Command Arguments Working Directory Attach Debugger Type Environment Merge Environment SQL Debugging			S(TargetPath) %crsp_dstk% 10 st S(ProjectDir) No Auto Yes No	ksamp1.out	×
▷ Build Even ▷ Custom Bi		Command Argu	mente				
۰	,	AND COMPANY AND COMPANY		uments to pass to	the application.		
						ОК	Cancel Apply

## Step 10:

Still under the **Configuration Properties**, click on **VC++ Directories**. Highlight the **Include Directories** row and click on the dropdown. Click on **Edit** and add the location of the Include folder in the CUPL tools.

In this example, c:\crsp86\include64. Click **OK**.



#### Step 11:

Next, expand the **C/C++** directory select the **General** tab. Highlight the **Additional Include Directories** and click on the dropdown and **Edit**. Enter the path for the CRSP include files. In the example, the path is c:\crsp86\include64. Click **OK** to close the window.

onfiguration: Release		Platform: Active(x64)	Configuration Manager
<ul> <li>Common Properties</li> <li>Configuration Propertie General Debugging VC++ Directories</li> <li>C/C++ General Optimization Preprocessor Code Generation Language Precompiled Hei Output Files Browse Informat Advanced Command Line</li> <li>Linker General Input Manifest File Debugging System Optimization</li> </ul>	≣ ide	Additional Include Directories Resolve ≢using References Debug Information Format Common Language RunTime Support Suppress Startup Banner Warning Level Treat Warnings As Errors Multi-processor Compilation Use Unicode For Assembler Listing	c:\crsp86\include64;%(AdditionalIncludeDirectories) Program Database (/Zi) Yes (/nologo) Level3 (/W3) No (/WX-)
Embedded IDL Advanced	-	Additional Include Directories Specifies one or more directories to add to the in (/I[path])	clude path; separate with semi-colons if more than one.

#### Step 12:

Still in the the C/C++ folder, select **Preprocessor**. Highlight **Preprocessor Definitions**, click on the dropdown and **Edit**. Enter WINNT and click **OK** to close the window.

onfiguration:	Release	Platform: Active(x64)	<ul> <li>Configuration Manager</li> </ul>
> Common I	and the second se	Preprocessor Definitions	WIN32;NDEBUG;_CONSOLE;WINNT;%(PreprocessorD
	tion Properties	Undefine Preprocessor Definitions	
Genera	Commence and the second s	Undefine All Preprocessor Definitions	No
Debug		Ignore Standard Include Paths	No
	Directories	Preprocess to a File	No
4 C/C++		Preprocess Suppress Line Numbers	No
	timization	Keep Comments	No
Cor Linker Ger Inp Ma Deb Syst Opt Emi	vanced mmand Line heral ut nifest File bugging tem timization bedded IDL vanced	Preprocessor Definitions Defines a preprocessing symbols for your source	- 6-
(	umandline .	bennes a preprocessing symbols for your source	e nie.

#### Step 13:

Next in **Configuration Properties**, expand the **Linker** folder and select **General**. Highlight the **Additional Library Directories** row and click on the dropdown. Enter the path for the CRSP libraries. In this example, it is c:\crsp86\acclib64.

Configuration:	Debug	Platform: x64	*	Configuration Manager
C/C++     Gen     Opt     Prey     Coo     Lan     Prev     Out     Bro     Adv     Cor     Linker     Gen     Inpu     Mar     Deb     Syst     Opt     Eml	ping Directories D	Output File Show Progress Version Enable Incremental Linking Suppress Startup Banner Ignore Import Library Register Output Per-user Redirection Additional Library Directories Link Library Dependencies Use Library Dependencies Use Library Dependency Inputs Link Status Prevent DII Binding Treat Linker Warning As Errors Force File Output Create Hot Patchable Image Specify Section Attributes	S(OutDir)S(TargetName)S(Tar Not Set Yes (/INCREMENTAL) Yes (/NOLOGO) No No C:\crsp86\acclib64;%(Additio Yes No	-
Manifes	· · · · · ·	Additional Library Directories Allows the user to override the environment	tal library path (/LIBPATH:folder)	

#### Step 14:

Stay in the Linker folder and select Input. Click on the Additional Dependencies row, click on the dropdown and Edit. Enter the CRSP library file name, crsp lib.lib and click **OK** to close the window.

2 2

	roperties A	Additional Dependencies	crsp_lib.lib;%(AdditionalDependencies)	
▲ Configurati	and the second se	Ignore All Default Libraries	ersp_mand, softwartening ependencies,	
General		Ignore Specific Default Libraries		
Debugg	ing	Module Definition File		
	lirectories	Add Module to Assembly		
4 C/C++		Embed Managed Resource File		
Gene	eral	Force Symbol References		
Opti	imization	Delay Loaded Dils		
Prep	processor	Assembly Link Resource		
Cod	e Generation	Assenioly Link Resource		
Lang	guage 🗉			
Prec	ompiled Heade			
Outp	put Files			
Brow	wse Information			
Advi	anced			
Com	nmand Line			
⊿ Linker				
Gene	eral			
Inpu	ıt			
Man	nifest File			
Debr	ugging			
	em			
Syste	imization			
Opti	edded IDL	Additional Dependencies		
Opti Emb		Additional Dependencies Specifies additional items to add to the link of	and the first free free (D2 (D2))	

## Step 15:

Finally, within **Linker**, select **Command Line** and click **Apply** in the lower right corner of the screen. Click **OK** to close the Properties Pages.

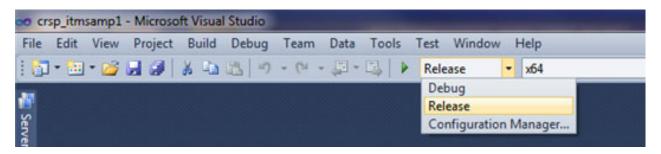
stkitm_samp1 Property Pages				? ×
Configuration: Release	• Platfo	orm: Active(x64)	•]	Configuration Manager
Common Properties     Configuration Properties     General     Debugging     VC++ Directories     C/C++     Linker     General     Input     Manifest File     Debugging     System     Optimization     Embedded IDL     Advanced     Command Line     Manifest Tool     XML Document Generator     Browse Information     Build Events	\crsp86\acclib64" '\ "ole32.lib" "oleaut32 \atkitm_samp1.exe.in /PDB:"c:\crsp86\wo /PGD:"c:\crsp86\wo	crsp_lb.lb <sup>*</sup> "kernel32.lb" "user32.ll 2.lb" "uuid.lb" "odbc32.lb" "odbcc ntermediate.manifest" /ALLOWISOL ork\stkitm_samp1\x64\Release\stki	itm_samp1.exe" /INCREMENTAL:NO // b" "gd32lib" "winspool lib" "comdig32 j32lib" /MANIFEST /MArfestFie":%64 ATION /MANIFESTUAC:"level='asinvo tm_samp1.pdb" /SUBSYSTEM.CONSO itm_samp1.pgd" /LTCG /TLBID:1 /DYN	b" "advapi32.lb" "shell32.lb" Release ker' ulAccess=Talse"' /DEBUG ILE /OPT:REF /OPT:ICF
Custom Build Step	Additional Options		inherit f	from parent or project defaults 📝
			ОК	Cancel Apply

## Step 16:

At this point, all entries should have been made in order to build the solution. From the menu bar, select **Build** > **Build** stkitm\_samp1. Assuming that the build runs successfully to completion, you ill see the following message once the build is complete:

Build: 1 succeeded, 0 failed, 0 skipped.

Prior to running your program, check the Visual Studio Menu bar to confirm that the Solution Configurations set the mode to **Release**. (*Note: At CRSP, if not set to Release mode, we encountered an error message stating that MSVCR100.dll is not found*)



#### Step 17:

Once you have built your program successfully, you can now run it to generate output. From the Menu Bar, click on **Debug** > Start Without Debugging. The program will begin running and for this example, will work sequentially through the universe of CRSP PERMNOS.

C:\Window	vs\systen	n32\cmd.exe			-	5.1
processed	1000	records;	current	permno	10999	
processed	2000	records;	current	permno	11999	
processed	3000	records;	current	permno	:13090	
processed	4000	records;		permno		
processed	5000	records;	current	permno	:18631	
processed	6000	records;	current	permno	24521	
processed	7000	records;	current	permno	:30330	
processed	8000	records;		permno		
processed		records;	current	permno		
processed	10000	records;	current	permno	:47854	
processed	11000	records;	current		:53700	
processed	12000	records;	current		:59539	
processed	13000	records;	current	permno	:65357	
processed	14000	records;	current	permne	:71504	
1	15000	records;	current		:75705	
processed	16000	records;			:76755	
processed	17000	records;	current		:77834	
processed	18000	records;	current		:79019	
processed	19000	records;	current		:80050	
processed	20000	records;	current		:81111	
processed	21000	records;			:82700	
processed	22000	records;			:83957	
processes	23000	records;		permno	:85323	
	24000	records;	current		:86395	
processed	25000	records;	current	permno	:87577	

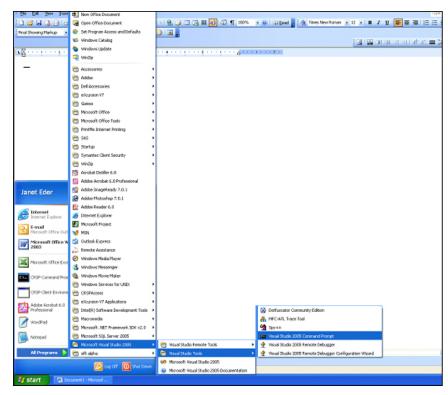
Your output will be located in c:\CRSP86\work, or as specified in your project.

ile Edi	t Format	View Help XSIRIUS INC MICRO DISPLAY SYSTEMS INC CEDAR REALTY TRUST INC ALLIANT COMPUTER SYSTEMS CORP BUTTE COPPER & ZINC CO ADVANCED MEDICAL SCIENCES INC MCDANIEL AUSTIN CORP FIRST CITIZENS FINANCIAL CORP BENJAMIN FRANKLIN F S L A OR INVESTORS BANK CORP MINTKA MN F B X CORP CENTENNIAL BANCORP BUTTERICK CO AMERICAN INTERNAT PETE CORP NEW NAYLOR INDUSTRIES INC CONFERTECH INTERNATIONAL INC AXOGEN INC CONNER PERIPHERALS INC FIRST CHATTANOOGA FINL CORP DATA MEASUREMENT CORP C I T FINANCIAL CORP ADVENT CORP REEDS JEWELERS INC M TECH PINNACLE BANCSHARES INC CRYOTECH INDUSTRIES INC C B & T FINANCIAL CORP ALLIANCE BANCORP OF NEW ENG INC MID AMERICA REALTY INVESTMTS INC COMPUTERIZED MEDICAL SYS PLC C P C REXEL INC					
839081	0 10950		2	3810	19861	216.	19940526
048333	10951	MTCPO DISPLAY SYSTEMS INC	2	3570	19861	217.	19890508
50602	10052	CEDAD DEALTY TOUST THE	1	6708	10861	217	20140228
188001	0 10052	ALL TANT COMPLITED SYSTEMS COPP	5	2570	10861	217	10011017
240010	10955	RUTTE CODDED & TINC CO	1	1000	10251	221	10600202
075281	0 10954	ADVANCED MEDICAL SCIENCES INC	2	1000	10730	231	19750602
800201	0 10056	MCDANTEL AUSTIN CORP.	5	7270	10861	217	10020615
105801	0 10950	ETDST CITTZENS ETNANCTAL CODD	3	6710	10861	217.	19970822
820721	0 10058	RENJAMEN EDANKIEN E S. L.A. OD	5	6020	10861	217	10000221
614621	0 10950	TNUESTOPS BANK COPP MINITKA MN	5	6710	10861	217.	19950428
0241 11	0 10960	E B Y COPP	5	3660	10861	217	10000620
512271	0 10961	CENTENNIAL BANCOPP	2	6020	10861	217	20021115
240020	10961	BUTTERICK CO	1	2710	10251	231	19360324
26000/	10963	AMEDICAN INTERNAT DETE CORD NEW	2	1380	10861	217	20001106
203034	0 10964	NAVIOR INTERNAT FETE CORF NEW	2	1620	10861	216	19930714
06001	10964	CONFERTECH INTERNATIONAL INC	3	4810	10880	210-	10050215
546221	0 10965	AVOCEN THE	5	2845	10861	210-	20140228
091091	0 10900	CONNED DEDTENEDALS INC	1	5045	1000	412	10060202
104511	0 10967	ETDST CHATTANOOCA ETNI CODD	5	6030	10861	210	100201202
270021	0 10900	DATA MEASUDEMENT CODD	5	2620	10861	219	10060110
255601	0 10909	C T T ETNANCTAL COPP	1	6146	10251	2210-	10800121
075511	0 10071	ADVENT CORP	5	2651	10721	214	10810414
592411	0 10971	ADVENT CORP	3	5044	10961	214	20040506
527881	0 10972	M TECH	5	7270	10861	210	10880620
220021	0 10973	DINNACLE BANCSHADES INC	5	6712	10861	217	20080214
229051	0 10974	CONCECH INDUSTRIES INC	5	2060	10861	210	10021028
290311	0 10975	C P & T ETNANCTAL CODD	3	6710	10261	219	10020625
195201	0 10970	ALL TANCE BANCORD OF NEW ENC THE	3	6026	10261	219	20040401
103201	0 10977	ALLIANCE DANCORP OF NEW ENG INC	4	6709	10061	219-	10080806
055592	10970	COMPUTERIZED MEDICAL SYS PLC	5	2600	10861	219	-19870706
261501	0 109/9	C P C REXEL INC	3	2070	10061	219	-19921123
9540C1	0 10980	NTD MATHE CANTING BANK FEB AUB	3	6026	10061	219.	10040720
604851	0 10981	MID MAINE SAVINGS BANK FSB AUB INTERNATIONAL TEXAS INDS INC LAKELAND FIRST FINANCIAL GRP INC	5	2820	10061	222	10871106
116581	0 10982	INTERNATIONAL TEXAS INDS INC	3	6020	10061	222.	10050620
	0 10983	LAKELAND FIRST FINANCIAL GRP INC	3	2010	10061	222-	20060212
489001 3732E1	0 10984	LOWRANCE ELECTRONICS INC	3	5810	10861	223-	10800630
	0 10985	HOME SAVINGS ASSN TAMAQUA PA	3	0020	19801	223-	10050524
209101	0 10980	LAKELAND FIRST FINANCIAL GRP INC LOWRANCE ELECTRONICS INC HOME SAVINGS ASSN TAMAQUA PA ALPHA 1 BIOMEDICALS INC TANGRAM ENTERPRISE SOLUTIONS INC VISION SCIENCES INC BESTFOODS ADVERTISING UNLIMITED LTD BANK OF EAST TENNESSEE	2	2030	10001	223-	20021000
759241	0 1098/	TANGRAM ENTERPRISE SOLUTIONS INC	2	75/0	10861	223-	10010304
279051	0 10988	VISION SCIENCES INC	5	3850	19861	223.	-19910304
865801	0 10989	BESTFOODS	+	2046	19251	231-	-20001004
075571 618791	0 10990	ADVERTISING UNLIMITED LTD	2	2/50	19/20	1003-	-198/1023

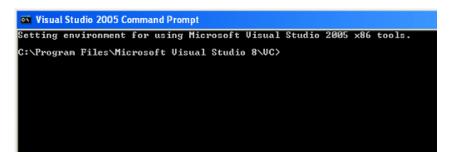
## Using the Command Prompt Window

The programs can also be compiled, linked, and run from a command prompt window. In order to do so, the environment variables for Microsoft Visual Studio 2005 must be set.

To set the environment to the Visual Studio 2005 click on Start→All Programs→Microsoft Visual Studio 2005→Visual Studio 2005 Command Prompt. When you do this you will open a prompt like below and then go to your directory using the appropriate DOS command:



A DOS window will open ready for you to run your C++ programs.



Copy the sample program to a local directory using the Explorer utility or the command prompt copy command, or use the Developer Studio to open the file and save to a new location with Save As.

Sample programs can be found in the %crsp\_sample% directory. The command prompt command, echo %crsp\_ sample% can be used to get the explicit directory needed. The explicit paths for %crsp\_include% and %crsp\_ lib% will be needed to set up projects in the Microsoft Visual Studio 2005. These too can be identified using the echo command.

```
> copy %crsp sample%\stkitm sampl.c .
```

> cl /D WINNT=2 /I%crsp include% stkitm samp1.c %crsp lib%\crsp lib.lib

> .\stkitm samp1 %crsp dstk% 10 myfile.out to run the program

Sample programs can also be compiled and linked using the nmake utility. The file *c\_samp.mak* in the %crsp\_ sample% directory is a description file to maintain the two stock sample programs. To run, copy the file to your program directory and run the utility with the command:

>	nmake /f c_samp.mak stkitm_samp1.exe	to compile a specific sample program
>	nmake /f c_samp.mak	to compile all sample programs
>	.\stkitm_samp1 %crsp_dstk% 10 myfile.out	to run the program

## Linux Systems

CRSP supports C programming for Linux Red Hat Enterprise Linux 5.10 on Intel x86 32-bit and 64-bit machines. C functions were compiled and tested using the gcc 3.2.3 compiler on the 32-bit computer, and gcc 4.1.2 on the 64-bit.

CRSP access depends on environment variables set during installation. Environment variables can be used on Linux with the name preceded by \$. All file names and environment variable names are case-sensitive on Linux systems. The env command can be used in a terminal window to find available environment variables.

Important CRSP files or directories can be found with the following names.

\$CRSP_BIN	directory containing Executable Sample Programs and Batch Files. This directory is in the PATH so programs can be run from any directory.
\$CRSP_LIB	directory containing CRSP object library and internal files.
\$CRSP_LIB/crsplib.a	CRSP object library.
\$CRSP_INCLUDE	directory containing CRSP header files referred to by #INCLUDE statements.
\$CRSP_SAMPLE	directory containing CRSP sample programs.
\$CRSP_MSTK	directory containing monthly CRSP stock and index databases.
\$CRSP_DSTK	directory containing daily CRSP stock and index databases.
\$CRSP_CCM	directory containing CCM database.

Following is an example of how to modify and to run a sample C program with Linux – gcc 3.2.3:

#### **Command line:**

- > cp \$CRSP SAMPLE/stkitm samp1.c .
- > chmod 660 stkitm sampl.c
- > Use an available text editor to make desired code changes.
- > gcc -DUNIX=1 -DUNIX2=1 -I\$CRSP\_INCLUDE -w -fPIC stk\_samp.c -o stkitm\_samp1 \$CRSP LIB/crsplib.a -lm
- > ./stkitm samp1 \$CRSP DSTK 10 myfile.out to run the program

Sample programs can also be compiled and linked using the make utility. The directory \$CRSP\_SAMPLE contains sample make description files for Linux, named *c\_samp\_stk.mk*. To use the make file, copy the relevant description file to your program directory, edit it to support the program(s) of interest and create local executables, and run with the commands:

#### Make file:

>	make -f c_samp.mk stkitm_samp1	to compile a specific sample program
>	make -f c_samp.mk	to compile all sample programs
>	./stkitm_samp1 \$CRSP_DSTK 10 myfile.out	to run the program