# The IMSL® Library for C

# Getting Started Guide – A Technical Guide by Rogue Wave Software

RogueWave
SOFTWARE
Accelerating Great Code

# The IMSL® Library for C
# Getting Started Guide

by Rogue Wave Software

## Trademark Information

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# Table of Contents

Screen shots are provided throughout this document, whenever possible, to provide clarity to the instructions.  Note that not all versions of Windows have the same user interface. Adjustments must be made accordingly.

# Installing IMSL Library for C

### *Executing the install program*

After you have downloaded the product from the FTP site, unzip the file into a temporary folder, then run "setup.exe" from that folder. You may have to run the Setup program with administrator privileges, depending on your User Account Control settings. To do this, right-click on setup.exe and choose, "Run as administrator".

## Welcome

The first window introduces the installation program for IMSL Library for C.
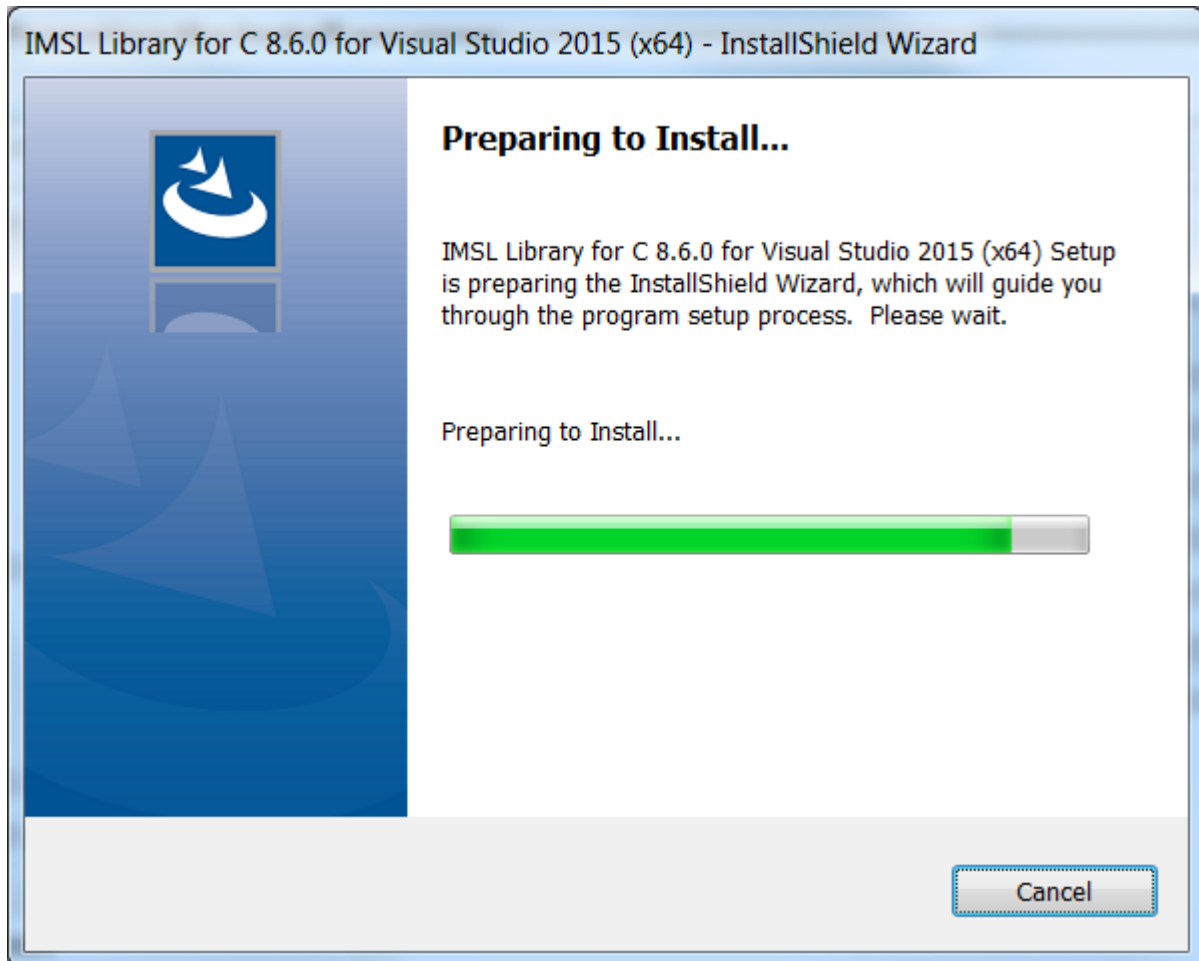
## Product Selection

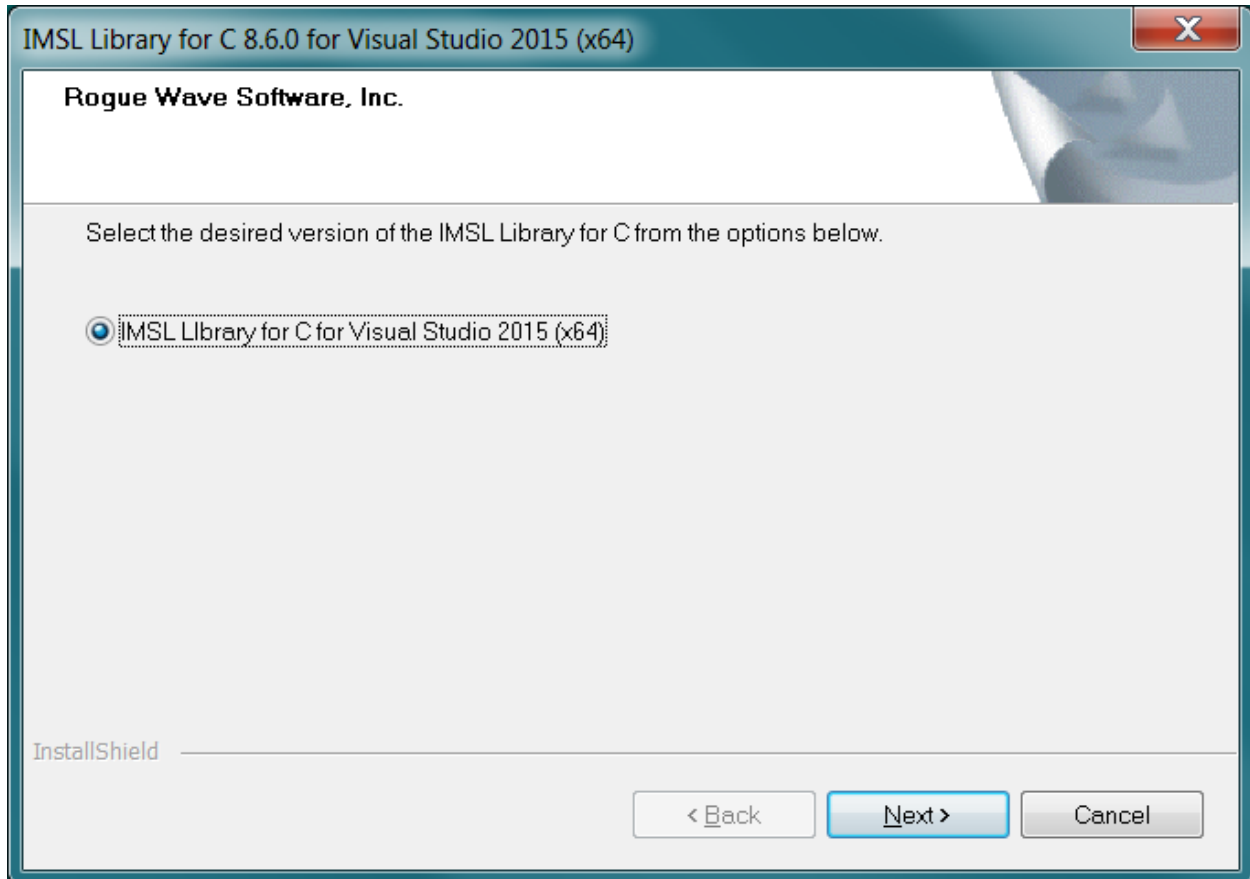Verify that the proper product for the appropriate version of the compiler is being installed. Press Next> to continue.

```
IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)                          [ X ]

   Rogue Wave Software, Inc.


      Select the desired version of the IMSL Library for C from the options below.


      ( ) IMSL Library for C for Visual Studio 2015 (x64)






   InstallShield ————————————————————————————————————————————————————————

                                        < Back      Next >        Cancel
```

## MKL/CUDA Acknowledgement

Two enhanced performance versions of IMSL Library for C, MKL-enabled and NVIDIA®
CUDA-enabled, are included with the installation. This screen informs you that the MKL and
CUDA redistributables are not covered by the IMSL end-user license agreement.  Press Yes to
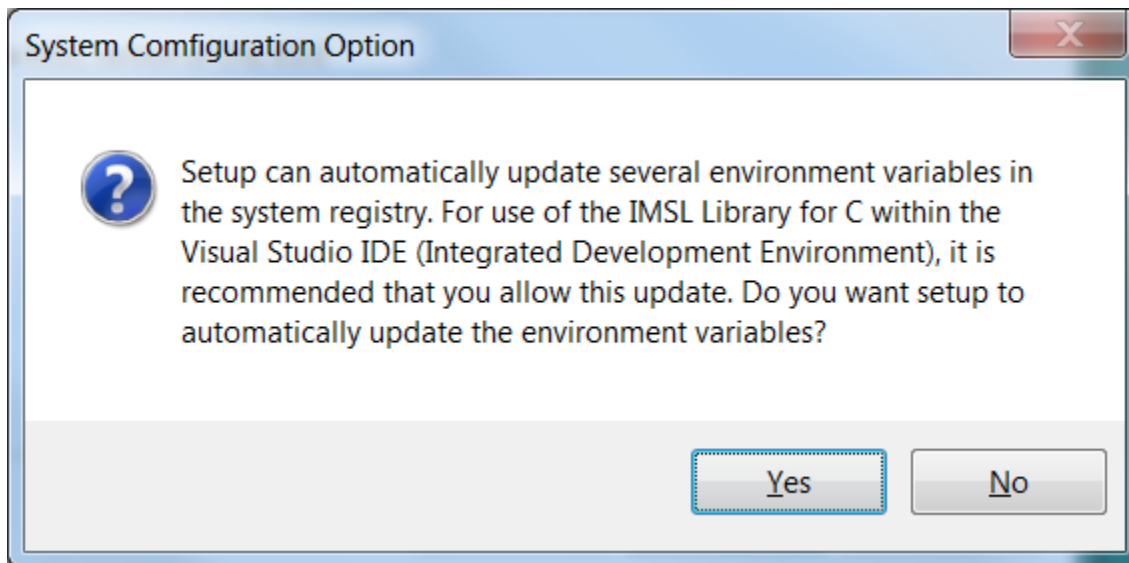continue with the installation program.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)

**MKL and NVIDIA CUDA(TM) Information**

Press the PAGE DOWN key to see the rest of the agreement.

The user can optionally install two additional versions of the IMSL Library for C.
Both versions of the Library are installed if this option is chosen.

The MKL-enabled version of the MSL Library for C leverages the Intel(R)
Math Kernel Library (MKL) to enhance performance in functions that use BLAS,
FFTs, or LAPACK routines.  Note that MKL is not covered by the IMSL License
Agreement.  Go to www.intel.com to obtain more information on Intel's MKL License
Agreement.

The CUDA-enabled version of the IMSL Library for C leverages NVIDIA

Do you want to continue with the installation?          Print

InstallShield

‹ Back          Yes          No

## Installation Option

You can select to install only the IMSL version of the product or the two performance versions as well.
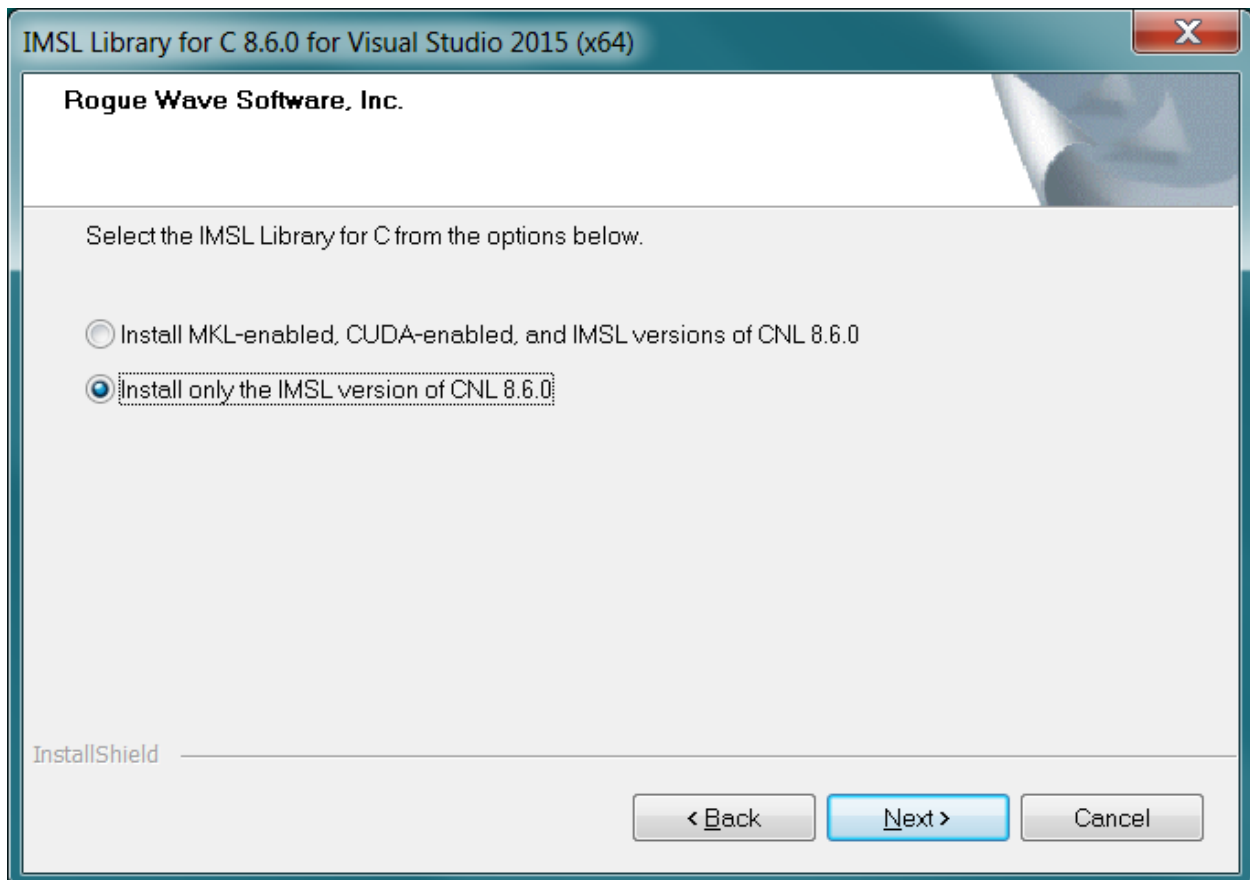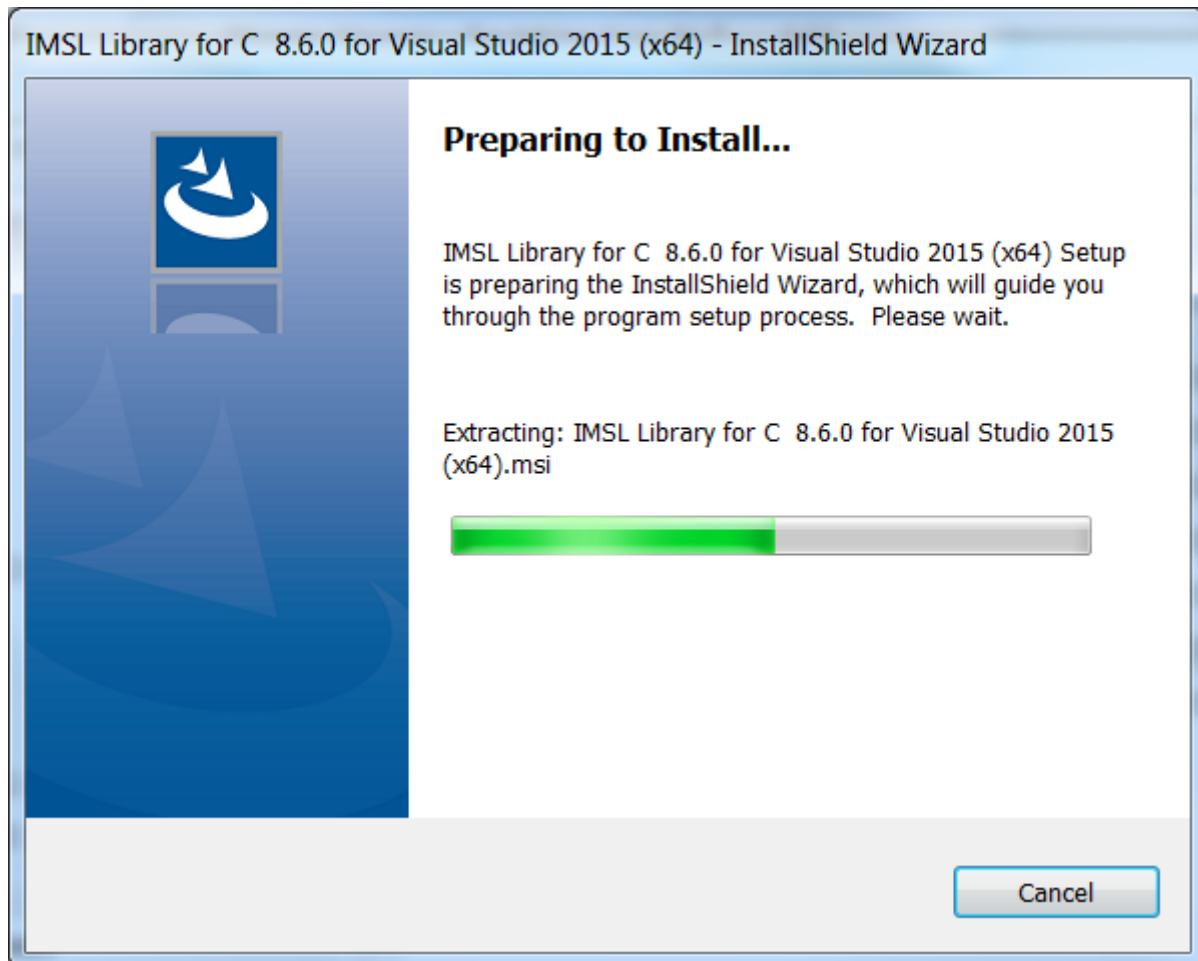
## Environment Variable Registration

You are prompted to automatically update environment variables required to use the IMSL Library for C. It is recommended that you perform this update.
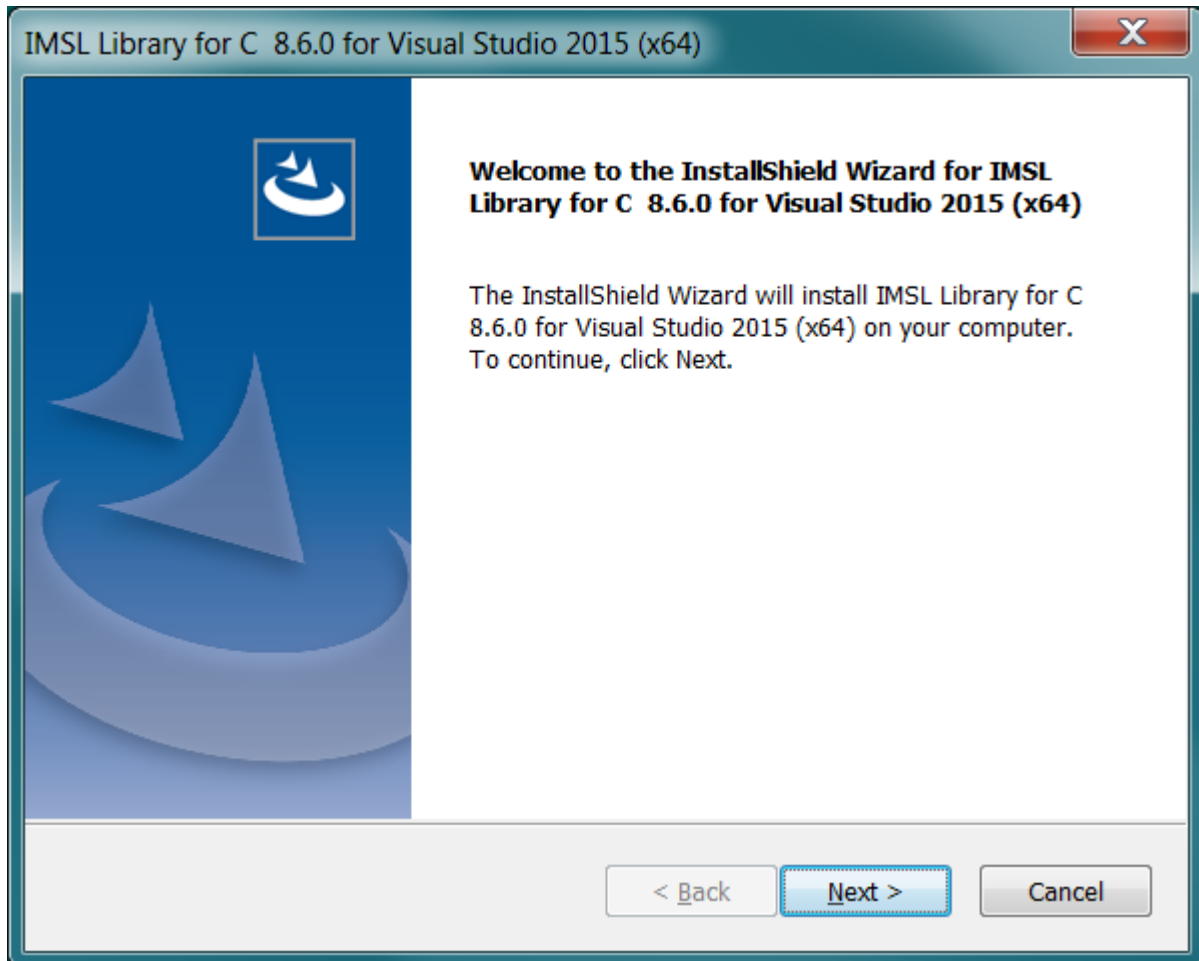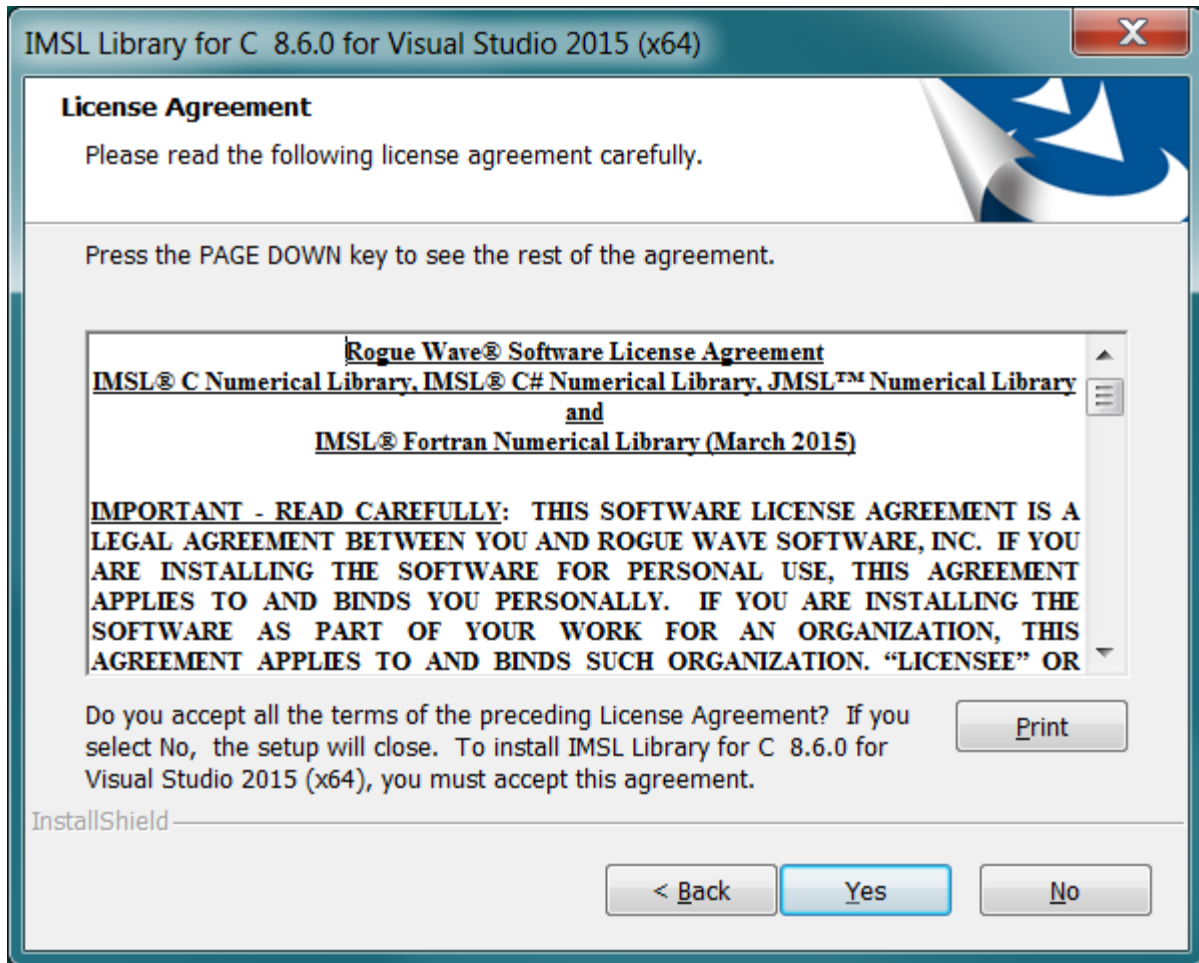
**Installation Start Screen**

## Initiate the Installation

Press Next > to initiate the installation.

## License Agreement

This screen presents the end user license agreement. When you have read the contents and agreed, press Yes to continue the installation.

## Confirm MKL/CUDA Installation

If installation of the MKL/CUDA enhanced IMSL Library for C was chosen during the selection process, the installation verifies that this was intended.
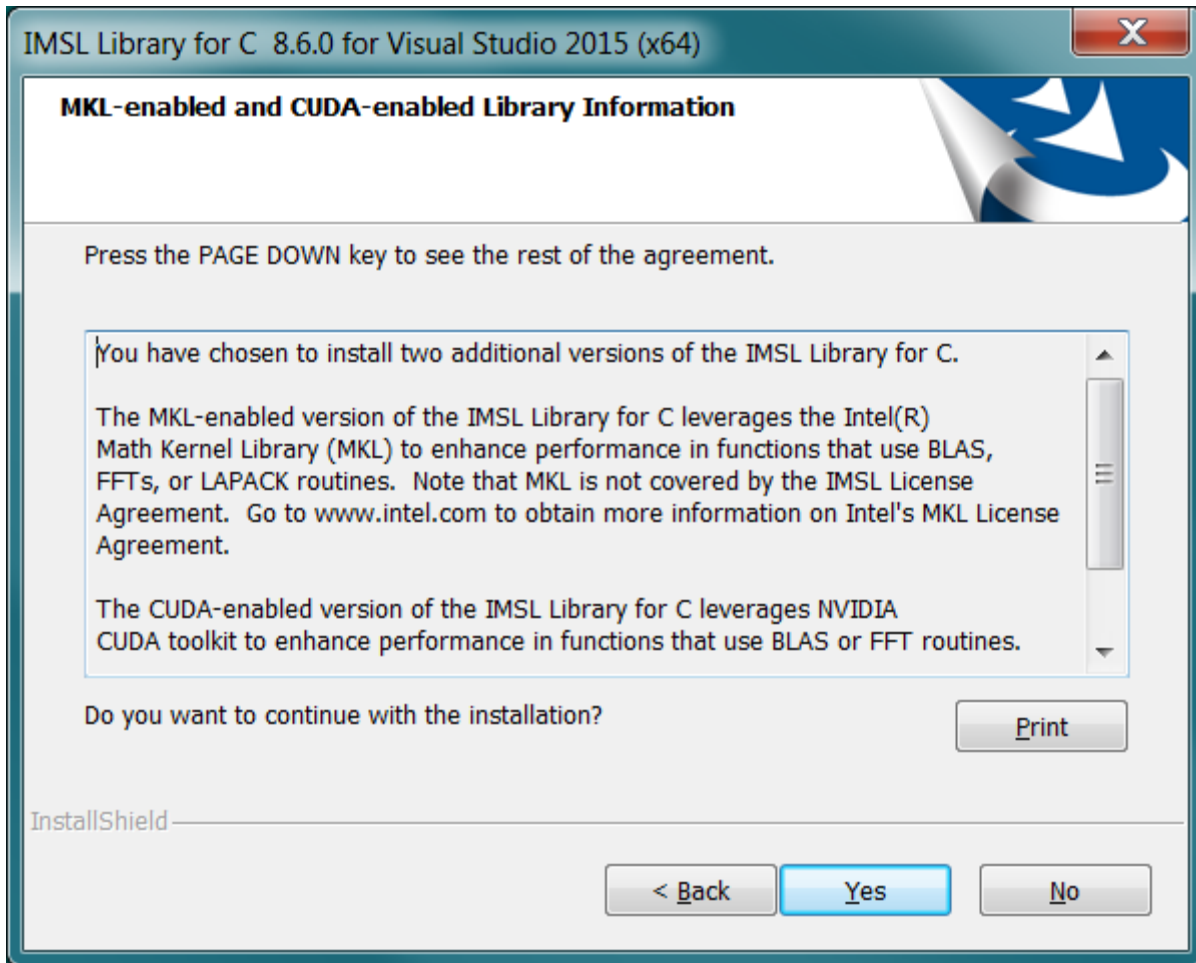
## License Number

If you have a license number, enter it at this point. If you do not yet have a license number, or are evaluating the product, input 999999. Press Next> to continue.
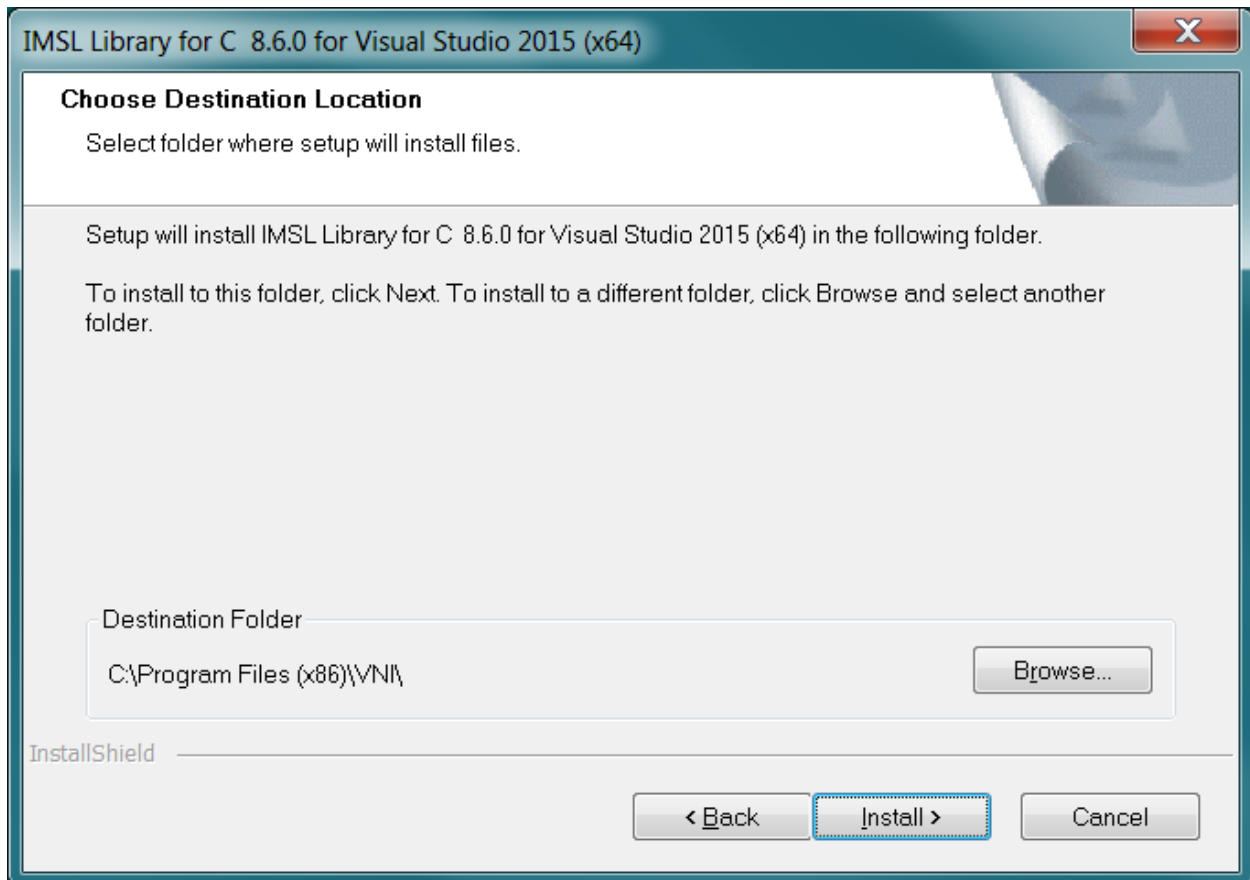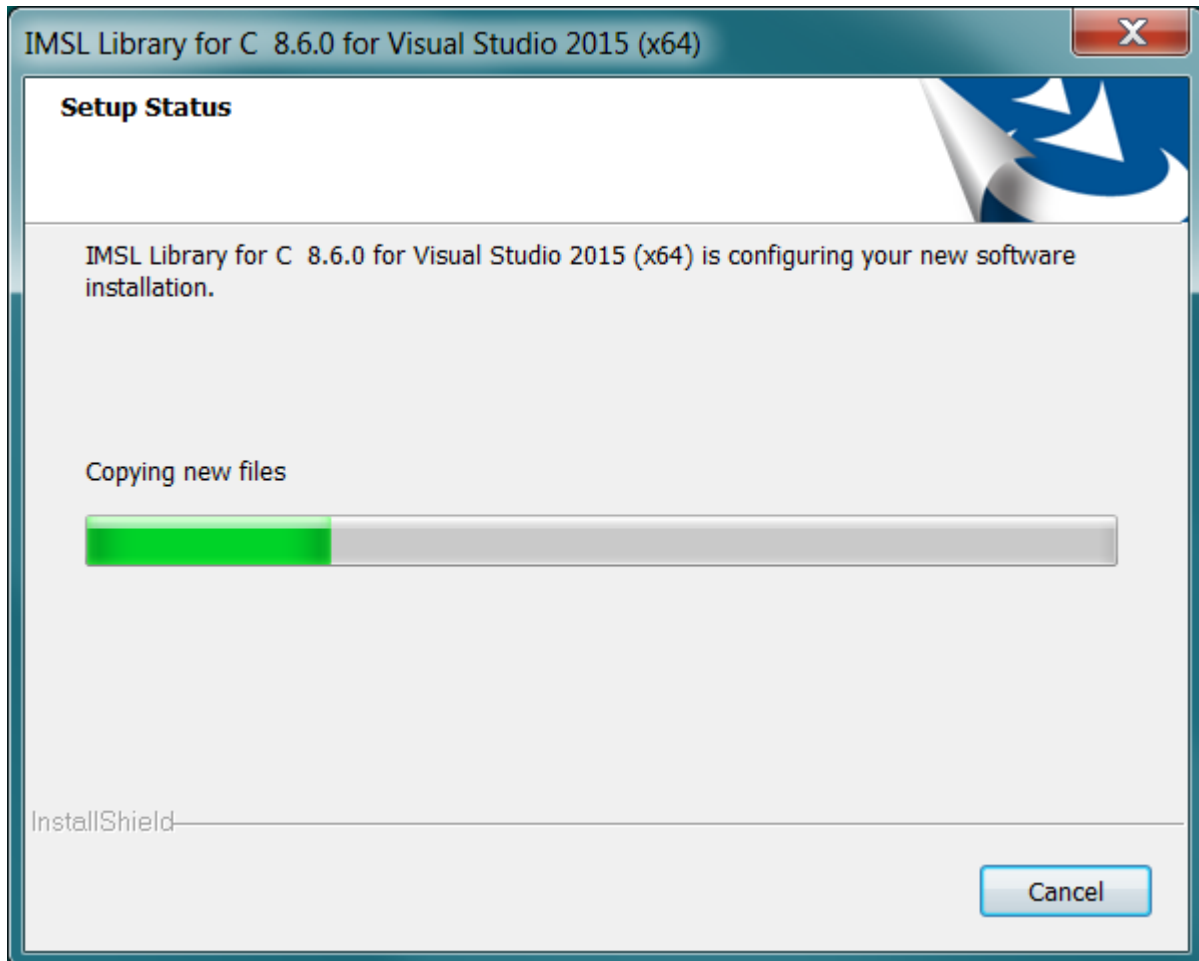
## Installation Directory

Set the directory where the IMSL Library for C will be installed. The default is `C:\<Program Files>\VNI`. Use the Browse button to select an alternate location. You may be prompted to create a directory if it does not exist. Press Install> when you are satisfied with the selection.
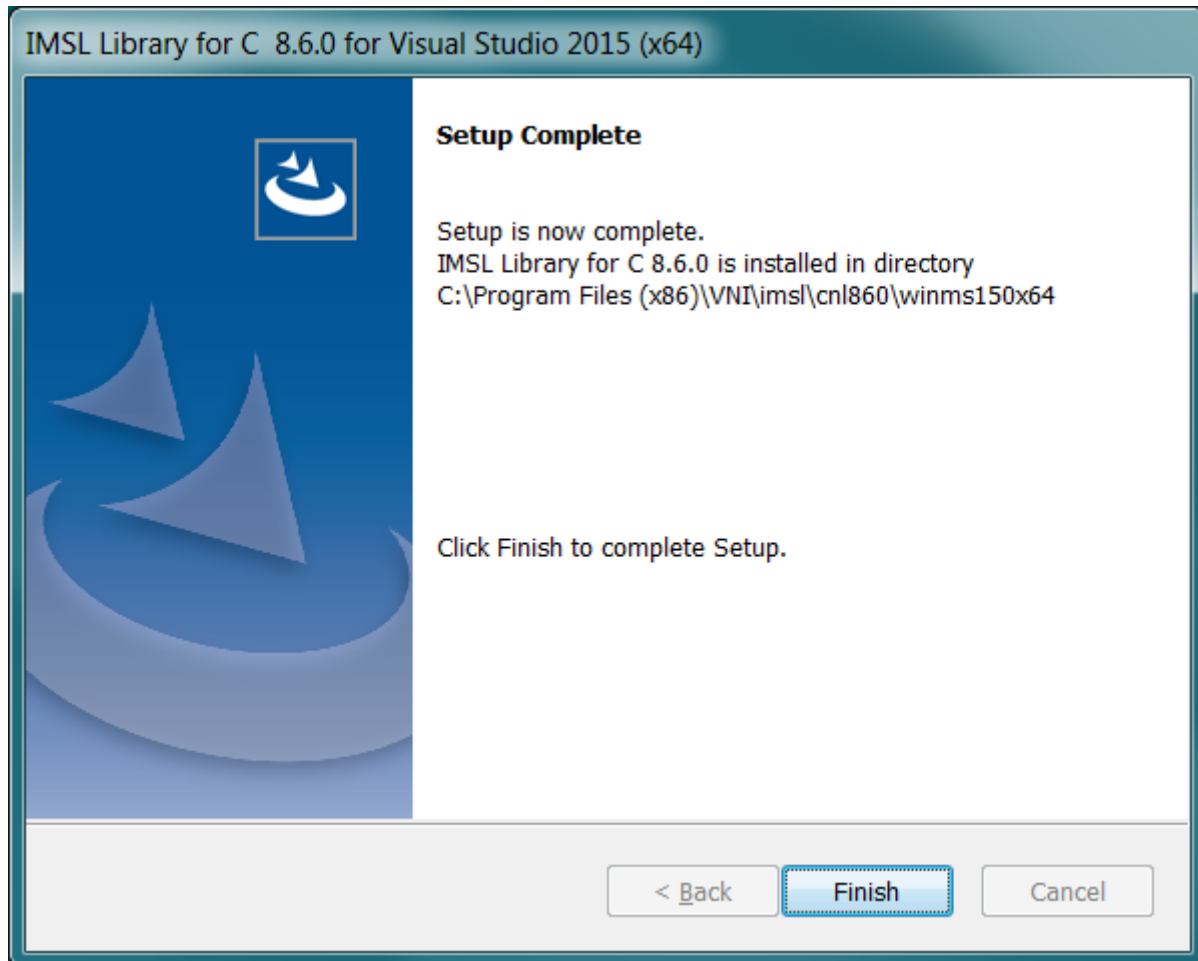
## Installation progress

You are updated as the installation proceeds.

## Installation Complete

When the setup is complete, you are prompted to click the Finish button.

```
IMSL Library for C  8.6.0 for Visual Studio 2015 (x64)

                    Setup Complete

                    Setup is now complete.
                    IMSL Library for C 8.6.0 is installed in directory
                    C:\Program Files (x86)\VNI\imsl\cnl860\winms150x64




                    Click Finish to complete Setup.



                              < Back    Finish    Cancel
```

## Restart

Depending on your system, you may be prompted to restart your computer to properly configure the environment variables. Select the appropriate selection to restart now or later.

## *License Key Setup*

This step is necessary only if you have an evaluation copy of IMSL Library for C.

### Create the License File

Using a text editor, create the license file `<install_dir>`\license\imsl_eval.dat, where `<install_dir>` is the directory in which IMSL Library for C has been installed.  Then, cut and paste the contents of the file you received via e-mail from the Rogue Wave License Administrator.

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Note: If due to local conventions or personal choice you do not wish to use the default license file name, set the environment variable `IMSL_LIC_FILE` to point to the license file name and the location of your choice. `(<path>\<name>)`

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# Using the IMSL Library for C

## *Documentation*

Documentation is supplied in both Portable Document Format (PDF) files and HTML files.

The PDF documentation system requires the use of Adobe Systems Incorporated Acrobat Reader(R) 9.0 or later.  This software is available at no charge and can be downloaded from the web site www.adobe.com.

To access the documentation, select
Start → All Programs → Rogue Wave Software → IMSL C Numerical Library User's Guide. Choose the desired documentation from the displayed screen.
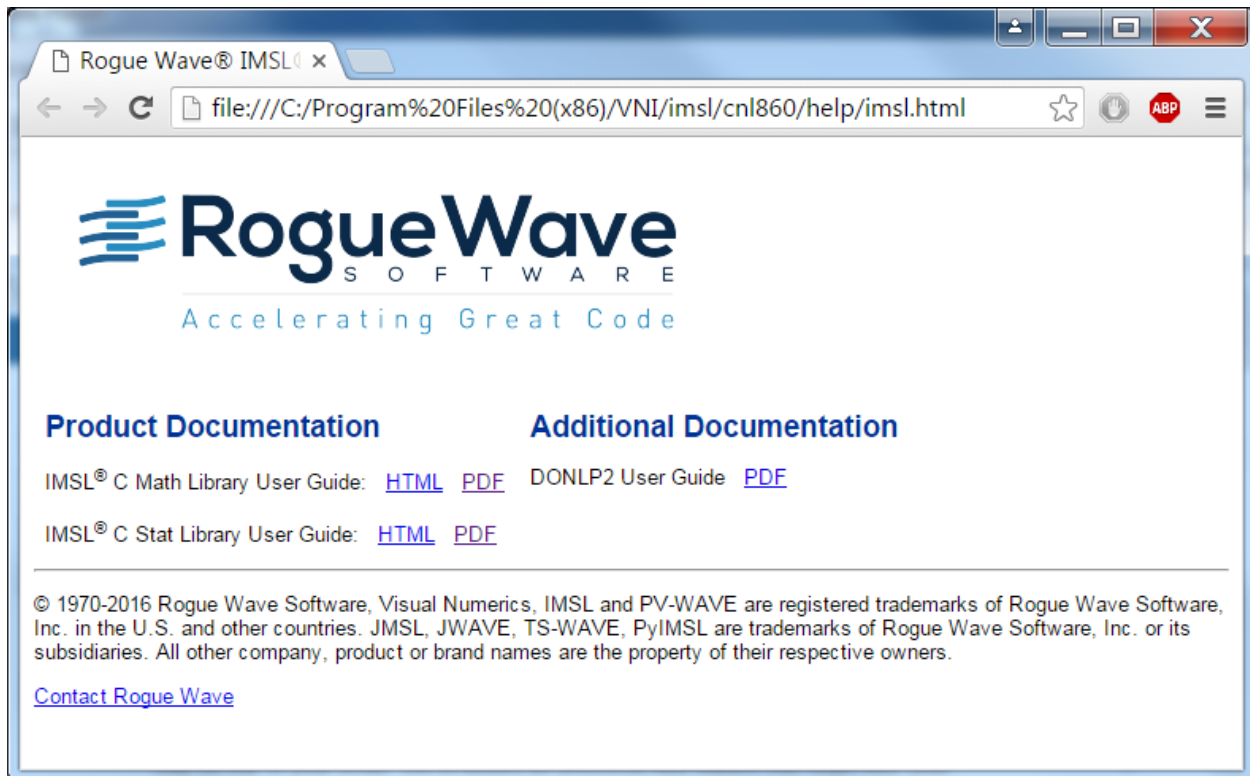


If your filename associations for PDF files are not set you may prefer starting Acrobat Reader and opening the file(s)  C_Math_Library.pdf and C_Stat_Library.pdf located in the `<install_dir>\imsl\cnl860\help\pdf` subdirectory.

## *Creating a program*

This simple example program solves the following system of linear equations:

```
33x + 16y +72z =129
-24x -10y-57z= -96
18x -11y +7z =8.5
```

Copy the following text into an editor and save the file as cn1.c.

```c
/* Program start */
/* The header file for Mathematics of the IMSL Library for C. */
/* For Statistics, use <imsls.h>. */
#include <imsl.h>


main()
{
    /* variable declaration */
    int n = 3;
    float *x;
    static float a [ ] = {33.0, 16.0, 72.0,
                          -24.0, -10.0, -57.0,
                          18.0, -11.0, 7.0};

    static float b [ ] = {129.0, -96.0, 8.5};
    float *p_inva;

    /* The main IMSL function call to solve for x in Ax=B.

     * This is the floating point version, to use
     * double-precision arguments, call
     * imsl_d_lin_sol_gen */
    x = imsl_f_lin_sol_gen(n, a, b, 0);

    /* Optional arguments are included after required

     * arguments. These are usually preceded by a constant
     * named IMSL_* indicating which optional argument is
     * being passed. In this example, we request the
     * inverse of the a matrix */
    x = imsl_f_lin_sol_gen(n, a, b, IMSL_INVERSE, &p_inva, 0);
```

```
/* Print the solution x and the inverse of a using
    * write_matrix, a printing utility */
   imsl_f_write_matrix("Solution x", 1, n, x, 0);
   imsl_f_write_matrix("Inverse of A", n, n, p_inva, 0);
}

/* Program end */
```

## *Run the Example from the Command Prompt*

### Setting the Environment Variables

The environment variables may be set automatically at installation time. If you chose not to set up the environment automatically, you must run the `cnlsetup.bat` batch file from the `<install_dir>\imsl\cnl860\<env>\bin` folder in the IMSL Library for C installation location.

### Compile the program from the command line

To use the cl command line compiler, start the Visual Studio 20xx .NET Command Prompt from the Start Menu: Start → All Programs → Microsoft Visual Studio 20xx → Visual Studio Tools → Visual Studio 20xx Command Prompt.

### Compile the program

Dynamic Library

```
cl cnl.c $LINK_CNL_SHARED
```

Static Library

```
cl cnl.c $LINK_CNL_STATIC
```

**Execute the Program**

```
./cnl.exe

                    Solution x

        1                    2                    3
       1.0                  1.5                  1.0


                    Inverse of A

        1                    2                    3
1       0.1464           0.1899           0.0403
2       0.1802           0.2237          -0.0321
3      -0.0933          -0.1367          -0.0113
```

For more information, refer to the readme files in `<install_dir>`\imsl\cnl860\`<env>`\notes.

## *Run the Example From Visual Studio*

- Start the Microsoft Visual Studio 20xx Developer Environment

    Start → All Programs → Microsoft Visual Studio 20xx → Visual Studio 20xx

- From the Microsoft Visual Studio 20xx Developer Environment create a new project:

  File → New → Project

  - Choose the template Visual C++ → Win32 Console Application.
  - Change the name and location of the project as needed.
  - Verify that the "Create directory for solution" box is checked.
  - Click OK.
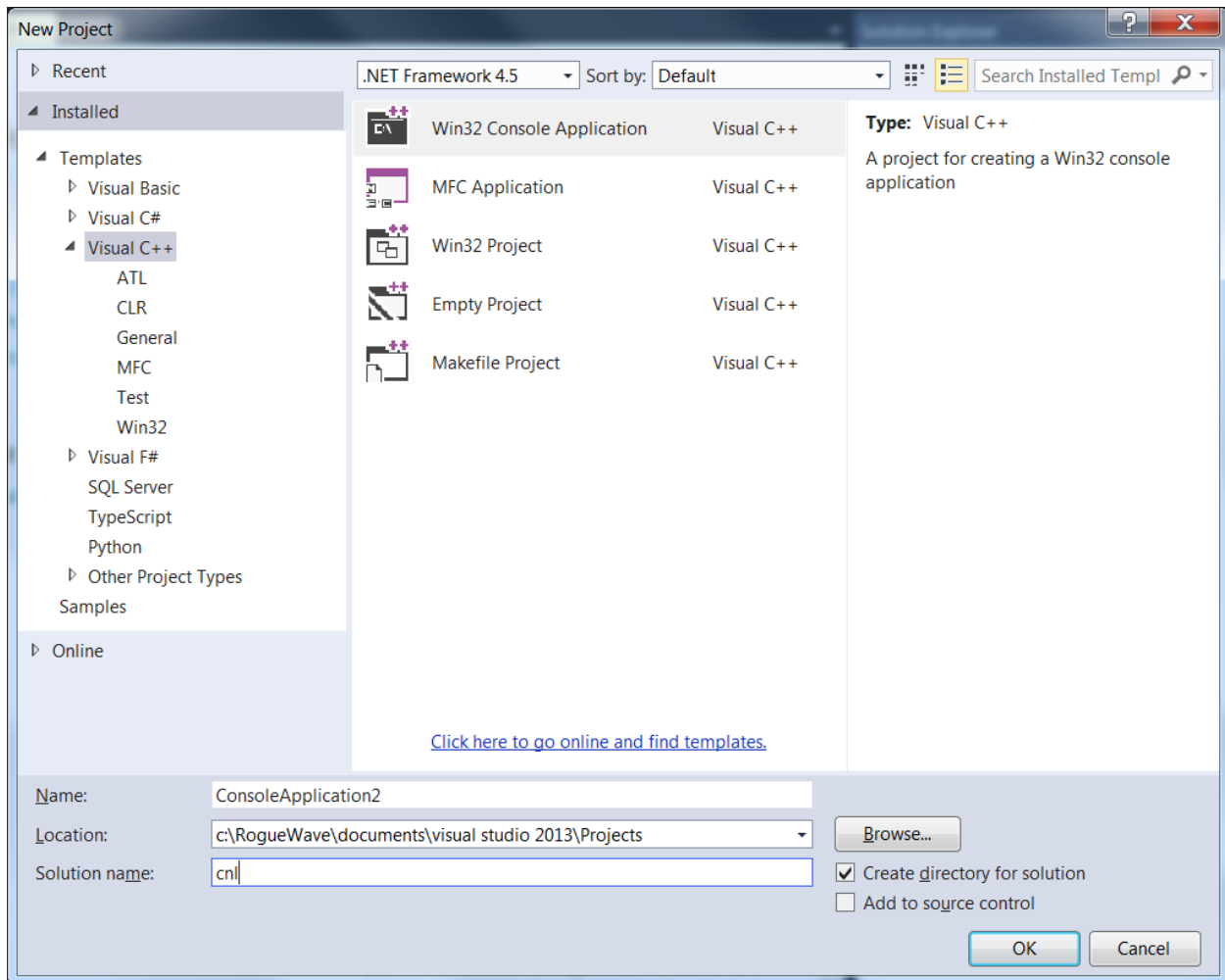
- From the "Win32 Application Wizard" window that is created click on "Application Settings". Choose "Empty Project" and then click "Finish".
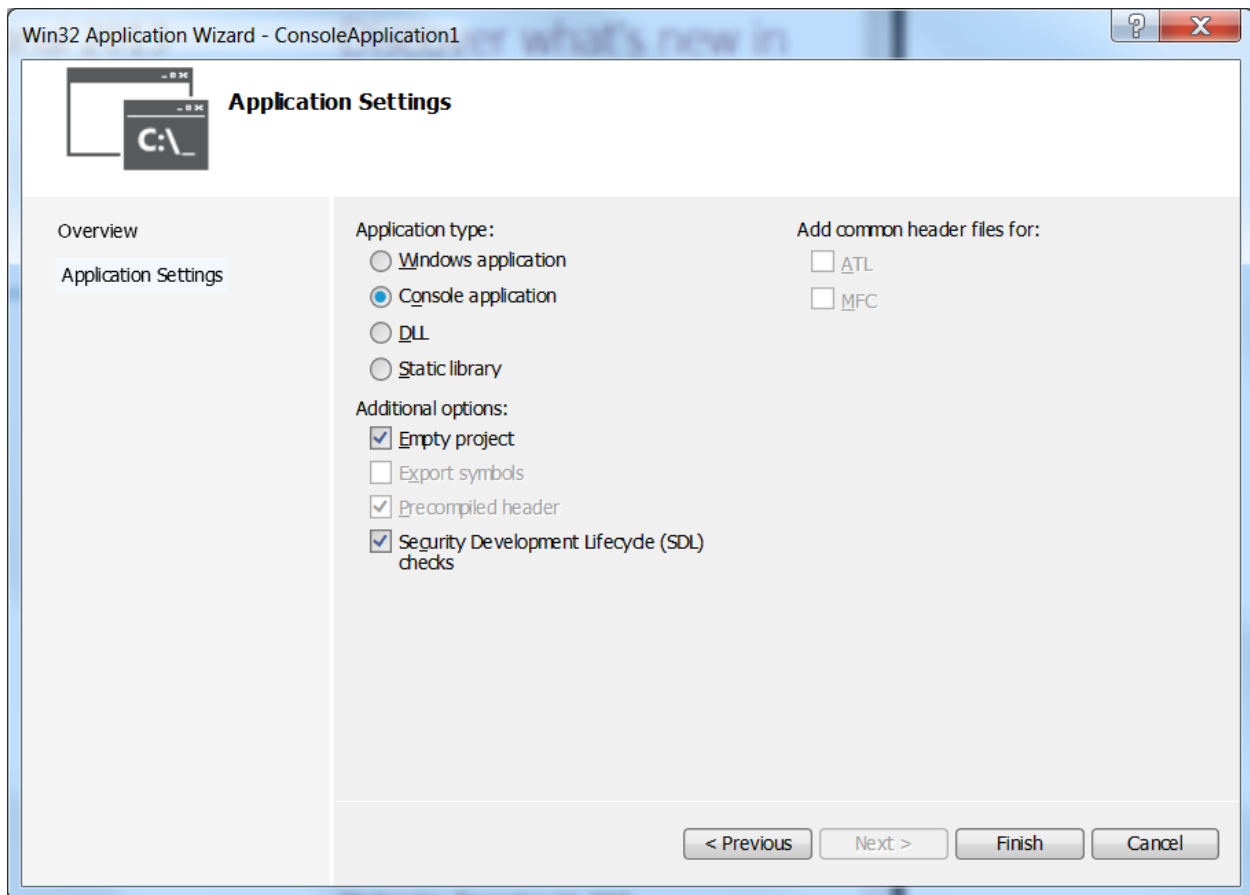


- Add Source Code to the Project:

  - From Solution Explorer right click on the project name.
  - Choose Add → Existing Item.
  - Browse to and select the C source file you created above and click Add.

- Add the include files directory to the project:

    - From Solution Explorer right click on the project name
      Choose Properties
    - Choose Configuration Properties → C/C++ → General
    - To the right of "Additional Include Directories" add the pathname to the appropriate include files `<install_dir>`\imsl\cnl860\`<env>`\include
    - Click OK
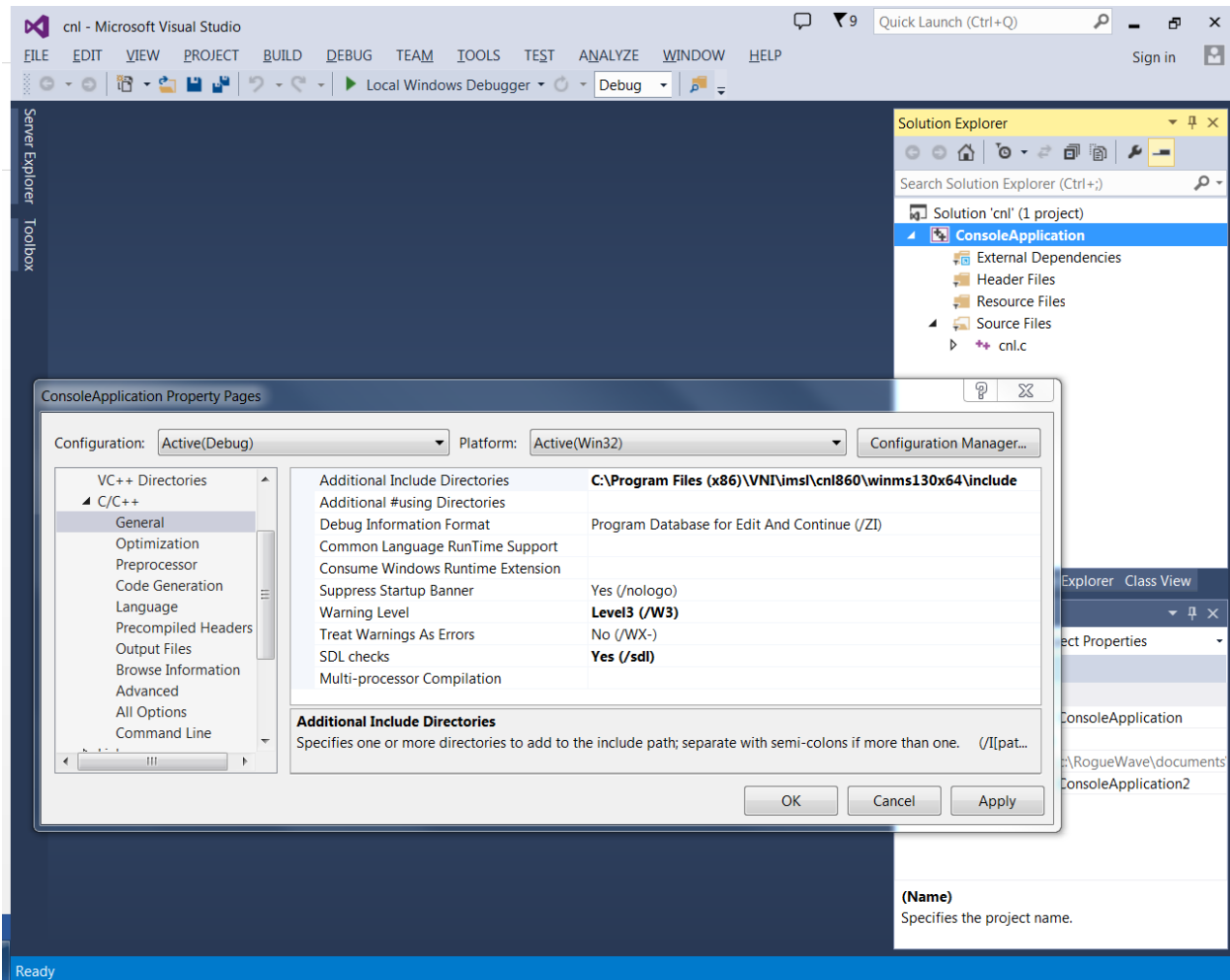
- Add the libraries to the project:

    - From Solution Explorer right click on the project name.
    - Choose Add → Existing Item.
    - Browse to the directory `<install_dir>\imsl\cnl860\<env>\lib`.
    - Choose the files imslcmath_imsl_dll.lib and imslcstat_imsl_dll.lib.
    - Click "Add".
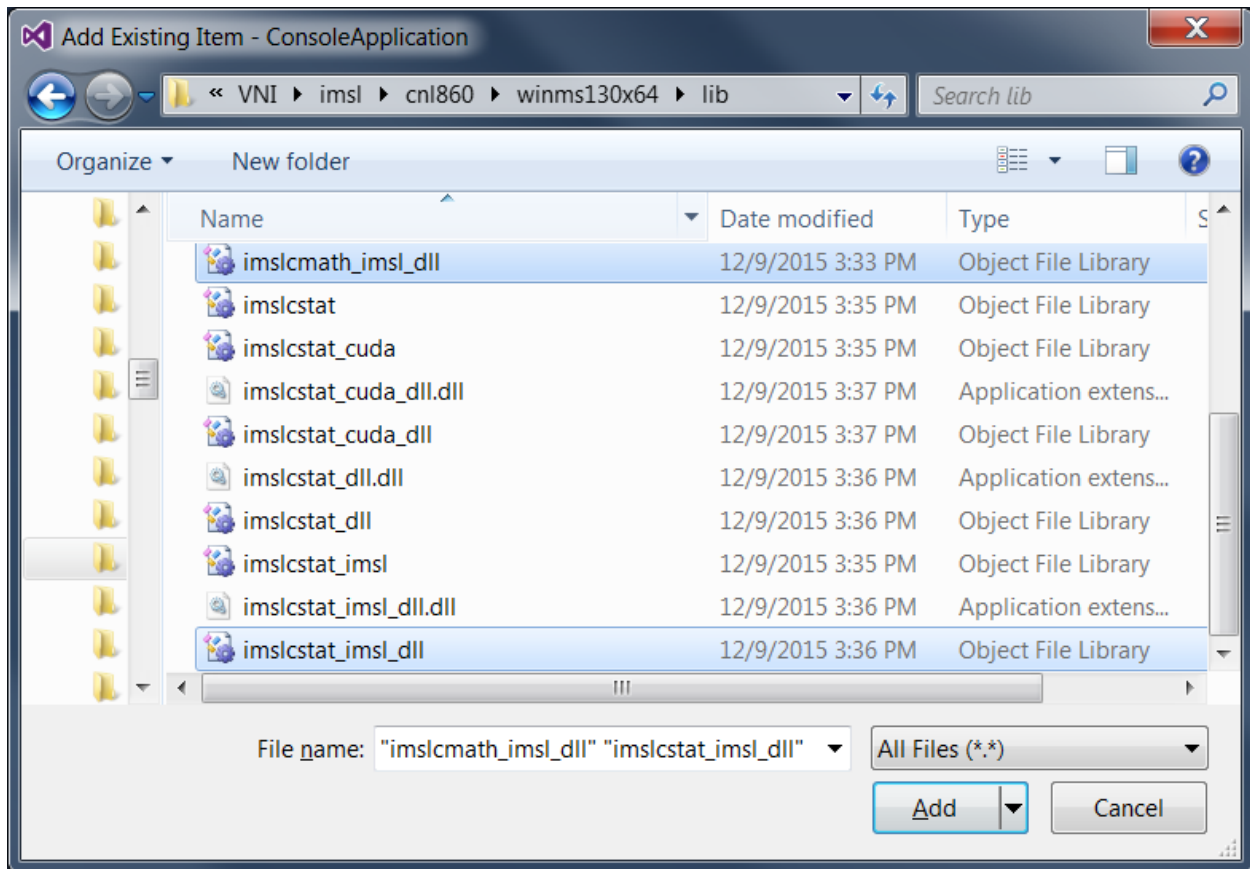
- Copy the Win32 project settings into an x64 project configuration:

Note: This step is not necessary if you are using a 32-bit version of IMSL Library for C.

- From Solution Explorer right-click on the project name.
- Choose Properties.
- Click Configuration Manager to open the Configuration Manager Dialog Box.
- Click the Active Solution Platform list, and then select the <New...> option to open the New Solution Platform Dialog Box.
- Click the Type or select the new platform drop-down arrow, and then select the x-64 platform.
- Click OK. The platform you selected in the preceding step will appear under Active Solution Platform in the Configuration Manager dialog box.
- Click Close in the Configuration Manager dialog box, and then click OK in the Property Pages dialog box.
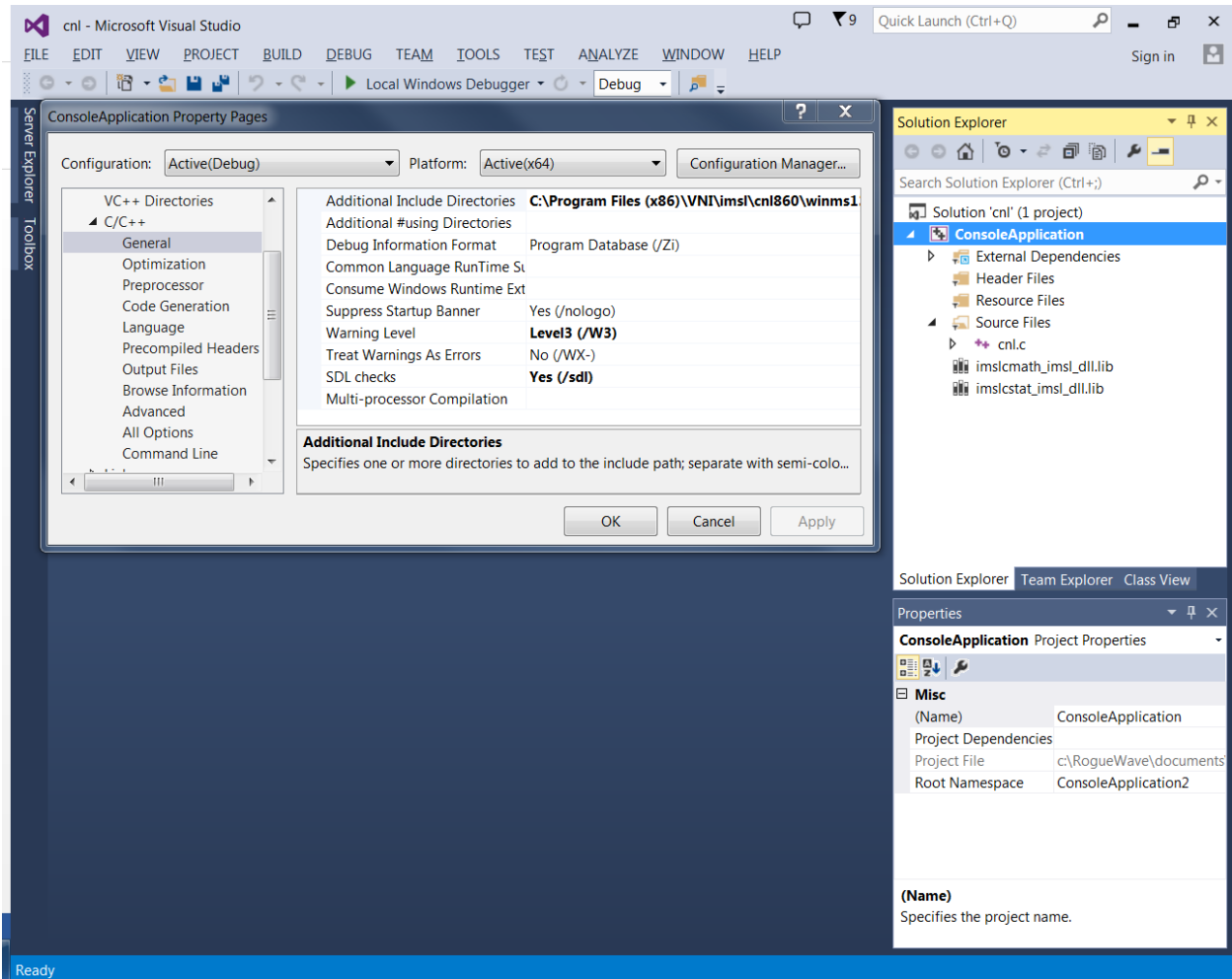
- Build the solution

  From the Microsoft Visual Studio tabs choose Build → Build Solution

- Run the program

  From the Microsoft Visual Studio tabs click Debug → Start Without Debugging

- View the output

  Microsoft Visual Studio creates a console window displaying the output

For more information, refer to the readme files in

`<install_dir>\vni\imsl\cnl860\<env>\notes.`