

INSTALLATION

This chapter provides detailed instructions for installing *FLOW-3D*, configuring software licensing, and setting up the remote solving features. For any trouble during the installation, please contact our support department at support@flow3d.com or by calling (505) 982-0088 and we will be happy to assist.

1.1 Computer setup

1.1.1 Supported operating systems

There are certain operating systems on which *FLOW-3D* and FlowSight are tested. While it may be possible to install and run both of these programs on other operating systems, Flow Science supports and provides installation assistance for only the following **64 bit** operating systems:

- Microsoft **Windows 7 SP1** and greater
- Microsoft **Windows Server 2008 R2 SP1** and greater
- **Red Hat Enterprise Linux 6** and greater
- **SUSE Linux Enterprise 12** and greater (Remote Solving is not available on this platform)

Note:

- Other Linux distributions (e.g. Fedora, Scientific Linux, Debian, Ubuntu) may be compatible but are unsupported.
 - The **lmgrd** license server is not compatible with Red Hat Enterprise Linux 7. The new **lmadmin** license server has been included instead.
-

1.1.2 Hardware requirements and recommendations

Some general recommendations on hardware selection for running *FLOW-3D* are listed below.

- **Processor:** An x86-64 compatible CPU is required. Multiple core CPUs, particularly **Intel Core i7** and **Intel Xeon** CPUs, are strongly recommended. **AMD** CPUs are not recommended.
- **Memory:** The software requires a minimum of 2GB RAM per processor core; 4GB per core is recommended. Note that the amount of RAM required is highly problem dependent. For simulations with large domains, or with complex geometry requiring fine resolution, significantly more RAM than the required minimum will be necessary. Memory speed has a small effect on simulation time and typically 1333 or 1600 MHz memory is adequate.
- **Hard drive:** Fast, high-capacity hard drives are recommended.

- The **Windows** installation requires at least 1GB of free disk space.
- The **Linux** installation requires least 1.2GB of free disk space is necessary.
- Additional space is required for simulation results which are commonly on the order of 10GB in size, though exceptionally large results files can be larger than 1TB.
- **Graphics: nVidia Quadro K series or nVidia Quadro M series** cards are highly recommended, and are ideal for Windows machines which will be accessed remotely. nVidia's **GTX series** (660 and above) and the **AMD FirePro W series** have shown decent performance on desktop and notebook machines but are not recommended for remote visualization.

Warning: Certain graphics implementations are blacklisted and will result in degraded graphics and/or unreliable performance. The following OpenGL renderers are neither recommended nor supported:

- Intel integrated graphics
- GDI Generic: This is the **Windows** default renderer when *FLOW-3D* is opened via **Remote Desktop Connection**.
- Mesa: This is a common default implementation for Linux machines.
- Gallium: This is a common default implementation for Linux machines.

Note: We recently encountered an issue with some Dell workstations where Dell's backup application conflicts with the Qt toolkit Flow Science uses to build its interface. The bug is confirmed on your system if you go to the File menu, select Add Existing Simulation and the GUI crashes. The resolution is described in the notification on the *FLOW-3D* User's Site [here](#).

1.1.3 Virtual machines

While *FLOW-3D* can be used on virtual machines, such as **VMware Workstation**, **Microsoft Hyper-V**, **VMware ESXi**, and **Oracle VirtualBox**, there are varying levels of functionality available with these platforms.

- The **FlexLM** license server runs well on virtual machines. Both **lmgrd** and **lmadmin** have been tested on these platforms. When using a dongle, it is necessary to pass USB through from the physical machine to the virtual machine.
- The *FLOW-3D* CFD solver may be run on virtual platforms from the command line. Scripts and tools are included in the software distribution for command line solver use. However, performance will be lower than when running the solver on a physical machine.
- Due to graphics limitations on virtual machines, the graphical user interface will lose some functionality and may either perform poorly or not at all.
- Similarly, the FlowSight post-processor will lose some functionality and may either perform poorly or not at all.

1.1.4 Remote Visualization for setup and post-processing

It is increasingly common to use graphical programs on remote hardware. This is usually done for simulation setup using the *FLOW-3D* graphical user interface and for post-processing simulation results using either the *Analyze* tab in *FLOW-3D* or the dedicated FlowSight post-processor. Doing so requires certain combinations of hardware and software.

Windows computers include built-in remote visualization tools; these include a terminal services server, a special protocol for connections, and a client commonly known as Remote Desktop. These tools can be used when connecting a **Windows** host machine to a **Windows** client. Please see the *Special Considerations for Remote Desktop* for hardware and software recommendations.

Our recommendations when using either a **Linux** host machine, or a **Linux** guest machine with a **Windows** host, are to use an **nVidia graphics card** which supports the newest available **proprietary nVidia driver** and either **Nice Software DCV** or **TeamViewer**. Both of these software packages consist of a server that runs on the host machine and a client that runs on the guest machine. Both packages render the graphics on the host machine's physical hardware. **Nice Software DCV** operates particularly well and performs well on low-bandwidth network connections, such as a VPN.

Intel integrated graphics or server motherboard graphics cards will perform poorly or not at all for remote visualization.

1.1.5 Settings

There are a few basic configuration settings that should be followed with **FLOW-3D** :

- It is **strongly** recommended that all input files be stored in a local directory on the machine instead of a network location. The solver will run faster, the GUI will be more responsive, and it eliminates the possibility of a network problem interfering with a running simulation.
- Make sure that the power settings for the machine are set so that it does not sleep, hibernate, or turn off after some period of inactivity. Failure to do this can result in the computer sleeping (or hibernating, etc.) during long simulations.
- It is recommended that **Windows** updates be configured to be installed after checking with the user. This will prevent update-related reboots while simulations are running.
- Using automatic file compression utilities is not recommended.

Additionally, there are some optional configuration settings that can affect the performance of the solver for certain problems and hardware configurations. There is no guarantee that these will make the solver run faster and they could make it run slower, so use them with caution. Due to the unreliable effect on performance these optional settings are considered compatible but are not supported.

- The `KMP_AFFINITY` environment variable gives users access to Intel's Thread Affinity Interface, which controls how OpenMP threads are bound to physical processors. Setting this variable to `scatter` can sometimes improve the performance of the solver.
- Disabling Intel Hyper-threading can sometimes improve the solver performance when Intel Hyper-threading is enabled. Similarly, limiting the number of processors used by the solver to the number of physical processors on the machine can help when Hyper-threading is enabled.

1.2 Licensing Information

1.2.1 Licensing Requirements

Please ensure that you have a valid **FLOW-3D** license file or the name or IP address of your **FLOW-3D** license server before beginning the installation. If you do not have a license file or a license server please contact your sales associate or licenses@flow3d.com and provide the following information:

- The host name of the machine that will run the license server software
- Either the FlexID (if using a hardware dongle; the FlexID is printed on the side of the dongle) or the MAC address of the machine

If the MAC address is not known:

- On **Windows** operating systems, the host name and MAC address can be found by opening the command prompt and entering `ipconfig /all`. When multiple ethernet cards are present, multiple MAC addresses may be listed in the output. The connected ethernet device or the first in the series is preferable.
- On Linux operating systems, typing `/sbin/ifconfig` in a terminal window will provide the MAC address, under the heading `HWAddr`. The host name can be found by entering the `hostname` command in a terminal window. When multiple ethernet cards are present, multiple MAC addresses may be listed in the output. `eth0` is usually best, but if you are unsure which MAC address to use, please send a text file or attach a screen capture with the output of the command, and the License Administrator will determine the best option.

Once the host name and MAC address or FLEXID have been received, the License Administrator at Flow Science will send the license file (`flow3d.lic`) as an email attachment. It is an ASCII text file with encryption codes that allow it to be used only on the computer or dongle for which it was generated. Check the license file to be sure that it contains the host name and HOSTID that matches the license server. More information about licensing can be found in the following sections on *FlexNet License Administration Tools* and *Licensing Terminology*.

1.2.2 FlexNet License Administration Tools

FLOW-3D uses the licensing package FlexNet Publisher, by Flexera Software. FlexNet enables **FLOW-3D** licenses to be shared across a network.

Flexera Software provides utilities for users or local license administrators to manage FlexNet licensing activities. The FlexNet End User Manual is available in the `utilities` subdirectory of the **FLOW-3D** installation in both PDF and HTML formats. For Windows computers, the program `lmtools.exe` is provided with all installations. With **LMTOOLS**, users can start, stop and configure FlexNet license servers, get system information, get server information, and more. For more information, please see Chapter 12 of FlexNet End User Manual.

On **Windows** computers, the license manager daemon `lmgrd` will restart automatically whenever the computer is rebooted. On Linux computers, however, the license manager must be started each time the computer is rebooted. To have the license manager start automatically on Linux requires editing the appropriate boot script and inserting the appropriate startup commands. See Section 6.2 of the FlexNet End User Manual for more information. A summary of commonly used administration tools on Linux is included here. Full descriptions of these and other available utilities can be found in Chapter 12 of the FlexNet manual.

- **lmdiag** - diagnoses license checkout problems Useful debugging command: `lmutil lmdiag -n -c "full_license_file_path"`
- **lmdown** - gracefully shuts down all license daemons on the license server node.
- **lmgrd** - the main daemon program for FlexNet
- **lmhostid** - reports the HOSTID of a system
- **lmreread** - causes the license daemon to reread the license file and start any new vendor daemons
- **lmstat** - helps monitor the status of all network licensing activities Useful debugging command: `lmutil lmstat -a -c "full_license_file_path"`
- **lmver** - reports the FlexNet version of a library or binary file

Note:

- Using `kill -9` to shut down the license server on Linux computers is not recommended. Instead, use either `lmdown` or use the `kill` command without the “-9” parameter.
 - The **lmgrd** license server is not supported on Red Hat Enterprise Linux 7
-

3. Reads the license file directly (%F3D_HOME%\licenses*.lic)

FLOW-3D is looking for the server, not necessarily the file. If the server is found, the local license file may not be read. However, if the server is not found, the license file is read as follows:

1. The **SERVER** line is read to find the location of the server.
2. The **VENDOR** line is read to find the name of the vendor daemon.
3. If the third line is **USE SERVER**, the rest of the file is skipped and the server is contacted directly.

USE SERVER is recommended as it improves performance when a license server is used. It also avoids a problem that may occur, where the license server is updated but local license files are not updated.

1.3 Procedure

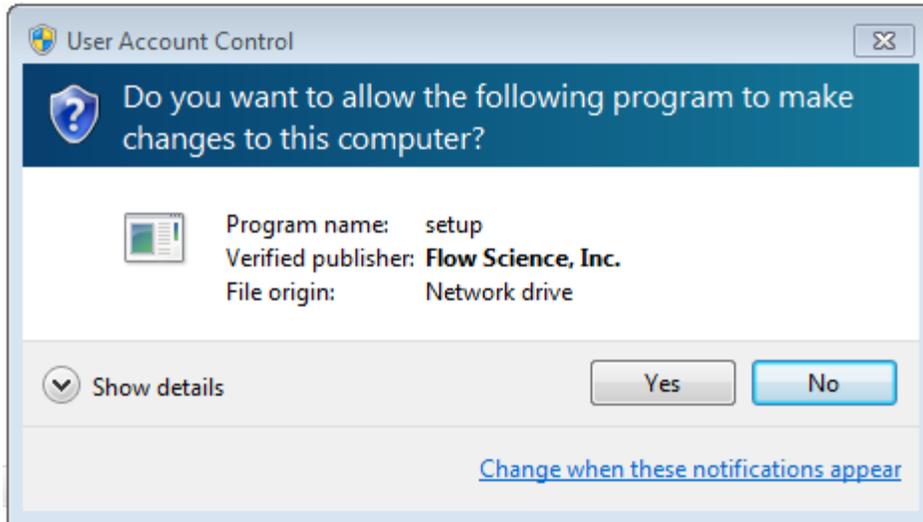
1.3.1 Windows Installation

Note:

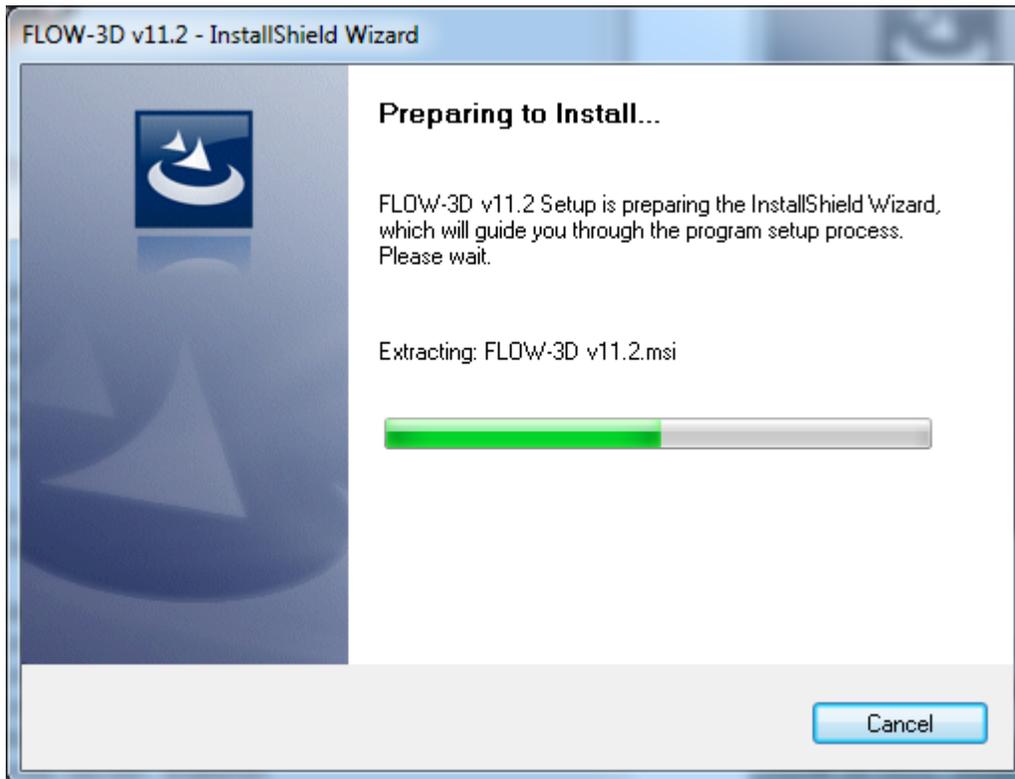
- Administrator privileges are necessary to install **FLOW-3D** on **Windows**. Before installing, please close all other running programs.
 - If installing on **Windows 8**, please consult the *Special Considerations for Windows 8 and 8.1*.
 - Third-party security software or firewalls, such as Norton 360, may interfere with license checkout and/or remote server operation. When using such software, temporarily disabling it and testing the license checkout is recommended. If the security software appears to be the issue, please consult the software vendor for the correct procedure to allow `lmgrd.exe` and `F3DTKINUX.exe` access through the firewall, or open the ports needed for proper operation. These ports are listed in the licensing documentation below.
 - If installing on a machine that has an earlier **FLOW-3D** version installed, please close any running copies of **RunnerServer.exe**. This can be done by either:
 - Right-clicking the green “running person” icon in the system tray, choosing *Open*, and choosing *Terminate*.
 - Opening the **Windows Task Manager** and stopping any `RunnerServer.exe` processes shown in the *Processes* tab. It may be necessary to click the *Show Processes from All Users* button to find the `RunnerServer.exe` process.
-

The installation can be started by double clicking the downloaded **flow3d_v11.2.exe** file.

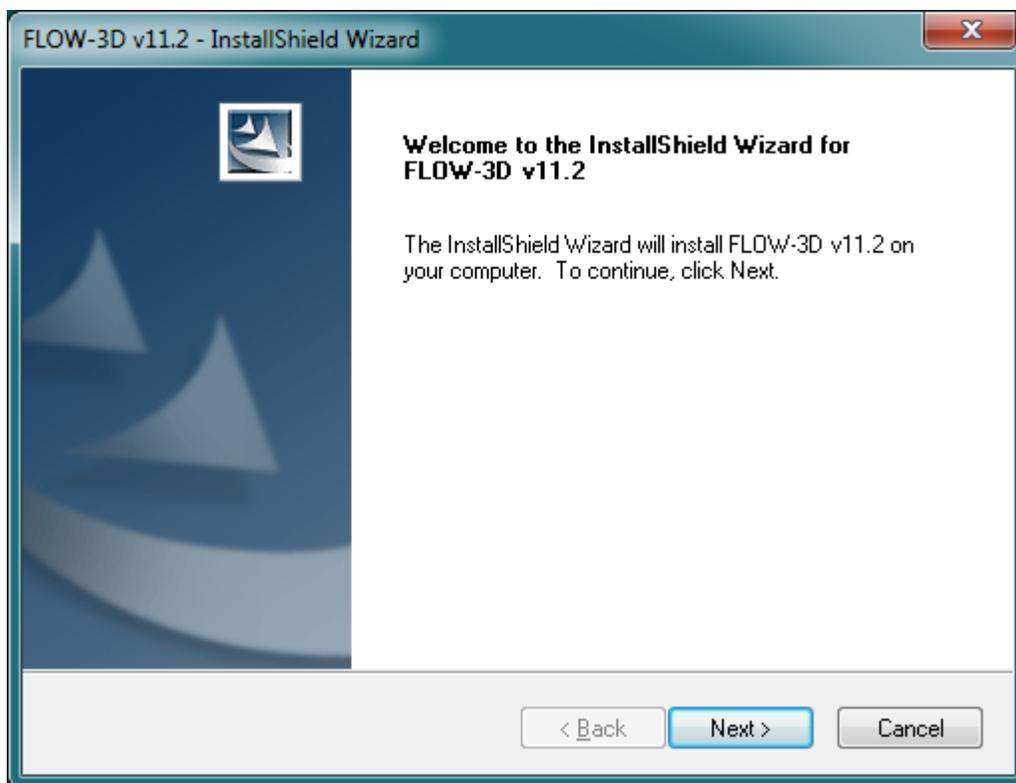
1. On **Windows** operating systems, a User Account Control dialog, similar to the one below, will appear. The “Verified publisher” entry should confirm that the executable has been digitally signed by Flow Science, Inc.



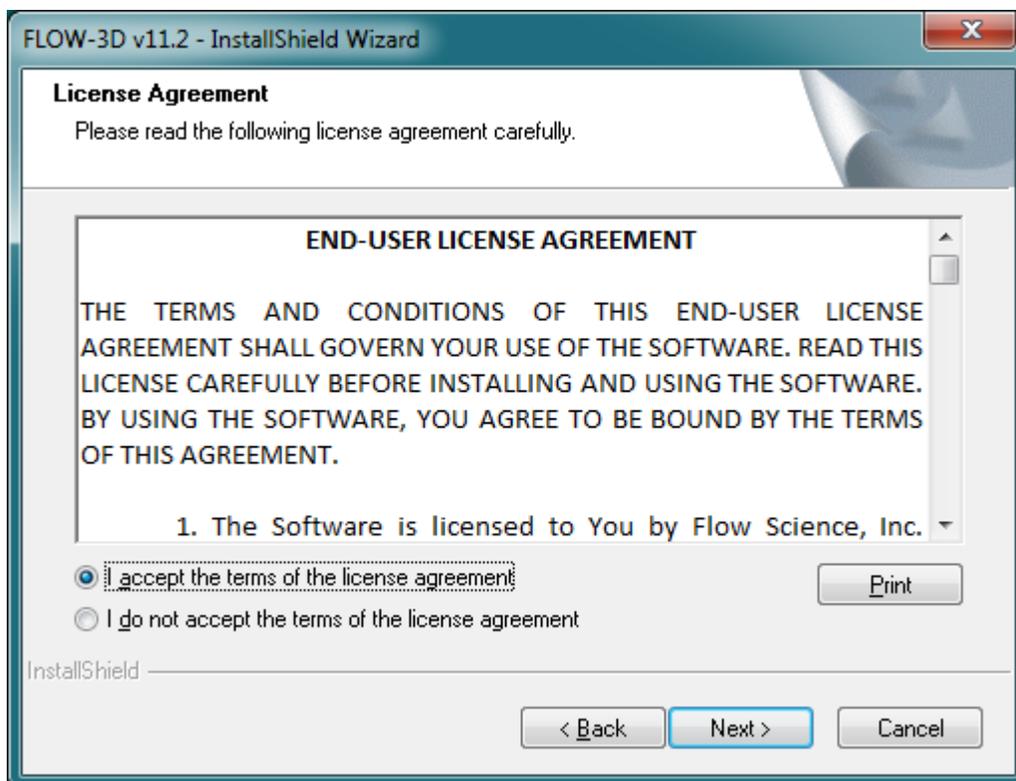
2. Next, the Preparing to Install dialog will be displayed. It requires no user input and will disappear after several seconds.



3. The next dialog to appear is the Welcome screen. Click *Next* to continue.



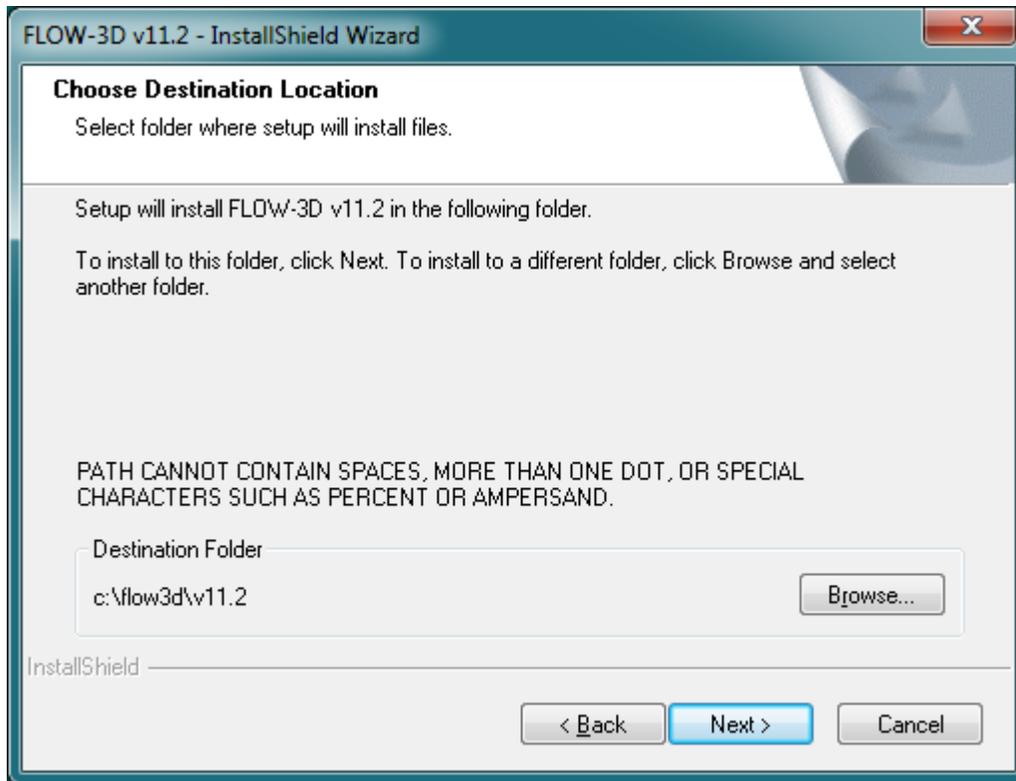
4. The next dialog is the *FLOW-3D* end user license agreement. Please read it carefully. If all the terms are acceptable, click the *Next* button to signify agreement and move to the next dialog.



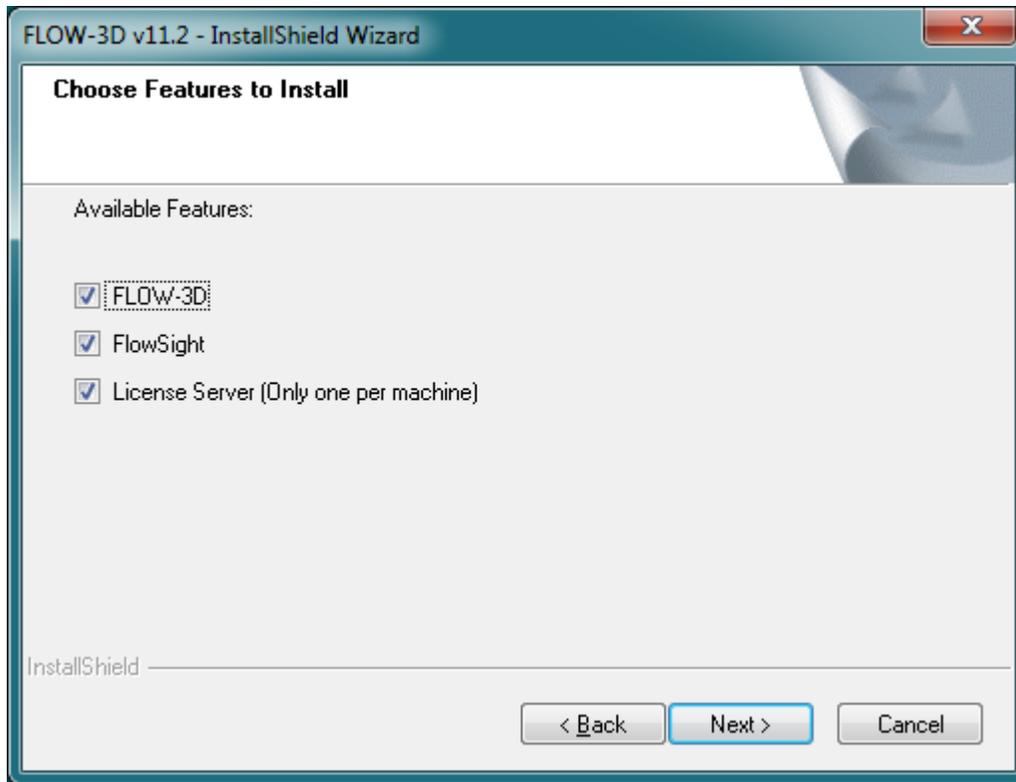
5. Now the install location can be chosen. The default directory can be used, or *FLOW-3D* can be installed to a

specific directory. Once the location is chosen, click *Next*.

Note: When installing to a location other than the default, it is important that the directory name not contain spaces, ampersand or other special characters, or multiple dots.



6. The available features are shown. Individual features may be selected for installation by checking the appropriate box. If this machine will connect to a remote license server, *License Server* should be unchecked. This is equivalent to the Client Only installation in older *FLOW-3D* versions.

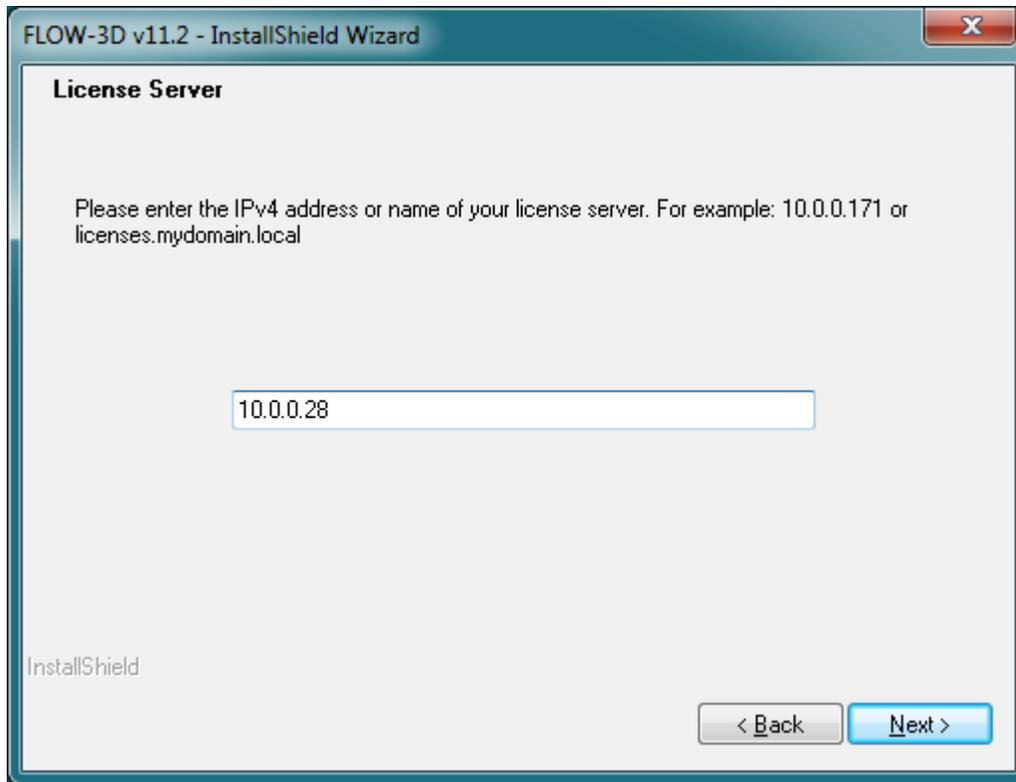


Note:

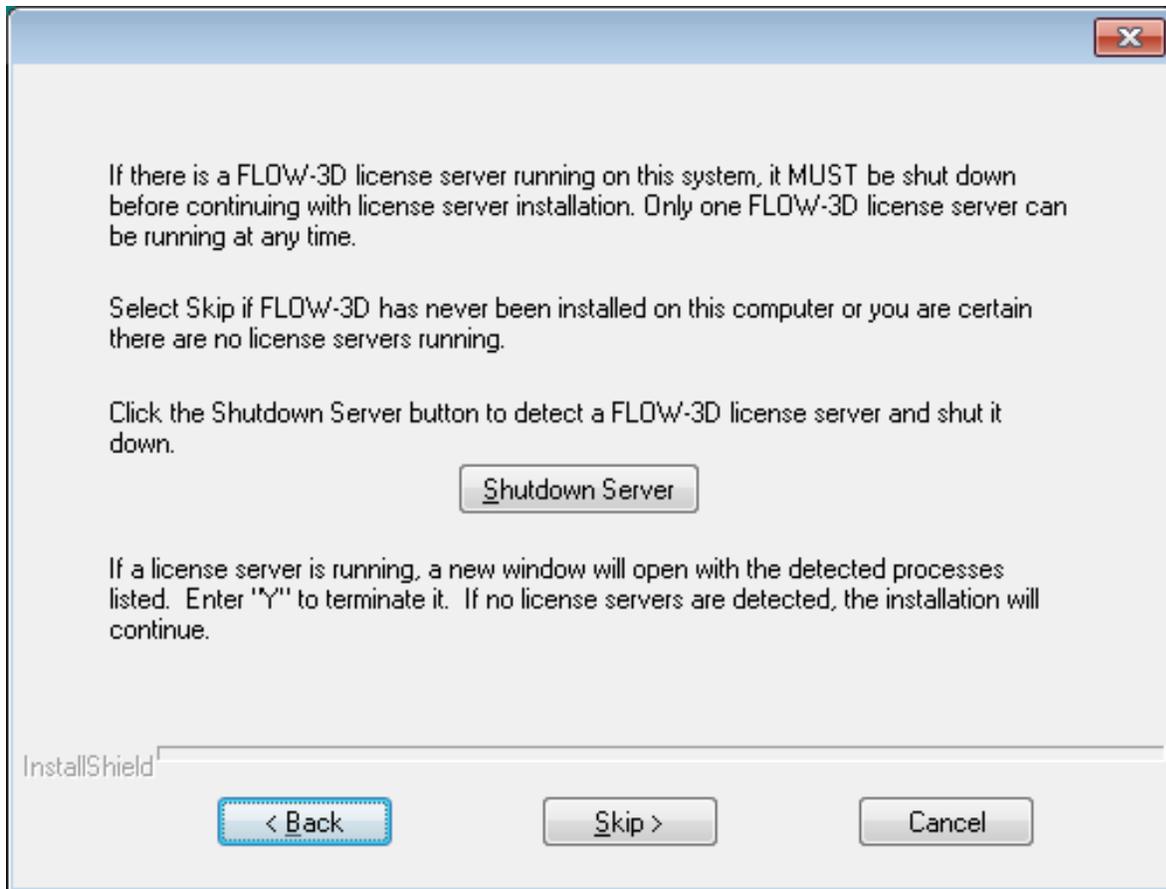
- For **FLOW-3D** v11.2.0 and newer, the License Server option is selected by default.
- If this machine is intended to act as a remote server with the Remote Solving feature (see *Remote Solving Setup*), **FLOW-3D** should be checked.

-
7. If the *License Server* option was not selected, this dialog will be shown. It allows an IPv4 address or a server name to be specified for the license server. If unknown, the IP address can be found by opening the command prompt and entering `ipconfig /all` on the license server machine. The name can be determined by opening a command prompt or terminal window and issuing the command `hostname`.

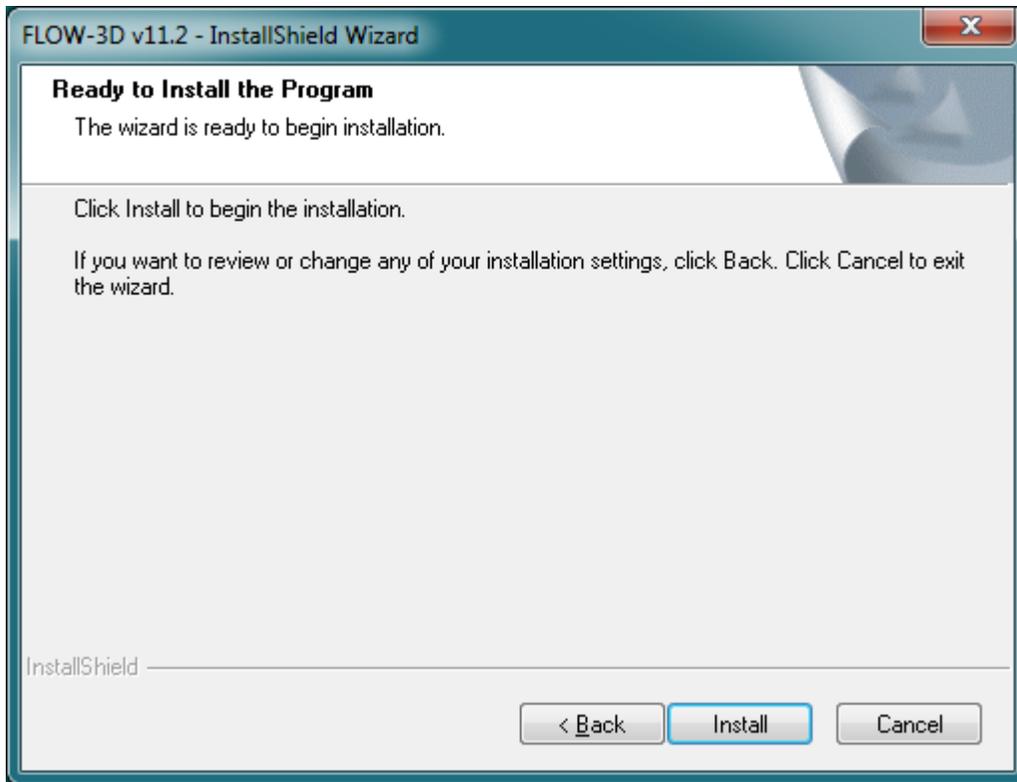
Note: When using a hostname, the server should respond to `ping` requests. The name required may differ based on the network. For example, a machine may respond to `ping host.company.com` but not to `ping host`. If this is the case, the full name must be used. If the hostname entered is not reachable, the client will not function.



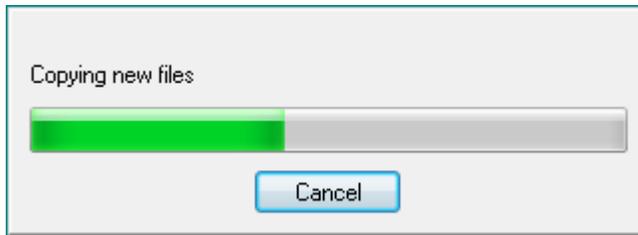
8. If the license server is being installed, *FLOW-3D* will ask to temporarily shut down any existing license servers. This allows the *FLOW-3D* license as well as **FlexLM** licenses from other vendors to be served. This can only be skipped safely when no other software that uses **FlexLM** licensing is installed, including older versions of *FLOW-3D* .



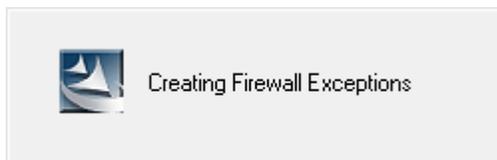
9. **FLOW-3D** is now ready to install.



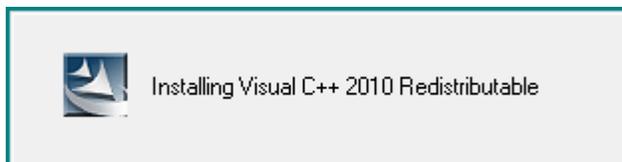
10. The *FLOW-3D* installer will copy the necessary files.

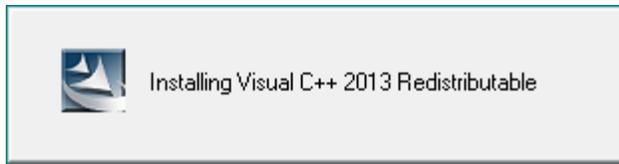


11. Next, the installer will create firewall exceptions to allow communication to remote license servers and for remote solving.

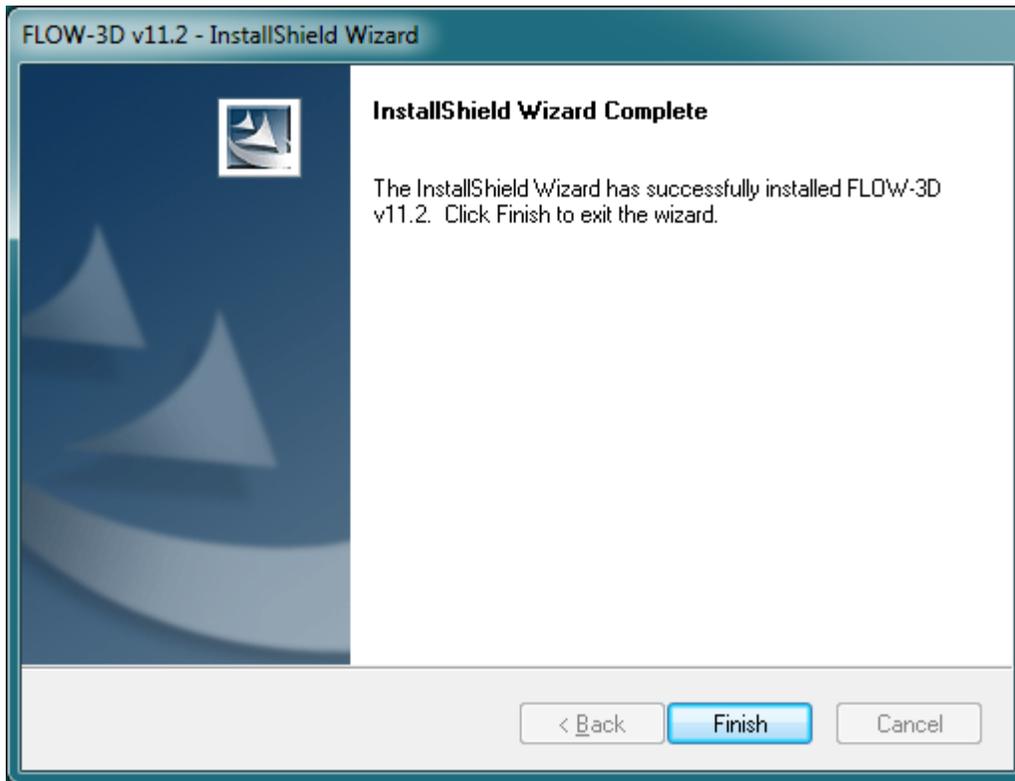


12. Finally, the Microsoft Visual C++ redistributables will be installed.

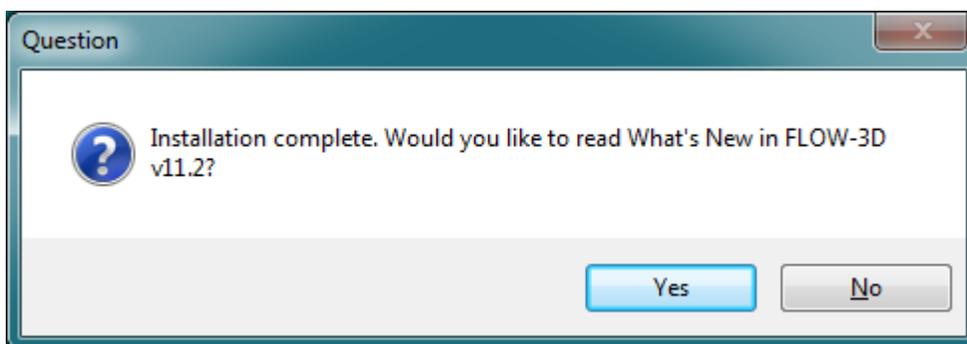




13. The installation is now complete.



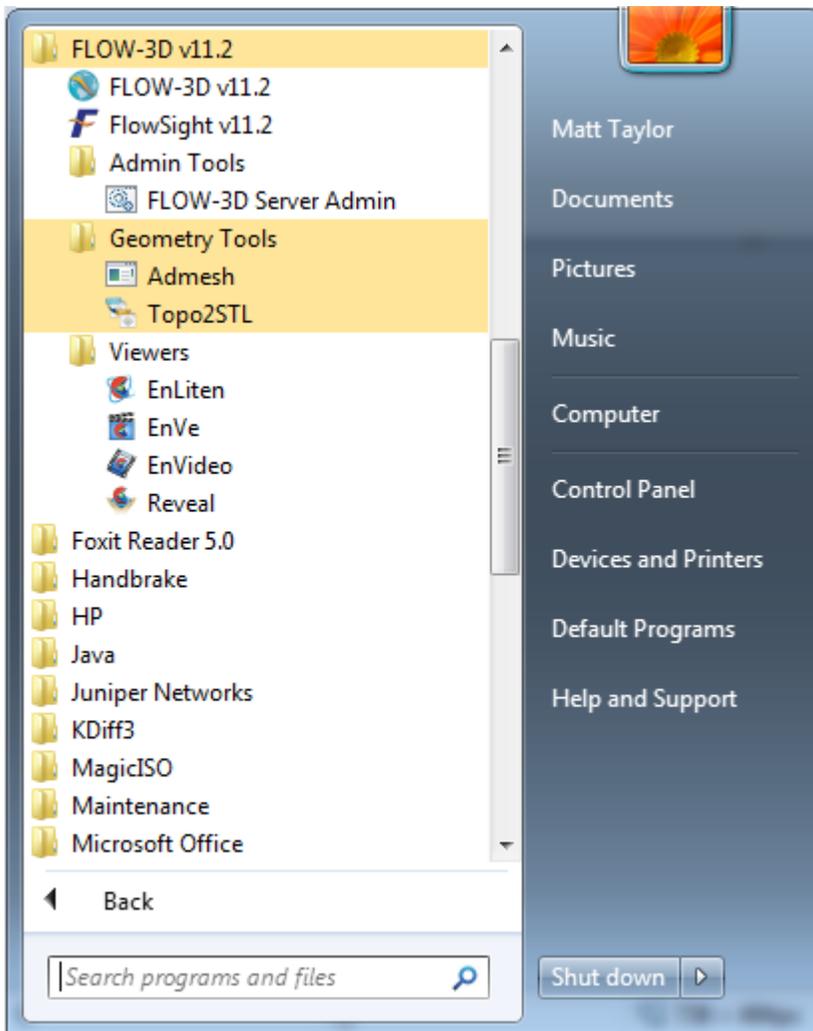
14. After installation, an opportunity is presented to learn about new features in this version.



15. The *FLOW-3D* and FlowSight (if installed) icons will now appear on the desktop.



16. Also, there will be a new *Program Group* in the **Windows Start Menu**. It includes tools and viewers appropriate to the features that were installed.



1.3.1.1 Special Considerations for Windows 8 and 8.1

Flow Science highly recommends updating **Windows 8** to **version 8.1 Update 1** (or the newest version available) before installing *FLOW-3D*.

- On all versions of the **Windows 8** operating system, including those which have been updated, the following considerations apply:
 - Secure boot must be temporarily disabled for the **Sentinel HASP USB drivers** to install. Please see <http://technet.microsoft.com/en-us/library/dn481258.aspx> for the procedure.
 - The “Creating Firewall Exceptions” dialog may not be shown. However, the firewall exceptions are created.
- When the **Windows 8** operating system has not been updated, the desktop icons are not created by the installer automatically.
 - One potential solution is to install a third-party Start Menu replacement, such as **Classic Shell** or **Start8**. If a Start Menu replacement is installed prior to installing **FLOW-3D**, the icons will be created correctly.
 - Another option is to use the Modern interface *All Apps* view. This can be done by:
 1. Right-clicking the Start Screen, then clicking *AllApps* at the lower right.
 2. There will be a Program Group for **FLOW-3D**.
 3. Right-click one of the icons and choose *Pin to Start* at the lower left to place the icon on the main Start Screen.
 4. The icon should now appear on the main Start Screen and can be used to launch the program.

1.3.1.2 Special Considerations for Remote Desktop

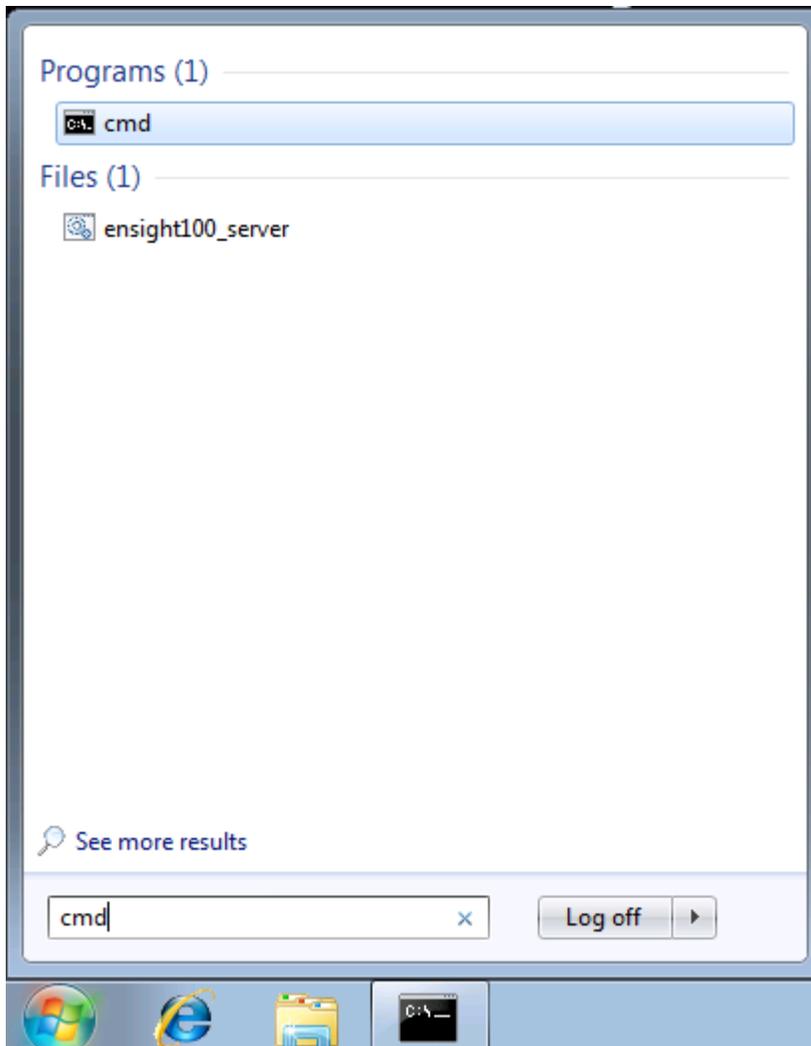
Flow Science highly recommends **nVidia Quadro K or M series** graphics hardware with nVidia driver version **341.05** or newer. With this combination of card and driver, remote desktop connections automatically run on the native hardware with full 3d acceleration.

When connecting to a remote desktop session, Windows uses software rendering unless an **nVidia Quadro K or M series** graphics card is installed. This impacts performance negatively for both **FLOW-3D** and FlowSight. To determine whether **FLOW-3D** is using software rendering, choose *About* from the **FLOW-3D Help** menu. The entry for `GL_RENDERER` will show *GDI Generic* if software rendering is being used.

Interface version	11.0.2.0 09/11
Solver version	hydr3d versic
Host Name	cast-test
Operating System	Microsoft Win
Number of Processors	2
Total Physical Memory (RAM)	2.04688 GB
F3D_HOME	C:\flow3d\w11
User F3D Home	C:\Users\dev\
f3dtknux_license_file	@10.0.0.28
GL_RENDERER	GDI Generic

If software rendering is being used, there are several options to enable hardware rendering. One easy option is to start **FLOW-3D** from the physical console, then connect the remote desktop session. Some VNC software, such as **Nice Software DCV**, uses hardware rendering by default. Finally, the **TSCON** command can be added to the batch file used to launch **FLOW-3D** to temporarily pass control back to the console session.

To use **TSCON**, determine which session is connected. This can be determined using a query. Click the Start button and type **cmd** in the box labeled **Search programs and files**. Click `cmd.exe` when it appears at the top of this window to open a **command prompt**.



At the prompt, type **query session** to receive a list of sessions. The relevant remote desktop session will be listed with a greater than symbol to its left and show the username with which you logged in. In this example, user dev is connected with a session ID of 1.

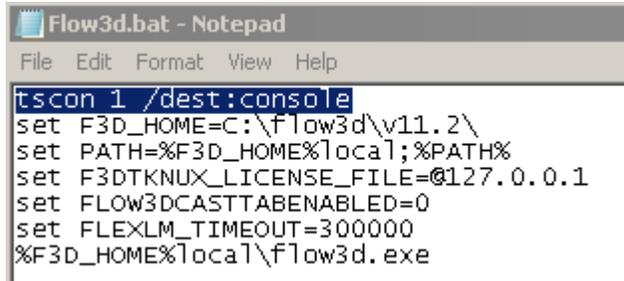
A screenshot of a Windows Command Prompt window. The window title is 'ca. Command Prompt'. The text inside the window shows the output of the 'query session' command. The output is a table with columns: SESSIONNAME, USERNAME, ID, STATE, TYPE, and DEVICE. The first row is 'services' with USERNAME 'dev', ID '0', STATE 'Disc', TYPE 'rdp', and DEVICE 'rdp'. The second row is '>rdp-tcp#0' with USERNAME 'dev', ID '1', STATE 'Active', TYPE 'rdp', and DEVICE 'rdp'. The third row is 'console' with USERNAME 'dev', ID '3', STATE 'Conn', TYPE 'rdp', and DEVICE 'rdp'. The fourth row is 'rdp-tcp' with USERNAME 'dev', ID '65536', STATE 'Listen', TYPE 'rdp', and DEVICE 'rdp'. The prompt is 'C:\Users\dev>_'.

```
ca. Command Prompt
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\dev>query session
SESSIONNAME      USERNAME          ID  STATE  TYPE  DEVICE
services         dev              0   Disc   rdp   rdp
>rdp-tcp#0       dev              1   Active rdp   rdp
console          dev              3   Conn   rdp   rdp
rdp-tcp          dev             65536 Listen  rdp   rdp

C:\Users\dev>_
```

To connect session 1 (for example) to the console, add `tscon 1 /dest:console` to the beginning of the *FLOW-3D* launch batch file (replace 1 with your session ID). To edit the batch file, right-click the *FLOW-3D* desktop icon and choose **Edit** or navigate to `%F3D_HOME%\local`, right-click `flow3d.bat` and choose **Edit**. In the resulting notepad window, the line can be added. It should be placed before all other lines in the file.



```
Flow3d.bat - Notepad
File Edit Format View Help
tscon 1 /dest:console
set F3D_HOME=C:\flow3d\v11.2\
set PATH=%F3D_HOME%\local;%PATH%
set F3DTKNUX_LICENSE_FILE=@127.0.0.1
set FLOW3DCASTTABENABLED=0
set FLEXLM_TIMEOUT=300000
%F3D_HOME%\local\flow3d.exe
```

After editing the file, save it and launch *FLOW-3D*. The remote desktop session will be ended, and when reconnected, the hardware renderer should now be shown in the *About* menu.

GL_RENDERER	GeForce 6800 GS/PCI/SSE2
GL_VENDOR	NVIDIA Corporation
GL_VERSION	2.1.2

There are a few potential problems with this approach:

1. The **TSCON** command must be run as administrator. If Error 5 occurs, right-click the *FLOW-3D* desktop icon and choose Run as Administrator.
2. The host machine must have a supported graphics card. See [Hardware requirements and recommendations](#)
3. Due to the graphics requirement, this will not work for virtual machines.
4. The user must have an open console session. This may not work after a reboot and is known not to work when another user is logged into the console session.

1.3.1.3 Special Considerations for Multi-User Machines

When not using **Windows Server**, *FLOW-3D* cannot be simultaneously run by more than one user. This is due to inherent limitations of the **Fast User Switching** functionality of the operating system. For example, on a **Windows 7** or **Windows 8** operating system, if User A starts a *FLOW-3D* simulation, and switches to User B or the Administrator account, another *FLOW-3D* simulation cannot be run by that user until the simulation launched by User A is complete.

As such, **Windows Server** or Linux operating systems are recommended if it is desired that multiple users be able to run *FLOW-3D* simulations simultaneously.

1.3.2 Linux Installation

FLOW-3D for Linux is distributed as a gzip-compressed tar archive, often called a tarball. The installation files can be extracted from `flow3d_v11.2.tar.gz` in a terminal window, using the command `tar -xzf flow3d_v11.2.tar.gz`. The tarball can be unpacked into any directory on the file system using the `-C` flag. For example, to extract the tarball to `/home/user`, use `tar -xzf flow3d_v11.2.tar.gz -C /home/user`.

`cd` to the directory where the installation files exist, or to which they have been unpacked, and run the script `install-flow3d.sh`. A preceding dot slash may be necessary depending on whether the current directory is