State-of-the-art software for fluid and process flow simulation with capabilities including heat transfer, fluid mixing, advanced compressible, 2-phase and non-Newtonian flow.

**FluidFlow** is the outcome of more than 25 man-years of research and programming resulting in a powerful liquid, gas, 2-phase, non-Newtonian, slurry and process fluids flow simulator. **Accutech has supplied FluidFlow to more than 100 organisations in Australia and New Zealand.**

Capabilities of **FluidFlow** include:

- 2-phase liquid/gas
- Non-Newtonian/non-settling liquids, settling slurries and paper pulp.
- Optional heat change calculation at each network component – heat loss/gain through pipe walls (lagged or unlagged) and heat change at equipment items such as heat exchangers.
- Different fluids within the same network with the software automatically determining the physical properties of mixtures where streams combine.
- Graphical interface showing the pipe network in flowsheet format, either in orthogonal or isometric view. The flowsheet can be fully annotated with input data and calculated results and free text.
- Reports in PDF, Word, HTML and Excel format.

Construction of the piping network is in a familiar flowsheet format using click-and-drag to select piping components from the toolbar in order to add equipment to the model. Pipes are rubber-banded between components. Panning, zooming and cut-and-paste operations are all available to allow you to design your network with minimum effort and maximum flexibility. Piping schematics can be displayed in orthogonal or isometric format.

The calculation capabilities of **FluidFlow** include the following:

**LINE EQUIPMENT:**

Almost any type of line equipment can be modelled including multiple pumps (end-suction centrifugal, rotating positive displacement, reciprocating) and fans/compressors in parallel, series and booster configuration; flow control, pressure control, non-return and relief valves; boundary conditions such as reservoirs, tanks and nozzles; etc; cyclones; shell and tube/plate exchangers (pressure loss and heat change), cooling towers, jacketed vessels, bursting discs, 3-way valves, knockout pots etc.
ANY NUMBER OF FLUIDS WITHIN THE SAME NETWORK:

Fluids are specified at each input boundary and the software takes care of composition changes. This means you can analyse networks containing as many fluids as you require. Physical properties of mixtures at flowing conditions are estimated as needed. Networks can also be analysed containing multiple fluids where mixing does not occur. For example, you can analyse cooling water and process streams within the same flowsheet.

TOTAL HEAT BALANCE:

This means you need only specify fluid temperatures at boundary components. All other temperatures as well as fluid phase states are calculated by the software. Temperature effects of pressure changes, heat loss or gain from the surroundings and heat exchange made at each network component make heat transfer an automatic part of network flow calculations.

CALCULATION TECHNIQUES:

Gas calculations make no simplifying assumptions of ideality, adiabatic or isothermal processes etc. Pressure losses are determined by solving the momentum and physical property equations simultaneously. This means more accurate results, particularly at higher Mach numbers.

USER INTERFACE:

You can open as many flowsheets as desired and cut, copy and paste between them. The flowsheet can be constructed with iso or ortho snap and can show free text, calculated or input values. The versatility of the flowsheet means that one picture can now become all you need to communicate design and performance data between colleagues. Additionally the flowsheet, result tables and graphs can be exported to Excel and Word or automatically output in HTML or PDF format.

DATABASE:

FluidFlow comes with over 1000 fluids fully defined for accurate calculations in the liquid, vapour and 2-phase regions. There are many new methods available for physical property prediction using the very latest techniques, for instance: liquid density can be determined by the following methods:- table, Yamada Gunn, Spencer Danner, Peng Robinson, BWR HS, Lee Kesler; and gas density by Peng Robinson, BWR HS, Lee Kesler. Consequently the fluids dataset is powerful resource in its own right. Many hundreds of pumps, control valves, manual valves, sprinklers, relief valves, pipe data etc. from a wide variety of manufacturers are included in user-definable datasets.

ADD-ON MODULES
(all specifications subject to change)

Slurry Module:

Slurry or non-Newtonian fluids regularly occur in the mining, process, food and pharmaceutical industries. The flow characteristics of these types of fluids can be divided into two broad categories, viz (a) non-Newtonian/non-settling liquids and (b) settling slurries. A non-Newtonian/non-settling liquid may be a mud- or a tailings-type flow, sewage sludge, food product etc; a settling slurry comprises a Newtonian "carrier fluid" with a solids component which may be in full or partial suspension. The Slurry module simulates both types of flow.

For non-Newtonian/non-settling three correlations are available:
- Bingham Plastic
- Power Law Fluid
- Herschel-Buckley (Yield Pseudoplastic)

For Newtonian settling (particulate) slurries five friction loss correlations are available:
- Wilson-Addie-Sellgren-Clift
- WASP
- Durand
- Selgren, Wilson Four-Component model
- Liu-Dezhong

For paper pulp:
- TAPPI Technical Information Sheet (TIS) 408-4
- Moller K
The fluids databases will accommodate the necessary data for non-Newtonian/non-settling liquids and a database of solids’ characteristics is included for settling slurries.

The screen image below shows a simple settling slurry calculation taken from our Slurry Training Course. The upper model shows the calculated head loss with water containing 40% particulate solids; the lower model with water only. The enlarged data display for a section of the slurry pipeline shows the deposition velocity at the current concentration and the maximum deposition velocity at any concentration.

**Scripting Module:**

Scripting allows you to make changes to any flowsheet element (node or pipe) via a Pascal or Basic-based scripting language and then study the effects of these changes at any other flowsheet component or component. Scripting therefore allows sequential steady-state calculations. These may be a sequence of “what-if” calculations, say trialing different orifice sizes to achieve a desired flow balance, or a time-based sequence of calculations, based on a user-defined time increment. An example of this type of real-time analysis might be to calculate the fall in level of a tank over time and perhaps associate this with the start-up of a pump triggered by a specified level.
The Pascal/Basic-type code has been specifically developed for use with FluidFlow3, but the coding style would be very familiar to anyone with a modest exposure to programming in Pascal or Basic. Typical FluidFlow3-specific commands include the Get.Element command which identifies a component by its ID ready for some change to its properties, or the GetPipes command which identifies all the pipes in the model and places them in an array. An example of how the GetPipes command might be used in a script would be to change the roughness of all the pipes in a model to determine the effect of sliming or deterioration.

The tank example above can be easily scripted. A time increment is defined and the total (steady-state) flow out of the tank over that period determined. After each flow calculation the volume of water discharged and the consequent lowering of the level in the tank is calculated. A new flowrate is then calculated on the basis of the revised fluid level. Other variables can be included, such as starting a pump to recharge the reservoir once the level reaches a set position and then stopping the pump once the reservoir was full – a sequence of events that may take place over several hours or days. The above image shows such an arrangement with multiple pumps. The script generates a “cascading” effect as pumps stop and start depending on the water levels in both their supply and receiving tanks.

The Scripting Results window allows the graphing of results – essential for time dependent investigations. So, for instance, the tank levels described above could be plotted. Results can also be exported to other applications such as Excel. Inbuilt code allows for convenient plotting of the hydraulic grade and energy lines.

Note: Accutech can provide a Scripting service. Send us your steady-state model and the specification of the extended time requirement (or other component action) and we will write the script for you. We charge for this on a hourly basis.

2-Phase Liquid/Gas Module:

The 2-Phase Liquid/Gas module allows a number of different correlations and makes considerable use of the following publication for the definitions below – “Mechanistic Modeling of Gas-Liquid Two-Phase flow in Pipes”, by Ovadia Shoham, pub Society of Petroleum Engineers...from which the following definitions are taken.

Drift Flux Model: Applicable to vertical flow with low frictional losses such as bubble flow. The basic assumption in the model is constant slippage between the gas and the liquid phases.

Beggs and Brill: applicable to the entire range of inclination angles, namely vertical upward flow through horizontal to vertical downward conditions.

Lockhart Martinelli: Correlation is limited to the calculation of frictional pressure losses in horizontal pipes.

Other correlations are: Friedel; Muller Steinhagen Heck; and Chisolm Baroczy.

FluidFlow draws on the extensive user-experience and feedback from users of its predecessor program, Piping Systems FluidFlow, both in terms of software useability and calculation capabilities. Piping Systems FluidFlow models and databases can be imported into FluidFlow3.

LICENCING AND PRICING

FluidFlow is available in two options

• Stand Alone

The application is available to a single user on a single PC. Licenses can be transferred across different PCs and Laptops (to the “receiving” computer), but once the licence has been transferred calculation will not work on the “sending” computer until licence has been transferred back. Full installation is required on each PC or Laptop.

• Network (and Citrix)

The software is typically installed once on a server. The application then becomes available to anyone with access to the server either via a LAN or via Terminal Services/Citrix. The number of concurrent users is controlled by a Licence Manager built into the application. Databases are held only on the server. Application is downloaded into the memory of the machine for each individual user. Licence Manager allows temporary transfer of each concurrent licence for Laptop/Off-Site use but each non networked PC must have a full installation. Databases may need to be transferred to depending on needs. Note: FluidFlow3 is designed to operate over a wide area network, but network speeds may influence the performance and this can only be determined by testing the system. LAN or WAN licences are strictly limited to use by a single company within the national boundaries of the location where the software is installed.
## PRICES: PERMANENT LICENCE

Prices are for single-user licences; for multiple licenses see the Notes below or contact Accutech.

<table>
<thead>
<tr>
<th>LICENSING OPTIONS</th>
<th>CORE LIQUID MODULE</th>
<th>CORE GAS MODULE</th>
<th>CORE LIQUID AND GAS MODULES</th>
<th>GAS MODULE IF CORE LIQUID MODULE ALREADY P'CHASED</th>
<th>LIQUID MODULE IF CORE GAS MODULE ALREADY P'CHASED</th>
<th>NON-NEWTONIAN/SETTLING SLURRY</th>
<th>SCRIPTING</th>
<th>2-PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand Alone</td>
<td>$6,950.00</td>
<td>$7,950.00</td>
<td>$12,950.00</td>
<td>$6,000.00</td>
<td>$5,000.00</td>
<td>$5,950.00</td>
<td>$3,900.00</td>
<td>7,950.00</td>
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<td>Network</td>
<td>$7,950.00</td>
<td>$8,950.00</td>
<td>$14,950.00</td>
<td>$7,000.00</td>
<td>$6,000.00</td>
<td>$5,950.00</td>
<td>$3,900.00</td>
<td>7,950.00</td>
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<tr>
<td>Maintenance, Update and Support (MUS)</td>
<td>$1,500.00</td>
<td>$1,500.00</td>
<td>$2,500.00</td>
<td>-</td>
<td>-</td>
<td>$950.00</td>
<td>$650.00</td>
<td>1,500.00</td>
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</tbody>
</table>

### Example Price Structures

- **Stand Alone Licence comprising Core Liquid only module:** $6,950.00. (Comes with 3 months updates and support). Annually renewable Maintenance Update and Support Agreement (MUS): $1,500.00
- **Network Licence comprising Core Liquid and Gas modules:** $14,950.00 (Comes with 3 months updates and support). Annually renewable Maintenance Update and Support Agreement: $2,500.00
- **Network Licence comprising Core Liquid and Slurry/non-Newtonian:** $13,900.00 (Comes with 3 months updates and support). Annually renewable Maintenance Update and Support Agreement: $2,450.00

Purchase of the MUS at the same time as the software will provide 15 months updates and support.

1. Core includes the steady-state analysis, heat transfer and multiple / combining fluids in the same network.
2. Second licence charged at a 10% discount to the first licence. Third and subsequent licenses charged at 20% discount to first licence. MUS is then charged at approx 17.5% of full retail price of total order.
3. Discounts on second and subsequent licenses/seats apply only if purchased at the same time as the first licence/seat.
4. For Citrix installations we supply only network licenses.
5. Network licenses are provided for use only within one country; for pricing on world-wide licenses contact Accutech.
6. For Australian orders only add 10% GST
7. Prices correct at above date and subject to change.

## PRICES: LEASE LICENCE

(PRICES ARE PER MONTH PER MODULE/SEAT)

### CORE MODULES

<table>
<thead>
<tr>
<th>CONTRACT PERIOD</th>
<th>LEASE PER MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 MONTHS</td>
<td>6 MONTHS</td>
</tr>
<tr>
<td>LIQUID OR GAS MODULE ONLY</td>
<td>500.00</td>
</tr>
<tr>
<td>LIQUID PLUS GAS MODULES</td>
<td>950.00</td>
</tr>
</tbody>
</table>

### OPTIONAL MODULES

<table>
<thead>
<tr>
<th>CONTRACT PERIOD</th>
<th>LEASE PER MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 MONTHS</td>
<td>6 MONTHS</td>
</tr>
<tr>
<td>SLURRY</td>
<td>450.00</td>
</tr>
<tr>
<td>SCRIPTING</td>
<td>300.00</td>
</tr>
<tr>
<td>2-PHASE</td>
<td>500.00</td>
</tr>
</tbody>
</table>

1. Prices apply to either stand-alone or network licenses.
2. A month is defined as 31 days.
3. Full lease price must be paid in advance.
4. Price includes MUS.
5. 100% the lease price is deducted from the purchase price provided...
   (a) purchase is contiguous with the end of the lease period, (b) the purchased modules are the same as the leased modules and (c) the discount is limited to a maximum of 50% of the normal retail price.
6. Minimum lease period is 3 months; minimum renewal period is 1 month.

*The Slurry module requires the Liquid module to run; Scripting requires either the Liquid or Gas module; 2-Phase requires both the Liquid and Gas Modules. Example: a three month lease of Liquid+Gas+Slurry costs $1,400.00 per month.*
NOTES ON PRICES AND LICENSING:

1. Prices correct at above date.
2. Software comes with 3 months free support and updates. Thereafter a Maintenance, Updates and Support agreement (MUS) is available priced as shown or at approximately 17.5% of the purchase price for multiple-seat licenses. Updates are provided only within the same product/module generation. Lease licenses include unlimited support and updates.
3. To re-establish an expired MUS we charge an additional 50% on the MUS price (for the first year only).
4. **GST will be charged in addition to the above prices except on exports.**
5. Multiple network licences of the liquid and gas modules: After the first licence, discounts are based on the stand-alone licence price. Discounts are as follows for network and stand-alone licences: Second licence = first stand-alone licence price less 10%; third licence = first stand-alone licence price less 20%.
6. All prices and specifications subject to change.

OPERATING SYSTEM AND SUPPORT

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Minimum CPU specifications</td>
<td>Not really specified, but if the PC supports the minimum OS specifications described in above it will be satisfactory.</td>
</tr>
<tr>
<td>Minimum memory specifications</td>
<td>256 MB RAM (512 MB recommended)</td>
</tr>
<tr>
<td>Minimum disk space requirements</td>
<td>20MB of free hard disk space</td>
</tr>
<tr>
<td>Local administrator privileges required</td>
<td>The user should have full access rights (read, write, create, delete) to the FluidFlow3 folder</td>
</tr>
<tr>
<td>Does the software require any modifications to printers or print drivers to print</td>
<td>No.</td>
</tr>
<tr>
<td>Is the software protected by license key, dongle or on-line activation</td>
<td>Activation code</td>
</tr>
<tr>
<td>Is the software developer pro-active with fixes and upgrades (such as that which would occur when an operating system is upgraded?)</td>
<td>Yes</td>
</tr>
<tr>
<td>Support</td>
<td>Accutech provides excellent support based on its 30 years+ involvement in fluid flow simulation software and engineering background in pump and pipe flow system design. Flite Software Ltd, the developer of FluidFlow3, also provides comprehensive technical support for the software.</td>
</tr>
</tbody>
</table>

Quality Assurance Document

Available on request.