EMPRESARIOS AGRUPADOS

EcosimPro Current Status and Future Improvements

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INTRODUCTION

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INTRODUCTION (1)

EcosimPro is the ESA software tool for the simulation of ECLS systems.

EcosimPro was designed as two parts:

> A Generic Simulation Kernel, which includes
- a **language** to define new modeling components
- a **graphical user interface**

> A Library of ECLSS components implemented using the language.

INTRODUCTION (2)

EcosimPro is not limited to ECLSS simulation and it is being applied to other simulation fields:

- Hydraulic and pneumatic circuits
- Simulation of Space Propulsion systems
- Simulation of Aircraft Gas Turbines
- Chemical process
- Electrical power plant cycles (Steam Cycle and Combined Gas Cycle)

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ECOSIMPRO HISTORY

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ECOSIMPRO HISTORY

Version 3.0 (December-1999) was the first commercial version for PC- windows.

There is a continuous development effort to produce upgraded versions:

Latest release:

> Version 3.3 (March-2004)

Future releases:

> Version 3.4 (December 2004)

> Version 4.0 (expected by 2005)

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ECOSIMPRO LATEST IMPROVEMENTS (version 3.3)

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ECOSIMPRO LATEST IMPROVEMENTS (1)

The major differences between version 3.3 and previous version 3.2 are:

> a new graphical model builder, EcoDiagram

> new connection between EcosimPro and Excel, which is very easy to use

> upgraded ECLSS library with new components

> multiple language improvements

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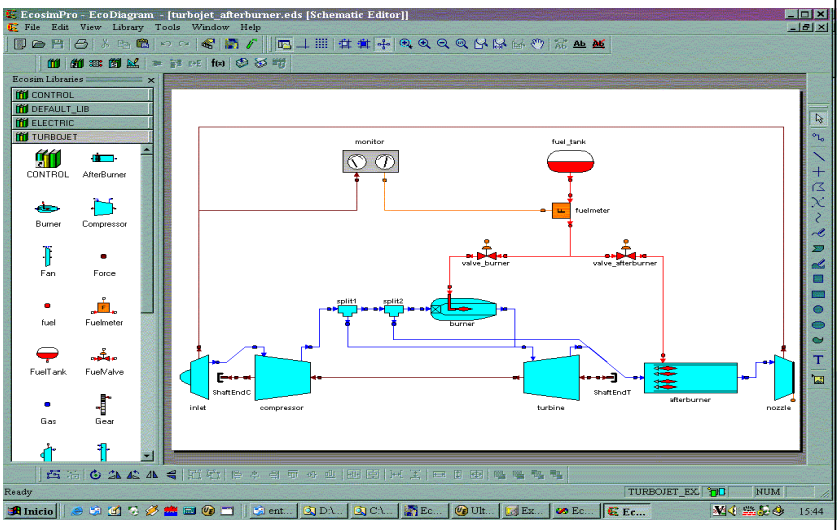
ECOSIMPRO LATEST IMPROVEMENTS (2)

New graphical model builder, **EcoDiagram**

> it eliminates the complexities of the previous graphical editor (a commercial tool named Smartsketch)

> Consistency between the text and graph is automatically kept

> Graphical models are saved using XML language (Ascii file)



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ECOSIMPRO LATEST IMPROVEMENTS (3)

New connection EcosimPro-Excel

> Connection between EcosimPro and Excel enables to deliver EcosimPro models that can be run by system engineers without any EcosimPro knowledge

> Previous connection between EcosimPro models needed Visual Basic programming to manage the EcosimPro model object

> An Excel Add-In has been designed that enables to link Excel cells to EcosimPro model variables only by selection in graphical menus.

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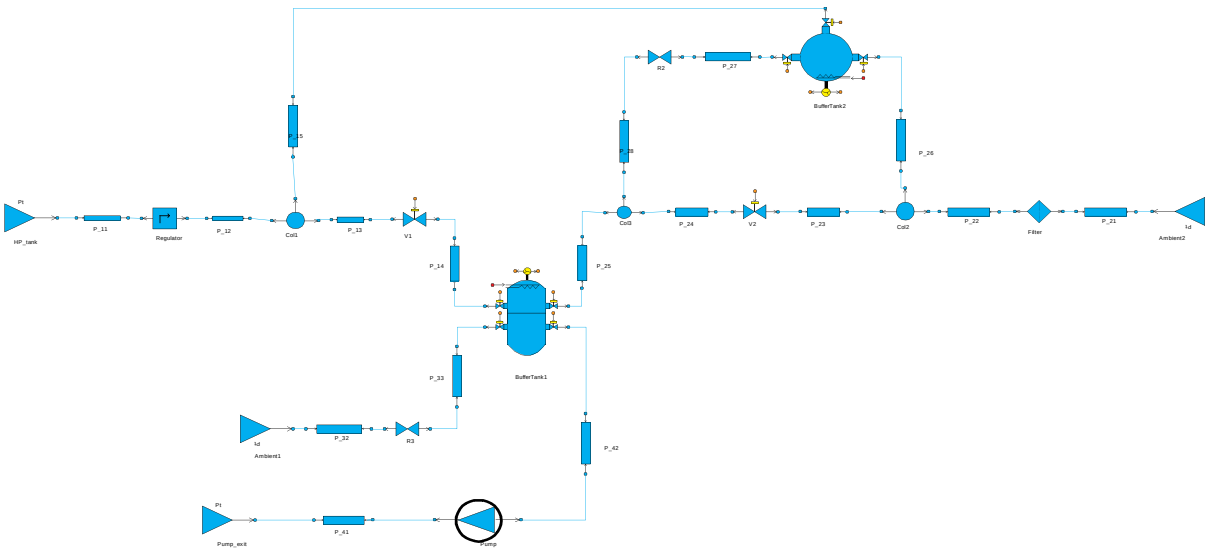
ECOSIMPRO LATEST IMPROVEMENTS (4)

EcosimPro Model of a pneumatic system connected to Excel for exploitation



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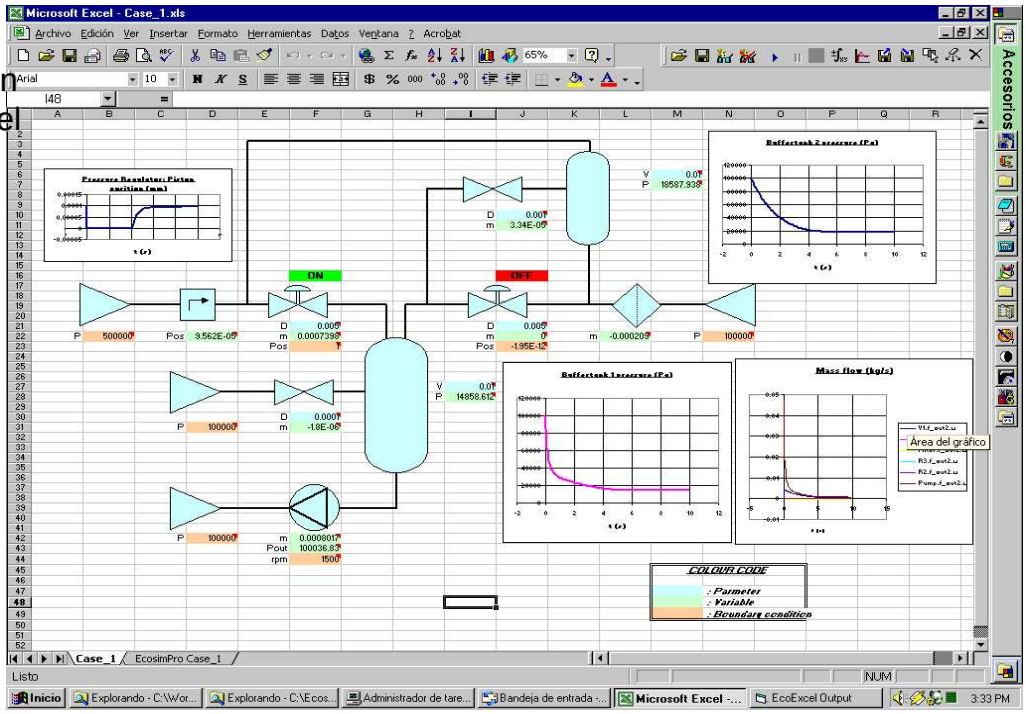
ECOSIMPRO LATEST IMPROVEMENTS (5)

Excel interface to run the EcosimPro model of the pneumatic system



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ECOSIMPRO LATEST IMPROVEMENTS (6)

Upgraded ECLSS Library:

> New components for molecular flow

- **Pipe** with compressible formulation, which is able to work in turbulent, viscous and molecular flow regimes
- **Orifice** with formulation including the compressible region, and the molecular flow region

> Very detailed crew model

> Pressure regulator valve model, and relief valve model

> Membrane Separator Model

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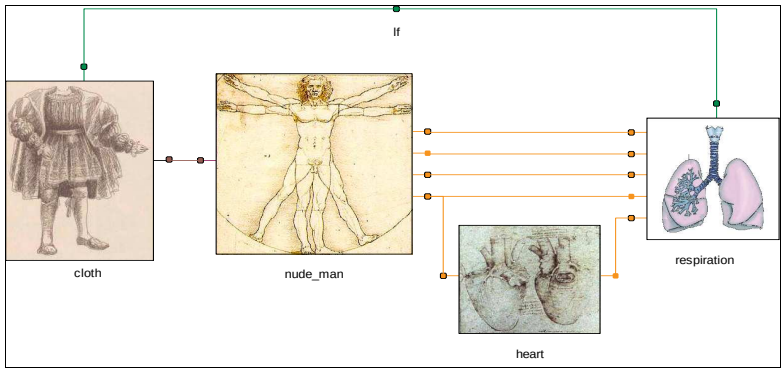
ECOSIMPRO LATEST IMPROVEMENTS (7)

Upgraded ECLSS Library: Detailed Crew Model

The detailed crew model was designed as a compound component consisting of:

- Nude man thermal model with 25 nodes
- A cloth model
- A heart model
- A respiratory model



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FUTURE IMPROVEMENTS

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EcosimPro Future Improvements

Ecosim Version 3.4 shall be released in December 2004. Major changes from an users view point:

> It shall have an optimization module callable from the experiments

> A pre-processor with “Include” and “Macro”, PDE’s easily modelled using the Macro

> Multiple functions to read tables in different formats

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EcosimPro Future Improvements

Ecosim Version 4 shall be released by the end of 2005

> Current EcosimPro version runs only in PC-windows, although it can generate model executables that run under Windows, Linux & Unix

- The graphical user interface was designed using Visual Basic and C++

> EcosimPro version 4.0 shall be multiplatform software running on Linux and Windows:

- EcosimPro Graphical User Interface is being redesigned using Qt

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EXAMPLE OF CONNECTION BETWEEN ECOSIMPRO AND EXCEL

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EXAMPLES (1)

An EcosimPro model of a cooling loop of an spacecraft has been built. The main features of the loop are:

- Mechanically pumped (COF pump)
- Single phase
- Working fluid is a design variable (the coolant can be selected between a set of predefined coolants)
- Thermal power to dissipate is 6000 W

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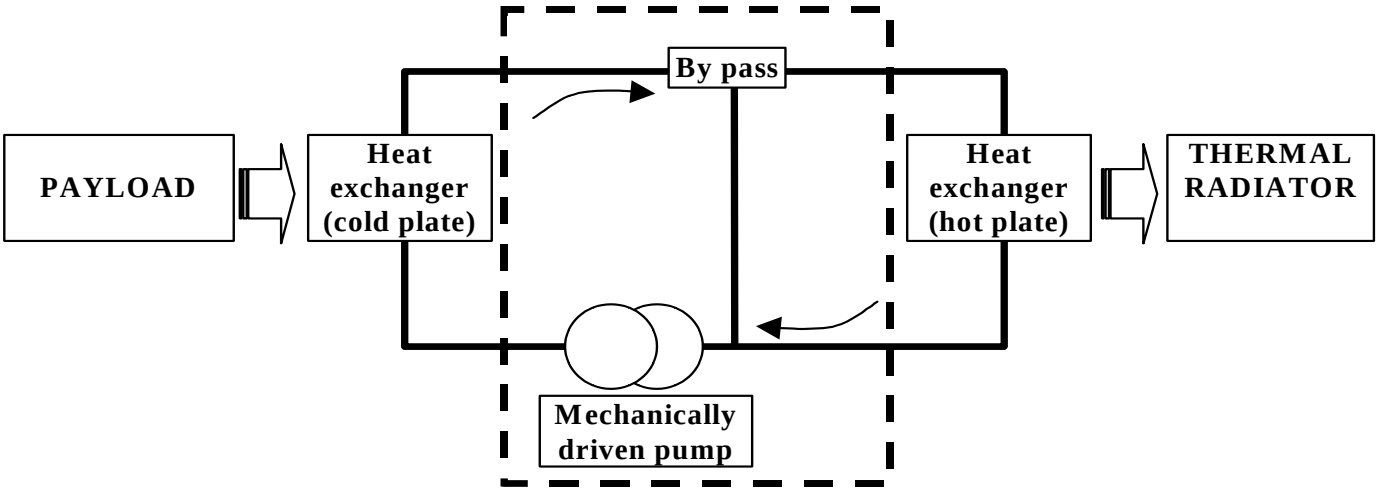
Example (2)
Schematics of the Cooling Loop to Simulate



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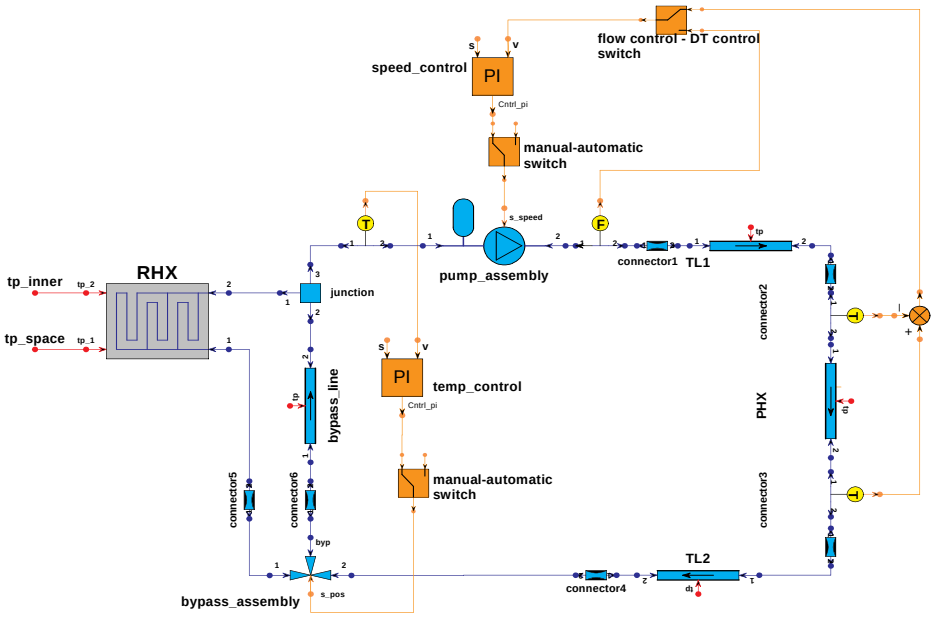
Example (3)
EcosimPro model of the cooling loop



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Example (4)
Excel Interface to the Cooling Loop Model