Q. Provide an overview of the Vista Hydrology program ("Vista") including the input sources of information.

A. A brief description of the Vista model is provided as PUB-NLH-006, Attachments 1 and 2. Key inputs to the Hydro's model include:

- Reservoir data inducing storage curves and water level constraints;
- Power plant data including unit efficiencies, turbine discharge curves, operating ranges;
- Watershed data including drainage areas, elevations, and calibrated parameters describing runoff characteristics;
- Historic and real time water levels;
- Historic, real time and forecast temperature and precipitation;
- Historic and real time snowpack data;
- Historic inflow sequences; and
- Real time and forecast load.

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POWER AND WATER OPTIMIZATION

Vista DSS™
Optimizing Power and Water Resources

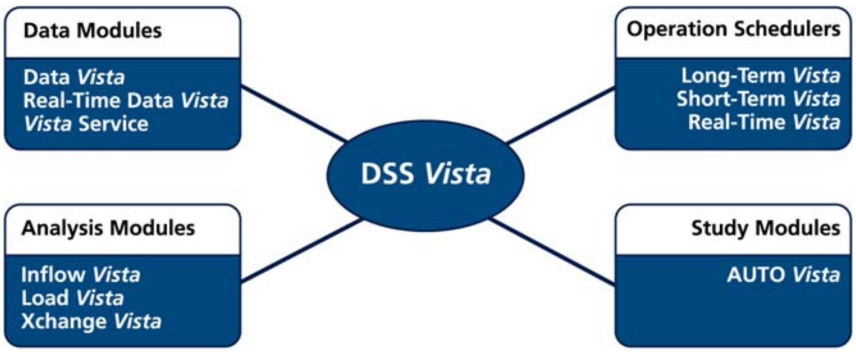
VISTA DSS™ DECISION SUPPORT SYSTEM

Vista DSS™ is a toolbox system operators and dispatchers, and engineering operations staff to assist the in short- and long-term scheduling to achieve maximum value for the water resource and generation systems.

In addition, *Vista DSS*™ be used as an analysis tool in study mode.

The principal components of *Vista DSS*™ are:

- **Data *Vista*** - for handling and accessing static system data
- **Real-Time Data *Vista*** - accessing and analyzing real-time data
- ***Vista* Services** - for downloading real-time data, calculating project outflow, local inflow and inflow forecasts as well as publishing reports
- **Inflow *Vista*** - for inflow forecasting
- **Load *Vista*** - to maintain and derive demand forecasts
- **Xchange *Vista*** - to define opportunities to buy or sell energy
- **Report *Vista*** - custom report generator for all dynamic data
- **LT *Vista*** - a generation scheduler, which guides medium- to long-term storage management, irrigation water supply, hydro generation, thermal plant use and transactions
- **ST *Vista*** - for optimization of short-term generation and transaction scheduling
- **RT *Vista*** - to determine optimum dispatch in real-time (unit commitment and loading)
- **AUTO *Vista*** - for analysis of system operation for multiple hydrologic scenarios over a one-year or longer study period



***Vista* DSS™ Suite**

The cornerstone of the *Vista DSS*™ procedure is the continuous determination of optimum operational actions on a recursive basis. This is in essence a dynamic operational policy, responding to changing conditions, unable to a static operating policy, which does not respond fully and immediately to change.

CONTACT

Stu Bridgeman
Director, *Vista* Sales and Marketing
+1 905 374 5200
sbridgeman@hatch.ca

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POWER AND WATER OPTIMIZATION

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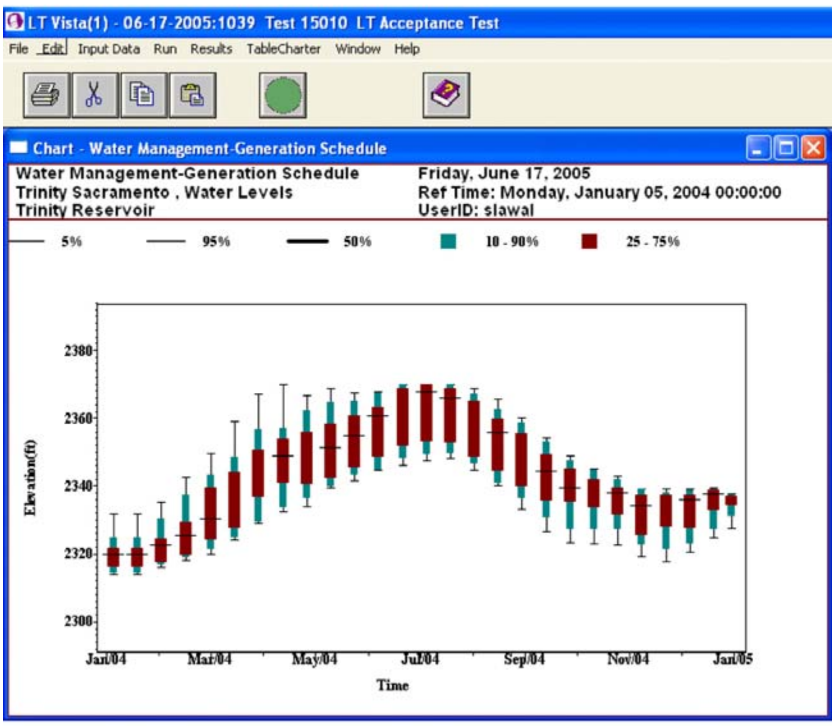
VISTA DSS™ PLANNING

Planning for water resources and power operations typically extends over several weeks or seasons, and sometimes over several years. The key issues are to make near-term decisions that take into consideration long-term influences, and to make probabilistic forecasts of possible outcomes.

The LT *Vista* module of the *Vista* DSS™ suite of programs is designed to handle strategic long-term planning. This module represents the water resource and power system, and hydraulic constraints, as well as key power flow constraints within the electrical network. The planning period is disaggregated into flexible duration periods (typically seven days) and further into sub-periods representing peak (heavy load), off-peak (light load), premium peak, and so on.

The database is pre-loaded with a set of many years of historic hydrologic inflows to each system watershed, to represent a plausible set of future inflow sequences. Alternatively, the user can elect to use a set of "extended streamflow predictions" (ESP) or ensemble forecasts. The user can then define a tree of feasible futures, comprised of inflow sequences, load forecasts and market price forecasts. Thus, the subsequent scheduling process takes into account the uncertainty in each of these three important variables.

The objective of this process is to maximize the net benefits (benefits minus costs) of the system operation over the planning period, subject to all the hydraulic and electric system constraints. In particular, the near-term operation (typically the first week) is optimized to determine the best use of storage facilities in the face of future uncertainty in inflows, loads and prices. Key outputs are as follows:



CONTACT

Stu Bridgeman
Director, *Vista* Sales and Marketing
+1 905 374 5200
sbridgeman@hatch.ca

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POWER AND WATER OPTIMIZATION

VISTA DSS™ PLANNING CONTINUED

Target water levels at storage reservoirs.

- Implied value-of-water in storage in each storage reservoir.
- Probabilistic definition of all variables over the planning period – revenues, costs, water levels, flows at all points in the network, generation for the system/plants/units, reserves, energy surpluses and deficits, market purchases and sales, compliance with constraints, and so on.

Benefits of LT *Vista* Planning

The benefits of planning with LT *Vista* are as follows:

- Determination of best timing of reservoir storage drawdown and recovery, and associate best timing of market purchases and sales. This considers the pattern and uncertainty in future inflows, loads and prices
- Minimization of spill
- Clear forecast of the probabilistic system operation, including revenues, costs, water levels, flows at all points in the network, generation for the system/plants/units, reserves, energy surpluses and deficits, market purchases and sales, compliance with constraints, and so on
- Direction for the short-term scheduling, in the form of either target end-of-week water levels, or value-of-water in storage.