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Station Report

Greenhouse Engineering
Division of Alex Turkewitsch, P.Eng. Ltd.

Projects Completed in 2005

We have completed the design phase of a major greenhouse project for Université Laval, Québec City, Québec. This involves a consolidation of greenhouse facilities for the FSAA and FFG departments and is characterized by containment considerations (level 2P+) and recirculation and extensive treatment of nutrient solutions. These greenhouses, totaling about 2,900 m² and divided into 29 zones, will be evaporatively cooled, using stainless steel cooler units for the smaller research compartments and fans and fog nozzles, for the larger growing compartments. The design team on this project includes Alex Turkewitsch, Bruno Faucher from EnviroSult and Ron Evans from CEA Technologies.

This will be our first application of scissor lift style vent actuators, from Lock Drives. These replace the convention rack and pinion vent actuators, with the goal of improving the insect exclusion (or inclusion) performance of the vent apertures. The scissor lift actuators do not extend into the greenhouse space and thus permit installation of full aperture screens without brush seals for rack penetration. The evaporative cooler units are provided with thrip screening on their inlets and have modulating control dampers on their outlets.

The Université Laval project had a strong emphasis on sustainable development. This concept was furthered by designing the irrigation system to be fully recycling, the collection and use of rainwater (mainly for evaporative cooler supply water), a fully integrated computer control system including irrigation management, double glazed sidewalls and gable endwalls, insulated foundations, thermal curtains and use of locally sourced materials.

The new electronic ballasted HPS lighting fixtures from PL Light Systems Canada Inc., in 600W or 1000W, were considered at length but were not selected, due to their non-standard voltage. The 400V operating voltage (+/- 10%) would have entailed a completely separated power transformer and power distribution system and this was considered impractical and costly, when the size of the installation and the number of fixtures was taken into account. A main feature of the electronic ballasted fixtures is the reduction of input energy costs of 15% when compared with the conventional 600W North American style ballasted fixtures. An attractive feature of the electronic ballasted fixtures is the fact that they maintain lamp output, using a feedback loop and lamp current regulation. Other advantages include reduced size and weight.

We were also the consultants for a growth chamber facility for the University of Chicago's Preuss Laboratories in the IRB building (a part of extensive renovations to that building). Since space was very tight, the clients wanted four tiered arabidopsis rooms and these were delivered by Conviron. Access to the top tier is only possible by stepladder. On site testing of the chambers in operation was performed by Conviron. The four tiered chambers maintain temperature, humidity and light to the same standards as comparable three tiered chambers.

New Projects

At 66% in the design phase, the replacement research greenhouse project for Agriculture and Agri-Food Canada at the Central Experimental Farm in Ottawa is a major and significant project. This consists of 1,450 m² of greenhouse space, in 18 compartments and is characterized by high light levels (300 µmol.m⁻².s⁻¹ infrastructure and 250 µmol.m⁻².s⁻¹ installed), from 600W HPS fixtures.

Sustainable development is also a feature and a design challenge of this project. By reusing an existing building and employing locally sourced materials, soft landscaping and insulated vertical walls and foundation walls, we are reducing the impact of replacing old and seriously outdated greenhouse facilities with this new Integrated Growth Facility. The consolidation of the old facilities, which number 7 or more at various locations around the Central Experimental Farm, into one compact facility introduces space efficiencies, energy conversion efficiencies, shared space and support function efficiencies and user access enhancements while providing a research facility capable of year-round performance.

At the Central Experimental Farm research greenhouses, we will be testing a new evaporative cooler unit being developed by Greenhouse Engineering in cooperation with Sigma Corporation. This unit, of stainless steel construction, will be particularly well sealed and will have an extended surface area thrip screen filter on its inlet. We will be monitoring pressure drop across the filter unit and recording frequency of cleaning required, to help in selecting a suitable screen area. The screens are to be constructed of conventional greenhouse thrip screen cloth, installed in an easily removable frame with tight seals on all four sides and between the screen and the cooler unit inlet. The concept is to make the screen easy to maintain. This is a distinct advantage over maintaining screens in ridge vent apertures, especially with the increases in heights of typical greenhouses and the proliferation of overhead systems and equipment.

Other projects in design include the Syracuse University rooftop greenhouse project, a new Agronomy greenhouse for North Dakota State University at Minot, and the Colgate University research and collections greenhouse project.

The Syracuse University and Colgate University projects are both air conditioned, using the under bench air handler units designed by Greenhouse Engineering, manufactured by Sigma Corporation, and now in use at the University of Toronto, University of Guelph and currently being installed at the University of Florida at Gainesville and the University of Pennsylvania at Philadelphia.

The greenhouses in Gainesville are being constructed by Frank Jonkman & Sons Ltd., greenhouse manufacturers. The greenhouses at the University of Pennsylvania are being constructed by Rough Bros. Inc., greenhouse manufacturers.

Cooperative Alliances

Over the past five years, Greenhouse Engineering has developed alliances with several consulting firms in complementary and related fields of practice. One of these is Montgomery Smith Inc., of Burlington, KY, headed by Jim Smith. Jim works extensively for conservatories, arboreta, botanical gardens, providing full scope design services, building evaluations, planning and advice for restorations. Our companies have collaborated on seven projects over the past five years.

We have also conducted six design projects in the past five years with CEA Technologies International, of Aylmer, Ontario, with agronomist Ron Evans. Ron is experienced with feasibility studies, economic analyses of greenhouse crop production systems, specialized growing systems and greenhouse technology.

We collaborate regularly with Envirosult, a greenhouse consulting company based in Québec and operated by Bruno Faucher. Bruno is experienced with all aspects of greenhouse design, with particular emphasis on greenhouse mechanical systems.

As the programming phase and the task of determining functional requirements for research and institutional greenhouse facilities has become increasingly complex, we have added to our resource base a horticulturist. Bruce Hall is chief horticulturist at the University of Toronto Botany Department and collaborates with Greenhouse Engineering to advise on greenhouse management, cultural techniques, pest management and practical containment considerations.

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