Superfurnace: It Walks, It Talks, It Crawls on Its Belly Like a Reptile....

Step right up to the most startling piece of alternative technology Canada has ever produced

By Robert Mariner

Like the Bearded Lady or the Three-Headed Calf at the county fair, the Charlottetown energy show seems to have a freak attraction of its own, judging by the crowds surrounding a woodburning furnace – "the furnace that burns without smoke" – as the curiosity seekers are calling it. To anyone who heats with wood, this sort of claim has a ring of W.C. Fields about it, calling to mind the huckster with a burned-out voice selling an elixir with the bold assurance that, "It cures hoarseness!"

Determined to see the furnace that is usurping the spotlight normally reserved at these events for such exotica as aerogenerators, solar panels and Swedish composting toilets, I work my way around the crowd until a bulge in the middle spills open just long enough to allow me inside the jostling maw. The centre of attraction is a polished, red metal woodburning unit being tended by an energetic man who is attempting to answer questions from the fairgoers.

"Do you mean that this thing will actually burn wood without producing creosote?" I finally ask. The man nods a response and nervously plucks another question from the barrage being directed at him by the crowd.

Follow-up questions prove impossible, and several hours pass before Roger Wright is freed of his duties and we settle inside the cab of his half-ton pickup truck to continue the question-and-answer session in less trying circumstances. His mind and eyes are locked on the Jetstream furnace on display, but he again reassures me that it produces virtually no creosote.

"Even if you burn green softwood?"

Wright's answer is still yes. Peering over his shoulder as we talk, he watches the crowd and the furnace exhaust stack through the back window of the truck cab. He has the intense, furrowed-brow concern of a director monitoring the response of his work from backstage on opening night. Suddenly the furrows deepen.

"Smoke!" he gasps, his voice rising in alarm. "Why is it smoking?"

Wright's body tenses as he apparently contemplates the feasibility of leaping from the half-ton and back into the display area in a single bound. Seeing that a spectator has opened the loading lid of the furnace and that the illicit peek inside has caused a single tuft of black smoke to puff out the chimney, Wright mutters a relieved, "Oh, yes, I see," and then beams broadly: "It's burning clean now . . . look at it!"

There isn't much to see, which makes this demonstration all the more impressive. Although the furnace is turning out huge amounts of heat, above its smokestack there is only the shimmering distortion of heat waves similar to the mirage visible above a blacktop road on a hot summer's day. There is no smoke, just clean, intense heat.

The excitement of the Prince Edward Island crowd at the energy fair is understandable. The woodburning equivalent of the Half Man/Half Woman has been examined and it is not a fake. The Jetstream design represents the single most important

Dennis Edell of Hampton Technologies loads demonstration Jetstream at the firm's Prince Edward Island plant.

Wayne Barrett

advance in residential woodburning technology in years.

The new furnace burns wood in an extraordinarily hot fire, with a turbulent supply of forced air and a flame path which is sufficiently long to result in a combustion so complete that it eliminates creosoting problems and makes pollutants in the exhaust gases almost non-existent. The 950-pound unit measures about three and a half feet in length, is two feet wide and stands just over three feet high. Despite its compact size, it delivers large amounts of steady heat with such ease of operation and safe convenience that one critic has dubbed it "the Esso furnace of the wood heat set."

WATER TRAP

Now being produced by Hampton Technologies Corporation of Charlottetown, Prince Edward Island, the Jetstream design is based on a concept of Professor Richard C. Hill of the University of Maine. It represents a complete rejection of the current movement toward airtight woodburning devices and draws heavily on a fact that old-time wood burners have known for years: a fast, hot fire burns cleanly and prevents creosote build-up in chimneys.

But the Jetstream design faces one essential reality of modern life: very few people want to be tied to feeding a wood stove or furnace constantly to keep a fast, hot fire in progress. Even fewer want to convert completely to wood as a source of heat if it means never being able to leave home for a winter weekend without fear of returning to frozen pipes and dead ferns.

Hill's design works to trap the heat produced by the furnace – at full tilt it blasts out energy at the rate of 120,000 Btu's per hour – and store it in a separate, unpressurized water tank. A special metal jacket containing an air-to-water heat exchanger surrounds the furnace, with water circulated through a series of tubes in the path of the exiting heat and thence on to an insulated storage tank. Relatively cooler water flows back from storage to the jacket around the furnace. This heat storage can then be drawn upon to feed a conventional hot water or hot air central circulation system over an extended period of time. With adequate heat storage, a single two- or three-hour burn in the Jetstream can produce enough heat to carry an average home in Canada or the northern United States for a day, while a larger water tank could absorb enough energy from an eight- to ten-hour burn to sustain the same house for a week after the furnace fire had died.

COMPACT INFERNO

Feeding the Jetstream requires a reversal of usual fire-lighting procedures: a few sticks of kindling are dropped down the nearly vertical loading tube, followed by a flaming piece of crumpled newsprint. A fan draws a strong draft of air down through the kindling, causing it to crackle and ignite with amazing speed – in less than 10 minutes the Jetstream's fire chamber can be at near-maximum performance with temperatures averaging 1600 degrees Fahrenheit and with a furious, inferno-like core of flame filling the unit. The draft set up by the fan directs the flame and gases from the wood through a firebrick-lined tunnel, assuring virtually complete burning of combustible gases and solid particles that all too often escape up the chimney in other woodburning systems.

Sliding down the vertical loading tube as it burns, a log feeds itself into the fire by gravity with just the burning end actually inside the combustion chamber. The creosote-forming gases are released only at the burning end of the log and the draft forces the mixture through the tunnel to be burned off.

The cigarette-like combustion in the Jetstream – only one end of the log is lit – resembles the burning action in some modern airtights. In an airtight furnace or stove, however, pyrolysis (the breakdown of solid wood into its component gases) takes place along the length of the log inside the combustion chamber and some of the creosote-forming gases inevitably escape into the chimney.

The best airtights achieve complete combustion only when the stove is very, very hot and there is a good supply of air, primarily in the middle of the burn cycle with the air intake fully open. During the early and late parts of the burn cycle, the temperature in the combustion chamber of an airtight stove is too low to burn off all wood gases. Even in the middle of the burn, most stove operators shut off the air supply, at least partially, to "choke" the fire for a prolonged and a more even supply of heat.

Combustion in the Jetstream is virtually complete, with 0.2 per cent of the wood, by weight, left behind as white ash. Some heat does escape up the chimney, however, and the overall efficiency of the furnace computed by applying the standard stack-loss method, has been estimated to be between 75 and 80 per cent. One unit tested by Hampton showed an 85 per cent efficiency rate, but company engineer David Murray emphasizes that the firm is cautious about any claims it makes for the Jetstream.

"How efficiently it will perform depends on how well the furnace is maintained," says Murray, who suggests that the white ash residue should be cleaned out after every full cord of wood is burned. Carried by the draft, some ash particles escape up the chimney and cling to its walls, leaving a whitish deposit instead of the black creosote found in chimneys connected to conventional wood burners. As in any furnace, the air filters should be changed periodically for efficient operation, and in the Jetstream the tubes of the heat exchanger must be brushed clean at least once every year.

The lower, 75 per cent, efficiency estimate compares favourably with the 60 to 75 per cent efficiency achieved by other airtight furnaces and state-of-the-art heaters. A well-tuned oil furnace, and few such furnaces are ever finely tuned, has a burn efficiency rate of 70 to 80 per cent, but this efficiency rating ignores the energy already used to refine and transport the fuel oil.

NO OVER-PROMISES

Despite the obvious enthusiasm for the Jetstream, Hampton's president Gordon Bond is as guarded about claims for his product as the firm's chief engineer. The company is in the process of setting up a network of dealers to cover North America, and Bond explains that "although based on our experience with furnaces and airtight stoves we can say that a 'typical' Jetstream will consume a third less fuel to do the same job as a 'typical' airtight unit, we caution our dealers not to over-promise what the Jetstream will do . . . a 20 per cent fuel saving would still be attractive to most customers.

"Our rule of thumb is that for every

hour the Jetstream is on it burns 20 to 22 pounds of seasoned hardwood and saves an equivalent of one gallon of fuel oil. We have to be very careful about any efficiency claims because there are so many variables. Someone burning wood with a 10 per cent moisture content might switch to a Jetstream in which they try to burn wood with a 40 per cent moisture content and then wonder, 'What's wrong with the Jetstream?' " It will burn wet, rotten or waste wood, but the Jetstream, like all woodburning equipment, performs best when stoked with dry, seasoned hardwood with a moisture content of 20 per cent or less. One cord of wood with a 20 per cent moisture content will deliver the same amount of heat as 200 gallons of fuel fed to an oil furnace, according to Hampton Technologies.

MARKETABILITY

David Murray took Professor Hill's bulky laboratory model and reduced its size by roughly one-third to allow easier placement in the basement. Hampton also developed heat storage tanks which come in sections that fit through most basement doors. In retrofitting applications, the Jetstream can be linked into most conventional hot air or hot water distribution systems, and Hampton Technologies is supplying its dealers with instructions for integrating the new furnace and heat storage design into older central heating systems.

The company currently offers new heat storage tanks in sizes ranging from 650 to 1,200 gallons, the latter standing six feet high and measuring six and a half feet in diameter and allowing the homeowner to space furnace fuellings three days apart in winter. After this interval, with the stored water at 120 degrees F, it would take between two and three hours to charge a 650-gallon tank to its maximum temperature of 180 degrees. Operation of the furnace and heat distribution system is completely automatic, according to Hampton, which describes it as a "hands-off" system.

An oil or an electrically-fired hot water heater can be used as an emergency backup to keep the storage tank charged. Another option for emergency situations, or when the dwelling has to be left unattended for several days, is the insertion of an electric immersion heater directly into the storage tank.

By eliminating creosote, the Jetstream theoretically does away with any risk of a chimney blaze. Other safety features have been incorporated into its design as well. Unlike conventional wood-fired boilers, which often spill scalding water during a power failure, the Jetstream will shut off automatically in an electrical outage. Since the fan cannot operate, there is no air turbulence in the combustion chamber and no draft; the fire dies.

The Jetstream also shuts off before it overheats. When the temperature of the water circulating inside the jacket around the furnace nudges up to 180 degrees F and threatens to boil, the "off" switch on the fan trips automatically. The furnace also passed another safety test for a pressure boiler: With the high temperature shutoff thermostat set at 240 degrees F, the pump circulating the water between storage and the furnace jacket was turned off. The fire roared on, pushing the temperature of the non-circulating water inside the jacket to 240 degrees F. As soon as this temperature was reached, the fan clicked off . . . the temperature rose a few more degrees, then began to drop quickly once the fire, starved of oxygen, snuffed out.

Alone, the furnace is now selling for $2,000. With the added costs of the storage tank set at about $1.00 per gallon of water capacity and the installation charge, the price tag for a ready-to-burn Jetstream system would fall between $3,000 and $4,000. Using recycled storage tanks and doing the installation oneself would reduce the price substantially. (Some Jetstream users have improvised their own storage systems by linking in a series three or more discarded 250-gallon oil tanks.)

Hampton says that the energy cost of running the fan and pump will amount to $3.00 or $4.00 per full cord of wood burned.

Oddly enough, Hampton, a Canadian company, has identified its first potential customers in the New England states where the Jetstream's design originated. "Let's face it," says the company's field representative, Dyer Drake, "besides the Maritimes, New England is the place where people already heat with wood and will be quickest to appreciate what this furnace can do."

With other firms gearing up to produce furnaces of similar design (see accompanying article), the Hill-type unit is expected to see a reasonably rapid jump into the marketplace, if measured by traditional alternative energy standards.

When offered the suggestion that the furnace's storage tank could easily be integrated with a rooftop solar collector, an installation that would provide emergency backup, reduce the amount of wood burned and eliminate the need to fire the unit in early fall or late spring, Gordon Bond of Hampton smiles with satisfaction.

"Exactly! You know, the promises we have been making about creating viable energy alternatives may seem a vision of a dream world, but it seems to be coming true and that's why we're here, working 24 hours a day." □

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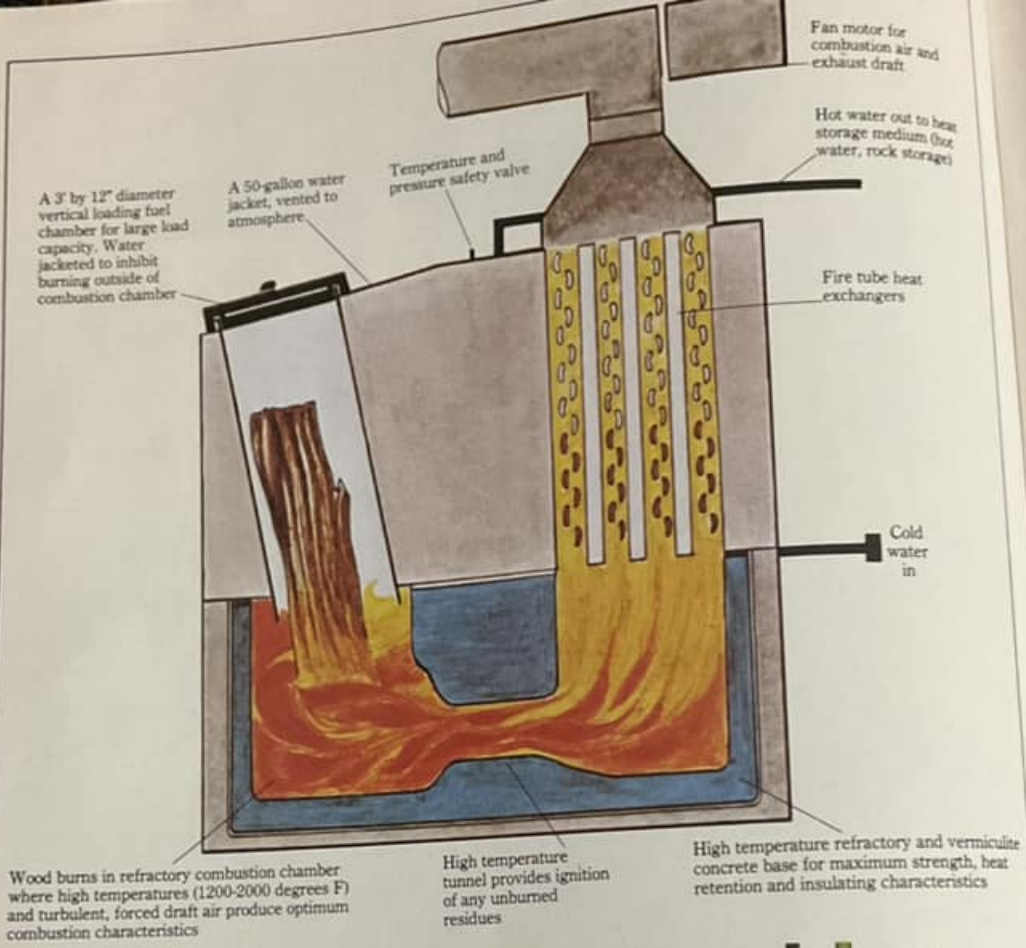

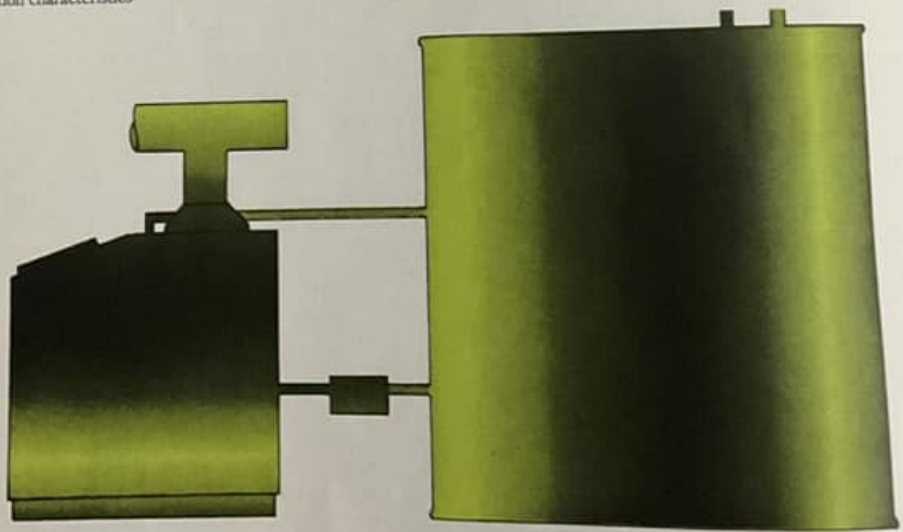

Jetstream Furnace

Storage Tank