



# Airways

**Hamilton Chapter No. 037**

*American Society of Heating, Refrigeration and Air Conditioning Engineers*

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**Tuesday February 13, 2001**

*The Use of CFD in Modeling Airflows in  
Occupied Spaces:  
Industrial and Commercial*

Computational Fluid Dynamics (CFD) is a modeling technique where a flow region is divided up into a large number of smaller regions to which the fundamental laws of fluid dynamics are applied. The first application of CFD to room airflows was in 1974. Since that time, computer technology and software developments have made CFD more accessible to the HVAC system designer. However, despite these advances, caution in its use is required: the users must understand their tool.

CFD has many advantages: it can be used to predict performance of systems before construction; investigate accidents or the risk from accidents; and to optimize designs. To the HVAC system designer, this means that a client may be shown the performance they can expect from their new HVAC system, how it may be optimized to enhance comfort or efficiency, or to analyse the potential risks from fires or contaminant releases.

While the presentation will provide a brief description of CFD itself, the focus of the presentation is to provide the audience with a sense of the potential of CFD, the cautions one should apply and how the results can be used to enhance designs, safety, and how it can fit into the engineer's toolbox. The emphasis is on a practical approach to a handy tool with lots of examples.

## *Tonight's Speaker*

Duncan Phillips graduated from the PhD program at the University of Waterloo. His research work was on the development of specialized instrumentation to track mixing of air and transport of contaminants within ventilated and occupied spaces. His post-doctoral work looked at the use of CFD in large scale industrial premises.



**Pinetree Restaurant**

**395 Centennial Parkway North (at QEW), Hamilton**

**5:00 PM Social Hour & Technical Session**

**6:00 PM Dinner & Business Meeting**

**7:00 PM Technical Program / Speaker Presentation**

*Chapter Members \$ 20.00 • Guests \$ 25.00 • Students \$ 20.00 • Meal Plan \$ 100.00*



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He is currently a Specialist in CFD and Industrial Ventilation at RWDI in Guelph. As a senior CFD practitioner at RWDI he is involved in many simulations of airflows in occupied spaces including stadia, tunnels, industrial facilities, atria, auditoria, offices, labs and concert halls.

He has spoken at a number of conferences including ASHRAE and contributes to a number of Technical Committees. He is a member of ASHRAE and a P.Eng.

## Message From The President

Welcome to February.

You have two things to look forward to this month. First, our ASHRAE program for February looks especially interesting. And, second, there is Valentine's Day on the 14th where you can spend time with your special person. However, I do think that ASHRAE may have a hard time competing with Valentine's Day.

Our Tech Session this month features a representative from Energy Controls and Mechanical Services who will be speaking on the fundamentals of local area networks. It seems that we can never get enough information to complete our learning curve of direct digital controls. If you hear this talk, I am sure it will bring your knowledge to a new and very useful level.

The speaker for our main topic is Duncan Phillips, P. Eng of RWDI in Guelph. His talk will feature applications of Computational Fluid Dynamics (CFD) to model air flows in industrial buildings. To any of us who have designed or installed industrial ventilation systems, you will know what a challenge it is to provide the optimal system for both the processes and occupants. Duncan's talk will help us to achieve a better understanding of this process.

Finally, the Hamilton Chapter has been discussing the best way of advising you of our upcoming meetings. As of next September, we will only be emailing the Hamilton Chapter Airways Newsletter. We have found that most people now have internet access and an email address and we would like to take advantage of the timeliness of email coupled with the reduced telephone costs. If you are presently not receiving Airways by email and have an email address, please forward your email address to Brian Beninger for incorporation into our database. Brian's email address is [beninger@vaxxine.com](mailto:beninger@vaxxine.com).

I am looking forward to seeing you all on Tuesday, February 13, 2001. And don't forget to reserve the 14th for your special person.

*George Robb, Hamilton Chapter President 00/01*

## Notice From The Executive

"The Hamilton Chapter executive has nominated the following individuals to serve on the 2001-2002 executive:

George Robb - President  
Dave Stacey - President Elect  
Steven Hey - Vice President

Nominations for these and any other positions will be accepted until February 13, 2001. Voting will take place at the Chapter meeting, March 13, 2001".

## Plant Tour

Note that there has been a change in our meeting schedule below. In April, we have booked a tour of the unique "Bigfoot System" at the Ford Winstar van plant in Oakville. Details to follow.

## Message From The Editor

For the past three years or so, this Airways newsletter has been distributed using three methods: email, fax and snail-mail. Starting in September 2001, we will be discontinuing the direct faxing and snail-mail methods and will be using email as the exclusive means to disseminate this publication. The reason for this change is that faxing directly to individual numbers takes hours and must be done during the weekend when my overextended computer is relatively free and snail mail is time consuming and more costly whereas a mass emailing takes minutes and can be done any time. Those who currently receive the Airways by fax and snail-mail will be reminded of this on their cover sheets for the next few months. Please advise me of an email address where I can send the newsletter in the future. If there is absolutely no way you can access email, please contact me and I will try to arrange that you get the Airways by some other method on a case by case basis.

Thanks for your co-operation.

Brian Beninger, Airways Editor, Webmaster

## Tech Talk

This month's Tech Talk comes courtesy of Duncan Varey of H.H. Angus:

*Jack the chief called, he had a question. Jack was a throwback to the old style Plant Engineer, his plant was his castle. He had a lifetime of hands-on experience. An argument with Jack was never wise, he was usually right. His plant operators always did what Jack wanted, no questions asked.*

*"My question is", Jack said, "If you needed two full truck loads of gravel, would you use 4 trucks at half load or 2 at full load"?*

*I said, "Jack, I would use 2 trucks at full load". Jack replied in that "Got Ya" voice!, he then said.*

*"Then how come the new Central Plant you designed has all 4 of the 2 speed cooling tower fans step controlled so that we can have 4 operating at 900 rpm, half speed, instead of 2 @ 1800 rpm full speed"?*

*Mind racing, I thought of the fan and pump affinity laws and said "Jack, I will fax you some data".*

The affinity laws (for an axial or centrifugal fan, as well as a centrifugal pump) are as follows:

$$\text{Flow} = \left( \frac{\text{New rpm}}{\text{Original design rpm}} \right) \times \text{original flow @ original design rpm}$$

$$\text{Pressure} = \left( \frac{\text{New rpm}}{\text{Original design rpm}} \right)^2 \times \text{original pressure @ original design rpm}$$

$$\text{HorsepowerHP} = \left( \frac{\text{New rpm}}{\text{Original design rpm}} \right)^3 \times \text{original HP @ original design rpm}$$

Therefore, for Jack's application @ \$ 0.07/kWh, the electrical cost using 30 HP fan motors, assuming the full 30 HP nameplate rating is used @ full load, the comparison is:

**1. Two 30 HP fans each operating @ 1800 rpm:**

$$= \left( \frac{1800}{1800} \right)^3 \times 2 \text{ fans} \times 30 \text{ HP / fan} \times .746 \text{ kw / HP} \times \$0.07 / \text{kWh}$$

$$= 1 \times 1 \times 1 \times 2 \times 30 \times .746 \times \$0.07 = \$3.1332 / \text{hour operating cost}$$

**2. Four 30 HP fans each operating @ 900 rpm:**

$$= \left( \frac{900}{1800} \right)^3 \times 4 \text{ fans} \times 30 \text{ HP / fan} \times .746 \text{ kw / HP} \times \$0.07 / \text{kWh}$$

$$= 0.5 \times 0.5 \times 0.5 \times 4 \times 30 \times .746 \times \$0.07 = \$0.7833 / \text{hour operating cost}$$

Saving is \$2.3499/hour for 4 fans @ 900 rpm, as compared to operating 2 fans @ 1800 rpm. Faxed data to Jack. Never heard a word until he called sometime later to nail me on another topic.

Jack is long gone but we still miss him. I always learned something every time we talked.

*Duncan Varey, ASHRAE Toronto Chapter*

## 2000 - 2001 Meeting Schedule

This year's meeting schedule is summarised below. Except for some special events, all meetings will be held at the Pinetree Restaurant, 395 Centennial Parkway North (at the QEW), Hamilton. During the 5:00 PM to 6:00 PM Social Hour, a half hour "technical session" on the basics of a particular subject relating to our industry is presented. If a session sounds interesting to you, feel free to attend. Presentations are made by our members and this forum is open to all who wish to share his or her expertise. New products and/or services are presented informally via a "table top demonstration". After dinner, the main topic of the evening is presented by a "feature speaker". If you are interested in presenting a technical session, please contact George Robb. If you want to book the table top space to promote your product or service, or if you have a suggestion for a feature subject and/or speaker, contact John Pollock, George Robb, or any other member of the executive. There is a charge of \$ 75.00 for "Table Top" demonstration space, and this includes a business card ad for one month.

2000 – 2001 ASHRAE HAMILTON CHAPTER PROGRAM ACTIVITY				
Month/Date	Theme	Tech Session 5:00 – 6:00 p.m.	Table Top Presentation	Guest Speaker/Main Topic
Feb.13, 2001	TEGA	Fundamentals of Local Area Networks		The Use of CFD in Modeling Airflows in Occupied Spaces: Industrial & Commercial (Duncan Phillips, P.Eng., RWDI)
Mar. 13, 2001	Refrigeration	Expansion Valves (John Pollock)	Copeland Alco	Supermarket Refrigeration (Paul Neelands, Neelands Refrigeration)
Apr. 2, 2001	TEGA	Ford Plant Tour – Oakville		
May. 8, 2001	Student	Industrial Tour - Westcast Industries		

Airways - Hamilton ASHRAE Chapter - February 2001

June 13, 2001	Membership/ Research	Annual Golf Tournament – Whirlpool Rapids
All meetings are at the Pinetree Restaurant, 395 Centennial Parkway North (at QEW), Hamilton, unless noted otherwise.		

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