Cool Cooling Technologies
and Where They are Coming From

Energy 2003
Orlando

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New Cooling Technologies

- First: Why
  - Regulations driving energy efficiency up and emissions down
  - Loads getting smaller (office buildings) as equipment, buildings get greener
  - Loads getting higher (data centers) as computers decrease in size but increasing in power/heat intensity
  - Chillers getting smaller, simpler, more flexible
  - Controls and piping/pumping methodologies are getting more complex

Cooling Industry Direction

- Chiller selection: Focus on the application, not the refrigerant
  - See EPA brochure (handout)
  - Note the sponsors on the back of it
    - Carrier, McQuay, Trane, York, etc.
    - *HPAC Engineering*
  - The end of the (overt) "refrigerant wars?"
    - Companies will compete
  - Europeans putting pressure on R-134a
    - Greenhouse gas (HFC)
    - In U.S. corner: ARI, ARAP, EPEE...
    - Go to www.arap.org for more info

Cooling Industry Direction

- Avoid over-sizing
  - Article by Mark Heizer, *HPAC Engineering*, May 2003
  - Article by Glenn Hourahan, *ARI Magazine*
    - Supplement to *HPAC Engineering*, May 2003
  - From the Editor, *HPAC Engineering*,
    - "Downside of Oversizing," May 2003
  - Not just cooling: boilers, fans, filters, valves...
  - Lots of reasons; really no longer valid
    - Trickiest is future growth... but
      - You're engineers!

Emerging Systems Concepts

- Energy-saving controls and pumping
  - Variable Primary flow for lower first and operating costs
  - Reduces pump head (and pumps)
  - Higher delta T performance
    - *HPAC Engineering* articles
    - *ASHRAE Journal* articles
  - This is the "hottest" cooling topic that I'm aware of

Emerging Systems Concepts

- All VFD-chiller plants for lower first and operating costs
  - Championed by Tom Hartman, PE
  - Some patent-pending aspects to Tom's no PID loop controls
  - *HPAC Engineering* (see references)
  - *ASHRAE Journal* articles

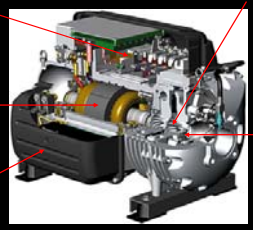
New Compressor Technologies

- Compressors
  - Turbocor Centrifugal Compressor
    - Demonstrated live at AHR Expo 2003
    - AHR Innovation Award for Energy, 2003
    - Magnetic bearings, VFD, advanced controls
    - R-134a refrigerant
  - Copeland Vapor Injected Scroll
    - *ASHRAE Journal*, April 2003

New Compressor Technologies

- Turbocor Frictionless Compressor
  - Very low noise, vibration
  - Has a soft-start, pulling only 2 amps
    - Typical screw compressor pulls 500 to 600 amps
  - Physical size is MUCH smaller
    - Weighs 1/5 that of a typical screw compressor
  - Has a built in VFD, inherent to design
  - 75 tons is only current size
  - Two can be linked together (more?)

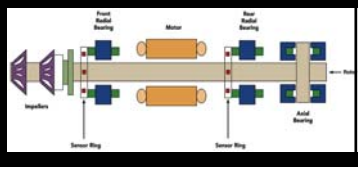
New Compressor Technologies



Turbocor Compressor

- The magnetic bearings have less than .2% the friction loss compared to conventional bearings

- Magnetic bearings and sensors keep the shaft properly centered and positioned at all times



New Chiller Technologies

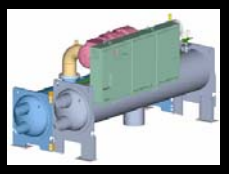
- McQuay frictionless water-cooled chiller
  - ARI-certified 550/590 using two Turbocor TT-300 75-ton compressors

New Chiller Technologies

- Trane S Series EarthWise CenTraVac
  - No oil or oil systems
  - R-123 is lubricant for high-tech bearings
    - SKF ceramic bearings in stainless steel raceways
  - Simpler design improves reliability
  - Tracer control panel comes standard
    - Meant to document energy performance
    - Future CO_2 emissions trading?
    - Also: alarming, trending, etc.
  - *HPAC Engineering*, June 2002

New Chiller Technologies

- Carrier Evergreen VSS
  - Variable-speed screw (standard)
  - Full-load below 0.52 KW per ton
  - IPLV estimated at 0.30 KW per ton
  - *HPAC Engineering*, June 2002
  - News: "soft delivery date" is 2004
  - Power factor: .99
    - Not .90
    - Smaller transformers
    - Happier utilities



New Chiller Technologies

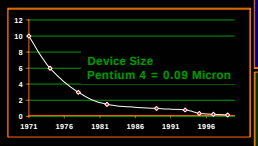
- Broad Spectrum LiBr Chiller
  - Full-load simultaneous cooling, heating, and hot water
  - Controls and mandatory maintenance prevent crystallization
  - Made in China
  - U.S. installations
  - *HPAC Engineering*, May 2000
  - Huge range: 33 - 2,600 tons
  - COP stated to be 1.34
  - Gas- or oil-fired
  - Continuous evolution
  - Go to www.broadusa.com

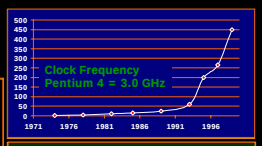
New Chiller Technologies

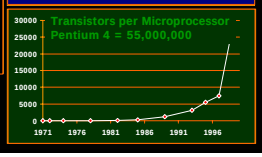
- York *Opti-Speed* and *Opti-View* technologies
  - Opti-Speed VSD controller
    - York's Adaptive Capacity Control (ACC) "learns optimum chiller runtime conditions by experimenting with run speed and vane positions...to minimize electricity usage"
  - Opti-View
    - Graphical user interface for real-time display of operating and trend data
    - Retrofits available for Carrier, Trane, and McQuay chillers

Data Centers are a Growing Challenge

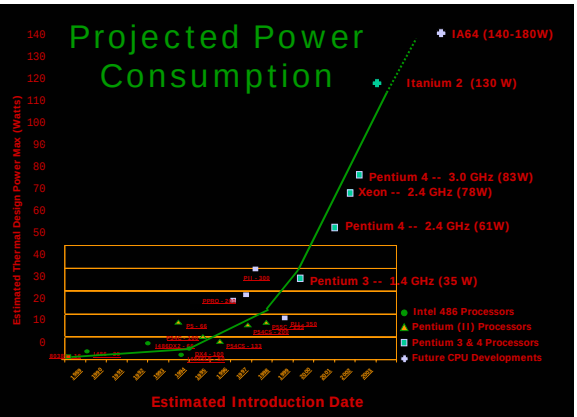
- High (Extreme) -density cooling
  - For data centers and telecomm facilities
  - Nanotechnology to the rescue?
    - On-board cooling
    - Self-cooling chips



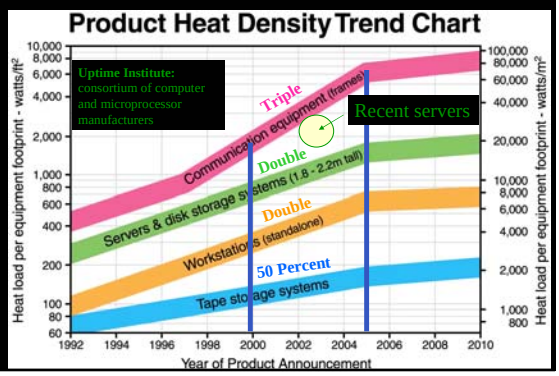




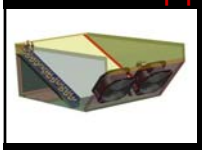
Projected Power Consumption

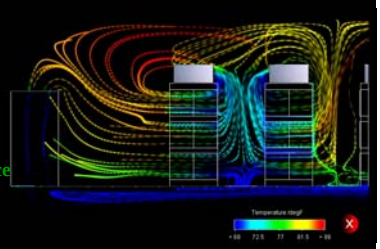


Emerging Systems Concepts



One Approach: Liebert XDV





- Rack-mounted
- Virtually no floor space
  - A premium!
- Refrigerant cooled

Something Different

- RediControls Refrigerant Purger
- Removes oil, acid and moisture from chiller's refrigerant charge
  - (to trace levels)
- Now available for low-pressure and high-pressure centrifugals
- Soon for high-pressure screws
- Saves energy (oper. costs)
- "$24,000 per year per chiller"
- "3-to-4 month payback"

Conclusions

1. Regulations driving energy efficiency up and emissions down
2. Loads getting smaller (office buildings) as equipment, buildings get greener
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4. Chillers getting smaller, simpler, more flexible
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Thank You

Send comments, suggestions, questions, and pointed anecdotes to *mivanovich@penton.com*

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