

**TC 1.5 Computer Applications
Research Subcommittee Meeting Minutes
ASHRAE Winter Meeting, Philadelphia, PA
Sunday, January 26, 1997**

1. Call to Order/Introductions

The meeting was called to order at 6:30 p.m. with 12 people in attendance.

2. TRP-966 PMS Report

Charlie Culp indicated that the PMS should be prepared to present its recommendation regarding TRP-966 at the full TC meeting on Monday.

3. Proposed Research

No new research projects were presented for consideration by the subcommittee chairs. The CAD subcommittee acting chair, Rob Briggs, reported that the subcommittee agreed to remove the one-pager entitled "Data Requirements for Energy Analysis Programs and Use of Self-Describing Techniques" (priority 5) from the TC's research plan. The author, Zulfi Cumali, was no longer actively participating in the TC and no other "champion could be found. The research subcommittee agreed to remove this one-pager.

4. Discussion/Review of Work Statements and One-Pagers

Jim Watts distributed a work statement entitled "Demonstration of the Use of Multimedia and Advanced Electronic Information Enhancements for a Chapter of the Handbook CD-ROM." The one-pager for this topic (priority 1) received a two star prioritization from R&T following the annual meeting in San Antonio. Following discussion on the project scope and the nature of the multimedia demonstrations, Jim agreed to rework the work statement and provide a revised version at the TC on Monday. (The goal is to submit this work statement to R&T for consideration NLT 15 Feb.) In the event that the work statement is approved by the TC, volunteers for the PMSC were identified. These volunteers include Jim Watts, Charlie Culp, Rob Briggs, and Brian Krafthefer. Van Baxter asked that he be sent a copy of the approved work order prior to the R&T meeting.

Dave Branson and Walter Grondzik agreed to prepare work statements for their respective one-pagers (priority 2 and 3, respectively.) These work statements will be sent to Bob Potter for review and comment NLT 1 March 1997. These work statements will then be electronically circulated for comment among the TC members. Collected comments will be sent to Branson and Grondzik for consideration with the goal of revised work statements completed in time for inclusion in the electronic agenda mailing for the Boston meeting.

Vernon Peppers will be asked to draft a work statement for his one-pager (priority 4) to meet the same review schedule. (At the TC meeting, Vernon indicated that he felt that the research described in the one-pager had been overcome by events and he did not feel inclined to prepare a work statement.)

5. Research Topic Prioritization

No changes were made to the TC's LRRP except for removing the one-pager entitled "Data Requirements for Energy Analysis Programs and Use of Self-Describing Techniques" (priority 5).

6. New Business

Jeff Haberl inquired as to the status of the TC's special publications efforts. Specifically, he asked how our special publication on KBS has sold and whether any other special publication have been considered. Bob Potter indicated that he would check with Special Publications to find answers to those questions.

Mike Brambley suggested that a packet should be assembled that provides guidance to members drafting work statements. Jeff Haberl provided an annotated work statement for inclusion in this packet. Bob Potter agreed to assemble a packet and to provide it to Dave Branson and Walter Grondzik. This packet would then be available for future work statement preparation.

7. Adjournment

The meeting was adjourned at 7:40 p.m.

Attachment C
WORK STATEMENT

FROM TC 8.2 CENTRIFUGAL MACHINES AND TC 1.5 COMPUTER APPLICATIONS

TITLE

Demonstration of the Use of Multimedia and Advanced Electronic Information Enhancements For A Chapter Of The Handbook CD-ROM

BACKGROUND

The ASHRAE handbooks are currently published in both printed and CD-ROM format. The latter method has many advantages including more convenient and powerful indexing and search functions, lower reproduction and dissemination costs, and more efficient storage. However, both formats are still just static expressions of written material accompanied by tables, graphs, equations and diagrams.

State-of-the-art multimedia techniques are increasingly being used to more effectively present factual information of all types. They can be used to create new content that will greatly enhance the value of the CD-ROM version of the Handbooks. For educational purposes, these techniques can provide a uniquely insightful and motivating method of learning about complicated systems such as compressors. For the practicing engineer, material of interest can be more quickly learned and understood and certain kinds of content such as algorithms could be presented in ways that enable their use in analytical and computational tasks.

JUSTIFICATION OF NEED

The ASHRAE handbooks are a widely used resource for the HVAC & R industry. Reflecting this importance, ASHRAE continually strives to improve and enhance the handbooks through the work of technical committees and in technical innovations such as the new CD-ROM format. The powerful new techniques that will be demonstrated in this project are a logical extension of these efforts. Perhaps more importantly, today's students and engineers are using these techniques now in their "everyday" work and will expect to use them even more in the future.

As a demonstration, this project will allow ASHRAE to:

- illustrate the power of advanced presentation techniques to further the educational objectives of the Handbook
- introduce new ways of presenting technical data and equations to increase analytical power and user productivity
- develop ways to increase the value and resulting revenues from the Handbooks and other technical publications
- assemble a set of guidelines for use of multimedia and other advanced electronic publishing techniques by Handbook authors, including a list of authoring tools and other technical resources.

OBJECTIVE

Develop a set of enhancements to a chapter of the ASHRAE Handbook to demonstrate the effectiveness of multimedia and other advanced presentation techniques and to serve as a model and guide for broader use of these techniques in other ASHRAE publications. The enhanced chapter can be used in the CD-ROM version of the Handbook, posted on ASHRAE's Web site, and used in other ways to promote the effectiveness of improved presentation techniques and the value of ASHRAE information resources. Using compressors as the subject, the project will expand on the material contained in Chapter 34 of the HVAC Systems and Equipment Handbook (recently-revised).

SCOPE

The demonstration should include a wide range of multimedia techniques and advanced methods of working with information. The following describes typical examples relative to the current subject material of Chapter 34:

- 2-D animations of dynamic elements in section views (rotating parts, translating parts, fluid flow vectors, color-coding to graphically indicate local fluid characteristics such as pressure or temperature, etc.).

This could be applied to 2-D Figures such as Nos. 4, 7, 9, 15, 23, 24, 26, 27, 34, 39, 41, 45, or 46 that show the method of operation of each kind of compressor. The animation could include a series of repeating “snapshots” to illustrate the intended cycle of operation.

- 3-D animations of dynamic elements describing “pictures” of compressor types such as shown in Figures 16, and 30 (or 31).

Solid-looking representations or “picture-quality” views of the major and critical components each type of compressor would be developed and animated to pictorially show how the components operate together (in slow motion). Fluid flow could be depicted as moving arrows through compressor passages with color again used to show physical characteristics. The user’s viewpoint 3-D orientation and extent (zoom) could be interactively moveable to allow views all around and “into” the animation model.

Audio feedback would be available at certain points shown in the animation. These would play back recordings from particular locations on a typical compressor such as the intake, discharge, bearings, etc. The recordings would allow the user to select from different operating scenarios such as “normal” (design point) operation, surge (centrifugals), incipient bearing failure, heavy versus light load operation, startup, etc.

- Interactive 2-D diagrams and charts.

Performance charts such as those in Figures 5, 21, 29, 36, 48, or 49 where the Handbook user could select from a list of independent variable values and view how the resulting operating point of the compressor moves in the chart. For example, a graphical operating point in Figure 48 would move when the user selects different values for rotating speed and volumetric flow. Similarly, Figure 49 would also let the user select inlet guide vane angles to see how this affects the operating point.

Another example would be to show the relationship between cycle configurations and pressure-enthalpy charts such as those shown in Figures 42 to 44. The user could point to a particular location in the system diagram and see the corresponding point on the chart. In addition, state condition data values (pressure, temperature and perhaps flow) for a typical chiller under typical ARI 550 conditions would be printed alongside the selection point.

- Alternate graphical approaches for presenting sets of data

The current figures in Chapter 34 reflect appropriate methods for representing data given the inherent limitations of the black and white printed page. Electronic representation of these same types of data provides additional opportunities for clarifying the data and their relationships and conveying greater understanding to the user. Some graphical methods that should be considered include 1) layering the data so that the user can selectively examine subsets of the data, 2) use of color and transparency, 3) use of 3-dimensional graphing techniques, 4) use of a movable viewpoint in 3-D, and 5) use of a matrix of contour or 3-D plots to show relationships among more than 3 variables. Some of these techniques may be most effective when used in combination, such as the color coding of contours on a 3-D mesh plot. Current figures that appear suitable for representation using alternate graphical methods include Figures 1, 2, 5, 29, 48, and 49.

- Ways of allowing algorithms to be extracted or used directly as pieces of usable code.

Sets of key equations in the chapter could be available in some form such as spreadsheet formulas or as a block of FORTRAN, C, or Java code that can be “extracted” for use in other software outside of the Handbook.

These equations would also be available in a directly “executable” form allowing the user to enter values for input variables and to see the resulting calculated values. Typical default values could be provided for all inputs which can be overwritten by the user. A printed report option could be available which would list the included equations, labeled input, intermediate, and output variable values.

The techniques demonstrated must be highly replicable and “generic”. They should not be limited to use with just the particular subject matter of this project. The intent is not to “hard code” a particular demonstration, but rather to illustrate techniques that result from the use of authoring tools and other resources that can be readily applied to the rest of the material in the Handbooks. ASHRAE’s preference is for demonstration of a variety of different types of multimedia enhancements over multiple applications of the same or similar methods. The tools needed to produce the demonstration should be affordable and preferably royalty-free so that they can be widely used to create additional enhanced Handbook material.

The software delivered must be at least compatible with 32-bit windows (WIN32). But solutions that work across several platforms are preferred. Also preferred are solutions of a form that can be disseminated across the Web as well as the CD-ROM such as HTML, VRML, or Java.

Please note that ASHRAE retains all intellectual rights and any copyrights for any software developed in this project. Licenses for software purchased as part of the project will either be registered as owned by ASHRAE or transferred to ASHRAE at the conclusion of the project.

The project will be divided into six phases as follows:

- a. Propose Enhancements: The contractor will evaluate and suggest techniques to be used to enhance the subject material. A short report will be sent to the PMS (Project Monitoring Subcommittee) for review and approval before beginning the next phase.
- b. Evaluate Tools: The contractor will explore authoring and other software tools that are available to develop the enhancements as well as the ultimate forms/methods to be used to create content. A short report proposing tools to use in the project will be sent to the PMS for review and approval before beginning the next phase.
- c. Gather Data: The contractor will identify and collect raw material (images, typical specifications, data sources, etc.) to be used to create the enhancements. A short report will be sent to the PMS for review and approval before beginning the next phase.
- d. Prototyping: A set of prototype screens representing the format and general content of the Handbook enhancements will be developed and submitted to the PMS for review and approval before beginning the next phase.
- e. Development: The enhancements will be developed, documented, and delivered.
- f. Prepare Informal Multimedia Guide: A brief guide and compendium of lessons learned for use by ASHRAE TCs and ASHRAE staff in performing and directing efforts to incorporate multimedia into ASHRAE technical documents. The guide (not to exceed 10 pages) should explain in general terms how the enhancements were created, where to go for up-to-date information on multimedia development tools and methods, and other general information helpful for getting ASHRAE members and staff started with publications containing multimedia.

DELIVERABLES

- a. Five (5) copies of a CD-ROM containing an executable form of the demonstration content will be delivered that is non-exclusive, preferably royalty-free, and freely distributable. ASHRAE will hold the copyright to the demonstration content.
- b. Licenses either registered to ASHRAE or transferable to ASHRAE and original documentation for all software tools used to create the demonstration content will be provided. Limited duration “trial” licenses are not acceptable.
- c. Progress and financial reports shall be made to ASHRAE through its Manager of Research at quarterly intervals; specifically on or before each January 1, April 1, June 10, and October 1 of the contract period.
- d. The Principal Investigator shall report in person to TC 8.2 at the annual and winter meetings, and answer such questions regarding the research as may arise. To coordinate with TC 1.5, the latter may choose to send representatives to the TC 8.2 review or the Research Subchair of TC 8.2 will make a report to TC 1.5 during each meeting.
- e. The short reports and prototypes described earlier as part of the project phasing will be provided to the PMS.
- f. A final report shall be prepared and submitted to the Manager of Research by the end of the contract period covering complete details of all work carried out on the project. Unless otherwise specified, six draft copies of the final report shall be furnished for review by the PMS.

Following approval by the PMS and TCs 1.5 and 8.2, final copies of the final report will be furnished as follows:

- An Executive Summary suitable for wide distribution to the industry and to the public.
 - Six bound copies.
 - One unbound copy, printed on one side only, suitable for reproduction.
 - Two copies on diskette(s); one in ASCII format and one in the word processing format used to produce the report.
- g. Three formal presentations will be made during a subsequent ASHRAE meeting: one each to the full TC 1.5 and TC 8.2 committees, and one to the general ASHRAE membership at either a forum, seminar, symposium, or special meeting (as determined by ASHRAE meeting organizers).
 - h. A technical paper suitable for publication in the ASHRAE Transactions in accordance with ASHRAE specifications.

Please note that one or more technical articles suitable for publication in the ASHRAE JOURNAL may be requested by ASHRAE. This is considered a voluntary submission and not a deliverable.

LEVEL OF EFFORT

This project is estimated to take no more than one year to complete. The level of effort is estimated to be:

<u>Experience Level</u>	<u>Man-months</u>
Principal Investigator	2
Application Developer	7
Mechanical Engineer	2

Estimated total cost is \$85,000

OTHER INFORMATION FOR BIDDERS

Bidders will be evaluated on the following criteria (with weightings):

- The bidder's understanding of this Work Statement as revealed in the proposal and the value of the proposed enhancements. (40%)
- The bidder's familiarity with, experience in using, and involvement in developing the ASHRAE handbook. (10%)
- The bidder's experience in developing multimedia and other software products. (30%)
- The bidder's familiarity with the engineering subject material. (20%)

A combination of multimedia software development experience and mechanical engineering expertise, especially with refrigeration compressors, by any one contractor is not expected. Teaming of contractors with backgrounds in each area is encouraged in order to ensure the success of the project.

Proposals should follow the following outline:

1. Description and Qualifications of Project Team

Experience and qualifications related to compressors and mechanical engineering

Experience and involvement in developing the ASHRAE handbook

Experience and qualifications related to technical communication

Experience and qualifications related to developing multimedia and other software products

2. Brief Description of specific enhancements proposed for Chapter 34 organized into two categories.

a) Required enhancements that will be completed under this contract

b) Optional enhancements that will add value to the Handbook but that will be completed under this contract only if adequate resources remain after completion of the required enhancements

Descriptions should be brief but detailed enough to convey to proposal reviewers clear expectations for what the proposer intends to develop. Where specific development methods and tools can be identified, this information should be included although it is not required.

3. Approach to Software and Licensing - This project will produce a software product and will demonstrate a process (which ASHRAE may choose to replicate) that uses software to enhance ASHRAE technical data. State what platform(s) the product will be usable on, what platform(s) will be used for development, and describe any software licensing issues affecting ASHRAE's ability to freely distribute the products of this research (e.g., if royalty fees were required, the expected terms should be disclosed).

4. Proposed Project Schedule and Planned Level of Effort for Project Staff

REFERENCES

The current CD-ROM version of HVAC Systems and Equipment Chapter 34 (Compressors).

AUTHORS

James H. Watts, Ingersoll-Rand/NREC (TC8.2)

Robert S. Briggs, Pacific Northwest National Laboratory (TC1.5)