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FOREIGN TRIP REPORT

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DATE: October 15, 1990

SUBJECT: Report of Foreign Travel of David T. Harrje,
Consultant to ORNL

TO: Alvin W. Trivelpiece

FROM: David T. Harrje

PURPOSE: Participation as U.S. Representative to the Sixth
International Energy Agency Experts Meeting of Annex 20,
Air Flow Patterns Within Buildings, Nice, France, and
present Annex 20 results at the 11th AIVC Conference,
Belgirate, Italy.

SITES VISITED: AIVC Steering Group Meeting, Turin, Italy, Sept. 17,
11th AIVC Conference, Belgirate, Italy, Sept. 18-21,
EPFL, Lausanne, Switzerland, Sept. 24, and Annex 20
Experts Meeting, Nice, France, Oct. 9-12, 1990.

Abstract

As Annex 20 enters the final year, deliverables in the form of reports, guidelines, and data formats are nearing completion. The Reporting Guidelines for the Measurement of Air Flows and Related Factors in Buildings will be published by the AIVC next month and was presented to the research community at the 11th AIVC Conference. Measurement guidelines and state-of-the-art equipment descriptions are part of a comprehensive manual, Measurement Techniques Related to Air Flow Patterns Within Buildings - An Application Guide, in the final stages of preparation in Part 2 of Annex 20, together with reports on how to estimate the effects of flow through large openings, as well as contaminant movements in buildings. The Measurement Manual will include the latest information from the AIVC. The next AIVC Conference, in Ottawa, Sept. 1991, will feature more than 12 presentations of Annex 20 results, including the information from Part 1 which has focused on the detailed air flow patterns in a variety of single-room configurations. Both complex modelling (including CFD) and detailed measurements have been completed, and it is now desirable that added tests be made in the next months by the University of Illinois, BERL, representing the US in Part 1 for the first time.

MASTER

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AIVC Steering Group Meeting - Turin, Italy (9/17/90)

The AIVC Steering Group Meeting covers a wide range of subject matter concerning the ongoing operation of the Centre and the important yearly conferences and workshops. The topics of interest to Annex 20 included new technical information that will aid in achieving the Annex goals concerning air flow patterns within buildings. Of special interest was the planning of the 12th AIVC Conference scheduled for the week of Sept. 23, 1991, in Ottawa, Canada. That conference will serve as the means to acquaint the participants with the results of the work of Annex 20 via 12 technical presentations covering Parts 1 and 2, i.e., single and multiroom air flow pattern topics. These papers have already been planned by Annex 20; the abstracts are almost completed. The grouping of the Annex 20 papers will also encourage in depth discussion and optimum technical information transfer. A small committee, including the traveler, is working out the remaining details for the sessions which have been given special AIVC priority.

11th AIVC Conference, Ventilation System Performance, Belgirate, Italy (9/18-21/90)

Again relating this meeting to the goals of Annex 20, one important presentation was the Reporting Guidelines for the Measurement of Air Flows and Related Factors in Buildings. Due to appear as a November AIVC publication, this joint Annex 20/AIVC effort was presented in a demonstration session where detailed questions could be asked. The accompanying paper forms an introduction to the format and will be part of the conference proceedings. In addition to the principal report, there will also be a disk version of the reporting format using dBase IV. The disk version will aid the researcher in placing experimental data in the AIVC Numerical Database. Although not demonstrated at the AIVC Conference, but rather demonstrated at the Annex 20 meeting in Nice, database information such as Air Leakage of Buildings were shown to be easy to access, and are an integral part of the database. Pressure Coefficient data will be treated next, to be followed by Standards and Whole Building Leakage databases. These are ongoing tasks at the AIVC conducted by James Piggins.

The Traveler was chosen to summarize the technical progress and principal concerns discussed in 11th AIVC Conference. It was stated that ventilation system performance was ultimately judged by user satisfaction. Standards can play an important role. IAQ factors and energy use are often balanced against cost and complexity. Sensor and system servicing are critical. There are many environmental goals to achieve: temperature, humidity, noise and especially indoor air free from pollutants. To achieve these goals there is a chain: Researcher-Designer-Manufacturer-User. The main question is, "Are they communicating with each other?"

To reach the goals a variety of design approaches were presented: demand control, floor systems, work stations and task ventilation, displacement ventilation, etc. Although a guide to pinpoint system problems was discussed, "doing it right from the start" was the far better way. Some of our buildings in trouble have required years for solutions to be found.

Nationwide emphasis on mechanical ventilation, controlled by humidistats (France, new construction) points out benefits as well as how the user can misuse the system. Natural versus mechanical approaches to provide the required ventilation levels remains an active subject for discussion -- mechanically aided designs present yet another option.

Measurement methods remains a key topic of AIVC conferences. Mapping, using particles as a tracer, special anemometers, etc., was discussed. Very evident in the modelling efforts was the

rapid ascendancy of CFD methods. Validation is often the item in short supply. Main frame versus PC advocates were evident. Parameters such as age of air are being emphasized, rather than just air changes per hour. Ventilation effectiveness is another parameter placing the "real world factors" in perspective, but exact definitions have often proved illusive. Our experience in buildings is often limited and major challenges continue to exist!

Meeting with C-A. Roulet EPFL, Lausanne, Switzerland (9/24/90)

The Measurement Manual of Annex 20, Part 2, is being edited by C-A. Roulet at EPFL, Lausanne, Switzerland. The reason for the meeting is the U.S. commitment to this task. The traveler has coordinated the U.S. contributions and is currently working closely with C-A. Roulet and L. Vandaele, Belgium. The meeting involved the latest corrections sent to Roulet and Vandaele, final contributions needed from the U.S., and preparations for the Annex 20 meeting in Nice, France in early October.

Sixth IEA Annex 20 Experts Meeting, Nice, France, (10/9-12/90)

The Annex 20 Experts Meeting began with a plenum session with experts from Part 1 and 2 in attendance. Thirty-eight representatives from 12 countries were present. A second U.S. representative, J. Zhang, was introduced to the Annex participants and he reviewed the structure of the Bioenvironmental Engineering Research Laboratory at the University of Illinois and how the staff of 22 from 12 departments might address the goal of improved understanding of the single room air flows (Part 1).

Also emphasized in the plenary session were the interactions between this annex and related international activities. Prior to the annex meeting, H. Feustel led discussions for two and one half days involving the start of Annex 23, Multizone Air Flow. Twenty representatives from 10 countries discussed possible annex goals and possible country commitments.

Another topic involving commitment to the IEA, and Annex 20 activities, has been the status of France. This was clarified later in the meeting; the French Minister has signed and France is awaiting IEA Headquarters action. France has been a very active participant and not only was the host for this meeting but 11 experts attended the meeting.

Part 2: Following the plenum session, the experts met separately in the two task groups. Part 2 activities are concerned with multizone questions: Flow through large openings; single-sided ventilation; ventilation efficiency; occupant effects; air flow driven contaminants; measurement techniques related to air flow pattern within buildings; as well as databases and datasets. Each of the tasks is closely following the prescribed schedule. Remaining tasks should be completed by the end of 1990. Reporting tasks become paramount at that point. A series of reports, guidelines and conference papers constitute the methods of technology transfer. Many of these details have been outlined elsewhere in this report and need not be repeated here.

Part 1: Details of Part 1 activities were provided to all experts in the final plenum session. The goals of Part 1 involve: improvement of air flow models in single rooms; evaluation of model performance; conducting experiments under steady 3D conditions using identical test rooms (multi-country); evaluating applications of models as design tools; and developing guidelines for the use of air flow models. The BERL could supply important test data for case D, (room with convective flow resulting from a heat source). Funding from DOE will be sought to allow for the required test room changes (matching other countries) and testing costs.

Post Annex 20 Workshop: International cooperative efforts that would extend technical activities beyond Annex 20 were discussed in a 12-member workshop. This was the third expert meeting which was led by A. Moser, Operating Agent for Annex 20 (previous meetings were held in June in Oslo, and in September in Belgirate). Three related topics were highlighted: Air Flow in Large Enclosures; Air Flow Patterns Around Buildings; and Air Flow in Stack Systems. These topics were presented to all Annex 20 participants in the final plenum session; the traveler presenting topic 3. These outlines of possible future annex(es) will be presented to the IEA Executive Committee at their next meeting.

Technical Visit To CSTB (10/11/90): A technical visit to the French laboratory specializing in energy conservation and related subjects, allowed the experts to view several projects. The meeting host, R. Pelletret, introduced the topic areas. Five were software demonstrations, including simplified flow modelling, the AIVC database on component leakage, and a very interesting program with an intelligent front end and a large component library. It was easy to build a complex model with OOP, the object oriented program. Another set of software was designed for teaching building systems technicians whether or not they really understood the principles. Test cells used in Annex 20 measurements were also visited as well as a robot that was designed to perform building-related tasks.

Future Meetings of Annex 20: Only two meetings remain to complete the work of the annex. The 7th meeting will be held in Aachen, Germany April 9-12, 1991. The 8th and final meeting will be held in conjunction with the 12th AIVC Conference in Ottawa, Canada September 23-27, 1991.

Documents Received

- * List of Annex Documentation - Version of October 1990
- * Measurement Techniques Related to Air Flow Patterns Within Buildings - An Application Guide, Draft, October 1990
C-A. Roulet and L. Vandaele (Eds.)
- * Validation of Concordia Code, September 1990, Z. Jiang and F. Haghghat
- * Inhabitant Behavior - the Use of Intakes, September 1990,
L. Vandaele and J. Verheyden
- * Measurements in a Ghent Attic - Campaign September 1990,
October 1990, D. L'Heureux, J. Verheyden, L. Vandaele, and
P. Wouters
- * Assessment of Ventilation Efficiency in Multiroom Buildings,
October 1990, W. de Gids, H. Phaff, D. Bienfait

LIST OF PARTICIPANTS

**IEA-ECB ANNEX 20 SIXTH EXPERT MEETING :
AIR FLOW PATTERNS WITHIN BUILDINGS**

**Nice - Westminster Concorde Hotel
October 9-12, 1990**

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