The Wind Engineer

The Chronicle of the

American Society of Wind Engineers

March 1995

American Society of Wind Engineers

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NINTH INTERNATIONAL CONFERENCE ON WIND ENGINEERING A BIG SUCCESS

The Ninth International Conference on Wind Engineering was held in New Delhi, India on January 9-14, 1995. The conference drew more than 300 delegates from all over the world despite early rumors of the plague and other diseases in India. More than 260 papers were submitted by about 450 authors

representing 25 countries. Subjects covered a wide spectrum of themes related to wind engineering, including wind characteristics, extreme winds, bluff body aerodynamics, wind tunnel techniques and studies, field/proto-type measurements, computational fluid dynamics and fluid-structure interaction, bridges and cable structures, roofs and low-rise buildings, tall buildings, towers, chimneys and transmission lines, vibrations and dampers, atmospheric dispersion and particle drifting, wind breaks, wind power and waves, wind codes and design problems and disaster assessment and reduction.

Preprint Volume

A preprint volume of summary papers was published prior to the conference. Final papers were reviewed and those accepted were published in a four-volume set of Conference Proceedings. Papers included in the Proceedings were presented at the conference.

Selected papers presented at the conference will be published by Elsevier Science Publishers, Netherlands in a special volume of their Journal of Wind Engineering and Industrial Aerodynamics. Also, Wiley Eastern Ltd., New Delhi plans to bring out thematic volumes.

Professor Prem Krishna served as Conference Chairman, Gopal Ranjanwas Vice Chairman and P.N. Godbole performed as OrganizingSecretary. All three gentlemen are from the University of Roorkee.

For information on copies of the Preprint Volume, the Four-Volume Proceedings or subsequent publications, contact Prem Krishna at theUniversity of Roorkee.

IAWE

The International Association of Wind Engineering has been holding conferences every four years since 1963. The conference rotates among three geographical regions, Asia and Pacific, Europe and Africa and the Americas. The first conference was held in the U.K. in 1963 followed by conferences in Canada 1967, Japan 1971, U.K.1975, USA (Fort Collins, Colorado) 1979, Australia and New Zealand 1983, Germany 1987, Canada 1991, and the Ninth Conference in January1995 in New Delhi, India. The conference is a major event for those interested in wind engineering research The conference produces rich collection of the latest research information on the subject. Delegates are drawn from a large number of countries interested in wind engineering. The occasion provides a forum for the exchange of ideas and interaction among participants, enabling them to identify future directions of research.

10th IAWE Conference

The International Association of Wind Engineering voted to hold the 10th International Conference on Wind Engineering Research in Copenhagen, Denmark in 1999. The invitation was extended by the Danish Wind Engineering Society.

PROPOSAL FOR NWHRP

In a recent issue of the Journal of Professional Issues in Engineering Education and Practice, Vol. 121, No. 1, Jan. 1995, published by the American Society of Civil Engineers, WERC members N.P. Jones, D. A. Reed and J.E. Cermak proposed the establishment of a National Wind Hazard Reduction Program (NWHRP) similar in format to the National Earthquake Hazard Reduction Program (NEHRP) now in existence to support earthquake engineering research. The abstract of the paper is given below:

Recent events such as Hurricanes Andrew and Iniki have shown that wind related disasters occur in the United States with consequences much more far-reaching and severe than expected. During this International Decade for Natural Disaster Mitigation (1991-2000), the U.S. wind engineering community is calling for the establishment of a wind hazards reduction program analogous in function to the National Earthquake Hazards Reduction Program. This proposed wind hazards program would provide badly needed leadership in improving codes of practice, in providing advanced methods for evaluating and predicting wind loadings, and in providing an impetus to structural engineers to develop new technologies for improving structural performance. In the paper, the need for such a program is discussed, and its organization and goals outlined.

The challenge to WERC members is how to implement this proposal.

PRESIDENTS MESSAGE

Greetings from Notre Dame. I am very pleased to have been given the opportunity to serve the wind engineering community. I plan to leave nothing short of excellence in my efforts to promote the mission of the Wind Engineering Research Council (WERC). In this regard, I seek your help through your input, comments, advice and willingness to volunteer time to WERC. I can be reached at (219) 231-6648 and through INTERNET at kareem@navier.ce.nd.edu.

Before I present some of my thoughts to you, I wish to express my sincere gratitude to my predecessors, Drs. J.E. Cermak, K.C. Mehta and D.C. Perry, who contributed their valuable time to guide WERC through its infancy to the present.

Some of the recent accomplishments are worth noting, e.g. presentation of WERC's point of view to the national television media and print media in the aftermath of Hurricane Andrew, a quick response report of winds and associated damage in South Florida, and most importantly, the efforts to get a bill through the U.S. House of Representatives and Senate for wind hazard mitigation. I would like to express the appreciation of the WERC membership to those who volunteered their valuable time to undertake these efforts. The WERC Board of Directors will be assisted by three committees dealing with Post Disaster Investigations, Codes and Specifications, and Congressional Affairs. We may expand by installing ad hoc committees as the need arises. We will be having a strategic planning retreat early next year to plan for the near future and for the long term. Besides issues concerning research funds, we need to address the needs of practicing engineers and industry, e.g. technology transfer and code related matters.

One of the issues in which I need your immediate input concerns the plans to change the name of the

Wind Engineering Research Council to the American Association of Wind Engineers (AAWE). I have been approached by several members who have expressed the need to make this change as the research council name does not convey the mission of the group and gives the impression that it is a council that deals only with research related matters. As practitioners make up a good part of our membership, including several corporate members, we would like to address their specific concerns as well. The name change will be a new beginning to serve the interests of both the researchers and practitioners. I look forward to your input so that we can legally initiate the proceedings necessary for the proposed change. I am also looking for a logo for the new association. Please send us your input as we would very much appreciate benefitting from the artistic talents of WERC members.

We need to initiate a drive to recruit new members and to bring back the ones we have lost. In order to succeed in this campaign, we need to make our prospective members aware of what WERC has done for membership lately and with their help what we may be able to achieve in the future. The WERC has brought visibility to the wind engineering community via the national media in the aftermath of Hurricanes Andrew and Iniki. We need to continue to inform consumers about the need for better infrastructure that can resist the effects of natural hazards more efficiently and economically. A multi-hazard approach towards addressing this concern is found to be more effective and I have begun a dialogue with the Earthquake Engineering Research Institute (EERI) to reach a memorandum of understanding for cooperation between the two hazards communities.

We plan to play a major role in promoting the need to encourage quality and excellence in engineering. This can be accomplished by enhancing efforts in providing our input to owners, designers, builders, contractors, developers, legal and insurance groups. We should emphasize improved design practice through implementation of the latest findings in wind engineering research. We must highlight the advantages of damage mitigation measures, their cost benefit analysis as well as their impact on sustainable development. We must offer our membership opportunities for educational and professional development. We plan to expand our current publication, the Wind Engineer, to include features such as Recent Research Developments, Engineers Column, and Membership News. Further, we will evaluate the merits of starting a wind engineering journal to address wind hazard-related issues of research, design, codes and economic impact. One of our key objectives will be to influence legislation concerning wind hazard mitigation. We have had initial success in receiving favorable responses to our proposal in both the House and Senate, but because of unrelated circumstances the parent bill did not receive the final approval during the last legislative session. We need to begin our work in this regard immediately to secure the passage of a wind hazard mitigation program to ensure the safety of the built environment under adverse wind conditions and to prevent the attendant human and economic sufferings.

I am pleased to inform the membership that we have a global interest in our organization. Recently, we welcomed new Japanese members and many others have shown an interest in joining. In other news of interest to the membership, early this year a new global group, the International Wind Engineering Forum (IWEF) was formed in Japan. This group will foster the transfer of technology between different countries. Specifically, there is a wealth of research available from Japan, but to this point language has been a barrier. The IWEF plans to translate this literature to make it available in English.

The WERC has close ties with the group as the IWEF Co-Chairman and two members of the Advisory Board are WERC members. Two of these gentlemen presently serve on the board of Directors of WERC. We will have more details in our next issue.

I am also pleased to extend Dr. Robert H. Scanlan a very happy 80th birthday from the WERC membership. In closing, I again seek your cooperation in providing a helping hand to make this organization a success and would like to welcome back those members who for some reason have lost interest in the organization. We very much want you back because working together we can make a difference.

THE 1994 HURRICANE SEASON

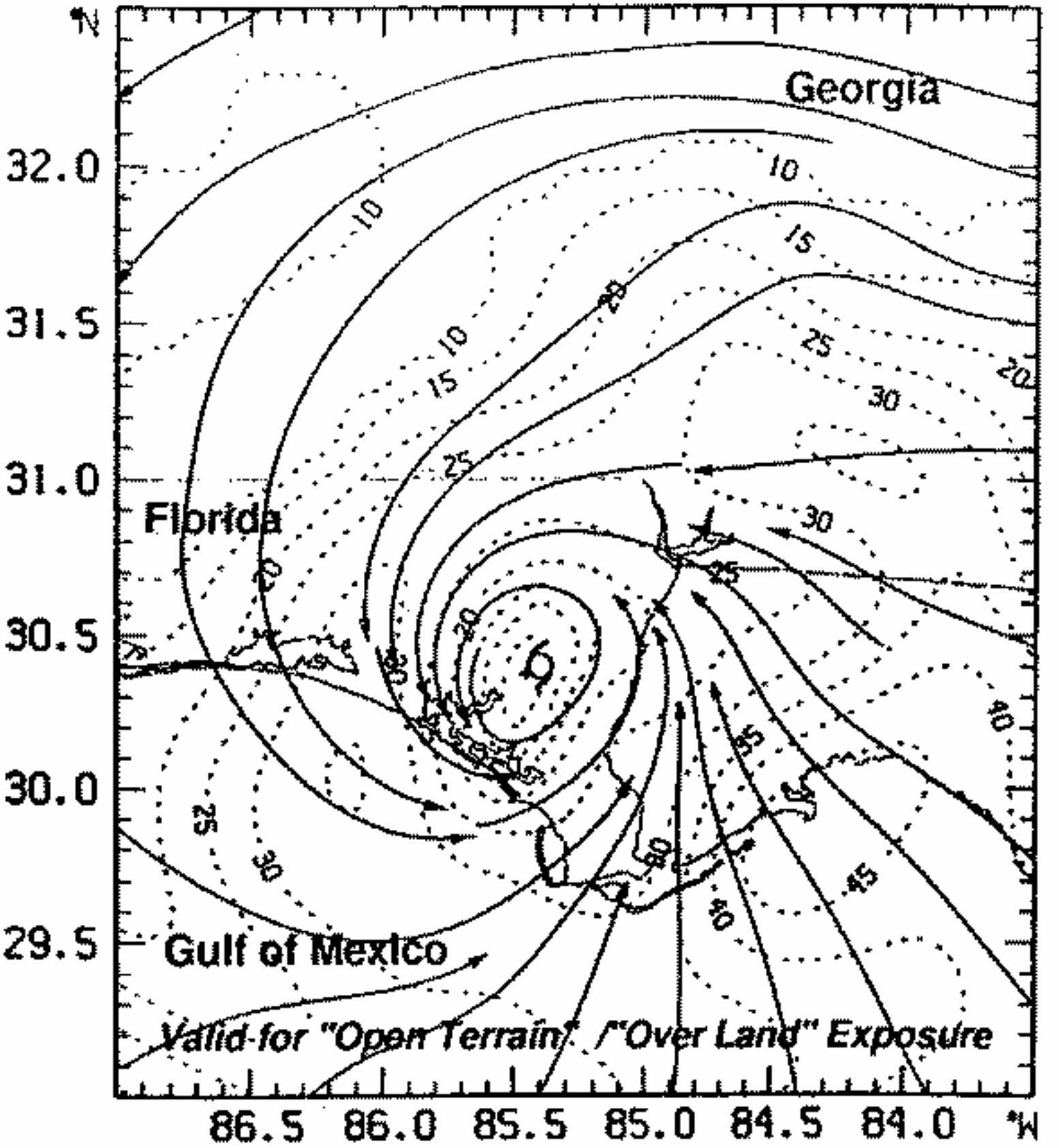
by Mark Powell

The hurricane season of 1994 was very inactive at first but ended with a very active November. There were seven named storms, three of which became hurricanes. On average there are 10 named storms with six becoming hurricanes. There were no storms in October but two hurricanes in November. the named Atlantic storms were:

- Alberto.....Tropical Storm
- Beryl..... Tropical Storm
- Chris..... Hurricane
- Debby..... Tropical Storm
- Ernesto.....Tropical Storm
- Florence.....Hurricane
- Gordon.....Hurricane

Alberto, Beryl and an unnamed gale struck the Florida Panhandle region causing limited wind damage and substantial storm surge in some locations. Alberto was the years most disastrous system in the US., claiming 30 lives in storm-related flooding and half a billion dollars worth of damage. Beryl visited some of the same area affected by Alberto and caused $73 million in damage due to flooding and coastal erosion.

Analysis of data collected in Tropical Storm Beryl by Air Force reconnaissance and Marine and land based platforms produced real time plats of wind streamlines and isotachs. These are shown in the figure below.



Chris was briefly a hurricane in the Atlantic but quickly weakened. Debby fizzled in the Caribbean and Ernesto meandered in the far eastern Atlantic for several days. Florence was the seasons strongest storm

with maximum one-minute sustained winds estimated at 110 mph, but moved into the North Atlantic well east of Bermuda during the first week of November. Gordon was the last storm of the season and persisted from November 8-21. It produced mud slides and flooding that claimed an estimated 2000 lives in Haiti. In Florida, Gordon produced 8-12 inch rains, winds gusting over 58 mph for three days, flooding, and storm-spawned tornadoes that contributed to seven deaths along with over $175 million in damages (mostly to agriculture). Gordon briefly threatened the Carolina outer banks as a hurricane before turning south so it could revisit Florida as a depression a couple of days later.

The main features responsible for the weak Atlantic season were the high sea level pressure in the Caribbean basin, strong easterly winds in the stratosphere over the tropics, a strong upper level westerly wind flow which became established over the tropics in September, and the influence of a new El Nino event which appears to be forming in the Pacific Ocean. Strong upper level wind, or wind shear, inhibit development by preventing thunderstorm heating from becoming concentrated enough to help the surface pressure to decrease hydrostatically. The El Nino climatic signal may also be associated with these upper level winds.

Many of you may be asking: "How did Bill Gray (Atmospheric Science Professor and long range prognosticator from Colorado State University) do in his long term forecast of hurricane activity for 1994?"

STATUS OF BILL GRAY'S ATLANTIC SEASONAL HURRICANE FORECAST (Issued June 7, 1994)

Activity..... Predicted.....Actual

Named Storms .....9..... 7

Named Storm Days..... 35.....28

Hurricanes.....5..... 3

Hurricane Days.....15..... 7

Major Hurricanes (Category 3-4-5)..1..... 0

Major Hurricane Days.....1..... 0

Here is a portion of Bill's response:

"September 1994 goes into the record as just about the most inactive September on record. Only 1925 and 1890 were as low. There were no hurricanes this September and only one weak tropical storm (Debbie) that lasted for little more than a day. Maximum estimated wind speed in Debbie was only 52 mph. Tropical Storm Ernesto occurred in the far eastern Atlantic in September. even the most inactive hurricane

season on record (1914) had more named storm days in September.

The five station Caribbean Basin sea level pressure anomaly (SLPA), which we have been monitoring, was a plus 1.2 mb--the highest September value in our records back to the late 1940s. These surface pressures show good statistical relationship to hurricane activity. I consider this a primary factor in the lack of Tropical Cyclone activity in September. Other important factors are the strongly easterly phase of the QBO and the strong low latitude 200 mb westerly winds which became established the second half of the month. These westerly winds are related to SLPA. Statistically they go together."

Bill Gray also noted that in the only other year that the World Series was canceled (1904) Atlantic storm activity was very low (only two hurricanes and a total of but five named storms)-- He says, "Cancel the Series and the Storms will Go!"

DIGITAL INFORMATION OPPORTUNITIES FOR WIND ENGINEERING

by

Michael P. Gaus

State University of New York at Buffalo

The Wind Engineering community has a golden opportunity to benefit from the rapidly growing array of digital information resources which have become available during the last couple of years. From humble beginnings of E-mail and news groups and elementary file transfer a powerful set of resources including anonymous ftp, GOPHER servers and html (MOSAIC, NETSCAPE, etc.) home pages operating on the World Wide Web are now making available in real time a wide variety of textual information, computer programs, data resources, graphics and multi-media programs. The integrating factor in this rapid development has been the growth of the INTERNET.The INTERNET had its origins in specialized networks originally intended to link military computers at diverse locations but it was soon realized that the technologies involved provided the basis for the development of information highways which could extend around the world. With governments support the information networks underwent rapid development and evolved into what is now the INTERNET. The bulk of the original users were universities and government organizations but there is a rapid expansion of users and suppliers of information and it is now fairly easy for any interested user to gain access to the INTERNET. Previously all users of the INTERNET have been non-commercial and non-profit but because of the speed and efficiency of the system some commercial uses of the system are starting to appear.

The availability of a variety of on-line resources is an interesting phenomenon but without some sort of organization the usefulness of the system would rapidly become marginal. It would be like throwing thing in your attic without much thought. Pretty soon you attic would be stuffed full of old treasures but it would become increasingly difficult to locate any of them in any reasonable amount to time. INTERNET resources could become like an old attic except that a huge amount of effort has been devoted to the problems of indexing and to provide a search capability to rapidly locate the resources desired. This

indexing and search capability are an integral feature of most of the INTERNET programs which are on-line.

Digital information services in the Natural Hazards area have been offered for the past two years through Information Service of the National Center for Earthquake Engineering and the Department of Civil Engineering at the State University of New York at Buffalo. Links are provided through the NCEER and CIE servers to access other information services around the world and to carry out high-level searches.

Although the initial emphasis in developing the system was on earthquake engineering, wind engineering information is being added and is dependent upon the wind engineering community providing resource material to be included in the system. Items which might be of interest include information on forthcoming meetings, information on wind codes and where to obtain them, information on WERC including membership directory, committees, organization and purposes, publications, sample wind records for illustration and teaching, computer programs for wind analysis, insurance information, damage reports, pictures of typical wind damage, design method s and connectors which can reduce wind vulnerability, retrofit measures for existing construction, government programs in the wind area, the research support picture in wind engineering, lists of on-going research projects and a large variety of other information which can be presented in digital form.

The QUAKELINE data base which includes a large amount of wind engineering information is also available for on-line searching through NCEER-CIE at no cost.

Some of the resources available on the INTERNET from NCEER-CIE are briefly described below:

Anonymous ftp

This is the most basic of the on-line services and only requires a basic INTERNET connection with a ftp capability. The remote computer which is to be accessed contains a special ftp program which permits a user to sign on to the computer as a local user using the login name "anonymous" and the users E-mail address as a password. Once logged-in the user can change directories, display the directory and file lists and download files to his own computer using the "get" command. It is not possible to view files before downloadinng but some limited information is furnished through "README" files which are automatically displayed. The NCEER-CIE computer can be accessed using :

ftp

nceer.eng.buffalo.edu

After signing on change directories to the "pub" directory and follow the tree structure to locate the computer programs or information desired.

GOPHER

GOPHER is a set of programs for storing and retrieving digital information with a relatively user-friendly interface for interacting with the information resources. The GOPHER server runs on the host computer and responds to requests from "client." GOPHER software which is mounted on your local computer. Client software is available free for UNIX, PC, and Mac systems. (ftp to boombox.micro.umn.edu) The "vanilla" server will connect to virtually all computer systems, either directly connected or through modems. Windows versions of the client software are much more user friendly but require Windows on a direct INTERNET connected computer or Windows and SLIP or PPP software for computers not directly on the INTERNET and connected through a modem to a service providing an interface or to a commercial service provider.

With GOPHER it is possible to view text files directly to decide whether you wish to download. Graphics files can also be viewed but require that viewer software be loaded on you local computer.

Archie and Veronica searching are available through GOPHER. The GOPHER system provides access to both ftp sites and to information which is directly on GOPHER servers. The NCEER-CIE GOPHER can be accessed using:

gopher

nceer.eng.buffalo.edu

or

xgopher

nceer.eng.buffalo.edu

if you have windows software.

MOSAIC AND WORLD WIDE WEB

MOSAIC is a series of programs originally developed at the University of Illinois and which provides a graphics intensive interface with resources on the INTERNET. There are now many other versions of the client browser program available the most popular of which is Netscape. Basic versions of the programs are available free although there are a number of commercial versions of these programs, such as NETSCAPE, CELLO, etc. appearing which offer added features, connectivity and user friendliness. MOSAIC provides "homepages" on a host system which can be accessed from other computers through the INTERNET. The homepages may provide some information directly but the power of the system is the use of hyperlinks and search capabilities which provide quick access to resources on the WORLD WIDE WEB. and which make it possible to easily move between home pages. The WWW has been designed to provide a standardized methodology for searching and accessing resources on the INTERNET. MOSAIC requires the use of a windows system. UNIX versions of client software are

available for systems such as X-windows, Motif and Open Windows.PC and Mac windows versions are available for direct connection to INTERNET through a Socket interface written for a particular computer and windows system.

Modem connection is possible using SLIPP software but baud rates must be 9600 or greater for satisfactory response time, however most commercial services offer this speed or higher. The NCEER-CIE MOSAIC home page is accessible using the Uniform Resource Locator (URL)

http://nceer.eng.buffalo.edu/

Each level of service accesses those below.

Access to digital information resources is very easy for persons at universities or research organizations which have direct connections to INTERNET. Persons in design offices or other locations which may not have a direct INTERNET connection can still easily tap into the digital resources using commercial services which provide access at relatively reasonable rates. A sampling of some commercial services providing INTERNET access are:

DELPHI INTERNET 1-800-365-4636

PSI InterRamp 1-800-774-3031

InterCon 1-800-INTERCON

Alternet 1-800-258-9691

CICNet 1-800-947-4754

Netcom 1-800-353-6600

PRODIGY Service 1-800-PRODIGY, ext. 513

If there is further interest in digital information opportunities additional details can be provided in future issues of the Wind Engineer. For additional information on current NCEER-CIE digital information services or to contribute information for the system or to establish links between other wind engineering ftp's, GOPHERS or home pages, contact:

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Buffalo, NY 14260-4300

(716) 645-2114, Ext. 2410 or
gaus@clark.eng.buffalo.edu

STATE OF THE ART IN WIND ENGINEERING

A state of the art volume was introduced at the 9th Conference on Wind Engineering Research in New Delhi. The State of the Art in Wind Engineering Volume was published in commemoration of them sixtieth birthday of Professor Alan G. Davenport by the International Association for Wind Engineering. The 417-page book brings together articles from leading experts of wind engineering covering the latest information in a field whose development during the last three decades is closely related to the name Alan G. Davenport.

Contributors include J.E. Cermak, on development of wind tunnels for physical modeling, measurements of fluctuating pressures by J.D. Holmes, applications of CFD to bluff body aerodynamics by S. Murakami, estimation of extreme winds by E. Simiu, wind loads on low-rise buildings by T. Stathopoulos, and wind induced response of chimneys by B.J. Vickery. Dr. R.H. Scanlan reviews some key developments in aeroelasticity of long-span bridges, buffeting is discussed by H.F. Xiang, H.J. Niemann and R. Hoffer. J.R. McDonald addresses wind damage studies and H.J. Gerhardt and C. Kramer treat small scale modelling of combined wind and buoyancy effects. The book is published by Wiley Eastern Limited, New Delhi, India.

Dr. Alan Davenport

Dr. Davenport joined the faculty of the University of Western Ontario in 1961. There he began a series of field based experiments on how air turbulence was translated into forces that act on man-made structures of various shapes and sizes. His first major building design project (for wind effects) was the twin towers of the World Trade Center in New York City. The Boundary Layer Wind Tunnel at the University of Western Ontario was designed by Dr. Davenport and was constructed and commissioned in 1965. Early projects carried out included the Sears Tower in Chicago and somewhat later the CN Tower in Toronto. In the 1970s more tall buildings were erected throughout the world than in any other decade. It is estimated that a staggering two-thirds of them were analyzed and tested at the University of Western Ontario BLWT.

Not only has Dr. Davenport contributed to technical knowledge, but has lent the benefit of his knowledge and experience in encouraging wind engineering development whenever sought. Ever since the United Nations conceived the idea of the current decade as an International Decade of Natural disaster Reduction, Professor Davenport has been a champion of its activities, particularly as related to wind disaster reduction.

MULTIHAZARD ASSESSMENT FORUM

At the invitation of the building seismic safety council and under the sponsorship of FEMA, fifty national experts in seismic, wind, flood and fire hazards met in Denver in June 1994 to assess common ground in the formulation of a national multihazards mitigation strategy. following briefings on the status of hazard

mitigation efforts in each area, the conferees set about the task of structuring a national hazards mitigation program that would take advantage of common technical aspects of the "big four" hazards while remaining sensitive to the economic, social and political characteristics of each.

Programs based on the four "hazards" (seismic, wind, flood and fire) and on four "user groups" (owner/ engineer/architect; jurisdictions/enforcement; research/technology; and insurers/lenders) were developed by two sets of four working groups. The conferees attempted to integrate these programs into an overall plan that will provide FEMA and other elements of the Federal Government with directions that should be taken to constituencies involved in mitigation of risks associated with the different natural hazards. Further, the plan should bring about the most effective and efficient approaches to MULTIHAZARD mitigation while giving serious consideration to the social, political and economical consequences of proposed technical solutions.

A report on the forum is being prepared by the National Seismic Safety Council for review by FEMA as part of FEMA's newly assigned responsibility for developing a national natural hazards mitigation strategy. Reports will be available from the Building Seismic Safety Council, 1201 l Street, Washington, D 20005.

Dr. Joseph E. Minor presented the current status of hazard mitigation efforts in the wind area to the forum. He observed that there is very little difference between the views of the seismic and wind engineering communities regarding the nature of the damage mitigation problem and its solution. Both seismic and wind engineers observed that over two thirds of all buildings are "non-engineered" and, as such, do not reflect the influence of the architect or engineer in the design for lateral loads. Further, seismic and wind engineers agree that we need to examine methods for applying what we already know and to emphasize implementation and education rather than place emphasis on addressing new design considerations.

ANNOUNCEMENTS, MEETINGS AND CONFERENCES:

Third International Colloquium on Bluff Body Aerodynamics & Applications BBAA III Blacksburg, Virginia, USA July 28-August 1, 1996 Contact:

Dr. M.R. Hajj, Organizing Secretary
ESM Department, Virginia Tech
Blacksburg, Virginia24061-0219
Tel (703) 231-4190, Fax: (703) 231-4574
E-Mail: hajj@vtvm1.cc.edu

Fifth Natural Phenomena Hazards Mitigation Conference

U.S. Department of Energy

Arlington, Texas

October 2-6, 1995

Contact:

Robert c. Murray
Lawrence Livermore National Laboratory
P.O. Box 808, L-193
Livermore, CA 94551
Tel (510) 423-0308
Fax (510) 423-2163

Symposium on Natural Hazard Phenomena and Mitigation

1995 ASME/JSME Pressure Vessel and Piping Conference

Hilton Hawaiian Village, Honolulu, Hawaii

July 23-27, 1995

Contact:

Dr. Robert C. Murray
Lawrence Livermore National Laboratory
P.O. Box 808 L-193
Livermore, CA 94550
Tel. (510) 423-0308
Fax (510) 423-2163

Hurricanes and Industry 1995

HESS

3121 Buffalo Speedway

Houston, TX

Contact:

Weather Research Center
3227 Audley
Houston, TX 77098
Tel (713) 529-3076
Fax (713) 528-3538

17th Annual National Hurricane Conference

Trump Taj Mahal Hotel

Atlantic City, New Jersery

April 11-14, 1995

Contact:

NHC
864 East Park Avenue
Tallahassee, Florida 32301
Tel (904) 561-1163
Fax (904) 561-1172

CSU Wind Tunnel Available to Scientists from other Institutions

The Fluid Dynamics and Diffusion Laboratory (FDDL) at Colorado State University offers the use of its extensive boundary-layer wind tunnel facilities to academic, government and industrial researchers for projects which require meteorological wind tunnels. Resources include the thermally stratified Meteorological Wind Tunnel, FID gas concentration sampling equipment , hot-film anemometry, force balances, visualization apparatus and data acquisition systems. We have unused capacity which could be devoted to projects run and directed by scientists from other institutions. Such investigators would be welcome to carry out their own investigations, paying for only the facility and instrumentation charges, technician time and associated overhead costs. Colorado State faculty need not be involved, although, we would be prepared to assist and advise if requested. In this manner, staff at institutions without large boundary-layer wind tunnels could have access to such facilities without incurring the costs of building their own. Interested parties should contact Dr. Robert Meroney, Director, Civil Engineering, Colorado State University, Fort Collins, CO 85023-1372. Phone (303) 491-8574, FAX (303) 491-8671, e-Mail meroney@lance.colostate.edu.

UCD Constructs New Wind Tunnel

The Mechanical Engineering Department at the University of California, Davis, recently completed

construction of a new boundary layer wind tunnel. According to Professor Bruce R. White, "The tunnel was constructed to study the diffusion of gases in the atmosphere and to develop instrumentation systems for studying air flow at low velocities."

The tunnel is an open-return type with the fan blades pulling air through the tunnel. Research has concentrated on dispersion of heavier than air gases in the atmospheric boundary layer and measurements of turbulent flow at low Reynolds numbers.

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