



American Association
for Wind Engineering

THE WIND ENGINEER

NEWSLETTER OF AMERICAN ASSOCIATION FOR WIND ENGINEERING

Bogusz (Bo) Bienkiewicz, Editor

November 2002



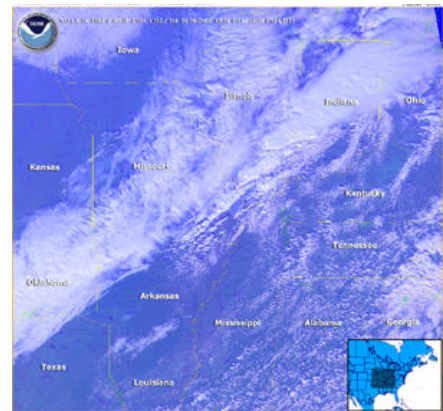
The Original "Twister" Group
(see story on p. 4)

Severe U.S. Weather of October and November 2002 (from NOAA News Online)

A widespread tornado outbreak claimed more than 30 lives in five states over the November 9-11, 2002, period. An estimated 88 tornadoes ripped through Arkansas, Tennessee, Alabama, Mississippi, Georgia, Ohio and Pennsylvania. Most of the deaths occurred in Tennessee, where at least 16 people were killed. Eleven people died in Alabama, five in Ohio and one each in Pennsylvania and Mississippi. Approximately 200 people were injured.

Hurricane Lili came onshore along the southern Louisiana coast, on Thursday, October 3, 2002. State-of-the-art equipment, including mobile Doppler radars, instrumented towers, were placed at various locations to study the structure of wind flow and the rainfall. was October. One of the Doppler radars was operated by researchers from Texas Tech University. This effort was coordinated by Tim

Doggett. The other two radars were the University of Oklahoma's Dopplers on wheels, operated by Josh Wurman. For the first time, the three radars were deployed to collect data simultaneously. They tracked the center of Hurricane Lili for about six hours as she moved inland, recording wind speed and direction and estimating rainfall amounts in an approximately 100-square-mile area.



Line of Severe Storms on Nov. 10, 2002

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Ahsan Kareem Receives the Jack E. Cermak Medal

Dr. A. Kareem, Prof. at Notre Dame University and Past President of AAWWE is the first recipient of the Jack E. Cermak Medal. This award was established by the Engineering Mechanics Division and Structural Engineering Institute of ASCE to recognize lifetime achievements in the field of wind engineering and industrial aerodynamics. This is a well deserved recognition of Dr. Kareem's contributions to research and practice in these areas. The award recognition ceremony took place in early November, during the 2002 ASCE Civil Engineering Conference & Exposition, in Washington, D.C. During the year following receipt of the medal, Dr. Kareem will be invited to deliver the Jack E. Cermak Lecture at one of the ASCE National Meetings, Congresses or Conventions.

Measurement of Ground Level Hurricane Winds

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Project Overview

Several universities in the U.S. have established programs to collect high fidelity hurricane wind field information near ground level to provide baseline information for improving the resistance of structures to severe winds. Clemson University has developed a unique approach to measure both the wind pressures in the envelope of residential structures, and the turbulent wind field near these structures. The University of Florida joined the Clemson research team in 1999, and together the CU/UF teams have collected data from nine storms over the 1998 through 2002 seasons. The two key components of the research are a set of portable towers to collect wind velocity information at five and ten-meter elevations, and individual homes along the Florida coastline instrumented to collect wind pressure data over the roof surface. Currently the project has four portable towers and 25 houses. The Florida

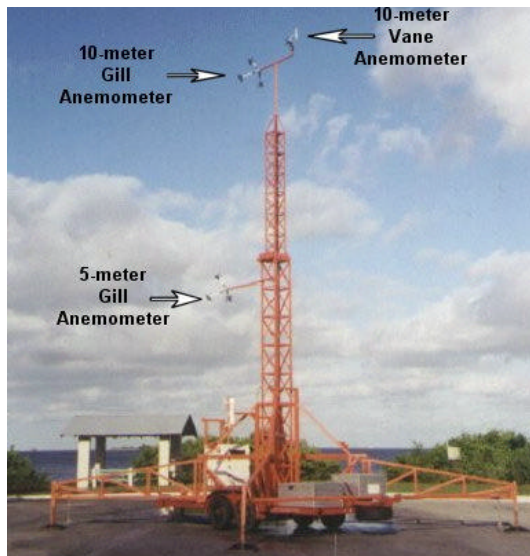


Fig. 1. Mobile Tower Deployed for Hurricane Gordon

Department of Community Affairs (FDCA) sponsors the research known as the Florida Coastal Monitoring Program (FCMP), and additional hardware and program development funding has been provided through South Carolina Sea Grant, Florida Sea Grant, and INEEL.

Portable Towers

Each of the four 10-meter mobile towers is constructed of two steel lattice-work sections that are hinged together and collapsed upon a 20-foot steel frame trailer. An onboard winch is used to erect the tower when assembled, and outriggers are folded out from the sides of the trailer to provide stability in up to 200 m.p.h. winds. One tower can be deployed by a crew of two people in 30-minutes on either pavement or earth. Each tower is instrumented with fixed anemometer arrays capable of measuring vertical, across-wind and along-wind velocity at both the 5 and 10-meter levels. A vane anemometer is located at 10 meters for redundancy. Each tower is also instrumented to measure barometric pressure, temperature, relative humidity and rainfall. All data is stored on two hard disks in an onboard computer. The units are operated at a sampling rate of 100 Hz, and write files in 15-minute increments. Each tower is outfitted with a gas generator and batteries to provide power to the data collection system for up to twenty-four hours. The mobility of the towers allows deployment anywhere along the Gulf or Atlantic coasts where storms threaten landfall. The deployment of multiple towers offers the possibility of evaluating the changes in wind conditions for different exposures as the storm progresses inland. Figures 1 and 2 show one tower after deployment for hurricane Gordon, and collapsed for transportation, respectively.

Instrumented Houses

There are a total of twenty-five homes participating in the FCMP. Ten are located in the Florida panhandle, and another fifteen are located on the east coast of Florida from Melbourne to Homestead, all within one mile of the coast. The homeowners are provided with storm resistant retrofits such as reinforced garage doors, hurricane shutters, gable end bracing, etc., as incentive for participation. The specific retrofits are tailored to the individual houses as deter-



Fig. 2. Mobile Tower Collapsed for Travel before Deployment for Gordon

mined by a risk analysis provided by Applied Research Associates in Raleigh, NC.

Each house is outfitted with wiring and brackets to receive up to 28 pressure sensors on the roof. The roof pressure measurement system has a dynamic range of -375 to 25 psf (± 3.0 psf) with respect to absolute pressure. For measurement, the transducers connect to a pre-wired end connector with a base mounting on 10 through 30 - degree gabled roofs along the ridges and edges. The hardwired output from the transducers are then collected on an on-site personal computer housed in a weather resistant metal box. In addition to the pressure sensors, a weather station is mounted on the roof to collect local wind velocity data, and a camera is placed in the yard of the house and wired to a time-lapse VCR set up in the weather resistant box to capture the occurrence and accumulation of damage. Figure 3 shows a house being instrumented for hurricane Floyd in 1999. Figure 4 shows a close-up of the wire housing from the sensors to the disconnect box. A UPS battery system is contained within the weather resistant box to allow additional data collection after the power to the house fails.

Deployment Plan

The deployment of the towers and home instrumentation takes place within days of a hurricane with a high probability of landfall. The pressure instrumentation is installed on the homes within the potential strike zone, two anemometer towers are deployed in optimal locations to measure eye wall wind velocity, and two are deployed to gather wind field informa-



Fig. 3. Jupiter, FL House Being Outfitted with Sensors to Measure Hurricane Floyd in 1999

tion in the vicinity of the instrumented homes. This simultaneous measurement of wind velocity and pressure fills a significant void in the current extreme wind databases, namely a comprehensive real time display of the wind speed - wind load - accumulated damage chain at low elevations typical of residential housing and human exposure.



Fig. 4. Sensor Wiring and Outlets

Current FCMP Database

The tower and house data collection systems operate independently. The towers have been deployed for nine storms since 1998 in locations ranging from Wilmington NC to the Florida Keys. Tropical storm and hurricane force wind data sets have been collected for Georges (1998), Dennis, Floyd and Irene (1999), Gordon (2000), Gabrielle and Michelle (2001), and Isidore and Lili (2002). The house instrumentation was deployed for Floyd, Michelle, and Isidore.

Additions to the Current Program

Several efforts currently underway will expand the capabilities of the FCMP. Five-meter towers now in development will travel with and be deployed around the ten-meter towers. This simultaneous measurement at multiple horizontally separated locations will provide the data necessary to determine lateral gust size. The 2003 season will also see the addition of real-time access to the data every fifteen minutes via wireless communication. A web site currently under development will include a detailed program description, downloadable data files and free software to analyze the data sets. The launch date will be announced in an upcoming newsletter.

Early Tornado Chasing and the Original "Twister" Group

*Based on information provided by J. H. Golden
NOAA Forecast Systems Laboratory, Boulder, CO*

The first tornado chasing took place in 1972. A tornado field project, based at the National Severe Storms Laboratory, was conducted from 15 April through 10 June, 1972. The purpose of this project was threefold: 1) to provide a field test of capability to bring scientists within visual range of tornadoes by use of a radio-equipped vehicle on Oklahoma roads, guided partly by information from well-trained radar meteorologist who had real time access to NSSL's contoured radar display; 2) to conduct preliminary field tests of navigational techniques and equipment, for approaching to a near (but safe) distance from tornadoes, after they are sighted from the vehicle; 3) to obtain, if possible, high quality still and motion pictures of tornado vortices and their attendant parent cloud structures, for the purpose of better determining the magnitude of the wind within them. The first two objectives were successfully accomplished, but the third was only partially accomplished, due to the vagaries of Mother Nature. The vehicle used was a 12-passenger Dodge Sportsman Wagon, fitted with a radio telephone. Meteorology students from the University of Oklahoma participated in the project on a voluntary basis.

On days when the National Severe Storms Fore-

cast Center or the developing local weather conditions indicated severe weather for Oklahoma, the NSSL vehicle and student cars would move in early afternoon into the area most likely to experience an outbreak of severe weather.

During April - June, 1972, the NSSL vehicle ventured 18 times and the crew was able to track 14 storm cell. Five of these cells were severe and contained large rotating storm systems. Two produced tornadoes, one produced a funnel aloft. These events were documented by still, time lapse and motion picture photography.

From a 30-year perspective (of 2002) the significance of the above project cannot be overstated. It initiated a new era in field investigations of severe weather phenomena and provided invaluable knowledge and experience fully utilized by today's tornado and hurricane chasers. Contributions of this community to improve protection of human life and reduce material damage caused by severe weather have been well recognized by researchers, emergency officials and society in general. The spirit and unique character of individuals involved in this effort captured imagination of writers and artists, and film making community. Indeed, the screenplay of movie "Twister" was inspired by imagination, spirit and courage of the members of the original "twister" group.

(Ref.: J.H. Golden & B.J. Morgan, "The NSSL-Notre Dame Tornado Intercept Program, Spring 1972", Bulletin of AMS, Vol. 53, No. 12, Dec. 1972, pp. 1178-1180)



*The Original "Twister" Group (Courtesy:
Dr. J. H. Golden - rightmost)*

Tacoma Narrows Bridge Project – New Suspension Bridge (Parallel and Adjacent to Existing Bridge)

*Based on information provided by T. M. Moore
Washington State DOT*

Owner: Washington State Department of Transportation; **Design-Builder:** Tacoma Narrows Constructors (TNC), a Bechtel and Kiewit Pacific joint venture; **Toll System Supply and Installer:** Transcore, Inc.; **WSDOT Project Website:** <http://www.wsdot.wa.gov/projects/sr16narrowsbridge/>; **WSDOT Project Office:** 1-877-7Narrows (877) 762-7769, (253) 534-4640

Project Details

The new State Route 16 (SR 16) Tacoma Narrows Bridge – the first long-span suspension bridge to be built in the United States since 1964 – will be 5,413 feet long, with a 2,800-foot main span and approximately 510-foot-tall towers, three traffic lanes, shoulders on both sides, and a separated bicycle/pedestrian path. The new bridge will carry eastbound traffic. The configuration will match and run parallel to westbound traffic and allow for standard-width traffic lanes (12-feet wide). The design will also allow for a future second deck. Other construction will include a toll plaza, access lanes, and a new interchange on the west shore. An additional high occupancy vehicle traffic lane will be constructed in each direction between the nearest interchanges on each side. Portions of the existing bridge will be structurally upgraded and reconfigured to three full-size lanes for westbound traffic. The existing bridge deck will be modified to remove surface grates.

Tacoma Narrows Constructors, a joint venture of Bechtel and Kiewit Pacific, is responsible for carrying out the bridge design and construction project. This fully integrated team of international and local suspension bridge specialists and experts is providing engineering management, procurement, and construction under a design-build, fixed-price, and lump-sum contract with WSDOT. The project notice to proceed was provided to the design-builder in September 2002. The project is scheduled to be completed in early 2008.

TransCore, the toll system and installation com-

pany, is a leader in providing transaction-based systems and services for mobile payment such as toll collection systems. TransCore is also a leader in the field of intelligent transportation systems (ITS) and provides traffic management systems and services throughout the world.

A \$3.00 toll will be charged on the eastbound (new) bridge only beginning when the new bridge is completed and opened to traffic sometime in 2007. Toll increases are initially estimated to rise \$1.00 approximately every 4 years until reaching \$6.00 in 2016 through 2030.

Other Information

Tower foundations (caissons), 7 knot (max) reversible currents, 15' tidal swings, water depth 150', 100' scour potential, seismic zone, concrete towers 510 feet high, towers and caissons designed for second deck (either road or light rail) to be added in the future, conventional gravity anchorages, main cables 21 inches in diameter made of 5,500 tons of wire, suspended superstructure (5,400' total length, 2,800' main span, three 12' traffic lanes, two 10' shoulders, and a 10' bicycle/pedestrian path separated by a barrier from shoulders), orthotropic deck with stiffening truss (total deck weight of 20,000 tons), aerodynamic influence of parallel suspension bridges (200' distance between center lines of bridge decks), 2.5 miles of approach roads and improvements, toll plaza and operations center, maintenance facility, existing suspension bridge modifications (fill in existing grating, replace rub rail with barrier), seismic upgrades (reinforcement of approach span supports).

The projected cost of the project is \$849 million.



Fire Whirls and Building Aerodynamics

Robert N. Meroney, Wind Engineering and Fluids Laboratory, Colorado State Univ., Fort Collins, CO

Introduction

Fire whirls are a typically rare but potentially catastrophic form of fire. They are observed during urban and forest fires, where fire tornadoes are characterized by large-scale whirling flames which rise in 2 to 360 m diameter vortices, from 10 to 1200 m high. These fire whirls accelerate combustion, produce significant suction pressures and lifting forces, and can carry burning debris, logs and even buildings thousands of meters from the main fire. During the Great Chicago Fire in 1871 fire whirls carried burning debris up to 3/8 mile beyond fire lines, rapidly extending the fire out of control. In the same year in Peshtigo, Wisconsin, the largest and deadliest fire in US history fire tornadoes were reported to lift roofs off buildings and resulted in the death of 1,500 people. In the 1923 Kanto Earthquake fire in Tokyo, 38,000 people were killed in 15 minutes when a huge fire whirl descended upon refugees sheltering in an open area adjacent to the urban fire.

Recently, CFD calculations performed by the author of atria fires inside a proposed building produced very energetic fire whirls 5 m to 20 m diameter and 40 m tall, which roared from one end of the 45 m open space to the other and back in less than a minute (Banks, Chang & Meroney, 2002). Unfortunately, as building atria get larger, attempts to control ventilation during fires in atria may introduce vorticity, which can thus generate "internal" fire whirls.

Fire Whirl Dynamics

The formation of fire whirls requires a source of ambient vorticity, a concentrating mechanism, and a favorable environment for fire whirl stability and growth (augmentation physics). Ambient vorticity can be produced by ground level boundary layers generated by the wind, wind shear from non-uniform horizontal densities, the earth's rotation, non-homogeneous surface heating, or wind shear produced as air passes over a ridge or hill. Concentrating mechanisms include rising air in a buoyant

column from unstable layers forming over sun-heated ground, the presence of a storm front, or hot gases from a fire. The concentrating mechanisms rotate the horizontal vorticity into the vertical direction and stretch the vortex tubes. Through conservation of angular momentum, the stretched tubes induce more rapid rotation resulting in lower axial pressures, which in turn encourages further entrainment of ground level vortex-rich air. Finally, the rotational structure of the vortex induces centrifugal forces which dampen turbulence near the vortex core; thus, reducing any tendency for the fire whirl plume to diffuse outward from the core.

Laboratory Fire Whirls

Byram and Martin (1962) used external vertical cylinders with tangential slots oriented to produce rotating flow about a fire source. They examined two sets of equipment of diameters and heights, 33 and 183 cm, or 66 and 335 cm, respectively. Burning alcohol pools within their apparatus, they reported visible fire whirls up to 300 cm tall with inner fire tube columns 2 cm in diameter. They observed horizontal velocities at the surface of the inner column of about 9 m/sec (~6000 rpm) and vertical velocities up to 18 m/sec.

Emmons and Ying (1966) used a rotating-screen apparatus to systematically evaluate the effects of angular rotation (Rossby number) and plume buoyancy (Froude number) on fire whirl dynamics. They reported that turbulent mixing coefficient decreases with increasing angular momentum, and increases with elevation above the ground. Later, Chigier et al. (1970) reproduced their apparatus, but they used a turbulent jet diffusion flame rather than a fuel pan.

More recently Satoh and Yang (1996, 1997) produced laboratory scale fire whirls by adjusting symmetrical vertical gaps separating the square vertical bounding walls surrounding a central fire pan. They examined the effect of gap size, wall height, fuel size, and heat load on the fire whirl. They determined that there is a critical gap size, which is not so large or small, that it inhibits the entrainment of air needed to sustain the fire. Stable whirls were generally associated with flame heights smaller than the wall height of the square enclosure. Flame temperatures were primarily affected by the magnitude of the volumetric heat source. (*continued on p. 9*)

AMERICAN ASSOCIATION FOR WIND ENGINEERING

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**American Association
for Wind Engineering**

OBJECTIVES

The American Association for Wind Engineering (AAWE) was established in 1966. The objectives of AAWE are: (1) the advancement of the science and practice of wind engineering and (2) the solution of national wind engineering problems through transfer of new knowledge into practice.

CURRENT OFFICERS

President: M. P. Gaus (Consulting Engineer)

Vice President: B. Bienkiewicz (Colorado State Univ.)

Secretary/Treasurer: P. Sarkar (Iowa State Univ.)

Board of Directors: A. Chiu (Univ. of Hawaii), T. Gibbs (Consulting Engineers Partnership, LTD), J. Golden (NOAA), M. Levitan (Louisiana State Univ.), T. L. Smith (T. L. Smith Consulting, Inc.), A. Kareem (Univ. of Notre Dame).

WHY YOU SHOULD JOIN:

AAWE provides networking opportunity with U.S. wind engineering community through regular and special publications, e-mail communication, internet resources, and technical meetings.

HOW TO JOIN

Fill-in the Membership Application/Renewal Form and forward it to AAWE Secretary/Treasurer. For more information visit AAWE web site or contact Mike Gaus (mgaus@gaussassoc.com, 757-258-1273, voice) or Bo Bienkiewicz (bogusz@engr.colostate.edu, 970-491-8232, voice).

Get involved in formulating
National Wind Hazard Reduction Program

Please Post

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**American Association
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Membership Application/Renewal Membership Year: 1 January - 31 December 2003

Dues (Check appropriate category):

Individual Membership: \$50____, Student \$10 _____

Corporate Membership; \$500 or more: ____ . Corporate membership can include up to five individual members. Complete one form for each individual member.

Please make checks or other payments (in U.S. \$ equivalents only) payable to American Association for Wind Engineering and mail to:

**Dr. Partha Sarkar, Dept. of Aerospace Engr. & Engr. Mechanics,
2271 Howe Hall, Room 1200, Iowa State University, Ames, IA 50011-2271
E-mail: ppsarkar@iastate.edu, Tel: 515-294-0719, Fax: 515-294-3260**

Name: _____

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Affiliation _____

City _____ State/Zip _____

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Your Wind Engineering Interests _____

Large-scale fire whirl simulations have been produced for video and movie effects by combining shrouded helicopter blades and ancillary fans to produce vortices 12 m (40 ft) high and core diameters of 30 cm (1 ft) by Reel (1995) for car commercials and adventure movies (Volvo-850 commercial and Twister).

Simulating Fire Whirls by CFD

Emmons and Ying (1966) describe integral plume models which are calibrated with experimental data. Satoh and Yang (1997) used the Notre Dame UNDSAFE code with associated 3D, compressible, buoyant, and constant turbulent viscosity specifications. Ten cases were considered which included validation exercises and parameter sensitivity studies.

Battaglia et al. (2000) simulated the laboratory experiments of Emmons and Ying (1966), Chigier et al. (1970), and Satoh and Yang (1997), which included cases for fixed circulation and variable fire strength, fixed fire strength and variable circulation, and jointly varied fire strength and circulation. The numerical code used was the NIST shareware FDS (Fire Dynamics Simulator) which includes 3D, compressible, buoyant and LES turbulent models (Baum et al., 1996).

This author has reproduced cases from Emmons and Ying (1966) and Satoh and Yang (1997) with both Fluent 6.0 and FDS. Finally, several case studies were examined for fire whirls growing within hypothetical building atriums. The validation runs were considered satisfactory; hence, case study results should be trustworthy. Building fire whirls were found to quickly form when cross-ventilation produced horizontal wind shear about the base of a fire.

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Miniature High Speed Pressure Measurement System for Wind Engineering Applications

L. Harris, Scanivalve Corp., Liberty Lake, WA

Scanivalve's ZOC pressure scanners have been used in Wind Engineering facilities for many years. The introduction of the RAD3200 complements and completes the pressure measurement system.

This recently introduced high performance pressure measurement system utilizes a user's PC and an extended USB cable. It was specifically designed for pressure surveys in wind tunnel models and wind engineering models. The relevant features of the product that lend so well to wind engineering applications are:

- Miniature Size
- Modular size based upon model size and pressure channel count
- Used with users PC
- One small diameter extended USB cable, up to 150 foot long
- High channel sampling and data throughput in Engineering Units

The RAD3200 (Remote A/D) is a miniature set of 16 bit A/D's. Each 16 bit A/D accepts the amplified analog signal from one ZOC pressure scanner. The signals are then digitized and sent out to the PC via the USB extended cable. The calibration coefficients of the pressure sensors are in the users PC where sensor temperature correction and Engineering Unit conversion are calculated. The RAD3200 is small enough to fit inside most models in close proximity to the ZOC pressure scanners.

The high density ZOC analog pressure scanners are located in the model or under it with tubing connecting to the measurement ports. Any combination of 8, 16, 32, or 64 channel pressure scanners can be used with one RAD3200 system. The RAD can accept a maximum of 8 each 64 channel ZOC pressure scanners (512 pressure measurements per system). For higher channel counts, 2 RAD systems can be used in parallel.

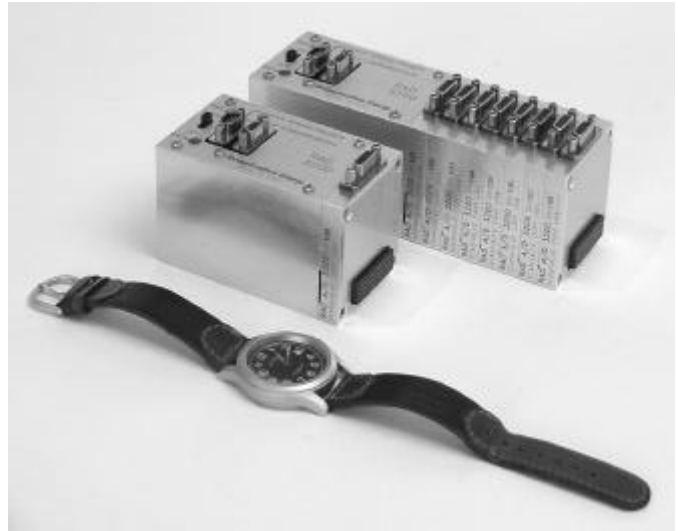
The users PC must have Windows2000 Professional or Windows XP operating systems as well as a processor of 800 MHz or faster. The RAD executable software runs on the PC and also contains the ZOC pressure sensor characterization tables. The software can then compensate the pressure measurements with tunnel ambient temperature changes. The raw counts signal from the RAD3200, via the US cable, is then converted into Engineering Units of psi, Kpa, Bar, mm Hg, inches H₂O, etc. This data can either be stored in a file or output from the PC Ethernet TCP/IP.

Communication to the RAD/PC system is local or remote. In local mode, ASCII commands are entered through the PC keyboard, using Telnet, DOS Window opened with the RAD.exe software, or RSMLINK menu-driven program. Data are stored on the hard disk. Remote operation is via Telnet, RSMLINK menu-driven program, or LabVIEW us-

ing Scanivalve's LabVIEW driver.

Each pressure channel can be sampled and throughput at 250-500Hz per channel, per second. The faster the PC processor, the higher the data throughput speeds. The USB and Ethernet connections allow for high sampling and data throughput rates.

This innovative product is ideal for universities and small research facilities. It is relatively low cost compared to the large data systems required in the past for the same task of pressure measurement.



Overall View of RAD3200

For more detailed information or technical specifications, please visit www.scanivalve.com or contact scanco@scanivalve.com

Open Position of Director of Wind Science and Engineering Research Center at Texas Tech University

Texas Tech University, Wind Science and Engineering (WISE) Research Center invites applications for the position of Director and Professor in the Department of Civil Engineering. As Director of WISE, the applicant chosen will provide leadership and vision for the internationally recognized, interdisciplinary research center. The Director works closely with faculty and students, both undergraduate and graduate, from engineering, atmospheric science, economics and architecture, on a variety of wind-related projects.

The successful applicant must have a Ph.D. in civil engineering or a closely related field. Preferably, he/she should be qualified to obtain professional engineering licensure in Texas. Significant research experience related to the wind science and engineering field, along with an extensive record of publications, presentations, and funded research are required. The successful candidate shall have management skills suitable for operating a multi-faceted organization; communication skills, both written and oral; and the ability to build teams and provide motivation. Evidence of national and international recognition through invited lectureships, awards and prizes along with evidence of leadership experience in professional organizations, boards and institutes will weigh heavily in an applicant's favor. In addition to the duties of Director, the applicant shall teach graduate and undergraduate classes, direct graduate student research and offer services to the university, community and profession.

The Wind Science and Engineering Research Center (WISE) is a comprehensive, interdisciplinary program whose mission is to mitigate the effects of windstorms on people and on the built environment. Research focuses on the nature of severe winds and the effects of wind on structures, developing technologies to make structures more wind-resistant and understanding wind erosion and transport of dust and chemicals by wind. Facilities that support this research include field laboratories and a 200 m meteorological tower, boundary layer wind tunnel, moving jet wind tunnel, debris impact facility, a number of mobile met towers, a mobile Doppler radar, and a series of 36 meteorological stations known as a mesonet. Support for the program comes from a variety of sources including the NIST, NSF, FEMA, State of Texas and private industry. More information on the program can be found at www.wind.ttu.edu.

Texas Tech University is located in Lubbock (population 200,000) and has a total enrollment of 27,000 students. The Department of Civil Engineering awards bachelors, masters, and doctoral degrees. The faculty consists of 20 full-time tenured or tenure-track personnel. Currently there are 432 undergraduates and 86 graduate students in the

various programs. Additional information about the Department is available on its website (www.ce.ttu.edu).

Evaluation of candidates will begin immediately and continue until the position is filled. A successful candidate could begin as early as June 1, 2003. Applicants should send a complete resume with names, addresses, e-mail address, telephone and fax numbers of at least three references to: WISE Director Search Committee, c/o Ms. Debbie Starcher, Department of Civil Engineering, Texas Tech University, Box 41023, Lubbock, TX 79409-1023; Ph. (806) 742-3524 (Ms. Starcher), Fax (806) 742-3488.

Texas Tech University is an Equal Opportunity/Affirmative Action Employer. Women and minority candidates are encouraged to apply.

Contributions to this Newsletter

K. R. Gurley and T. Reinhold, "Measurement of Ground Level Hurricane Winds."

T. M. Moore, "The Tacoma Narrows Bridge Project."

R. N. Meroney, "Fire Whirls and Building Aerodynamics."

L. Harris, "Miniature High Speed Pressure Measurement System for Wind Engineering Applications."

The remaining stories were compiled by the Editor, from various sources.

From the Editor

Contributions to the AAWE Newsletter by AAWE members and other readers of the Wind Engineer are very welcome. Please forward your articles, notes and other materials suitable for publication in the Newsletter to B. (Bo) Bienkiewicz, at bogusz@engr.colostate.edu.

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Objectives:

- The advancement of science and practice of wind engineering.
- The solution of national wind engineering problems through transfer of new knowledge into practice.

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