From time to time, many members of the academic community give thought to how to improve interaction between their college or university and the general public. Such interaction, and service, generally are important to all institutions that seek the intellectual support of the outside community, and particularly important to public-supported institutions. The article that follows provides an excellent example of a high visibility, university-promoted activity that is useful and enlightening to the citizens of the state and nation. The incorporation of students into the activity gives an educational benefit to them that can't be duplicated in the classroom. The department's "stock" on its own campus, and in the statehouse, will surely go up as well.

—Owen E. Thompson, Educational Affairs Editor

An Interactive Weather Exhibit at OMNIPLEX

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1. Introduction

A large weather exhibit, sponsored jointly by the National Science Foundation's Public Understanding of Science Program and the Kerr Foundation, has been established recently at the OMNIPLEX Museum in Oklahoma City, Okla. OMNIPLEX was planned as a participatory museum of science and art. The main exhibit floor covers over 4100 m$^2$ (45 000 ft$^2$). The individual exhibits are designed to ensure a maximum of visitor "hands-on experience" and interaction. For example, visitors can compose words and sentences on a computer-driven speech simulator, swing on a device constructed to duplicate the moon's gravity field, feed a shark, and study astronomy and lasers in a full-sized planetarium. Other exhibits explore acoustics, optics, animal and plant behavior, holography, and space exploration, to mention a few. OMNIPLEX schedules special events and classes for all age groups and provides temporary space for outstanding exhibits on loan from other museums and organizations. OMNIPLEX first opened in February 1978 and attracted approximately 250 000 visitors during its first two years of operation.

Planning for an interactive weather exhibit began even before OMNIPLEX opened its doors. The initial impetus for the exhibit came from the keen interest the residents of the Great Plains have in weather and climate. The relatively high frequency of severe thunderstorms and tornadoes, the anomalously cold winters in 1977-78 and 1978-79, and the agricultural basis of the area's economy are topics of daily conversation. In the Oklahoma City area, for example, local television stations support no fewer than eight professional meteorologists, a situation unparalleled by other cities of comparable population. The desire to understand the weather has led to increased emphasis on weather-related topics in the science curricula of primary and secondary schools, and increased enrollments in weather/climate courses at the universities.

However, despite this desire to comprehend not only the weather, but other facets of science as well, it is often beyond the means of most interested schools and individuals to provide a program of adequate depth and breadth to do so. Furthermore, this heightened awareness of weather and climate would seem to provide an excellent medium in which to communicate the methods and challenges of science to the public. With this in mind, the School of Meteorology at the University of Oklahoma and the Education Department at OMNIPLEX began a cooperative effort in 1978 to develop a major participatory weather exhibit that would serve the educational needs and curiosities of the residents in this geographical region.

2. Constructing and equipping the exhibit

The construction of the weather exhibit was planned and carried out in two distinct stages. The first stage involved the construction of a working weather station. A schematic diagram of the station's design is shown in Fig. 1 and a photograph of the completed station is shown in Fig. 2. (The final design and construction of the weather station was provided by Raymond Larson, Professor of Drama at the University of Oklahoma.)

In order to obtain real-time weather information, transmission lines and equipment were installed to receive Service A and State Weatherwire teletypewriter data and the National Facsimile circuit (NAFAX). A series of hinged panels was designed to display facsimile products in a minimum amount of space. Local weather observations, obtained from sensors located on the roof of the building, are displayed on clock-style dials built into the exhibit wall, and include sta-
tion pressure, temperature, relative humidity, wind speed, wind direction, and precipitation amount. A microbarograph and a Fortin barometer are also at hand.

Three rear projection screens were incorporated into the weather station design. The central screen is for showing 16 mm movies, while the side screens are for 35 mm slide projections. A large table in the center of the exhibit is used for demonstrations, map analyses, and other projects. The weather station is shown in use in Figs. 3 and 4.

The second stage of construction consisted of adding a tornado-like vortex generator or "tornado simulator" to the weather station portion of the exhibit. The tornado simulator was designed and constructed by Philip McDonald, a graduate student at the University of Oklahoma, and is shown in Fig. 5.

The OMNIPEX tornado simulator is of the type developed by Niel Ward (1972) of the National Severe Storms Laboratory, Norman, Okla. This type of simulator is diagramed in Fig. 6 and is comparable in size, design, and operation to the apparatus constructed recently at Purdue University (Church et al., 1977). A vortex is produced in the OMNIPEX simulator by drawing air upwards through the
FIG. 3. Danny Satterfield explains weather features on satellite charts using the hinged panels designed to display facsimile products.

convection zone by means of the exhaust fan at the top of the device. Air entering the lower portion of the apparatus through the rotating screen spins up as it nears the center of the convergence zone. Thus, several of the features of a rotating thunderstorm are modeled (Davies-Jones, 1976).

The OMNIPLEX simulator was designed to allow for variation in the rotation rate of the screen and in the volume flow rate (controlled by the speed of the exhaust fan); thus, vortices of different sizes and characteristics, including multiple-vortex phenomena, can be produced (cf. Church et al., 1977; Leslie, 1977). For the theoretical and technical details of tornado simulators in general the reader is referred to the studies cited previously. Further information about the OMNIPLEX simulator is available from the author on request.

Airflow visualization in laboratory simulators is frequently accomplished with a kerosene/mineral oil smoke. This material, however, has a highly disagreeable odor that is best alleviated by discharging the exhaust from the simulator into the air outside the building. This technique was impractical at OMNIPLEX, so an alternative visualization material was tried. Dry Ice fog, generated by the immersion of Dry Ice in warm water, proved to be generally satisfactory, as evidenced in Fig. 7. This fog is introduced through the bottom of the simulator into the convergence zone at the axis. A horizontal deflector is used to disperse the fog over a wide area for greater visual effect.

The exhibit was essentially completed in October 1979 and has been open to the public Tuesdays through Sundays.

3. Staffing and administration

In keeping with the "hands-on" philosophy of OMNIPLEX, the staffing of the weather exhibit was considered critical to
These students bring a level of knowledge and enthusiasm to its success. Furthermore, a study by Kimche (1978) has shown that interaction increases the average length of time spent by a visitor at a particular museum exhibit. Presumably the quantity and quality of information transfer is related, in part, to the length of time a visitor spends at a particular exhibit.

As mentioned previously, the overall goal of the exhibit is to increase the public’s understanding of weather as a science. Therefore, the staffing of the exhibit was accomplished by employing junior- and senior-level students from the School of Meteorology at the University of Oklahoma. These students bring a level of knowledge and enthusiasm to the exhibit that normally is not found in a museum setting. Their efforts contribute greatly to improving interaction between visitor and exhibit. Current student-employees are Jami Allard, Richard Murnan, Shelly Kennedy, and Earl Chandler.

The organization and management of the weather exhibit reflects the cooperative relationship between OMNIPLEX and the School of Meteorology at the University of Oklahoma. The Director of OMNIPLEX, Sherman Kent, is ultimately responsible for all phases of the exhibit, including funding, maintenance, and future plans. The author acts as the chief technical consultant in all matters relating to exhibit design, proposal preparation, educational programs, and student-employees.

Since OMNIPLEX is a nonprofit organization, it is eligible for federal and corporate grants, and private contributions. Thus, funding for the weather exhibit was obtained by OMNIPLEX, and OMNIPLEX in turn supported the construction of the exhibit, its continued operation, and the student-employees’ wages. This administrative structure has allowed OMNIPLEX to secure funding to develop a popular exhibit that is unique among participatory museums. Students benefit from the part-time employment opportunities and from the professional experience gained in relating their meteorological expertise to the general public. The public relations value to the School of Meteorology, the University of Oklahoma, and the profession and science of meteorology must also be considered.

4. Exhibit utilization

Since its opening, the exhibit has been used in a wide variety of formal and informal programs designed to appeal to all age groups. Approximately 40% of the OMNIPLEX visitors are school-aged children (6 through 18). The wide range of age groups and educational levels encountered made it necessary to ensure flexibility in the design of any presentation. School groups visiting the weather exhibit are able to request one of three prepared programs in advance. These three 30–50 min laboratories focus on making weather measurements, weather forecasting, and severe thunderstorms.

a. Weather measurements laboratory

The measurements laboratory involves making temperature, humidity, and pressure measurements with thermometers, sling psychrometers, and the microbarograph, respectively. Wind observations are taken with anemometers and vanes sometimes constructed by the student visitors. These observations, which are taken to be representative of Oklahoma City conditions, are plotted according to the standard model. The student visitors then examine radiosondes, which were provided by the Oklahoma City National Weather Service Forecast Office, and view a slide presentation of an actual rawinsonde launch.

b. Weather forecasting laboratory

The weather forecasting laboratory consists of studying current weather information that is available over the State Weatherwire and the National Facsimile Circuit, under the guidance of Oklahoma University Meteorology students. Special emphasis is placed on satellite imagery, obtained via facsimile, of weather features in the local area. Employing the continuity method, the student visitors then make forecasts for Oklahoma City and compare them to the official National Weather Service Forecast. More advanced students also compare their forecasts to output from the Limited Fine-Mesh Model (LFM).

c. Severe thunderstorm laboratory

The severe thunderstorm program begins with a demonstration simulating cloud formation using a large mayonnaise jar (cloud bottle) containing a small amount of water. A rubber diaphragm covering the mouth of the jar is pushed inward by hand and then released to provide the cooling necessary for condensation to occur. Visualization is enhanced if a little smoke is introduced into the jar first. After the demonstration, the student visitors are treated to slides and films showing examples of severe thunderstorms in all stages of development. Finally, the OMNIPLEX tornado simulator is demonstrated, stressing the importance of rotation and updraft velocity to vortex formation and configuration.

d. Informal programs

Adults constitute a larger proportion of the visitors to the weather exhibit on weekends. Films and demonstrations of the tornado simulator are scheduled periodically each Saturday and Sunday. The meteorology students from the University of Oklahoma are on hand to answer questions and stimu-
late discussion on topics of interest to the visitors. Slides and films are readily accessible where appropriate, but the transfer of information depends primarily on the meteorology students’ breadth of knowledge and/or their communicative skills. Current weather is always a popular topic, and near real-time satellite pictures command a high degree of public interest. Other frequent topics are weather forecasting methods (including why forecasts are sometimes inaccurate), the jet stream, hurricanes and other storms, instrumentation, atmospheric optics, and safety rules. This relatively informal use of the weather exhibit on weekends is quite popular with the museum visitors and with the meteorology students themselves.

5. Concluding remarks

The weather exhibit at OMNIPLEX has proved to be a popular attraction, as evidenced by the fact that over 100 different groups from Oklahoma schools requested at least one of the three available programs during the past year. The total number of visitors to the exhibit during this same time period was in excess of 100,000 individuals.

An attempt was made to sample visitor opinion with regard to the quality and appropriateness of the weather exhibit. Questionnaires were prepared and randomly distributed to museum visitors during the past year. From the approximately 80 questionnaires returned, 94.3% strongly agreed or agreed that they definitely had gained insight into weather as a science. Fully 100% strongly agreed or agreed that the idea of an exhibit with presentations centered around weather is appropriate at a science museum. There also was agreement that the explanations and graphics provided were appropriate to the various respondents’ age and education level (100%), and that the weather exhibit was one of the best at OMNIPLEX (89%).

Various aspects of the weather exhibit, particularly the tornado simulator, have been featured on three local television newscasts, and videotaping of the simulator was completed recently by the Japan TV Workshop Co., Ltd., as a portion of a special program on tornadoes to be shown throughout Japan.

Whatever success the weather exhibit enjoys can be attributed in part to the knowledge, dedication, and enthusiasm of the participating meteorology students from the University of Oklahoma. The educational experience they have gained in relating meteorological information to the general public has been invaluable. Eight undergraduate students have been or are employed at the weather exhibit. Of the eight, four have completed studies for their meteorology degrees. Two are currently on the air as television newscasters, one is employed by the National Weather Service, and the fourth has entered graduate school.

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References


announcements

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WISE (Women in Science and Engineering) is an interagency subcommittee that reports to the Office of Personnel Management's Federal Women's Program. WISE is preparing a new Directory of Federally Employed Women Scientists and Engineers. Those who would like to be included in this directory should submit the following information: name; address (office or home); telephone number (office or home); discipline; highest degree attained; employing government agency; grade level; and government occupational series. The above information should be submitted to, and more information about WISE is available from: Joan Humphries, WISE Chairman, National Science Foundation, 1800 G. St., N.W., Washington, D.C. 20550.

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