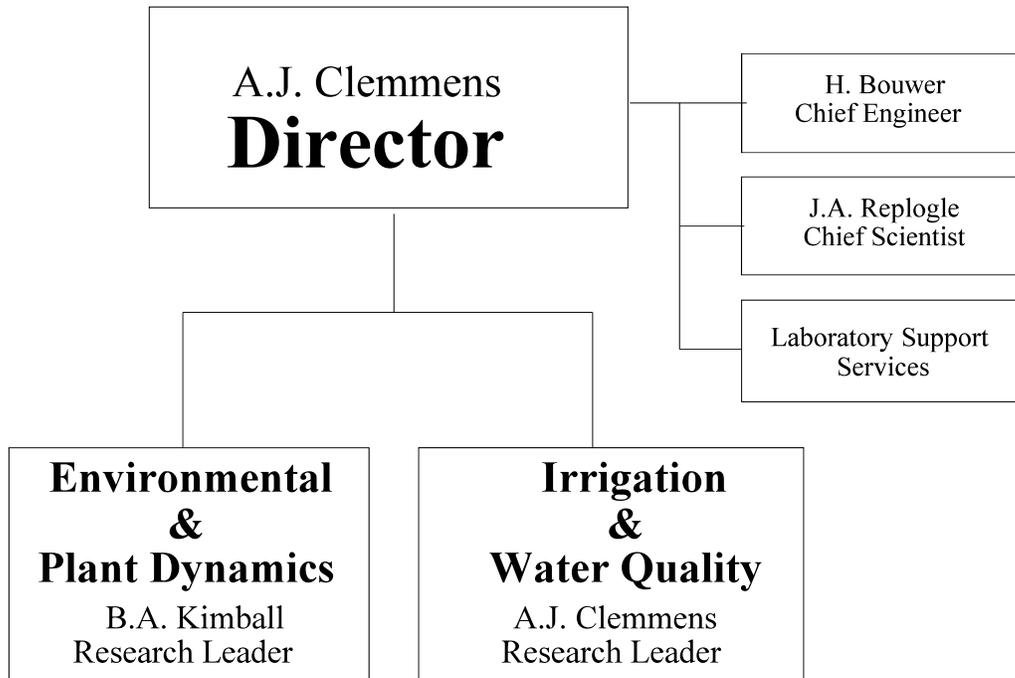


# LABORATORY PROGRAM

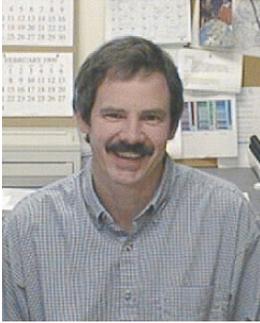
# Laboratory Organization



## Mission

The mission of the U. S. Water Conservation Laboratory (USWCL) is to conserve water and protect water quality in systems involving soil, aquifers, plants, and the atmosphere. Research thrusts involve developing more efficient irrigation systems, improving the management of irrigation systems, developing better methods for scheduling irrigations, developing the use of remote sensing techniques and technology, protecting groundwater from agricultural chemicals, commercializing new industrial crops, and predicting the effect of future increases of atmospheric CO<sub>2</sub> on climate and on yields and water requirements of agricultural crops.

## LABORATORY MANAGEMENT



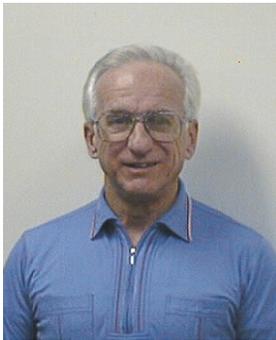
**ALBERT J. CLEMMENS, B.S., M.S., Ph.D., P.E., Laboratory Director, Research Leader for Irrigation and Water Quality, and Supervisory Research Hydraulic Engineer**

Surface irrigation system modeling, design, evaluation, and operations; flow measurement in irrigation canals; irrigation water delivery system structures, operations management, and automation.



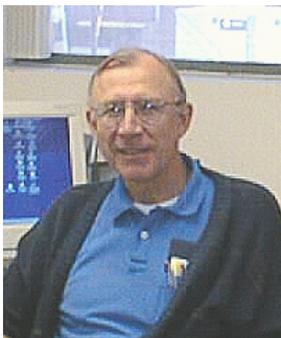
**HERMAN BOUWER, B.S., M.S., Ph.D., P.E., Chief Engineer and Research Hydraulic Engineer**

Water reuse; artificial recharge of groundwater; soil-aquifer treatment of sewage effluent for underground storage and water reuse; effect of groundwater pumping on stream-flow; surface and groundwater relations.



**JOHN A. REPLOGLE, B.S., M.S., Ph.D., P.E., Chief Scientist and Research Hydraulic Engineer**

Flow measurement in open channels and pipelines for irrigation; irrigation water delivery system structures, operations, and management.



**BRUCE A. KIMBALL, B.S., M.S., Ph.D., Research Leader for Environmental and Plant Dynamics and Supervisory Soil Scientist**

Effects of increasing atmospheric CO<sub>2</sub> and changing climate variables on crop growth and water use; free-air CO<sub>2</sub> enrichment (FACE) and CO<sub>2</sub> open-top chambers and greenhouses; micrometeorology and energy balance; plant growth modeling.

## **LABORATORY SUPPORT SERVICES**

### **ELECTRONICS ENGINEERING LABORATORY**

D.E. Pettit, Electronics Engineer

The electronics engineering laboratory is staffed by an electronics engineer whose duties include design, development, evaluation, and calibration of electronic prototypes in support of U.S. Water Conservation Laboratory research projects. Other responsibilities include repairing and modifying electronic equipment and advising staff scientists and engineers in the selection, purchase, and upgrade of electronic equipment. Following are examples of work performed in 2001:

- Completed designing and implemented use of the software for the Generation II(GEN II) probes which measure flood irrigation water advance and recession dates and times.
- Designed the GEN III probe utilizing a surface-mount microcontroller that is flash programmable and interfaceable to a new 24-cm variable water detection transducer.
- Wrote new software programming to accommodate new advances in the microcontroller hardware being implemented in the new GEN III probe.
- Designed a 24-cm low-power optics source/detector transducer using surface mount technologies to interface to the GEN III probe. Designed, constructed, and experimented with several optic transducers for variable water level detection.
- Designed and assisted in the construction of the mold for a 24-cm multiple optic transducer for the Gen III probe and also constructed several 24-cm transducers.
- Designed and constructed several visual test displays to control and read the 24-cm transducers.
- Continued designing schematic capture parts and circuit board footprints for the appropriate ORCAD libraries.
- Repaired LPKF circuit board mill machine and updated the hardware.
- Continued performing multiple tests of the 10 fiber optic sensing GEN II probes with acceptable results.

### **LIBRARY AND PUBLICATIONS**

Lisa DeGraw, Publications Clerk, and Thelma Lou Draper, EPD Secretary

Library and publications functions, performed by one publications clerk, include maintenance of records and files for publications authored by the Laboratory Research Staff, and publications co-authored with outside researchers, as well as holdings of professional journals and other incoming media. Support includes searches for requested publications and materials for the staff. Library holdings include approximately 2600 volumes in various scientific fields related to agriculture. Holdings of some professional journals extend back to 1959.

The U.S. Water Conservation Laboratory List of Publications, containing over 2300 entries, is maintained on ProCite, an automated bibliographic program. The automated system provides for

sorting and printing selected lists of Laboratory publications and is now accessible on LAN by the Research Staff and on the USWCL home page ([www.uswcl.ars.ag.gov](http://www.uswcl.ars.ag.gov)) by the public. Publications lists and most of the publications listed therein are available on request.

We are in the process of converting publications into pdf files which will allow easy access to our lab publications through our home page on the web. There are currently approximately 200 publications available for public use.

### **COMPUTER FACILITY**

T.A. Mills, Computer Specialist

The computer facility is staffed by one full-time Computer Specialist and one full-time Computer Assistant. Support is provided to the ARS Phoenix Location, including the U.S. Water Conservation Laboratory (USWCL), the Phoenix Location Administration Office, and the Western Cotton Research Center (WCRL).

The facility is responsible for designing, recommending, purchasing, installing, configuring, upgrading, and maintaining the Phoenix Location's Local and Wide Area Networks (LAN, WAN), computers, and peripherals. The USWCL LAN consist of multiple segments of 10 Base-T, 100 Base-T, 1 Gigabit hubs and switches. The LAN is segmented using a high speed switches. Segments are made up of fiber optics, CAT 5 and standard Ethernet. This configuration currently provides over 200 ports to six USWCL buildings plus those at WCRL. Internet service is provided by Arizona State University (ASU) via a Point-to-Point T-1 line. The facility maintains two Internet domains [uswcl.ars.ag.gov](http://uswcl.ars.ag.gov), and [wcr1.ars.usda.gov](http://wcr1.ars.usda.gov). The Laboratory LAN is comprised of several servers operating under Windows NT 4.0. End users operate mainly under Windows 95, 98, 2000, and Windows NT 4.0 with a few OS/2 workstations. Security is currently being provided through the USWCL router. A Cisco PIX firewall is in the process of being implemented.

Services such as print, file, remote access, and backup are provided by the USWCL LAN. Other services such as DNS and E-Mail are provided to both the USWCL and WCRL. The USWCL maintains Web Servers for both USWCL ([www.uswcl.ars.ag.gov](http://www.uswcl.ars.ag.gov)) and WCRL ([www.wcr1.ars.usda.gov](http://www.wcr1.ars.usda.gov)). Currently FTP access is restricted to local accounts. This policy may be relaxed during the coming year.

### **MACHINE SHOP**

C.L. Lewis, Machinist

The machine shop, staffed by one machinist, provides facilities to fabricate, assemble, modify, and replace experimental equipment in support of U.S. Water Conservation Laboratory research projects. The following are examples of work orders completed in 2001:

- Constructed mold for a 24-cm multiple optic transducer for the GEN III probe, as described in the electronics section above, and adjusted specification where necessary.

- Constructed an adapter which fits on an automatic polishing machine arm for polishing the ends of a 3-mm fiber optic light pipe.
- Manufactured multiple sample cup and cap for ball grinding of plants and soil samples.
- Manufactured a catch release tool for removing rubber hoses from bulkhead fittings.

## USWCL OUTREACH ACTIVITIES

The USWCL staff participates in numerous activities to inform the public about ARS and USWCL research, to solicit input to help guide the USWCL research program, to foster cooperative research, and to promote careers in science.

**“Experiments for the Classroom.”** The USWCL web site ([www.uswcl.ars.ag.gov/events/exper/exper.htm](http://www.uswcl.ars.ag.gov/events/exper/exper.htm)) contains experiments suitable for high school science classes.

**Support for Minority Graduate Student.** The Irrigation and Water Quality MU supports an Hispanic graduate student in an assistantship at the Agricultural and Bio Engineering Department, University of Arizona.

**Program for Moroccan Visitors, February 9.** USWCL and Western Cotton Research Laboratory staff presented and discussed their respective research, focusing on cooperation with universities, with Mohamed Kamal and Mohamed Moussaoui from the Moroccan Institut National de la Recherche Agronomique and Recherche Agronomique de Meknes, respectively.

**Martin Luther King Day Celebration, January 21, 2003.** Kathy Johnson, Stephanie Johnson, and Michelle Worthen volunteered to assist with the celebration.

**6<sup>th</sup> Annual Vegetable Crops Field Day, February 13.** Ed Barnes gave a presentation on using remote sensing to monitor irrigation, fertility, and pest incidence levels in crops. The event was hosted by the University of Arizona Cooperative Extension.

**Arizona Science Bowl, March 2, 2003.** Kathy Johnson, Mike Wiggett, and Gail Dahlquist participated in the Arizona Science Bowl at Glendale Community College.

**Students visit from De la Universidad Autonoma Chapingo, Chapingo, Mexico, March 12, 2003.** Thirty students from the seventh-year irrigation class of the De la Universidad Autonoma Chapingo visited the laboratory. Ujohn Replogle hosted them and presented the overall laboratory history and current programs along with a hydraulics laboratory tour featuring recent innovations involving flumes, Venturi meters, pitot tubes, flap-gate studies and the modification of velocity profiles in pipes to improve flow meter performance and accuracy. John Replogle's former graduate, Dr. Mauricio Carrillo-Garcia, accompanied the group.

**Talk given to researchers and students from The University of Arizona, March 29, 2003.** Glenn Fitzgerald gave a talk titled “Hyperspectral remote sensing and spectral mixture analysis for agriculture” to approximately 25 researchers and students interested in remote sensing applications to agriculture.

**Arizona's Governor's Advisory Committee, December 13, 2003.** Bert Clemmens attended meetings of the Governor's Advisory Committee on Agricultural Best Management Practices. This committee was set up by Governor Hull to provide guidance on implementing an interim practice for

the Third Management Plans for the state's Groundwater Active Management Areas.

**"Water & Science Ag-Ventures," February 15 & 16.** USWCL, in cooperation with the University of Arizona Maricopa Agricultural Center (MAC) and the Natural Resource Education Center of the Natural Resources Conservation Service, sponsored "Water & Science Ag-Ventures," an annual educational program for junior and high school students, held at MAC, near Maricopa, Arizona. The USWCL staff provided hands-on demonstrations based on USWCL research programs, with an accompanying brochure to be pursued further in the classroom. The students also received information on careers in science, specifically in ARS. USWCL's partners in the event provided hands-on experience with an actual irrigation event and a tour of the MAC aquaculture ponds.

**Arizona Ag Day, February 28.** The USWCL continued its participation in the annual Arizona Agricultural Day (Ag Day) in downtown Phoenix. The purpose of Ag Day is to inform the public of the importance of agriculture in their daily lives. The theme is "Arizona Agriculture, Something You Should Know About." The exhibit featured an ARS backdrop depicting a variety of ARS research areas; handout materials such as "Science in Your Shopping Cart," *Agricultural Research* magazine; and displays and materials on USWCL research. The exhibit also included educational and career materials for teachers and students. Several thousand people attended the event, and the ARS exhibit was well attended.

**Bring-Your-Child-to-Work Day, April 26.** Twenty-one children, ages 6 to 16, participated in "Bring-Your-Child-to-Work Day" at the U.S. Water Conservation Laboratory and Western Cotton Research Laboratory in Phoenix. The staffs of the two laboratories provided a full morning's participatory program that related the science to the children's day-to-day lives. In addition to the planned program, the children also spent time at their parent's work site. The Location Administrative Office coordinated and assisted with the day's activities that included a festive outdoor picnic lunch.

**Planning Workshop for Joint Chinese-Japanese CO<sub>2</sub> Project, March 5-8.** Bruce Kimball participated in a workshop at Nanjing and Wuxi, China, to plan a joint Chinese-Japanese Free-Air CO<sub>2</sub> Enrichment (FACE) project on rice and wheat.

**Visit by Mexican Students, March 6.** Eduardo Bautista, Fedja Strelkoff, and John Replogle provided a program on USWCL research on irrigation for students from the University of Chapingo, Mexico.

**Visitors from India, March 14.** Sherwood Idso met with visitors from India who were seeking information on carbon sequestration and other areas related to global climate change.

**Training for South African Student, March 18-24.** Terry Coffelt provided a one-week training session for a South African graduate student working on an MS degree in South Africa. The student was sponsored by international affiliates to study the production and seed harvesting of the Guayule plant. He hopes to duplicate the success of this plant's resources in his home country.

**Summer Agricultural Institute for Teachers, June 22.** Ed Barnes and Shirley Rish provided an ARS and USWCL exhibit at the week-long Summer Agricultural Institute for 32 elementary and junior high teachers. The program encourages teachers to incorporate agricultural information into school curricula. Materials distributed at the USWCL exhibit included information on careers in

science and ARS and experiments that can be done in the classroom.

**Minority Technician Recruited, July.** The Environmental & Plant Dynamics MU recruited a minority technician for a two-year term appointment.

**Attendance at EEO Conference, September 4-7.** Rich Lee, Location Administrative Office ; and Skip Eshelman and Carl Arterberry attended the EEO Quad Conference in Concord, California.

**Annual Conference to Advance Chicanos/Latinos and Native Americans in Science, September 27-30.** Representatives of the USWCL, Western Cotton Research Laboratory, and Phoenix Location Administrative Office participated in the annual conference of the Society for the Advancement of Chicanos/Latinos and Native Americans in Science (SACNAS), which was held in Phoenix, Arizona. ARS scientists spoke at symposia detailing career opportunities with ARS and hosted a field tour of the Phoenix location with demonstrations of ongoing research projects. Phoenix location representatives also helped staff the ARS exhibit booth at the conference.

**ARS Irrigation and Drainage Exhibit at the International Irrigation Show, November 2-4.** Shirley Rish coordinated an exhibit on irrigation and drainage research at the annual Irrigation Association International Show in San Antonio, Texas. John Replogle provided display materials and helped staff the exhibit. ARS scientists from Florence, South Carolina; Bushland, Texas; Baton Rouge, Louisiana; Ft. Collins, Colorado; Stoneville, Mississippi; and the National Program Staff also assisted. The exhibit was supported by Dale Bucks, ARS National Program Leader for Water Quality and Management. The Irrigation Association provided complimentary exhibit space. Registered attendance was more than 6000, and the ARS exhibit was well attended.

**Seminar at Grand Canyon University, November 16.** Bert Clemmens gave a seminar, "Finding your Way Through the Fog--Expanding the Frontiers of Engineering and Science," to a group of 30 students and faculty in the College of Science at Grand Canyon University.

**Visitors from Central Asian Countries, Nov. 30.** Representatives of government ministries for natural resources, water, environment, and foreign affairs from Kazakhstan, Kyrgystan, Tajikistan, Turkmenistan, and Uzbekistan visited USWCL on a tour under the International Visitor Program of the U.S. Department of State. These governments are seeking the most efficient ways to manage their water resources. Presentations and discussions focused on integrated water management and included global perspectives, climate change, dams, artificial recharge of aquifers for underground storage of water, water banking, water reuse, virtual water, efficient irrigation, and water measurement.

**Training and Learning Opportunities for Minority Students.** USWCL continued to provide training and learning experiences for part-time minority student employees from Arizona State University.

## **SAFETY**

T. Steele

The Laboratory Safety Committee enjoys well-deserved respect from the employees. It is a time-consuming commitment and requires judicious management of time and work priorities. Serving on the safety committee, however, is gratifying in terms of its record of accomplishments. A few examples of our accomplishments follow:

- a. A program for the installation and use of Automatic External Defibrillators (AED) was developed and implemented. The AED has been installed and is available for use. A first responder team has been identified, and they are in the process of finalizing notification and response procedures. The City of Phoenix Fire Department Emergency Access Services Department has been notified of the installation.
- b. The Safety Committee's project of gathering information for inclusion into a database that the Phoenix Fire Department uses in a emergency response data base is ongoing.
- c. Increased security measures have been implemented, and additional measures to control access to the facility buildings and grounds are being considered.
- d. Employees are still encouraged to report all safety concerns, even those that might seem trivial.
- e. The committee takes its duties seriously and has worked diligently to insure compliance with all EPA and OSHA regulations and radiological safety protocols.

The location staff thanks the committee for their good work on our behalf and looks forward to another year of safety awareness and exemplary records.

## **STUDENTS AT USWCL**

J. Askins

The USWCL has enjoyed a mutually beneficial relationship with students from nearby Arizona State University over the years. Students come under work-study agreements and student federal appointments. They perform a variety of tasks from collecting samples to solving computer problems, from numbering vials to writing protocols, from weighing soil to processing and analyzing non-soil data. Students who work in the clerical/administrative area have worked in personnel and safety areas as well as doing general clerical work such as filing and copying. Operation of ARS automated systems, publication clerk duties, and literature searches are also performed.

The students benefit from the income and experience, and we benefit from their enthusiasm, up-to-date expertise, and energy. Some have stayed on after graduation, even earning Ph.Ds. under ARS assistance programs.