

**Hydrologic Instrumentation Facility  
of the U.S. Geological Survey  
Annual Report for Fiscal Year 1993**

**By VITO J. LATKOVICH and DEBRA C. TRACEY**

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# Hydrologic Instrumentation Facility of the U.S. Geological Survey Annual Report for Fiscal Year 1993

By Vito J. Latkovich *and* Debra C. Tracey

## INTRODUCTION

The Hydrologic Instrumentation Facility (HIF) of the U.S. Geological Survey (USGS) has nationwide responsibility for all aspects of hydrologic field instrumentation in support of USGS data-collection programs. The HIF has 36,000 square feet of office, laboratory, and warehouse space at the John C. Stennis Space Center (SSC) on the Mississippi Gulf Coast, approximately 50 miles northeast of New Orleans, Louisiana. With the National Aeronautics and Space Administration (NASA) serving as host agency, 19 other Federal and State agencies located at SSC benefit from contractor-supplied technical and facility-support services and technology-exchange opportunities available at SSC.

The Instrumentation Committee (ICOM) serves as a senior advisory group for policy, projects, and budget that meets periodically to provide the HIF with guidance on the instrumentation needs of the USGS. The ICOM met in Denver, Colorado, in January and August 1993. Committee membership as of September 30, 1993, is listed in appendix 1. The Instrumentation Management Advisory Committee (IMAC) is a Water Resources Division (WRD) senior staff advisory group that acts as an interface between ICOM and the senior staff on instrumentation policy, manpower, and budget matters. Committee membership as of September 30, 1993, is listed in appendix 1.

The Instrumentation Technical Advisory Subcommittee (ITAS), an advisory subcommittee of the ICOM, is composed of individuals involved in field-level data collection. This subcommittee makes recommendations to the ICOM concerning instrument needs and assists the HIF staff with the formulation of functional requirements for new instrumentation. Resource persons from other organizational units are

available to ITAS as requested by the subcommittee chairperson. The ITAS met in Denver, Colorado, in January and August 1993. Both meetings were held in conjunction with those of the ICOM. Committee membership as of September 30, 1993, is listed in appendix 1.

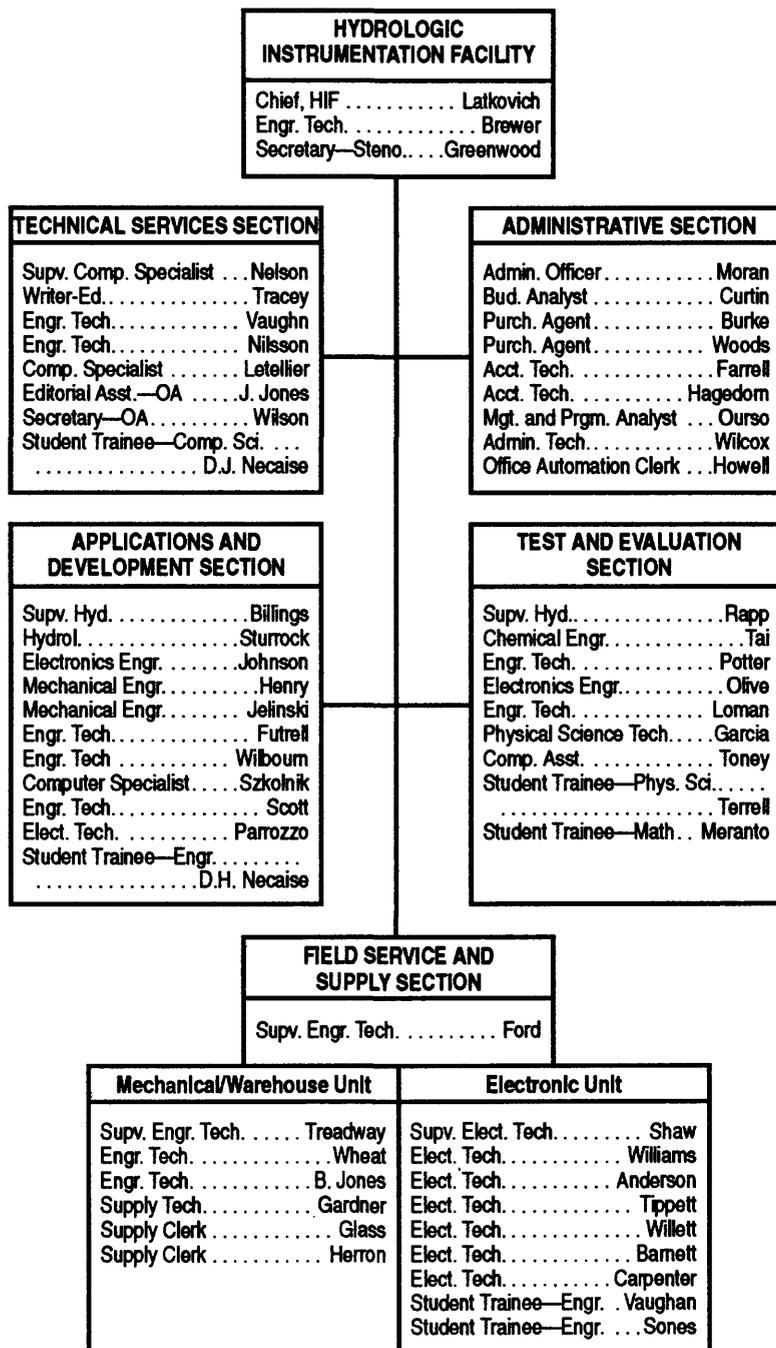
A staff of 58 professional, technical, and clerical USGS personnel at the HIF is organized into five sections: Technical Services Section (TSS), Administrative Services Section (AS), Applications and Development Section (ADS), Test and Evaluation Section (TES), and Field Service and Supply Section (FSS). Organization of the HIF staff is shown in figure 1. In addition to HIF personnel listed in figure 1, approximately 10 contract employees worked on HIF projects during the year.

The primary purpose of this annual report is to inform WRD personnel of progress made by the HIF in fulfilling its mission to improve instrumentation services to the division. This report describes the activities of the HIF during fiscal year 1993 (FY93).

## Fiscal Year 1993 Overview

Fiscal year 1993 was the 14th and most prosperous year of operation for the HIF. Warehouse sales were \$2.1 million—about \$300,000 more than in FY92, which was a record year. The total HIF budget in FY93 was \$8,870,000.

The reorganization of the HIF, which occurred as a result of the 1987 Management Review, has been in place for 6 years. Since the reorganization, the HIF has focused on two major objectives. First, the HIF strives to be more responsive to the wide variety of hydrologic field instrumentation needs and requirements. Second, the HIF makes use of commercially



**Figure 1.** Hydrologic Instrumentation Facility organizational chart as of September 30, 1993.

available products when possible, by direct use or use after minor modification, before undertaking any research and development efforts. Field applications and technical support have ranged from advice and guidance given over the telephone to onsite visits in the field by one or more HIF personnel for instrument installation and calibration and personnel training.

During FY93, HIF personnel visited 73 WRD offices, 33 of which were district and field offices (appendix 3), and attended 26 professional and technical meetings (appendix 4). Instrumentation briefings were presented at 28 WRD offices, and 12 presentations were made at professional and technical meetings. Visitors to the HIF included 137 USGS employees, 302 representatives from vendors, 27 representatives from various college and universities, and numerous onsite agency, local government, and other Federal agency (OFA) personnel. HIF personnel visited eight vendors (appendix 5). The HIF hosted several conference and ad hoc committee meetings as well as training courses. Employees of the HIF are active in numerous professional and technical societies and associations.

### Major Accomplishments for Fiscal Year 1993

- Completed the development and dissemination of the first release of the new HIF Computerized Support System II for field implementation as of October 1, 1993.
- Conducted 12 training courses at the HIF, National Training Center, and district offices.
- Completed the procurement contract for an environmentally sound hand-held field computer that has removable data storage and program cards.
- Procured the following priority instrumentation:
  - Data-collection platforms ..... \$625,000
  - Data loggers and related items..... \$620,000
  - Pressure sensors..... \$650,000
  - Water-quality monitors ..... \$235,000
  - Encoders ..... \$189,000
  - Ultrasonic velocity meters and transducers ..... \$350,000
  - Field computers ..... \$ 30,000
  - National Water Quality Assessment (NAWQA) components ..... \$ 32,000
- Completed the HIF statement of work for bar-code contract implementation.

- Fabricated a portable (trailer-mounted) instrumentation exhibit for WRD, which was used at the National Boy Scout Jamboree and will be used for demonstrations in the future.
- Worked out procedures for the disposition of mercury manometers.
- Conducted a procurement contract for a pressure sensor alternative to the mercury manometer.
- Supported NAWQA by (1) preparing a detailed listing for ground-water sampling equipment parts and fabrications; (2) procuring parts, assemblies, bottles, septa, and syringes; and (3) procuring and stocking field kits for the solid phase extraction program.
- Established a policy for HIF surplus property dispositions.
- Completed and distributed the video tape "Introduction to Ultrasonic Velocity Meter Systems."
- Open-filed the HIF FY92 Annual Report.
- Open-filed the Proceedings of a Pressure Transducer-Packer Workshop held in 1991.
- Developed a required HIF Chemical Hygiene Plan.
- Implemented HIF's part of NASA/SSC Hazardous Materials, Hazardous Waste, and Solid Waste Plan.
- Implemented a new Customer Relations Work Team to respond to HIF customers' concerns.
- Implemented a new "Town Meeting" approach to conducting visits at WRD offices.
- Received and acceptance-tested 246 equipment procurements for warehouse stock.
- Lost no time at the HIF as a result of on-the-job injuries or accidents.
- Contracted for an SDI-12 interface simulator/verifier.
- Completed an inventory of WRD radioactive geophysical-logging sources.
- Modified over 950 mechanical drawings to include metric equivalents.
- Published the *WRD Instrument News* quarterly.
- Implemented an online instrumentation catalog including three dimensional drawings and scanned images.
- Developed and completed 12 field questionnaires concerning data loggers, long-term instrumentation needs, water-quality instrumentation requirements, samplers, ADR alternatives, and other subjects.
- Completed 14 instrumentation releases concerning water-quality meters/probes, disposition of

mercury manometers, data logger problems, equipment rental costs, ground-water sampler tests, property control transfers and inventories, mercury thermometer alternatives, and other subjects.

- Completed a special high-priority instrumentation development, fabrication, and test package for a WRD project in Antarctica.
- Completed installation of instrumentation at 10 field sites and implemented test and evaluation of new pressure sensor alternatives for the mercury manometer.
- Completed six instrument tests under the new HIF instrumentation test program.
- Completed work on the HIF Quality Improvement Concepts (QIC) Documentation, Quality of Work Life, and Alternate Work Schedule Process Action Teams (PAT's). Started a new Warehouse Procurement PAT (the seventh team at the HIF).
- Procured moderate to large quantities of high priority, relatively expensive items, such as pressure sensors, electronic data loggers, DCP's, ultrasonic velocity meters, water-quality monitors, encoders, and current meters, for sale and rental.
- Assisted in the development of a 5-year instrumentation requirements plan for WRD.
- Conducted work and provided assistance for programs with or in Japan, China, and Slovakia for WRD and other Federal agencies.
- Supported the hazardous waste project by providing rental instrumentation and technical assistance. Added three new instruments to the rental program.
- Provided about 2 man-years of technical services in a variety of forms on a real-time basis to WRD field personnel in support of the application and use of hydrologic instrumentation.
- Responded to more than one thousand formal inquiries from WRD offices for field coordination and assistance.
- Dealt with almost four hundred formal inquiries for direct field systems applications support. Wrote more than one hundred software programs for data input and retrieval in connection with data loggers. Assembled and tested 15 instrumentation systems for direct field installation and operation.

- Processed the following publications: seven open-file reports (two published; three in process; two reprints); three technical information sheets (two revised; one reprinted); seven abstracts; five in-house reports; and four issues of the *WRD Instrument News* (circulation 2,700). Provided limited editorial assistance with three Office of Surface Water (OSW) open-file reports and one OSW abstract.

- As of September 30, 1993, the HIF rented the following:
  - Analog-to-digital recorders (ADR's) ..... 9,290 units
  - Monitors, flowthrough ..... 45 units
  - Minimonitors ..... 396 units
  - Monitors, commercial ..... 9 units
  - DCP's ..... 890 units
  - DCP shaft encoders ..... 1,281 units
  - Data loggers ..... 1,318 units
  - Data-logger storage modules ..... 947 units
  - Special equipment ..... 181 items
  - Hazardous-waste equipment ..... 8 items
  - UVM's (five units sold; one unit on loan) ..... 111 units
  - Pressure sensor/recorder systems .. 206 units

- The 10 most active districts in procuring equipment and instrumentation from the HIF in FY93 were
 

1. California	6. South Carolina
2. Colorado	7. Tennessee
3. North Carolina	8. Wisconsin
4. Texas	9. Georgia
5. Oregon	10. Arizona

For purposes of comparison, the activities of the Field Service and Supply Section at the HIF for FY87, FY90, FY91, FY92, and FY93 are listed below. The list clearly indicates that activities have increased substantially in recent years.

Item	FY87	FY90	FY91	FY92	FY93
Work orders	963	2,028	2,079	2,163	2,459
Minimonitor repairs— base unit	61	NA	423	436	369
Minimonitor repairs— cables and probes	165	NA	1,464	1,339	1,763
DCP repairs— Synergetics	—	198	366	385	323
DCP repairs— Sutron	—	—	—	38	69
DCP repairs— Handar	—	73*	142*	150	222

\*Includes numerous Handar 524's that the HIF repairs for WRD and other Federal agencies.

## Operational Actions

- **Bar Code System.**—The development of a statement of work for the implementation of bar coding at the HIF was completed in August 1992 and forwarded to the WRD Bar Code Committee for inclusion in the requirements analysis document for the WRD-wide bar-code contract. The effort to implement bar coding at the HIF has been slowed to coincide with the WRD-wide effort.

The WRD Bar Code Committee has submitted a report to the Assistant Chief Hydrologist for Operations outlining committee progress to date and proposing a WRD-wide contract to provide bar-code hardware, software, and labels for implementing bar coding at any level as management sees fit. The WRD Bar Code Committee is moving forward to obtain Information Systems Division (ISD) approval to continue with the contract. During July, the WRD senior staff gave approval to continue with the bar-code procurement.

The HIF Bar Code Team will ultimately oversee the installation of bar-code technology at the HIF.

### New Chronology of Events

- HIF's statement of work submitted to WRD Committee .....August 1993
- HIF Bar Code Team to serve as COR for bar-code implementation at the HIF ..... September 1994
- WRD bar-code contract to be awarded..... October 1994
- Bar coding to be implemented at the HIF ..... October 1994
- Staff to be trained..... October 1994
- HIF Bar Code Team's work to be completed.....December 1994
- **New Customer Service Process Action Team.**—HIF recently created a Customer Relations Group, and, from it, a formal QIC Customer Service Process Action Team (PAT) was spawned. The HIF needs a more effective and efficient process for monitoring the requests for assistance it receives from the field, the commitments it makes, and the actions it takes to respond to those requests. The process action team was formed to look into developing an internal data base that will facilitate tracking such requests and the status of the HIF's responses thereto.

The Customer Relations Group will consider the following:

- Conducting a standardized annual customer satisfaction survey.
- Sponsoring town meeting-type information-gathering visits to WRD offices.
- Formally debriefing HIF personnel when they return from WRD office visits.
- Developing an internal data base using "keys" to enter and retrieve data.
- Providing pertinent information ahead of time to WRD offices being visited and to HIF personnel conducting visits.
- Giving feedback to offices visited and including coverage of pertinent issues in the *WRD Instrument News*.

The HIF wants not only to maintain the excellent customer relations it currently has, but also to strive for improvement. The HIF's renewed efforts, coupled with the new Computerized Support System II, equipment tracking system, and bar-coding capability, should further enable the HIF to continue to be an instrumentation service and support facility that WRD can depend on.

- **Instrumentation Test Program.**—Tests on six instruments have been completed as part of this highly successful program. There are six additional instruments awaiting testing. The data base can be tapped by simply logging in to INFORMATION and entering the password HYDRO. The rest is outlined on the computer screen.
- **HIF Computerized Support System II (HIF-CSS II).**—HIF-CSS II came online in FY93.
  - Parallel testing of the HIF functions of the software began in April 1993. Accounting procedures, as well as day-to-day operations, were tested and problems resolved.
  - The HIF-CSS II software was distributed to Florida, Texas, and Iowa in May for beta-testing of the district functions. Extensive testing by district personnel uncovered some minor problems, and these were corrected.

- The software, loading instructions, and user's manual were distributed to each district office by September 15. *Divisionwide use of HIF-CSS II began October 1, 1993.*
- HIF-CSS II is designed to operate across the USGS computer network. ISD and the Distributed Information System (DIS) office are in the process of upgrading network capabilities. Sites may experience slow operation of the software until the entire network is upgraded. Requests from any HIF-CSS II users for modifications or changes to HIF-CSS II will be addressed in future releases. TSS will be the focal point for collection of the proposed changes.
- The manner in which HIF personnel sign off on controlled property and forward the signed-off transfer has been improved. Please refer to WRD Memorandum No. 93.41—Controlled Property Transfers. Using Custodial Property Officers (CPO's), sending the transfer to the HIF, and keeping a suspense file at the HIF will be an improved means of controlling the receipt and movement of HIF property.

- Review the results of the Iowa District pressure sensor test and evaluation project.
- Continue implementation of the HIF QIC process.
- Continue development of PFC software for laptop and hand-held computers.
- Continue to support the acoustic Doppler current profiler moving-boat measurement system operational activities.
- Investigate the possibility of upgrading the gas-purge system for nonsubmersible pressure sensors.
- Continue to support the upgrade and operations of cableways and cable cars used by WRD.
- Continue to test and evaluate suggested instrumentation through the HIF instrumentation test program.
- Continue to market search, test, and evaluate pressure and acoustic sensors, both submersible and nonsubmersible, that would be acceptable alternatives to the mercury manometer.
- Develop an interface that allows the use of the USGS minimonitor conductivity and temperature probes together with electronic data loggers and DCP's equipped with analog sensor inputs.
- Modify the wire-weight gage to improve its security.
- Conduct a market search for nonmercury thermometers.
- Continue to integrate DIS-II hardware and software into the HIF operating system.
- Procure additional quantities of SDI-12-based data loggers, pressure sensor, shaft encoders, ultrasonic velocity meters, water-quality monitors, and data-collection platforms.
- Provide instrumentation application, installation, marketing, and procurement support services to the field.
- Continue to provide a variety of technical services on a real-time basis to WRD field personnel in support of the application and use of hydrologic instrumentation.

### Planned Activities for Fiscal Year 1994

- Complete the HIF Computerized Support System II.
- Complete 75 percent of the bar-code implementation contract.
- Complete the SDI-12 interface simulator contract.
- Convert as many mechanical drawings as possible to metric equivalents.
- Complete and circulate a videotape on installation and operation of data loggers, pressure sensors, and encoders.
- Develop a 3-year strategic plan for the HIF.
- Complete field tests of new pressure sensors at 10 district sites.
- Complete field tests of new Sand Point cable-car brake.
- Conduct training courses as required.
- Support and assist NAWQA for procurement of instrumentation.
- Complete FY93 annual report.
- Complete report on the proceedings for the Surface Water Pressure Sensor Workshop.
- Publish quarterly issues of *WRD Instrument News*.

### QUALITY ASSURANCE

In line with the unquestioned commitment of the USGS to quality, the HIF has an active quality assurance program, the bases of which are written documentation of work processes, reliance on quality improvement concepts (QIC), and a pervasive customer orientation. The program promotes the

continuous improvement of performance at every level and in all areas of responsibility. Its ultimate goal is to increase user/customer satisfaction. Persons at the HIF are working to meet that goal by delivering high-quality products and services consistently and in a timely manner to each of their many customers.

## **Procedures**

During FY93, the HIF renewed its efforts to achieve consistency of purpose and output within all its sections through the development of written procedures. A template that will help section chiefs develop and maintain an awareness of procedures that need to be documented was made available on all computer workstations. Additionally, the HIF staff was given training in analyzing and flowcharting current work methods, which should enhance their ability to write the needed procedures for their sections.

## **Quality Improvement Concepts**

The HIF relied heavily on the TQM process to focus its efforts during FY93. A standing Quality Council, consisting of seven employees—four supervisors and three nonsupervisors, coordinates the activities of process action teams (PAT's) tasked with solving specific problems. Council members serve 2-year terms. Three members are replaced one year; four members are replaced the next year. In any given year, council membership is balanced as equally as possible between supervisory and nonsupervisory personnel with at least one representative from each section.

The Technical Coordination Group (TCG) functions much like the Quality Council, but limits its scope to technical working issues. This group monitors the Training Team and the Systems Application Team (SAT), which are ongoing, and charters work teams as needed to address specific technical problems. The TCG keeps the Quality Council apprised of its activities.

## **Quality Council**

As of the beginning of the year, the Quality Council was working with five PAT's. During the year, three of the teams fulfilled their missions and disbanded, and one new team was chartered. The Quality Council reviewed monthly reports from all of the

active teams and provided them with direction and support as needed. The Council also studied the recommendations made by the team in their final reports and worked to ensure that, with approval of senior management, the recommendations were carried out.

Also during FY93, the Quality Council conducted a brainstorming session with all HIF employees to document lessons learned during the early phases of QIC implementation at the HIF and to identify the benefits that QIC implementation had afforded the HIF. The Council followed up with its own meeting to consolidate the ideas generated in the brainstorming session into a coherent statement of lessons learned. A second followup meeting of the Quality Council will focus on preparing the statement of benefits. Upon completion, these two statements will be submitted to the Branch of Quality Assurance for inclusion in a report on the WRD's pilot QIC projects.

In other efforts to evaluate the implementation of QIC and its effects on the HIF's organization, the Southeastern Regional Quality Council visited with the Quality Council at the HIF. The two councils discussed their experiences with QIC.

Through its work in FY93, the Council recognized the need for a strategic plan for the HIF. Plans are underway for a workshop to be attended by the senior staff and Quality Council. The agenda tentatively calls for redefining the mission and vision of the HIF and for developing a strategic plan.

## **Process Action Teams**

**Quality Of Work Life Team.**—The Quality of Work Life PAT finished its work and submitted its final report early in FY93. On the basis of its survey of HIF employees, the team recommended that certain social functions be held and that other teams be chartered to address various aspects of work life identified as needing improvement. In response to the team's recommendations, the HIF established a Social Function Group to plan special events and chartered the Alternate Work Schedule PAT.

**Alternate Work Schedule Team.**—The Alternate Work Schedule PAT, an outgrowth of the Quality of Work Life Team, was chartered to investigate the level of interest in an alternate work schedule at the HIF and, if interest warranted, to make recommendations concerning implementation. The team surveyed HIF employees and, finding a high level of interest, checked OPM regulations and researched work schedules used by other agencies. The team recommended

that a maxiflex schedule be implemented at the HIF on a trial basis. As a result of the team's efforts, a proposal for a maxiflex pilot project at the HIF was submitted to headquarters for approval. As of September 30, 1993, approval was still pending.

**Documentation Team.**—The Documentation Team, the first established by the HIF Quality Council in October 1991, finished its work in FY93. This team came about as the direct result of surveys conducted by the district chiefs and the Branch of Instrumentation. These surveys indicated a perception that documentation was difficult to follow, sometimes incomplete or out of date, and sometimes nonexistent. The team determined which equipment was documented and which was undocumented and then polled a sampling of USGS employees working in hydrologic surveillance or data sections in connection with documented equipment. Those surveyed were asked to evaluate the documentation relative to specific criteria. The team's final report included recommendations for improving content and coverage of documentation and for making documentation more widely available. The team emphasized the need for documentation to be considered an integral part of the acquisition and distribution of all new equipment supplied or supported by the HIF. In response to the team's efforts, the HIF committed itself to providing more "user-friendly" documentation.

**Instrumentation Catalog Team.**—The Instrumentation Catalog Team is ongoing. This team consolidated the efforts of many members of the HIF staff into a single publication, the WRD Instrumentation Catalog. Working closely with HIF-CSS II development personnel, the team saw the catalog brought online as of the end of the FY93. The team is writing a quality assurance procedure that will ensure that the catalog is kept up to date. The team will submit its final report in FY94 and turn over responsibility for completion of a print version of the catalog to the Publications Unit.

**Bar Code Team.**—The Bar Code Team was initially chartered to oversee the implementation of a bar-coding system at the HIF, but the team's charter has been expanded to encompass involvement in bar-code implementation for the division. The team has completed specifications, justifications, and statements of work in support of both efforts. The team was on standby as of the end of FY93 pending notification from the National Committee that the contract has been awarded.

**Warehouse Procurement Team.**—The Warehouse Procurement Team was chartered at the recommendation of the Technical Coordination Group to streamline the existing procurement process. This team, as its starting point, documented the existing procurement process. The team then evaluated that process and developed proposed revisions to it using a hybrid value added/deployment flowchart technique. The final report, which will be submitted early in FY94, will propose a revised Quality Assurance Procedure covering the procurement process.

### **QIC Coordinator**

During FY93, the QIC Coordinator made arrangements for training in the areas of team dynamics and deployment flowcharting. Two 3-hour sessions on both topics were presented. All HIF employees were encouraged to attend. The Coordinator provided "just-in-time" training for teams as needed and served as facilitator for the Warehouse Procurement Team, the Catalog Team, and the Bar Code Team.

The QIC Coordinator began the flowcharting of HIF organizational processes. Initial efforts focused on warehouse processes. These flowcharts are incorporated into the Quality Assurance Procedures as they are completed.

The Coordinator attended the QIC Coordinator's Meeting held February 21-March 1, 1993, in Albuquerque, New Mexico. She also attended training in Customer Satisfaction and Quality Measurement on March 8 and 9, 1993, in New Orleans, Louisiana.

### **Customer Relations**

The third element of the HIF's quality assurance program is a focused customer orientation. In this connection, a Customer Relations Group was formed to ensure that all efforts at the HIF are driven by a desire to serve its customers. This team is made up of section supervisors and other senior HIF personnel. This team has met weekly since its founding and will continue to do so into the new year. During FY93, the team's objectives were as follows:

- To implement a consistent method of conducting town meetings with district offices.
- To capture the data collected as a result of these town meetings to maintain the necessary focus to better service customer needs.

- To place more focus on districts where there has been limited HIF contact.
- To analyze audits conducted on HIF's customers. As an example, the Second Annual Survey of USGS customers has recently been received. The audit is being studied. A briefing of all HIF personnel concerning the results of this audit will be conducted by this team during the first months of fiscal year 1994.
- To explore new methods of promoting HIF's services by making them more widely known.
- To correct any problems identified as a result of customer complaints.
- The Safety Office of NASA, HIF's host agency, conducted an audit of HIF's safety program. This was the first comprehensive audit of the HIF to be conducted by the host safety office. No significant findings were identified. Several positive comments were made concerning the overall execution of HIF's safety program.
- There was no lost duty time reported as a result of injuries during this fiscal year.
- A chemical hygiene plan was developed, written, and implemented. This plan received favorable comments during a host site chemical hygiene audit.

## **SAFETY**

Safety is an ongoing concern at the HIF. It is the policy of the HIF to comply with the safety and health standards of the Occupational Safety and Health Act of 1970. Management takes those standards seriously and makes every attempt to ensure safe and healthful working conditions for all HIF employees. The HIF strives to maintain a work environment that is free of recognized hazards and to promote the safety and well-being of its employees. The safety program provides a framework for employing safe practices and maintaining safe conditions in every HIF activity.

During FY93, activities focusing on employee safety included the following:

- Quarterly assessments of HIF's radiation safety program were conducted with no significant areas of concern being noted.
- As a result of the phaseout of the Borehole Project, all remaining well-reconnaissance parts and some generic spare parts were distributed to WRD logger operators.
- Management curtailed plans for disposal of radioactive sources until further notice. This does not preclude individual district offices from contracting to dispose of sources currently in their possession. The HIF is still accepting any sources left in the districts where proof can be offered that the sources originated from the HIF.
- The Safety Officer attended the meetings of and otherwise participated in the activities of the following safety councils to maintain proficiency and update skills.
  - SSC Safety and Health Council
  - Gulf Coast Area Safety Council
  - Department of the Interior Safety Council

## **FIELD COORDINATION**

Coordination of HIF programs and activities for field personnel is the responsibility of the HIF Field Coordinator. The major duties of the Field Coordinator are to provide assistance and technical support to the field and to provide training in the applications, operation, and maintenance of field instrumentation.

### **Field Assistance**

During FY93, the HIF received 1,376 requests for assistance in the application and support of field instrumentation. About one man-year of effort, contributed by the Field Coordinator and personnel of the Applications and Development, Test and Evaluation, and Field Service and Supply Sections, was expended in responding to these requests. More than 25 percent, or 366, of these inquiries, came from six districts—California, 95; Colorado, 64; Florida, 63; Nevada, 48;

New York, 48; and Washington, 48. Assistance was provided in the following categories.

Category	Number of requests	Percent of effort
Data logger/sensor systems	115	8
Miscellaneous instrumentation	421	31
Availability of warehouse item	713	52
Pressure sensor systems	96	7
Ultrasonic velocity meters	31	2

### Technical support

The Field Coordinator contacts field personnel who order data-logger systems from the HIF to ensure that the systems ordered are suitable for the intended applications and to determine whether technical support is needed. The Field Coordinator is also a member of the System Applications Team that devises instrumentation systems and instrumentation programs for district or projects that need assistance.

### Training

The Field Coordinator organized or otherwise participated in the following HIF-sponsored instrumentation workshops and training courses:

- Basic Electronics (Madison, Wisconsin)
- Basic Data Recording Systems (National Training Center, Denver, Colorado)
- Operation and Maintenance of Ultrasonic Velocity Metering Systems (HIF)
- Basic Electronics and Troubleshooting Hydrologic Instrumentation (HIF)
- Campbell CR10 and Personal Field Computer (HIF and National Training Center, Denver, Colorado)
- Basic Data Recorders and CR10 data loggers (Raleigh, North Carolina)
- Voltage Surge Protection Seminar by Phoenix Contact, Inc. (HIF)
- Western Region Technicians Advisory Committee Meeting (HIF)

### ADMINISTRATIVE SECTION

The Administrative Section is responsible for the formulation and execution of the budget, accounting, procurement, personnel, and office management necessary to support the operating needs of the HIF

and Office of Surface Water Programs at SSC. The AS staff consists of nine employees: an administrative officer, a budget analyst, two accounting technicians, an administrative technician, two purchasing agents, a management and program analyst, and an office automation clerk.

In fiscal year 1993, the AS staff administered a budget of approximately \$8.6 million. Much of this budget was generated as income to the Field Service and Supply Section, by the Analog-to-Digital Recorder Rental Program, the Water-Quality Monitor Program, and the Special Equipment Rental Program in the form of fees charged for services rendered, goods supplied, and equipment leased to WRD projects. ADS and TES operated with direct Federal program funding. Support of the Administrative Section was funded by assessment of the operating sections.

Approximately six thousand documents were transmitted through AS for verification, processing, and monitoring. In addition, the AS staff processed about four hundred documents for the Office of Surface Water programs at SSC.

In FY93, AS procured supplies and services totaling \$4,387,211 as listed below:

Procurements submitted to Procurement and Contracts .....	14	totaling	\$ 611,000
Procurements processed at HIF .....	1,053	totaling	\$3,726,000
Type A laptop computer accessories .....	2	totaling	\$ 237
Hand-held field computer .....	10	totaling	\$ 49,974

The AS provided administrative support for approximately 50 full-time employees, 4 part-time employees, and 2 intermittent employees. Seventy-eight personnel actions for these employees were processed by AS during the year. Support included training documentation for HIF employees who attended 59 training courses and job-related college-credit courses.

### TECHNICAL SERVICES SECTION

The Technical Services Section provides in-house technical support to other HIF sections. Drafting and graphics services are provided to create and maintain engineering drawings of WRD equipment. A computerized file of specifications for WRD equipment is maintained, and specifications for existing equipment are written. Assistance in the preparation of

specifications is provided to the HIF staff during product development. Computer operation and support is provided in programming, training, and user assistance. Editorial assistance is provided in the preparation of all HIF publications. The TSS staff was augmented by contractor support in drafting and computer operations.

## **Engineering Documentation**

The Drafting Unit completed 225 new drawings in FY93. The unit also completed 50 work requests received during the year and 14 engineering change requests (ECR's) received. The microfilm drawing file and the index of drawings were routinely updated throughout the year as new or revised drawings were completed. The unit filled requests for copies of drawings and artwork, distributing 1,790 copies. Unit personnel created 35 new pieces of artwork to replace photographs of WRD field equipment in the WRD Instrument Catalog. This artwork consisted of three-dimensional and exploded three-dimensional artwork. There were 95 new drawing packages completed; about one thousand drawings were converted to metric equivalents.

## **Computer Support**

Computer support for the HIF's 40 personal computers, 38 workstations, local area network, and Prime minicomputer was provided throughout the year. The section installed six additional workstations with software applications ranging from FrameMaker to INGRES. HIF-CSS II, the new DIS-II version of HIF-CSS has been completed and distributed to all sites.

## **Publications**

The Publications Unit provided editorial support to the HIF staff throughout the year. During the year, two open-file reports were completed, three more were in process, and two others were reprinted to fill orders placed through the HIF warehouse. The unit also processed three technical information sheets, seven abstracts, five in-house reports, and four issues of the *WRD Instrument News*. The Publications Unit also provided limited editorial assistance to Office of Sur-

face Water (OSW) personnel with three open-file reports and one abstract.

## **APPLICATIONS AND DEVELOPMENT SECTION**

The Applications and Development Section is the WRD's principal engineering resource for developing, acquiring, and providing application support for field instrumentation and related software. With a staff of six scientists and engineers and four technicians, the section has a capability in surface-water hydrology, hydrometeorology, electrical and mechanical engineering, computer science, and technical support. The section's capabilities are augmented with contractor support in computer science.

The section coordinates the HIF field assistance and technical support program and provides the primary engineering and technical resources needed to conduct the program. The objective of the program is to provide direct support to the field in areas such as locating and procuring instruments, assembling and programming data-collection systems, and solving application problems. The program also includes a variety of instrument training courses. About half of the section's human resources were committed to this program.

The section is responsible for providing new instruments and software products for use by the WRD in its hydrologic data-collection program. In pursuing this objective, the staff performs a variety of activities, including searching the market for products, investigating the potential for application of those that are found, working with vendors to modify products, conducting contract developments, and, if necessary, performing in-house developments. In the case of products that are developed in-house, every effort is made to make the technology available to industry.

## **Fiscal Year 1993 Project Highlights**

ADS provided technical assistance and support to field personnel. These activities included assembling and programming operational systems, assisting in the application and use of instruments and software, and assisting in locating and procuring products. The section also established and administered division-level procurement contracts for hand-held computers.

A version of the personal field computer (PFC) software for use in hand-held computers was

developed and released. This software provides support for the operation of CR10, BDR 301, ESC 80, and SM192 data loggers and for the transfer of data files between the hand-held computer and PC, Prime, and DG computer systems.

The section conducted market searches for products to be used as replacements for bubble-gage manometers, ADR's, and R200 downhole recorders.

Contracts were completed for the development of an SDI-12 interface testing and verification instrument and for the modification of the broad-band acoustic Doppler current profiler to improve shallow-water operation.

ADS organized and conducted training courses dealing with basic data recorders, CR10 data loggers, ultrasonic velocity meters, and operation and troubleshooting of hydrologic instrumentation. The courses were held at the HIF, NTC, and district offices.

A prototype interface was developed for converting SDI-12 sensor outputs to incremental encoder signals. The interface is intended primarily for use with NWS LARC data recorders but can also be used with a variety of non-SDI data-collection platforms.

Literature was assembled on a variety of instrument products. This literature was distributed to the field and assistance in procuring instruments provided.

## Project Status

Of 17 continuing projects in the Applications and Development Section, 7 were active in fiscal year 1993. Brief descriptions of all open projects are listed in table 1, and accomplishments during the year and plans for FY94 are described in the project summaries that follow.

### Current Meter Technical Support

**PROJECT NUMBER.**—ADS78-001.

**OBJECTIVE.**—To provide technical support to the Office of Surface Water (OSW) current-meter study and to perform other tasks related to current-meter technology.

**RESULTS OF FY93.**—No support requested by OSW current-meter study. Article describing the low-velocity current-meter swivel and providing details on its commercial source was prepared for inclusion in the *WRD Instrument News*.

**PLANS FOR FY94.**—No support requested from the OSW current-meter study for more than a

**Table 1.** Applications and Development Section projects continuing in fiscal year 1993

[L, low; M, medium; H, high]

Number	Name	Chief	Priority	Period
78-001	Current-meter technical support	Futrell	L	Oct. 1980 to Jan. 1993
78-005	Evapotranspiration instrumentation	Sturrock	M	Oct. 1978 and continuing
81-014	Ultrasonic velocity meter (UVM)	Futrell	H	Jan. 1981 and continuing
84-032	R200 downhole recorder	Johnson	M	July 1984 to Oct. 1993
87-041	Personal field computer (PFC)	Henry	H	Jan. 1987 to Oct. 1994
87-042	Basic data recorder systems	Billings	H	July 1987 to Oct. 1993
90-001	Plastic float wheel	Jelinski	H	Oct. 1989 to Oct. 1993
90-004	Hydrologic Benchmark Program	Sturrock	L	Oct. 1989 to Oct. 1993
91-002	Acoustic Doppler instrumentation	Henry	M	Oct. 1990 to Apr. 1994
91-003	Bank-operated cableway	Jelinski	M	Apr. 1991 to Apr. 1994
91-004	ADR replacement systems	Henry	H	July 1991 to Oct. 1994
91-005	Static tube for pressure sensors	Futrell	H	Oct. 1991 to Oct. 1992
92-001	Cable-car improvements	Jelinski	H	Apr. 1992 to Apr. 1995
92-003	Commercial product utilization and support	Henry	H	Apr. 1992 and continuing
93-001	Conductivity-temperature system	Johnson	H	Oct. 1993 to Oct. 1994
93-002	Pressure sensor procurement	Henry	H	Oct. 1992 to Oct. 1993
93-003	LARC interface device (LID)	Johnson	H	Nov. 1992 to Oct. 1994

year and no further requests anticipated. Project was complete as of January 1993.

### Evapotranspiration Instrumentation

**PROJECT NUMBER.**—ADS78-005.

**OBJECTIVE.**—To develop and update instrumentation used to determine evaporation losses from lakes and vegetated surfaces.

**RESULTS OF FY93.**—Completed anemometer calibrations for lake evaporation study sites in Nebraska, North Dakota, and Florida districts. Published two reports on energy budget evaporation from

Williams Lake, Minnesota, in the *Water Resources Research Journal*. Completed a report on empirical methods to determine evaporation (third in this series). Completed analysis of data from Hubbard Brook, New Hampshire, for 1982 through 1987. Completed the preliminary analysis of data from Cottonwood Lake, North Dakota, for 1982 through 1987.

**PLANS FOR FY94.**—Test two rain gages, an Australian 8-inch-diameter tipping-bucket-type gage with a unique siphon and an American 12-inch-diameter weighing-type gage using a transducer, and compare results to standard gage catches at a selected site. Evaluate an aspirated radiation shield (powered by a 12-volt direct-current battery) housing a Rotronics psychrometer in comparison with other aspirated and nonaspirated units. Provide continuing technical support to ongoing and proposed studies.

### Ultrasonic Velocity Meter

**PROJECT NUMBER.**—ADS81-014.

**OBJECTIVE.**—To provide technical support to the WRD in establishing an operational data-collection capability based on the ultrasonic time-of-travel measurement technique.

**RESULTS OF FY93.**—Participated in a user effort to define requirements for processing ultrasonic velocity meter (UVM)-system data records; provided a PC-based preprocessor program that will be used on an interim basis until suitable facilities are included in ADAPS II. Coordinated field evaluations of responder kits for UVM 7300's; released the kits for operational use. Performed initial testing of an AFFRA flowmeter and worked with the vendor to upgrade the packaging of the system. Conducted two UVM training courses and provided operational support to the field.

**PLANS FOR FY94.**—Continue to provide software support to the UVM data-processing requirements study and operational support to the field. Continue the UVM training program. Organize and coordinate field evaluations of the AFFRA flowmeter.

### Downhole Recorder

**PROJECT NUMBER.**—ADS84-032.

**OBJECTIVE.**—To search for commercial products that can be used in 2-inch wells to measure and record water-level data and evaluate those products that appear to be suitable replacements for the R200 recorder.

**RESULTS OF FY93.**—Located several down-hole recorder systems and reported results to the Instrument Committee, which recommended a testing program to determine suitability of one or more of the products.

**PLANS FOR FY94.**—Transfer product testing responsibilities to TES. Project complete as of October 1993.

### Personal Field Computer

**PROJECT NUMBER.**—ADS87-041.

**OBJECTIVE.**—To provide field computers and software with which technicians can service the variety of data recorders and transmission systems used in the WRD's evolving data-collection network.

**RESULTS OF FY93.**—Modified an existing contract for hand-held computers to include a standard PCMCIA memory-card interface. Tested prototypes of the modified product. Sent information to the field describing the product and providing ordering instructions. Developed and released a personal field computer (PFC) program for the hand-held computer that provides support for standard data loggers (CR10, BDR 301, BDR 320, ESC 80, 21X, SM192) and includes utilities for file handling and file transfer to and from Prime, Data General, and PC computers.

**PLANS FOR FY94.**—Process orders for hand-held computers. Develop a plot utility for the PFC program that works with nonstandard data files. Revise and release the laptop and hand-held versions of the PFC program with the new plot utility.

### Basic Data Recorder (BDR) Systems

**PROJECT NUMBER.**—ADS87-042.

**OBJECTIVE.**—To acquire electronic data recorders that are suitable for replacing ADR's in applications other than simple stage data-collection systems.

**RESULTS OF FY93.**—Received and tested prototype units of a memory-module enhancement for the ESC 80 data recorder. Initiated a long-term program to modify the HIF stock of BDR 301 data loggers.

**PLANS FOR FY94.**—Project complete as of October 1993.

## Plastic Float Wheel

**PROJECT NUMBER.**—ADS90-001.

**OBJECTIVE.**—To develop and test a one-piece plastic design that can be used as a future replacement for metal float wheels.

**RESULTS OF FY93.**—Completed a manufacturing contract for a moderate quantity of prototype plastic float wheels.

**PLANS FOR FY94.**—Perform engineering tests and complete manufacturing drawings of the prototype units. Transfer the units to TES for long-term field evaluation.

## Hydrologic Benchmark Program

**PROJECT NUMBER.**—ADS90-004.

**OBJECTIVE.**—To provide support in the acquisition, testing, and calibration of instrumentation to be used in upgrading hydrologic benchmark sites.

**RESULTS OF FY93.**—All equipment readied and made available. No installations scheduled during the year by Headquarters.

**PLANS FOR FY94.**—Transfer all property to Benchmark Project personnel. Project terminated as of October 1993.

## Acoustic Doppler Instrumentation

**PROJECT NUMBER.**—ADS91-002.

**OBJECTIVE.**—To provide technical support to the WRD in establishing an operational capability for collecting current profiles and making real-time measurements of discharge using acoustic Doppler technology.

**RESULTS OF FY93.**—Provided the prototype broad-band acoustic Doppler current profiler (BBADCP) for evaluation by several districts throughout the year. Completed modifications (by contract) to enhance the system's shallow-water performance.

**PLANS FOR FY94.**—Continue field evaluations and provide technical support as required.

## Bank-Operated Cableway

**PROJECT NUMBER.**—ADS91-003.

**OBJECTIVE.**—To develop a portable cableway reel and meter-sampler carrier that can be operated remotely from the stream bank and deliver one prototype system to the North Carolina District.

**RESULTS OF FY93.**—Conducted preliminary evaluations of an engineering model of the reel/carrier

at a field site. Revised the design to correct deficiencies noted during the evaluation. Began fabrication of a prototype system.

**PLANS FOR FY94.**—Complete fabrication of the prototype system. Conduct engineering tests of the prototype and perform final design modifications as necessary. Furnish the prototype system to the North Carolina District for extended field evaluation.

## ADR Replacement Systems

**PROJECT NUMBER.**—ADS91-004.

**OBJECTIVE.**—To identify commercial products that could serve as replacements for ADR-based stage-measurement systems in warm- and cold-weather environments and test those that are considered viable, cost-effective alternatives.

**RESULTS OF FY93.**—Completed tests of five candidate products and published a report of the results in the *WRD Instrument News*. Initiated a systems engineering effort to add an ADR-replacement system to the HIF equipment rental program. The system, which is based on a modified version of one of the products tested, comprises a data logger and a companion shaft encoder that collects and stores fixed-interval records of stage data. The data logger is programmed through a panel-mounted keypad and display, and the data are stored in a removable, nonvolatile memory card. The system is packaged in a hermetically sealed enclosure and has the footprint and input-shaft hardware configuration of an ADR.

**PLANS FOR FY94.**—Purchase the initial order of equipment and evaluate the modifications performed by the vendor. Develop software for use in Data General and IBM-compatible computers to retrieve data from the memory cards and convert to ADAPS standard format. Prepare a user manual for the system.

## Static Tube for Pressure Sensors

**PROJECT NUMBER.**—ADS91-005.

**OBJECTIVE.**—To develop a device that can house a variety of submersible pressure transducer types and will eliminate pressure measurement errors induced by flow velocity.

**RESULTS OF FY93.**—Report on test of design concept that utilizes a galvanized pipe and the standard crest-stage gage cap completed by OSW. Design Analysis Associates (DAA) H300 and Druck sensors successfully used with the device. Results indicate that

the device works well in flow conditions up to about 8 feet per second.

**PLANS FOR FY94.**—Project complete as of October 1992.

#### **Cable-Car Improvements**

**PROJECT NUMBER.**—ADS92-001.

**OBJECTIVE.**—To improve the performance and safety of cable cars, specifically with respect to braking, load capacity (up to 2,500 pounds), and the potential for accidents caused by snagged cables.

**RESULTS OF FY93.**—Performed production engineering on a brake designed for use with cable cars by the Idaho District. Fabricated a model of the brake and completed evaluations of the model at the Sandpoint, Idaho, office.

**PLANS FOR FY94.**—Revise the design of the brake to reflect the results of the field evaluation, complete the manufacturing drawings, produce a quantity of prototypes, and initiate a field evaluation of the prototypes at several districts. Perform an analysis of the load-bearing capability of cable cars and provide a report of the results and recommendations to the Instrument Committee.

#### **Commercial Product Utilization and Support**

**PROJECT NUMBER.**—ADS92-003.

**OBJECTIVE.**—To inform districts of the variety of available commercial products and assist them in selecting and purchasing those that meet their needs.

**RESULTS OF FY93.**—Assembled notebooks with pricing and technical literature for a variety of products, distributed them to WRD Instrument Coordinators, and furnished updated information for the notebooks. Provided information and procurement support in response to several hundred field requests. Served as technical liaison between the HIF and the Office of Procurement and Contracts regarding procurement of instrumentation products.

**PLANS FOR FY94.**—Update product notebooks. Continue to provide information and procurement support to the field. Continue to serve as technical liaison between the HIF and the Office of Procurement and Contracts regarding the procurement of instrumentation products.

#### **Conductivity-Temperature System**

**PROJECT NUMBER.**—ADS93-001.

**OBJECTIVE.**—To provide a two-parameter water-quality system that utilizes the minimonitor conductivity and temperature probes and operates directly with electronic data loggers (EDL's) and data-collection platforms (DCP's), to package the system in a small rectangular case, and to allow the probes to be connected individually using cables up to several hundred feet long.

**RESULTS OF FY93.**—Analyzed the minimonitor conductivity and temperature circuits and prepared a design concept for the two-parameter implementation that uses the existing minimonitor probes and provides 0- to 5-volt analog signal outputs compatible with standard analog sensor inputs on EDL's and DCP's.

**PLANS FOR FY94.**—Complete the two-parameter design and fabricate several prototypes. Verify the design through laboratory tests of the prototypes. Initiate field evaluations of the prototypes. Prepare drawings to support the manufacture of the system.

#### **Pressure Sensor Procurement**

**PROJECT NUMBER.**—ADS93-002.

**OBJECTIVE.**—To establish a contract for stocking the HIF warehouse with pressure sensors to fulfill the demand for manometer replacement equipment. Procurement to be aimed toward existing commercial products that fully meet the essential performance requirements for the PS-2 pressure sensor, modified in accordance with OSW's revised goal for stage-measurement accuracy.

**RESULTS OF FY93.**—Prepared specifications and test plan, and submitted a procurement requisition. Received and evaluated proposals. Because no proposal met all requirements for technical performance, commerciality, and price, solicitation was terminated prior to award.

**PLANS FOR FY94.**—This project terminated as of October 1993.

#### **LARC Interface Device (LID)**

**PROJECT NUMBER.**—ADS93-003.

**OBJECTIVE.**—To develop an interim interface that converts SDI-12 sensor outputs to incremental encoder signals suitable for input to the LARC recorder used by the National Weather Service and,

optionally, to a mechanical output capable of driving a strip-chart recorder.

**RESULTS OF FY93.**—Completed design of the interface, without the mechanical output option, and initiated fabrication of 20 prototypes. Tested the design with a variety of SDI sensors, the NWS LARC, and non-SDI DCP's. Optional mechanical output eliminated from the design owing to the availability of a commercial SDI/mechanical interface.

**PLANS FOR FY94.**—Complete fabrication of the prototypes and have them tested to verify the suitability of the design. Initiate a field evaluation program at several joint USGS/NWS data-collection sites.

## TEST AND EVALUATION SECTION

The Test and Evaluation Section (TES) provides instrument test and evaluation services to the HIF and WRD. With a staff of three engineers, three technicians, and a computer assistant, the section has experience and knowledge in the areas of hydrologic data collection, organic chemistry, water-quality testing, electrical engineering, and instrumentation tests and calibration. The section's capabilities are augmented with contractor support for tests and by direct access to the National Aeronautics and Space Administration's Standards and Calibration Laboratory located near the HIF.

The section recommends minimum performance standards for instrumentation to ensure that WRD data-collection requirements are met and that legal and scientific credibility continues. TES recommends acceptance standards, develops quality-control procedures and test procedures for procurement actions, and works closely with Survey offices and other Federal agencies to ensure that the evaluation criteria and calibration procedures used are in compliance with all applicable legal and operational requirements. TES provides quality-control acceptance-test services for all items stocked by the HIF warehouse and items repaired or modified by HIF shops.

TES designs and conducts engineering tests and analyses of commercial hydrologic instrumentation. Tests have been conducted on a variety of products, and the results are published in the *WRD Instrument News*, *Instruments continuum*, and the HIF's computer data base. All WRD offices are encouraged to check with HIF if procurement of unfamiliar instrumentation is being considered. In addition to information about the products tested at the HIF, TES may also be able to pass on information regarding the experience of other

Federal agencies. WRD offices are encouraged to pass on information to TES regarding their experience with new commercial instrumentation.

Neither TES nor the HIF approves commercially available products for WRD use. TES conducts the necessary testing programs to determine whether the products meet their stated specifications. The resultant test data are disseminated throughout WRD so personnel and technical offices can judge whether the products meet their needs. The technical offices have the oversight responsibility for ensuring that the instrumentation used for water-resources data collection performs to the accuracy, precision, and resolution required by WRD.

## Fiscal Year 1993 Project Highlights

TES conducted acceptance tests on 246 new item shipments received by the warehouse. This is about one hundred more tests than in an average year and 38 more than last year. Approximately 87 percent of all 1993 shipments passed all HIF requirements.

A number of commercial products were tested to determine that WRD and HIF operational requirements were met. Laboratory tests were conducted on new SDI-12 products: data-collection platforms, data loggers, and water-quality monitors. Laboratory tests were conducted on a single-channel water-level recorder, four different water-level sensors, four pH meters, five conductivity meters, five dissolved oxygen (DO) meters, two nonglass pH electrode systems, and prototype DO sensors and new pH electrodes for the USGS water-quality monitor.

Ten used Price type AA and Pygmy meters were recalled from district offices for inspection and calibration as part of the Office of Surface Water and HIF QA program. This meter recall program helps establish the reliability of meters used by WRD.

Forty-two instruments and sensors were calibrated for the Yucca Mountain Project (YMP).

Field tests were conducted at two sites in the Iowa District for the Fluid Data Systems WaterGages I and II balanced-beam manometers, Design Analysis Associates H300 SDI-12 submersible pressure transducer, PS-2 Paroscientific nonsubmersible pressure transducer, and STACOM manometer.

## Project Status

There were seven continuing projects in the Test and Evaluation Section in fiscal year 1993. Brief descriptions of these projects are listed in table 2, and accomplishments during the year and plans for fiscal year 1994 are described in the project summaries that follow.

### Quality Control of Warehouse Procurements

**PROJECT NUMBER.**—TES79-5410A.

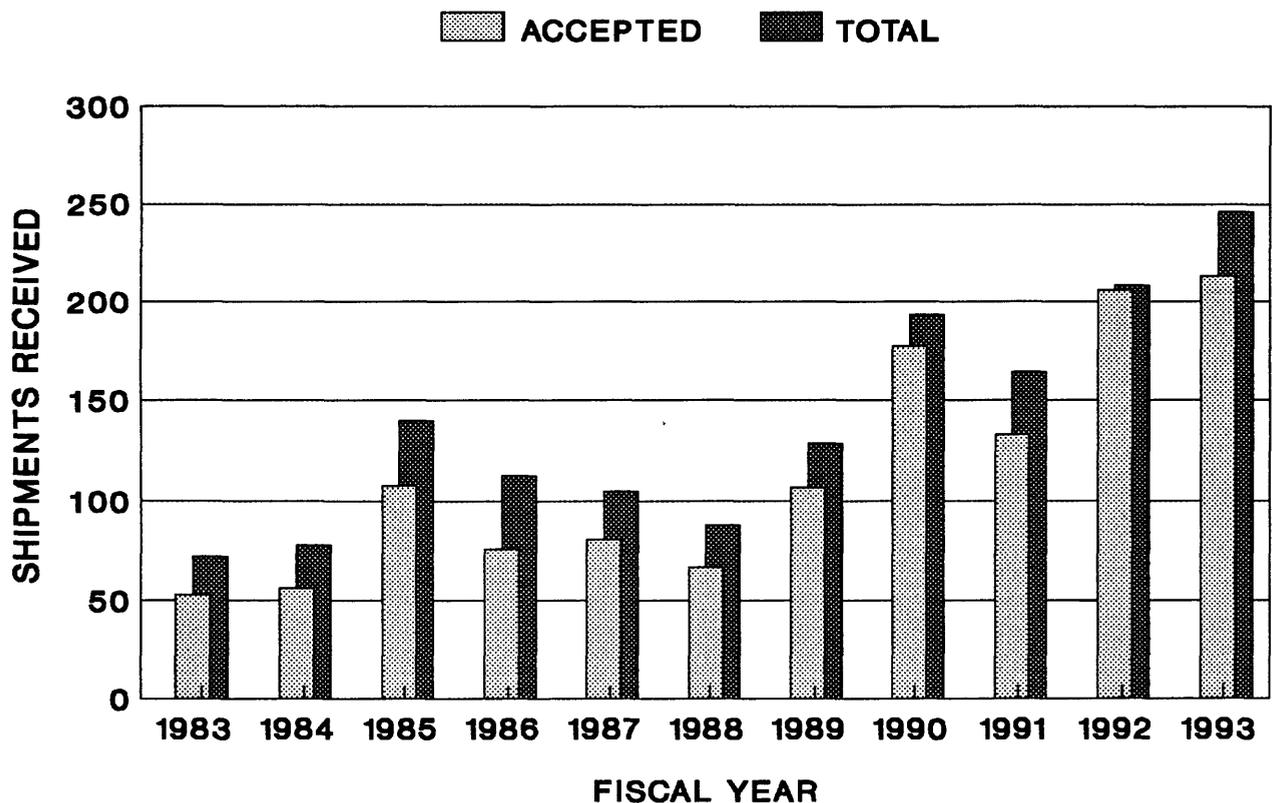
**OBJECTIVE.**—To ensure that WRD-purchased instruments meet all contract specifications and that in-house assembled, fabricated, and repaired equipment meets WRD specifications before being stocked in the warehouse.

**RESULTS OF FY93.**— Accepted 213, or 87 percent, of the 246 shipments received and tested last year. (Compares to acceptance of 83 percent of 1,536 shipments during preceding 11 years as shown in figure 2.) Made arrangements for the OSW hydraulics laboratory to calibrate, in the condition received, 10 used Price type AA and Pygmy meters, which were returned in conjunction with the OSW district reviews;

**Table 2.** Test and Evaluation Section projects continuing in fiscal year 1993

Number	Name	Chief	Period
79-5410A	Quality control of HIF warehouse procurements	Olive Potter	July 1979 and continuing
79-5410B	Test and evaluation of hydrologic instrumentation	Potter	July 1979 and continuing
87-5413D	Ground-water sampler testing	Tai	March 1987 and continuing
88-5413A	Hazardous-waste instrumentation support	Tai	Oct. 1987 and continuing
89-5410A	Yucca Mountain Project	Treadway Toney	March 1989 and continuing
89-5413B	Submersible water-quality monitor tests	Tai	June 1989 and continuing
91-5413A	Water-quality meters and sensors tests	Tai Garcia	Jan. 1991 and continuing

inspected and rebuilt the meters. This meter recall program helps establish the reliability of current meters used by WRD.



**Figure 2.** Results of 1983 to 1993 acceptance tests of shipments received by the HIF warehouse.

**PLANS FOR FY94.**—Test all shipments of new and repaired items received in the warehouse. Support the meter recall program. Assist in the teaching of various HIF training courses.

### **Test and Evaluation of Hydrologic Instrumentation**

**PROJECT NUMBER.**—TES79-5410B.

**OBJECTIVE.**—To test new commercial products to determine whether WRD and HIF operational requirements are met.

**RESULTS OF FY93.**—Completed laboratory tests of the Lundahl ultrasonic stage sensor, Hydrologic model Limnimeter LPN 8/3 CD nonsubmersible pressure transducer with an air pump, Stevens A/F single-channel water-level recorder, and Sensotec submersible pressure transducers. Conducted joint district-HIF field tests in Iowa District for the Fluid Data System WaterGages I and II balanced-beam manometers, Design Analysis Associates H300 SDI-12 submersible pressure transducer, PS-2 Paroscientific nonsubmersible pressure transducer, and STACOM manometer.

**PLANS FOR FY94.**—Complete the field comparison tests in Iowa of the PS-2, WaterGages I and II, STACOM manometer, Design Analysis model 300. Release the Iowa field test results in a *WRD Instrument News* article. Continue comparison field tests of the Design Analysis model 350 and PS-2 at two sites and begin tests at eight other sites throughout the USA. Conduct laboratory and field tests of the Sutron Accubar nonsubmersible SDI-12 pressure transducer. The Accubar will be added to these 10 field test sites in December. TES will test and evaluate new commercial products that appear to be direct replacements for manometers, including tests of new submersible and nonsubmersible pressure transducers and acoustic transducers.

### **Ground-Water Sampler Testing**

**PROJECT NUMBER.**—TES87-5413D.

**OBJECTIVE.**—To perform comparative tests of various samplers to determine the effectiveness of water-sample collections of volatile organic compounds (VOC's).

**RESULTS OF FY93.**—Having assisted the Indiana District and EPA Region 5 (Chicago) with the evaluation of ground-water samplers in May and September 1992, completed the summary test report of the eight samplers, sent it to EPA and the Indiana District,

and released the results in the *WRD Instrument News*, December 1992 issue. Reviewed EPA's final draft article for journal publication.

Presented the test results of the Grundfos pump and the Solinst VOC trap samplers at the National Groundwater Symposium in November 1992. Exhibited HIF's hazardous-waste equipment at the USGS/Defense Environmental Contamination meeting in Las Vegas, Nevada, in August 1993. Provided an instructor for the National Training Center's course on Sampling and Analysis of Organic Contaminants in Surface and Ground Water.

**PLANS FOR FY94.**—Continue testing commercially available samplers and prepare a report on those tests.

### **Hazardous-Waste Instrumentation Support**

**PROJECT NUMBER.**—TES88-5413A.

**OBJECTIVE.**—To support HIF's hazardous-waste instrumentation rental program.

**RESULTS OF FY93.**—Stocked instrumentation for the hazardous-waste program, including, as of the end of the year, eight HNU photoionization analyzers, seven Foxboro OVA-128 meters, one Photovac GC with capillary column and oven, one Jerome model 431-X mercury vapor analyzer, one Photovac Microtip model HL2000 VOC detector, and one HNU model DL-101 photoionization analyzer. Serviced these instruments routinely and rented them to WRD district offices.

**PLANS FOR FY94.**—Continue instrumentation support for the hazardous-waste program.

### **Yucca Mountain Project**

**PROJECT NUMBER.**—TES89-5410A.

**OBJECTIVE.**—To provide the Nevada Nuclear Waste Storage Yucca Mountain Project the required National Institute of Standards and Technology (NIST)-traceable calibration and test support.

**RESULTS OF FY93.**—Calibrated 42 instruments and sensors and returned them to YMP.

**PLANS FOR FY94.**—Provide calibration and test support for YMP, the Nevada District, and all districts that request NIST-traceable calibrations and products.

## Submersible Water-Quality Monitor Tests

**PROJECT NUMBER.**—TES89-5413B.

**OBJECTIVE.**—To test commercially available water-quality monitors to confirm that they meet manufacturer's specifications and to evaluate the effectiveness of calibration and data handling.

**RESULTS OF FY93.**—Completed the field test of the H20 with flowthrough cell in the Ohio district; results to be reported in the December 1993 issue of *WRD Instrument News*. Assisted in the purchase of 10 Hydrolab model H20 monitors and three Data Sonde 3 monitor-logger systems after successful completion of laboratory and field tests, which are now rented by the HIF to WRD offices; supported WRD customers by performing routine maintenance and acceptance tests of the units before they were shipped to users and by providing monitor configuration and operation information. Tested four Royce self-cleaning DO meters in the laboratory; found problems in all the Royce units, which were returned to the manufacturer for repair and modification on three occasions; laboratory tests to be completed when units are returned. Considered possible replacements for the Innovative sensors now in use with the water-quality minimonitor; selected and tested Sensorex and Royce pH sensors with BNC connectors that allow quick installation of a sensor tip at the gaging station as compared with existing sensors that require the whole sensor and cable to be returned to the HIF for replacement. Identified Sensorex pH sensor as the more reliable replacement candidate and continued field tests in the Ohio and Texas Districts. Evaluated one YSI model 3800 water-quality monitor-logger system in the laboratory and in a brief field test.

**PLANS FOR FY94.**—Test the YSI-6000 series submersible water-quality monitor systems, complete the Sensorex pH sensor field tests, and provide support for the H20 monitors. Assist in teaching the water quality monitor course at the HIF in April 1994.

## Water-Quality Meters Tests

**PROJECT NUMBER.**—TES91-5413A.

**OBJECTIVE.**—To test and evaluate commercial water-quality meters and sensors for field measurements of conductivity, pH, DO, temperature, and turbidity for general field use, and especially for the NAWQA and Hazardous-Waste Programs.

**RESULTS OF FY93.**—Tested two Cole-Parmer model 90201-10 digital thermometers in the laboratory and found them to meet the manufacturer's speci-

fications. Reported the results in the QW Talk continuum and in the September 1993 *WRD Instrument News*. Evaluated two models of nonglass electrode pH systems—the Sentron 2001 and the Unifet UF100. Released the test report in the QW Talk continuum and in the March 1993 *WRD Instrument News*. Selected and tested five models of portable hand-held DO meters—the YSI models 50 and 55, the Orion models 820 and 840, and the Hanna model 9145. Reported the results in the September 1993 *WRD Instrument News*.

**PLANS FOR FY94.**—Select and test a group of commercially available turbidimeters and nonmercury thermometers.

## FIELD SERVICE AND SUPPLY SECTION

The Field Service and Supply Section operates the warehouse, provides electronic and mechanical repair and calibration services, initiates procurement actions to purchase warehouse stock, monitors contracts, fills orders, and serves as technical liaison with the districts.

The FSS staff consists of four engineering technicians, eight electronics technicians, and three supply technicians. Section activities are supported by technical and administrative personnel in other HIF sections.

### Procurement

Procurement actions, comprising 16 contracts, 68 purchase orders, and 16 HIF work orders, were issued totaling \$2,117,667.06.

### Property Management

Field Service and Supply tracks and accounts for rental property held by district offices with HIF-CSS.

### Equipment Rental

The equipment rental program, a major effort of the HIF, is operated by FSS. In most cases, equipment is sold to field offices; however, in the case of widely used recording and monitoring equipment, the HIF maintains a rental program for the field and is responsible for procurement and maintenance of the equipment. The rental program is divided into four

major categories: recorders and timers, water-quality monitors, telemetry equipment, and special equipment.

### Electronic/Mechanical Repair Services

Services provided include maintenance, repair, and calibration of district-owned and rental-program equipment. In the HIF Mechanical and Electronic Units, capabilities exist, either in-house or by contract, to repair, adjust, or calibrate virtually any type of USGS-owned equipment. Charges to field offices are assessed on a straight time-and-materials basis. Activity in FSS units and special programs is summarized in table 3.

### Borehole Equipment Support Project

The Borehole Equipment Support Project (BESP) leasing program was terminated effective September 30, 1992, except for repairs of system probes and tools, which will be made upon request through FY94.

### Warehouse Activity

In addition to 4,619 orders totaling \$2,157,073.78 shipped to district offices, the HIF warehouse also sold a significant volume of hydrologic instrumentation to other Federal agencies. The warehouse is called upon to respond to frequent requests from other Federal agencies regarding the availability of instrumentation for sale or rent. One hundred seventy-four orders from other Federal agencies, totaling \$155,427 were filled. Monthly warehouse sales for FY93 along with the maximum and mean monthly sales are shown in figure 3. A full listing of all USGS activity as tracked by the HIF Computerized Support System is provided in table 4.

### Hydrologic Instrumentation Facility Computerized Support System

The processing of field orders is supported by HIF-CSS II, an interactive computerized support system. Sixty-eight cost centers are registered to use HIF-CSS II, with a total of 370 users allowed access to the field office functions. These functions include the ability to scan the computerized price list and place orders

**Table 3.** Activity totals for Field Service and Supply units and programs in fiscal year 1993

<b>Electronic Unit</b>	
2,459	Work orders received
2,192	Work orders completed
349	Handar equipment serviced
313	Synergetics DCP's serviced
69	Sutron 8200 DCP's serviced (factory)
45	7300 Ultrasonic Velocity Meters
67	R200 downhole recorders serviced
1,022	Timers (model III) (June-August)
369	Minimonitors serviced
372	Minimonitor printed cards serviced
289	Minimonitor pH probes serviced
233	Minimonitor conductivity probes serviced
213	Minimonitor temperature probes serviced
226	Minimonitor dissolved oxygen probes serviced
417	Minimonitor extension cables serviced
1	Flowthrough monitors serviced
46	Flowthrough signal conditioners serviced
116	Flowthrough probes serviced
8	Flowthrough power supplies serviced
<b>Mechanical Unit</b>	
780	Work orders received
16	Work orders in mechanical shop
764	Work orders in meter shop
241	Work orders from field
539	Work orders from HIF
620	Work orders completed
160	Work orders in progress
<b>Analog-to-Digital Recorders Rental Program</b>	
864	ADR's to contractor for repair
1,034	ADR's repaired by contractor
1,650	ADR's in storage for repair/teardown
190	ADR's ready to be shipped (warehouse inventory)

directly from interactive terminals, determine the status of previously placed orders, and retrieve numerous accounting reports by cost center. HIF-CSS II also generates accounting documents, tracks inventory and procurement actions, and generates management reports used to improve future stocking and procurement decisions based on sales patterns. HIF-CSS II automates the tracking of controlled property, eliminating the need for processing hardcopy property transfer forms for each transaction.

FSS maintains close contact with field offices, is cognizant of equipment needs, and adds to or deletes from the inventory in response to field needs. Approximately 1,250 catalog items are in the warehouse inventory. With the exception of some convenience items such as boots and waders, all items are built to USGS drawings and specifications and require tight quality-control procedures to ensure that USGS data-collection standards are met.

### Water-Quality Monitor Equipment

Flowthrough monitor rentals remained largely unchanged in FY93, whereas minimonitor demand declined slightly. Major expenses incurred in support of the water-quality monitor program included the fabrication of specific conductance, pH, temperature, and DO sensors and the purchase of extension cables.

### Special Equipment Rental Program

The Special Equipment Rental Program (SERP) received \$31,275 from the rental of 181 pieces of equipment. No new equipment was purchased, but several pieces of equipment were returned to the manufacturer for repair. Equipment covered by the program included flowmeters, sediment samplers, pipe thickness gages, precipitation gages, oscilloscopes, and hazardous-waste detection equipment. During the

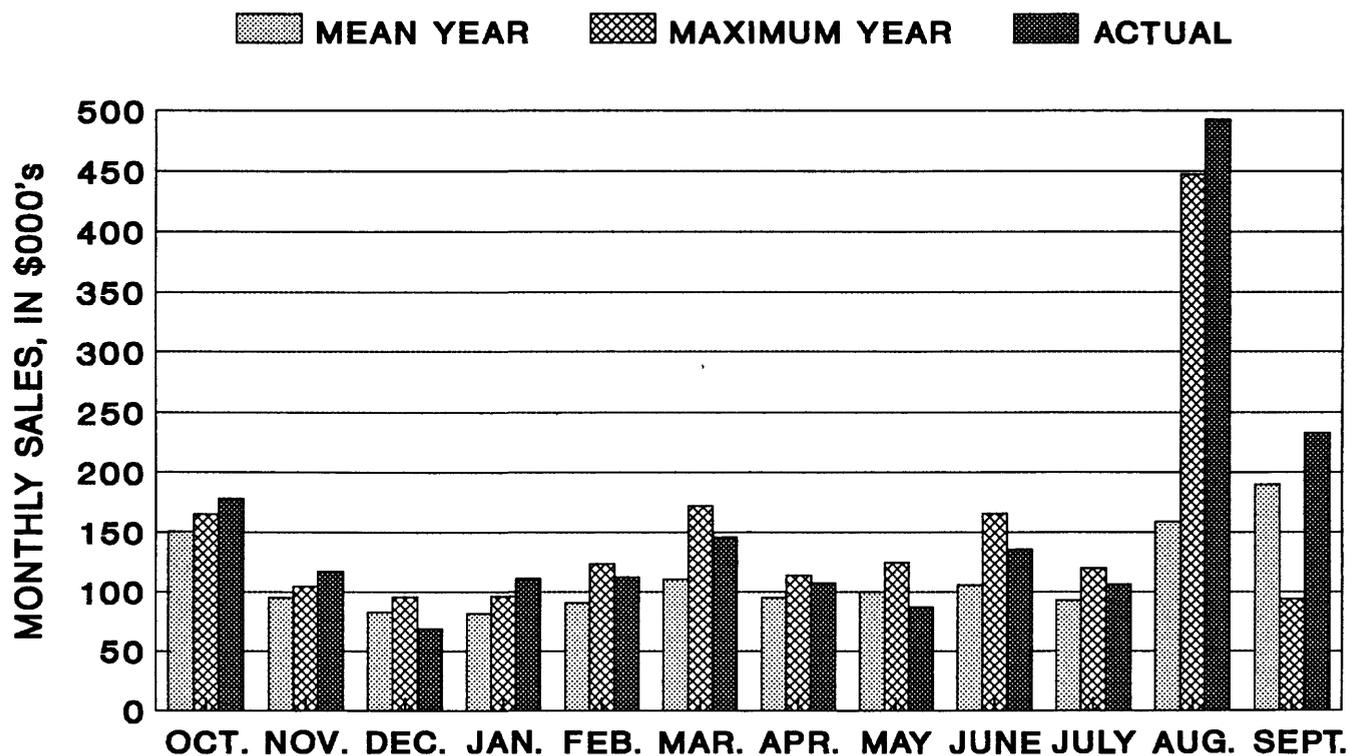


Figure 3. Monthly warehouse sales for fiscal year 1993 and the maximum and mean monthly sales.

**Table 4.** Hydrologic Instrumentation Facility Computerized Support System activity in fiscal year 1993

<u>Activity</u>	<u>Quantity</u>	<u>Dollar Value</u>
<b>TOTAL ORDERS</b>		
Orders placed FY93	4,619	\$2,157,073.78
Orders cancelled	( 188)	( 170,734.95)
Total orders not cancelled FY93	4,431	\$1,986,338.83
Refunds FY93	( 86)	( 16,577.61)
<b>NET SALES FY93</b>	<b>4,345</b>	<b>\$1,969,761.22</b>
 <b>ORDERS, ITEMS IN STOCK</b>		
Orders placed, items in stock	3,269	1,242,773.44
Orders cancelled	( 5)	( 19,008.41)
Orders filled and shipped	3,219	\$1,223,765.03
Mean value per filled and shipped order:	\$408.10	
 <b>BACKORDERS</b>		
Backorders placed FY93	1,350	1,009,133.10
Unfilled backorders placed in FY92	5	1,375.00
Backorders cancelled	( 138)	( 151,726.54)
Total backorders not cancelled FY93	1,217	\$ 858,781.56
FY93 backorders filled and shipped	693	188,466.85
Mean value per filled and shipped backorder:	\$271.96	
FY92 backorders filled and shipped in FY93	180	361,257.75
FY93 backorders remaining	358	583,628.30
FY92 backorders remaining	5	1,375.00
Total backorders remaining in system	363	\$ 585,003.30
 <b>WAREHOUSE INVENTORY</b>		
Warehouse inventory, September 30, 1993		\$2,641,371.64

year, approximately 29 inquiries concerning SERP were handled.

**Analog-to-Digital Recorders, Timers, and Basic Data Recorders**

As of September 30, 1993, 10,536 recorders were in field use. Of these, 9,219 were analog-to-digital recorders, 796 were CR10 electronic data loggers, and 521 were basic data recorders. Although the demand for ADR's continued to decrease, a total of 1,165 ADR's were repaired during the year. Figures 4 through 11 present results of the recorder repair

program. The following repair and maintenance support for these programs was provided.

<u>Description</u>	<u>Repaired, modified, or refurbished</u>	<u>Shipped to field</u>
Fischer and Porter (F&P) ADR	670	685
F&P ADR with telekit	21	16
Leupold and Stevens (L&S) ADR	278	198
L&S ADR with module A	113	76
L&S ADR with input/output	83	64
CSI BDR 301	7	79
ESC 80 BDR	11	141
CR10	23	344
<b>TOTAL</b>	<b>1,206</b>	<b>1,603</b>

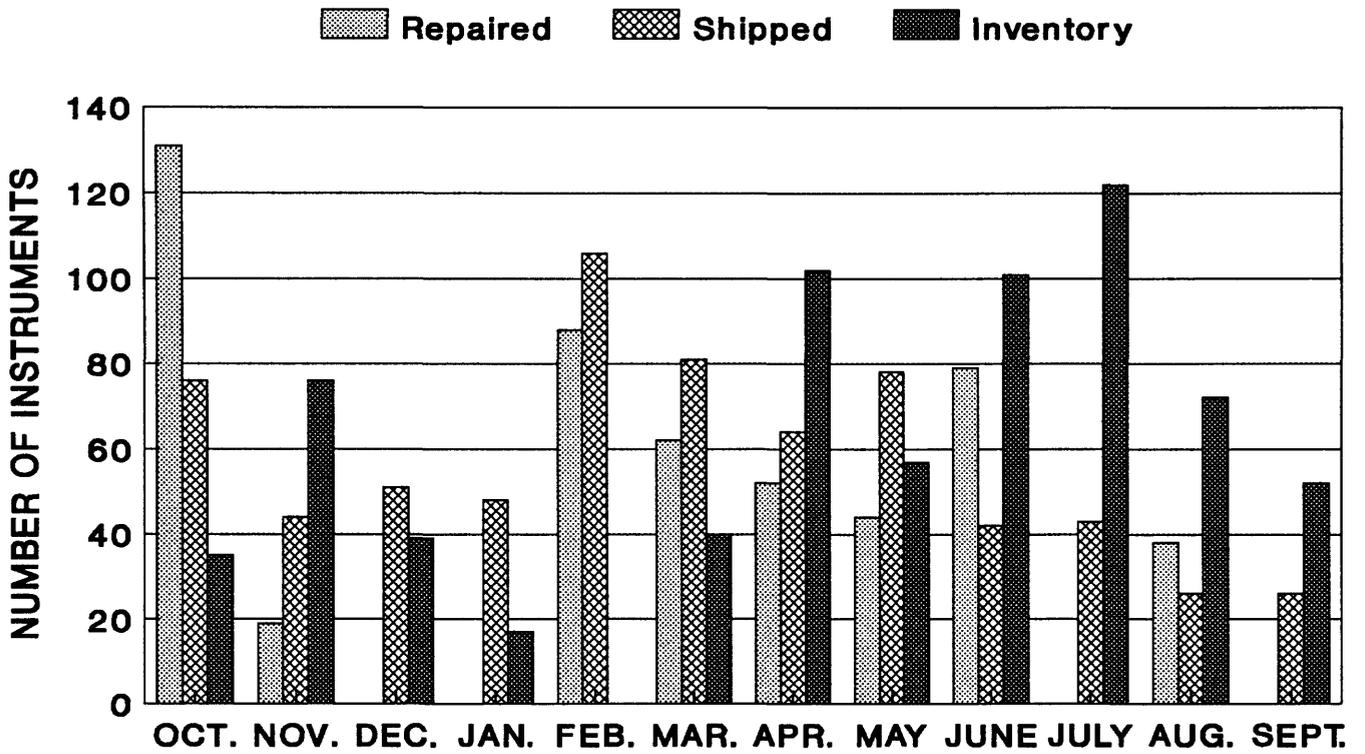


Figure 4. Repairs, shipments, and inventory of Fisher and Porter model 1542 analog-to-digital recorder by month.

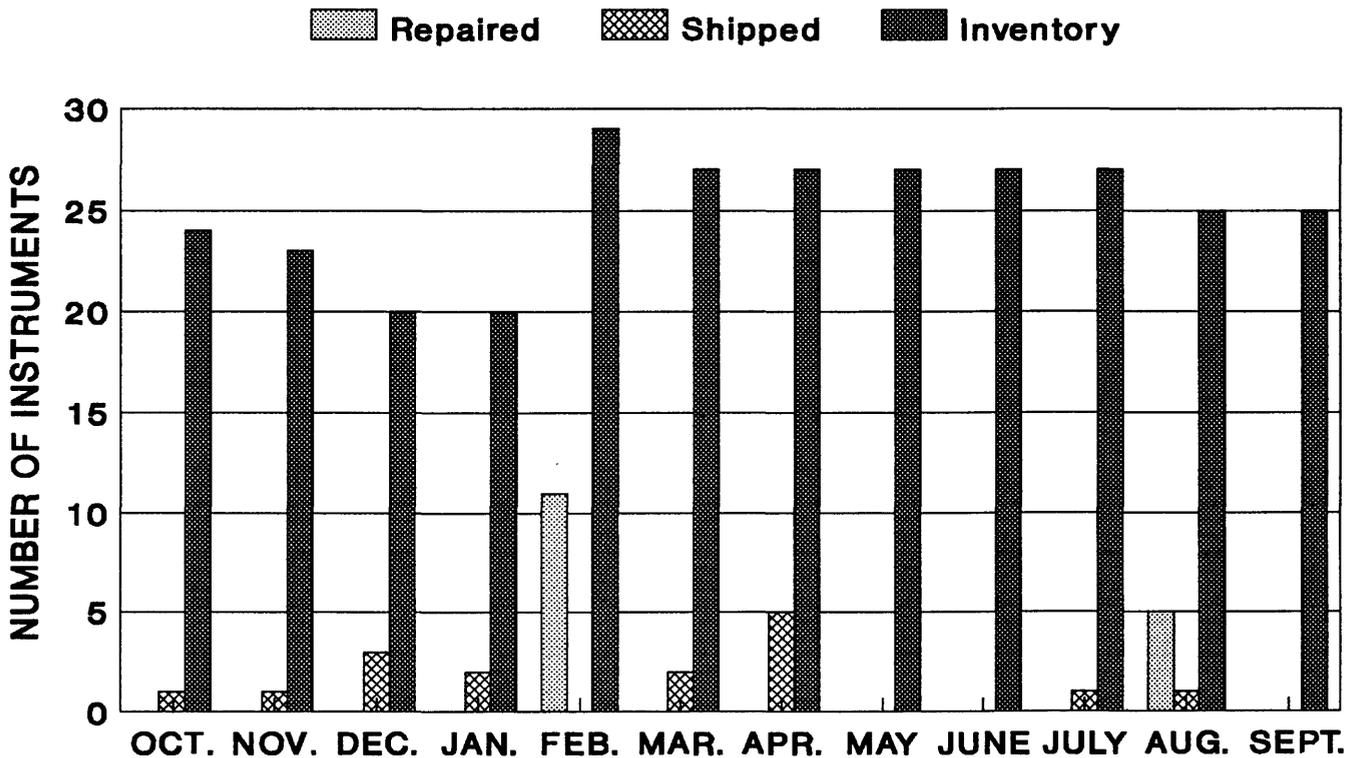


Figure 5. Repairs, shipments, and inventory of Fisher and Porter model 1542 analog-to-digital recorder with telekit by month.

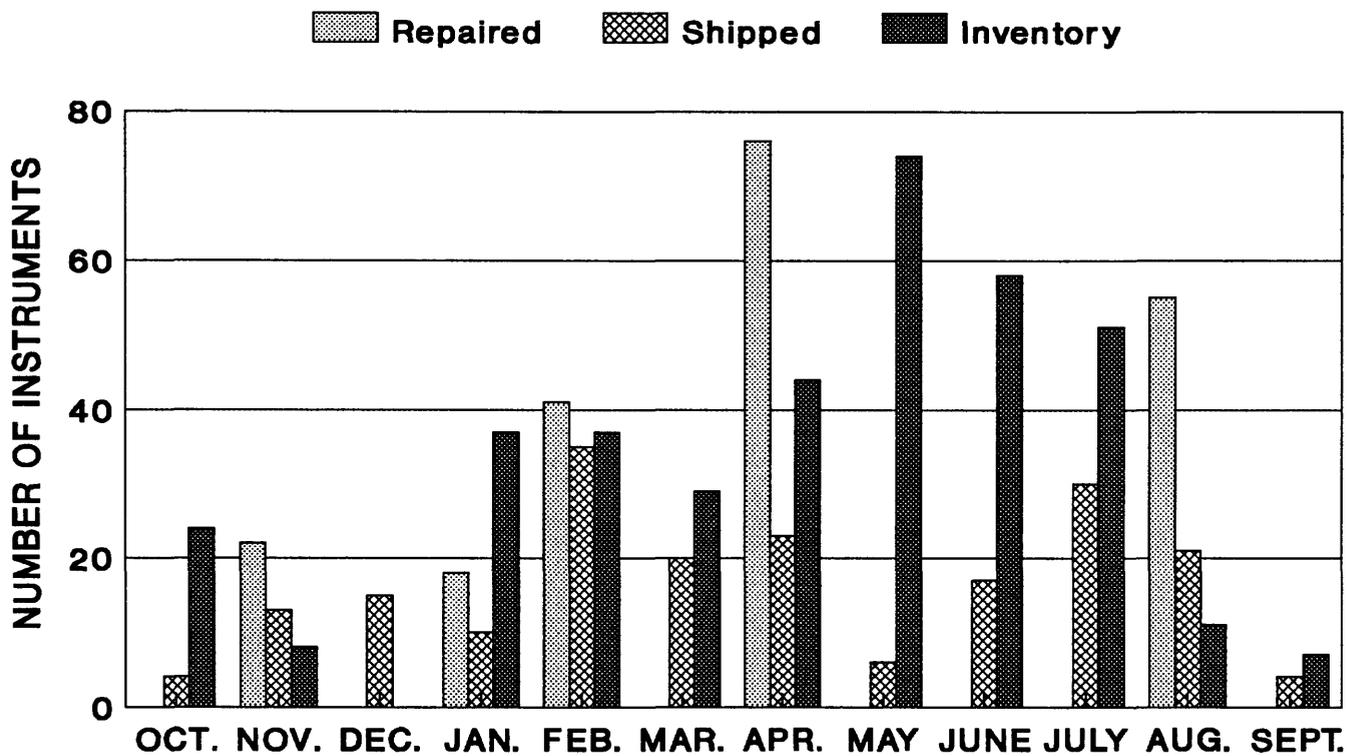


Figure 6. Repairs, shipments, and inventory of Leupold and Stevens model 7000 analog-to-digital recorder by month.

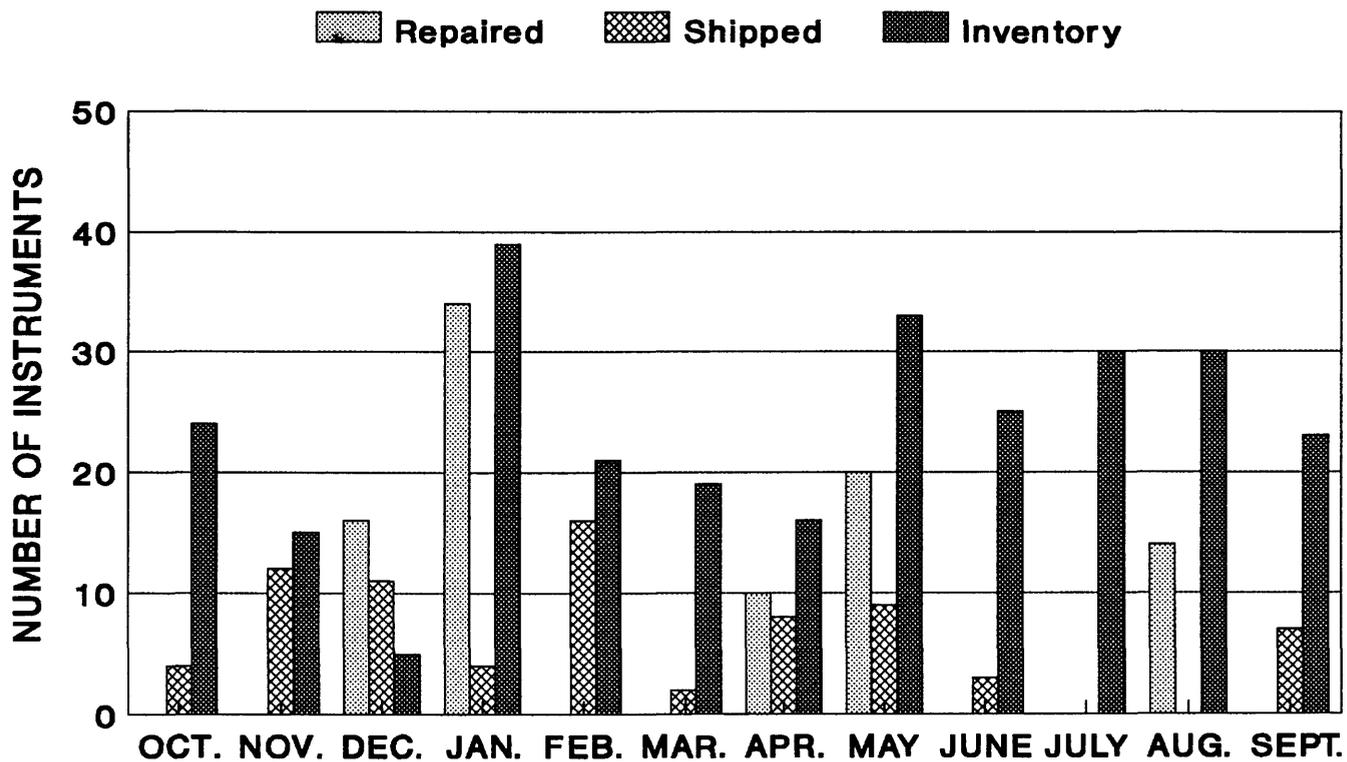


Figure 7. Repairs, shipments, and inventory of Leupold and Stevens model 7000 analog-to-digital recorder with module A by month.

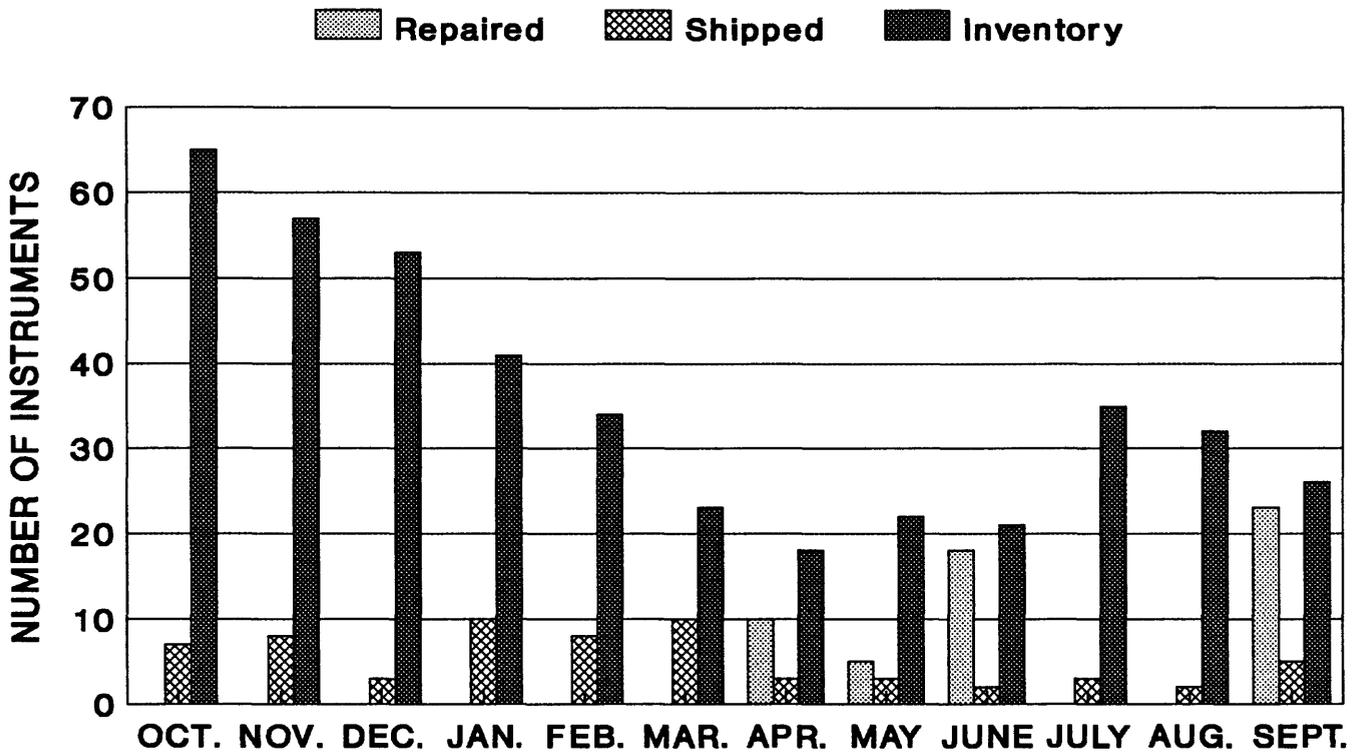


Figure 8. Repairs, shipments, and inventory of Leupold and Stevens model 7000 analog-to-digital recorder with input-output by month.

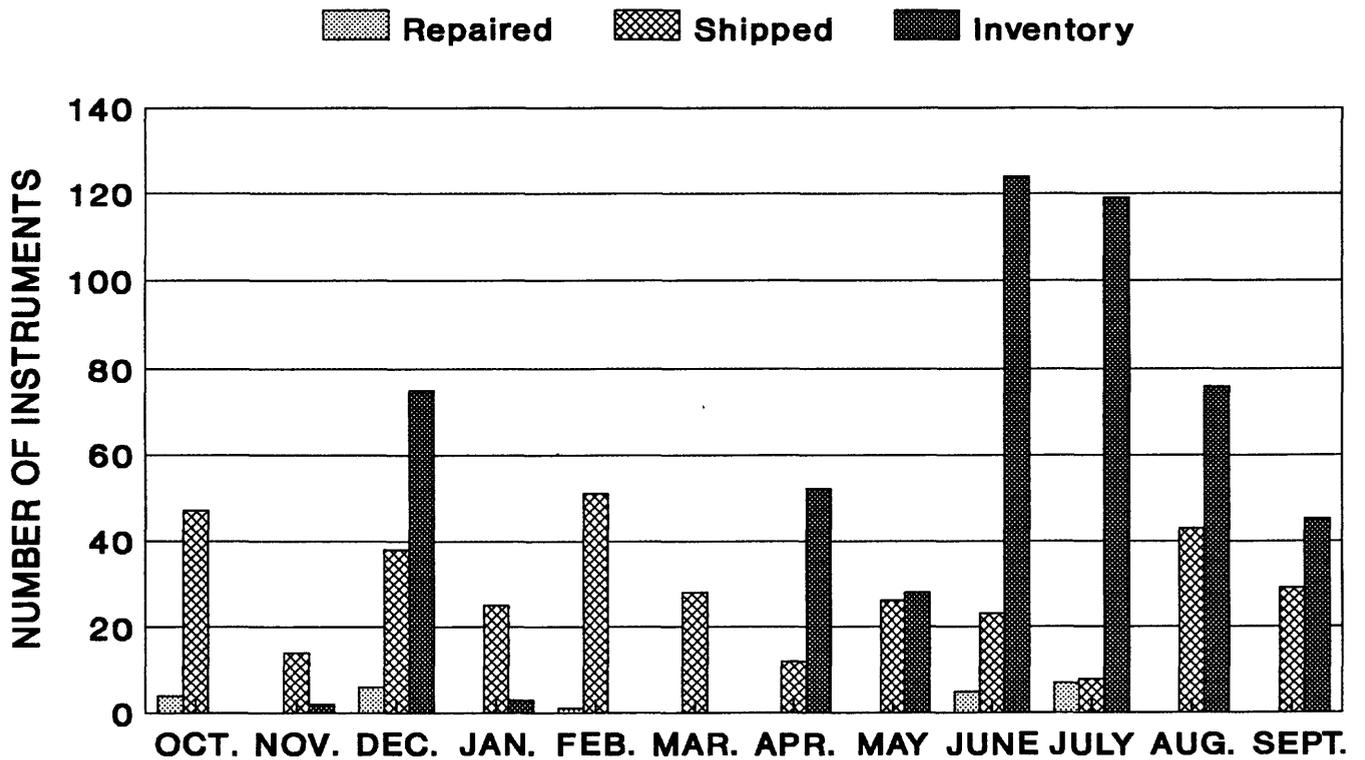


Figure 9. Repairs, shipments, and inventory of Campbell Scientific model CR10 basic data recorder by month.

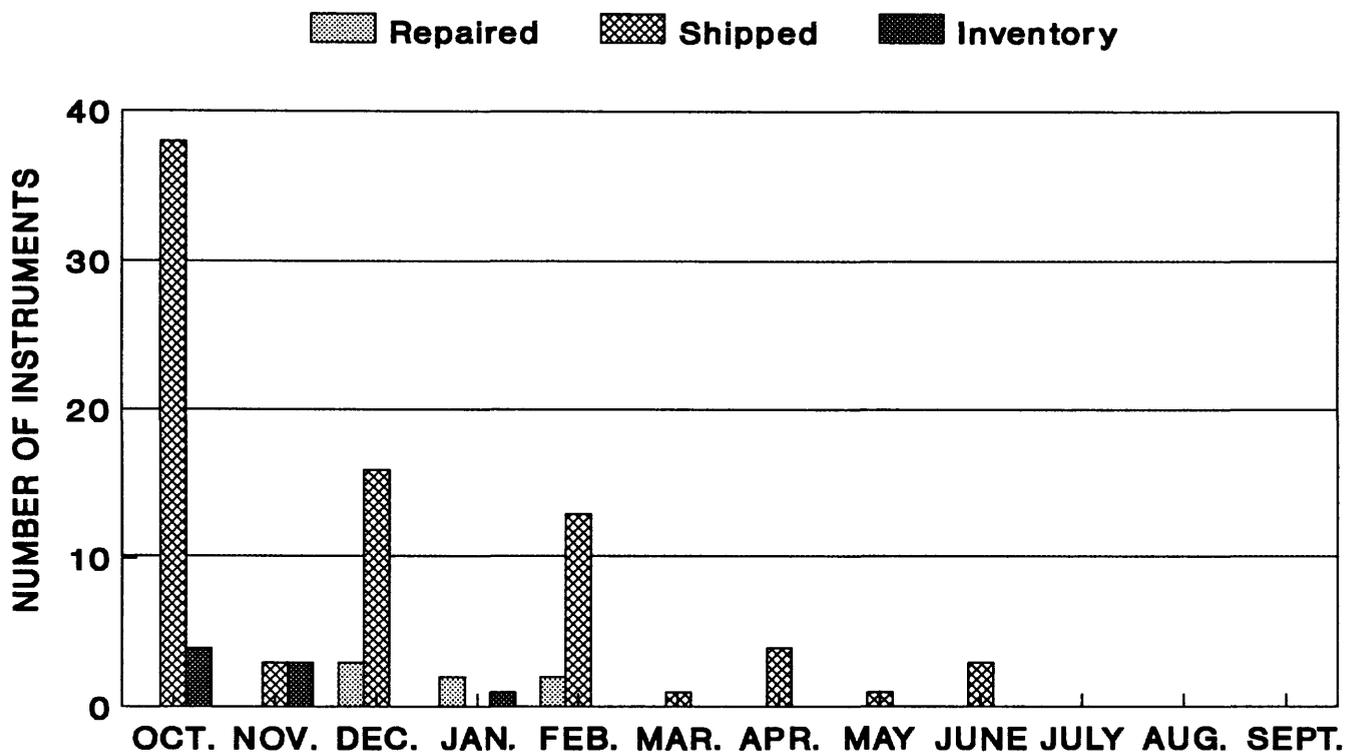


Figure 10. Repairs, shipments, and inventory of Campbell Scientific model 301 basic data recorder with junction box by month.

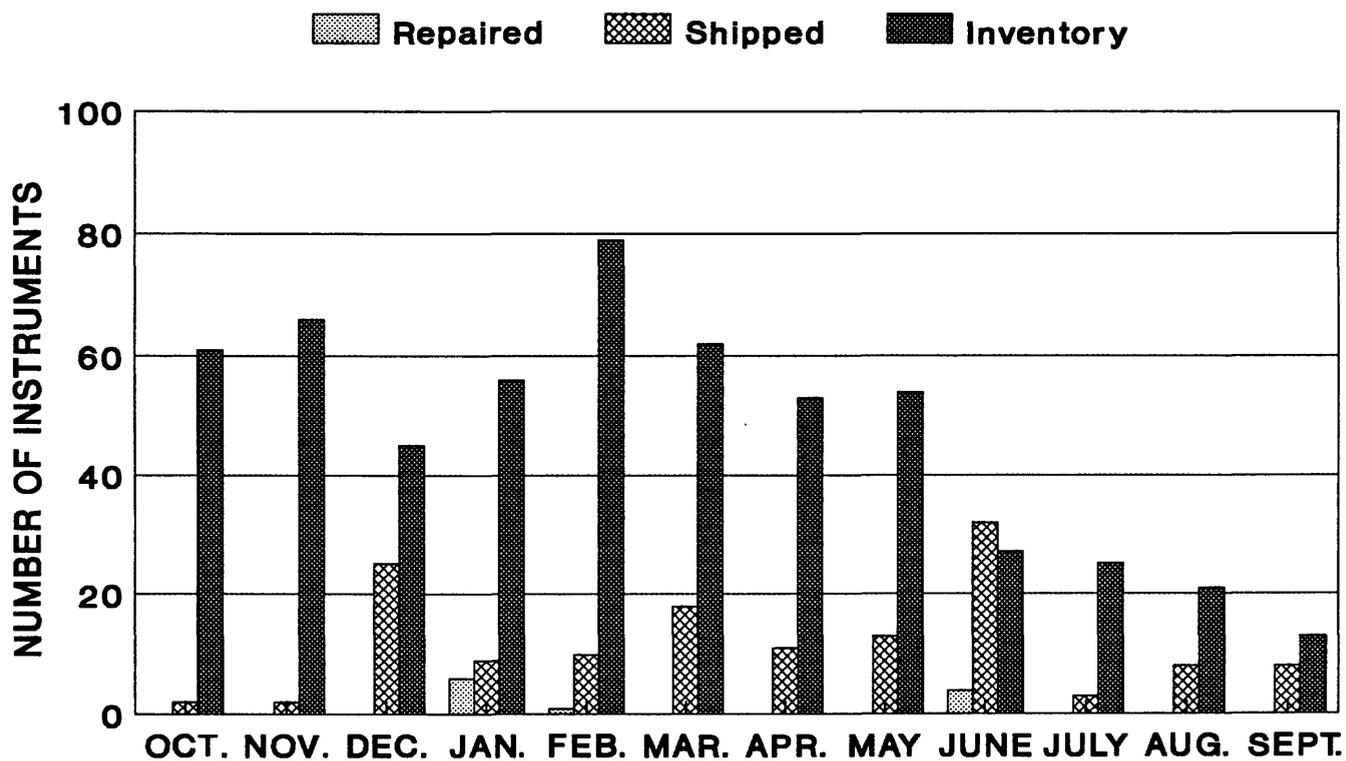


Figure 11. Repairs, shipments, and inventory of Environmental Systems Corporation model 80 basic data recorder with junction box by month.

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## APPENDIXES

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**APPENDIX 1. INSTRUMENTATION COMMITTEE, INSTRUMENTATION MANAGEMENT ADVISORY COMMITTEE, AND INSTRUMENTATION TECHNICAL ADVISORY SUBCOMMITTEE MEMBERSHIP, AS OF SEPTEMBER 30, 1993**

**INSTRUMENTATION COMMITTEE**

<b>Member</b>	<b>Title/Office represented</b>
William G. Shope	Chief, Branch of Instrumentation
Vito J. Latkovich	Chief, Hydrologic Instrumentation Facility
Carl R. Goodwin	District Chief, Washington
Nick B. Melcher	District Chief, Iowa
Derrill J. Cowing	District Chief, Maine
Timothy W. Hale	District Chief, Georgia
Ernest D. Cobb	Office of Surface Water
Kenneth J. Hollett	Office of Ground Water
Kathy Fitzgerald	Office of Water Quality
John C. Briggs	Office of Assistant Chief Hydrologist for Scientific Information Management
William N. Herkelrath	Regional Research, Western Region
Dallas Childers	Project Office, Office of the Regional Hydrologist, Western Region, Vancouver, Washington

**INSTRUMENTATION MANAGEMENT ADVISORY COMMITTEE**

<b>Member</b>	<b>Title/Office represented</b>
William B. Mann IV	Assistant Chief Hydrologist for Operations
Verne R. Schneider	Assistant Chief Hydrologist for Program Coordination and Technical Support
James L. Cook	Regional Hydrologist, Norcross, Georgia
James F. Blakey	Regional Hydrologist, Lakewood, Colorado
T. J. Conomos	Regional Hydrologist, Menlo Park, California
William J. Carswell, Jr.	Acting Regional Hydrologist, Reston, Virginia

**INSTRUMENTATION TECHNICAL ADVISORY SUBCOMMITTEE**

<b>Member</b>	<b>Title/Office represented</b>
Sammy L. Wilbourn	Hydrologic Instrumentation Facility Stennis Space Center, Mississippi
Wayne Rodman	Yucca Mountain Project Lakewood, Colorado
Michael L. Plunkett	Southeastern Region Jackson, Mississippi
Robert L. Goemaat	Central Region Oklahoma City, Oklahoma
Hubert L. Reed	Southeastern Region Rolla, Missouri
Richard L. Kraus	Western Region Medford, Oregon
Richard D. Hayes	Western Region Carson City, Nevada
Max S. Katzenbach	Northeastern Region Columbus, Ohio
George M. Farlekas	Northeastern Region Trenton, New Jersey
Kathleen R. Wilke	Central Region Lakewood, Colorado
Lynn K. Miller	Central Region Albuquerque, New Mexico

## APPENDIX 2. INSTRUMENT COORDINATORS

Member	District represented
James L. Pearman	Alabama
Robert J. Burrows	Alaska
Kendall R. Thompson	Alaska
Edward E. Morris	Arkansas
Harry M. Sleeper	Arizona
Michael D. Webster	California
Kathleen R. Wilke	Colorado
Michael A. Cervione, Jr.	Connecticut
John E. Coffin	Florida
Russell E. Curtis	Florida
Marvin A. Franklin	Florida
Edward P. Simonds, Jr.	Florida
William R. Stokes III	Georgia
Vaughn E. Kinishige	Hawaii
Joseph T. Bunt, Jr.	Idaho
James J. Duncker	Illinois
James A. Stewart	Indiana
Rodney E. Southard	Iowa
Claude O. Geiger	Kansas
Michael S. Griffin	Kentucky
George Arcement	Louisiana
Bernard M. Helinsky	Maryland
Joseph P. Nielsen	Maryland
Russell A. Gadoury	Massachusetts
Stephen P. Blumer	Michigan
Kurt T. Gunard	Minnesota
Michael L. Plunkett	Mississippi
Hubert L. Reed	Missouri
Ronald R. Shields	Montana
Glenn B. Engel	Nebraska
Lloyd C. Van Gordon	Nevada
Kenneth W. Toppin	New Hampshire
William R. Bauersfeld	New Jersey
John P. Borland	New Mexico
George C. Gravlee	New York
Thomas J. Zembrzuski	North Carolina
Russell E. Harkness	North Dakota
Max S. Katzenbach	Ohio
Robert L. Blazs	Oklahoma
Richard L. Kittelson	Oregon
Clayton D. Kauffman, Jr.	Pennsylvania
Pedro L. Diaz	Puerto Rico
Curtis S. Bennett III	South Carolina
Ralph W. Teller	South Dakota
Jerry F. Lowery	Tennessee
Pat W. Skinner	Texas
George E. Pyper	Utah
Bryon J. Prugh, Jr.	Virginia
Winston C. Stokes	Washington
William D. Wiggins	Washington
Stephen M. Ward	West Virginia
Barry K. Holmstrom	Wisconsin
Stanley A. Druse	Wyoming

### APPENDIX 3. DISTRICT, SUBDISTRICT, AND FIELD OFFICE VISITS

Date	Office/Location	Personnel
Oct. 1992	District Office, Austin, Texas Subdistrict Office, Fort Worth, Texas Field Headquarters Wichita Falls, Texas	E. L. Ford
Oct. 1992	District Office, Raleigh, North Carolina	J. C. Jelinski
Oct. 1992*	Subdistrict Office, Knoxville, Tennessee	R. H. Billings
Oct. 1992†	Central Region, Denver, Colorado	B. J. Ourso
Oct. 1992*	National Training Center, Denver, Colorado	P. W. Potter P. S. Tippett
Oct. 1992†	Southeast Region, Atlanta, Georgia	B. J. Ourso
Nov. 1992	Central Region, Denver, Colorado	J. C. Jelinski
Nov. 1992	Central Region, Denver, Colorado	E. L. Ford
Nov. 1992	District Office Carson City, Nevada	E. L. Ford
Nov. 1992	Field Office, Flagstaff, Arizona	E. J. Parrozzo
Nov. 1992*	National Training Center, Denver, Colorado	M. D. Szkolnik
Nov. 1992*	National Training Center, Denver, Colorado	C. T. Scott
Nov. 1992	Headquarters, Reston, Virginia	E. L. Ford
Nov. 1992	Southeast Region, Norcross, Georgia	W. M. Wilson
Nov. 1992	Headquarters, Reston, Virginia	G. E. Loman
Jan. 1993*	Subdistrict Office, San Antonio, Texas	V. J. Latkovich
Jan. 1993*	Headquarters, Reston, Virginia	V. J. Latkovich
Jan. 1993	Headquarters, Reston, Virginia	P. D. Farrell
Jan. 1993	Field Headquarters, Baton Rouge, Louisiana	J. B. Treadway
Feb. 1993	Central Region, Boulder, Colorado	V. J. Latkovich
Feb. 1993†	Southeastern Region, Biloxi, Mississippi	B. J. Ourso
Feb. 1993	District Office, Albuquerque, New Mexico	D. Y. Tai
Feb. 1993	Central Region, Denver, Colorado	E. L. Ford
Feb. 1993*	District Office, Raleigh, North Carolina	R. A. Johnson C. T. Scott
Feb. 1993†	Subdistrict Office, Albuquerque, New Mexico	R. H. Billings B. J. Ourso
Feb. 1993*	National Training Center, Denver, Colorado	C. T. Scott
Feb. 1993	Headquarters, Reston, Virginia	E. L. Ford
Feb. 1993	Subdistrict Office, Altamonte Springs, Florida	M. D. Szkolnik
Feb. 1993	National Training Center, Denver, Colorado	P. W. Potter

**APPENDIX 3. DISTRICT, SUBDISTRICT, AND FIELD OFFICE VISITS—Continued**

<b>Date</b>	<b>Office/Location</b>	<b>Personnel</b>
Mar. 1993	National Training Center, Denver, Colorado	L. A. Garcia
Mar. 1993	Subdistrict Office, Austin, Texas	D. Y. Tai A. A. Shaw
Mar. 1993	District Office, Logan, Utah	P. W. Potter
Mar. 1993	Central Region, Denver, Colorado	E. L. Ford
Mar. 1993†	Central Region, Denver, Colorado	B. J. Ourso
Apr. 1993	Central Region, Denver, Colorado	E. L. Ford
Apr. 1993	Central Region, Denver, Colorado	B. D. Brewer
May 1993	Subdistrict Office, Miami, Florida	M. D. Szkolnik
May 1993*	District Office, Portland, Oregon	V. J. Latkovich R. H. Billings
May 1993	Central Region, Denver, Colorado	D. Y. Tai
May 1993*	Project Office, Vancouver, Washington	V. J. Latkovich R. H. Billings
May 1993†	Southeast Region, Harrisonburg, Virginia	B. J. Ourso
May 1993*	Central Region, Denver, Colorado	P. W. Potter
May 1993	Headquarters, Reston, Virginia	E. L. Ford
May 1993*	District Office, San Juan, Puerto Rico	S. L. Wilbourn P. S. Tippett
May 1993	District Office, Atlanta, Georgia	R. H. Billings F. S. Henry
May 1993	Southeast Region, Atlanta, Georgia	V. J. Latkovich
June 1993	Central Region, Colorado Springs, Colorado	G. M. Moran
June 1993	District Office, Atlanta, Georgia	B. J. Ourso
June 1993	District Office, Nashville, Tennessee	P. W. Potter
June 1993	Central Region, Denver, Colorado	P. W. Potter
June 1993†	District Office, Columbus, Ohio	B. J. Ourso
June 1993	District Office, Mounds View, Minnesota	V. J. Latkovich J. C. Jelinski
June 1993*	District Office, Tuscaloosa, Alabama	D. H. Rapp
July 1993	Subdistrict Office, Ithaca, New York	M. D. Szkolnik
July 1993*	Subdistrict Office, Charlotte, North Carolina	R. H. Billings
July 1993	Central Region, Lakewood, Colorado	A. M. Sturrock
July 1993	Headquarters, Reston, Virginia	E. L. Ford
July 1993	Central Region, Lakewood, Colorado	R. H. Billings
July 1993*	District Office, Madison, Wisconsin	A. A. Shaw R. A. Johnson
July 1993	National Training Center, Lakewood, Colorado	L. A. Barnett

**APPENDIX 3. DISTRICT, SUBDISTRICT, AND FIELD OFFICE VISITS—Continued**

<b>Date</b>	<b>Office/Location</b>	<b>Personnel</b>
July 1993	Headquarters, Reston, Virginia	E. L. Ford C. P. Nelson
Aug. 1993*	Southeastern Region, Atlanta, Georgia	B. J. Ourso
Aug. 1993	Subdistrict Office, Huron, South Dakota	J. C. Futrell
Aug. 1993*	Central Region, Lakewood, Colorado	V. J. Latkovich R. H. Billings
Aug. 1993	Subdistrict Office, Altamonte Springs, Florida	M. D. Szkolnik
Aug. 1993*	National Training Center, Lakewood, Colorado	R. A. Johnson C. T. Scott
Aug. 1993	Subdistrict Office, St. Louis, Missouri	J. C. Futrell
Sept. 1993†	District Office, Rolla/Potosi, Missouri	B. J. Ourso
Sept. 1993*	District Office, Rolla/Potosi, Missouri	R. H. Billings
Sept. 1993	Subdistrict Office, San Antonio, Texas	V. J. Latkovich
Sept. 1993	National Training Center, Lakewood, Colorado	D. C. Tracey J. C. Jones

\*HIF presentations and instrumentation discussions

†QIC briefings and training

(PAGE 37 FOLLOWS)

## APPENDIX 4. PROFESSIONAL AND TECHNICAL MEETINGS ATTENDED BY HYDROLOGIC INSTRUMENTATION FACILITY PERSONNEL

Date	Meeting	Attendee(s)
Oct. 1992	SCAN-TECH 1992, Anaheim, California	E. L. Ford
Oct. 1992*	American Institute of Hydrology, American Society of Civil Engineers, Portland, Oregon	V. J. Latkovich
Oct. 1992	Instrument Society of America, Houston, Texas	D. H. Rapp
Oct. 1992*	Southeastern Region Annual Management Conference, Norcross, Georgia	V. J. Latkovich P. W. Potter
Oct. 1992	Federal Interagency Hydraulic Laboratory Techniques and Instrumentation Group Meeting, Knoxville, Tennessee	R.H. Billings
Nov. 1992*	Northeastern Region District Chief Caucus, Detroit, Michigan	V. J. Latkovich
Nov. 1992*	American Water Resources Association (AWRA) 28th Annual Conference and Symposium, Reno, Nevada	V. J. Latkovich
Nov. 1992*	8th Australian Hydrographic Workshop, Canberra, Australia	R. H. Billings
Nov. 1992	SDI-12 Support Group, Reno, Nevada	R. H. Billings
Jan. 1993*	Army Corps of Engineers, Mobile, Alabama	P. W. Potter
Feb. 1993*	American Society of Civil Engineers, Buffalo, New York	V. J. Latkovich
Mar. 1993	American Society for Quality Control, New Orleans, Louisiana	R. H. Billings B. J. Ourso
Mar. 1993	Pittsburgh Conference, Atlanta, Georgia	D. Y. Tai
Mar. 1993	International Trade Show, New Orleans, Louisiana	J. C. Jelinski E. J. Parrozzo
Apr. 1993*	Federal Interagency Sedimentation Project Meeting, Vicksburg, Mississippi	V. J. Latkovich J. C. Jelinski
Apr. 1993	Instrument Society of America, Kenner, Louisiana	S. L. Wilbourn J. C. Jelinski E. J. Parrozzo
Apr. 1993	Supercomm International Conference on Communications, Atlanta, Georgia	E. J. Parrozzo
May 1993	COMDEX Computer Industry Trade Show, Atlanta, Georgia	R. H. Billings F. S. Henry
June 1993	Tennessee Valley Authority-U.S. Army Corps of Engineers-USGS Annual Coordination Meeting, Chattanooga, Tennessee	D. H. Rapp
June 1993	Gulf Coast Safety Conference, Gulfport, Mississippi	B. D. Brewer
June 1993*	Federal Interagency Sedimentation Project Meeting, Mounds View, Minnesota	V. J. Latkovich J. C. Jelinski
Aug. 1993*	Department of Defense Environmental Contamination Program Meeting, Las Vegas, Nevada	D. H. Rapp L. A. Garcia
Aug. 1993*	American Water Resources Association (AWRA) 29th Annual Conference and Symposium, Tucson, Arizona	V. J. Latkovich R. H. Billings D. H. Rapp D. Y. Tai

**APPENDIX 4. PROFESSIONAL AND TECHNICAL MEETINGS ATTENDED BY HYDROLOGIC INSTRUMENTATION FACILITY PERSONNEL—Continued**

Date	Meeting	Attendee(s)
Aug. 1993*	Instrumentation Committee and Instrumentation Technical Advisory Subcommittee, Lakewood, Colorado	V. J. Latkovich R. H. Billings P. W. Potter
Sept. 1993	Toxic Substance Hydrology Technical Meeting, Colorado Springs, Colorado	D. Y. Tai
Sept. 1993	Computervision User Group Conference, Kansas City, Missouri	E. J. Nilsson

\*HIF presentation/technical paper

**APPENDIX 5. VENDOR VISITS BY HYDROLOGIC INSTRUMENTATION FACILITY PERSONNEL**

<b>Date</b>	<b>Vendor/Location</b>	<b>Personnel</b>
Oct. 1992	ESC, Incorporated, Knoxville, Tennessee	R. H. Billings
Nov. 1992	Campbell Scientific, Logan, Utah	R. H. Billings F. S. Henry
Apr. 1993	Earth and Atmospheric Sciences, Inc., Miamisburg, Ohio	D. H. Rapp
Apr. 1993	Yellow Springs Instrument Company, Dayton, Ohio	D. H. Rapp
Apr. 1993	Design Analysis, Logan, Utah	P. W. Potter
May 1993	Leupold and Stevens, Beaverton, Oregon	V. J. Latkovich R. H. Billings
July 1993	NR Systems, Logan, Utah	R. H. Billings F. S. Henry
Sept. 1993	Scientific Instruments, Inc., Milwaukee, Wisconsin	G. E. Loman

## APPENDIX 6. REPORTS BY HYDROLOGIC INSTRUMENTATION FACILITY PERSONNEL

- Anderson, C.E., 1992, Hydrologic Instrumentation Facility Technical Information Sheet for care and handling of minimonitor pH combination electrode (ISI model 11), 2 p.
- Billings, R.H., 1992, Hydrologic Instrumentation Programs of the U.S. Geological Survey: 8th Australasian AWRC Hydrographic Workshop, Canberra, Australia, November 9–13, 1992, Proceedings.\*
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## GLOSSARY OF ACRONYMS

ADAPS	Automated Data Processing System	ISD	Information Systems Division
ADR	Analog-to-digital recorder	ITAS	Instrumentation Technical Advisory Subcommittee
ADS	Applications and Development Section	L&S	Leupold and Stevens
AFFRA	Acoustic flowmeter for remote areas	LARC	Limited Automated Remote Collector
AS	Administrative Services Section	NASA	National Aeronautics and Space Administration
AWRA	American Water Resources Association	NAWQA	National Water Quality Assessment
BBADCP	Broad-band acoustic Doppler current profiler	NIST	National Institute of Standards and Technology
BDR	Basic data recorder	NR	Natural Resources
BESP	Borehole Equipment Support Program	NTC	National Training Center
CMD	Current-meter digitizer	NWS	National Weather Service
COR	Contracting Officer's Representative	OSW	Office of Surface Water
CPO	Custodial Property Officer	PAT	Process Action Team
CSI	Campbell Scientific, Incorporated	PC	Personal computer
DAA	Design Analysis Associates	PFC	Personal field computer
DCP	Data-collection platform	PS-2	Pressure sensor 2
DG	Data General	QA	Quality assurance
DIS	Distributed Information System	QIC	Quality Improvement Concepts
DIS-II	Distributed Information System-II	QW	Water Quality
ECR	Engineering change requests	SDI	Serial digital interface
EDL	Electronic data logger	SERP	Specialized Equipment Rental Program
ESC	Environmental Systems Corporation	SSC	John C. Stennis Space Center
F&P	Fisher and Porter	STACOM	Stabilized and temperature-compensated manometer
FSS	Field Service and Supply Section	TES	Test and Evaluation Section
FY91	Fiscal year 1991	TSS	Technical Services Section
FY92	Fiscal year 1992	UVM	Ultrasonic velocity meters
FY93	Fiscal year 1993	USGS	United States Geological Survey
FY94	Fiscal year 1994	VOC	Volatile organic compound
GC	Gas chromatograph	WRD	Water Resources Division
HIF	Hydrologic Instrumentation Facility	YMP	Yucca Mountain Project
HIF-CSS	HIF Computerized Support System		
ICOM	Instrumentation Committee		
IMAC	Instrumentation Management Advisory Committee		