ORNL/TM-12446

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OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

Instrumentation and Controls Division Technical Support Department Management Plan FY 1993–FY 1996

Participating Staff

B. P. Adkisson
C. W. Kunselman
R. P. Effler
D. R. Miller
A. J. Millet
C. T. Stansberry

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/TM-12446

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38

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OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U. S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

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ABSTRACT

This report describes the organization, key functions, and major activities of the Technical Support Department. The Department is the programmatic support element of the Instrumentation and Controls Division.

The Department's primary focus is the support of existing equipment and systems at Oak Ridge National Laboratory that are generally characterized as instrumentation and controls. The support takes the form of repair, calibration, fabrication, field engineering, preventive maintenance, software support, and record keeping.

1. INTRODUCTION

This document will define the organization and key activities of the department. Traditionally, the basic function of the department has been to provide research support functions in ten specialized technologies. These research support functions are performed by about 150 instrument technicians, engineering technologists, engineers, and supervisory personnel. In recent years, this support has broadened to include paraprofessional operational support. The department endeavors to further the mission of Oak Ridge National Laboratory (ORNL) by continuously reviewing and optimizing its functional groups and policies. The operational goal is to improve effectiveness, reduce controllable costs, optimize on-the-job safety, and maintain a formal record of those activities.

The department staff consists of a department head, two general supervisors, 11 specialty groups (each headed by a craft supervisor), and administrative staff. The Quality and Performance Standards Group, formed in 1990 to strengthen the response to those issues, has proven to be very successful. The staffing in the department continues to be about 150 persons, and the gross annual budget was in excess of $9.0 million during 1993.

1.1 POLICY STATEMENT

The general policy of the department is to establish and maintain personnel and equipment resources appropriate for the Instrumentation and Controls Division (I&C) support needs of ORNL. This policy is accomplished by cultivating an hourly technician population with suitable individual specialties and by continuous attention to tools and procedures. The staff is assigned to working groups, nominally by technology or geographic areas, to provide the most economical maintenance support effort to ORNL. Technical, compliance-related and safety training for the staff continue to be a major element of the Department's activities as we approach the year 2000. Management by objective is a fundamental approach to the Department's operation. Each employee is encouraged to make daily and long-term personal work plans that support and enhance the overall programmatic goals of the Department and the Laboratory.

1.2 POLICY DOCUMENTS

The Department has primary responsibility for I&C Division maintenance support of equipment owned by the U.S. Department of Energy (DOE) at ORNL as well as designated equipment owned by programmatic sponsors of ORNL-based programs. The umbrella document that sets our general policy is derived from the DOE Oak Ridge Operations contract with Martin Marietta Energy Systems, Inc. (referred to as Energy Systems). This contract carries with it certain other implied or expressed requirements such as compliance with DOE Order 4330.4A and 5480.19. DOE Order 4330.4A provides guidance for the support of real and programatic property and equipment for maintenance programs within Oak Ridge Operations. DOE Order 5480.19 specifies guidelines for conduct of operations.

The Martin Marietta Energy Systems, Inc., contract DE-AC05-84OR21400, Oak Ridge Operations Award Fee Determination Plan states under Engineering and Maintenance, that

1. the Maintenance Management Program effectively and efficiently uses the elements outlined in 4330.4A and
2. the Maintenance Management Program meets the requirements of DOE Order 4330.4A.

1.3 APPLICABLE ENERGY SYSTEMS/ORNL AND DOE PROGRAMS

The department functions under the guidance of several mandated Department of Energy, other federal agency, and Martin Marietta directives and policies. The most fundamental level of policy that impacts operations is the cost accounting and timekeeping systems. These systems are documents in internal Martin Marietta Energy Systems policy manuals. Work management and safety related policies are significant elements of department operations as well. Work management is described in Sects. 4 and 5 of this plan. Safety policy is primarily detailed in ORNL policy manuals, with further details in federal Occupational Safety and Health Department guidelines. Specialized guidance applicable to the ORNL work environment is detailed in the following sections.

1.3.1 Safety

TSD complies with DOE safety standards. A copy of the ORNL safety manual shall be kept in each supervisor's office and in the Department Office. Safety is the primary concern in all TSD activities, and each member of the staff is directed and expected to work safely.

1.3.2 Reactor Personnel Qualification and Training

Department staff who are assigned to full time nuclear reactor work must meet additional requirements beyond the basic Instrument Technician qualifications. Department policy and qualification requirements specify the specific process required to achieve qualification. The Department meets all provisions of DOE Order 5480.20, "Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities," which requires compliance for qualification and training.

1.3.3 Operational Safety Requirements (OSR)

To meet all instrument maintenance and personnel training requirements for each nuclear facility, TSD adheres to DOE Order 5480.20, "Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities." Programs, action plans, and records are kept on file in the Department Office.

1.3.4 Quality Assurance

TSD follows the guidelines established by the ORNL Quality Assurance Program, which is based on DOE 5700.6C (Quality Assurance). A copy of the ORNL quality assurance manual and a copy of the I&C quality assurance operating procedures manual are kept in each supervisor's office and in the Department Office. Forms and records are kept by the TSD quality and performance standards coordinator and the I&C Division quality assurance specialist. Each member of the staff is given regular orientations on quality assurance (QA) subjects.

1.3.5 Emergency Preparedness

In accordance with the ORNL emergency plan, TSD prepares for emergency situations to minimize material loss and personal injury. This preparation includes participating in evacuation drills and staffing the emergency squad. A copy of the ORNL emergency manual is kept in the department office.

1.3.6 Supplemental Maintenance Plans

Supplemental maintenance plans are developed by the Department as needed to assist the operating divisions and ensure the availability and timely delivery of instrument maintenance services. Several Memoranda of Understanding between the I&C Division and other divisions are in place to ensure the availability of trained, qualified personnel to support other division's operations.

1.3.7 Training

The objective of the TSD Training Program is to provide technology-specific training for maintenance personnel. Technical, administrative, and management skills training is performed as needed to maintain a first-rate instrumentation and control maintenance organization. A further intent of the Training Program is to provide training and information on procedures and practices as required or beneficial to operation of the Department.

1.3.8 Reactor Maintenance

"Safety of Department of Energy-Owned Reactors," DOE Order 5480.6, which applies to maintenance of instrumentation in reactor facilities, is specifically followed by TSD. The Department employs a systematic method of maintenance by tracking instrument repair, replacement, calibration, and other maintenance functions and documenting each activity. TSD coordinates its reactor maintenance functions with those of the Reactor Systems Section of the I&C Division, as approved by the ORNL RRD.

2. ORGANIZATION

The Department continues its traditional role of providing technical support services and products to the three I&C internal Division engineering sections as well as ORNL divisions. The current annual budget of the Department is ~$9.5M. Activities performed include maintenance and fabrication involving >80,000 instruments. The value for the 55,000 instruments in active status exceeds $117.3M. The Department employs management and staff personnel, technical support personnel, and 100 instrument technicians. The TSD personnel distribution percentage is shown in Fig. 1. Figure 2 represents the Department organization chart.

Strengthening the TSD support of environmental monitoring and nuclear facility instrumentation represented a major effort during the past three years. This effort consisted of developing and publishing a comprehensive instrument calibration plan,[1] writing and issuing detailed instrument-calibration procedures, increasing calibration training for technicians, and conducting special training for all personnel on QA topics. Also, significant improvements were made in the TSD Work Management Software Program [*Maintenance Information and Data Acquisition System (MIDAS)*,[2] described in Sect. 3.1] to fully meet the requirements of the ORNL RRD. The tools and work space directly involved in support of environmental monitoring and nuclear facility instrumentation were extensively upgraded.

2.1 ENVIRONMENTAL AND PROCESS INSTRUMENTATION (*B. P. Adkisson*)

This group provides support for analytical instrumentation, pulse height analyzers, test equipment, process instrumentation, environmental and radiation monitoring equipment, and other related research instrumentation.

This group is composed of 1 general supervisor, 6 supervisors, 12 engineering technologists and 1 staff engineer who direct and assist 52 instrument technicians located in 19 field shops. This area has experienced a continued addition and upgrade of equipment and the introduction of new technology in many areas, which has required additional personnel training. State-of-the-art gaseous and liquid effluent radiation and water quality monitors are among the major improvements realized during the ORNL Environmental Monitoring System Upgrade. This equipment monitors air quality for ORNL as well as the entire Oak Ridge area. A total of 21 stations monitor the air and report the results to a central data center. TSD personnel have assisted in the development of specifications and procedures to maintain operations and system reliability.

The TSD calibration plan[1] was written as part of our continuing improvement of maintenance activities. This document prescribes the methods and procedures for management of the TSD Calibration Program and is undergoing review for revision in 1993. Additional calibration procedures are written as needed. The TSD Operational Safety Requirements Program provides a surveillance plan for nonreactor nuclear facility operating requirements.

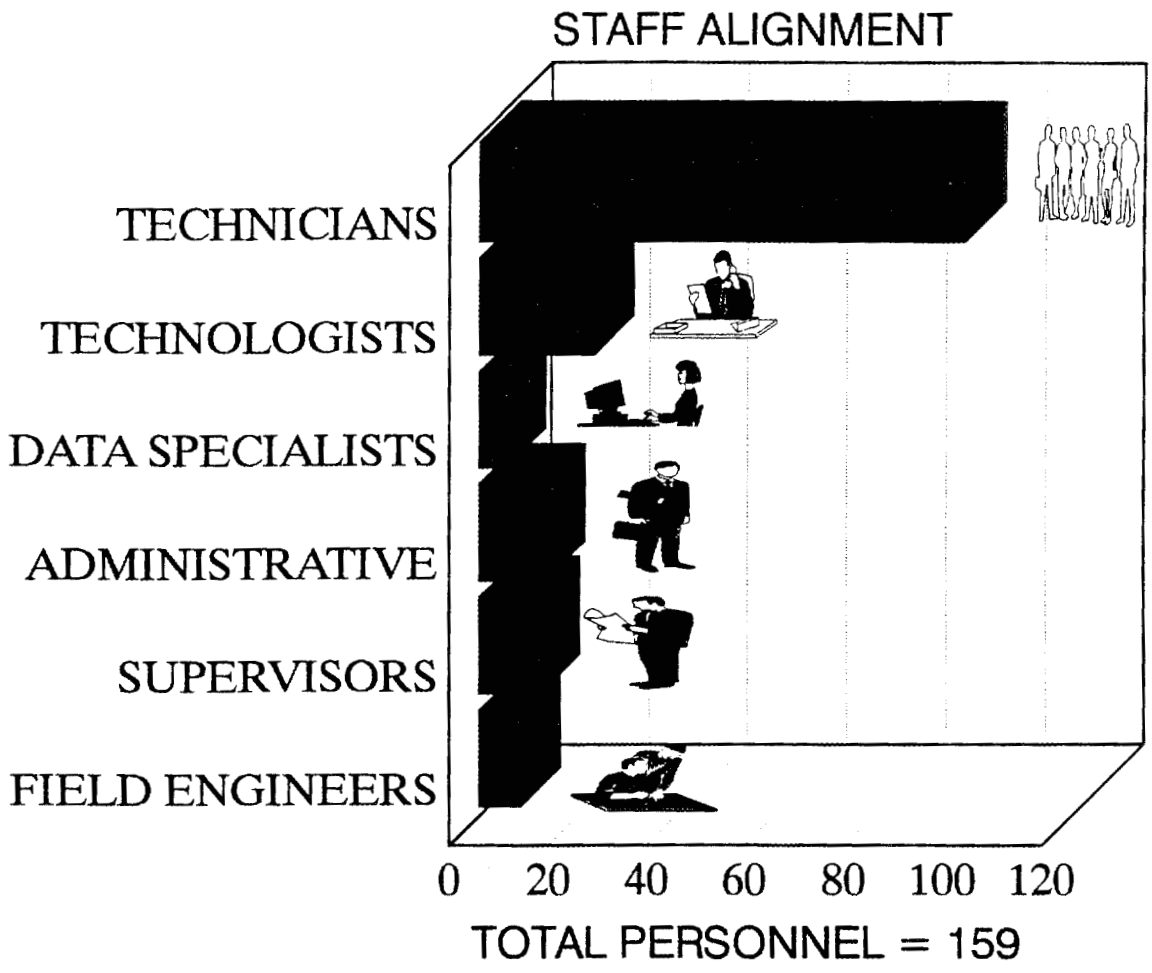


Fig. 1. Technical Support Department personnel distribution percentage.

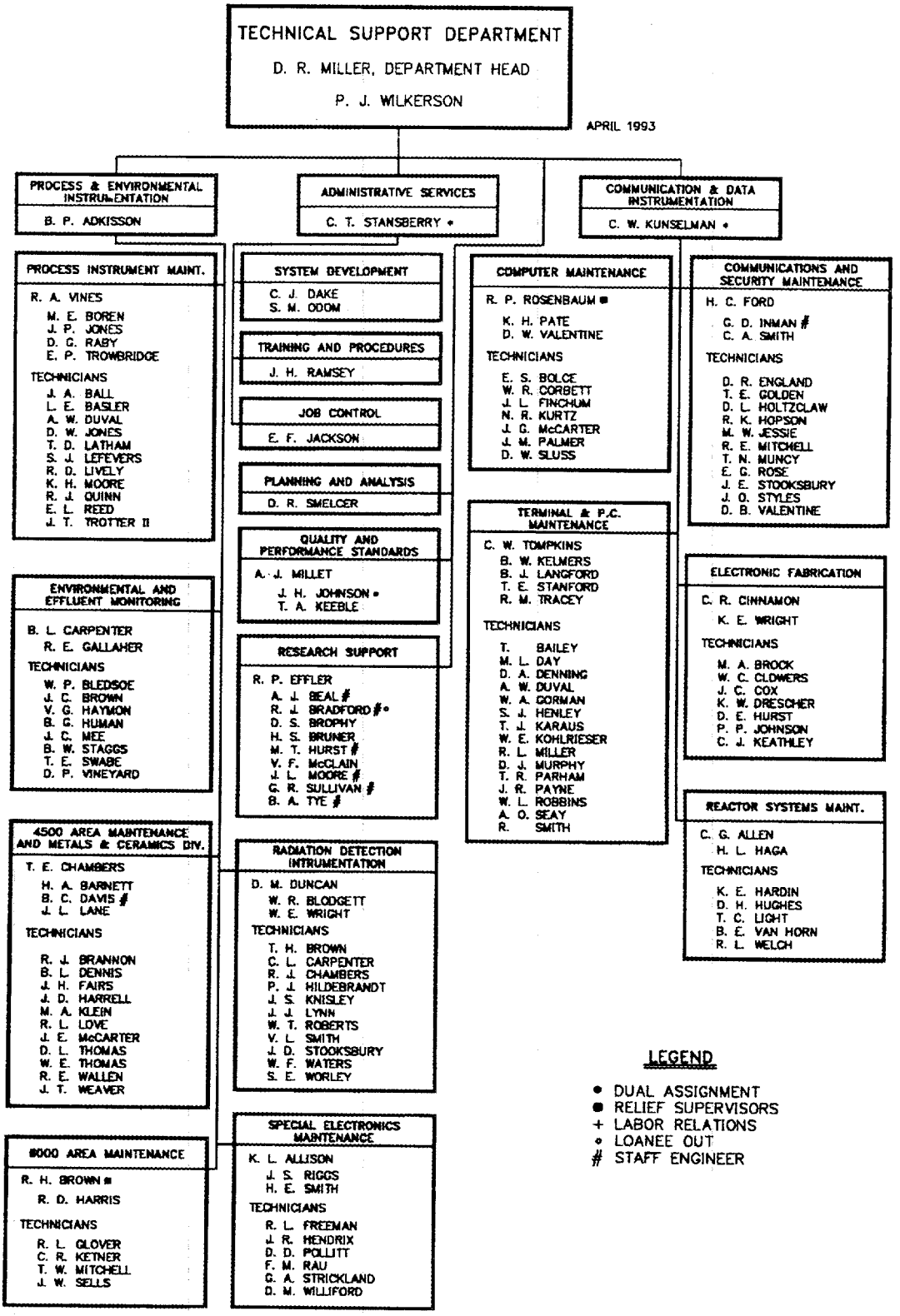


Fig. 2. Technical Support Department organization chart.

2.1.1 Process Instrument Maintenance (*R. A. Vines, M. E. Boren, J. P. Jones, E. P. Trowbridge, and D. G. Raby*)

The Process Instrument Maintenance Group includes the main shop in Building 3500 and three satellite shops in buildings 2519, 3005, and 3606. The group is staffed by 1 supervisor, 4 engineering technologists, and 11 instrument technicians and is primarily responsible for providing process instrument systems maintenance, calibration, and fabrication throughout ORNL.

The main shop provides field maintenance and calibration of all customer instruments as required; calibration of secondary field standards; fabrication and testing of thermocouples; inspection and calibration of new instruments; and design, fabrication, and installation of control loops and associated electronics. This shop is also responsible for the maintenance and calibration of leak detectors and vacuum systems. One technician in Building 2519 is responsible for the maintenance and calibration of all steam plant, waste water treatment plant, and laboratory water supply system instrumentation.

2.1.2 Environmental and Radiation Monitoring Maintenance (*B. L. Carpenter, D. M. Duncan, R. E. Gallaher, W. R. Blodgett, and W. E. Wright*)

The E&RMM Group includes 2 supervisors, 3 engineering technologists, and 20 instrument technicians who provide maintenance and other support for portable radiation survey, fixed-station, and other monitoring equipment for the ORNL Environmental & Health Protection Division. In addition to servicing all ORNL portable radiation survey instrumentation, two technicians also service portable units for the Radiological Survey Activities Group of the ORNL Health and Safety Research Division as well as all portable radiation survey instruments at the Oak Ridge K-25 Site. A service group of nine technicians has maintenance responsibility for stationary monitoring instrumentation; fallout; and local, perimeter, and remote air monitoring systems as well as all facility radiation, contamination, and similar alarm systems. In addition to normal maintenance and routine system checks, this group provides support in checking the new perimeter air monitoring system, a water quality monitoring system, and stack monitoring systems. One technologist and six technicians provide service to the Gaseous and Liquid Waste Disposal Station, including normal routine maintenance and system checks. The group also provided support for checking and the successful operation of the process waste monitoring equipment and supported the upgrade and modification of the Waste Operations Control Center.

2.1.3 Special Electronics Maintenance (*K. L. Allison, J. S. Riggs, and H. E. Smith*)

The Special Electronics Maintenance Shop consists of one supervisor, two engineering technologists, and six instrument technicians. To provide efficient maintenance support, the shop is divided into three sections.

1. The Analyzer Maintenance Section provides maintenance support on pulse-height analyzer systems, liquid scintillation counting equipment, phototypesetting equipment, and miscellaneous nuclear instruments located throughout ORNL.
2. The Test Equipment and Oscilloscope Calibration Section provides maintenance and calibration on test equipment and oscilloscopes. This section is staffed by two instrument technicians and one engineering technologist. Equipment calibrated by

this section is traceable to the National Institute of Standards and Technology (NIST) (successor to the National Bureau of Standards). A portable, computer-controlled oscilloscope calibrator that makes field calibrations possible results in reduced labor costs, reduced downtime, and less chance of equipment damage during handling. The upgrading of this and other calibration equipment has resulted in a more efficient overall operation.

3. The Field Support Section, staffed by one engineering technologist and three instrument technicians, provides support for the Solid State and Environmental Sciences divisions and the ORNL Quality Department in Building 2000. (Field shops are located in buildings 3001, 2001, and 1505.)

2.1.4 4500 Area Maintenance (*T. E. Chambers, B. C. Davis, J. L. Lane, and H. A. Barnett*)

The 4500 Area Maintenance Group consists of 1 supervisor, 1 staff engineer, 2 engineering technologists, and 11 instrument technicians. The group provides support for buildings 1505, 2011, 2026, 4500N, 4500S, 4508, 4515, 5500, 5505, and 5507, which house the following divisions: Chemistry, Physics, Chemical Technology, Analytical Chemistry, Metals and Ceramics, Health, Health and Safety Research, and Environmental Sciences. To provide efficient maintenance support, this group operates six field shops (one near each research area). The shops are combined administratively to reduce costs by sharing personnel, expertise, test equipment, and materials.

The first shop in Building 4500S, staffed by one engineering technologist and four instrument technicians, provides maintenance, calibration, and design support for the Metals and Ceramics Division. The primary function of this shop is to maintain creep test machines that must operate at controlled temperatures for long time periods. This group was involved in a major project to upgrade the outmoded temperature control systems to state-of-the-art. These systems are in operation throughout the Creep Test Facility.

A second shop in Building 4500S has two engineering technologists and five instrument technicians. This shop provides maintenance and calibration support of chemical analysis instrumentation used by the Chemistry and Analytical Chemistry divisions and the Walker Branch and Melton Branch Watershed projects for the Environmental Sciences Division.

The third shop in the High Temperature Materials Laboratory (HTML) is staffed by one instrument technician, who provides support for installation of state-of-the-art instrumentation.

2.1.5 6000/7600 Area Maintenance (*R. H. Brown and R. D. Harris*)

The 6000/7600 Area Maintenane Group is composed of one supervisor, one engineering technologist, and four instrument technicians. Two instrument technicians provide service in support of work primarily related to the 25-MV Tandem and Oak Ridge Isochronous Cyclotron accelerators at the Holifield Heavy Ion Research Facility. This support includes service of machines as well as support to research programs from ORNL and guest scientists. Two instrument technicians provide service in support of work primarily related to the Oak Ridge Electron Linear Accelerator and research personnel.

2.2 COMMUNICATION AND DATA INSTRUMENTATION (*C. W. Kunselman*)

The Communication and Data Instrumentation Group is composed of 1 general supervisor, 5 supervisors, 1 staff engineer, 8 engineering technologists, and 45 instrument technicians who provide maintenance support from 12 field shops. The activities of this group include maintenance of computers, data terminals and data communication equipment, reactor instrumentation, two-way radio communication equipment, video equipment [including broadband and cable television (CATV) systems], and security systems. The group has a facility for fabrication of instrumentation, printed circuit boards, and photometal for plaques. The consolidation of the printed circuit, photometal, and drilling operations makes possible additional services such as silk screening, different plating for circuit boards, and colored photometal. The greatest area of growth during this reporting period has been in the support of automated data processing equipment (ADPE) and installation of local area networks.

2.2.1 Personal Computer Maintenance and Terminal Shop (*C. W. Tompkins, T. E. Stanford, B. W. Kelmers, and R. M. Tracey*)

The Personal Computer Maintenance and Terminal Shop consists of 1 supervisor, 3 engineering technologists, and 15 instrument technicians responsible for maintaining, installing, and upgrading personal computers (PCs) and associated equipment, data terminals, remote job entry stations, and support of Computing and Telecommunications Division communication and plotting equipment.

The PC population has grown to ~6000 units plus associated peripherals representing numerous manufacturers. Two representatives from this shop are serving on the evaluation team for the Accelerated Vendor Inventory Delivery (AVID) system for PCs.

2.2.2 Computer Maintenance (*R. P. Rosenbaum, K. H. Pate, and D. W. Valentine*)

The Computer Maintenance Group consists of one supervisor, two engineering technologists, and seven instrument technicians responsible for maintenance on mini- and midsize computer systems, Ethernet communication networks, and Hewlett-Packard (HP) equipment at ORNL. The ~325 computer systems supported range in size from desktop HPs to the Digital Equipment Corporation VAX 11/785 along with related peripheral equipment such as disk drives, printers, plotters, magnetic tapes, and data-collection equipment. The Ethernet communication network is undergoing rapid expansion to include the entire ORNL complex.

Strong emphasis is placed on training, maintaining adequate spare parts, exercising rigorous preventive maintenance, and ensuring factory backup service through service contracts. Innovation and vendor support permit this group to perform required services in a timely and cost-effective manner.

2.2.3 Communication and Security Maintenance (*H. C. Ford, G. D. Inman, and C. A. Smith*)

The Communication and Security Maintenance Group consists of one supervisor, one staff engineer, one engineering technologist, and eleven instrument technicians who are responsible for maintaining site-wide, two-way radios; the security cable television (CATV) network and other security alarm systems and badge readers; the broadband data system;

building sound systems; and video equipment. They also provide audiovisual support for meetings at ORNL.

Preventive maintenance and checkout procedures for the security maintenance system are being rewritten to cover changes in the system. This system is still expanding with installation of additional alarm points and changes in badge reader requirements.

2.2.4 Electronic Fabrication (*C. R. Cinnamon and K. E. Wright*)

The Electronic Fabrication Group consists of one supervisor, one engineering technologist, and seven instrument technicians who are responsible for building instrument prototypes, making major instrument modifications, and assembling electronic instruments. Technicians working with the I&C Division engineering staff construct prototypes and fabricate instruments for I&C Division engineering groups and other ORNL research staff members. Printed circuit boards, produced in small quantities in the group PC Board Facility from drawings generated by the Product Development Drafting Group, are used in prototypes and small production jobs. Photometal work for panels, decals, plaques, and nameplates is also performed in this facility.

2.2.5 Reactor Systems Maintenance (*C. G. Allen and H. L. Haga*)

The Reactor Systems Maintenance Group consists of one supervisor, one engineering technologist, and five instrument technicians. They are responsible for maintenance on all ORNL operating reactors. Reactor systems maintenance, which may be performed only by technicians certified for reactor control work, provides maintenance services to all reactors at ORNL. This group provided maintenance assistance for several significant design changes to the control and safety-related systems at the High Flux Isotope Reactor (HFIR) facility. Previously established maintenance programs have continued.

Maintenance personnel continue to gain experience with the systems and increase their diagnostic ability with equipment malfunctions or abnormal conditions. Increased proficiency, redundant instruments, and interchangeability of modules have enabled the technicians to perform all routine plant maintenance on-line while reactors are operating. Preventive maintenance capability also improved so that, through careful scheduling, <10% of the programmed maintenance work will require reactor shutdown.

2.2.6 Research Support (*R. P. Effler, A. J. Beal, R. J. Bradford, M. T. Hurst, G. R. Sullivan, B. A. Tye, H. S. Bruner, and V. F. McClain*)

The Research Support Group coordinates field installation of engineering projects for ORNL Engineering. I&C Division Maintenance procures or provides (or both) parts and material; submits cost estimates; ensures proper assignment of work to respective crafts; and coordinates, fabricates, calibrates, installs, and checks systems in a timely and orderly manner in accordance with ORNL Engineering-approved drawings. The scope of such projects requires close coordination of I&C Division and Plant and Equipment Division services. Upon completion of each project, a fully functioning system is delivered to the operating organization. During the past two years, this group has been involved in several large-scale improvement projects. A nonradiological wastewater treatment project (NRWTP) for the Operations Division included installation of two distributed control systems accommodating ~340 field process signals. Coupled with the NRWTP was an upgrade of process waste monitoring methods and installation of a liquid waste metals

monitor at the HFIR–Thorium-Uranium Recycle Facility and Transuranium Waste Program facilities.

TSD engineering assistance was provided by the I&C Division Measurement and Controls Engineering Section staff to design, fabricate, install, and test a new flow stand calibration system for the I&C Division. Another large project was design, fabrication, installation, and testing of a data acquisition/control system and signal instrument upgrade for the design basis accident process control system at Building 2026.

3. RECORDS SYSTEMS

3.1 WORK REQUEST SYSTEM

TSD has established a formal, documented, interactive management information system to facilitate uniform collection of work request data, proper assignment of work, preparation of work report summaries, and control of manpower and materials.

This system is a 1032 data base program developed in house, entitled *Maintenance Information and Data Acquisition System (MIDAS)*,[2] which was updated to its current format. The primary goal of the MIDAS system is to ensure that data are accurate and collected in a timely manner to provide reliable, traceable maintenance information.

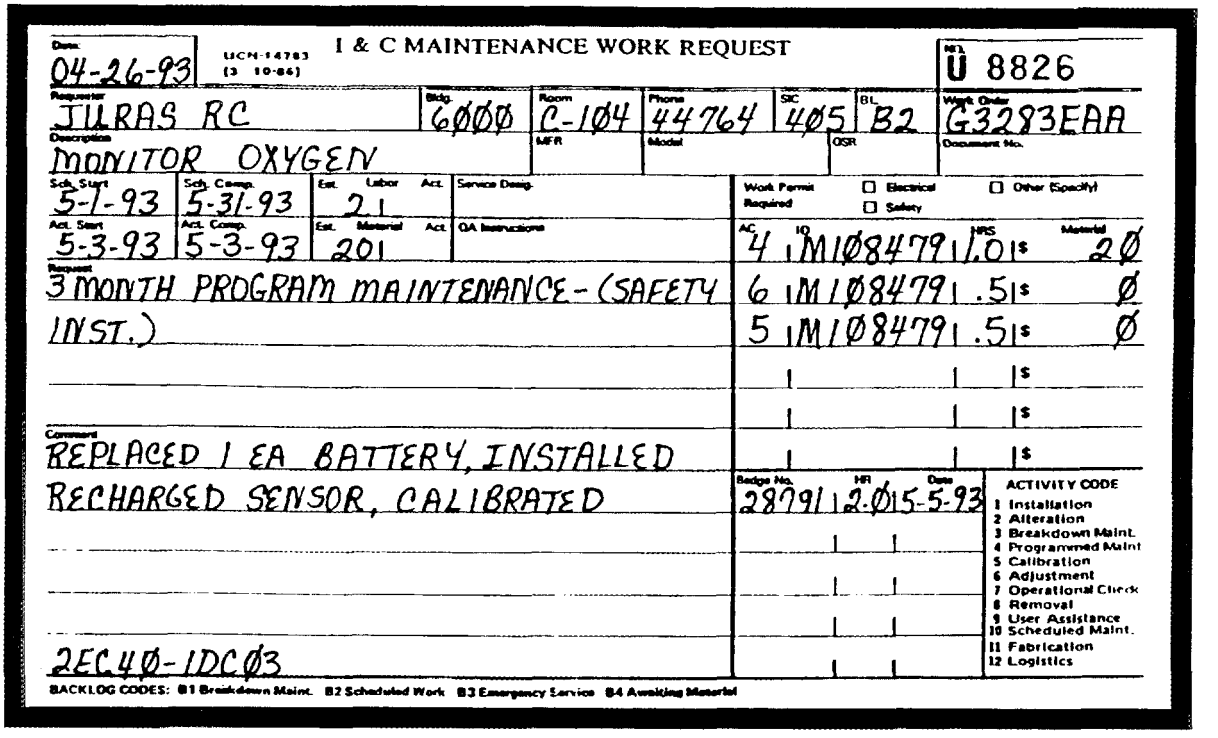
The work order system in MIDAS is identified as "Maintenance, Accountability, Jobs, and Inventory Control (MAJIC)." This part of MIDAS, primarily dedicated to work requests and equipment inventory, contains data on personnel assignments to supervisors, Calibration Program, Preventive Maintenance Program, equipment histories, and tracking and tracing of calibration standards.

MAJIC is a tool that aids in work planning and scheduling, cost collection (labor and material), and equipment maintenance history and provides a basis for reporting job backlogs, job status, and work performance. Every job requested or scheduled is described and documented by a work request generated at the shop level by a supervisor, an engineering technologist, or an instrument technician. A work request is written on a standard form (UCN-14783), shown in Fig. 3a, for later entry into MAJIC or can be entered directly into the MAJIC system through a local terminal, as shown in Fig. 3b.

3.2 EQUIPMENT RECORDS

The inventory system is designed to provide, in one central location, a record of all equipment at ORNL maintained by the I&C Division. Although the inventory system is used mainly by the I&C Division in its maintenance activities, the information is available as a service to other ORNL divisions. Read-only access to the I&C Division MIDAS system for obtaining maintenance information needed in day-to-day operation and to ensure compliance with Laboratory policies is available upon request. Equipment records are maintained in MAJIC, as shown in Fig. 4.

All instruments for which the I&C Division has maintenance responsibility are identified with a bar-coded ORNL property or I&C Division Maintenance number and documented according to TSD inventory system requirements. The primary objectives of the inventory system are to (1) maintain an up-to-date list of instruments; (2) maintain a history of each instrument, including its maintenance and calibration history; (3) provide systematic recall for calibration and programmed maintenance; (4) provide scheduled maintenance and recall for special programs or facilities; (5) identify those instruments that require excessive maintenance in a specified time period; (6) identify problem items and help justify modification or replacement; and (7) identify the ten most costly items in the inventory in terms of maintenance costs to assist in management decisions relating to equipment procurement. The system also provides summarized historical data on maintenance activities for use by staff personnel in making decisions to improve maintenance efficiency.



I & C MAINTENANCE WORK REQUEST

Date: 04-26-93 (UCN-14783 (3 10-84))

No. U 8826

Requester	Bldg.	Room	Phone	SIC	BL	Work Order
JURAS RC	6000	C-104	44764	405	B2	G3283EAA

Description: MONITOR OXYGEN — MFR — Model — OSR — Document No.

Sch. Start	Sch. Comp.	Est. Labor	Act.	Service Desig.
5-1-93	5-31-93	2.1		
Act. Start	**Act. Comp.**	**Est. Material**	**Act.**	**QA Instructions**
5-3-93	5-3-93	201		

Work Permit Required ☐ Electrical ☐ Safety ☐ Other (Specify)

Request: 3 MONTH PROGRAM MAINTENANCE-(SAFETY INST.)

AC	ID	HRS		Material
4	M108479	1.0	$	20
6	M108479	.5	$	0
5	M108479	.5	$	0

Comment: REPLACED 1 EA BATTERY, INSTALLED RECHARGED SENSOR, CALIBRATED

Badge No.	HR	Date
28791	2.0	5-5-93

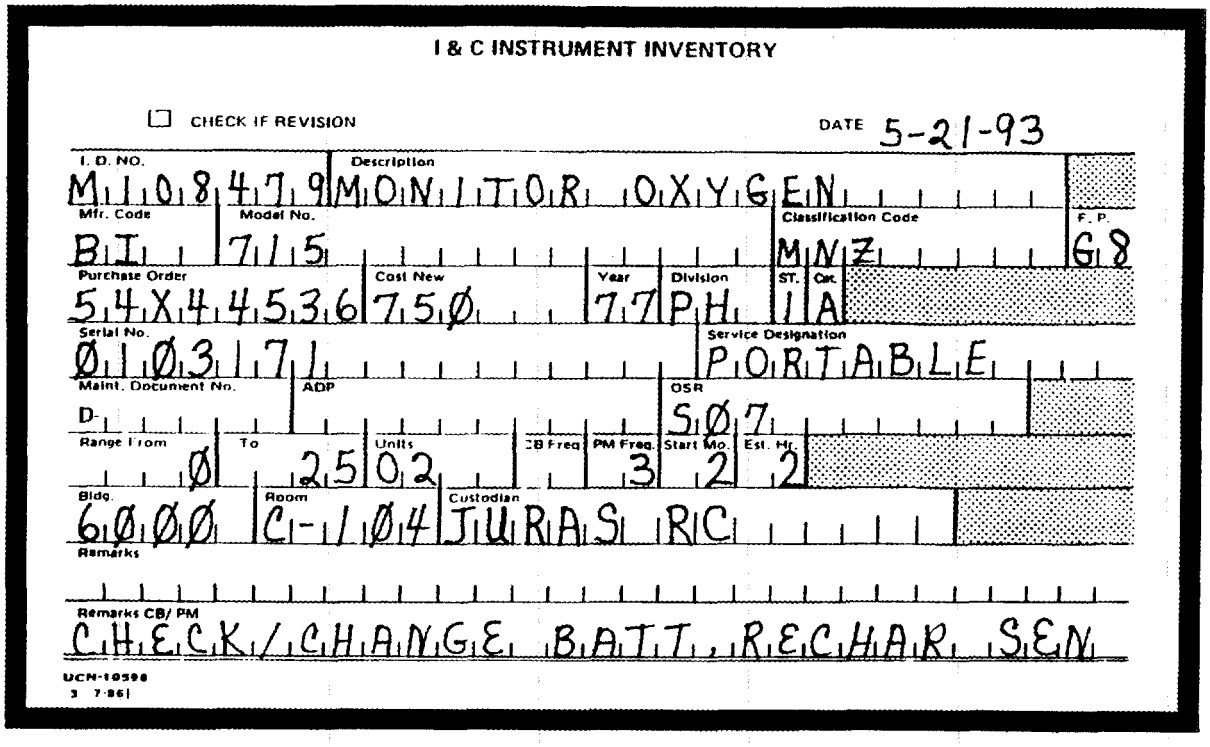
ACTIVITY CODE
1 Installation
2 Alteration
3 Breakdown Maint.
4 Programmed Maint
5 Calibration
6 Adjustment
7 Operational Check
8 Removal
9 User Assistance
10 Scheduled Maint.
11 Fabrication
12 Logistics

2EC40-1DC03

BACKLOG CODES: B1 Breakdown Maint. B2 Scheduled Work B3 Emergency Service B4 Awaiting Material

```
DATE: 04/26/1993     BADGE NO.  16545                          JOB NO.: X68379

REQ JURAS RC         BLD 6000   RM C-104  PH 44764   SIC 405  BL B2  WO G3283EAA
DESC MONITOR OXYGEN        MFR        MDL                OSR        SLNO

SCH ST 05/01/1993 SCH CP 05/31/1993 LBR EST     2 ACT     2.0SD PORTABLE
ACT ST 05/03/1993 ACT CP 05/03/1993 MTL EST    20ACT     20 QA
            C o m m e n t s                    AC     ID          HR       MATRL
3MONTH PROGRAM MAINTENANCE-(SAFETY INST.)       4   M108479       1.0        20
REPLACED 1 EA BATTERY,INSTALLED RECHARGED       6   M108479       0.5         0
SENSOR,CALIBRATED                               5   M108479       0.5         0


                                              BADGE      HR        DATE
                                               28791      2.0   05/05/1993


   MAINTENANCE CODES: 2EC40     1DC03
            <Type JOB NUMBER You Wish To Review and/or press ENTER>
```

Fig. 3. Maintenance Work Request: (*a*) standard form and (*b*) terminal display.



I & C INSTRUMENT INVENTORY

☐ CHECK IF REVISION

DATE 5-21-93

I. D. NO. M108479	Description MONITOR OXYGEN								
Mfr. Code BI	Model No. 715						Classification Code MNZ		F. P. G8
Purchase Order 54X44536	Cost New 750		Year 77	Division PH	ST. 1	Cat. A			
Serial No. 0103171					Service Designation PORTABLE				
Maint. Document No. D-	ADP			OSR S07					
Range From 0	To 25	Units 02	CB Freq	PM Freq. 3	Start Mo. 2	Est. Hr. 2			
Bldg. 6000	Room C-104	Custodian JURAS RC							
Remarks									
Remarks CB/ PM CHECK/CHANGE BATT, RECHAR SEN									

UCN-10598
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MAJIC INVENTORY
TECHNICAL SUPPORT DEPARTMENT

I.C.NO. 13040
I.D. NO. M108479 DESCRIPTION MONITOR OXYGEN

MFR.CODE BI MODEL NO. 715 CLASS CODE MNZ FP G8
P.O. ORDER 54X44536 COST 750 YEAR 77 DIV PH ST 1 CAT A

SERIAL NO. 0103171 SERVICE DESIGNATION PORTABLE
S.L.NO. ADP OSR S07

RANGE FROM 0 TO 25 UNITS 02 CBF PMF 3 START MO. 2 EST HR 2
BLDG 6000 ROOM C-104 BADGE NO. 16545 CUSTODIAN JURAS RC

REMARKS
REMARKS CB/PM CHECK/CHANGE BATT,RECHAR SEN

TSD PROCEDURE SYSTEM PROCEDURE

<Revise Inventory - BLANK DESC Cancel - RETURN next field - ENTER accept form>

Fig. 4. Instrument Inventory: (*a*) standard form filled in by hand and (*b*) computer display of data entered by supervision.

3.3 TRAINING AND RECORDS

The exponential increase in the technological data available to designers of instrumentation and controls systems requires that a continuous and intensive training program be an integral component of an effective maintenance organization. TSD maintains a training program covering subjects ranging from the fundamentals of technical theory to the practical application of theory to the specifics of a particular instrument or system. Safety topics such as cardiopulmonary resuscitation and first aid are also taught because they are considered essential to the well-being of all laboratory employees.

Special training is a general classification that includes all TSD-sponsored training conducted under classroom conditions and directed toward improving job performance. Training courses comprise in-house lecture classes, video tape classes (TSD maintains a library of >400 tapes), outside seminars, and satellite-transmitted training sessions. These media are used to cover such diverse topics as the fundamentals of digital logic, operational safety requirements, reactor-access training, laboratory emergency response center, microprocessors, and a broad range of on- and off-the-job safety concerns. This type of training may be used exclusively or it may be incorporated into special training. Advanced education, course work completed outside normal working hours, is directly applicable to improving job performance.

The TSD Training Program is dynamic. Its content and format are constantly reviewed and updated to reflect the changing scientific and technological environment of ORNL. All TSD courses are available to any laboratory employee who has a need for the subject material presented. Employee training records are kept in a data base on the I&C Division VAX 6310 computer system, and this information is available to those for whom it is essential (e.g., maintenance supervisors). Adequate, high-quality training is an indispensable tool to a research facility such as ORNL.

4. JOB SCHEDULING AND CONTROL SYSTEMS

4.1 JOB SCHEDULING

Requests for services from customers are received by the shop supervisor or shop personnel. Work request forms are completed for all jobs and entered into the TSD job control system. Jobs are assigned to instrument technicians by the shop supervisor or representative according to the needs of the customer and shop workload. Urgent requests are given top priority. Reports generated by the MAJIC system at the request of the supervisor or TSD staff provide a mechanism for monitoring job progress. These reports indicate jobs in the queue but not in progress, jobs in progress, jobs behind schedule, and jobs exceeding estimated cost. On the basis of this information, needs of the customer, and available shop manpower, schedules are modified to provide optimal service to TSD customers. Unexpected increases in workload in a particular shop may require the temporary reassignment of technicians from other shops. Such reassignment of technicians reduces Department overhead, provides cross training for technicians, and results in a minimum of customer downtime.

The TSD Research Support Group coordinates large-job planning with I&C Division personnel and representatives from other ORNL divisions. Using CS^2 charts, critical-path scheduling, quality assurance (QA) plans, and other planning techniques, TSD can control and monitor the progress and cost of each job to ensure smooth and continuous work flow.

4.2 FORMAL JOB PLANNING

I&C Division Maintenance support activities consist of a broad, continually changing equipment environment. Work planning must be adaptive to the individual work center. Job planning is a high priority activity with as much structure and documentation as the individual task permits.

Formal job planning in TSD ranges from executing a maintenance work request for small jobs accepted over the telephone to detailed planning efforts including charts, QA plans, site visits, work permits, and checklists for complex jobs. Reactor maintenance requires completion of a formal work package before work is performed.

Recognizing the benefits to be gained by freeing instrument technicians from detailed job planning to fully apply their technical skills and realizing the need for a high degree of flexibility in carrying out their responsibilities, TSD uses supervisors, engineering technologists, engineers, and computer systems to plan and control maintenance activities. Work planning is based on priorities, scope, and content. From many standpoints, the techniques and resources developed, implemented, and upgraded have proven both successful and economical. The maintenance work request is a flexible, cost-effective planning tool for all work performed by TSD. Status reports are available as an aid in planning work center activities such as breakdown maintenance, calibrations, preventive maintenance, scheduled work, and fabrication.

Excessive maintenance and maintenance history reports are used by the supervisor in planning the work activities of the work center. Excessive maintenance reports identify equipment that needs to be replaced or rebuilt because of high maintenance costs. Equipment maintenance history is used by the supervisor to make reasonable estimates of

the labor and material required to complete the work before customer approval is obtained for work completion.

Weekly staff may be used to assist in the preparation of work request estimates for labor and material. Only engineering technologists with many years of experience are assigned to this estimating activity. The key function of the supervisor is to adequately supervise work center activities.

4.3 BACKLOG CONTROL

Backlog is defined as work not completed by the scheduled completion date. The reliability of instruments affects the level of work or research accomplished by staff members at ORNL. For this reason, TSD places high priority on prompt repair of failed instruments and in keeping the breakdown maintenance backlog at an absolute minimum. Maintenance activities are therefore scheduled according to the needs of the various operating divisions or laboratory experiments. The TSD backlog consists primarily of preventive maintenance, calibration, and other routine tasks. Preventive maintenance and calibration tasks are controlled by a computerized recall system. The actual scheduling of work is a function of shop manpower considerations, availability of equipment, and customer needs.

4.4 JOB PRIORITY SYSTEM

The TSD job priority system was established to carry out the assigned tasks of the Department in an orderly manner. Several factors are considered in assigning job priorities: (1) urgency (consequences of delayed repairs), (2) personnel requirements, and (3) TSD priorities.

The requester or the requester and appropriate TSD staff members evaluate(s) the effects of delayed repairs on (1) human health and safety, (2) security, (3) programmatic needs, (4) data protection, and (5) downtime. The requester and the TSD supervisor work together to set job priorities for work requests categorized as follows:

1. emergency maintenance: work required immediately for health, safety, security, programmatic needs, data protection, or downtime reduction;
2. breakdown maintenance: work required to repair failed equipment;
3. preventive maintenance: work scheduled in advance and performed on a routine basis;
4. calibration maintenance: work scheduled in advance and performed on a routine basis; and
5. scheduled work: work scheduled for completion in a timely manner with respect to facility operations or other factors.

Categories are established to facilitate setting priorities on the wide range of TSD work activities, and each work request is monitored until completion. The TSD computerized inventory system is used to schedule preventive maintenance and calibration activities. The MAJIC data base monitors and reports all maintenance activities. Scheduled start and completion dates are monitored to provide exception reports on activities not meeting scheduled start dates or failing to meet completion dates. The

maintenance backlog is also monitored. The job control system provides exception reports on maintenance activities by category of work (e.g., emergency, breakdown). Backlogs, due dates, and job priorities are combined to ensure that high-priority needs are met, jobs are performed in a reasonable length of time, and maintenance resources are efficiently used. The success of any priority system depends greatly on the relationship between the requester and the maintenance organization. The requester must act responsibly to identify needs and establish deadlines. Setting reasonable, realistic priorities enables the maintenance supervisor to plan effectively and reduces unnecessary priority conflicts.

Job priorities are also influenced by Standard Practice Procedures and special programs such as Quality Assurance, Safety, Industrial Safety, Applied Health Physics, Operational Safety Requirements, and Reactor Safety. Some policies and procedures of these programs can significantly affect the time required to complete a job. Appropriate manuals outlining these policies and procedures are used by maintenance personnel.

4.5 PREVENTIVE MAINTENANCE AND INSPECTION

Preventive maintenance (PM) is defined as the routine, recurring work required to keep a facility and its equipment in a condition such that it can be operated at its original or design specifications for an extended period of time. Tasks in a preventive maintenance program consist of specifically defined work such as inspection, cleaning, making minor adjustments, lubricating, testing, measuring, and replacing minor expendable parts. Key objectives of a preventive maintenance program are to (1) extend the life of equipment to minimize capital expenditures, (2) reduce the number of repair calls due to breakdown maintenance, (3) reduce equipment downtime, (4) minimize costly delays of work in progress, and (5) improve the productivity of maintenance personnel by channeling their efforts and time to priority areas.

The instrument and equipment PM Program in TSD is controlled by the MAJIC inventory system (see reference 2). By definition, PM is performed on a schedule rather than in response to a specific failure. MAJIC schedules work in the program by issuing preprinted PM requests. Frequency of PM is determined by vendor recommendations, customer programs, or needs as well as feedback from users and supervisors. Computer printouts for PM identify instruments or equipment on recall, frequency of PM, last date of PM performed, and next scheduled date.

Not all instruments or equipment can or should be included in a PM program. The decision to place instruments or equipment in a PM program may be based on one or more of the following factors:

1. Is PM more economical than breakdown maintenance?
2. Is the instrument or equipment vital to the project?
3. If a failure occurs, does it result in a safety hazard?
4. Is the instrument or equipment included in a program that requires PM or inspection?
5. Will the instrument or equipment need to be replaced soon because it is obsolete?
6. Is funding available for PM?
7. How important to the project is prolonging instrument or equipment life?

5. MANAGEMENT PLANNING AND ANALYSIS

5.1 INFORMATION COLLECTION AND ANALYSIS

MIDAS[2] was created to establish an effective management information system for TSD. This system was designed to incorporate existing programs and add new programs to fulfill management requirements and needs as well as to provide useful information for better job function performance. This system was designed to assist in the management of requirements derived from the ORNL Quality Assurance Program, DOE orders, and divisional and departmental policies and procedures.

The goal of the MIDAS system is to provide rapid access to a broad range of management information programs as easily as possible. Doing so at the touch of a single computer key thus lives up to the MIDAS legend—the "Golden Touch."

The MIDAS system was designed to consider the needs of multiple users through both menu access and direct interactive access to all component data sets. The ability to control system evolution by in-house programmers and system managers is a crucial aspect, with the added advantage of spin-off auxiliary programs created by advanced users.

The organization of this system was developed to permit user access to major areas as quickly as possible without progressing through unrelated menus or long lists of options. It also incorporates fast return to the main menu as well as progressive steps through previous menus. The MIDAS system is divided into the following five major sections:

1. MAJIC (Maintenance Accountability, Jobs, and Inventory Control). This section is dedicated primarily to job control and equipment inventory. It also contains data on personnel assignments to supervisors as well as the Calibration Program, including tracking and tracing calibration standards.
2. ANALYSIS: This section relates to analysis of data, personnel performance appraisals by the Job Control Office, and time distribution.
3. ADMINISTRATIVE: This section is used primarily by administrators to manage major activities such as maintenance contract information; accounting of engineering line items; and tracking reactor drawings, overtime, and procedures. It also contains the TSD training recall and records program. The reports program of this section will be amended continuously to add management reports and summaries as needed.
4. COMMUNICATION: This section contains mail utilities and methods to simplify sending electronic memos. It also contains a directory of Martin Marietta Energy Systems, Inc., personnel as well as a program for TSD news.
5. APPENDIX/HELP: This section contains lists and summaries for quick reference to file point information, classification codes, and manufacturer codes as well as useful hints and "help" information for more effective use of the system.

Section 2.1 of the MIDAS manual is an index cross-referencing the MIDAS computer menus to each section and subsection of this document.

Since the philosophy of the system is dedicated to continuous growth and dynamic change, sections of the MIDAS manual are incomplete or may be subject to frequent change. Replacement sections will be distributed as they are completed.

5.2 COST IDENTIFICATION AND CONTROL

The goal of the Department is to provide cost-effective maintenance support for research instrumentation at ORNL. Such support can be accomplished through only a well- planned program of cost identification and control. MIDAS[2] provides TSD management with the capability to identify and directly influence the cost of labor, material, equipment downtime, and ownership. The system allows for a real-time appraisal of maintenance efforts to identify and correct inefficiencies as needed and provide a method of evaluating improvements. Each level of supervision is assigned responsibilities for identifying the needs and objectives of cost control. These responsibilities are divided among management levels. The craft supervisor has the responsibility for cost-effective management of direct labor and material within the field shop. Each field shop is responsible for the acquisition of material used within that area. Most commonly used material is stocked in a bench stock inventory to reduce the downtime required for repairs. Records of labor and material costs for each job are accumulated in the MIDAS system. Monthly reports are reviewed to identify trends or departures from planned expenditures. Job cost variances are evaluated, and corrective action is taken when necessary.

The general supervisor has the responsibility for the overall coordination of Department resources and evaluation of maintenance policies and procedures to ensure a cost-efficient maintenance program. The costs of labor, material, and overhead for major projects are carefully evaluated and coordinated with other groups and divisions within the laboratory. Field shop performance is assessed and corrective actions are taken to correct perceived problems.

The Planning and Analysis section of the Department is responsible for recording, classifying, reporting, and interpreting Department financial data. A major function is to provide management with the data needed for decision making and efficient operation of the Department. The standard maintenance rate is established annually to cover the projected cost of providing instrumentation maintenance support for ORNL. Department cost is analyzed and cost variances are calculated monthly to verify that cost is within the established budget projections. Outstanding purchasing commitments are continuously monitored to ascertain that needed material is cost-effectively procured. Economic order quantities are established to provide a minimum spares level to support our maintenance efforts and to prevent purchasing material that will not be used or could become obsolete before it can be used. Reports available to management from the MIDAS system provide detailed information about labor, fringe, and job costs; job schedules; backlog status; planned preventive maintenance; and employee hours worked. This management information enables Department managers to make effective decisions concerning the efficient operation of the Department.

5.3 COST/SCHEDULE MANAGEMENT CONTROL SYSTEM (CS^2)

CS^2 is a method for tracking, analyzing, and reporting project management data for large line-item projects and other major-expense projects within DOE. This method provides the contractor and the government with information on cost, schedule, and technical problems while they are occurring and while there is time available to make decisions on alternative courses of action. CS^2 provides management and technical personnel with the information necessary to take corrective action in anticipation of a cost

or schedule variance rather than after one has occurred. CS^2 also meets DOE requirements regarding reporting labor and material data for large line-item projects.

5.3.1 Design

The method used by TSD for collecting, analyzing, and reporting CS^2 data is the 2020 mainframe spreadsheet program, located on the I&C Division VAX 6310 computer. Spreadsheets adapt well to the type of analysis needed for CS^2. The 2020 spreadsheet makes it possible to download cost data from the Finance and Materials Division data bases directly into the program for analysis.

As work packages are received from ORNL Engineering, they are entered into the CS^2 spreadsheet program. The spreadsheet includes information about the nature of the project, baseline data showing monthly budget for labor and materials, and information on the actual monthly cost and project status. Formulas built into the spreadsheet automatically calculate cost and schedule variances as the spreadsheet is updated monthly. The updates provide management with timely, accurate information concerning the status of each project.

5.3.2 Attributes

The spreadsheet comprises the following fields:

- budgeted cost of work scheduled,
- budgeted cost of work performed, and
- actual cost of work performed.

Cost and schedule variances are calculated on the basis of work scheduled and work actually performed. The results indicate the overall status of the project and the success or failure of reaching the projected milestones within the guidelines established in the work package.

5.4 PERFORMANCE MEASUREMENT AND IMPROVEMENT

The goal of TSD is to develop and implement effective procedures for measuring individual and group job performance. Individual judgement and experience are important factors in measuring the quality of performance, but they do not quantify work output. The TSD job control system ($MIDAS^2$) contains data for systematically quantifying and evaluating performance of individual maintenance shops. Several canned reports available from the system can be used to measure performance:

- percentage of jobs completed by due date,
- percentage of jobs completed within cost estimate,
- percentage of jobs started by scheduled start date,
- percentage of scheduled jobs awaiting material,
- percentage of jobs not completed on time because of material delays,
- individual instruments requiring excessive maintenance, and
- customer feedback.

Performance indicators by themselves cannot improve maintenance effectiveness. Indicators can only identify areas where improvement is needed. TSD management can use these identifications for determining the actions necessary to correct and improve deficiencies and thus enable the Department to progress toward established goals. Current performance can be compared with goals to determine what actions are necessary to streamline work, maintain sufficient flow of planned work, and reduce delay and coordination problems.

The qualitative aspects of performance must be considered also when quantitative performance measures are evaluated. TSD uses a customer appraisal form to monitor customer satisfaction and improve customer relations. This form, a questionnaire distributed to a random sampling of customers at regular intervals, provides requested feedback to aid in the evaluation of the maintenance support provided to the customer. The returned appraisal forms are analyzed, and the results are reviewed by TSD staff to determine compliance with customer needs and the overall quality of the maintenance effort.

5.5 QUALITY AND PERFORMANCE STANDARDS

TSD has developed a program of self-assessment and -evaluation to ensure compliance of TSD policies and activities as well as foster a Department-wide awareness in quality matters. The primary objective of the program is to monitor compliance in the areas of operating safety requirements (OSR), limiting condition documents (LCD), quality assurance, technical safety appraisal activities, audit tracking and response, and Occupational Health and Safety Act regulations. Data bases have been developed to track audits and ensure timely responses to deficiencies noted. Internal audits and surveillances provide a mechanism whereby policies and activities of the Department are effectively evaluated and ensure that corrective actions have been implemented.

Program goals are to (1) maintain a viable and cost-effective support activity for those OSR and LCD facilities deemed active by the Office of Operational Readiness and Facility Safety (OORFS), (2) maintain a close working relationship with ORNL staff responsible for environmental safety and health upgrades and translate the program into recommendations for TSD response, and (3) maintain a close working relationship with TSD and I&C Division training personnel to ensure that TSD personnel training complies with DOE orders for reactor and nonreactor nuclear facilities.

5.6 CALIBRATION PLAN

This document prescribes the methods and procedures for management of the I&C Division TSD Calibration Program[1] as required by ORNL quality assurance procedures and this I&C Division Maintenance Management Plan. The Calibration Program is a planned, systematic schedule of all actions necessary to provide adequate confidence that equipment used to make measurements or quality judgements conforms to established technical requirements. It also ensures measurement traceability to NIST or other nationally recognized standards. The primary function of the TSD Calibration Program is to ensure the measurement of any instrument used in inspection or testing to provide quantitative or qualitative data concerning end items, systems, or subsystems.

5.7 ANNUAL WORK PLAN

The Department provides services such as fabrication, modification, installation, calibration, operation, repair, and preventive maintenance of instruments and related equipment. Most of the work performed by TSD supports basic and applied research and development (R&D), engineering, and instrument and computer maintenance on programs for DOE and other federal agencies. The mission of TSD is to support the programs and policies of ORNL, emphasizing safety and ensuring cost-effective support for R&D.

The TSD annual work plan[3] depends upon the programmatic activities of the laboratory. As laboratory funding allocations and priorities change, the activities of the Department must also adapt to provide flexible programmatic support as needed. TSD planning is based on assumptions of future maintenance needs in the ORNL divisions that we support. Several trends will impact the Department during this planning period. These trends include reductions in manpower by attrition or budget cuts, increases in manpower resulting from future requirements, aging ORNL equipment and facilities, increases in Laboratory overhead costs, and proposed new facilities and programs.

TSD does not have an established annual budget to cover the operating expenses incurred in providing instrumentation maintenance support to ORNL. Each year, TSD contacts the ORNL finance managers or divisional finance officers to obtain information about projected funding levels of the programs and facilities they manage. TSD manpower and resource projections are based on the information obtained and are weighted by the percentage of support provided to each division or program. Annually, TSD sets the standard hourly rate to be charged for the following fiscal year. The standard rate is based on the annual projected inflation rate, proposed increases in manpower caused by perceived increases in program or division funding, upgrade of aging equipment or facilities, increased overhead burden, compliance with new requirements or directives, and increased fringe benefit rate. The standard rate is charged to customer accounts or work orders as work is performed.

5.8 LONG-RANGE WORK PLAN

Each year, a long-range work plan is also completed. This plan is based on the long-range priorities and directions of the Laboratory. Identifiable, proposed new facilities and programs provide a basis for long-range planning. After identifying long-range initiatives, TSD planning includes analyzing future training requirements, evaluating preferable qualifications for new-hires, and identifying essential test equipment. One major initiative planned for fiscal year (FY) 1995-96 is the construction of a new maintenance facility for the Department. This new facility, the Advanced Technology Maintenance Facility, will be $\sim$1,100 m^2 (12,000 ft^2). It will contain several maintenance shops, training rooms, offices, and material storage areas. This facility will allow the consolidation of several remote field shops and thus increase the effectiveness and efficiency of field support for several research groups. The additional space provided by the new facility will result in significant improvement in TSD's information management system. A dedicated training facility will permit improvement of TSD's training programs for meeting accreditation objectives and future DOE training requirements.

5.9 THE ORNL HIGH FLUX ISOTOPE REACTOR

The Department has a significant commitment to provide maintenance support for all ORNL research reactors. In the past two years, this support has been undergoing change and upgrade in response to new DOE regulations and recommendations relating to reactor operation. Following the shutdown of the ORNL HFIR ordered by DOE, TSD solicited guidance from several experts and then formulated a strategy for increasing its capability and expanding and improving its management systems.

One of the first goals set was that of beginning a multiyear program aimed at becoming the leading maintenance organization among all DOE contractors in instrument calibration. The Department initiated this process with a significant lead because of the excellent synergism between the engineering and maintenance segments of the I&C Division. A TSD calibration committee was formed to gather data about the state of the art in metrology and our local calibration systems. The committee recommended that a definitive calibration plan be written to address the diverse needs of a multiprogram laboratory such as ORNL. The resulting document[1] prescribes the methods and procedures for management of the TSD Calibration Program.

A companion goal suggested by the calibration committee was to develop detailed, individual-instrument calibration procedures. These procedures would be in a uniform format and apply to ORNL reactors as well as other ORNL nuclear facilities. A special meeting was called in March 1988 to discuss this project with the I&C Division technical staff. Several TSD staff members were assigned responsibility for drafting segments of the total package. By July 1988, drafts of more than 40 calibration procedures were delivered for editorial review. The edited procedures were then copied in a format specific to the ORNL Research Reactors Division and issued for use at HFIR.

The second element of overall TSD reactor support improvement was to substantially strengthen management systems, of which the key system was determined to be the TSD work and equipment information management system. This set of software packages (the MAJIC[2] system and its associated operating procedures) was examined to identify weaknesses in light of current DOE and RRD requirements. We determined that significant improvements were needed in the preventive maintenance recall procedure, calibration standard identification system, and storage of specific calibration data. By the end of this reporting period, all planned improvements were being implemented in software and operating procedures were in preparation.

The third major element of the reactor support upgrade was the TSD Instrument Technician Training Program. In many ways, this program was the most challenging of the three projects. TSD personnel visited a training center operated by a commercial power utility and studied its program and practices. The Department concluded that the extensive effort required makes preparation of a revised, comprehensive training plan a long-range goal. For the near term, TSD elected to revise and reissue the existing in-house training plan based on ANSI 3.1 guidance and begin job-specific training immediately. All of this training, given to all I&C Division personnel regularly assigned or identified as backup personnel for HFIR support, is recorded on videotape for future use.

5.9.1 Outside Automatic Data Processing Equipment Contract Management

TSD has the responsibility for managing outside automatic data processing equipment (ADPE) contracts at ORNL. This endeavor began three years following a successful competitive bid on two large ADPE maintenance contracts, which resulted in a

considerable reduction of contract maintenance cost. Management became concerned that there might also be a reduction in the level of service provided by the vendor. It was decided that the maintenance organization had the necessary expertise to properly audit vendor performance activities on these contracts. An ADPE site maintenance coordinator (SC) was selected from TSD to manage ADPE contracts at ORNL. The ADPE contract flow chart is shown in Fig. 5.

5.9.2 Responsibilities of the TSD ADPE Site Maintenance Coordinator

1. System evaluation

    a. ensures that systems meet the 95% up-time requirements as stated in the contract,
    b. ensures that preventive maintenance (PM) activities are completed as required,
    c. ensures that breakdown maintenance is handled correctly and in a timely manner,
    d. ensures that systems are kept updated to the proper Engineering Change Order, and
    e. ensures that all PM and breakdown maintenance is properly logged.

2. Vendor performance evaluation

    a. audits vendor response to PM maintenance,
    b. audits vendors' PM procedures,
    c. audits vendors' work quality,
    d. audits vendor response to breakdown maintenance,
    e. ensures timely repairs,
    f. ensures that vendors follow correct procedures, and
    g. ensures that vendors contact higher levels of support when needed.

3. Procurement and logistics

    a. conducts maintenance activity audits of contracted equipment;
    b. audits PM activities to ensure that PM is performed and properly logged;
    c. obtains and provides information required by Procurement and users to issue and administer maintenance contracts;
    d. develops and maintains a data base of contract equipment for tracking additions, deletions, and renewals throughout the year;
    e. assists in expediting purchase requisitions through proper channels as quickly as possible;
    f. expedites blanket shipping orders for parts exchange/repair agreements to avoid excessive downtime;
    g. coordinates maintenance activities with Procurement, vendors, and maintenance users;
    h. assists Procurement and users in evaluating vendor performance;

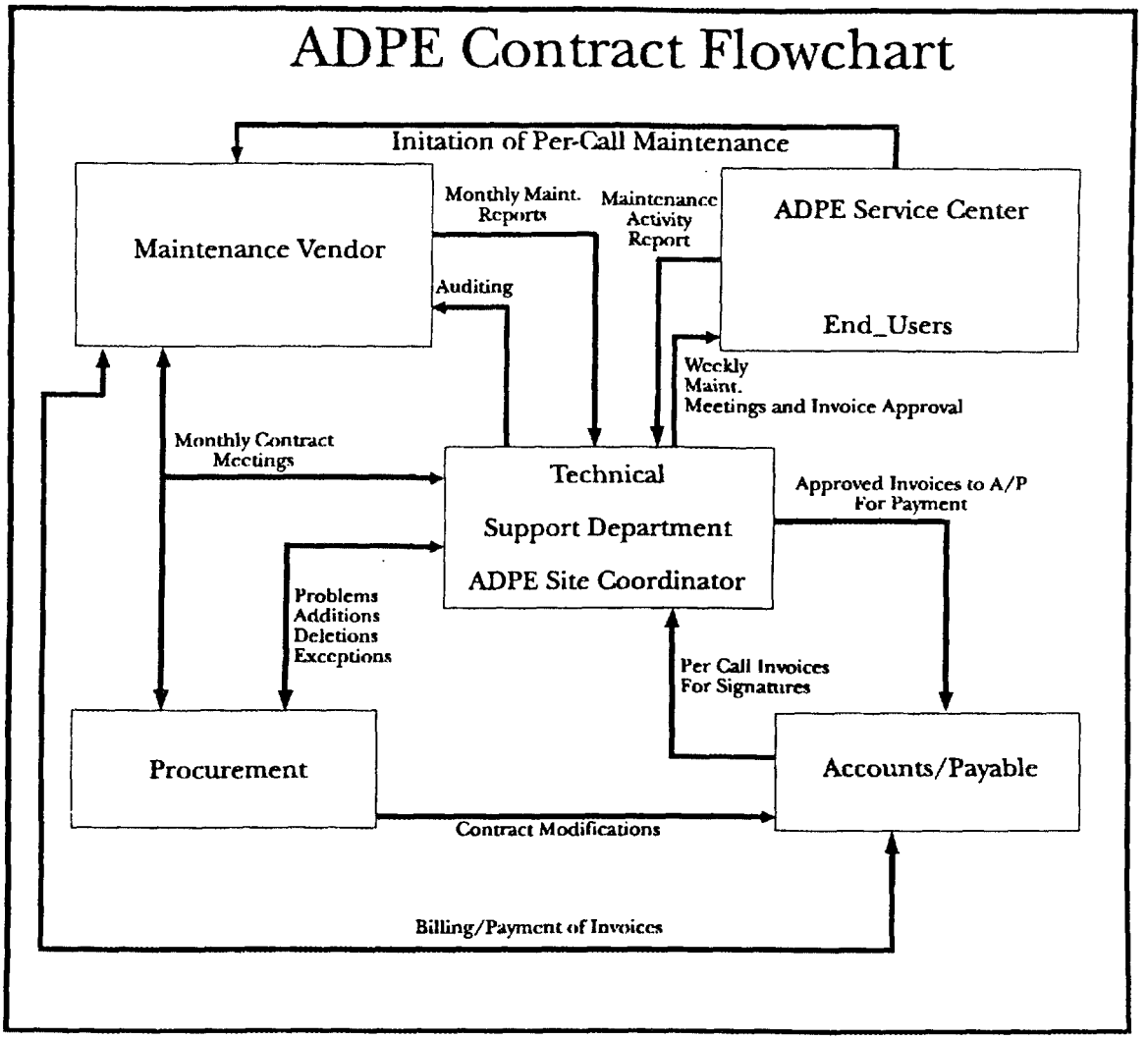

Fig. 5. Diagram illustrating the interaction between Procurement, the maintenace vendor, and the Technical Support Department ADPE site coordinator (ADPE = automatic data processing equipment; A/P = Accounts/Payable).

i. makes recommendations to Energy Systems' Maintenance Steering Committee on ways to improve maintenance services; and
j. reviews all maintenance/repair or contract purchase requisitions to determine cost- effectiveness of in-house or contract maintenance support.

The contract management responsibilities of the TSD have increased considerably over the past two years. The Department has become the main contact for all ADPE maintenance at ORNL. ADPE maintenance is constantly reviewed to ascertain that the most cost-effective method (in-house or contract) is used for maintaining the various types of ADPE. On larger contracts, all contract modifications (additions and deletions) are made at monthly meetings with Procurement, vendors, and the TSD ADPE SC. All necessary changes are communicated from the ADPE service centers and other end-users to the TSD SC before each monthly meeting. At the time of installation, new equipment is added to the contract as a "no-charge" item to ensure that the equipment will receive contract coverage at warranty expiration. Equipment that has been removed from service can be deleted from contract coverage at the next monthly meeting. All changes are effective on the first day of the month following the meeting. The timeliness of these contract changes ensures cost-efficient ADPE maintenance.

TSD also reviews all purchase requisitions involving ADPE outside maintenance, repair, or contracts. Requisitions are approved, disapproved, or modified depending on the type of equipment and whether similar equipment is maintained in-house or by contract. All equipment is evaluated to make certain that the most cost-effective method of maintenance support is employed. When necessary, make/buy analyses are performed to compare outside contract cost with the fixed/variable cost of performing maintenance in-house. This maintenance review ensures that maintenance support efforts for various types of equipment do not become fragmented by having some identical equipment supported by contract and some supported in-house. The main objective is to provide end-users with the most cost-effective maintenance support through the use of all known resources. A subcontract data base is maintained to collect and report these data to the I&C Division director.

TSD has established an important link for Procurement, ADPE service centers, and ADPE end-users. This beneficial link provides cost savings to Energy Systems through the improved efficiency of ADPE contract management and coordination of maintenance activities.

6. PUBLICATIONS

Instrument Calibration Plan of the Technical Support Department[1] documents the methods and procedures for management of the I&C Division TSD Calibration Program as required by ORNL quality assurance procedures and by the *Instrumentation and Controls Division Technical Support Department.*[4] The primary function of the TSD Calibration Program is to ensure the measurement integrity of any instrument used in inspection or testing to provide quantitative data concerning end items, systems, or subsystems. The TSD Calibration Program covers measurement standards and equipment, technical personnel, plant-wide work centers, measurement equipment users, calibration data, and integrated planning. These elements are combined in a structured program to ensure the reliability and accuracy of systems, subsystems, and equipment by verifying that equipment used to make measurements or qualify judgments conforms to established technical requirements.

Technical Support Department Operational Safety Requirements Program[5] describes the requirements, procedures, and responsibilities of the I&C Division TSD for instrument maintenance in ORNL nonreactor nuclear facilities with designated operational safety requirements. This report outlines applicable DOE, Martin Marietta Energy Systems, Inc., and ORNL procedures. The objective of this document is to present a surveillance plan for nonreactor nuclear facility safety hardware, thereby fulfilling the requirements of the responsible ORNL operating division.

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