PREVENTION OF DETERIORATION CENTER
DIVISION OF CHEMISTRY AND CHEMICAL TECHNOLOGY
NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL

ANNUAL REPORT

1963 - 1964

Also

FINAL REPORT

Under

Office of Naval Research Contract Nonr-2300(17)

May 31, 1964

2101 Constitution Avenue
Washington, D. C. 20418

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I. PREFACE

This report serves two purposes: 1) it is the Annual Report of the Prevention of Deterioration Center for 1963-1964 (actually for the period of March 1, 1963 - May 31, 1964), and 2) it is the final report which will be issued by the Center under the Office of Naval Research Contract Nonr-2300(17) which terminated May 31, 1964. It is not, however, a terminal report of the Center.

With the termination of Contract Nonr-2300(17) the scope and mission of the Center changed considerably. The functions and services reduced or eliminated due to the funding reduction include (a) provision of an advisory and consultative service on broad deterioration problems; (b) searching a wide segment of USA and world journal and report literature in the field of materials deterioration and its prevention; (c) acquisition of journal articles, reports, patents, and other documents in this field; (d) preparation, publication, and dissemination of an abstracts service on the most significant portion of those documents acquired; (e) responses to subject matter inquiries in the deterioration field; (f) performance of literature searches in materials deterioration and prevention; (g) preparation of annotated and unannotated bibliographies; (h) preparation of analyses, evaluations, or state-of-the-art reports; (i) publication of lists of documents in deterioration specialties; (j) publication of a quarterly PDC Newsletter; (k) sponsoring of conferences in the materials deterioration field; and (l) provision of a document loan service.

The Center will continue to operate, but after June 1, 1964, until further notice, under Contract NASr-182 with the National Aeronautics and Space Administration, and Contract DA-18-064-AMC-243(A) with the Department of the Army Biological Laboratories. The NASA contract NASr-182 commenced January 1, 1964, and thus a portion of the work reported in the Annual Report was accomplished under that contract. The NASA work is also reported in quarterly reports. Contract DA-18-064-AMC-243(A) with the Army Biological Laboratories commenced on May 11, 1964. This work is quite distinct from both Nonr-2300(17) and NASr-182, and progress is to be reported in a separate series of quarterly reports. For further information with regard to PDC functions under the NASA contract and the contract with the Army Biological Laboratories, the reader is invited to direct his inquiry to the Center.

Although this particular document does not report the termination of the Center, it does represent a transition point in a long and useful relationship. Thus, it appears quite appropriate to include a history and account of activities and accomplishments up to the present date in the section regarded as a final report.

It is also thought appropriate to include a foreword, outlining briefly the need for recognition of a unified field in the materials/environment relationship.

C. J. Wessel, Director
Prevention of Deterioration Center

II. ACKNOWLEDGEMENTS

Because this is both an annual report of the Prevention of Deterioration Center and the final report of the Center under its long-term Office of Naval Research contract, it is the final instrument for making certain acknowledgements. The Center was supported financially under the tri-service funding of Nonr-2300(17), or preceding similar ONR or ORI contracts, for practically the entirety of the nineteen years to date of its existence. It is indeed a real pleasure to acknowledge the cordial and satisfying relationship that has existed during those years with its sponsors in the Departments of the Navy, the Air Force, and the Army, and, of course, in the few months of the present year with its new NASA sponsors under NASr-182. It is the earnest hope of the Center that the services it has rendered to its sponsors have fulfilled their needs adequately.

Over the past nineteen years, many people have been helpful to the Center. Although the PDC certainly wishes to express its deepest appreciation to all these people--in the Armed Forces, in the National Academy of Sciences-National Research Council, in the Center itself, and in many other organizations--it is almost impossible to list them all. Nonetheless, it wishes to make known its debt of gratitude to the following people associated either presently or in the past with the organizations shown:

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Because of the informational nature of the Center and its dependence on the scientific literature, the organization naturally worked closely during its entire existence with the Library of the National Academy of Sciences. The assistance provided by the NAS Library was essential to the successful document acquisition program of PDC. For this reason the Center wishes to make special acknowledgement of this assistance to the two immediate past librarians of the Academy, Miss Callie Hull and Dr. John Gribbin, and the present NAS librarian, Mr. James L. Olsen, Jr.

Lastly, acknowledgements by Center management would not be complete or meaningful if no mention were made of the staff of the Center. I am sure the former director of PDC, Dr. Glenn A. Greathouse (1945-1955), would join

with me in expressing gratitude and admiration for a fine staff over these nineteen years. Substantial in number, the staff embodied a group of highly qualified and generously motivated people who gave the Center largely whatever measure of success it enjoyed during its existence. If, through inadvertence, some names have been omitted, the indulgence of the bearers is begged.

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C. J. Wessel, Director
Prevention of Deterioration Center

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III. FOREWORD

The field of scientific and technical effort which the Center strives to serve is not clearcut with widely recognized and highly professional authorities to act as spokesmen for the over-all field. This field, not clearly delineated by the title of the Center--Prevention of Deterioration Center--has in the past several years been described by the Center as dealing with the deteriorative effects of environments on materials and equipment. Thus, although there are authorities who are spokesmen for certain highly specialized aspects of environmental effects on materials such as corrosion, or polymer degradation, or textile or wood rotting, or highly degradative space environments, the collective effort has few if any authoritative voices clearly announcing that here is a field of endeavor that can make more meaningful advances if the many highly specialized areas band together for a common attack on environmental problems--still a specialized area in itself. This lack of kinship and failure to recognize the over-all environmental problem of materials has led to situations where consideration of environmental problems more often than not comes as a by-product of other needs or, worse, comes only after materials, equipment, structures, or systems suffer environmental failures in use. That is no time for prevention; at best it permits only alleviation, or it may necessitate costly replacement.

There is no lack of evidence of environmental problems. Everywhere about us we see the results--metals still corrode; pests still ruin wood, textiles, paper, books; plastics and rubber still age too rapidly; paints and coatings still crack and peel; shock and vibration still ruin equipment; concrete structures still spall and crack; heat, light, moisture, oxygen, ozone, pests, dust, salts, contaminants still cost us untold dollars of loss, and space environment problems greatly limit space programs.

Is this because nothing has been done about these serious and costly problems? Emphatically not. Much very good work has been done to improve materials and give resistance to environmental deterioration. Products are available today that have high resistance. Excellent protective coatings and systems are known. Preventive or corrective designs are known.

Why then is there still such an enormously expensive problem? One reason is that environmental problems are for the most part isolated and handled singly. A corrosion problem is seen only as a corrosion problem. Marine borer attack is seen only for what it does to wood in the sea. Textile rotting is seen only as a problem of overcoming fungal organisms. Plastics and coatings degradation is seen only for itself. Shock and vibration and other "induced" environmental phenomena are regarded as far removed from any of the foregoing problems.

The workers in these isolated fields do not see their kinship, one with the other, as commonly motivated to conserve valuable materials, equipment, manpower, and dollars. Not being closely allied they cannot make a non-existent collective voice be heard calling attention to the heart of the environmental problem of materials. Consequently, each has to wage his isolated battle alone. And even winning that battle, that is all he wins.

That battle and all the similar skirmishes of his unknowing and unknown co-workers are not coordinated in the over-all war against environmental failures and the fight for materials conservation.

A second group of reasons for the existence of these continued failures and high costs include the very human tendency to shirk responsibility for costly errors of judgment, existence of a very apparent lack of knowledge, or even an inability to use resistant materials, treatments, or designs because of economic limitations or undue competitive situations. To overcome these reasons there is need for an understanding management, the removal of fear of reprisal, and the recognition that no one man or small group can possibly have all the knowledge to prevent all environmental failures.

A third reason is reluctance to recognize environmental failures for what they are so that the true costs of deterioration may be known. By such knowledge and motivation adequate recognition of the environmental problem could be attained and backing obtained for the necessary research and development, to say nothing of the collection and meaningful dissemination of knowledge required for a substantial reduction of deterioration costs and the conservation of materials and manpower. When a wooden structure fails because of termites or rot, it should be so stated in the records. The fact should not be lost because of lack of methods to report it. The recorded impression should not be left that repairs were made because of another reason or the fact lumped under some vague generality. The same may be said of many other forms of deterioration from corrosion to carpet beetles, from silo failures of missile electronic equipment to radiation failures in space. Were the total costs of these failures known, the environmental problem could be put into its proper perspective, the recognition given to the endeavor which it merits, and the necessary steps taken to cope with the problem in an organized program.

C. J. Wessel, Director
Prevention of Deterioration Center

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IV. Historical Sketch of the Center

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A. Background

During the early years of World War II the Armed Forces of the United States found themselves faced with perplexing problems of deterioration of service materials and equipment. Such materials and equipment, with a predictable life of months or years when used in temperate climates, became inoperable in a matter of weeks when employed in the tropics or in the polar regions.

In the United States, among the first to recognize the gravity of the deterioration problem were certain forward-looking officers and civilian scientists in the Navy Department. The Army, of course, was faced with similar problems. After a series of discussions, the two services cooperated in the establishment of a Joint Army-Navy Deterioration Steering Committee under the National Defense Research Committee. Together with the necessary subcommittees, it set out to analyze the needs of the Armed Forces and to find means of satisfying those needs. Subsequently, with the establishment of the Office of Scientific Research and Development in June 1941, the Tropical Deterioration Information Center was instituted using the services and facilities of The George Washington University.

The combined efforts of these two groups led to recommendations for emergency measures which brought substantial improvements. By the close of World War II, the activities had clearly demonstrated their continuing usefulness. In 1945, therefore, the Office of Research and Inventions of the Navy Department recommended a more permanent organization. The functions of the wartime steering committee were transferred to a new Joint Army-Navy Deterioration Prevention Committee, and the group at the University was reconstituted as the Prevention of Deterioration Center, under an ORI contract with the National Academy of Sciences-National Research Council. Some months later the Army, also recognizing the value of continuing the work, renewed its financial cooperation and, when the Department of the Air Force was created as a separate service, it joined in the effort with a cross-service order of its own. The Prevention of Deterioration Center thus eventually came into being with the sponsorship and financial support of all three Services of the Department of Defense. Situated initially at the NAS-NRC within the Division of Biology and Agriculture, the Center was transferred in 1948 to the Division of Chemistry and Chemical Technology.

The chief purposes of the Prevention of Deterioration Center included collecting and organizing in one depository the latest scientific and technical research information on workable techniques of deterioration prevention; serving in a consulting and advisory capacity on such matters for the military agencies, for other government groups, and for other authorized persons not directly associated with the Federal Government, and providing other services such as publications, conference host facilities, and government and non-government liaison. In the years since its inception in 1945, the Center accumulated a comprehensive knowledge and facility on this highly specialized subject not readily available elsewhere, including wide coverage of Department of Defense and other government reports.

The title of the earlier organization, the Tropical Deterioration Information Center, describes accurately the scope of the work then accomplished. The main problems of that time in deterioration centered around tropical effects. When the Prevention of Deterioration Center was established at the NAS-NRC in 1945, the scope of the work was enlarged and it became the responsibility of the Center to concern itself with all environmental situations involving what might be termed natural, terrestrial or near-terrestrial climatic factors. These factors included the following:

Physical-Chemical Agents

Heat and Cold (temperature extremes of the natural climates)

Solar Radiation (as influenced by the earth's atmosphere)

Sand, Dust, Dirt, and Grit

Wind and Pressure

Moisture (water, water vapor, condensed water, fog, rain, sleet, ice, snow, etc.)

Salts (salt water, salt spray, salt dust, etc.)

Acids and Alkalies (as in nature)

Gases (oxygen, ozone, CO_2, SO_2, H_2S, etc.)

Electrostatic discharges

Biological Agents

Fungi (mildew, mold, rot)

Bacteria

Algae

Insects

Rodents

Marine Boring and Fouling Organisms

The materials and equipment of concern included all those items usually designated by the Defense Department as materiel. The scope and functions of the Center did not include environmental effects on man, on food, or on drugs.

At the May 1957 annual meeting of its Scientific Advisory and Services Technical Committees, the Center was urged by the Department of the Air Force (with the later concurrence of the Army and Navy) to survey the field of "induced" and operational environments to determine whether in this field there was a need of the Department of Defense and its contractors

for the same type of service the PDC had been providing in the "natural" environments. "Induced" and operational environments include such factors as explosive atmospheres, mechanical and acoustical vibrations, impact shock, acceleration, chemical deterioration, nuclear radiation, thermal shock, pressure shock, atmospheric composition, high vacuum, high and low temperature extremes, zero gravity, solar radiation, cosmic radiation, dissociated gases, ionized gases (plasma range), aurorae, corona, magnetic fields, and solid particles of grit and meteoric dust. (Some of these factors, such as nuclear radiations, were already being handled by other information centers and would not become part of the Center's work).

The Center and its Scientific Advisory Committee conducted such a survey over a period of about one year and reported on it at the annual meeting of the Committee in May 1958. The survey included visits to major missile and rocket installations of the Department of Defense, attendance at scientific society meetings where such environments were discussed, visits to industrial manufacturers of missiles, a survey of the scientific literature, and a large number of conversations with government and industry personnel in the missiles and rockets field. It was concluded that the Department of Defense and industrial organizations needed an information and consulting service in the field of induced environments similar to the service then being rendered by the Prevention of Deterioration Center in the field of natural environments.

After considerable deliberation the Center and its Scientific Advisory Committee decided that the PDC could provide such a service if funds for its support were made available. On the occasion of the May 1958 meeting, the PDC Scientific Advisory Committee adopted the following resolution:

"Whereas testimony received from all three of the Armed Services supports the original request submitted by the Environmental Criteria Branch, Engineering Services Division, Directorate of Laboratories, Wright Air Development Center, that the Prevention of Deterioration Center extend its documentation and consultative services to include the field of induced environments, and

"Whereas the available evidence indicates that the Armed Services desire that the Prevention of Deterioration Center continue its present documentative and consultative services in the field of natural environments at substantially its present level of operations, and

"Whereas the Director of the Prevention of Deterioration Center and members of its Scientific Advisory Committee have by means of personal surveys of many installations of the defense departments and by conferences with personnel at these installations established the need for documentation service in the field of induced environments, and

"Whereas the Prevention of Deterioration Center has had twelve years of successful experience in the storage and retrieval of useful information for defense departments and other governmental agencies

"Therefore, be it resolved, (a) that the Scientific Advisory Committee of the Prevention of Deterioration Center advise the Services Technical Committee, representing the sponsoring agencies of the Prevention of Deterioration Center, to authorize the Prevention of Deterioration Center

to extend its documentation services into the field of induced environments, and

"(b) that the Scientific Advisory Committee of the Prevention of Deterioration Center advise the Services Technical Committee of the sponsoring agencies to seek an amendment to Contract N7onr-291 permitting financial support of the operations of the Prevention of Deterioration Center up to $250,000 annually, thus making possible the extension of its documentation services, and

"(c) that the Scientific Advisory Committee of the Prevention of Deterioration Center advise the Division of Chemistry and Chemical Technology to seek approval of the Governing Board of the National Academy of Sciences-National Research Council to accept funds up to $250,000 per year for the support of the work of the Prevention of Deterioration Center."

By negotiations concluded June 1, 1960, the Departments of the Air Force, Navy, and Army increased the PDC funding from $125,000 to $175,000 per year. Of this $50,000, $15,000 represented a "cost of living" increase, and $35,000 was allocated to work in the new field.

When the decision was made to add the new environments to the PDC scope, it was made clear that the services being rendered by the Center in the field of "natural, climatic" environments should continue as in the past. This policy was followed and, if anything, the actual extent of services rendered in the "natural" environments increased. It is only factual to state, however, that the advent of the new task in June 1960 altered the over-all character of the Center, and that a great deal of time, thought, and energy were allocated to launching the new effort productively and efficiently.

In June 1960, the Center faced the task of entering a field in which it had only pilot plant experience. It was felt, by advisory groups and the staff of the Center, that the most significant service which could be provided immediately would be the publication of a series of substantive abstracts and extracts of the current significant literature in the new field. To accomplish this end several tasks were involved. Whereas, most of the prior work of the Center was related chiefly to the disciplines of chemistry and biology with little emphasis on physics and engineering, the work of the new field emphasized physics and engineering with less emphasis on chemistry and biology. Therefore, it became necessary to alter the character of the Center staff and advisory groups. Two full time engineers were employed, and several part time physicists and engineers added to the abstracting staff.

It also became necessary to broaden PDC coverage of the scientific literature in gathering information in the newer fields. Cognizance of several hundred additional journals became necessary from which to select those considered to be the richest sources of information on the effects of space-associated environments on materials and equipment. The new environmental factors for which the Center became responsible included extremes of temperature, vacuum, mechanical and acoustical vibration, shock, acceleration, chemical deterioration, space radiation, upper atmosphere composition, ionized and dissociated gases, meteoric dust, and gravity.

The surveillance of literature in the new fields and the acquisition of articles from the open literature, from foreign sources, from government and contract reports, as well as all other sources, greatly increased the load on the Center's library staff in acquiring the information, cataloging the reports, and passing them through the various stages required of an abstracting group. It was thus necessary to increase the number of library catalogers to handle this task.

Upon designing the new abstracts service, the Center noted that, while the pace of research and development work in the older fields of the natural environments had proceeded at a more leisurely rate, thus not making necessary the imposition of stringent time limitations on the publication of an abstracts service, national work in the field of the new environments was such that the imposition of severe time requirements was a necessity. Such time limitations required the close scheduling of all steps in the process of gathering information, preparing abstracts, and publication of a monthly bulletin. A new abstracts publication, entitled ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT, was commenced in January 1961* for the field of the "induced" environments.

By early 1961 it had become evident that the funding of the Center was insufficient for the task required. Negotiations were re-opened in April 1961 with the Departments of the Air Force, Army, and Navy with a request for an annual rate of $225,000. By early 1962, these discussions culminated in a new funding rate of $225,000 per year, plus $10,000 per year to support special work in microbiology.

In considering the question of categories used in the environmental field in the past to differentiate classes of environments, some confusion and even controversy had arisen over the use of the terms "natural" and "induced." The scope of the Center itself, as well as the contents of the two sections, A and B, of the abstracts publication, ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT, are made vague and a point of issue by the confusion. The Center held the view that it is not essential to classify environments as "natural" or "induced" and, as a matter of fact, the use of such categories artificially introduces problems, the time for discussion of which could more profitably be spent upon real problems.

The environments, therefore, for which the Center attempted to provide coverage in relation to effects on materials and equipment became:

ENVIRONMENTAL FACTORS
(See Notes 1, 2, 3)

Alphabetical Listing

1. Acceleration

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*In January 1962 this became Section B of ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT and the former PREVENTION OF DETERIORATION ABSTRACTS became Section A of ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT.

2. Biological Agents

    a. Algae
    b. Bacteria
    c. Fungi
    d. Insects
    e. Marine boring and fouling organisms
    f. Rodents

3. Chemicals (occurring in nature)[4]

    a. Gases

        i. Unionized -- oxygen, ozone, etc.
        ii. Ionized
        iii. Dissociated

    b. Liquids

        i. Acids
        ii. Alkalies
        iii. Salts

    c. Solids

        i. Acids
        ii. Alkalies
        iii. Salts

4. Gravity

5. Heat -- (Extremes ranging from orders of magnitude of negative hundreds to positive thousands of degrees F, recognizing that in practical cases only limited increments of this range must be considered)[5]

6. Particulate matter (which causes damage because of its motion, or because of its presence due to motion)

    a. Sand
    b. Dust
    c. Dirt
    d. Meteoric dust or fragments

7. Pressure (earth's ambient at sea level as reference)

    a. High -- such as hydrostatic pressure in the deep sea
    b. Low -- of the order of 10^{-9} to 10^{-12} mm Hg in space

8. Radiation[6]

    a. Electromagnetic
    b. Corpuscular

9. Shock

10. Vibration

11. Water

    a. Gas[4]
    b. Liquid
    c. Solid

12. Wind

Footnotes

1. An attempt is made here to class together those items which may be regarded as causative agents and to avoid purely adjectival phrases such as "corrosive environments."

2. The factors here listed may be regarded as "dynamic" in contra-distinction to certain sets of circumstances also alluded to as environmental, such as "terrain;" presence of vegetation such as forests; streams which must be crossed; sandy and muddy areas which bog down vehicles; mountains and valleys which must be traversed; etc.

3. It should be noted that none of these environmental agents ever acts alone but always in some combination. For example, a temperature is always measured at some pressure; an electrochemical reaction is always at some temperature; humidity is always at some temperature and pressure, etc.

4. Including combinations referred to as corrosive environments.

5. It is recognized here that sudden changes in heat cause "temperature shock."

6. Not duplicating work of Radiation Effects Information Center (REIC).

The environments listed above are important as causes of malfunctioning of material entities. The materials and equipment affected by these environmental factors may be categorized:

Materials						Equipment/Systems
Textiles Cordage Leather	Wood Paper	Plastics Resins Rubbers Waxes	Lubricants Fuels Hydraulic fluids	Metals Ferrous Non-ferrous	Ceramics Glass Plaster	Ground Air Marine Space Electrical Electronics Optical Photographic Mechanical Etc.

What the environmental factors do to materials and equipment is legion and could be delineated in a variety of ways depending upon need, but in every case the result is a form of deterioration, degradation, malfunctioning, damage, lessened efficiency, inability to operate, or other manifestation of decreased ability to fulfill a function for which the material or equipment was chosen or designed. The materials or equipment are said descriptively to have suffered corrosion, erosion, rotting, decay, mildew, oxidation, reduction, crazing, peeling, polymerization, depolymerization, cracking, breaking, bending, deformation, freezing, embrittlement, softening, hardening, or a great variety of other symptomatic failures.

To negate the failures listed in the foregoing paragraph, one may apply preventive, remedial and preservative measures. These may include the use of resistant materials; special design; adequate packaging, storage and transportation; and addition of agents that inhibit corrosion, oxidation, ozonation, radiation damage, biological attack, etc. These agents include coatings, biotoxics, antioxidants, antiozonants and cathodic protection devices.

Analysis of the materials/environment field indicates that the over-all problem may be split into four categories:

1. The environments as causes.

2. The materials, or equipment made of materials, which must exist in these environments.

3. The effects of the environments on the materials and equipment.

4. Programs or steps to negate the effects referred to in No. 3, that is, preventive, remedial, or protective measures.

In this four-way field the Prevention of Deterioration Center served by providing the following activities:

1. Secretariat for JAN (Joint Army-Navy) Deterioration Prevention Committee.

2. Advisory, consultative and conference activities.

3. Information services--responses to inquiries.

4. Liaison and coordination activities.

5. Acquisition and organization of pertinent world literature.

6. Dissemination of information

   a. Abstracts
   b. Advance List
   c. Information storage and retrieval system
   d. PDC Newsletter
   e. Textbook on deterioration

f. State-of-the-art reports
g. Hyperthermal re-entry environmental glossary
h. Miscellaneous scientific and technical publications
i. PDC reports to sponsors
j. Literature searches and bibliography preparation
k. Document loans

7. Special programs

a. Fungicide Screening Program
b. Associated fungicide and other microbiological deterioration activities

i. List of Industrial Fungicides and Suppliers
ii. Fungicide Handbook
iii. Special List of Reports on Microbiological Deterioration
iv. Card file on microbiological resistance of materials

B. Activities and Accomplishments

1. Secretariat for JAN Deterioration Prevention Committee

From the commencement of PDC in December 1945, and continuing for several years, the Center acted as the Secretariat for the Joint Army-Navy-Air Force Deterioration Prevention Committee. This organization was composed of a Main Committee, Executive Council, and nine Subcommittees and Panel:

Optical Instruments Subcommittee
Photographic Equipment Subcommittee
Rubber and Plastics Subcommittee
Test Methods Subcommittee
Textiles and Cordage Subcommittee
Corrosion Subcommittee
Fungicide Subcommittee
Electric and Electronic Subcommittee
Marine Borer Panel

This function of the Center entailed all activities common to a secretariat: arranging meeting dates, providing conference rooms (usually at the National Academy of Sciences), recording proceedings, providing minutes and meeting notices (see list of publications), and keeping records on membership on all committees, subcommittees, and panel. This effort continued until 1949 when the Deterioration Prevention Committee structure was disestablished by order of Mr. Johnson, Secretary of Defense. With that development, it was felt that one of the main objectives of the Center was to provide a focal point for work, interest, and continuity in the field of materials deterioration and its prevention.

2. Advisory, Consultative, and Conference Activities

The advisory and consultative aspects of the Center's work ranged over the spectrum of providing a question-answering service by staff to consulting through the members of its Scientific Advisory Committee on

problems of a broader nature. The broader consultative services by staff or Advisory Committees generally culminated in sponsoring conferences, among which are the following:

a. Navy-Army Plastics Seminar, August 21, 1947.
b. Low Temperature Rubber Panel meetings, September 22, 1947, and October 6, 1947.
c. Arctic Rubber Problems, Rubber Reserve Board and University Research Directors of High Polymer Studies, October 29, 1947.
d. Symposium on Corrosion, Subcommittee on Corrosion, Deterioration Prevention Committee, held at the National Academy of Sciences, February 3-4, 1949.
e. Meeting of ONR contractors on research on wood, cellulose, and lignin, at NAS-NRC, June 15, 1949.
f. NRC-ONR Wood Symposium, NAS-NRC, June 16-17, 1949.
g. Conference to Discuss Marine Borer Situation, jointly sponsored by California Academy of Sciences and the PDC, held in San Francisco, California, July 20, 1949.
h. One-day Symposium on Cellulose Degradation, cosponsored by PDC and the American Chemical Society, at ACS meeting, Atlantic City, New Jersey, September 1949.
i. Wrightsville Beach Marine Conference, cosponsored by PDC and the International Nickel Company, Wrightsville Beach, North Carolina, June 5-6. 1950.
j. Microbiological Deterioration of Organic Materials, cosponsored with AAAS (Gordon Research Conference), New Hampton, New Hampshire, July 31-August 4, 1950.
k. Conference on the Present Status of Research and Development on Fungicides, held at the National Academy of Sciences, March 19, 1951.
l. Problems in Packaging and Storage of Optical Equipment, held at the National Academy of Sciences, September 27, 1951.
m. Meeting on Environmental Deterioration, guest speaker - H. R. Ambler, Director, British Ministry of Supply, Tropical Testing Establishment, Nigeria, West Africa, held at the National Academy of Sciences, October 17, 1951.
n. Conference on Second Stage Screening of Fungicides, held at the National Academy of Sciences, February 19, 1952.
o. Conference on Rubber Deterioration, held at the National Academy of Sciences, September 29, 1953.
p. Conference on Mode of Action of Fungicides, held at the National Academy of Sciences, November 24-25, 1952 (note in Science, Vol. 117, No. 3505, February 27, 1953).
q. Review of Soil Burial Procedures, a series of six conferences held March 21, 1956, April 22, 1958, September 26, 1958, April 28, 1959, May 7, 1959, and September 13-14, 1960.
r. Conference on Metal Metabolism and Microbiological Deterioration, held at the National Academy of Sciences, June 1, 1956.
s. Conference on Deterioration of Plastics, Rubbers, and Protective Coatings, held at the National Academy of Sciences, May 28, 1957.
t. Conference on Stability of Plastics, cosponsored by PDC and the Baltimore-Washington Section of the Society of Plastics Engineers, held at the National Academy of Sciences, December 1, 1959.
u. Meeting of the Ad hoc Subcommittee Advisory to PDC on Induced Environments, January 12-13, 1960 (to determine role of PDC in induced environments).

v. Review of Microbiological Test Procedures, a series of five conferences held March 2-3, 1960, March 21-22, 1960, June 20-21, 1960, April 10-11, 1961, and October 10-11, 1962.
w. Conference of PDC Subcommittee on U.S. Army Chemical Corps Proposal on Materiel Deterioration, Its Causes and Its Control, held at the National Academy of Sciences, November 22, 1960.
x. Missile System Capabilities of the ARGMA, Redstone Arsenal, held at the National Academy of Sciences, December 19, 1960.
y. Interservice Basic Research Planning Conference on Hydrocarbon Jet Fuels and Fuel System Microbiology, held at the National Academy of Sciences, August 3, 1961.
z. Conference on Jet Fuel Microbiology and Corrosion, held at the National Academy of Sciences, April 9-10, 1962.
aa. Conference on Oil Slick Pollution of Harbors and Associated Waters, held at the National Academy of Sciences, March 18, 1964.

3. Information Services - Responses to Inquiries

The PDC information services alluded to in this section refer chiefly to responses to inquiries or "question-answering" services. This activity was provided to a large clientele of Army, Navy, Air Force offices and personnel, as well as to their contractors, and to other Federal Government offices, industry and the general public. This function of the Center provided by permanent PDC staff personnel, was regarded as one of the Center's most valuable services. The average volume of inquiries increased over the years until it amounted conservatively to 50-60 requests per month. During the nineteen years of Center activity under ORI (Navy Office of Research and Inventions) and ONR (Navy Office of Naval Research) contracts, the Center provided responses to many thousands of inquiries, questions, and other requests for information.

The types of inquiries and requests were very diverse. Generally speaking, PDC provided responses only when the inquiry was directly on a deterioration subject. The inquiries were received via telephone, correspondence, or visit. They varied from the quite simple to the quite complex. Replies varied from direct responses with information satisfying specific questions, to long term servicing on difficult or extensive problems. Some responses consisted of verbal replies, some were by correspondence, some comprised document loans, some required extensive searches of PDC files and the preparation of bibliographies. A fairly complete record of the inquiries is to be found in the series of progress reports of PDC to its sponsors discussed in another section of this report.

4. Liaison and Coordination Activities

The dictionary states that the work "liaison" means " a bond or connecting link; a linking-up; also coordination of activities." Although the Center did not have a specifically stated contract task to provide formal liaison among DOD personnel working in the materials and equipment deterioration prevention field, it has been recognized informally since the establishment of PDC that it could be regarded as a focal point for DOD people in the field. These people were always welcome to bring deterioration problems to PDC. Indeed it was PDC responsibility to provide information to DOD on such problems. And when PDC did not have such information, it ordinarily went out and obtained it.

In order to make the necessary contacts both with DOD clients and with potential sources of information, the Center was continually encouraged to visit Army, Navy, and Air Force installations; and other locations where related research was being conducted such as industry, research institutions, and universities. The Center was also encouraged to attend professional society meetings and other conferences, to present scientific or technical papers at such meetings, and to participate in official positions in such societies or on technical committees or subcommittees. Over the nineteen years of PDC existence, a very large number of such activities were carried out. Some of these are obvious from the titles of various papers published. Trips made to Army, Navy, Air Force, and other related places, as well as unpublished talks given by PDC staff members are far too numerous to list. However, the professional society affiliations of staff are exemplified by the following memberships:

a. American Chemical Society
b. Society for Industrial Microbiology
c. National Association of Corrosion Engineers
d. American Association for Textile Chemists and Colorists
e. National Federation of Science Abstracting and Indexing Services
f. Institute of Environmental Sciences
g. American Institute of Biological Sciences
h. American Association for the Advancement of Science
i. American Society for Testing and Materials
j. American Geophysical Union
k. Acoustical Society of America
l. American Documentation Institute
m. Association for Computing Machinery
n. American Institute of Chemists
o. Corrosion Research Council
p. Seahorse Institute
q. American Institute of Aeronautics and Astronautics
r. American Ordnance Association

Examples of committee, subcommittee, and other professional organization activities are:

a. Armed Forces Pest Control Board, liaison membership.
b. Army Committee on Environment, Panel on Environmental Research, liaison membership.
c. IES, Committee on Air Force Specification Review.
d. IES, Committee on Handbook of the Environment.
e. Army Committee on Revision of AR 705-15, Subcommittee on Induced Environments, liaison membership.
f. Organization for Economic Cooperation and Development, Group of Experts on Biological Fouling and Corrosion of Ships' Hulls, Fundamental Research Commission; National liaison membership of Expert Group on Biological Deterioration of Materials; and chairmanship of ad hoc group concerned with Microbiological Effects on Optical Systems. (None of cost of transportation to foreign OECD meetings paid by PDC).
g. ASTM, Chairmanship of Section M, Effects of Microorganisms, Subcommittee V, Permanence Properties, of Committee D-20, Plastics.

h. ASTM, Committee D-20, Subcommittee III, Thermal Properties, Section L, Ablation Tests.
i. IES, ASA, Committee Z-84, Environmental Glossary, Subcommittee on Chemical Terms.
j. National Association of Corrosion Engineers, Group Committee T-9, Corrosion of Military Equipment.
k. International Electrotechnical Commission, Environmental Test Committee TC-50, Working Group 5 on Mould.
l. ASTM, Committee G-1, Corrosion of Metals.
m. DOD Informal Working Group on Environmental Handbook.
n. Secretaryship of Division 15, XIIth International Congress of Pure and Applied Chemistry, 1951.

Another liaison function of the Center was reception of visitors. In the nineteen years of PDC services, a very large number of visitors was received from the Army, Air Force, Navy, other Federal Government agencies, industry, and various other groups. The purposes of these visits varied widely and included those in which the visitor was seeking or providing substantive information, seeking guidance on various research programs, planning conferences, or any of a large number of related reasons.

A complete record of the details of the above liaison functions, such as visits, visitors, talks, and coordinating activities are to be found in the PDC quarterly and annual reports.

5. Acquisition and Organization of Pertinent World Literature

When the Tropical Deterioration Information Center was formed in 1944 and then succeeded by the Prevention of Deterioration Center in 1945, the general concept of specialized information centers was not well established. The mode of operation of such organizations was evolving but had not yet taken clear form and substance in the minds of many people.

The basic requirements of a specialized information center demand that first the organization have personnel who are adequately trained and substantially experienced in the field of the specialization, and secondly, that the organization have access to information in the specialty field. To obtain the information the personnel must (a) search the open scientific and technical information, and (b) arrange to obtain the pertinent information not in the open literature. The latter comprises government reports, contractor reports, industrial company reports and other releases, foreign information, etc. It is necessary to arrange to be placed on distribution lists, to make direct requests for reports or data and to take any other steps necessary to obtain all the needed information.

These steps were followed by the Prevention Center in its specialty with the result that over the years the Center has been able to collect a very high percentage of all pertinent world information in the materials and equipment deterioration field. By 1964 this collection was of the order of 70,000 documents. Over the years the number of open literature journals regularly searched grew until in 1964 it amounted to approximately 570 journals. A list of these journals is enclosed with this report. The great majority of the listed journals are the so-called "primary" journals. These

publish articles or reports which are directly usable. It was PDC policy to acquire a copy of all articles selected. Thus the Center had either to own copies of journals from which to remove articles, or to have copies of articles made when they were found in journals it did not own. Generally speaking, experience provided knowledge to determine which journals to subscribe to as rich sources of information in the deterioration field and which to review with borrowed copies as less frequent producers of pertinent articles.

A small but significant number of the journals are the so-called "secondary" journals. For the most part, these are journals devoted to publishing abstracts of articles from a wide scope of world literature. Examples are Chemical Abstracts, Biological Abstracts, Defense Documentation Center TAB, Astronautics Information Abstracts, Applied Mechanics Review, Corrosion Abstracts, Geophysical Abstracts, Geosciences Abstracts, Monthly Index of Russian Accessions, U.S. Patent Gazette, and many others. It was PDC policy to search a significant number of these secondary journals regularly and thus to locate articles from primary journals the Center did not regularly see. After such references were located the original articles were screened and, if found to be pertinent, copies of the articles were obtained.

When copies of selected and accepted documents came to the Center, they were routed to the PDC library where accessioning was carried out. The articles were assigned an accession number and cataloged. From the accessioned documents, a further selection process provided articles for abstracting, key word or "descriptor" assignment, and publication in one of the Center's abstracting journals.*

6. Dissemination of Information

a. Abstracts

One of the first acts of the PDC after it was established was to commence an abstracting service. The predecessor "Tropical Deterioration Bulletin" provided abstracts from August 1, 1944, to November 1, 1945. Indexes for that Bulletin were published in July 1946 by the Prevention of Deterioration Center. Also in April 1946 the Prevention of Deterioration Center commenced publication of the "Prevention of Deterioration Abstracts." This publication, published in monthly installments, continued through 19 volumes:

Volume 1 - April-December 1946
Volume 2 - January-June 1947
Volume 3 - July-December 1947
Volume 4 - January-June 1948
Volume 5 - July-December 1948
Volume 6 - January-June 1949
Volume 7 - July 1949 - June 1950
Volume 8 - July 1950 - June 1951

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*For a brief discussion of the PDC Information Storage and Retrieval System, see Section 6c.

Volume 9 - July 1951 - June 1952
Volume 10 - July 1952 - June 1953
Volume 11 - July 1953 - June 1954
Volume 12 - July 1954 - June 1955
Volume 13 - July 1955 - June 1956
Volume 14 - July 1956 - June 1957
Volume 15 - July 1957 - June 1958
Volume 16 - July 1958 - June 1959
Volume 17 - July 1959 - June 1960
Volume 18 - July 1960 - June 1961
Volume 19 - July 1961 - June 1962

When the scope of the PDC was broadened and it was decided to publish abstracts in the so-called "induced" environments, it was also decided to establish a new format and a new name for the abstracting publication which would be more indicative of its contents. Thus, in January 1961, PDC commenced publication of ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT, devoted to abstracts of articles on effects of induced environments on materials and equipment. In January 1962, this new publication was split into two sections. Section A succeeded the former Prevention of Deterioration Abstracts and Section B continued on the induced environments. In capsule summary, the PDC abstracting services as of January 1, 1961 - April 1964, were:

ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT

	Successor to PDA for "Natural" Environments	New for "Induced" Environments
Jan.-Dec. 1961	----	Volume 1
Jan.-Dec. 1962	Volume 2, Section A	Volume 2, Section B
Jan.-Dec. 1963	Volume 3, Section A	Volume 3, Section B
Jan.-April 1964	Volume 4, Section A Issues 1-4 Terminated	Volume 4, Section B Issues 1-4 Terminated

Note: There was a six months overlap of PDA, Volume 19, January-June 1962, with EEME, Volume 2, Section A, January-June 1962.

Under the new name and format the circulation of the abstracts grew considerably and was approximately 1000 each for Sections A and B when the service was stopped May 1, 1964.

As mentioned in the prior discussion, not all articles selected and accessioned by the Center were abstracted and published in the Prevention of Deterioration Abstracts. Furthermore, in the early days of the Center not all articles selected and accessioned were adequately indexed for easy searching, other than by means of the classical catalog card system which, of course, the Center's library maintained. Only those items which were abstracted, and thus were indexed yearly in the Prevention of Deterioration Abstracts, were easily searchable. It was essential that the entire body of literature collected be treated to make it (i) available to the using clientele in an "Advance List" and (ii) easily searchable by PDC staff personnel in an information storage and retrieval system. Two steps were taken:

b. Advance List

A so-called "Advance List" was established in January 1948 and disseminated monthly to PDC clients. This listed, and provided standard bibliographic information on, all reports received and retained at the Center in the field of materials and equipment deterioration and its prevention, and thus served to keep the PDC clientele notified of a broad scope of new developments in the field. This service continued until August 1, 1957, or for approximately 116 monthly issues.

In 1957 it was decided to combine the "Advance List" with the "Prevention of Deterioration Abstracts." This combination commenced with Volume 15 of PDA in July 1957. Thus, all articles received and retained at the Center were represented in PDA abstracts either by an abstract plus the usual bibliographic data or, improving the "Advance List" concept, by bibliographic data plus "keywords." The "keywords" or as some call them--"descriptors," telegraphically describe in perhaps 10-15 words the briefest idea of the contents of the article, and in effect constitute a very abbreviated abstract. PDC chose to call these abbreviated abstracts by the term "extract." Thus, commencing with Volume 15, PDC provided either full abstracts or brief extracts on all articles retained at the Center on the subject of materials and equipment deterioration and its prevention. Incidentally, all regular abstracts were also accompanied by keywords.

c. Information Storage and Retrieval

At about the same time as the Center established its "Advance List" for client notification of accessions, it also introduced an information storage and retrieval system. Until that time it was necessary to rely solely on indexes to the Prevention of Deterioration Abstracts and of the Tropical Deterioration Bulletin to make searches of its files on specific subjects. As pointed out before, this did not permit searching documents which were in PDC files but which had not been abstracted in PDA. Thus in 1948, after a considerable study of various information storage and retrieval systems then available, the Center chose a system based on McBee edge-punched cards. A direct coding system was adopted based on some 15 different subject categories and all articles retained were coded into this system. Coding was also accomplished on the majority of documents received prior to adoption of the system so that eventually practically all usable documents at PDC were coded into the system. The system was utilized until the middle of 1957 when it was supplanted by a modified Batten or "field-punch" card system based on the "keyword" system adopted at that time by the Center for its abstracts. Nonetheless, the McBee system provided a welcome searching tool for the PDC and, for the documents coded, still provides reasonable access to their information. From 1957 onward the field-punch concept was utilized at the Center until the general searching requirement ended with the ONR contract termination on May 31, 1964.

d. PDC Newsletter

When the PDC was established in 1945, the clientele was fairly small and well known to the Center and to the committees under which the Center functioned. Furthermore, in those days there were relatively few information centers in existence. There was little if any hue and cry about an "information explosion." No great need was felt for wide publicity of the services of the Center.

As the field of materials deterioration grew and more people and organizations became involved; as the concept of information centers became more common; as more was written and said of the "information explosion," the need was felt increasingly to publicize the fact that an information center on materials deterioration existed. For these reasons, in October 1957 the Center commenced publication of its quarterly four-page "PDC Newsletter." This continued actively through Volume VII, Issue 3, April 1964, a total of 27 quarterly issues. The circulation of the Newsletter grew steadily until in 1964 it amounted to approximately 3120.

Although the chief purpose of the Newsletter was to inform Army, Navy, Air Force, and other Federal Government groups of the existence and services of the Center, secondarily it served the important functions of disseminating information to this wide audience. Each issue contained a "lead" article on a subject of current interest in the materials deterioration field, listings of recently issued literature in the field, new texts, meetings, and special news items. The lead articles in the 27 issues were as follows:

Vol. I, No. 1, October 1957. Deterioration and Economic Responsibilities, C. J. Wessel, Director, PDC.

Vol. I, No. 2, January 1958. The Environment of Space, Captain M. H. Brewer, Materials Branch, Office of the Deputy Commander, R & D, Headquarters, Air Research and Development Command.

Vol. I, No. 3, April 1958. Laboratory Simulation of Combined Environments, A. W. Baldwin and J. C. New, Environmental Simulation Division, U.S. Naval Ordnance Laboratory, White Oak, Silver Spring, Maryland.

Vol. I, No. 4, July 1958. Standardization of Environmental Test Methods, David Askin, Chief, Environmental Testing Branch, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia, Pa.

Vol. II, No. 1, October 1958. New Airframe Materials, H. K. Growald, Chief of Engineering Tests, Convair, Division of General Dynamics Corporation, Fort Worth, Texas.

Vol. II, No. 2, January 1959. Comparative Storage Conditions Test, George W. Higgs, Jr., Manager, Marine Corps Supply and Research Facilities Branch, Bureau of Yards and Docks, Department of the Navy.

Vol. II, No. 3, April 1959. Deterioration Costs and Consumer Goods, Franklin P. Huddle, Conservation Specialist, Office of Fuels, Materials, and Ordnance, Office of the Director of Defense Research and Engineering, Department of Defense.

Vol. II, No. 4, July 1959. A New Look at Environmental Testing, Alfred N. Bloch, U.S. Army Chemical Corps Engineering Command, Army Chemical Center, Maryland.

Vol. III, No. 1, October 1959. Engineering for Reliability and Speedy Development, J. R. Townsend, Special Assistant to the Director of Defense Research and Engineering, Department of Defense.

Vol. III, No. 2, January 1960. Microbes in Jet Fuels, John M. Leonard, U.S Naval Research Laboratory, Washington 25, D. C.

Vol. III, No. 3, April 1960. Missile Testing and Environmental Chambers, A. H. Abernathy, Jr., Chief, Stratosphere Chamber Branch, Air Force Missile Development Center, Holloman Air Force Base, New Mexico.

Vol. III, No. 4, July 1960. The Department of Defense Environmental Program, Gerard J. Marks, Staff Specialist, Office of the Director of Defense Research and Engineering, Department of Defense.

Vol. IV, No. 1, October 1960. Environmental Engineering--A New Discipline, William B. Brierly, Chief of Logistics Applications, Environmental Protection Research Division, Quartermaster Research and Engineering Center, Natick, Massachusetts.

Vol. IV, No. 2, January 1961. New Induced Environments Abstracts--ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT, Carl J. Wessel, Director, Prevention of Deterioration Center.

Vol. IV, No. 3, April 1961. The Deteriorating Effects of the Space Environment, Wernher von Braun, Director, Marshall Space Flight Center, National Aeronautics and Space Administration.

Vol. IV, No. 4, July 1961. Environmental Testing--For What? Leonard S. Wilson, Chief, Earth Sciences Division, Army Research Office (R&D), Department of the Army.

Vol. V, No. 1, October 1961. Environmental Chemistry, Frank W. Reinhart, Chief, Plastics Section, National Bureau of Standards.

Vol. V, No. 2, January 1962. The Environmental Matrix, Hans Janecka, Editor, Prevention of Deterioration Center.

Vol. V, No. 3, April 1962. Launch Environment of Air Booster Rockets, James J. Murray, Director, Engineering Sciences Division, U.S. Army Research Office (Durham).

Vol. V, No. 4, July 1962. Current Knowledge of the Deep Sea Environment, J. C. Thompson, U.S. Navy Electronic Laboratory.

Vol. VI, No. 1, October 1962. Stress Corrosion Problems in High Strength Structures, W. F. Payne, 1st Lt., U.S. Air Force, Materials Central, Wright-Patterson Air Force Base, Ohio.

Vol. VI, No. 2, January 1963. Deep Vacuum Simulation of the Space Environment, John C. Simons, Jr., National Research Corporation, Cambridge, Massachusetts.

Vol. VI, No. 3, April 1963. Corrosion Research and National Prosperity, Herbert H. Uhlig, Director, Corrosion Laboratory, Department of Metallurgy, Massachusetts Institute of Technology.

Vol. VI, No. 4, July 1963. Similarities and Differences of Random and Sinusoidal Vibrations, Irwin Vigness, Head, Shock and Vibration Branch, U.S. Naval Research Laboratory.

Vol. VII, No. 1, October 1963. The Challenge--Deteriorative Environment, Colonel George F. Leist, Staff Coordinator, U.S. Army Research and Development Directorate.

Vol. VII, No. 2, January 1964. Corrosion Work in Russia, Edward C. Greco, Senior Research Associate, Research Department, United Gas Corporation, Shreveport, Louisiana.

Vol. VII, No. 3, April 1964. Air Force Corrosion Control Program, Colonel H. E. Burns, USAF, Directorate of Maintenance Engineering, DCS S&L.

e. Textbook on Deterioration

Commencing with the early days of the Deterioration Prevention Committee one of the objectives was to assemble the salient information of the materials deterioration problem into a single book. As a matter of fact some members of the Committee visualized two books, the first to be a so-called "primer" of small format and perhaps 50 pages length. This was to treat the subject very superficially. The second was visualized as a very extensive and detailed treatment of the entire field in great depth and might better be termed a "handbook," or "encyclopedia."

After much discussion and several false starts, the plan for the publication evolved into that of a single textbook, the various sections and chapters of which would be prepared by people working in the field and assisted by PDC personnel wherever necessary. The over-all effort required several years and finally culminated in the publication of "Deterioration of Materials, Causes and Preventive Techniques," edited by G. A. Greathouse and C. J. Wessel, published by Reinhold Publishing Corporation, New York, N. Y. Rhetorical editing services were provided by Bryson Fleer. A total of 24 authors contributed material for the 835-page book. More than 5000 copies of the text have been sold to date.

The scope of this text is indicated by its table of contents:

Part I. Some Important Factors in Deterioration

Chapter 1. Climate and Deterioration. Carl J. Wessel and H.C.S.Thom.

Chapter 2. Chemical and Physical Agents of Deterioration. Glenn A. Greathouse, Bryson Fleer, and Carl J. Wessel.

Chapter 3. Biological Agents of Deterioration. R. A. St. George, T. E. Snyder, W. W. Dykstra, L. S. Henderson, and others.

Part II. Materials and Their Preservation

Chapter 4. Metals. N. E. Promisel and G. S. Mustin.

Chapter 5. Wood and Wood Products. George M. Hunt.

Chapter 6. Paper. Carl J. Wessel.

Chapter 7. Textiles and Cordage. Carl J. Wessel.

Chapter 8. Leather. Robert M. Lollar.

Chapter 9. Plastics and Rubber. Albert Lightbody, Merritt E. Roberts, and Carl J. Wessel.

Chapter 10. Paints, Varnishes, Enamels, and Lacquers. Jack E. Cowling and Merritt E. Roberts.

Part III. Some Assembled Units and Their Preservation

Chapter 11. Electrical and Electronic Equipment. H. C. Gilbertson.

Chapter 12. Optical Instruments and Photographic Equipment. Harold G. Shirk.

Part IV. Some Special Aspects of Preservation

Chapter 13. Dehumidification. Albert S. Gates, Jr., George W. Higgs, Carl J. Ebert, and Martin R. Borger.

Chapter 14. Packaging. T. A. Carlson.

Chapter 15. Toxicological Evaluation of Preservatives. Wesley Cintra Cox.

Appendix: Government Specification Numbers. Sherman F. Booth.

f. State-of-the-art Reports

The subject of state-of-the-art report preparation can be made as inclusive or exclusive as one wishes, depending upon the definition used.

If one chooses to define such reports as representing a critical review, evaluation, and summary of the literature and other information sources in a limited subject matter field by a person competent in that field, the PDC has prepared many such reports. Most of these are to be found in the Center's list of publications.

Examples of such reports are:

i. The textbook, "Deterioration of Materials, Causes and Preventive Techniques," 1954.

ii. "Industrial Fungicides," Industrial and Engineering Chemistry 51: 52A-63A, April 1959.

iii. "Microbiological Deterioration of Manufactured Materials," Ann. Rev. Microbiol. 5:333-358. 1951.

iv. "Treatment of Cotton to Provide Mildew and Rot Resistance," in Chemistry and Chemical Technology of Cotton, edited by Kyle Ward, Jr., New York, Interscience, 1955.

v. "Care and Maintenance of Stainless Steel," Hospitals, J.A.A.A. 31: 88-90, September 1957.

vi. PDC Handbook of Fungicides, containing a series of 15 exhaustive reviews of chemicals used as fungicides plus several experimental sections.

vii. "Recent Developments in the Control of Microbial Growth on Leather and Fabrics," from Vol. 5, Developments in Industrial Microbiology, p. 36-49. 1964.

viii. "Biodeterioration of Plastics," SPE Trans. July 1964, p. 193-207.

Two additional state-of-the-art reports to be released in the fall of 1964 are:

ix. "Effects of Low Temperature (below -300°F) on Materials and Equipment."

x. "Meteoric Particle Impact, Environment, Effects on Structures and Surfaces, and Protective Design."

g. Hyperthermal Re-Entry Environment Glossary

As is the case in practically all the materials/environment field today, there is a real need for clarification of the definitions of terms depicting the hyperthermal re-entry environment. Considerable confusion exists because of the ambiguity of these terms.

Under the support of the National Aeronautics and Space Administration and with the cooperation of the American Society for Testing and Materials, Committee D-20, Subcommittee III, Section L, Task Group for Standard Terms and Symbols for Hyperthermal Environments, the Center has

gathered some 450 definitions on more than 200 terms and is submitting these for discussion and voting to a group of approximately 32 highly qualified investigators in the field. It is expected that out of this work will come a recommended terminology acceptable to the greater number of investigators of the hyperthermal phenomena field of research.

h. Miscellaneous Scientific and Technical Publications

One measure, certainly of the activity and possibly of the value, of a scientific research group is the record of publications generated by the group. This should be true also of a scientific-technical information center. The record of its publications should be a definite clue of effectiveness during its existence.

Attached to this report is a list of publications of the Prevention of Deterioration Center. Many of the periodical publications, such as the Prevention of Deterioration Abstracts, Environmental Effects on Materials and Equipment Abstracts, Sections A and B, PDC Newsletter, Advance List, List of Reports on Microbiological Deterioration and Its Prevention, Fungicide Handbook, and Fungicide Screening Reports, have been described in detail in separate sections of this report. The remaining publications may be grouped together as "miscellaneous," but each represents some significant function of the Center or of a part of its staff at the time of the publication.

Copies of most of the publications are available on loan from the Center. In some cases, copies are available for retention. In unusual cases, copies may be reproduced from library file originals.

i. PDC Reports to Sponsors

The first contract under which PDC operated was that between the Navy Office of Research and Inventions and the National Academy of Sciences-National Research Council--Contract N5ori-177--which became effective December 1, 1945. This required quarterly reports to the Chief, ORI. The first such report was submitted April 29, 1946, covering the period of December 1, 1945 - April 1, 1946. A regular series of quarterly reports followed. A separate contract was entered into with the Air Force (Contract No. W33-038-AC-16806(17513)), November 1, 1946. This contract required and received monthly reports from PDC, November 1, 1946, to October 1, 1947. In November 1947, permission was requested of the Air Force to change from monthly to quarterly reports. Permission was granted in December 1947. Thus, from October 1, 1947, forward the Center provided quarterly reports on its contracts until April 1960. (A combined contract with the Office of Naval Research, funds for which were provided by the Departments of the Navy, Army, and Air Force commenced in 1949). From April 1960 on, with permission of contract officers, the Center submitted annual reports at the time of the annual spring meetings of its Services Technical and Scientific Advisory Committees. These meetings and the dates of the annual reports were: May 24-25, 1960; June 6, 1961; May 22, 1962; May 23, 1963. The present document contains the annual report for the period ending May 31, 1964. The complete list of progress reports is to be found in the attached list of publications.

j. Literature Searches and Bibliography Preparation

Literature searches have been mentioned at several other places in this report. The literature search is one of the main tools of an information center. But to avoid confusion one must understand better what the word "literature" means. The phrase "literature search" is time-honored and formerly meant pretty much what you would expect--a librarian searched the files for literature, books, pamphlets, reports, theses, dissertations, etc.--in short, documents. The search was document-oriented. Today it is better to say "information search," for one is making the search oriented toward information, whether it be numerical data or descriptive information. It will be found in documents or in literature but it is the information one seeks, not the documents.

From the early days of its existence the Center has made a great many "literature" or "information" searches, usually in response to a question or an inquiry of a client. These searches located documents. Depending upon the question, the client, the priority, the PDC staff, the information was sent to the inquirer as (i) a list of documents (a bibliography), (ii) the documents themselves, (iii) a specific answer extracted from the documents, or (iv) a condensed review of a situation from the whole of the document collection found. In any event, the effort stemmed from a search of PDC document files. During the nineteen years of PDC activity many hundreds of such searches were made. Until recent years, although these searches were reported in quarterly or annual reports, the series of searches made was not formalized. During the past few years the series was made formal and a number system developed for them. Thus, whenever a search was made for a client, the subject matter of which was felt to be of general interest, the resulting bibliography was published and made available to the PDC clientele. The following 52 bibliographies represent the published series as the effort stopped May 31, 1964:

PDC Search No.	PDL No.	DDC AD No.	Title
58-003	42285	601280	Bibliography on bacterial degradation of textiles and cellulose.
58-028	42276		Bibliography on microorganisms affecting plastics, plasticizers, organic coatings, resins, rubbers, and waxes; test procedures and control.
60-010	40595		Galvanic corrosion of nonferrous metals.
60-013	50016	440946	Bio-deterioration of materials and structures in the marine environment.
60-041	49596	601238	Bibliography on corrosion inhibitors for nonferrous metals.
60-051	42277	601281	Bibliography on microorganism control by ionizing radiation.

PDC Search No.	PDL No.	DDC AD No.	Title
61-003	42275	601286	Bibliography on polyethylene sheathed cables.
61-007	42283	601285	Bibliography on degradation of poly-(vinyl chloride) by soil microorganisms.
61-016	49279	601284	Bibliography on aging of natural and synthetic rubber and rubber products in storage.
61-018	42279	601288	Bibliography on microbiological deterioration of paint films.
61-022	49724	601283	Bibliography on marine boring organisms and their control.
61-027	41293	601278	An introductory bibliography on microbial resistance of thermosetting plastics.
61-037	42278	601282	Bibliography on properties and degradation of polyethylene terephthalate and methyl methacrylate polymers.
61-038	42574	601287	Bibliography on radioactive isotopes as tools for determining small changes in composition and structure of materials.
62-009	43106	601293	A preliminary survey of literature relating to rodent and insect repellency of wood-fiber insulation materials.
62-010	43215	601303	Introductory bibliography on collection, identification, and storage of anaerobic bacteria.
62-013	43216	601304	Sprayed metallic coatings for ferrous metals, an introductory bibliography.
62-025	43969	601292	References pertaining to moisture sensing devices.
62-028	44131	601305	Bibliography on marine fungi and algae--their fouling problems and control.
62-032	48991	601306	Optical systems microbiology: Monographic elements.
62-033	44360	601291	Bibliography on ozone deterioration of rubber.
62-037	44481	601290	Bibliography on microorganisms affecting petroleum and petroleum products, including reports on sulfate-reducing bacteria.

PDC Search No.	PDL No.	DDC AD No.	Title
62-038	44499	601307	Selected literature references on critical relative humidities for corrosion- and fungus-free storage.
62-040	44736	601308	A select bibliography on aeromicrobiological studies.
62-044	45268	601309	Bibliography on resistance of plastics to microorganisms, insects, rodents and other pests.
62-049	49705	601310	Fouling by marine animals and anti-fouling methods.
62-051	45840		Bibliography on degradation of textiles by microorganisms, weathering and atmospheric pollutants.
62-053	45762	601311	Effects of storage on electronic equipment and components, a preliminary literature survey.
62-056	45841	601289	References pertaining to resistance of cable insulation and jacketing material to rodent attack.
62-058	45936	601294	Bibliography on corrosion resistance of cadmium coatings.
62-001	46037	601301	Effects of fungi on electric and electronic equipment, an introductory bibliography.
63-003	46195	601298	Effects of Van Allen radiation belts on electronic materials, an introductory bibliography.
63-004	46448	601299	Bibliography on metal-bonding adhesives.
63-008	46815	601297	Recent studies on mercurial preservatives, an indicative literature survey.
63-009	46816	601296	References pertaining to dynamic environments during transportation.
63-013	46876		Bibliography on microbiological degradation of asphalt.
63-022	48073	601300	References pertaining to corrosion resistance of zinc and zinc coatings under conditions of high humidity or in contact with ground waters.

PDC Search No.	PDL No.	DDC AD No.	Title
63-025	48074	601247	Bibliography on microbial corrosion of metals.
63-028	48237	600529	Control of microbial growth on leather and textiles, a survey of recent literature.
63-034	48377	601248	Microbiological activities in petroleum and petroleum products, an annotated bibliography.
63-035	48427	601239	Marine borers and foulers--their growth and control.
63-045	49630	600642	Preservation of inactive equipment and long-term storage of materials.
63-046	49679	600643	Bibliography on vapor phase corrosion inhibitors for non-ferrous and ferrous metals.
63-047	50015	600644	Effect of microorganisms on natural and synthetic rubbers.
63-048	50066	600530	Packaging of electronic equipment for transportation in vibration environments with emphasis on seagoing vehicles.
63-050	50150	601295	Performance above 1000F of superalloys and protective coatings.
63-057	50174		Elastomers for high temperature applications.
64-001	50205		Protective coatings systems for niobium in the range of 1800-2500 F.
64-002	50728	601249	The aging of natural and synthetic rubber and rubber products. An annotated bibliography.
64-009	50534		Reinforced plastics and laminates for hot structures (600 F and above).
64-011	50915	601279	Polyurethane coatings, use and performance. An annotated bibliography.
64-012	50859		Enzymes vs. materials. Selected references.

k. Document Loans

As mentioned elsewhere in this report, it has been PDC policy since establishment of the Center not only to identify and locate references

to documents in its field, but also to obtain copies of the documents for permanent possession. This led eventually to a document collection of about 70,000 at the PDC.

The purpose of this was manifold:

a) To have immediate access to the information with which to serve clients.

b) To educate PDC scientific personnel to do a maximal job.

c) To be able to operate an abstracts service.

d) To be able to operate a document loan service for clients.

The last named, "document loan service," became well recognized among PDC clientele as an extremely valuable service. Although the volume of the service never approached that of a major library, it assumed very respectable proportions in this highly specialized field. At the termination of the contract, documents were being borrowed by clientele at a rate greater than 3000 per year.

During the entire period of PDC activity a surprisingly low number of documents were lost during loans--perhaps of the order of 50-100 in the nineteen years.

7. Special Programs

a. Fungicide Screening Program

Among the so-called "special" activities of the Prevention of Deterioration Center was its "Fungicide Screening Program." The screening program commenced under the organizational structure of the former JAN Deterioration Prevention Committee. A rather complete history of the work is to be found in Fungicide Screening Report No. 10, issued by the PDC on September 15, 1961, and only highlights of the history will be presented here.

One of the subcommittees of the JAN Deterioration Prevention Committee was that on Fungicides. The Center provided both the secretariat for the subcommittee and its chairman. Twelve Army, Navy, Air Force and other laboratories were represented on the subcommittee. Among other things, the Center had the task of soliciting samples of candidate chemical compounds for screening as fungicides in the program. More than 11,000 chemical samples were collected by the Center from a total of 173 companies, universities, research organizations, Federal Government groups, the Chemical-Biological Coordination Center of the NAS-NRC, and individuals. The great majority of compounds were provided by the U.S. Department of Agriculture and the Chemical-Biological Coordination Center of NAS-NRC.

When the testing program commenced, eight Army, Navy, and Air Force laboratories participated, in addition to the National Bureau of Standards and the laboratory of the Prevention of Deterioration Center.*

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*Located first at the Naval Research Laboratory in Anacostia, D. C., and later at the University of Maryland by subcontract.

As the program progressed, all laboratories but PDC dropped the screening work. The PDC screening continued actively for several years, however, and out of a total of 13,099* compounds screened, 12,076 were screened by PDC.

The screening accomplished in the program was performed almost entirely according to a standard method adopted by the Fungicide Subcommittee. A copy of the method is also included in Fungicide Screening Report No. 10.

As the program progressed, a series of screening reports was prepared and released to offices of the Departments of the Air Force, Army, and Navy**:

Fungicide Screening Report No. 1, March 1, 1949
Fungicide Screening Report No. 2, September 1, 1949
Fungicide Screening Report No. 3, June 1, 1950
Fungicide Screening Report No. 4, June 1, 1951
Fungicide Screening Report No. 5, May 1, 1952
Fungicide Screening Report No. 6, August 1, 1952
Fungicide Screening Report No. 7, August 1, 1954
Fungicide Screening Report No. 8, May 15, 1958
Fungicide Screening Report No. 9, December 28, 1959
Fungicide Screening Report No. 10, September 15, 1961
(Final Report)

During the course of the screening program there was also the opportunity for PDC to conduct a certain amount of research on the mode of action of selected chemicals on fungi. A series of research papers was published in several journals. These are shown in the enclosed publications list. The screening work and research also provided the material for many talks and lectures by PDC personnel at a variety of meetings.

One of the final phases of the fungicide screening program was to separate out the chemical compounds which had shown most activity and to perform certain physical tests on them as further investigation of their qualifications as usable fungicides. These tests included solubility in a number of solvents; surface tension properties; stability to ultraviolet; corrosive effects on copper, brass, cold rolled steel, hot rolled steel, and aluminum; color; odor; and melting point.

Assuming that permission was granted by the suppliers of the chemical samples, PDC intended to release publications in a well recognized journal to the scientific public summarizing the findings of the program. The plan called for separation of the chemicals into two groups according to degree of activity in the biological tests. A publication summarizing the so-called "negative" results was to be filed with the American Documentation Institute for reference by interested persons. A second publication was planned for release through a journal. This was to contain both biological and physical-chemical test results on the approximately 1000 compounds which displayed

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*Total number of compounds screened is larger than number of compounds submitted by suppliers because of some duplicating in testing.

**The information was not released to the general public, for the chemical samples were obtained in a large number of cases in commercial confidence.

"appreciable" biological activity. Unfortunately, for several reasons, neither of these publications was completed. It would still be valuable to complete and publish these compilations.

In the course of operating the fungicide screening program the Center developed and maintained a set of files on the chemicals gathered. The files also contained information on several thousand additional chemicals on which data but no samples were available. In all about 15,000 compounds were included in the files. Four separate file sets were kept:

i. Numerical (accession number)
ii. Alphabetical (naming by Chemical Abstracts rules of nomenclature)
iii. Empirical formula
iv. McBee edge-punched Keysort system according to chemical constitution of the compounds

Moreover, a file of laboratory test result cards was kept, as well as records of all samples distributed and results received.

b. Associated Fungicide and Other Microbiological Deterioration Activities

i. List of Industrial Fungicides and Suppliers

As a part of its general interest in microbiological deterioration and, thus, in fungicides, the Center undertook to gather together as much information as it could on commerically available industrial fungicides. Eventually this amounted to information on 403 different fungicide products, representing 140 different preservative chemicals or combinations, manufactured by 171 different companies. This information was published as "Industrial Fungicides," Industrial and Engineering Chemistry, Vol. 51, 52A-63A, April 1959.

ii. Fungicide Handbook

As a further service to the Army, Navy, and Air Force, in the field of microbiological deterioration, the Center published a Fungicide Handbook for several years. This effort originally commenced by request of the Department of the Air Force for a generalized handbook in the field of deterioration. Samples of handbooks were prepared in several fields such as fungicides, organic coatings, and wood and paper, and submitted for analysis. After due consideration and reassessment of the magnitude of the over-all task, the Center was requested to continue the effort only in the field of fungicides.

The objective of this handbook effort was to select individual commercially available fungicides and assemble all available information on those few chemicals. Handbook sections were prepared on the following fungicides:

1) Copper-8-quinolinolate - 91 pages
2) Copper naphthenate - 22 pages (experimental section only)
3) Copper hydroxynaphthenate - 3 pages (experimental section only)

4) Copper oleate - 4 pages (experimental section only)
5) Copper pentachlorophenate - 53 pages
6) Copper resinate - 3 pages (experimental section only)
7) Copper tallate - 6 pages (experimental section only)
8) Copper 3-phenylsalicylate - 24 pages
9) Phenylmercury acetate - 159 pages
10) Pyridylmercury stearate - 4 pages (experimental section only)
11) Mixture of zinc salts of dimethyldithiocarbamic acid and 2-mercaptobenzothiazole - 144 pages
12) Zinc naphthenate - 3 pages (experimental section only)
13) Bis(tri-n-butyltin) oxide - 57 pages
14) Trimethylcetylammonium pentachlorophenate - 3 pages (experimental section only)
15) 2,2'-Methylenebis(4-chlorophenol) - 76 pages
16) p-Chloro-m-xylenol - 17 pages
17) Sodium pentachlorophenate - 3 pages (experimental section only)
18) Tetrabromo-o-cresol - 3 pages (experimental section only)
19) Salicylanilide - 286 pages
20) p-Nitrophenol - 51 pages
21) Pentachlorophenol - 10 pages (experimental section only)
22) o-Phenylphenol - 131 pages
23) 2-Mercaptobenzothiazole - 2 pages (experimental section only)
24) 2-Mercaptobenzothiazole monoethanolamine salt - 2 pages (experimental section only)
25) 2-Mercaptobenzothiazole cetylamine salt - 2 pages (experimental section only)
26) 2-Mercaptobenzothiazole, β-hydroxyethylpyridinium salt - 2 pages (experimental section only)
27) 5-Chloro-2-mercaptobenzothiazole - 2 pages (experimental section only)
28) 5-Chloro-2-mercaptobenzothiazole, laurylpyridinium salt - 2 pages (experimental section only)
29) 5-Chloro-2-mercaptobenzothiazole, benzylpyridinium salt - 2 pages (experimental section only)
30) 5-Chloro-2-mercaptobenzothiazole, zinc salt - 2 pages (experimental section only)
31) 8-Quinolinol - 3 pages (experimental section only)
32) N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide (Captan) - 29 pages
33) m-Cresyl acetate - 66 pages
34) Tetrachloro-p-benzoquinone and tetrachlorohydroquinone - 99 pages

iii. Special List of Reports on Microbiological Deterioration

At the 5th Conference on Prevention of Microbiological Deterioration of Military Materiel, held at the Army Quartermaster Research and Development Command, Natick, Massachusetts, November 27-28, 1956, the request was made that the Prevention of Deterioration Center institute a service of circulating titles of reports on the subject of microbiological deterioration to interested groups within the Department of Defense. The list was planned to include report titles which otherwise would not be circulated by PDC in its Abstracts or Advance List (although it was thought possible that titles which appear in those two publications might occasionally be included in the new list). The list was to include titles of such reports as those "For Official Use Only," or similar designations, submitted to PDC with the express understanding that, unless otherwise permitted, use would be limited to the new list

only. The mailing list of the new service would include DOD groups only. The prime idea was that groups within DOD doing microbiological deterioration research would by this list be able to keep abreast of their DOD colleagues' work as reported in limited distribution documents.

The first issue of this publication appeared May 1, 1957, and continued through 29 issues to May 1, 1964. The circulation list was small, never exceeding 30 people at 17 Army, Navy, and Air Force locations.

The original intent of the list altered in a fairly short time due to the fact that few of the informal, "limited distribution" documents were deposited at PDC. Therefore, the character of the list was changed to include all microbiological deterioration reports received at PDC and later, all biological deterioration reports. This developed into a highly specialized service providing information on worldwide developments in biological deterioration arranged by country of origin.

iv. Card File on Microbiological Resistance of Materials

A number of years ago the Department of the Air Force requested PDC to commence assembling data on the microbiological resistance of specific materials. The objective, of course, was to build up a file of such information on a large number of materials so that upon demand specific answers could be provided to specific questions on particular materials. Over a number of years, by the application of a nominal amount of staff time, a file of several hundreds of such cards was prepared. Copies were provided to the Department of the Air Force, and later, parts of the information were also sent on an experimental basis to a total of twelve DOD installations. The file was not received enthusiastically and deemed of too low priority to warrant a major effort.

Although the concept of such a file is fundamentally sound, certain drawbacks make preparation of a really valuable collection of data very difficult. In the field of microbiological deterioration of materials, it is unusual to find truly quantitative data. Oftentimes resistance is expressed qualitatively, as by such terms as "good," "excellent," "poor," etc. So-called quantitative data may be based on an arbitrary numerical scale of, say, "1 to 10." Furthermore, actual composition of materials tested may be largely unknown or the identity and concentrations of preservatives used may be ambiguous. It becomes extremely difficult, and sometimes actually misleading to compare one material with another. It is not mysterious, therefore, to find that such a compilation is not deeply valuable. In defense of the idea, however, it should be stated that such a file of information can be helpful as a deterioration indicator and that furthermore it is first rate proof that the quality of microbiological deterioration research and test measurement has a great need for quantitative improvement.

C. Termination of Contract Nonr-2300(17)

In May 1963, the Center was informed by its financial supporters in the Departments of the Navy and Air Force that funding from those sources

was being terminated. Meanwhile, concepts within the DOD on the support of information centers were undergoing reappraisal and were tending toward single service support. The Director of Technical Information, ODDRE, requested the Department of the Army to study possible support of PDC by the Army alone. Center funds terminated January 31, 1964. Preliminary action by the Department of the Army provided funds through May 31, 1964. The Army study indicated, however, that the Army did not wish to continue the Center on its funds beyond May 31, 1964.

A good deal of effort was expended by the Center and its advisory committee, as well as the Chairman and Executive Secretary of the Division of Chemistry and Chemical Technology during the period of June 1963 to May 31, 1964, toward seeking renewal of PDC funds or establishment of new sources of financial support, but without success. Prior to that time the Center, incidentally, had been in the process of arranging contracts with the National Aeronautics and Space Administration and with the U.S. Army Biological Laboratories, to perform special services. The funding by the NASA contract commenced January 1, 1964, and by the U.S. Army Biological Laboratories on May 11, 1964.

A short time prior to May 31, 1964, when it was decided that no funds would become available for general support of the Center, a reduction of staff was arranged from 28 full- and part-time personnel to 9 full-time staff. Fortunately, through the good cooperation of the NAS Office of Personnel it was possible to situate practically all released personnel in new positions either at NAS-NRC or elsewhere. All services provided under the former general support contract were terminated as of June 1, 1964, and public notices to that effect were distributed to all former clients of the Center. The activities and services terminated included: Environmental Effects on Materials and Equipment Abstracts, Sections A and B; PDC Newsletter; responses to inquiries on deterioration problems; literature searches; preparation of bibliographies and other special publications; and library document loans.

Anomalously the activities of the Center were at their highest point and the Center was serving its largest clientele at the time funding was terminated. Many inquiries and requests for PDC services continue to be received.

The organization as of June 1, 1964, comprised nine staff members. The activities and attention of the staff are devoted to carrying out the provisions of the contract with NASA in preparing state-of-the-art reports in selected subjects, preparing a glossary of acceptably defined terms for the field of hyperthermal re-entry environment, and responding to NASA inquiries; and to carrying out the contract with the U.S. Army Biological Laboratories for a special service.

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V. Annual Report by PDC Staff

1963 — 1964

V. Annual Report by PDC Staff for 1963—1964*

A. Foreword

The annual report has been regarded in past years as the document in which the Center not only reports the activities and accomplishments of the preceding year at its annual Scientific Advisory Committee Meeting but also expresses its appreciation to its scientific and financial supporters, its advisors and counselors, and its many colleagues and associates. It has also offered a vehicle for outlining plans for the future.

The circumstances surrounding the developments in 1963-1964 with regard to the PDC alter the past procedures. The customary spring (May) meeting of the Scientific Advisory and Services Technical Committees was not held but rather postponed until later in the year. Acknowledgements have already been made to the many friends and benefactors of the Center in a separate section. Plans for the future are as yet not sufficiently firm to announce.

The annual report for 1963-1964 will, therefore, simply recount the activities of the year.

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*The period actually reported on is March 1, 1963—May 31, 1964. For the period of January 1, 1964 to May 31, 1964, the support of the PDC was provided not only by Navy Contract Nonr 2300(17) but in part also by the National Aeronautics and Space Administration, Contract NASr-182. These activities reported include those for NASA.

V. Annual Report

B. Report by C.J. Wessel, Director
Prevention of Deterioration Center

B. Report by C. J. Wessel, Director

1. Introduction

The background, financing, functions and scope of the Prevention of Deterioration Center are summarized in earlier sections of this report and provided in detail in prior annual reports.

It may be well, nonetheless, to restate here the salient functions of the Center as stipulated in Contract Nonr 2300(17):

a. To serve in a consulting and advisory capacity on deterioration prevention problems, as requested by the Scientific Officer.

b. To collect information from Government, industrial and academic institutions on problems of the prevention of deterioration of materials and make such information available in readily usable form to the Office of Naval Research and to such others as may be directed or approved by the Scientific Officer.

c. To maintain contact with work on the prevention of deterioration of materials which is being done by the Government, particularly the Army, Navy and Air Force.

d. To conduct studies and surveys in fields of deterioration prevention as requested or approved by the Scientific Officer.

In addition to these services, the Center has, through its facilities and experience, developed collateral interests:

a. To stimulate research in the field of prevention of deterioration of materials, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.

b. To promote cooperation among research workers engaged in the field of deterioration in order to concentrate effort and minimize duplication.

c. To direct the attention of scientific and technical investigators to the current research problems of the Department of Defense, and, on request, to aid in the solution of these problems by consulting with the best qualified scientists, by organizing committees, and by suggesting the approach.

2. Progress during past year

a. Advisory, Consultative and Conference Activities

During the past year the Center held the following conferences:

i. "Conference on Oil Slick Pollution of Harbors and Associated Waters" National Academy of Sciences Building, March 18, 1964.

ii. Scientific Advisory and Services Technical Committees, Annual Meeting, May 23, 1963. The minutes of this meeting are attached as one of the appendixes to this report.

b. Information Services—Responses to Inquiries

The information service requests remained at a high level during this period. The following are interesting examples:

i. 3M Company, St. Paul, Minn. - request for information on toxicity of Benzil.

ii. Armed Forces Pest Control Board - request for permission to copy or otherwise reproduce abstracts from EEME A and B.

iii. Polycomb Corp., LaGrange, Ill. - request for information on research activities to develop laboratory working surfaces with high resistance to chemical corrosion.

iv. Dittbrenner Associates, Inc., Rockaway, New Jersey - request for information on attack by microorganisms on masonry and related materials.

v. George C. Marshall Space Flight Center, NASA, Huntsville, Ala. - request for information on packaging.

vi. Wright-Patterson Air Force Base, Ohio - request for a directory of experts in a variety of deterioration specialties.

vii. Wright-Patterson Air Force Base, Ohio - request that PDC provide services to Dr. Miles Sharpley of Sharpley Laboratories on his Air Force contract concerned with microbial contamination of jet fuels.

viii. U.S. Air Force, Mira Loma Air Force Station, California - request for several reports, loan copy of PDC textbook, and references for several reliable corrosion textbooks.

ix. Wright-Patterson Air Force Base, Ohio - request for information on deterioration of cable insulation by microorganisms in the ground.

x. U.S. Naval Ammunition Depot, Crane, Ind. - request for tabulation of articles on microbial deterioration of plastics, etc.

xi. Ministry of Defense, Government of India, Hebbal, Bangalore, India - request for a number of papers on fungal deterioration of electronic equipment.

xii. H.C. Price Company, Philadelphia, Pa. - request for information on attack by microorganisms on pipe coating materials.

xiii. Air Force Materials Laboratory, W-P AFB, Ohio - a six part request for preparation of bibliographies on (1) the resistance of super-alloys, with or without protective coatings, to oxidation, erosion, corrosion, carburization, sulfurization, and spalling, and related loss of mechanical properties including thermal fatigue; (2) evaluation of potentially new heat-resistant reinforced plastics for radome and structural applications, and the effect of high temperature on mechanical and electrical properties; (3) protective coatings for niobium and niobium alloys in applications involving temperatures between 1800-2500° F, and the usefulness of these coatings on molybdenum and tantalum; (4) high temperature protective coatings for alloys of tantalum,

molybdenum, and niobium for application in a low pressure environment; (5) correlation between processes, chemistry, structure, and resulting protectiveness of silicide coatings; (6) strength of elastomeric vulcanizates at elevated temperatures for use in sealants, tires, etc., emphasis on particulate reinforced elastomers.

xiv. District Public Works Office, 1st Naval District, Boston, Mass. - request for information on the economic aspects of biological deterioration.

xv. Plymouth Cordage Company, Plymouth, Mass. - information on Teredo attack on nylon.

xvi. Faculty of Science, Jogja, Indonesia - request for information on the tropicalization of electronic and optical equipment.

xvii. U.S. Army Biological Laboratories, Fort Detrick, Md. - request for literature survey on the cost of corrosion in particular, and deterioration in general.

xviii. U.S. Army Logistics Management Center, Fort Lee, Va. - request for information on the effect of climate and terrain on the wear-out of vehicles and environmental conditions as factors in evaluating the average life expectancy of vehicles.

xvix. Pacific Missile Range, Point Mugu, Calif. - request for information on the performance on two-component amine curing polyurethane coatings.

xx. Northern Electric Co., Ltd., Ottawa, Canada - request for information on the reliability of tropicalized communications equipment.

xxi. U.S. National Park Service, San Francisco, Calif. - request for information on a power cable environmental difficulty in Carlsbad Caverns.

xxii. BuYards & Docks - request for information on recent work on marine environmental effects on materials.

xxiii. Military Engineering Branch, ERDL, Fort Belvoir, Va. - request for information on effects of field environments on nickel-cadmium batteries.

xxiv. Metals Information Center, Metals Division, Olin, New Haven, Conn. - request for information on temperature of aluminum in sunlight with reference to ambient temperature.

xxv. Pesticides Division, USDA - request for information on Pullularia pullulans in latex paints in cans.

xxvi. Federal Communications Commission - request for information on possible fungus problem on 1300 TV sets in Columbia, South America.

xxvii. Office of Oceanography, Coast and Geodetic Survey - request for information on cost of deterioration, borers, foulers, corrosion, marine, etc.

xxviii. Air Force Office of Aerospace Research - request for information on motion picture films on the subject of information storage and retrieval.

xxix. Robert S. First, Inc. - request for information on fungicides for plastics.

xxx. Defense Materials Services - request for advice on whether to treat burlap bags now used for storage of asbestos.

xxxi. Chas. Pfizer Co. - request for information on rodent repellency of morpholine derivatives of tributyl aconitate.

xxxii. McGraw Hill Co., New York, N.Y. - request for information contributory to their making bid for ARO contract on survey and critical evaluation of humid tropics research.

xxxiii. Stevens Institute of Technology - request for bibliography on microbial deterioration of plastics.

xxxiv. Materials Test Laboratory - request for information on correlation of outdoor and laboratory ozone tests.

xxxv. DuPont Company, Wilmington, Dela. - request for information on methods of testing microbiological deterioration of plastics and methods for rodent tests on plastics.

xxxvi. National Concrete Masonry Association - request for information on how to stop corrosion of manufacturing equipment by hydrogen sulfide, high temperature steam, acids, etc.

xxxvii. Fourth Weather Group, Air Force Systems Command, Andrews AFB - request for information on effects of humidity on cryogenics.

xxxviii. New England Regional Office of DDC, Boston, Mass. - request for information on effects of nerve gas (SARIN) on enzyme systems.

xxxix. BuYards & Docks - request for reference to a German patent.

xl. Bendix Corp. - request for information on contamination of spacecraft.

xli. Office of Technical Services - request for information on toxicity of plastics materials and leachability of toxicants in seawater.

xlii. ATAC, Warren, Michigan - request for information on corrosive properties of molybdenum disulfide.

xliii. Aircraft Armaments, Inc. - request for information on crystal structure defects, and where contract support for such research might be obtained.

xliv. Melpar, Inc. - request for information on test sites alternate to Panama for Signal Corps contract test work on electronic equipment.

xlv. National Bureau of Standards - request for information on fungicide application problem of a national linen organization.

xlvi. Glidden Co. - request for information on barium metaborate as a paint preservative.

xlvii. Hydronautics, Inc. - request for information on high pressure metal fatigue corrosion in the deep sea.

xlviii. Electric Boat Division of General Dynamics Corp. - general discussion of their problem of testing a wooden drydock for use at Quincey, Mass., and associated preservation problems and marine borer activity at Quincey.

xlix. District of Columbia Government - request for information on fungicides for neoprene gaskets used with cast iron pipes in sewerage systems.

l. Office of Technical Services - request for information on effects of chemicals on foreign materials.

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li. Walter Reed Medical Center, Forest Glen Section - request for information on effects of fungi on plastics, resins, rubbers, and plasticizers.

lii. Pioneering Research Division, QM R&E Command, Natick, Mass., - request for summary toxicity data on several organic chemicals.

liii. U.S. Air Force, Chanute Technical Center, Chanute AFB, Ill., - request for assistance in preparing documents for a course in Integral Fuel Tank Maintenance.

c. Liaison and Coordination Activities

The liaison functions are carried out by PDC with the Department of Defense, industry, and others by means of visitors to PDC, visits by PDC to DOD and other organizations, and membership or liaison of PDC staff members on committees.

i. Visitors to PDC.

Approximately 150 visitors came to the PDC during the period covered by this report. Representative organizations from which these visitors came are as follows: Frankford Arsenal, Chapman Chemical Company, Magna Corporation, MIT, Radio Corporation of America, Franklin Institute, Melpar, Inc., Travelers Research Center, Plastics Institute of America, Hughes Aircraft, American Cyanamid, Bureau of Mines, Naugatuck Chemical, DuPont, General Dynamics, Mobility Command, Edgewood Arsenal, U.S. Army Biological Laboratories, Fort Detrick, Chas. Pfizer Company, Sanders Associates, Bureau of Ships, National Referral Center, U.S. Naval Civil Engineering Laboratory, Port Hueneme, Mechanical Technology Company, Wright-Patterson Air Force Base, Ohio, Bureau of Yards and Docks, Georgia Institute of Technology, Maumee Chemical Company, Army/STINFO, ARO, U.S. Coast Guard, Battelle Memorial Institute, Norwich Pharmacal Company, Electric Boat Division of General Dynamics Corporation, Institut Francais du Petrole, Sandia Corporation, Aerojet General Corporation, Department of State.

ii. Visits by PDC Staff

During the course of this contract period, personnel of PDC made visits to some 40-50 offices. Among these are the following representative examples:

Office of Dr. Earl Hayes, ODDRE, Pentagon

General Electric Company, Informations Systems Operation, Bethesda, Md.

Office of Mr. Norman Klein, Army Materiel Command

Office of Colonel John Hearn, Air Force Systems Command, Research & Technical Division

National Aeronautics and Space Administration

Office of Colonel A.A. Aines, ARO

Office of Mr. Freyvogel, Air Force, Pentagon

ARO, Durham, North Carolina

Edgewood Arsenal

Germany, Spangdahlem AFB, Headquarters 49th Tactical Fighter Wing, USAFE, June 4, 1963

France, Paris, Thermoline 200 European Distributor

France, Evreux AFB, Headquarters 322, Air Division, USAFE, June 6, 1963

Germany, Bitburg AFB, Headquarters 36th Combat Group, USAF, June 3, 1963

Note: The four overseas visits were made as a part of OECD business and the transportation costs were not borne by PDC.

iii. Meetings Attended

Among meetings attended by staff of PDC are the following:

NACE Annual Meeting and Second International Congress on Corrosion, New York, N.Y., March 1963

National Federation of Science Abstracting and Indexing Services, Washington, D.C., March 1963

Annual Meeting of Institute of Environmental Sciences, Los Angeles, Calif., 1963

Armed Forces Pest Control Board meetings at Main Navy Building (several during 1963 and 1964)

Navy-Lockheed Symposium on "Toxicity in the Closed Ecological System" at Palo Alto, California, July 1963

Gordon Research Conference on Microbiological Deterioration, August 1963

NACE Committee T-9, Corrosion of Military Equipment, Brookley Air Force Base, October 1963

Symposium on Liquid Metal Embrittlement, Frankford Arsenal, Philadelphia, Pa., November 1963

Symposium on "Time-Dependent Effects on Plastic Materials," First Annual Conference of Plastics Institute of America, Stevens Institute of Technology, Hoboken, N.J., December 1963

Annual National Meeting of the National Federation of Science Abstracting and Indexing Services, San Antonio, Texas, March 1964

Institute of Environmental Sciences, National Meeting, Philadelphia, Pa., April 1964

Corrosion Research Council, April 1964

iv. Membership or Liaison of PDC Staff Members on Committees

Organization for Economic Cooperation and Development, Group of Experts on Biological Fouling and Corrosion of Ships Hulls, Fundamental Research Commission; national liaison member of the Group of Experts on Biological Deterioration of Materials; and chairman, Ad hoc group concerned with microbiological effects on optical systems, W.M. Bejuki, member.

Armed Forces Pest Control Board, C.J. Wessel, liaison member.

Institute of Environmental Sciences - Committee on Air Force Specifications Review, C.J. Wessel, Chairman of section on Natural Environments; W.M. Bejuki, Chairman of Subcommittee on Fungus.

ASTM, W.M. Bejuki, Chairman, Section M, Effects of Microorganisms, Subcommittee V, Permanence Properties, of Committee D-20 on Plastics.

National Federation of Science Abstracting and Indexing Services, C.J. Wessel, Board of Directors and NFSAIS Secretary.

Corrosion Research Council, C.J. Wessel, member.

International Electrotechnical Commission, TC-50, Working Group 5, Mould, C.J. Wessel, member.

Institute of Environmental Sciences - ASA Committee Z-84, Subcommittee on Chemical Terms, C.J. Wessel.

Institute of Environmental Sciences, C.J. Wessel, Chairman, Handbook Committee.

d. Acquisition and Organization of Literature

The Prevention of Deterioration Center regards its repository of documents as one of the bases of its operations. The staff is at all times on the alert to acquire these documents and spends a considerable amount of time reviewing sources of the documented information, such as primary journals, government and contractors' reports, patents, industrial literature, books, and miscellaneous publications. An especial effort is made to cover the secondary or abstract literature, such as Chemical Abstracts, Biological Abstracts, listings from the Defense Documentation Center, Office of Technical Services, and STAR of NASA.

After the documents are chosen, they are acquired and screened. The screening step evaluates the pertinency and importance of the document in the materials deterioration field. The Center does not accept all information on deterioration and its prevention, but rather only that which may be regarded as significant and contributory to the field in a fundamental or applied fashion.

A complete list of the scientific and technical journals screened by the Prevention of Deterioration Center staff is available in the appendix to this report. The list comprises journals regularly reviewed by the Center, but does not include special sources also used by PDC in obtaining documents. These latter special sources chiefly provide reports coming directly from Government agencies and contractors, and are either received by request or by having PDC on automatic mailing lists.

The most significant of the literature selected and obtained by the Center is scheduled for abstracting or extracting for the two sections of the publication, ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT. This abstracting effort, of course, ceased with Vol. 4, No. 4, Sections A and B of EEME, in April 1964.

All of the selected literature of the Center is kept in a repository for loaning to clientele, question-answering, and for staff use. A complete report of statistics on library activity during the year is provided in Miss White's report.

The present size of the PDC repository is estimated to be of the order of 70,000 documents. It is a unique collection and is not duplicated anywhere else in the world. It is important to note at this point that, should the Prevention of Deterioration Center operation be cancelled, it would be very desirable to locate the PDC document collection in a responsible organization where it may be kept intact and made available for use.

e. Dissemination of Information

i. Abstracts

Although Contract Nonr 2300(17) did not terminate until May 31, 1964, the Center found it necessary to cease publication of its abstracts service—Environmental Effects on Materials and Equipment, Sections A and B—with the April 1964 issues. An explanatory statement was sent to all subscribers and gratis recipients of the abstracts. Refunds were made to all paid subscribers for the balance of issues they did not receive. The distribution list of the two sections of the abstracts was at its peak at the time the publication was stopped—approximately 1000 for each section.

For further information on the Abstracts, EEME, Sections A & B, see sections by Mrs. Chapman and Mr. Cosby.

ii. PDC Newsletter

The PDC Newsletter ceased publication with the April 1964 issue. For complete details on the Newsletter, refer to Mr. Janecka's section of this annual report.

iii. Information Storage and Retrieval

For information on PDC activities on the subject of information storage and retrieval during the period of this report see section by Mr. Janecka.

iv. State-of-the-art Reports

For a discussion of PDC activity in preparing state-of-the-art reports under NASA Contract NASr-182, see sections by Mr. Lyle and Mr. Peden. For other state-of-the-art reports, see the PDC publications list.

v. Hyperthermal Re-entry Environment Glossary

The work of PDC during the period in preparing a hyperthermal re-entry environment glossary for the National Aeronautics and Space Administration is discussed in the sections by Mr. Lyle and Mr. Tejuja.

vi. Miscellaneous Publications, Speeches, Reports, Etc.

During the period of this report the following publications and speeches were presented by the PDC Staff:

"Is There An Information Problem?" C.J. Wessel, presented at the Annual Meeting of the Institute of Environmental Sciences, April 1963, and printed in the Proceedings of the meeting.

"Biodeterioration of Plastics," presented by C.J. Wessel at the First Annual Conference "Time-Dependent Effects in Plastics Materials," Plastics Institute of America, December 3-4, 1963, Stevens Institute of Technology, and published in the SPE Trans., July 1964, p. 193-207.

"Recent Developments in the Control of Microbial Growth on Leather and Fabrics," by C.J. Wessel, R.W.H. Lee, and H.T. Janecka, presented at the meeting of the Society for Industrial Microbiology in conjunction with the annual meeting for 1963 of the American Institute of Biological Sciences, and published in "Developments in Industrial Microbiology," Vol. 5, 1964. p. 36-49.

"Metals, Microbes, and Information Modules," by Walter M. Bejuki, presented at the Annual Meeting of the Society for Industrial Microbiology, in conjunction with the Annual meeting of the American Institute of Biological Sciences, 1963, and published in "Developments in Industrial Microbiology," Vol. 5, 1964.

"Harmful Effects on Materials and Equipment," by C.J. Wessel, in a Symposium on Toxicity in the Closed Ecological System, sponsored by the Department of the Navy and Lockheed, presented at Palo Alto, Calif., July 1963, and published in the Proceedings, edited by M. Honma, and H.J. Crosby, Lockheed Aircraft Corporation, Missiles and Space Company, 1963. p. 77-102.

Questionnaire on Information Facilities for the Select Committee on Government Research of the U.S. House of Representatives, May 11, 1964.

Position Paper by the Prevention of Deterioration Center for the National Federation of Science Abstracting and Indexing Services, March 1964.

Report of Prevention of Deterioration Center for inclusion in the Annual Report of the Division of Chemistry and Chemical Technology, for the period of July 1962—June 1963, prepared February 20, 1964.

Brief Description of the Prevention of Deterioration Center, May 1963.

"Environmental Effects on Materials and Equipment," lecture by C.J. Wessel, presented at the 1962-1963 Seminar Series of the Travelers Research Center, Inc., Hartford, Conn., April 25, 1963.

"Microbiological Contamination of Aircraft Fuels and Associated Equipment, Flight Safety Implications," lecture presented by W.M. Bejuki, April 7-8, 1964, at the Maintenance Session, 9th Annual Business Aircraft Safety Seminar, Flight Safety Foundation, Inc., International Inn, Washington, D.C.

"An Idealized Composite Information System for a Specialized Scientific and Technical Field," by C.J. Wessel and Robert G. Lyle, informal report prepared June 25, 1963.

"An Idealized Composite Information System for a Specialized Scientific and Technical Field, Application of the Concept to the Prevention of Deterioration Center," by C.J. Wessel and Robert G. Lyle, prepared June 25, 1963.

"Prevention of Deterioration Center, Operation of the Center, Cost Analysis (Approximate)," one-year period of March 1, 1962 - February 28, 1963, prepared May 23, 1963.

"Ordnance Corps Specialists in Chemistry of Corrosion and Inhibition," April 25, 1963.

"Laboratories Interested in Corrosion Research, Development and Applications," March 1963. (Extracted from Industrial Research Laboratories of the United States, 11th Ed., NAS-NRC, 1960).

"List of Persons and Organizations Served by the Prevention of Deterioration Center, January 1, 1962 - June 30, 1963."

vii. Literature Searches and Bibliography Preparation

Literature searches and bibliography preparation have been regarded as one of the more important functions of the Prevention of Deterioration Center. Activity along these lines was at a high level during the past year and is reported in the section by Mr. Janecka.

viii. Document Loans

The statistics on document loans are to be found in the section by Miss Virginia White.

ix. Special List of Reports on Microbiological Deterioration

This quarterly list of reports, prepared for a rather small select group of highly specialized personnel in the Departments of the Army, Navy and Air Force was terminated in May 1964 with Volume VIII, No. 2. Additional information on this publication is to be found in W.M. Bejuki's section of this report.

x. Card File on Microbiological Results of Materials

Reported in the section by W.M. Bejuki.

f. Special Programs

i. Fungicide Program

The disposition of the fungicide chemical samples is discussed in the section of this report by W.M. Bejuki.

ii. Jet Fuel Microbiology and Corrosion Project

See section by W.M. Bejuki

iii. Organization for Economic Cooperation and Development (OECD)

See section by W.M. Bejuki

iv. Manuals in Preparation

See section by W.M. Bejuki

v. Soil Burial and Specification Microbiology Conferences

See section by W.M. Bejuki

vi. Oil Slick Conference

See section by W.M. Bejuki

vii. PDC Thesaurus

See section by Mrs. Grace Chapman

viii. List of Experts

It has long been the intention of the Prevention of Deterioration Center to publish a list of experts in the various specialties within the materials/environment field. Practically all of the information for such a publication is already available within PDC, and a sizeable amount of the information has been collected and is available for use. However, lack of staff time and the need to carry out duties of higher priority has prevented the preparation of a formal publication.

V. Annual Report

C. Report by W.M. Bejuki, Assistant Director
Prevention of Deterioration Center

C. Report by W.M. Bejuki, Assistant Director

1. Fungicide Screening Program

a. Terminal Disposition of Samples

The candidate fungicide samples have been transferred to the U.S. Department of Agriculture at Beltsville, Maryland, with the assistance of Dr. Paul Marsh, and the entire collection is being considered for utilization by this station.

The 800 compounds supplied by the American Cyanamid Company were included in the transfer pending any contrary notice by this company. PDC requests to the American Cyanamid Company for advice relative to these test samples have not been answered; it seems reasonable to assume that no strong interest exists in the company in governing the disposition of the chemicals.

b. Publication Plans

Little or no progress has been made in releasing the data generated by the fungicide screening program to the general scientific public. The compilation of these data in various forms continues as time and circumstances permit.

2. Jet Fuel Microbiology and Corrosion Project

This general problem has decreased in priority at the Center. It is being served mainly by an effort to mobilize all the reports resulting from the million dollar research program of the Air Force in this field. The recurring nature of fuel problems arising from new materials, new systems, and changing environmental and engineering conditions, makes it seem advisable that for future needs, the present data be organized and centralized as a permanent information source from which knowledge may be drawn.

An illustration of such a case is provided by a recent Chanute Air Force Base request for suitable reference materials for use in training courses. The Chanute Technical Training Center in Illinois is in the process of designing a Fuel System Mechanics Course to support the C-141, Starlifter, aircraft. The request letter received by the Center further adds: "It is our desire to design a course which will be compatible with the using command's maintenance requirements to adequately maintain the C-141 Aircraft for mission performance.

It is understood that your Academy has done considerable research in the area of fuel contamination, corrosion control, and general deterioration of fuel cells and integral tanks. This Center, (Chanute) would greatly appreciate any information you may be able to provide to assist us in designing our fuel system course."

The response of PDC to this request has taken the form of defining the aims of the course, type of personnel involved, duration of training period, the general time frame for the requirements and other similar

factors. A review is now underway of existing manual and similar material, such as are listed below:

a. T.O. 1-1-3 "Repair, Handling and Inspection Instructions Integral and Removable Metal Tanks, Rubber and Nylon Fuel, Oil and Water-Alcohol Cells."

b. Job Training Standard 42430/50/70, "Aircraft Fuel Systems Mechanic and Aircraft Fuel Systems Technician."

c. Syllabus of Instruction, AAR42470, "Aircraft Fuel Systems Technician."

d. Special Training Standard ATS42450-1, "B-52 Fuel System Repairman and Wet Wing Sealing."

e. Tentative ATC Course Training Standard 52-AZR42450, "B-52, C-135, and KC-135 Fuel System Repairman and Wet Wing Sealing."

f. Air Force Manual 85-16, "Maintenance of Permanently Installed Petroleum Storage and Dispensing Systems."

Essentially the challenge here is to take the knowledge which has accumulated in the form of inspection, re-work and surveillance data from various fleet commands using B-52, C-135, and KC-135 airplanes, and to apply that experience to practices which will minimize or eliminate potential problems in the newly developed C-141 airplane. Thus, the Center loaned to Chanute Air Force Base its complete project files, maintained by the Assistant Director, for use in any way that it may be helpful in obtaining their objectives. These files included the following categorical information:

a. **Petroleum Microbiology Special File**

i. Colonel Montgomery's reports

ii. Experimental samples

iii. Minutes, Symposium on Contamination of Jet Fuels, 13-15 September 1961.

iv. Corrosion Research Council reports provided by Mr. Robert Edwards

v. Air Force Research Reports

vi. Research Proposals, Plans

b. "Microbiological Contamination of Aircraft Fuels and Associated Equipment, Flight Safety Implications," a paper presented by the Assistant Director of the Center, to the Flight Safety Foundation, held in Washington, D.C., April 7, 1964.

c. A copy of a letter addressed to Walter P. Conrardy, Wright-Patterson Air Force Base, which summarizes the observations of the PDC Assistant Director during his visit in 1963 to Air Force Bases in Europe.

d. An annotated bibliography, compiled by Mr. Richard W.H. Lee, a former staff member of PDC entitled, "Microbiological Activities in Petroleum Products."

The store of information on the subject of Microbial Contamination of Fuel Systems has also been used as a basis for several review articles. The most recent such occasion is represented by a paper entitled, "Microbiological Contamination of Aircraft Fuels and Associated Equipment, Flight Safety Implications," presented by Walter M. Bejuki to the Ninth Annual Business Aircraft Safety Seminar, April 7, 1964, sponsored by the Flight Safety Foundation, Inc.

The substantive observations and findings coming to the Center from the various Air Force Contracts in the field have been very satisfying in several ways. The new methodologies, the accumulation of data related to corrosion rates, and similar aspects should be recognized, in most cases, as distinct contributions to the control and/or solution of the basic problem and its understanding.

Although a direct effort, in the form of a request letter to Air Force Contract Monitors, has been made to assure PDC receipt of all reports; to date the mechanism for this is not yet entirely established. The following table, "U.S. Air Force Studies in Fuel and Fuel Systems Microbiology 1963-1964," briefly summarizes the nature, duration and other aspects of this work and provides a running record of the dates reports on the various efforts were received at the Center. This attempt to achieve total coverage is inherent to the objectives and recommendations made to Dr. Edward Wichers in response to his request for a summary memorandum and recommendations for future PDC or higher echelon NAS-NRC considerations of the petroleum microbiology problem. The referenced memorandum is dated February 1, 1963 and is entitled, "PDC Position in Jet Fuel Problems."

U.S. Air Force Studies in Fuel and Fuel Systems Microbiology, 1963-1964

	Dates Reports Received
Battelle Memorial Institute, Columbus, Ohio. #33(657)-9804, "Elastomers for Fuel Systems Containing Micro-organism Controlling Additives." $200,000 - 2 yr duration Chief Investigator: Mr. C.W. Cooper Contract Monitor: Mr. P. House Symbol: ASRCNE-1	5/6/63; 8/5/63; 12/31/63 (10/1/62-8/31/63); 12/31/63 (10/1-12/31/63)
Monsanto Research Corporation, Everett, Mass. #33(657)-9814, "Effects of Micro-organisms on the Composition of Fuels and Lubricants." $139,103 - Initiated 13 Aug 62 - 3 yr duration Chief Investigator: Dr. J.O. Smith Contract Monitor: Mr. A.V. Churchill Symbol: ASRCNL-3	3/7/63; 3/15/63; 6/3/63; 8/19/63

U.S. Air Force Studies in Fuel and Fuel Systems Microbiology, 1963-1964 (cont.)

	Dates Reports Received
Southwest Research Institute, San Antonio, Texas #33(657)-9762, "Development Program for Investigation, Laboratory Analysis & Evaluation of Base Fuel Handling Procedures with Regard to Microorganism Contamination." $66,661 - Initiated 2 Aug 62 - 1 yr duration Chief Investigators: Mr. R. Johnson, F.W. Bieberdorf Contract Monitor: Mr. K.F. Stevensen Symbol: ASNNSF	
University of Dayton, Dayton, Ohio #33(657)-9175, "Research on Advanced Aerospace Fuels Under High Mach Number Flight Stresses." $150,000 - Initiated 15 Jun 62 - 3 yr duration Chief Investigators: Dr. D. Nunn, Dr. Higgins Contract Monitor: Mr. A.V. Churchill	11/63
USA Chemical Corps., Biol. Labs. Ft. Detrick, Maryland MIPR #33-657-2-RD-264, "Study of Microbiological Contamination." $90,000 - Initiated 13 Jul 62 - 3 yr duration Chief Investigator: Dr. H.M. Hodge Contract Monitor: Mr. A.V. Churchill Symbol: ASRCNL-3	
General Dynamics, Ft. Worth, Texas #33(657)-9181, "Mechanical Techniques for Filling, Removing or Controlling Microorganisms in Hydrocarbon Fuels." $67,300 - Initiated 1 Jul 62 - 1 yr duration Chief Investigators: Dr. D.J. Pritchard, Dr. H.G. Hedrick Contract Monitor: Mr. C.R. Martel Symbol: ASRMFS-2	12/63
USA Engineer R & D Labs., Ft. Belvoir, Va. MIPR #33(616)61-9 and MIPR #33-657-2-RD-154 "Project Bears"	

U.S. Air Force Studies in Fuel and Fuel Systems Microbiology, 1963-1964 (cont.)

	Dates Reports Received
USA, E R&D L, Ft. Belvoir (cont.) $103,000 - Initiated 29 Dec 61 - 2 yr duration Chief Investigator: Mr. R. Rogowski Contract Monitor: Mr. T. Drennen Symbol: ASNNSF	
General Dynamics, Ft. Worth, Texas #33(657)-8752, "Microbiological Corrosive Effects on Structural Materials Used in Aircraft Fuel Tanks." $150,000 - 18 mo duration Chief Investigators: Mr. D.C. Wilson Dr. H.G. Hedrick Contract Monitor: Mr. B. Ward Symbol: ASRCEE-1	3/7/63; 5/20/63; 8/19/63; 11/15/63; 2/15/64
Sharpley Labs., Fredericksburg, Va. "Handbook for Hydrocarbon Microbiology." 1 yr duration Chief Investigator: Dr. J.M. Sharpley Contract Monitor: Mr. A.V. Churchill Symbol: ASRCNL-3	
Melpar, Inc., Falls Church, Va. #33(657)-9186, "Research on Contaminants in Aircraft Fuel Systems and the Development of Rapid Methods for the Detection of Microbial Contaminants." 3 yr duration Chief Investigator: Dr. G.C. Blanchard Contract Monitor: Mr. A.V. Churchill Symbol: ASRCNL-3	3/1-6/1/63; 6/1/-9/1/63; 8/1/63
Automation Industries, Torrence, Calif. "Applicability of Ultrasonic Techniques for Evaluation of Corrosion in Integral Fuel Tank Assemblies of Military Aircraft." $85,953 - 1 yr duration Chief Investigator: Mr. J.B. Ramsey Contract Monitor: Mr. E. McKelvey Symbol: ASRCEE-1	

On a continuing basis, PDC support of the Department of Defense Studies in Petroleum Microbiology and Associated Corrosion seems to be most useful in the form of providing a more definitive bibliography on this

subject. The current, "Microbiological Activities in Petroleum and Petroleum Products," PDL-48377 is an 'annotated' bibliography in which the annotations are, in actuality, the entire abstracts of the reports cited where the papers were originally used for the Center's abstracting services. PDL-48377 also includes an author index. This bibliography has been enthusiastically received. The current research program on the subject has unearthed many more references as associated with specific projects, however, and a revision seems indicated. The U.S. Army Biological Laboratories at Fort Detrick have expressed a need for an early revision and have further suggested that they will be able to contribute a fairly large number of additional titles.

3. Organization for Economic Cooperation and Development (OECD), and the American Society for Testing and Materials (ASTM) Activities

a. OECD

OECD work continues on a somewhat more routine basis and only in two specific subject areas. The third subject area, "Microbiological Effects on Optical Systems," has resolved itself to a practically completed function of an ad hoc group whose work largely, it is expected, will be confined from now on, to a cognizance function.

Various working groups have now been established within the OECD Committee on Scientific Research under the "Expert Group on Biological Deterioration of Materials." Task Forces in taxonomy, microbial corrosion, and test methods, as related to cellulose and plastics, have met and U.S. representation provided through the U.S. Consultative Group organized for this purpose. Dr. Warren Iverson, USA Biological Laboratories, Fort Detrick, has met with his counterparts from other countries to consider "Microbial Corrosion;" Dr. Emory Simmons, USA Quartermaster Laboratories, Natick, has met with his counterparts to consider "Taxonomy and Test Organisms (fungi)." Drs. Kaplan and Klausmeier have attended the Second Plenary Meeting of the Expert Group on "Biological Deterioration of Materials," along with the Assistant Director of the Prevention of Deterioration Center who continues to serve as the U.S. National Liaison Officer for this activity. The Center has, through the office of the Assistant Director, been instrumental in providing a list of research organizations in the U.S. which have an interest in microbiological deterioration of materials. Other national liaison officers are also making such surveys in their countries, and it is expected that a consolidated directory, encompassing the majority of OECD countries, will soon be published.

The work of the OECD "Expert Group on Biological Fouling and Corrosion of Ships Hulls," has now been incorporated into a new group and the Ships Hulls Group, as an entity with a title, will no longer exist. The superseding group is the "Expert Group on the Preservation of Materials in the Marine Environment." The State Department-National Science Foundation complex guiding the scientific work of the OECD in the U.S., has seen fit to appoint the Assistant Director of the Prevention of Deterioration Center as the U.S. National Liaison Officer to this group also.

The technical subject matter of these two OECD/CSR Projects, being so closely related to the principal objectives of the Prevention of

Deterioration Center, has suggested that possibly PDC should be permitted to broaden its service area to include foreign scientists participation. A formal request to this effect was initiated in December of 1963 at the Second Plenary Session of the "Expert Group on Biological Deterioration of Materials," and preliminary steps have been taken to arrive at the several official positions related to the matter. Dr. Carl Walske, U.S. Science Attache to France, is considering the matter from his position in the U.S. Regional Office in Paris. It is expected that after proper routing through protocol, Dr. Seitz, President of the National Academy of Sciences, and the sponsors of the Prevention of Deterioration Center will be formally contacted.

b. American Society for Testing and Materials (ASTM) Activities

The Prevention of Deterioration Center continues to provide, through its Assistant Director, the Chairmanship of Section M (Effects of Microorganisms) of Subcommittee V (Durability) within D-20 (Committee on Plastics).

The technical effort in this program is concerned chiefly with mastering enough applied bacteriology, principally knowledge dealing with the genus Pseudomonas, so that a safe, meaningful assay for durability and product acceptability in plastics can be developed.

Section M is also contributing to the international program in this work through its efforts in the International Standards Organization (ISO). As a group, Section M, with certain invited scientists, has recently reviewed and constructively criticized the Second Draft Proposal of ISO/TC 61, entitled, "The Determination of the Resistance of Plastics to Mould by Visual Evaluation." This utilization of U.S. experience, as shared in the OECD and ISO programs, illustrates a coordination function, the value of which would seem to increase as more and more international efforts by trade associations, international unions, and other similar programs reach further into the industrial microbiology of materials deterioration and fouling.

The work of Subcommittee III, in D-20 of the ASTM, is also of interest to the Prevention of Deterioration Center particularly since the PDC work in this field has resulted in a specific contract with NASA under the contract no. NASr-182. Details of the technical task of the contract are given in the report by Mr. R.G. Lyle.

4. Manuals in Preparation

This program, was reported upon by Dr. Lawrence M. Ames, former Research Associate at PDC, in the 1962-1963 annual report. The two specific manuals in preparation deal with the effects of temperature and humidity on the growth of fungi, and fungus tests in specifications. Both manuals are practically at the same level of completion having been brought up to the present pre-publication state by Dr. Ames before he left the Center in 1963. The photographs, illustrations, and editorial changes contributed by Dr. Ames are now ready for critical administrative review.

5. Special Projects and other Activities

a. Soil Burial and Specification Microbiology Conferences

No formal requests to call any further meetings on these two subjects have been received by the Center. The development of programs in these subject areas by the Organization for Economic Cooperation and Development, the International Electrotechnical Commission, the Aerospace Industries Association, and the U.S. Army Cognizance Group in Biological Deterioration of Materials, would obviate an urgent need for additional meetings sponsored by PDC. Department of Defense representation in several of the above groups, by Dr. Arthur Kaplan, Dr. Robert Klausmeier, Dr. Dorothea Klemme, Mr. Vincent Bagdon, Mr. Sidney Ross, Dr. Leonard Teitell, Dr. John Leonard, Dr. Emory Simmons, Dr. Paul Marsh and others, provides the opportunity for discussion, or cooperative experiment and additional forums seem unnecessary.

b. Resistance of Materials to Microbiodeterioration

The desire of the Center to make engineering type data in the field of materials/biological deterioration available in a readily usable form continues. A survey has now been completed designed to indicate some measure of information consumer preference, based on a proposed analytical form described in the reprint, "Microbes, Materials and Matrices." The questions were intended to collect information on preferred data form, and to offer a choice between an existing individual analysis sheet form, and a proposed summary table or information matrix. A third, related question was also posed and dealt with the desirability of maintaining a data bank in any form. The results of this survey are given in the table on the following page.

The table provides certain possible choices on which some administrative action could be based. The construction of sample information matrices-summary tables, for further evaluation, and a tightening up of the analytical process based on acquired experiences seems a logical next step. No formal action on this matter, however, has been considered.

c. List of Reports on Microbiological Deterioration and Its Prevention

This quarterly release is now in Volume VIII and apparently continues to be a welcome by-product of the PDC accessions and review function. A broader distribution of this effort possibly should be considered particularly in the form of a consolidated or cumulative special subject area bibliography. It also seems appropriate to indicate that the microbiological list could well serve as a model for similar treatment of reports in other fields, such as corrosion.

d. Society for Industrial Microbiology

The Assistant Director continues to serve as a Director of the Society for Industrial Microbiology. The Center was indirectly contributory to the SIM manual on sampling procedures for use in evaluating microbial contamination of fuels, by providing its consulting services to the society in matters of prepublication review and suggestions. Members of the SIM

b. SURVEY ON READ-OUT PREFERENCE ON MICROBIODEGRADABILITY OF ENGINEERING MATERIALS

Prevention of Deterioration Center
November 5, 1963

Cooperator	Favors Existing Individual Analysis Sheet Form	Favors Proposed Tables or Matrices	Favors Maintenance of Data Bank; any form	Remarks
1	+	+	+	For multiple filing suggests analysis sheets over matrix forms or summary table. Recognizes effort as contributing to information command function
2	+		+	Would appreciate expanded analytical forms.
3	+		+	Professes a broad use base.
4		+		Broad categorical arrangement preferred.
5			—	Interpretations lacking in both, would appreciate fuller citations.
6		+		No longer directly involved.
7			—	Sees danger in either form being used, wrongly, as an authority list.
8	+		+	Interested in both forms.
9	+		+	Suggests giving authors, year, and use of card stock to facilitate filing.
10		+		Possibly neither system adequate for handling the voluminous literature.
11		+	+	Suggests broad Navy distribution; suggests orientations.

committee who worked on the manual have also, on several occasions, availed themselves of PDC staff services.

e. Visits to Overseas DOD Bases

In cooperation with Mr. Walter Conrardy of the Wright-Patterson Air Force Base, the Assistant Director of the Center was able to include several Air Force Base visits in Germany and France while in Europe on OECD business. At the bases in Bitburg, Spangdahlem, and Evreux-Fauville, discussions on icing of runways, general corrosion and microbiological contamination of fuel tanks storage and handling facilities, and of integral tanks aboard aircraft, were held with commanding officers, POL staff and other personnel. The results of these visits were sent to Mr. Conrardy in a letter-report in July of 1963, with information specifically on the following visits:

i. France, Evreux-Fauville Air Force Base, Headquarters 322, Air Division (combat cargo) (USAFE) June 6. 1963

ii. Germany, Bitburg Air Force Base, Headquarters, 36th Combat Group, USAF, June 3, 1963

iii. Germany, Spangdahlem Air Force Base, Headquarters, 49th Tactical Fighter Wing (USAFE) USAF, June 4, 1963

iv. France, Paris, Thermaline 200, European Distributor

f. Oil Slick Conference

The transcript of this meeting has been received from the stenotyping company and a preliminary evaluation started. The appendix material for the Proceedings is being collected and will include additional literature references, photographs, program notes, and other similar information. Letters urging the meeting attendees to submit their contributions at their earliest convenience have been sent out. A visit to the American Petroleum Institute (API) by staff personnel has provided numerous references from the API files.

The PDC Library staff is now organizing the above and other materials and is giving the collection standard bibliographic form. The Library is also borrowing journals and other reference material for incorporation into the collection as the citations are brought to their attention. The Proceedings will be distributed as soon as possible.

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V. Annual Report

D. Report by Mrs. Grace D. Chapman,
Supervisor of Publications

D. Report by Mrs. Grace Chapman, Supervisor of Publications

1. Abstracting at PDC

PDC, and other information groups, are reassessing not only the high cost of collecting information but the most useful way of disseminating it once it is collected. To date the most promising way that has been found for cutting costs is the use of author-written abstracts. More and more journals and contractors are stipulating that with the completed report an author-written abstract must be submitted. Often detailed instructions are furnished as to its desired content and form. Use of author-written abstracts has the advantage of satisfying the many people who feel that abstracts should be written at the level of experience of the writer of the report. This questioning of the ability of professional abstracters is only a part of the much larger problem of the qualifications of people working at the input stage in the huge storage and retrieval systems being set up today.

One technical group, interested in both costs and quality, is studying the feasibility of establishing requirements for standard abstracts. Since abstracts are generally of at least two kinds, indicative or substantive, at least two standards would seem to be necessary. If standard abstracts can be written according to a set of rules, their content should be more consistent and their costs lower. Quality, however, would not necessarily be improved.

Another suggestion which has been made for reducing costs is for each technical society to take responsibility for abstracting reports in its own field. These would then be pooled in a central depository with those of other technical groups, and drawn on as needed. Thus a report would be abstracted only once and the same abstract might appear in many publications. One disadvantage of this is that abstracts are often slanted for a particular audience. This is true at PDC where interest is primarily in the deterioration or deterioration prevention aspects of a report.

One of the difficulties with most cost saving suggestions is that there is no agreement as to what is desirable or necessary in an abstract. A citation, perhaps with appended descriptors of some kind, may answer one man's needs whereas nothing less than a resume satisfies another. Difference in the type and amount of information desired, the availability of the report, the language of the report and the amount of time and talent available to produce the abstract, make the idea of a standard abstract unrealistic.

At PDC, author-written abstracts are used when they are adequate. Costs are held down by abstracting only the reports thought to be the most valuable and suitable for abstracting. Only keyword treatment is given to abstracts not in these categories. It is felt that PDC operates efficiently; yet costs of producing abstracts remain high. Perhaps abstracts are not the answer; some other form of information dissemination may be less expensive and equally or more useful to PDC subscribers. Since documents are available on loan from the Center, an unusual feature of PDC services, merely a citation of the report together with descriptors might be adequate. An objection to this is that researchers say repeatedly that they want information, not documents. Time spent in abstracting might be utilized in deeper coding and indexing and in incorporating all the key terms we have collected over

the past years into a mechanized system where the information contained therein would be readily available for question answering, bibliographies, state-of-the-art reports, etc. The Center believes that the nearly 70,000 reports that have resulted from screening efforts over the past 20 years, constitute the most complete assembly of information in the world on the special phases of deterioration of materials which comprise the PDC field of interest.

2. Environmental Effects on Materials and Equipment Abstracts, Section A

Volume 3 of EEME Section A was completed in December 1963. The appended table gives pertinent statistics on Section A together with those for Section B. (Section B will be discussed in a later part of this report). For purposes of comparison, statistics for 1962 and for January through May 1964 are included.

Below are listed the percentage of reports for each of the eleven categories in Section A. To show how little change the relative numbers of each change from year to year, figures for 1962 also are given. In selecting documents there is no favored category; anything falling within the area of interest is accessioned.

	1962	1963
Biological Agents	8.6%	9.7%
Ceramics, Cement, Glass and Plaster	3.6%	3.6%
Electrical and Electronic Equipment	3.4%	2.7%
Fungicides and Other Toxic Agents	9.9%	9.7%
Lacquers, Paints and Varnishes	6.7%	6.6%
Metals	22.1%	23.6%
Miscellaneous	10.2%	11.6%
Packaging and Storage	3.6%	2.3%
Plastics, Resins, Rubbers and Waxes	11.9%	10.4%
Textiles and Cordage	7.2%	6.4%
Wood and Paper	12.8%	13.4%
	100.0%	100.0%

PDC has increased its journal coverage in 1963 to slightly more than 550. About 100 of these journals are in a foreign language; reports selected from this group amount to 18.5% of the total. Of these, 5% are in Russian. PDC language capabilities, in addition to Russian, include French, German, Italian, Spanish, Czech, Hungarian, Rumanian and Polish.

At present most abstracting in Section A is done by three part time abstractors. The time of Center personnel is devoted to document selection, abstract review, editing, proofreading, indexing and record keeping.

ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT ABSTRACTS

	1962		1963		1964 (Jan-May)	
Total Personnel						
Professional	6 1/4		5		5	
Nonprofessional	3		3 1/6		3 1/6	
	Sec. A	Sec. B	Sec. A	Sec. B	Sec. A	Sec. B
Total Abstracts	960	483	971	480	331	160
Total Extracts	816	932	733	1423	257	324
Total Titles Covered	1776	1415	1704	1903	588	484
Number of Issues Published	12 & Index	12 & Index	12 & Index	12 & Index	4	4
Total Circulation	909	920	970	941		

3. PDC Thesaurus

During 1963 only limited progress was made in developing the PDC thesaurus. Some new terms were added and some definitions supplied. Total terms now number about 3300. At the last annual meeting Mr. Lee submitted a proposal for the use of the Termatrex field-punched Peek-a-boo system for the storage of key terms that have accumulated from the coding of about 20,000 documents collected since 1957. Cost estimates for implementation of the Termatrex systems also were submitted. Because of Mr. Lee's resignation and because of lack of funds no action was possible on this proposal. Adoption of this or some other system is a first order requirement for efficient use of the information contained in the more than 70,000 documents collected by the Center.

Work under a new contract at PDC centers around collecting information on special aspects of deterioration. In assigning key terms to reports collected in this study three main categories are of primary interest: the material, the environment and the degradation itself. To make coding more definitive and searching easier, the thesaurus developed over the years has been edited and broken down into three main sections. Section I deals with materials or systems whose degradation is under study. Materials are listed separately by base substance (e.g., nylon) and by form or use (e.g., cordage). Section II deals with environments responsible for degradation. A separate listing gives modifiers and locators for the environmental terms. Section III is concerned with the degradation itself and is subdivided into (1) the general property of the material which is being affected by the environment (e.g., mechanical), (2) the mechanism of degradation (e.g., oxidation), and (3) the specific form of degradation (e.g., fracture). When a term may be used in more than one section, the section it is in is designated.

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V. Annual Report

E. Report by Robert G. Lyle,
Research Assistant

E. Report by Robert G. Lyle, Research Assistant

1. PDC Progress in Work on Thermal, Mechanical and Space Environments

One indicator of activity on a task within the scope of an information center such as PDC is document input. Since our last report, an estimated 2500 documents have been accessioned relative to the effects on materials and equipment of shock, vibration, thermal extremes, low pressure, composition of the upper atmosphere, gravitational and magnetic fields, meteoric particles, naturally occurring radiations and the surface and atmospheric environments of the moon and several planets. Mr. Cosby, who is now editor of ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT, SECTION B, will report on the dissemination of information from these documents through the abstracts journal. It should be noted that a continuing effort is made to provide key-word descriptors (extracts) for those documents that are not abstracted in the EEME journal. In this way, practically all the documents added to the PDC collection have been analyzed for significance of content and thus contribute to meaningful searches in response to service requests or specialized tasks. The depth of this analysis and coding process is reflected in the average of approximately ten descriptors per document.

Yearly since 1961 PDC has reported its observation of the large growth rate in published material that must be reviewed to maintain coverage of its field. In this reporting period it is estimated that more than 100,000 titles were reviewed. This search was primarily for information related to the thermal, mechanical and space associated environments, but included some input for the other subject areas in the Center's field of coverage. The sources of these titles are indicated in large part by the journal list appended to this report. The other major sources are national and international scientific and technical symposia.

2. Projects under NASA Contract

An outgrowth of this type of collection and analysis activity can be seen in the contract between the PDC and the National Aeronautics and Space Administration which became effective in January, 1964. This contract calls for two projects centered squarely in the thermal, mechanical and space associated environments area of PDC scope. A glossary is to be developed to cover the hyper-thermal aerodynamic environment terminology. This task is an outgrowth of an effort early in 1962, involving approximately 60 terms on the subject for the ASTM (Committee D-20), Sub-Committee III, Section L Task Group on Standard Terms and Symbols for Hyperthermal Environments. The other project under the NASA contract involves the preparation of technical review reports (state-of-the-art summaries) on the behavior of materials and equipment under the influence of particular environmental stresses.

The terminology project has progressed at a good rate since late January of this year when Mr. Hotchand Tejuja joined the PDC staff. Much of his time was devoted to the detailed task of identifying pertinent terms, locating and deriving definitions as appropriate, and organizing these inputs. Mr. Tejuja is reporting the details of his effort. Progress over approximately two and one-half months since an organized effort has been applied to this work can be summarized as follows:

a. More than 200 terms with one to ten definitions each have been collected.

b. Liaison has been maintained with the ASTM D-20, III-L. A report of this work was given at the committee's last meeting in Philadelphia, Pennsylvania, February 27, 1964.

c. Nominees have been selected for a hard-core working group who will be asked to ballot on the proposed definitions. These nominees were selected by a coordinated effort of representatives of NASA, PDC, and ASTM D-20, III-L and represent the industrial enterprises and several government agencies most active in work related to this environment. It is anticipated that this group will number between 25 and 35.

d. The invitation to participate and the first ballot are expected to go out in early May.

Discussions with NASA representatives late in 1963 concerning the particular coverage desired in the technical reviews called for in the contract, led to a submittal by PDC of the following list of ten suggested subject areas:

a. Degradation of high temperature nickel and cobalt base alloys above 1000 F and preventive techniques.

b. Bearings in the space environment, design problems and remedies.

c. Meteoric particle impact, environment, effects on structures and surfaces and protective design.

d. Behavior of materials in a low pressure environment (below approximately 10 mm Hg).

e. Lubricants and hydraulic fluids for high temperature applications (above 300 F).

f. Thermal environment problems of entry into planetary atmospheres and related materials and design concepts.

g. Dynamic loading of spacecraft launch vehicles (a) launch and flight.

h. Effects of low temperature (below -100° F) on material and equipment.

i. Space radiation damage mechanisms and preventive measures for:

   i. Polymers
   ii. Semiconductor materials
   iii. Electrical equipment

j. Experimental and analytical methods for evaluation of materials and equipment behavior in the following environments:

   i. Shock
   ii. Vibration
   iii. Thermal Cycling and Thermal Shock
   iv. High Velocity Impact
   v. Sustained High Temperature
   vi. Low Temperature
   vii. Solar Electromagnetic Radiation

The NASA representative chose "Effects of low temperature on materials and equipment" for our first report. The temperature of -300 F was stipulated as the upper temperature limit. Work commenced on the task in early February 1964 with Mr. Robert Peden of our staff who devotes the major part of his time in searching out the information needed. Mr. Peden is reporting the details of this work. The outline describing our proposed concept and structure of the finished report has been submitted to NASA for approval. (A copy of this outline appears in the appendix of this report). Upon approval, pertinent substance of the many references now organized in accordance with this outline will be coordinated into a narrative summary report.

The contract officer at NASA has indicated that the next two subjects for state-of-the-art reports should be "Meteoric particle impact environment, effect on structures and surfaces and protective design" and "Space irradiation damage mechanisms and preventive measures for semiconductor materials." Subjects indicated for subsequent consideration are Items d, j-ii, j-i, and j-iii of the list submitted by PDC and summarized above. The scheduling and rate of progress on these subjects must necessarily await administrative decisions concerning the level of staffing and allocation of assignments. Work on the second subject "Meteoric particle impact environment," however, has progressed through the development of a tentative outline.

3. Service Requests

Responses to requests for information on specific problems comprise a significant portion of the PDC total work load. A few remarks are in order concerning requests that have required considerable input from those staff members whose primary efforts have been in furtherance of the above described projects.

In November 1963, a six-part request was received from the Air Force Materials Laboratory, Wright-Patterson Air Force Base, Ohio. The request was for all available information and a technical discussion of:

a. The resistance of superalloys (nickel- and cobalt- base), with or without protective coatings, to oxidation, erosion, corrosion, carburization, sulfurization and spalling, and related loss of mechanical properties including thermal fatigue.

b. Evaluation of new potentially heat resistant reinforced plastics for radome and structural applications. The effect of high temperature on mechanical and electrical properties.

c. Protective coatings for niobium and niobium alloys in applications involving temperatures between 1800 and 2500 F. The usefulness of these coatings on molybdenum and tantalum.

d. High temperature protective coatings for alloys of tantalum, molybdenum, and niobium for applications in a low pressure environment (10 mm Hg or less).

e. Correlation between processes, chemistry, structure and resulting protectiveness of silicide coatings.

f. Strength of elastomeric vulcanizates at elevated temperatures for use in sealants, tires, etc. with emphasis on particulate reinforced elastomers.

Shortly after commencing work on this request PDC was advised by the requestor that, due to the shortness of time, response in the form of an annotated bibliography would be preferred rather than technical discussion. Annotated bibliographies were prepared in response to this request and sent to the Materials Laboratory. The preparation of these bibliographies involved the review of approximately 1200 abstracts plus approximately 800 reports which had not been previously abstracted at the Center. The included items which were not previously abstracted at PDC were coded and the author abstract, if any, was included in the response. Messrs. Cosby, Janecka, and Peden each contributed largely to this effort and report on the various parts of our response in their separate sections of this report.

Other requests not related to the mechanical, thermal or space associated environments, but serviced by this writer included questions on:

a. Protection of magnesium against corrosion.

b. The resistance of polyurethane foams to marine biodeterioration.

c. Methods of drying sealed radio sets after field-maintenance.

d. Resistance of polyethylene foam to microbial deterioration.

e. The application of magnesium-iron cells in seawater.

f. Effective methods of salvaging sea-water flooded electrical and electronic equipment.

g. Removal of oil slicks from harbors.

h. Liquid-metal corrosion of various substrates.

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V. Annual Report

F. Report by William A. Cosby,
Research Assistant

F. Report by William A. Cosby, Research Assistant

1. Environmental Effects on Materials and Equipment, Section B

The third volume of EEME B contained 480 abstracts and 1423 key-word extracts, a total of 1903 documents for the year. The journal list appended to this annual report reflects sources of approximately half of this total; sources for the remaining half include reports generated as a result of government sponsored or conducted research and development (particularly by the Armed Forces and NASA) and technical and scientific symposia. Subscriptions in 1963 totaled 941; categorically, this broke down as:

Air Force	166
Army	221
Navy	205
Other Government Agencies	158
Industry, Libraries, etc.	191

With the exception of approximately 580 hours provided by part-time abstractors, the total of the technical input to Section B during the period covered by this report was provided by two men. This input, in addition to writing and editing of the 1903 published abstracts and extracts, consisted of searching and screening in excess of 100,000 titles, articles and reports. Approximately 2400 references were selected from the more than 100,000 reviewed and these were catalogued by the Center's library; the 1903 abstracts and extracts published in EEME B were selected from the 2400 catalogued documents. It is immediately obvious that EEME B, Volume 3 represented about 80% of the open literature related to the mechanical, thermal and space associated environments. Still, the total references published in the journal represented an increase of approximately 100% over the original yearly quota of 480 abstracts and 480 extracts established in 1960. The elements of time and cost prevented entire coverage of the field by the journal, but the fact that the 20% of the open literature not reflected is catalogued by the library makes the material available for literature searches and as references on which consultative advice can be based.

The problem of not being able to obtain technical writers willing to apply the disciplines demanded continued to plague the Center throughout 1963. During the year, frequent advisory and instructive sessions were held with six applicants but without tangible benefits. It is extremely difficult to enforce the criterion of rigor without direct supervision. Of the part-time abstractors writing for Volume 3, only two, Messrs. Carlin and Humphrey, holdovers from 1962, contributed useful work with any degree of regularity.

In 1964, every effort possible will be made to bring the journal back to schedule while maintaining the present standards on the substantive abstracts. This will include continuing the effort to find part-time writers. To this end, the pay rate for an abstractor is being increased in the hope of enticing more qualified persons for the position; a method of making cognizant this offer to those qualified persons who find it attractive is yet to be determined and the Center would welcome suggestions. In addition, since the

number of documents presently published per month considerably exceeds the original quota, this will be reduced. That is, until the journal is on schedule, a maximum of 80 extracts plus the usual 40 abstracts will be published per issue. Though this procedure will considerably increase the number of documents not made available to our readers, it still reflects an increase of 100% over the original quota for the number of extracts to be published. The excess documents will be catalogued by the library, as in the past, and will be available for inclusion in literature searches, etc. Finally, Mr. Gajinder B. Singh (Mech. Engr.) has been added to the staff on a full-time basis. The addition of Mr. Singh represents not only an attempt to offset the inability to find adequate part-time technical writers but also to release a part of the present EEME B staff for other duties. In particular, the efforts of Mr. Lyle, heretofore a large contributor to EEME B, will be channeled in new areas as detailed in his section of the annual report. Until the journal is on schedule, Mr. Singh's efforts will be directed to this end, however, his contribution cannot be regarded as an additional man-year input.

It is emphasized that even when the journal is being published on schedule, complete coverage of the literature relating to the mechanical, thermal and space associated environments cannot be obtained with the present level of funding and with the criterion of substantive abstracts. The level of coverage reflected in the 12 issues of volume three which were published over a 12 month period appears to be the maximum. This coverage, as stated above, was 80%. If the literature appearing in these fields continues to increase, and there is no evidence for a cutback, the percent coverage by EEME B will continue to decrease if the schedule is to be maintained. With these facts in mind, the Center is presently trying to determine which would be of more value, total coverage or partial coverage with substantive abstracts. Substantive abstracts are encouraged by the Center but in view of the recent criticism to which it has been subjected and the apparent indifference of those we are serving to having their literature digested in such a manner, perhaps it is time to reflect on their actual value. If no use is being made of the abstracts in their present form, and the criticism the Center receives seems to reflect this, perhaps descriptive type abstracts and total coverage of the related fields should be considered. The time used by the staff members in preparing the substantive abstracts could then be directed in areas which would result in more tangible benefits; specifically, these areas would include state-of-the-art reports, literature searches and consultation services.

2. Service Request of Wright-Patterson Air Force Base - Material Laboratory

This service request is discussed in detail in Mr. Lyle's report. Contribution to this effort by this staff member amounted to approximately three weeks during which time bibliographies were generated on the following questions:

a. "Evaluation of new potentially heat resistant reinforced plastics, for radome and structural applications, especially S994 cloth reinforcements, using heat resistant resin materials such as thermo-setting, modified acrylics and polyphenyl epoxides. Glass finishes and fabrication and processing

conditions for retention of strength properties at high temperatures. Mechanical and electrical properties of laminates."

b. "Elastomer reinforcement-particulate. Strength to 500 F of elastomeric vulcanizates for seals, sealants, tires, etc."

V. Annual Report

G. Report by Robert C. Peden, Research Assistant

G. Report by Robert C. Peden, Research Assistant

During the employment period of August 29, 1963 through May 31, 1964, this staff member assisted in the following projects:

1. Research of Literature on the Effects of Low Temperature (Below -300 F) on Materials and Equipment

This project is being carried out for the National Aeronautics and Space Administration under Contract NASr-182. The increasingly severe environments being encountered during this space age demand of materials and components ever greater performance characteristics. In this project, concern is primarily with the effects of extremely low temperatures. Such temperatures can be encountered in deep space (maximum approximately -453 F); contacted directly in systems liquefying gases, such as helium (-452 F), hydrogen (-423 F) and nitrogen (-352 F) and in their storage on transport containers; and where, by proximity and thermal losses, subjection exists. Close and reliable measurements of materials under natural or simulated conditions are paramount. At such cold, many metals become so embrittled as to be structurally unusable. Under stress, a high strength but brittle material may be weaker than a low strength but ductile material. Several metals and many alloys and compounds lose their electrical resistivity entirely and become superconductive. Subjecting such a superconductor to a magnetic field which exceeds the critical field strength of the material, disestablishes the superconductivity and the material becomes resistive. Non-metallics may be too permeable to contain low density gases such as hydrogen (4.43 lb/cu ft. - parahydrogen).

Initially, all efforts were directed towards mobilizing pertinent information on the effects of cryogenic conditions (specifically -300 F and below) on materials and equipment. Subject matter of the Prevention of Deterioration Center has been collected and assembled with the documents continually being received from outside sources through request or regular distribution. By screening, references were selected and reviewed and an outline for the final report composed. References on hand are being grouped by subject to facilitate individual drafting of the different sections of the report. Study review of documents is in progress.

2. Literature Searches

For the request of the U.S. Air Force, Materials Laboratory, Wright-Patterson Air Force Base, Ohio, assistance was provided in making literature searches and bibliographies on the following items:

a. Superalloys (excluding iron-base high temperature alloys) and protective coatings for "hot section" (1000 - 2200 F) application, as coated Rene 41 and TD Nickel. Properties considered were resistance to oxidation, erosion, corrosion, carburization, sulfurization and spalling; mechanical property data included thermal fatigue.

b. Long-time high-reliability coatings (not limited to thin ceramic coatings) for 1800 to 2500 F niobium applications including both propulsion components and foil and filament structures. Included were ductility, long-time reliability under severe thermal shock and cycling, resistance to impact abrasion, and vibration, flexibility, thickness, and diffusional stability.

c. Aluminide coatings for tantalum alloys at reduced pressures ($\leq$ 10 mm Hg, temperature $\leq$ 2500 F) for both tin-aluminum and alloy aluminide systems. Sn-Al or aluminide slurry coatings for molybdenum alloys composition and processing, including diffusion treatments and pre-oxidation. Slurry applied silicide coating for molybdenum and PFR-silicide coatings for niobium alloys; Cr-Ti, Si coatings for niobium and tantalum alloys. Applying metal-bonded modified oxide coatings under development for tungsten to high-strength tantalum alloys.

3. Environmental Effects on Materials and Equipment, Sections A & B

A limited amount of assistance was provided in abstracting and coding articles for ENVIRONMENTAL EFFECTS ON MATERIALS AND EQUIPMENT, SECTIONS A AND B.

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V. Annual Report

H. Report by Hotchand K. Tejuja,
Research Assistant

H. Report by Hotchand K. Tejuja, Research Assistant

In the time period of February 3, 1964 through May 31, 1964, this staff member assisted in:

1. Hyperthermal Re-entry Environment Glossary

a. Search for Terms and Definitions

A search for technical terms in the field of hyperthermal environment has updated the glossary from 54 to 210 terms with a range of 1 to 10 definitions per term (averaging approximately to two definitions per term). A collection of 4-5 definitions per term is desired, though in some cases 2 definitions per term seem to be sufficient.

The literature reviewed so far consists of over 100 PDC accessions, standard text books, handbooks, and glossaries. Among the subjects reviewed are materials development efforts, design methods, experimental techniques, and theoretical studies related to the field of hyperthermal environment.

A card index has been prepared which includes all definitions selected to date for easy reference. A complete listing of selected terms has been prepared for use in critique of scope by members of Section III-L of ASTM Committee D-20.

A large number of journals have been reviewed to identify knowledgeable persons in the field for consideration in the selection of an editorial board to assist in the selection of useful terms and in evaluating the merits and completeness of the definitions in the field of hyperthermal environment.

b. Objectives and Methods

The objective of the hyperthermal environment terminology project, as stated by representatives of the National Aeronautics and Space Administration, is "introducing standard terms, symbols and dimensions representing the thermal capabilities of materials systems." Of the various concepts and parameters involved, particular emphasis has been given to aerodynamic heating which is indicated by NASA to be of prime interest. After much discussion with Mr. Lyle, it has been decided that the glossary should reflect the following characteristics.

In all appropriate cases or where possible, a search for definitions should be in terms of fundamentals, e.g., a definition should not reflect a particular application, but one which is universally applicable which only can be satisfied by leaning toward the basic fundamental definition. Where such a definition does not exist, it is PDC intention to indicate the variance in usage or meaning. The following example will illustrate the point: Ablation: The process in which the skin of a hypersonic re-entry vehicle degrades thermally, but does not fail structurally. (This definition is meaningful only to the aerothermodynamics engineer). Ablation: A process of absorbing heat energy by removal of solid surface material either by melting possibly accompanied by vaporization of the

molten material or by sublimation. (This definition leans more toward the basic, hence has a wider application).

Some frequently used words are found to have variations in definition from one reference to another which, if closely looked at, do not have the same meaning. The word "spalling" is commonly defined in different ways:

1) tearing away of the surface
2) flaking of the surface
3) chipping or fragmenting of the surface

This reflects an inconsistency in the context as to the mechanism involved which should be further refined.

At this stage PDC is ready to form the first ballot of selected terms which shall be investigated further as soon as an editorial board on definitions is formed.

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V. Annual Report

I. Report by Hans Tyler Janecka,
Research Assistant

I. Report by Hans T. Janecka, Research Assistant

1. Literature Searches and Bibliographies

a. As a Major Function of PDC

PDC's response to any problem created by or associated with deterioration usually involves a search of the literature. Depending on the specific question asked or the problem area outlined by individuals or organizations eligible for PDC services, the Center provides specific information that may range from a two-page "current awareness" account to an annotated (digest) bibliography.

Between 1 March 1963 and 31 May 1964 a total of seventy-one (71) searches were carried out by the Center. A partial but representative listing of subjects investigated relates to:

Metal-bonding adhesives

Economics of dehumidified storage

Mercurial preservatives

Dynamic environment during transportation

Marine deterioration of free-floating wood

Artificial ultraviolet light effects on materials

Efflorescence, waterproofing and microbial degradation of masonry and cement products

Microbiological degradation of asphalt

Design problems in storage of electronic and nonelectronic parts

Sodium arsenate in textile preservation

Additives for polyurethane and other polymers for undersea use

Epoxy coatings for marine and other environmental exposure

Biodeterioration in the marine environment

Corrosion resistance of zinc and zinc coatings under conditions of high humidity in contact with ground waters

Temperature of aluminum in sunlight with reference to ambient temperature

Microbial corrosion of metals

Fungicidal treatment of electronic equipment with salicylanilide

Control of microbial growth on leather and textiles

Soil microorganisms affecting butyl insulation of buried cable

Salvaging electronic equipment after immersion in sea water or salt spray

Cost of marine deterioration

Microbiological activities in petroleum and petroleum products

Marine borers and foulers—their growth and control

Corrosion of metals in pure oxygen at low pressures, ambient temperatures and humidities

Chromatic alterations of parchment

Preservation of equipment in community shelters

Preservation of inactive equipment and long-term storage of materials

Vapor phase corrosion inhibitors for nonferrous and ferrous metals

Effect of microorganisms on natural and synthetic rubbers

Packaging of electronic equipment for transportation in vibration environments with emphasis on seagoing vehicles

Performance above 1000 F of superalloys and protective coatings

Biodeterioration of plastics

Preservation of small biological specimens

Aging of natural and synthetic rubber and rubber products

Elastomers for high temperature application

Protective coating systems for niobium in the range 1800 - 2500 F

Toxicity of plastics materials and their leachability in seawater

Reinforced plastics and laminates for hot structures (600 F and above)

Formation, prevention or removal of sulfide or oxide films on copper coated steel wire

Use and performance of polyurethane coatings

Enzymes vs. materials

Low temperature effects on materials and equipment with some consideration of humidity

Each of these searches is based on the total of documents accessioned by the Center at the time the search was made. PDC Library holdings increase at a rate of more than 5,000 accessions per year and currently approximate 70,000 documents. The literature searches are aided by the PDC Tropical Deterioration Bulletin, Prevention of Deterioration Abstracts Indexes, Advance Lists, McBee file, Batten Peek-a-Boo file, PDC Library Cards, and the subject index of both sections of Environmental Effects on Materials and Equipment Abstracts. The bibliographies prepared, depending on the information available on a given subject, have ranged from below 100 to above 1,000 selected references.

The over-riding objective of PDC literature searches is to provide information that is adequate for arriving at the possible solution of

the problem at hand. Thus, any problem, if it cannot be solved on the basis of available knowledge, receives a maximum of possible documentation. Depending on the individual problems submitted for study, the Center responds with services that may be defined as:

i. Spontaneous documentation or "Boxing" (of evaluated original documents for direct shipment)

ii. "Current awareness" reports

iii. Compilation of a PDC Bibliography

iv. Compilation of the annotated PDC Bibliography

i. Spontaneous documentation or "Boxing" was a service frequently provided by the Center in 1963. From the reactions of those who became acquainted with it, this type of PDC service is being favorable received and seems to be rather popular. Apparently, the reason lies in efficiency and convenience of the selected material for the one who receives it. The only paper work necessary in the transactions, which, at the same time satisfies the Center's permanent record, is the standard library loan certificate.

ii. "Current awareness" reports give assistance in the solution of special problems. "Special" in this context simply refers to volume and distribution pattern of knowledge available in the literature. Principally, only two groups of special problems necessitate the "current awareness" report: those too individual and those too general for conventional documentation or referencing. The "current awareness" report is the device of choice in communicating the "state-of-the-art" in documented and readily absorbable form; in other words, perhaps remains the most desirable of information services.

iii and iv. Compilation of PDC Bibliographies and Annotated PDC Bibliographies sometimes, as shown in practice, may be prompted by searches associated with i or ii; however, realities other than those indicated by simple supply and demand of information govern titles and amount of the bibliographies published. Into the more complex considerations enter factors such as available funds, personnel required, degree of comprehensiveness expected, as well as the condition of the overall PDC schedule at the time, urgency of other work, priorities and PDC policy. All final decisions, therefore, relative to the compilation of iii and iv require directional judgment and, at his discretion, are made by the Director of the Center.

All PDC searches and bibliographies as projected through these communications should be viewed against the background of the Centers' entire literature holdings. Typical variations in the four concepts of documented information defined above are brought out by the individual service examples. Generally, both the "current awareness" report and spontaneous documentation of "Boxing" focus on the latest developments in a given problem area, with the earlier information available in depth providing complementary or supporting facts. Some of the searches resulted in comprehensive bibliographies later. Others initially suggested bibliographic services. In each instance the one approach deemed most suitable for prompt response to the respective problem was chosen. As mentioned earlier, the major prohibitive factor in preparing the "current awareness" report more frequently, is the limited amount of time available for such treatment.

b. An Effort Toward Integrated Information Storage and Retrieval

Lack of funds precluded any further attempt to implement the "integrated PDC system for information storage and retrieval and publication" as presented in the annual report in May 1963. Thus, all of the problems enumerated a year ago have faithfully remained with us; the man who so ably had presented them, our former colleague, Mr. Lee, has not. The information retrieval aspect of PDC operations especially remains in critical need of technical improvement. In the present system, the searcher, needle-in-hand must literally dig through 15,000 McBee cards, turn thousands of library catalog cards, coding slips, and screen subject indexes prior to arriving at each and every service response to problems of deterioration. This is cumbersome, hampers the transmission of information and is becoming progressively inefficient considering the yearly increase in PDC accessions and in the number of inquiries and service requests received by the Center.

A fresh attempt was made to integrate PDC information storage and retrieval to a manageable degree with the cost held at a bare minimum. After careful evaluation of its needs as dictated by service demand, the Center, in close working relation with its documentation consultant, Mr. John R. Dere, is currently studying such a method. So far, in stepwise progression, a system has been developed by using a random sample of PDC information retrieval that involves some 145 documents. Termed "Information Storage and Retrieval by Pre-Coordination," the system for all practical implications is based on IBM cards; printouts are automatic and relatively inexpensive.

Shown below is a sample printout arrangement illustrating the inherent potentialities of information input—preliminary evaluation—information output. The important feature of this system is that it enables the searcher or bibliographer to screen all entries with the aid of: strictly defined subject areas, author, title, source; a set of descriptors (comparable to an abstract's skeleton); and an alphabetical column of all the key words used, each accompanied by all PDL numbers associated with the respective key word. By the last of these screening aids a significant degree of flexibility is introduced into the system that will permit elimination and/or addition of key words in accord with new developments in any given subject area or field of specialization.

Proceeding from the general to the particular, the searcher thus may turn to "Ablation" (page identified alphabetically at upper right hand corner). Titles listed, author, source and date (left column) are found arranged in PDL numerical sequence; the "A" or "E" preceding PDL numbers tell whether one is dealing with an "A"bstract or an "E"xtract. Concentrating now on the descriptors in the center of the page will help to decide whether or not one wishes to see the actual document for individual evaluation. This decision is further facilitated by a look at the right hand column where all key words in alphabetical order are matched against PDL shelf list numbers. See printout on the next page.

/.....POL-41993/
RAY L. HAUSER
PROGRESS IN HIGH TEMPERATURE COATINGS.
ABLATIVE COATINGS.
MATERIALS IN DESIGN ENG.
54/8/. 135-137. NOVEMBER 1961

/.....POL-45895/
EDWIN G. CZARNECKI
BOEING AIRPLANE CO
AERO SPACE DIVISION, SEATTLE, WASH.
STATE OF THE ART - 1962.
STRUCTURES AND MATERIALS.

/.....POL-46390/
ROBERT L. PETERS
THERMAL RETARDATION COATINGS IN ROCKET
NOZZLES AND SKIRTS.
CERAM. AGE
78@ 41-43 DECEMBER 1962

/.....POL-48912/
HAGERSTOWN
M.D. JONES AND J. E. PERHAM
FAIRCHILD STRATOS CORP., HAGERSTOWN, MD.
BIBLIOGRAPHY OF ABLATION MATERIALS.
FSC REPORT EPHR-6
ASTIA DOC. 276028-APRIL 196?- 101 P.

/.....TEMPERATURE 230,-5300 F
/ABLATION, COATINGS -ORGANIC-, HIGH
TEMPERATURE, METALS, POLYMERS, REVIEW

/.....TEMPERATURE 2400 F
/ABLATION, AERODYNAMICS, ALLOYS, CERA-
MICS, DEVELOPMENTS, HIGH TEMPERATURE,
INSULATION, JOINING, MATERIALS, ME-
TALS, METEORIC PARTICLES, POLYMERS,
STRUCTURES -ENGINEERING-, SUMMARY,
VIBRATION.

/.....TEMPERATURE 2000, 7000 F
/ABLATION, COATINGS -CERAMIC- COATINGS
-METALLIC-, CRITERIA, DESIGN, ENGI-
NES -ROCKET-, FUELS, HEAT TRANSFER,
HIGH TEMPERATURE, LIQUIDS, MECHANICAL
PROPERTIES, NOZZLES, PHYSICAL PROPER-
TIES, SOLIDS, TABULATION.

/.....TEMPERATURE
/ABLATION, AERODYNAMICS, ALLOYS, ANALY-
SIS, ANNOTATED, BIBLIOGRAPHY, CERA-
MICS, CERMETS, COATINGS -CERAMIC-,
COATINGS -ORGANIC-, FILAMENTS, FOAMS,
HEAT SINKS, HEAT TRANSFER, HIGH TEM-
PERATURE, IMPACTS, INSULATION, MECHA-
NICAL PROPERTIES, MECHANISMS, METALS,
METEORIC PARTICLES, MISSILES, PHYSI-
CAL PROPERTIES, POLYMERS, RATES, RE-
ENTRY BODIES, REINFORCEMENTS, SPACE-
CRAFT, STRUCTURES -ENGINEERING-,
TECHNIQUES, TEST EQUIPMENT, TESTING,
THEORY, THERMAL SHOCK, WHISKERS.

.0003.000.ABLATION.

AERODYNAMICS.....45895@ 48912@
ALLOYS.....45895@ 48912@
ANALYSIS...48912@
ANNOTATED..48912@
BIBLIOGRAPHY.....48912@
CERAMICS...45895@ 48912@
CERMETS....48912@
COATINGS -CERAMIC-.....46390@ 48912@
COATINGS -METALLIC-.....46390@
COATINGS -ORGANIC-.....41933@ 48912@
CRITERIA...46390@
DESIGN.....46390@
DEVELOPMENTS.....45895@
ENGINES -ROCKET-..46390@
FILAMENTS..48912@
FOAMS.....48912@
FUELS.....46390@
HEAT SINKS.48912@
HEAT TRANSFER.....46390@ 48912@
HIGH TEMPERATURE..41933@ 45895@ 46390@
48912@
IMPACTS....48912@
INSULATION.45895@ 48912@
JOINING....45895@
LIQUIDS....46390@
MATERIALS..45895@
MECHANICAL PROPERTIES....46390@ 48912@
MECHANISMS.48912@
METALS.....41933@ 45895@ 48912@
METEORIC PARTICLES.....45895@ 48912@
MISSILES...48912@
NOZZLES....46390@
PHYSICAL PROPERTIES.....46390@ 48912@
POLYMERS...41933@ 45895@ 48912@
RATES.....48912@
RE-ENTRY BODIES...48912@
REINFORCEMENTS....48912@
REVIEW.....41933@
SOLIDS.....46390@
SPACECRAFT.48912@
STRUCTURES -ENGINEERING-.45895@ 48912@
SUMMARY....45895@
TABULATION.46390@
TECHNIQUES.48912@
TEST EQUIPMENT....48912@
TESTING....48912@
THEORY.....48912@
THERMAL SHOCK.....48912@
VIBRATION..45895@
WHISKERS...48912@

/.....POL-39592/
L. HABRAKEN AND D. COUTSOURADIS
CENTRE NATIONAL DE RECHERCHES METAL-
LURGIQUES, LIEGE, BELGIUM.
PROPERTIES OF THE NEW COBALT-BASE
ALLOY UMCO 50.
COBALT NO 10@ 3-21- MARCH 1961-.

/.....POL-40865/
F.R. MORRAL
ALLOYS FOR THE AIRCRAFT INDUSTRY.
THE ROLE OF COBALT.
COBALT NO 2@ 23-36.-MARCH 1959-.

/.....POL-40935/
ALFRED F. HOFSTATTER
PROTECTING METALS AT HIGH TEMPERATURES
MATERIALS IN DESIGN.47/4/@ 115-119
APRIL 1958.

/.....POL-45501/
ROBERT A. FABIAN.
PLATED CERMET COATINGS FIGHT HEAT,
WEAR.
DESIGN ENG. 56/3/@ 105-107
SEPTEMBER 1962

/.....TEMPERATURE ROOM, 1000 C
/ABRASION, ACIDS, ALLOYING AGENTS, CAR-
BON, CHROMIUM, COBALT ALLOY, CORRO-
SION, CORROSIONPROOF, FORMULATION,
HIGH TEMPERATURE, IRON, MECHANICAL
PROPERTIES, MOLYBDENUM, OXIDATION,
PHYSICAL PROPERTIES, THERMAL SHOCK,
TITANIUM SILICON.

/.....TEMPERATURE 1500, 2200 F
/ABRASION,ALLOYING AGENTS, COBALT, CO-
BALT ALLOYS, COMPARISON, CREEP, FOR-
MULATIONS, HIGH TEMPERATURE, MECHANI-
CAL PROPERTIES, NICKEL ALLOYS, OXIDA-
TION, REVIEW, RUPTURE, SULFURIZATION,

/.....TEMPERATURE 600, 3000 F
/ABRASION, ALLOYS, COATINGS -CERAMIC-,
COATINGS -METALLIC-, COATINGS -ORGA-
NIC-, CORROSION, HARDNESS, HIGH TEM-
PERATURE, METALS, OXIDATIONPROOFERS,
REVIEW, THERMAL SHOCK, USES.

/.....TEMPERATURE
/ABRASION, ALLOYS, CERMETS, COATINGS -
CERAMIC-, COATINGS -METALLIC-, COMPO-
SITES, FILLERS, FORMULATION, HIGH
TEMPERATURE, METALS, POWDERS, PROCES-
SING, REVIEW, TECHNIQUE.

.0005.507.ABRASION.

ACIDS.....39592@
ALLOYING AGENTS...39592@ 40865@
ALLOYS.....40935@ 45501@
CARBON.....39592@
CERMETS....45501@
CHROMIUM...39592@
COATINGS -CERAMIC-.....40935@ 45501@
COATINGS -METALLIC-.....40935@ 45501@
COATINGS -ORGANIC-.....40935@
COBALT.....40865@
COBALT ALLOYS.....39592@ 40865@
COMPARISON.40865@
COMPOSITES.45501@
CORROSION..39592@ 40935@
CORROSIONPROOF....39592@
CREEP.....40865@
FILLERS....45501@
FORMULATION.....39592@ 40865@ 45501@
HARDNESS...40925@
HIGH TEMPERATURE..39592@ 40865@ 40935@
45501@
IRON.....39592@
MECHANICAL PROPERTIES....39592@ 40865@
METALS.....40935@ 45501@
MOLYBDENUM.39592@
NICKEL ALLOYS.....40865@
OXIDATION..39592@ 40865@
OXIDATIONPROOFERS.40935@
PHYSICAL PROPERTIES.....39592@
POWDERS....45501@
PROCESSING.45501@
REVIEW.....40865@ 40935@ 45501@
RUPTURE....40865@
SULFURIZATION.....40865@
TECHNIQUE..45501@
THERMAL SHOCK.....39592@ 40935@
TITANIUM SILICON..39592@
USES.....40935@

Information Storage and Retrieval by Pre-Coordination*

This system, in principle, constitutes a method whereby a print-out is made in anticipation of possible or organized associations of descriptors; this provides a master ready for reproduction with the answer to possible inquiries. As a result, one has at all times a complete inventory of the stored information, accessible from the various points of view from which this information may be considered.

Aside from the advantage of permitting an inventory look-up for the subsequent search, the print-out provides an excellent browsing field guiding the inquirer to synonyms and associations which were not anticipated.

The three parts (columns) of the print-out provide three different types of information:

i. The Bibliographical Information

Full bibliographical information is printed out next to each document (PDL) number; this is done to avoid the necessity of references to other parts of the print-out.

ii. The Descriptors Assigned to Each Document

These are arranged in alphabetical sequence for easy look-up. By printing these descriptors along with the bibliographical information one also avoids having to make a look-up in another part of the print-out.

iii. The Associated Descriptors

This print-out which is printed first or along the right margin, and looks like an index guide, consists of all the descriptors used in all documents in which a set of specific descriptors has also been used. In some cases the main entry may have been used more than once in the various documents with a specific associated descriptor; in such case the document numbers will be indicated alongside in order to facilitate the look-up. If one wishes to compare various associations it is easy to locate the descriptors that have the same document number.

Conclusion: The method consists in a synoptic grouping of indexing and bibliographical information available on demand. Further refinement in association patterns is possible; the technique used is flexible and can be adapted to the changing needs of PDC or the size of the Center's document collection.

Some Technical and Economic Considerations

Input: The bibliographical information is punched on tabulating cards (80 cols). A separate card is made for each descriptor as well as for each

*It is a pleasure to acknowledge the ideas and technical assistance of our documentation consultant, Mr. John R. Dere, provided from conception throughout development of this system.

INPUT

Indexing
Descriptor assignment
Coding

KEYPUNCHING

cards for
Bibliographic data /A/
Descriptors

PROOFLISTING

ALPHABETIZATION OF DESCRIPTORS

by
Sorting
Repunching /B/

ASSOCIATED DESCRIPTORS

Inventory of all descriptors associated through common document numbers, available in the system.

/C/

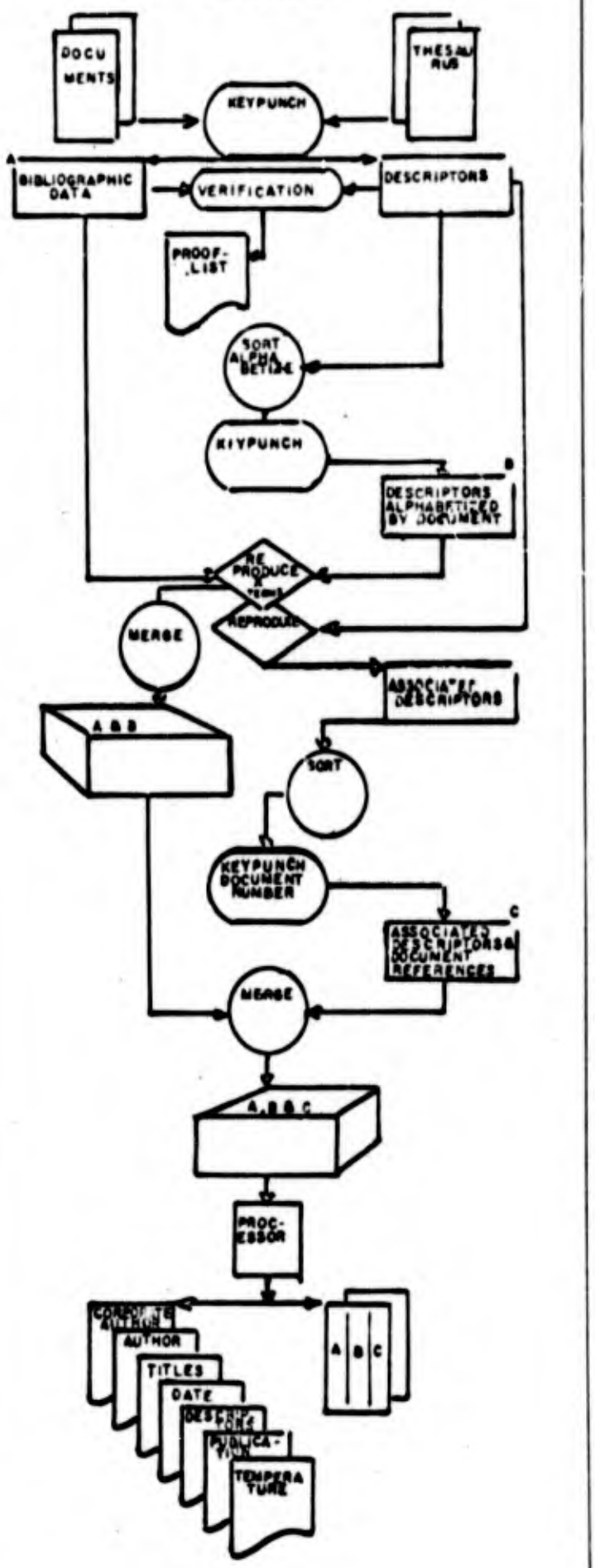
MERGING OF DATA

from
/A/, /B/ and /C/.

PRINTOUTS

1/ Pre-Coordination Index
2/ Special Indexes of Bibliographic data.

FLOWCHART



type of information (e.g., author, corporate author, title, document, etc.). The number of cards will be determined by the length of the entry. The total number of descriptors will also be punched into the cards. The various types of information thus will have to be reproduced that many times.

Keypunch: An 026 IBM Keypunch (printing on top of the cards) is used. The monthly rental of an 026 is $65. Average salary for keypunching is $2.50 an hour inhouse or $4.50 on a service bureau basis. A good keypunch operator will punch from 1000 to 2000 cards a day, depending on the amount of information, the type of source document and the coding requirements.

Verification: Verification by a mechanical verifier (IBM 056) is possible but not considered. This function will be replaced by proofreading of print-outs. Proofreading will be reduced to one set of source documents, which from there will be machine reproduced.

Prooflisting: This will allow the spelling verification but is also recommended for improving the arrangement of information.

Processing: With proper coding the input material can be reproduced and sorted by various types of equipment:

a. EDP equipment can be used, a print-out can be made on an IBM 407 printer;

b. Magnetic tape equipment can be used to expedite operation and to reduce the bulk of the file;

c. Random access equipment permits reduction of the size of the file and offers the most flexible medium for this type of application.

Print-out: Various print-out patterns can be adapted to the specific needs of PDC. The width of the print-out can comprise one, two or three fields. It is possible to use the full capacity of a 120 typewheel printer (12 inches) which can be reduced to 60/65% of the original size for reproducing on an 8.5 x 11 inch sheet.

Conclusion: Once a specific pattern is adopted and the available equipment determined, the programming will allow one to produce the print-out in a minimum of time. After the original setup, the input requirements will be limited to the punching of IBM cards and this operation will replace the previous typing function.

Merits of the Integrated System

i. No capital investment. Low rental, i.e., $65.00 a month, for 026 IBM Keypunch.

ii. Compatibility with PDC established operations and procedures.

iii. Simplicity of approach to the complex problem that results from increasing volume of information to be stored, a current library holding of 70,000 documents, and the trend toward rapid retrieval of specific knowledge.

iv. Flexibility permitting gradual incorporation of all of the Center's past accessions and, as future need will arise, ready conversion to the more sophisticated computer processes.

2. The PDC Newsletter

The PDC NEWSLETTER has continued actively to serve its 3100 plus readers in many countries. Its effect on professional people everywhere finds expression in document requests (see PDC Library report), requests for PDC bibliographies, and in parameters such as the obliging readiness of authorities in their field to write our lead articles and of those who reprint them in their own journals. Other active forms of response to this phase of PDC work are requests for additional information on material published in the PDC NEWSLETTER, and specific questions, inquiries and service requests that are reflected in a generally increased service activity following publication of every new issue.

A representative account of material published in the PDC NEWSLETTER (Vol. VI, No. 2 through Vol. VII, No. 2) is listed below in chronological order. Titles marked with an asterisk, according to available PDC records, have received more than the usual reader attention:

Deep vacuum simulation of the space environment
*Biochemical activity of microorganisms isolated from various regions of the world
*Storage pack preserves military hardware
*Fungi in fuel
*Fungitoxic effect of some derivatives of substituted phenoxyacetic acids
*An investigation into the influence of the method of application on the behavior of anticorrosive paint systems in seawater
*Evaluation of various weather-ometers for determining the service life of organic coatings
*Longevity of microorganisms
*Materials and structures for space stations
*Jet fuel contamination: water, surfactants, dirt and microbes
*Prevention of marine corrosion of steel plates by an epoxy resin coating
Resistance of cable insulation and jacketing materials to rodent attack
Degradation of textiles by microorganisms, weathering and air pollutants
*Effects of storage on electronic equipment and components
Resistance of plastics to microorganisms, insects, rodents and other pests
*Critical relative humidities for corrosion- and fungus-free storage
*Corrosion research and national prosperity
*Should the embedded parts of steel structures partly embedded in concrete first be treated with a protective coating
*Damage by termites to cable covering material and a preventive method
*Estimating shelf life of products affected by moisture
*Steps to slow down corrosion in and around the home
*New techniques for measuring corrosion with resistance probes
*A study of the deterioration of fungicide-treated fabrics in soil burial

*New corrosion test for stainless steel
Environmental deterioration of serious concern to the Army
Research problems—Navy Bureau of Yards and Docks
Spacecraft test facilities
An appeal for action: Corrosion Research Council
Space environment effects on plastics and related materials
The atmospheric sciences
*Cytochemical studies in fungi which contaminate aircraft fuels and deteriorate materials
*Teflon resins in the space environment
*Selecting electronic components for space radiation
*Dielectrics in 1962
European space research
Scandinavian research guide
The nation's big rockets
Air pollution research—1962
*Metal-bonding adhesives
*Effects of fungi on electric and electronic equipment
Corrosion resistance of cadmium coatings
*Non-metallic coatings: mechanical properties and resistance to corrosion fatigue
*Treatment of aluminum prior to painting
Similarities and differences of random and sinusoidal vibrations
*Effects of sterilizing agents on microorganisms
What is a surface—?
Academy's expanding role in international science
1963 Space Communications Institute at Maryland University
*Stresses in anodic films
*Aviation fuel problems
*Effect of space environment on reinforced plastics
*Microbiological leaching of metallic sulfides
*A simple method of determining the accessibility of cellulose to enzymic attacks
*Environmental effects in metal fatigue
*Animals that bore through rock
*Microbial corrosion of metals
Corrosion resistance of zinc and zinc coatings under the conditions of high humidity or in contact with ground waters
Dynamic environments during transportation
Molecular freedom in solids
*Damage to plastics by animals
The challenge—deteriorative environment
*Microbiological corrosive effects on structural materials used in aircraft fuel tanks
*A field survey of the microbiological contamination present in JP 4 fuel and 115/145 Avgas in a military fuel distribution system
*Chromate coatings for protecting nonferrous metal surfaces
The science of materials
First meeting of Engineering Science Society
*Antifouling paint
*Method for preventing the growth of fungi in leathers, paints, foods and fabrics

*A new approach to fatigue testing
New British Science Library
ASTIA reconstituted: DDC
Much about marine borers
*Cement that resists corrosion by waters, sets quickly and is compact and strong
A project to 'translate' research findings into comprehensible English
Time dependent effects in polymeric materials
*Insect-proof packaging nearing a practical stage
*Effects of metal surface conditions on durability of protective coating bonds
*Paints and pigments for spacecraft
*Control of microbial growth on leather and textiles
*Microbiological activities in petroleum and petroleum products
*Marine borers and foulers—their growth and control
Corrosion work in Russia
*Performance of urethane vulcanizates in environments of high humidity
*Biological corrosion of steel pipe
*Filiform corrosion: an evaluation of vehicles on metal substrates
*Synthesis of low temperature oil resistant urethane elastomers
*Rust removing corrosion preventives—literature report
*Understanding plating and corrosion
Effect of thermic processing of pine wood on its decay resistance
Preservation of inactive equipment and long-term storage of materials
*Vapor phase corrosion inhibitors for nonferrous and ferrous metals
*Effect of microorganisms on natural and synthetic rubbers
*Bio-deterioration of materials and structures in the marine environment
*Packaging of electronic equipment for transportation in vibration environments with emphasis on seagoing vehicles
*Case history report on long-term coating performance
*Anticorrosion packaging
*Relation of mechanical properties to solid rocket motor failure
Pitfalls in germicide testing
Effect of light upon wool
Studies with a simulated Martian environment
New data on insect infestation
Effects of air pollution on electric contacts
A study of the basic mechanisms of dust erosion
*Organic chromates as corrosion inhibitors in primers
*Effect of diurnal freeze-thawing on survival and growth of selected bacteria
New world directory of hydrobiological institutions
*A tensile strength test for comparative evaluation of wood preservatives
*Specificity of the solute requirement by marine bacteria on primary isolation from sea-water

Soviet Academy of Sciences Journal: High Temperature
*Research in crystal growth and defect characterization
*Molybdenum disulfide: its adverse effects on metals when incorporated into a grease
*Two new organotin complexes for use as bactericides and fungicides

It is the editorial policy of the PDC NEWSLETTER to give, wherever possible, the exact source (person or place) to contact if additional information is desired on a given project, and in all cases where a service such as a publication (book, journal, brochure, patent), a new product or a new method is involved. As a result, active reader response over a considerable area of our published information does not enter PDC's records and thus remains beyond methodical analysis.

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V. Annual Report

J. Report by Virginia M. White,
PDC Librarian

J. Report by Virginia M. White, Librarian

1. PDC Library Activities

As may be seen from the statistics cited in the accompanying table, the activities of the PDC Library have doubled, and in some cases tripled, since 1954. If PDC were in a position to keep its orders, both retention and interlibrary loan, on a completely current basis, the figures would reach much greater proportions.

Attention is drawn particularly to the number of documents loaned for the past year, 3003. At the annual meeting in 1963 Dr. Lewis Larrick of ONR asked how many of the reports loaned by the Center were ASTIA (Armed Services Technical Information Agency, now the Defence Documentation Center) documents. Dr. Larrick was questioning the advisability of continuing our loan services since contractor's reports are available for retention to those requestors with a registered field of interest at DDC. A check of our records for the past year shows that, of the 3003 documents loaned, only 112 were obtained from DDC. No figure is available on the number of reports loaned which might have been obtained there but instead were obtained by the Center directly from the author or issueing agent or journal. The number is probably not large and there would seem to be little duplication of effort in DDC and PDC.

Another figure worthy of attention is that for "Publications borrowed." Last year it was stated that this figure was misleading because of the growing trend among Government lending libraries to furnish photocopies of the articles requested rather than furnish the journals in which the articles appear. This year the effect of this trend can be seen. The Center has received 119 fewer journals through interlibrary loans this year than last. PDC requests account for 40% of the National Academy of Sciences Library's workload as compared with 37% for the previous year.

In addition to the PDC loan service, Government personnel as well as contractors avail themselves of the opportunity of working directly in the PDC Library. Several of these visits are listed below:

a. Mr. Albert L. deGraffenried, Sanders Associates, Inc., Plainview, Long Island, New York, working under Navy contract, reviewed and selected material in the field of marine biodeterioration.

b. Mr. George Hutton, on leave from the Bureau of Yards and Docks, and at present attending the Industrial College of the Armed Forces, Fort McNair, Washington, D.C., obtained information for his thesis on microbiological deterioration and the economics related to this problem.

c. Mr. Robert Forshaw of the Peabody Manufacturing Company, New London, Connecticut, working under Navy Contract Nobs 88506 spent practically the entire summer of 1963 photographing information from our holdings which was to be the basis for a report on the study of the deterioration characteristics of materials in various environments.

d. Mr. Rocco Ficcki, Radio Corporation of America, obtained information for a report on long-term storage.

e. Dr. Miles Sharpley, Sharpley Laboratories, Fredericksburg, Virginia, working under Air Force contract, reviewed and selected photographs from our files to be used in a handbook.

In addition to the activities cited in the accompanying table, which account for the major portion of our time, the Library staff, as time permits, conducts literature searches, verifies bibliographic references, reviews bibliographic entries for correct form and continuity of styling, reviews publishers' galley proof, and answers outside inquiries.

Looking to the future, the PDC Library is faced with a deterioration and preservation problem of its own. Many of the Center's most valuable documents were issued during World War II by the United States Government and the governments of Great Britain, Canada, and Australia. Because of the wartime shortages, the paper used in these reports was not of the best quality. These documents are in use constantly and because of the wear and tear of handling and shipping, some are almost beyond the point of repair. Many of the issuing agencies are no longer in existence and, according to some clients, PDC has the only copies that can be located. These documents should be microfilmed for posterity; they are part of the history of this country. This problem should be given serious consideration in planning future budgets.

PDC Library Statistics

Action Taken	1954	1956	1958	1960	Mar.-Feb. — 63 - 64	May 31 1964
Reports ordered	2790	3787	4311	4475	5946	7447
Reports received	1889	3066	3217	3562	5699	6939
Reports catalogued	1972	2877	2224	2802	5182	5997
Periodicals rec'd & routed	1055	1198	1233	1181	1379	1679
Publications borrowed	964	1368	1017	1027	884	1084
Reports loaned	579	584	760	1766	3003	4275
Army	53	56	277	508	472	1035
Air Force	76	85	56	177	260	346
Navy	15	57	170	383	694	902
Miscellaneous	435	386	257	698	1553	1915
NASA (only part of year)					24	77
Bibliographies sent for retention					197	230

VI. APPENDIXES

A. Agenda and Minutes of PDC Scientific Advisory Committee Meeting of May 23, 1963.

PREVENTION OF DETERIORATION CENTER
DIVISION OF CHEMISTRY AND CHEMICAL TECHNOLOGY
NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL

MINUTES

PDC SCIENTIFIC ADVISORY COMMITTEE

and

SERVICES TECHNICAL COMMITTEE

Meeting

Thursday, May 23, 1963 - 9:00 AM

Room 250

National Academy of Sciences Building
2101 Constitution Avenue
Washington, D. C. 20418

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AGENDA

Thursday, May 23, 1963, 9:00 AM

Joint Session, Room 250

Chairman - Dr. Burnard S. Biggs

I. Welcome and Introductory Remarks by Dr. Burnard S. Biggs, Chairman, Scientific Advisory Committee for PDC

II. Presentation of Annual PDC Report

A. C. J. Wessel, Director

1. Progress during past year
2. Plans for future

B. W. M. Bejuki, Assistant Director

1. Fungicide program
2. Jet fuel microbiology and corrosion project
3. OECD activities
4. ASTM activities
5. Other activities

C. L. M. Ames, Research Associate

1. Specification Test Manual
2. Manual on Effects of Temperature and Humidity on the Growth of Fungi

D. Mrs. Grace D. Chapman, Supervisor of Publications

1. Environmental Effects on Materials and Equipment, Section A
2. Status of PDC Thesaurus

E. Robert G. Lyle, Research Assistant

1. Environmental Effects on Materials and Equipment, Section B
2. Developments in PDC work concerning mechanical, thermal, and space-associated environments
3. Hypertnermal environment terminology project
4. Technical personnel requirements and program -- (a) full time; (b) part time

F. Richard W. H. Lee, Research Assistant

1. Literature searches and bibliographies
2. An integrated PDC system for information storage and retrieval of publications
3. Information retrieval system for PDC correspondence file

G. Hans P. Janecka, Editor

1. PDC Newsletter - present status and future potential

H. Miss Virginia White, Librarian

1. Report on PDC Library activities

III. Current Status of PDC Support

A. Current Air Force, Army, Navy funds
B. ARO Special Project Proposal
C. NASA Proposal
D. Others

IV. Miscellaneous Items

A. NFSAIS affiliation and Heller report
B. Foreign EEME subscriptions
C. PDC services - Cost analysis
D. Chemistry of Materials Conservation
E. OECD affiliation
F. Shock and Vibration and Environmental Engineering suggestions by C. S. O'Hearne, Martin-Marietta Corp.

V. Discussion of Items II-IV.

12:30 PM Luncheon - Refectory

Room 250
1:30 PM

VI. Executive Session, PDC Scientific Advisory Committee (closed)

A. Discussion of future status of the Prevention of Deterioration Center
B. Role of the PDC Scientific Advisory Committee
C. Other business

VII. 4:30 PM Adjournment

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Attendance List

Lawrence M. Ames, Prevention of Deterioration Center
Burnard S. Biggs, Sandia Corporation
Paul R. Burkholder, Lamont Geological Observatory of Columbia University
Robert W.Cairns, Division of Chemistry & Chemical Technology, NAS-NRC
Grace D. Chapman, Prevention of Deterioration Center
George Chernowitz, American Power Jet Company
Morris Cohen, National Research Council of Canada
Walter P. Conrardy, Wright-Patterson Air Force Base
S.Douglas Cornell, National Academy of Sciences-National Research Council
William A. Cosby, Prevention of Deterioration Center
Wesley I. Grieve, Department of the Air Force
Hans Janecka, Prevention of Deterioration Center
Bernard L. Kropp, National Academy of Sciences-National Research Council
Frank L. LaQue, The International Nickel Company, Inc.
Lewis Larrick, Office of Naval Research
Richard W. H. Lee, Prevention of Deterioration Center
Robert G. Lyle, Prevention of Deterioration Center
D. J. Salley, American Cyanamid Company
Hubert Sauter, National Aeronautics & Space Administration
John H. Shenk, Office of Naval Research
Donna Spiegler, Office of the Director, Defense Research & Engineering
Eugene M. Sporn, Army Research Office
John W. Tamblyn, Tennessee Eastman Company
C. Irwin Vigness, Naval Research Laboratory
P. N. Vlannes, Army Research Office
Carl J. Wessel, Prevention of Deterioration Center
Virginia M. White, Prevention of Deterioration Center
Edward Wichers, Division of Chemistry & Chemical Technology, NAS-NRC

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MINUTES

I. Welcome and Introductory Remarks by Dr. Burnard S. Biggs, Chairman, Scientific Advisory Committee for PDC.

The Annual Meeting of the Scientific Advisory and Services Technical Committees, Thursday, May 23, 1963, Room 250 of the National Academy of Sciences Building, was called to order at 9:00 AM by Dr. Burnard S. Biggs, Chairman.

Dr. Biggs welcomed all the members and guests and requested that each person introduce himself by name and organization. Following this, Dr. Biggs presented brief remarks on the purpose of the meeting. He indicated that the order of the agenda would probably be altered somewhat in view of the nature of the subjects to be discussed. Emphasis was placed on the fact that several of the items of the agenda are of utmost importance to the Center and that most time would be spent in discussion of those topics. He urged, therefore, that the routine report matters be handled as expeditously as possible to permit adequate discussion of the more important points.

II. Presentation of Annual PDC Report.

Dr. Biggs then called upon the PDC Director to commence the staff reports of the Center. Dr. Wessel stated that the annual report of the staff was presented in detail in the document, "Annual Report for Presentation at the Annual Meeting of the PDC Scientific Advisory Committee and Services Technical Committee," dated Thursday, May 23, 1963. This document was sent to all members of the two committees at least two weeks in advance of the meeting for their examination and study. It was deemed unnecessary to repeat all of the details of the report, but some of the major topics were mentioned and questions solicited of the attendees on any points on which they wished to ask questions.

Dr. Wessel called attention to the display of published documents on the bulletin board and table in the meeting room. This display consisted of one copy of each publication issued by the Center during the past year. He indicated that copies of any or all of these documents would be provided upon request.

A very brief review of progress during the past year was presented under A. Advisory, Consultative, Conference, and Special Activities; B. Acquisition and Organization of World Literature; C. Question, Inquiry, and Literature Request Servicing; D. Publications; and E. Liaison Activities.

Under the heading of "Plans for the Future," Dr. Wessel indicated that he would touch on this matter after the routine report of the Center.

Dr. Larrick raised a question as to the number of ASTIA (now DDC) documents loaned by PDC to its clients. Dr. Larrick pointed out that it is a function of DDC to loan documents, and there is at least a question as to whether this is a proper function of PDC. Dr. Wessel replied that he did not have detailed information on this number at the moment. It was suggested

that a survey should be made by PDC to determine how many DDC documents are included in the total number of documents loaned by PDC to its clients. The Center agreed to do this.

By way of explanation of the functions of PDC in comparison to those of DDC, Dr. Wessel commented that the missions and orientations of the two groups are entirely different. Whereas, the coverage of DDC is of a very broad scientific and technical field, the Prevention of Deterioration Center specializes in one aspect (effects of the environments on materials and equipment) and thus provides a specialized service comprising five main functions. To accomplish this the Center must delve into literature of many varieties involved in a wide spectrum of scientific disciplines and technical specialties to select that literature which is pertinent to the Center's rather narrow specialty. Documents received through DDC (unclassified) are viewed as representing one source of information and may be compared with documents received from other sources such as various federal government contractors, Office of Technical Services, the open scientific literature, patent information, and miscellaneous other sources.

In the absence of Dr. Walter M. Bejuki, Assistant Director, who was on official travel on OECD-PDC business, Dr. Wessel made brief mention of a few of the highlights of Bejuki's written report.

In the PDC Fungicide Program, the contract between the Center and the University of Maryland was terminated May 31, 1962. It is expected that the positive results from this program will be presented in an article to be published by one of the journals of the American Chemical Society.

The residual chemical samples are presently stored at Dr. Ames' home in Virginia. These samples have been offered to laboratories of the Army, Navy, and Air Force, and if not wanted by these groups probably will be sent to another interested testing laboratory, such as the Radiobiology Section of the Walter Reed Medical Research group, or the Department of Agriculture.

The jet fuel microbiology and corrosion conference of April 9-10, 1962, was described briefly and it was noted that a set of proceedings was prepared and distributed. It was pointed out that the Center has addressed a memorandum to the Division of Chemistry and Chemical Technology with reference to the jet fuel problem. seeking advice as to what if anything further should be done in an advisory capacity.

With reference to the OECD (Organization for Economic Cooperation and Development), the Prevention of Deterioration Center has participated to a limited degree during the past year. This participation has been through the Assistant Director of the Center, Dr. Walter M. Bejuki, and is principally in three subject areas: Expert Group on Ships Hulls Biological Fouling and Corrosion, Expert Group on Biological Deterioration of Materials, and Ad hoc Group concerned with Microbiological Effects on Optical Systems. Dr. Wessel pointed out that it is thought proper for the PDC to participate in the OECD program on an international level and that such participation was not undertaken until permission was received from the Services Technical Committee to use a limited amount of PDC funds in this effort. In connection with OECD visits to Europe, occasion has been taken also to make side trips to DOD

installations on PDC business. Advice has been sought first from the Army, Navy, and Air Force as to which installations should be visited and what particular business might be transacted.

Dr. Lawrence Ames was requested to make brief comments on the two documents he is preparing for the Center. These include (1) "Manual on the Effects of Temperature and Humidity on the Growth of Fungi," and (2) "Fungus Tests in Specifications, Elementary Guide." Dr. Ames indicated that work on both of these publications was proceeding at a good pace, and it was expected that both publications would be issued during the coming year.

Mrs. Grace D. Chapman, Supervisor of Publications, was asked to comment on "Environmental Effects on Materials and Equipment" abstracts, Section A, and on the PDC thesaurus. Mrs. Chapman called particular attention to the chart on page 39 of the annual report which provides statistics on the abstracts publication, Sections A and B, for 1961, 1962, and 1963. It was pointed out that this chart was prepared at the initial request of the National Federation of Science Abstracting and Indexing Services, of which the PDC is a member organization, but that the statistics so developed would undoubtedly be of interest to the members of the two committees.

The question was raised as to the number of professional and non-professional personnel working on the two sections of the abstracts. The number of professionals has decreased from 6-3/4 in 1961 to 6-1/4 in 1962 and 1963, in spite of the fact that the over-all coverage of the two publications has increased considerably.

Attention was called to the journal listing commencing on page 105 of the annual report in which all or most of the journals covered by PDC in its abstracts publication are presented. The ability of the Center to increase the number of journals being covered may be attributed at least in part to the fact that one of the Center's part time abstractors, Mr. Curtis L. Brown, regularly surveys a large number of journals and thus enables the PDC to increase its coverage substantially. It was pointed out that this aspect of the PDC work, that is, the regular surveying of a large number of journal sources for PDC documents and information represents a very heavy part of the PDC load. Dr. Wessel stated that the present listing of journals covered by the Center represents the first really definitive list. The Center has been covering these journals for quite some time, but has not hitherto amalgamated them in a single list.

With reference to the PDC thesaurus, Mrs. Chapman pointed out that this is a continuing function of the Center and the thesaurus is gradually being built into a well-defined and useful list.

Mr. Robert Lyle was requested to make brief remarks on "Environmental Effects on Materials and Equipment," Section B, as well as the development of PDC work in the mechanical, thermal, and space-associated environments, the hyperthermal environments terminology project, and technical personnel requirements program.

Mr. Lyle pointed out some of the problems that are currently facing the Center in obtaining adequately trained part time abstractors who also have an ability to write the type of abstracts required by PDC. This discussion opened up the matter of importance of abstracts and how much time the Center actually should spend on this function. There was a discussion of the economics of abstracts preparation, how abstracts should be prepared, how much importance might be attached to abstracts, and similar questions. Dr. Cohen questioned whether the PDC coverage of corrosion actually contributes significantly to the corrosion field. He pointed out that he is a corrosion specialist and is likely to look for his information in abstracts prepared by the National Association of Corrosion Engineers, as well as an organization in Sweden. In discussing this matter Dr. Wessel pointed out that the PDC does not attempt to cover corrosion in the same broad fashion that the NACE does. It was also brought out that the group in Sweden is a new group and has been issuing abstracts for a year or less. Dr. Cohen stated that his remarks should not be interpreted beyond the field of corrosion.

The question of whether PDC should prepare abstracts was discussed at some length, and the matter arose as to how PDC got into the abstracting business. Dr. Wessel stated that the Center was assigned the responsibility to provide an abstracting service from the very beginning. As a matter of fact, the first function of the predecessor organization of the PDC, that is, the Tropical Deterioration Information Center, which commenced under the OSRD-NDRC during World War II, was the preparation of the Tropical Deterioration Abstracts. This commenced in 1944. When the PDC was initiated at the National Academy of Sciences in 1945 as an outgrowth of the TDIC, it was given the assignment of commencing an abstracts service. This was continued as the Prevention of Deterioration Abstracts through 19 volumes. At the time the PDC was requested by the Department of the Air Force to survey the needs of the so-called "induced" environments in 1957, the survey determined that an abstracts service was greatly needed in this field. At a subsequent annual meeting the Center presented this matter to the Scientific Advisory and Services Technical Committees, suggesting several types of abstracts that might be desirable. After due deliberation the present PDC type of abstracts in the induced environments field was recommended by the Committees and the Center has continued along these policy lines ever since.

Dr. Cohen suggested that it is possible that the time spent on the preparation of abstracts might be used in other services. Such services could include the preparation of "state-of-the-art" reports. Dr. Wessel stated that the Center desired greatly to prepare such types of reports and, as a matter of fact, had asked to do this in a limited number of fields in its proposal to the National Aeronautics and Space Administration. However, the preparation of abstracts has been regarded as one of the more important functions of the Center and serves to inform a fairly large number of clients of current awareness as well as lead them to articles they may wish to borrow. The question then arose as to what types of articles are borrowed--are these articles represented by the informative PDC abstracts, or are they representative of the abstracts of the "key word" or telegraphic type. The PDC staff personnel were unable to answer this question specifically. Mr. LaQue suggested that it might be a good idea to look into this matter as a way of evaluating which type of abstracts is most desirable. Dr. Wessel agreed that this would be a good idea, but suggested that it might not be completely definitive in that the Center has very little feedback on the actual use of the informative type of abstract for its current awareness value.

Dr. Wessel then pointed out that the PDC is involved in the National Federation of Science Abstracting and Indexing Services. This Federation is presently in the process of evaluating a "National Plan" in the field of scientific and technical abstracting and indexing services. Mr. Lyle then discussed briefly the fact that many articles in the scientific and technical literature are written in such a way that even highly qualified readers in their own specialized fields oftentimes have great difficulty in understanding the articles. As an illustration of what he was getting at, he quoted the editorials which are reproduced on pages 48-52 of the 1963 annual report, written originally by M. H. Aronson and R. C. Nelson, reproduced from the journal "Instruments and Control Systems."

Mr. Richard Lee was then requested to say a few words on literature searches and bibliographies, the proposed integrated PDC system for information storage and retrieval, and the information retrieval proposed for PDC correspondence files. Mr. Lee reviewed some of the aspects of the literature searches he has made during the past year and pointed out that examples of these were shown on the display table.

Dr. Wessel interspersed a short discussion of the background of the PDC system of information storage and retrieval to explain the reason why the Center is interested in at least a moderate mechanization of its information handling system.

Mr. Lee then described in detail the mechanized system the Center is proposing for handling its information collection. This detailed information is available on pages 56-73 of the May 23, 1963, annual report.

At the close of Mr. Lee's presentation, Mr. Frank LaQue stated that he had asked the information handling group of International Nickel Company to review the PDC proposal. The Inco information people found the proposed system very attractive and appeared to be in general agreement with the sense of the proposal. Mr. Chernowitz of American Power Jet Company later made the remark that his information handling people had also reviewed the proposal and found it satisfactory. The general reaction to the proposal was one of agreement by those present at the meeting.

Dr. Wessel pointed out that several additional systems had been evaluated and, in view of the economics involved, the system outlined in the report was felt to be adequate for the needs of the Center at the present time. With regard to the search aspects of the proposed system, in which the Jonkers Termatrex system is recommended when moderate cost is demanded, it was pointed out that several other more "sophisticated" systems are available but at a greatly increased cost. It was also emphasized that the system proposed by PDC is fully convertible to the more sophisticated types on magnetic tapes if this should be necessary in the future.

It was agreed that probably more study should be made of this system before any final action is taken, but that in general the system appeared to be a sensible one.

Mr. Janecka was requested to make a brief review of the PDC Newsletter work during the past year. After going over the present coverage of the PDC Newsletter, Mr. Janecka indicated that it might be advisable for the Center

to enlarge the publication and, for example, to carry two instead of one full length leads, thus covering the "natural" as well as the thermomechanical and space-associated environments in every issue. Among other suggestions was that the "Recent PDC Accessions" might be enlarged and that "Short Original Contributions" might be solicited The additional space could be obtained by inserting 4-8 sheets of white paper between the traditional covers of the current PDC Newsletter.

Dr. Biggs, in commenting on the presentation by Mr. Janecka, indicated that it might be a good idea at the present time to maintain the PDC Newsletter in its present form, and that although it would be highly desirable to discuss this further, the press of other more crucial points precluded such a discussion at the present time.

Miss Virginia White was requested to report on the PDC library activities during the past year. Miss White presented statistics as shown on page 81 of the annual report, comparing the library activities of the current year with those of 1958. In general the over-all activities of the library have increased greatly. The numbers of reports ordered, received, and cataloged have gone up considerably and the number of reports loaned has increased from 760 in 1958 to 1931 in the period of time covered by the present annual report.

At this point in the proceedings Dr. Wessel was requested to review the "Plans for the Future." These items are outlined on pages 18 and 19 of the annual report, and may be reviewed there in detail. Some of the items that received emphasis were: (a) The proposal made to the National Aeronautics and Space Administration for generalized support of PDC, plus a special project in the hyperthermal environments terminology field. It appears at the present time that the NASA will provide funds for this proposal. (b) A special proposal to the Army Research Office now gives evidence of being accepted. (c) Participation in advisory functions should be expanded. (d) Participation in the work of the OECD should be formalized, but should be continued. (e) Greater use should be made of the PDC service on question-answering and literature requests, and the Center looks to the DOD agencies supporting the Center to make this service known throughout its agencies. (f) Special publications now under preparation by the Center should be completed in the coming year. (g) A mechanical system for handling information at the Center should be instituted and implemented.

IV. and V. Miscellaneous Items and Discussion.*

Under IV, "Miscellaneous Items," the next item for discussion was the NFSAIS affiliation and the Heller Report. Dr. Wessel explained that the Prevention of Deterioration Center is one of the member groups of the National Federation of Science Abstracting and Indexing Services through the National Academy of Sciences' Office of Documentation. During the past year and a half the NFSAIS, with funds from the National Science Foundation, has administered a contract with the Robert Heller Associates in Cleveland, Ohio, to prepare a "National Plan for Science Abstracting and Indexing Services." The Heller Report has recently been made available and all adhering groups to the

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*Item III was tabled until the afternoon session.

NFSAIS were asked to comment on it. The Center distributed copies of the Heller Report to members of the Scientific Advisory Committee. Because of the very close time schedule it was necessary for PDC to submit its comments to NFSAIS before all the members of the PDC Scientific Advisory Committee could comment. Dr. Wessel prepared comments, therefore, and sent them to the Federation. The Scientific Advisory Committee requested that copies of Dr. Wessel's letter should be sent to all committee members for their comments and possible revision.

The next item of discussion was "Foreign EEME Subscriptions." Dr. Wessel stated that PDC had received many requests from Iron Curtain countries and from China for subscriptions to EEME, as well as requests for other documents originating in the Center. It remains a rather stubborn problem as to how the PDC should treat such requests. Dr. Iarrick made the statement as to the general position of the DOD on this matter. In addition he pointed out that many of these documents are available from the Office of Technical Services by purchase. The PDC publications are supposed to be submitted to DDC which in turn makes many of these documents available to the Office of Technical Services for sale. Thus, most of the PDC publications would be generally available for purchase regardless of PDC position. (This was later found not to be the case).

The point was brought out by Dr. Wessel that the Center feels one of the most difficult problems to solve in the question of Iron Curtain countries subscriptions to the PDC publications is whether or not such a distribution might tend to dry up the information sources now serving the PDC information collection.

The question was brought up as to certain reports such as Air Force documents received by PDC, but which contained a statement to the effect that "This document is not for distribution to the Office of Technical Services." When documents such as this are received at the Center, the Center seeks permission before abstracting and listing them. This type of document is quite hard to handle at information centers such as PDC. The question was asked as to who would finally release such a document for PDC to abstract--a particular person or an organization. Miss White replied that our letters seeking permission to abstract these documents are sent to the responsible agencies and that replies are received from the agencies.

A suggestion was made that it might be better to wait until such documents are finally cleared for the open literature before PDC attempts to handle them. It was brought out that this would greatly delay information handling in many cases.

Mr. LaQue suggested that instead of asking for permission to publish an abstract on these limited distribution documents, the Center should rather ask for notification for a change in status of the documents.

It was suggested that the Center might seek an example of one of these limited distribution reports to determine what finally happens to it and when, so that an idea might be gained of the time interval involved.

Dr. Cornell was requested to contribute remarks on the position of the National Academy of Sciences with regard to distribution of Academy publications to Iron Curtain countries. Dr. Cornell stated that the Council of the Academy could give a policy statement, but that they would want to have the PDC Scientific Advisory Committee's views first. Dr. Cornell suggested that the matter might be handled by replying to such Iron Curtain country requests to the effect that the PDC publications are available through the Office of Technical Services, but that the Center might also inquire as to the possibility of exchanging documents. If it were possible to gain documents which would otherwise be unavailable to the Center, this might be an advantage.

The general position taken by the PDC Scientific Advisory Committee was that the Center, upon receipt of requests from Iron Curtain countries, might first explore the possibility of exchange of documents for like material from the Iron Curtain countries. If this could be effected, something might be gained by such an exchange. If it does not appear that such an exchange is likely or possible, or that no material exists in the Iron Curtain countries to exchange, reference might be made to the availability of the documents through the Office of Technical Services. It was not felt in general that the distribution of PDC documents in Iron Curtain countries would influence PDC sources of information in the Army, Navy, and Air Force.

Dr. Larrick was asked to contribute his views on what should be done. Dr. Larrick stated that this is strictly a problem of the National Academy of Sciences and the PDC. There are official documents published by the U. S. Government with its policy on exchange of technical information with foreign countries.

The remaining items of IV. "Miscellaneous Items" were postponed until the afternoon session. The morning session adjourned at 12:00 Noon for lunch.

Afternoon Session

Convened at 1:00 PM by Dr. B. S. Biggs

IV. and V. Miscellaneous Items and Discussion (continued).

Copies of the document, "Operation of the Center, Cost Analysis (Approximate)," for the one-year period of March 1, 1962 - February 28, 1963, were distributed to the attendees. Dr. Wessel described the procedure by which the data were gathered and pointed out that the information presented in the report is for the most part raw data from which to obtain costs of particular PDC functions. For example, the cost analysis gives information on preparation and distribution of the PDC abstracting service, Environmental Effects on Materials and Equipment, Section A. By extraction of the various items in the report bearing on the preparation and distribution of EEME-A, it is possible to arrive at a total figure of about $45,700, as shown on page 2 of the cost analysis. This represents an approximation of the yearly

cost of preparing this particular section of the abstracts service. The question was asked as to how much Section B would cost. Dr. Wessel indicated that would be approximately the same.

Dr. Salley was asked if this was the type of information he desired when he requested that the cost analysis be made. Dr. Salley replied that he did not expect to have the information this detailed, but rather wanted to see a table of the various functions of the Center in which the costs were tabulated. Dr. Wessel replied that time did not permit preparation of this sort of table, but indicated that the data are all available in the cost analysis to determine these figures for any function desired.

III. Current status of PDC support.

Dr. Larrick was requested by Dr. Biggs to give a report on the status of financial support for the Center by the Departments of the Army, Navy, and Air Force. Dr. Larrick stated that as he left his office this morning, he had records to indicate that the contract is being amended to extend from March 1, 1963, through January 31, 1964, with the following funds: $95,000 from the Air Force, $55,000 from the Army, and $50,000 from the Navy. This is a total of $200,000 for 11 months. This represents the terminal Navy financing. It represents less than Dr. Wessel had requested for one year's operation of the Center.

Dr. Larrick went on to say that the Air Force has no funds in its 1964 budget plan for the PDC and has also made the decision to withdraw from PDC support. The Department of the Army has $55,000 in its 1964-65 budget for PDC. A summary of this information therefore indicated that the financial support of the Center by the Departments of the Navy and Air Force would terminate with funds through January 31, 1964. Presumably the support by the Department of the Army is not yet a settled matter, but some funds have been budgeted for the Center.

Dr. Biggs indicated that this situation poses an obviously crucial problem for the Center which will have to be investigated immediately. Dr. Biggs reviewed steps which had already been taken with Mr. Walter Carlson in the Department of Defense to examine the possibility of PDC support. About two months ago Dr. Cairns arranged a meeting of Mr. Carlson and Admiral Martell with Dr. Cairns, Dr. Biggs, and Dr. Wessel in the PDC offices. The purpose of this meeting was to review the various functions of the Center in scope, financial support, and other aspects of PDC operations.

Dr. Larrick was asked to make a statement with regard to the reason the Navy has for dropping support of the Center. Dr. Larrick stated that he had been informed that a review was made with the responsible representatives of the Navy Bureaus of services rendered by the PDC. The results of the survey indicated that they were not enthusiastic in their support of the Center and rejected the notion of their putting up money for the support of Center activities. Under these conditions, with money being as tight as it is in the national research picture, and every contract into which ONR puts money being competitive with all other contracts, the decision had to be made to withdraw support of PDC. With respect to the case of the Air Force support,

Dr. Larrick indicated that the reason for dropping support was that they also needed their 1964 funding elsewhere. They originally had a plan to come back into support of the Center in 1965 budget, but when they discovered that the Navy had made its survey and had reached its decision, the Air Force likewise decided to drop support. The decision was made largely in light of the competition with other demands on their funds.

Mr. Conrardy indicated that the Air Force had not made a survey similar to that of the Department of the Navy. He had made some inquiries in the Air Force Logistics Command which is the organization servicing the day-to-day field problems. These inquiries did not indicate any outstanding value they were attributing to the Center. Mr. Conrardy went on to say that many of the people in the Air Force do not know of the existence of the Center or do not use it. However, from the viewpoint of the Air Force Materials Laboratory, only a small part of the over-all Air Force, this laboratory is providing the total funding for PDC but feels that as a laboratory they use it very little. The laboratory management does not feel it is getting $55,000 worth of services from PDC at the laboratory. Quite possibly the Air Force as a whole is obtaining this value, but it is difficult to assign a value to the Air Force at large of a service such as PDC. Thus, these dollars being put up by the Materials Laboratory are competing with other demands for the same funds, and it was necessary to make the decision. Mr. Conrardy went on to say they would have carried on the funding of PDC on a twelve-months basis until the end of next March and partial funding to the end of fiscal year 1965, but were influenced by the Navy decision, and probably partially influenced by Mr. Carlson's current activity when he reported a desire to have single service funding. In any case, all these items put together at the present time indicate there are no additional funds in their 1964 budget.

Dr. Cairns asked a question as to whether the establishment of Mr. Carlson's office in handling the information problem had a bearing on the decision made on the funding of PDC. In reply to this Dr. Larrick stated that the services PDC rendered for the Department of the Navy were not judged sufficiently high priority to warrant funds. This is not a statement that the services are not valuable and that the services are not used. It means, however, that the responsible customers and the people in the Navy Department did not feel that they were worth paying for directly from Bureau levels. Dr. Larrick also went on to say that the decision in the Air Force was certainly coordinated with higher staff and was not just purely a laboratory decision.

Dr. Biggs stated that this situation then obviously poses a very serious problem to the Committee and to the Center. He asked the question as to whether the Center either goes out of business January 1964 or has to find new support. Dr. Cairns commented that regardless as to how these services are appreciated, they are services to the Defense Department chiefly. Thus, if the Defense Department terminates support, it would seem that it is making a judgment on the termination of the function. Dr. Cairns suggested that there are a number of alternatives to sole DOD support for PDC. One is to ally it with another specialized information center. But the problem appears to be purely a funding matter.

The question then arose as to the part which might be played by Mr. Carlson in determining the support of the Center. Dr. Larrick commented that Mr. Carlson had been making a review of the specialized information centers as to what they are doing and the reasons for doing it, with the objective of eliminating those which are not needed and strengthening those which are needed, and possibly creating centers if centers are needed but do not now exist. It is his responsibility under his charter to provide the Department of Defense with an adequate program of scientific processing of information.

The over-all matter of the support of the Center, the services and functions it provides, and the products it disseminates were discussed in a general fashion for several minutes. At this point the open meeting was declared adjourned and an Executive Session of the PDC Scientific Advisory Committee was convened. In addition to the members of the Scientific Advisory Committee, the following were present: Dr. Cairns, Dr. Cornell, Mr. Robert Lyle, Mr. Bernard Kropp, Dr. Carl Wessel.

VI. Executive Session.

The Executive Session of the PDC Scientific Advisory Committee was convened at 2:30 PM. The detailed minutes of this session will not be presented here, but are available in a set of stenotyped notes if required.

Subjects discussed during this session included: 1) Review of brief history of the development of PDC, its funding, scope, functions, services, and development across the years, to attempt to understand why the present funding situation exists; 2) Review of the present financial support of the Center and ways and means of stabilizing the situation; 3) PDC report to Mr. Carlson of services performed for the Department of the Navy; 4) Non-identity of people in the military served by PDC and those in the military who provide PDC funds; 5) Need for a scientific-technical evaluation of the Center; 6) Need to establish a line of communication with Mr. Carlson, Director of Technical Information, Office of the Director of Defense Research and Engineering, Department of Defense; 7) The possibility of the need for a realignment of PDC operations with the suggestion that new concepts of an "ideal" center are needed. Are abstracts emphasized too much and other present or potential services not emphasized sufficiently? 8) The position of PDC at the National Academy of Sciences; 9) The position of PDC with respect to the NASA contract and the special Army (Fort Detrick) project; 10) Participation of PDC in the Organization for Economic Cooperation and Development (OECD).

Out of these discussions a number of definite conclusions were reached, as follows:

1) There appears to be inadequate communication between PDC subject matter clients in the military and PDC funding sources in the military.

2) There is a definite need for a scientific-technical evaluation of the Center to determine if it is a worthwhile effort. The Committee was of the opinion that the services of the Center had, nonetheless, paid for its cost many times over.

3) Representatives of the PDC Scientific Advisory Committee should meet with Mr. Carlson at the earliest possible time.

4) There should be a closer relationship between the Scientific Advisory Committee and the PDC staff. To accomplish this there should be a revision of the Scientific Advisory Committee structure.

5) The PDC staff should draw up a positive plan outlining what an "ideal" information center should be; this should be looked upon as a proposal to the Department of Defense for consideration of the future of the Prevention of Deterioration Center.

VII. Adjournment

The Executive Session of the Scientific Advisory Committee and the annual meeting was adjourned at 4:30 PM.

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VI. APPENDIXES

B. Journal List

JOURNAL LISTING

Abstract Bulletin (Aluminum Laboratories Ltd.)
Abstract Bulletin of the Institute of Paper Chemistry
Abstract Review
Academia Republici Populare Romine, Filiala Iasi, Studii si Cercetari Stiintifice, Chimie
Academie des Sciences. Comptes Rendus.
Acta Biologica
Acta Botanica Sinica
Acta Chemica Scandinavica
Acta Chimica
Acta Chimica Sinica [Hua Hsueh Hsueh Pao]
Acta Crystallographica
Acta Physica
Activities Report of Food & Container Research & Development Work of the [U.S.] Quartermaster Food & Container Institute for the Armed Forces
Adhäsion
Adhesives Age
Advancement of Science
AFSC News Review
Agricultural Research (U.S. Agricultural Research Service)
Agronomy Journal
AIAA Journal
A.I.B.S. Bulletin
A.I.Ch.E. Journal
Air Engineering
Air University Periodical Index
Aircraft Engineering
Allgemeine Papier-Rundschau
Allis-Chalmers Electrical Review
Aluminium Courier
The American Archivist
American Ceramic Society Bulletin
American Documentation
American Dyestuff Reporter
American Ink Maker
American Journal of Physics
American Journal of Public Health & The Nation's Health
American Scientist
Aminco Laboratory News
The Analyst
Analytica Chimica Acta
Analytical Chemistry
The Analyzer (Beckman Instruments, Inc.)
Angewandte Chemie, International Edition in English
Annales de Geophysique
Annals of the New York Academy of Sciences
Antibiotic Medicine and Clinical Therapy
Antibiotics & Chemotherapy
APL Technical Digest
Appita
Applied Mechanics Review

Applied Microbiology
Applied Optics
Applied Physics Letters
Applied Science & Technology Index
Applied Spectroscopy
Archiv für Druck & Papier
Archives of Biochemistry & Biophysics
Arctic
Army Information Digest
Army Research & Development
AROD Bulletin
ASARCO Digest
ASTIA (KWIC)
ASTIA TAB
ASTIA Technical Abstract Bulletin
Astronautics & Aerospace Engineering
Astronautics Information Abstracts
Astronomical Journal
Astrophysical Journal
ATCP
ATIP Bulletin
Atmospheric Pollution Bulletin
Australian Journal of Agricultural Research
Australian Journal of Applied Science
Australian Journal of Biological Sciences
Australian Journal of Botany
Australian Journal of Chemistry
Australian Journal of Experimental Biology and Medical Science
Australian Journal of Marine and Freshwater Research
Australian Journal of Physics
Australian Journal of Science
Australian Journal of Zoology
Australian Packaging
Australian Paint Journal
Aviation Week
Bacteriological Proceedings
Bacteriological Reviews
Bakelite Review (Union Carbide Plastics Co.)
Battelle Technical Review
Bausch & Lomb Focus
Bell Laboratories Record
Bell System Technical Journal
The Betz Indicator
Biochemical & Biophysical Research Communications
Biochemical Journal
Biochemistry
Biochimica & Biophysica Acta
Biokhimiya
Biological Abstracts
Biological Reviews
Biologicheskaya Khimiya
Biophysics
BoardPackAge
Botanical Gazette

The Botanical Review (New York Botanical Garden)
Boxboard Containers
British Chemical Engineering
The British Packer
British Plastics
Building Science Abstracts
Buletinul Institutului Politehnic din Iasi
Bulletin of the Academy of Science (USSR), Biological & Geophysics Series
Bulletin de l'Institut Textile de France
Bulletin of Entomological Research
Bulletin of the Chemical Society of Japan
Bulletin of the Textile Research Institute of [the] Japanese Government
Bureau of Ships Journal
Canadian Chemical Processing
Canadian Journal of Biochemistry & Physiology
Canadian Journal of Botany
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Canadian Journal of Microbiology
Canadian Journal of Physics
Canadian Journal of Zoology
Canadian Packaging
Canadian Plastics
Canning & Packing
Cellulosa & Carta (Roma)
Celuloza & Hirtie (Bucuresti)
Ceramic Age
Chemical Abstracts
Chemical Engineering
Chemical & Engineering News
Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Progress (Union Carbide Chemicals Co.)
Chemical Reviews
Chemical Week
Chemicke Zvesti
Chemicky Prumysl
Chemiefasern
Chemie-Ingenieur-Technik
Chemiker-Zeitung
Chemische Berichte
Chemist-Analyst (J. T. Baker Chemical Co.)
Chemistry & Industry (London)
Chemistry in Canada
Chemurgic Digest
Chimie & Industrie (Paris)
Chromosoma
Ciba Review
Clay Minerals Bulletin
Cobalt
Collection of Czechoslovak Chemical Communications
Columbia Southern Chemicals
Commercial Fisheries Abstracts

Composite Wood (India)
Consolidated Translations Survey
The Container
Container Development Bulletin (Wooden Box Institute)
Contamination Control
Copeia
Corrosion
Corrosion Abstracts
Corrosion Reporter
Corrosion Science
Corrosion Technology
COSPAR Information Bulletin
Crane Valve World
C.S.I.R. Research Review
Current Technical Papers (Bell Telephone Labs., Inc.)
The Cyanamid Magazine
Datamation
Deep Sea Research
Discovery
Dominion Engineer
Dow Diamond
Dow Metal Products News
Down to Earth
Drevarsky Vvskum
Drevo
Du Pont Magazine
Dyes & Chemicals Technical Bulletin
Dyestuffs (National Aniline Division, Allied Chemical Corp.)
L'Eau
Ecology
Economic Botany
Elastomers Notebook
Electrical Engineering
Electromechanical Design
Electronic/Electromechanical Production
Electronics
Electro-Technology
Endeavour
Energie Nucleaire
Engineer's Digest, U.S. Coast Guard
Environmental Engineering Quarterly
Environmental Quarterly
European Scientific Notes
Evolution
Excerpta Medica, Section IV
Experientia
Faserforschung & Textiltechnik
Federation Proceedings
The Fibreboard Container
FID News Bulletin
Finnish Paper & Timber
Folletos Tecnicos Forestales (Buenos Aires)
Food Engineering
Food Technology

Forest Industries
Forest Pest Leaflet (U.S. Forest Service)
Forest Products Journal
Forest Science (Society of American Foresters)
Forestry Abstracts
Frontier (Armour Research Foundation)
General Electric Research Laboratory Bulletin
Genetics
Genie Chimique
Geophysical Abstracts
Geophysics
Geoscience Abstracts
German Science Bulletin
Gidroliznaya & Lesokhimicheskaya Promyschlennost
Global Technology
Good Packaging
GSE-Ground Support Equipment
Heat Engineering (Foster Wheeler Corp.)
Helvetica Chimica Acta
Hercules Chemist
Hereditas
Highway Research Abstracts
Holz als Roh- & Werkstoff
Holzforschung (Berlin)
Holzforschung & Holzverwertung
I.G.Y. Bulletin
Index of Federal Specifications & Standards
Indian Print & Paper
Indian Pulp & Paper
L'Industria della Carta (Milan)
Industrial Bulletin of Arthur D. Little, Inc.
Industrial Chemist
Industrial Control News (Minneapolis-Honeywell Regulator Co.)
Industrial & Engineering Chemistry
Industrial & Engineering Chemistry, Fundamentals
Industrial & Engineering Chemistry, Process Design & Development
Industrial & Engineering Chemistry, Products Research & Development
Industrial Quality Control
Industrial Research
Industrial Research Newsletter
Industrial Science & Engineering
Industrial Science & Technology
Industrial Water & Wastes
Industrial Woodworking
Informationen über Verpackungs- & Transportfragen
Inorganic Chemistry
Institute of Packaging Journal (London)
Instrument Engineer
Instrumentation
Instruments & Control Systems
International Aerospace Abstracts
International Bulletin of Bacteriological Nomenclature & Taxonomy
International Chemical Engineering
International Paper Board Industry, European Edition

International Science & Technology
Israel Research Council Bulletin
Journal of the Acoustical Society of America
Journal of Agricultural & Food Chemistry
Journal of the Air Pollution Control Association
Journal of the American Ceramic Society
The Journal of American Chemical Society
Journal of the American Leather Chemists Association
The Journal of the American Medical Association
Journal of the American Oil Chemists' Society
Journal of American Pharmaceutical Association
Journal of the American Water Works Association
Journal of Applied Chemistry (London)
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Applied Physiology
Journal of Applied Polymer Science
Journal of the Astronautical Sciences
Journal of the Atmospheric Sciences
Journal of Atmospheric & Terrestrial Physics
Journal of Bacteriology
Journal of Basic Engineering
The Journal of Biological Chemistry
Journal of Catalysis
Journal of Cell Biology
Journal of Chemical & Engineering Data
The Journal of Chemical Physics
Journal of the Chemical Society
Journal of the Chemical Society of Japan
Journal of Chromatography
Journal of Colloid Science
Journal of Economic Entomology
Journal of the Electrochemical Society
Journal of Engineering for Industry
Journal of Environmental Sciences
Journal of Fluid Mechanics
Journal of Food Science
Journal of Forestry
Journal of the Franklin Institute
Journal of General Microbiology
Journal of Genetics
Journal of Geophysical Research
Journal of Heat Transfer
The Journal of Heredity
The Journal of Histochemistry & Cytochemistry
Journal of the Institute of Wood Science (London)
Journal of the Japan Wood Research Society [Nippon Mokuzai Gakkaishi]
Journal of the Japanese Technical Association of Pulp & Paper Industry
[Kami-pa Gikyoshi]
Journal of Lipid Research
Journal of Mathematics & Physics
Journal of the Mechanics & Physics of Solids
Journal of Medicinal & Pharmaceutical Chemistry
Journal of Microbiology, Epidemiology & Immunobiology

Journal of Molecular Biology
Journal of Molecular Spectroscopy
Journal of the Optical Society of America
The Journal of Organic Chemistry
The Journal of Physical Chemistry
Journal of Polymer Science
Journal of Research of the National Bureau of Standards. Sections A, B & C
Journal of Scientific & Industrial Research (India)
Journal of Scientific Instruments
Journal of the Society of Dyers & Colourists
Journal of the Society for Industrial & Applied Mathematics
Journal of the Society of Textile & Cellulose Industry, Japan [Sen-i Gakkaishi]
Journal of Soil & Water Conservation
Journal of Teflon
Journal of the Textile Institute. Abstracts & Transactions
Journal of Ultrastructure Research
Journal of the Washington Academy of Sciences
Journal of the Water Pollution Control Federation
JPL Reports & Summaries
Justus Liebig's Annalen der Chemie
Khimicheskie Volokna
Kolloid-Zeitschrift/Zeitschrift für Polymere
Kolloidnyi Zhurnal
Kunststoffe
The Laboratory (Fisher Scientific Co.)
The Laboratory, Clinical Edition
Lead
Lesnaya Promyshlennost
Lesnictvi; Sbornik Ceskoslovenske Akademie Zemedelskych Ved
Lesnoe Khozyaistvo
Lesnoi Zhurnal
Light Metal Age
Limnology & Oceanography
Loss Prevention
Lubrication (Texaco, Inc.)
Lumber Letter
Magazine of Magnesium
The Magazine of Standards
Magnesium Topics
Magyar Textiltechnika
Makromolekulare Chemie
Materials in Design Engineering
Materials Protection
Materials Research & Standards
Mechanical Engineering
Mechanical Topics
Melliand Textilberichte
Merchandising Vision (British Cellophane, Ltd.)
Metal Progress
Metalscope
Meteorological & Geoastrophysical Abstracts
Microbiology (Translation of Mikrobiologiya. USSR)
The Microchemical Journal
Mill & Factory

Miscelaneas Forestales (Buenos Aires)
Missiles & Space
Modern Packaging
Modern Plastics
Modern Textiles Magazine
Monatshefte für Chemie & Verwandte Teile Anderer Wissenschaften
Monsanto International
Monsanto Magazine
Monthly Announcement Bulletin, Library of Congress
Monthly Index of Russian Accessions
Monthly Newsletter (BuS&A)
NAC News and Pesticide Review
National Bureau of Standards, Technical News Bulletin
Natural Rubber News
Nature
Naturwissenschaften
Naval Research Logistics Quarterly (ONR)
Naval Research Reviews
Navy Civil Engineer
Die Neue Verpackung
New Research Literature, NRL
New Scientist
New Zealand Journal of Agricultural Research
New Zealand Journal of Geology & Geophysics
New Zealand Journal of Science
Nickel Topics
Noise Control
Nondestruc ive Testing
Norsk Skogindustri
Notas Silvicolas (Buenos Aires)
Notas Tecnologicas Forestales (Buenos Aires)
NRL Library Bulletin
Nuclear Science Abstracts
Nucleonics
Obaly
Official Digest, Federation of Societies for Paint Technology
Oil, Paint & Drug Reporter
Optics & Spectroscopy (USSR)
O-R, Operational Research Quarterly
Ordnance Research Bulletin
Overseas Geology & Mineral Resources
Package Engineering
Packaging
Packaging, Management/Marketing Edition
Packaging, Technical/Production Edition
Packaging Panorama (Dow Chemical Co.)
Packaging Progress
Packaging Review (Union Bag-Camp Paper Corp.)
Packaging Trends (Du Pont)
Packaging with Plastics (Union Carbide Corp.)
Pakistan Journal of Scientific & Industrial Research
O Papel (Sao Paulo)
Paper, Film & Foil Converter

Paper Packs
Paper & Paper Products
Paper Technology
Paper & Twine Journal
Paperboard Packaging
Das Papier
Papier, Carton & Cellulose
Papier & Druck
Patentblatt
Pest Control
Pesticides Abstracts & News Summary, Section A & C
Philips Research Reports
Philips Technical Review, English Edition
Philosophical Transactions of the Royal Society of London, Series A & B
Photographic Science & Engineering
Physical Review
Physical Review Letters
Physics of Fluids
Physics Today
Phyton
The Plant Disease Reporter
Plant Physiology
Plasticheskie Massy
Plastics
Plastics in Australia
Plastics World
Polar Record
Polymer
Power
Power Drive Engineering
Proceedings of the Chemical Society (London)
Proceedings of the National Academy of Sciences (U.S.)
Proceedings of the Royal Society of London, Series A & B
Product Engineering. R & D Edition
Products Finishing
Progress thru Research (General Mills, Inc.)
Pulp & Paper International
Pulp & Paper Magazine of Canada
Pure & Applied Chemistry
Pyrethrum Post
Quarterly Reviews
RCA Review
Record of Chemical Progress
Recueil des Travaux Chimiques des Pays-Bas
Report of NRL Progress
Reports of the Government Chemical Industrial Research Institute, Tokyo
[Tokyo Kogyo Shikensho Hokoku]
Research
Research Applied in Industry (London)
Research/Development
The Research Engineer
Research for Industry
Research Trends
Resin News

Resin Review (Rohm & Haas Co.)
Review of Current Literature (England)
The Review of Scientific Instruments
Reviews of Geophysics
Reviews of Modern Physics
Revista de Investigaciones Forestales (Buenos Aires)
Revue de la Documentation
Revue de Mechanique Applique
La Revue des Papiers & Cartons
Revue de Physique
Revue des Produits Chimiques
Rohm & Haas Reporter
Rubber Chemistry & Technology
Rubber Developments
Sales Appeal & Packaging Technology
Science
Science Abstracts
Science News Letter
Science Progress
Science Tools
Scientia
Scientific American
Scientific Information Notes
Scientific & Technology Aerospace Reports (NASA)
Sechenov Physiological Journal of the USSR
Seifen-Öle-Fette-Wachse
Shirley Institute Memoirs
Soap & Chemical Specialties
Soil Science
Soil Science Society of America Proceedings
Solid State Physics
Sound
Soviet Physics—Acoustics, Crystallography, "Doklady", JETP, Technical Physics
Space Aeronautics
Space World
SPE Journal
SRI Journal
Stain Technology
Die Stärke
Svensk Kemisk Tidskrift
Svenska Träforsknings-Institutet, Meddelande
SVF Fachorgan für Textilveredlung
Tappi
Technical Translations
Technometrics
Tekstilnaya Promyshlennost
Telescoping Technical News
Test Engineering
Tetrahedron
Tetrahedron Letters
Textil
Textil-Praxis
Textil-Rundschau
Textile Bulletin (Charlotte, N.C.)

The Textile Institute & Industry
Textile Research Journal
Textile World (New York)
Transactions of the American Geophysical Union
Transactions of the Faraday Society
Transactions of the New York Academy of Sciences
Transactions of the Society of Rheology
Transactions of the Wisconsin Academy of Sciences, Arts & Letters
Tropical Science
Ultrasonic News (Branson Instruments, Inc.)
Unasylva
Undersea Technology
U.S. Armed Forces Medical Journal
U.S. Atomic Energy Commission. Research & Development Abstracts
U.S. Department of Agriculture, Monthly List of Publications & Motion Pictures
U.S. Forest Products Laboratory, Library Accessions
U.S. Government Research Reports
U.S. National Science Foundation, News Releases & Miscellaneous Numbers
U.S. Navy Medical News Letter
Vacuum
Verpackungs-Berater
Verpackungs-Rundschau
V.I. Pamflet
Vysokomolekulyarnie Soedineniya
Werkstoffe & Korrosion
Wochenblatt für Papierfabrikation
Wood Preserving News
Wood Research (Kyoto) [Mokuzai Kenkyu]
Wood Saver
World Review of Pest Control
Zeitschrift für Physikalische Chemie (Frankfurt)
Zeitschrift für Physikalische Chemie (Leipzig)
Zeitschrift für Wissenschaftliche Mikroskopie & Mikroskopische Technik
Zellstoff & Papier

VI. APPENDIXES

C. List of Publications*

* For listing of PDC Bibliographies see p. 23-26.

Hanson, A.C. Development of optical cements by the Ordnance department. Paper presented at the Optical Instruments Subcommittee meeting, U.S. Joint Army-Navy Deterioration Prevention Committee, 11 Sept. 1946. [AN-251(3)]

King, Peter, and Don M. Packer. Optical cements. Paper presented at the Optical Instruments Subcommittee meeting, U.S. Joint Army-Navy Deterioration Prevention Committee, 11 Sept. 1946. [AN-251(3)]

Klemme, D.E. [Work being conducted at present on preservation of leather]. Paper presented at the Optical Instruments Subcommittee meeting, U.S. Joint Army-Navy Deterioration Prevention Committee, 11 Sept. 1946. [AN-251(3)]

PDA directions manual. [n.d.] 49 p. [Reference and style guide manual to be used by abstracters in connection with the Prevention of Deterioration Abstracts.]

Prevention of Deterioration Abstracts. Volume I, April 1946, through Volume XIX, June 1962.

Stief, J.L., and J.J. Boyle. Effect of fungicides on rubber. Paper presented at the Plastics and Plasticizers Subcommittee meeting, U.S. Joint Army-Navy Deterioration Prevention Committee, 24 Oct. 1946. [AN-253(3)]

Timmins, A.R. Report on the hot dip method of packaging optical instruments. Report presented at the Optical Instruments Subcommittee meeting, U.S. Joint Army-Navy Deterioration Prevention Committee, 13 Nov. 1946. [AN-251(4)]

U.S. Deterioration Prevention Committee. Fungicide Panel. Official screening test method for determining fungicide activity of candidate fungicides. [n.d.] 9 p. [X-352]

U.S. Joint Army-Navy Deterioration Prevention Committee.

1. Executive Committee
   - a. Recommendations of the Executive Committee of the Joint Army-Navy Deterioration Prevention Committee to be submitted to the Main Committee. Date of meeting, 31 May 1946. 2 p. [AN-261(1)]
   - b. Minutes of meeting, 23 July 1946. 8 p. [AN-261(2)]
   - c. " 19 Sept. 1946. 9 p. [AN-261(3)]
   - d. " 25 Nov. 1946. 9 p. [AN-261(4)]
2. Main Committee
   - a. Memo from Chairman, Main Committee to Chairman, Sub-Committees, dated 18 Oct. 1946. Subject: Methods of handling proposals and reports. 5 p. [AN-256(A)]
   - b. Minutes of meeting, 28 Feb. 1946. 6 p. [AN-256(1)]
   - c. " 24 May 1946. 29 p. [AN-256(2)]
   - d. " 5 June 1946. 4 p. [AN-256(3)]
   - e. " 1 Aug. 1946. 7 p. [AN-256(4)]
   - f. " 3 Oct. 1946. 16 p. [AN-256(5)]
   - g. " 5 Dec. 1946. 13 p. [AN-256(6)]
3. Corrosion Subcommittee
   - a. Minutes of meeting, 27 May 1946. 5 p. [AN-250(1)]
   - b. " 9 July 1946. 5 p. [AN-250(2)]
   - c. Minutes of joint meeting with Test Methods Subcommittee, 24 Sept. 1946. 8 p. [AN-250(3)]
4. Electrical and Electronic Equipment Subcommittee
   - a. Minutes of meeting, 5 June 1946. 20 p. [AN-248(1)]
   - b. " 11 July 1946. 3 p. [AN-248(2)]
   - c. " 4 Sept. 1946. 21 p. [AN-248(3)]
   - d. " 4 Oct. 1946. 11 p. [AN-248(4)]

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5. Fungicide Testing Subcommittee
   a. Minutes of meeting, 1 Aug. 1946. 6 p. [AN-262(1)]
   b. " 7 Aug. 1946. 3 p. [AN-262(2)]
   c. " 28 Oct. 1946. 8 p. [AN-262(3)]
6. Optical Instruments Subcommittee
   a. Minutes of meeting, 22 May 1946. 2 p. [AN-251(1)]
   b. " 17 July 1946. 3 p. [AN-251(2)]
   c. " 11 Sept. 1946. 23 p. [AN-251(3)]
   d. " 13 Nov. 1946. 10 p. [AN-251(4)]
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   a. Minutes of meeting, 27 June 1946. 2 p. [AN-252(1)]
   b. " 14 Aug. 1946. 2 p. [AN-252(2)]
8. Plastics and Plasticizers Subcommittee
   a. Minutes of meeting, 28 May 1946. 4 p. [AN-253(1)]
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   a. Minutes of meeting, 4 June 1946. 3 p. [AN-254(1)]
   b. " 22 July 1946. 3 p. [AN-254(2)]
   c. " 19 Nov. 1946. 2 p. [AN-254(3)]
10. Textiles and Cordage Subcommittee
   a. Minutes of meeting, 28 May 1946. 3 p. [AN-249(1)]
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Aug. 4, 1947	May 1 to July 1, 1947
Oct. 14, 1947	July 1 to Sept. 1, 1947

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   - b. " 20 March 1947. 2 p. [AN-261(6)]
   - c. " 21 May 1947. 2 p. [AN-261(7)]
   - d. " 24 July 1947. 2 p. [AN-261(8)]
   - e. " 24 Sept. 1947. 3 p. [AN-261(9)]
   - f. " 20 Nov. 1947. 2 p. [AN-261(10)]
2. Main Committee
   - a. Minutes of meeting, 6 Feb. 1947. 5 p. [AN-256(7)]
   - b. " 3 April 1947. 8 p. [AN-256(8)]
   - c. " 5 June 1947. 10 p. [AN-256(9)]
   - d. " 7 Aug. 1947. 14 p. [AN-256(10)]
   - e. " 2 Oct. 1947. 9 p. [AN-256(11)]
   - f. " 19 Dec. 1947. 7 p. [AN-256(12)]
3. Corrosion Subcommittee
   - a. Minutes of meeting, 5 Feb. 1947. 8 p. [AN-250(4)]
   - b. " 12 June 1947. 12 p. [AN-250(5)]
   - c. " 22 Sept. 1947. 5 p. [AN-250(6)]
   - d. " 24 Nov. 1947. 4 p. [AN-250(7)]
4. Electrical and Electronic Equipment Subcommittee
   - a. Minutes of meeting, 5 March 1947. 3 p. [AN-248(7)]
   - b. " 22 May 1947. 2 p. [AN-248(8)]
   - c. " 23 July 1947. 2 p. [AN-248(9)]
   - d. " 25 Sept. 1947. 11 p. [AN-248(10)]
   - e. " 25 Nov. 1947. 2 p. [AN-248(11)]
5. Fungicide Testing Subcommittee
   - a. Minutes of meeting, 17 Feb. 1947. 7 p. [AN-262(4)]
   - b. " 8 Aug. 1947. 16 p. [AN-262(5)]
   - c. " 14 Nov. 1947. 8 p. [AN-262(6)]
6. Marine Borer Panel
   - a. Minutes of meeting, 24 Sept. 1947. 2 p. [AN-428(1)]
   - b. " 13 Oct. 1947. 2 p. [AN-428(2)]
   - c. " 12 Nov. 1947. 3 p. [AN-428(3)]
   - d. " 10 Dec. 1947. 2 p. [AN-428(4)]
7. Optical Instruments Subcommittee
   - a. Minutes of meeting, 22 Jan. 1947. 3 p. [AN-251(5)]
   - b. " 19 March 1947. 4 p. [AN-251(6)]
   - c. " 21 May 1947. 2 p. [AN-251(7)]
   - d. " 10 Sept. 1947. 9 p. [AN-251(8)]
   - e. " 12 Nov. 1947. 2 p. [AN-251(9)]
8. Plastics and Plasticizers Subcommittee
   - a. Minutes of meeting, 20 Feb. 1947. 4 p. [AN-253(4)]
   - b. " 1 July 1947. 4 p. [AN-253(5)]
9. Rubber and Plastics Subcommittee (formerly Plastics and Plasticizers)
   - a. Minutes of meeting, 11 Sept. 1947. 2 p. [AN-253(6)]
   - b. Minutes of meeting of Rubber Panel, Rubber and Plastics Subcommittee, 22 Sept. 1947. 1 p. [AN-430(1)]

U.S. Joint Army-Navy Deterioration Prevention Committee (cont.)

10. Test Methods Subcommittee

a. Joint meeting with Subcommittee on Textiles and Cordage, 15-16 Jan. 1947. 2 p. [AN-254(4)]

b. [Textile and leather test methods]. Contents: Introduction, by D.L. Putt; Air materiel command test methods for textiles, by William A. Corry; Aspects of Monsanto's collaboration with the Joint Army-Navy Deterioration Prevention Committee - textile preservation, by P.G. Benignus; Water repellents, by Jay Harris; Fire retardants, by Dr. Nielson; The leather program and leather test methods, by Dr. Lollar; Laboratory methods for evaluating the biological degradation of textiles, by P.B. Marsh. 15-16 Jan. 1947. 18 p. [AN-254(4A)]

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   b. " 18 March 1948. 3 p. [AN-261(12)]
   c. " 20 May 1948. 3 p. [AN-261(13)]
   d. " 5 Aug. 1948. 4 p. [AN-261(14)]
   e. " 3 Dec. 1948. 13 p. [AN-261(15)]
3. Main Committee
   a. Minutes of meeting, 5 Feb. 1948. 10 p. [AN-256(13)]
   b. " 1 April 1948. 5 p. [AN-256(14)]
   c. " 7 Oct. 1948. 4 p. [AN-256(15)]
4. Corrosion Subcommittee
   a. Minutes of meeting, 30 March 1948. 8 p. [AN-250(8)]
   b. " 3 June 1948. 8 p. [AN-250(9)]
   c. " 21 Oct. 1948. 8 p. [AN-250(10)]
5. Electrical and Electronic Equipment Subcommittee
   a. Minutes of meeting, 10 Feb. 1948. 2 p. [AN-248(12)]
   b. " 6 April 1948. 3 p. [AN-248(13)]
   c. " 10 Aug. 1948. 3 p. [AN-248(14)]
   d. " 28 Sept. 1948. 3 p. [AN-248(15)]
6. Fungicide Testing Subcommittee
   a. Minutes of meeting, 18 Feb. 1948. 10 p. [AN-262(7)]
   b. " 9 June 1948. 6 p. [AN-262(8)]
   c. " 14 Oct. 1948. 5 p. [AN-262(9)]
   d. " 2 Dec. 1948. 2 p. [AN-262(10)]
7. Marine Borer Panel
   a. Minutes of meeting, 10 March 1948. 4 p. [AN-428(5)]
   b. " 14 April 1948. 1 p. [AN-428(6)]
   c. " 15 Sept. 1948. 6 p. [AN-428(7)]
   d. " 20 Oct. 1948. 2 p. [AN-428(8)]
   e. " 17 Nov. 1948. 2 p. [AN-428(9)]
8. Optical Instruments Subcommittee
   a. Minutes of meeting, 22 Jan. 1948. 2 p. [AN-251(10)]
   b. " 7 April 1948. 2 p. [AN-251(11)]
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4. Marine Borer Panel
   a. Minutes of meeting, 19 Jan. 1949. 1 p. [AN-428(10)]
   b. " 16 Feb. 1949. 2 p. [AN-428(11)]
5. Textiles and Cordage Subcommittee
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VI. APPENDIXES

D. Outline of State-of-the-Art Report on Effects of Low Temperature (below -300° F) on Materials and Equipment

EFFECTS OF LOW TEMPERATURE (below -300°F) ON MATERIALS AND EQUIPMENT

V. ELECTRIC AND ELECTRONIC COMPONENTS

A. Current carrying elements (including electron emission devices) (conductors, capacitors, resistors, and other circuit elements, vacuum tubes, superconductors, semiconductors)

B. Dielectrics

VI. MECHANICAL COMPONENTS

A. Power Transmission and Control Devices (Bearings and gear trains and other power train components)

1. Bearings

2. Gearing

3. Lubricants

B. Seals and Sealants

C. Energy Absorbing Devices (springs, shock absorbers)

D. Fluid System Control Devices (valves, pumps and other fluid system components)

VII. THERMAL CONTROL COMPONENTS

A. Insulation (Conduction, convection and radiation considerations)

1. Polymers

2. Mineral compositions

3. Ceramics

4. Other Materials

B. Conductors and Other Heat Transfer Material Concepts

1. Metals and Alloys (Convection and radiation)

2. Polymers and Organics

3. Composites

4. Other Materials

VIII. WORKING FLUIDS

A. Liquids (for Hydraulic Systems, etc.)

B. Gases (for Pressurized Systems)

Note: Item VIII may be included in Item VI, depending upon the amount and merit of the literature available.

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VI. APPENDIXES

E. Organization Chart

PREVENTION OF DETERIORATION CENTER
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Morris Cohen (National Research Council of Canada)
Edward C. Greco (Representative of the National Association of Corrosion Engineers, United Gas Corporation)

Thermal & Mechanical Environments Subcommittee

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Olive H. Bennett, Administrative Assistant

Consulting Staff

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Environmental Effects on Materials & Equipment

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13 ABSTRACT This paper includes both the annual report of the Prevention of Deterioration Center for 1963-1964 and the final report of the Center operating under Office of Naval Research Contract Nonr-2300(17) which terminated May 31, 1964. This contract for the most of its life was jointly funded by the Army, Navy, and Air Force. The Center was established at the National Academy of Sciences-National Research Council in 1945 and was the successor of the Tropical Deterioration Information Center set up in 1941 by the Army and the Navy at The George Washington University. The final report section includes a general discussion of the whole environmental deterioration problem, a historical sketch of the Center, and a detailed account of activities and accomplishments during its nineteen-year history. Broad functions of the Center have been to furnish advisory and consultative services on deterioration of materials and its control. Appended to this report are the minutes of the PDC Scientific Advisory Committee held in May 1963, a list of journals covered routinely as a part of the information collecting function, a list of publications of the Center from 1946-1964, an outline of a state-of-the-art report on cryogenics now in preparation, and an organization chart of the Scientific Advisory Committee, the Services Technical Committee, and the permanent staff of the Center.

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14 KEY WORDS	LINK A		LINK B		LINK C	
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