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ABSTRACT

The development of machine or computer applications for the arrangement, storage, retrieval, and display of literature references or classification schedules, vocabularies, and indexes used with the Universal Decimal Classification (UDC) System as an access point is reviewed. Activities of the Subcommittee on Mechanization of the UDC Central Classification Commission of the International Federation for Documentation are described and international conferences on "UDC in Mechanized Retrieval Systems" are summarized. More than 60 existing operating systems in 15 countries are described and samples of their output are provided. A bibliography on mechanization and the UDC is included. (Author/DGC)

# COMPUTERS AND THE UDC

International Federation for Documentation

# COMPUTERS AND THE UDC

## A DECADE OF PROGRESS 1963-1973

prepared by

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## Abstract

The development of machine or computer applications for the arrangement, storage, retrieval, and display of literature references or classification schedules, vocabularies, and indexes used with the UDC (Universal Decimal Classification) System as an access point is reviewed from the earliest attempts which used edge-notched, optical coincidence, or punched cards with simple mechanical systems, to the more recent experimental or operational batch processing or on-line systems for control of citations, abstracts, or subject indexing terminology. The activities of the FID/CCC-M (Subcommittee on Mechanization of UDC of the Central Classification Commission of the International Federation for Documentation) over the past decade are then outlined, including the co-sponsoring of two major international seminars on the "UDC in Mechanized Retrieval Systems" -- one in Copenhagen (1968) and one in Frankfurt (1970). Finally more than 60 experimental or operational systems attempted in a dozen or more countries during the past 10 to 12 years are described briefly and some of the display products (printouts) are illustrated. An extensive bibliography on mechanization and the UDC is appended for those who want greater detail than is provided in this report.



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C O N T E N T S

## Editorial

Over the past decade, the difficulties that discouraged individuals from using the Universal Decimal Classification (UDC) in mechanized library or documentation systems have been proven to be mainly conceptual rather than actual.

The main objection was based on the variable length of code groups, but recent trends toward use of paper or magnetic tape, or console rather than card input to computers have largely overcome this apparent obstacle. Objections arising from nonstandard characters and arbitrary filing order for auxiliaries have been minimized. Freeman (and also Schneider and Koch) have demonstrated that letters or other codes can be substituted for auxiliary symbols in sorting, and that satisfactory substitutions can be made in printing, pending general availability of all required characters on print chains of computers. The filing order is now being standardized by the FID/CCC (International Federation for Documentation, Central Classification Committee) as well as by the International Organization for Standardization (ISO).

The FID/CCC-M (Subcommittee on Mechanization) acts as adviser to the FID/CCC and the classification department of the FID Secretariat on matters pertaining to the impact of automation on UDC development and use, and on UDC work at the secretariat. During the next decade, the principal additional tasks of the subcommittee will be: (1) to inform persons needing suggestions for solving special problems related to the UDC in automated systems about the capabilities and limitations of the UDC to perform many functions by computers, and (2) to make the use of natural language more effective for functions such as filing and retrieving than would be possible with thesauri or any other classification system.

Of course, the UDC will always be more urgently needed in large heterogeneous or multilingual than in small homogeneous or large monolingual communities. The trend in the 1970's is toward use of the UDC as one of a number of retrieval points in such large mechanized bibliographic systems or even in major computerized networks, including those that are hospitable toward other competing classification or descriptor systems, and toward the use of the UDC as a link in multilingual vocabularies and thesauri.

Malcolm Rigby

## Preface

The purpose of this report is:

(1) to document the history and activities of the FID/CCC-M (Subcommittee on Mechanization of the UDC) from its inception in 1963 to the present;

(2) to review briefly various pilot projects and experimental and operational systems which involve the UDC and its manipulation by tabulators or electronic computers;

(3) to describe the various types of applications of machines to UDC arrangement, filing, storage, retrieval, display, or communication for the benefit of those who might want to attempt a similar application;

(4) to point out the technical and economic limitations and difficulties as well as the benefits involved with use of machines to control UDC schedule maintenance or use; and

(5) to provide an up-to-date bibliography on mechanization and the UDC and to elicit from readers further references or comments.

The detail of description of each system has largely depended on personal knowledge or the availability of published material on the system or systems. As the descriptions were in many instances derived from manuscripts that were often prepared early in the history of a system, it has not been possible to determine how long the systems continued, or whether or not they are still viable.

No attempt has been made to go into details of design or programming, for each new system must be designed to suit the purpose and the hardware available at the place and time. Works referred to in the bibliography, however, do contain, in most instances, more specifics. For complete details of programs, one must write to the authors of the respective systems.

It would be appreciated if readers would submit comments, corrections, or additional references (and the actual papers if possible) to the FID/CCC-M for use in further revisions or reports of the committee.

## PART I - THE UNIVERSAL DECIMAL CLASSIFICATION SYSTEM

The Universal Decimal Classification (UDC) is the most widely used system for classifying and indexing books, documents, or articles in any field of knowledge. The other widely used classification systems are the Dewey Decimal Classification (DDC) system from which the UDC was derived, and the Library of Congress Classification (LCC) system. Both of these latter systems are used primarily in classifying books as distinguished from documents, which are, of course, far more numerous and a great deal more specific than are books. DDC (the least specific) is used mainly in public libraries, and the LCC (because it appears on all Library of Congress printed cards and is subdivided to a greater degree of specificity), is used increasingly in college and university libraries.

The UDC, as well as the DDC, attempts to have a completely hierarchical, or tree-form, structure and to maintain some logical relationship between and within main classes. The UDC, unlike the other systems, can be used in a faceted or coordinate mode so that in addition to the basic 200,000 subdivisions (in the full editions), an infinite number of concepts may be identified by using colon relationships or one of more of the dozen auxiliary relators. These relators or standard auxiliaries are used to designate facets of time (by means of quotation marks), place (using parentheses with the standard 2 to 9 subdivisions), form of publication (parentheses with the 0 subdivisions), language (equal sign), race (parentheses with equal sign), point-of-view (.00 subdivisions), as well as the Boolean operators for addition ( + ) and inclusion (slash), plus many other general and special auxiliaries (.0, _, ', etc.).

The UDC began developing in 1895 as a French translation of the DDC, authorized by Melvil Dewey. It has gradually been expanded by international study committees, and altered to provide more space for expansion in newly and rapidly developing fields, so that today it resembles the DDC only with respect to the first two or three digits; in a growing number of classes it no longer follows the DDC even at the third or second levels of subdivision. Even at the first level, main classes, class 4 has recently been vacated by the UDC. Moreover, all of the thousands of time, place, point-of-view, and other subdivisions developed in the UDC are not included as independent entities, in DDC and LCC. In these systems they appear only in abridged form, if and where needed and according to the dictates of each discipline or branch of knowledge.

The UDC is also unique in its mechanisms for extending and revising schedules as need arises. These consist of a small staff at the FID Secretariat in The Hague, a Central Classification Committee (FID/CCC) consisting of a score of editors of language or national editions of the UDC or co-opted technical experts, and 25 to 30 International UDC Study Committees consisting of specialists in as many separate subject fields. Some of these work in collaboration with other international organizations such as the WMO (World Meteorological Organization), FAO (Food and Agricultural Organization), UNISIST (an organization for developing a world science information system), or IBCC (International Building Classification Committee).

The UDC is also unique in having full, medium, abridged, and special editions as well as guides to the use of the UDC in about 20 languages: Czech, Dutch, English, Finnish, French, German, Hebrew, Hungarian, Italian, Japanese, Korean, Macedonian, Polish, Portuguese, Romanian, Russian, Serbo-Croat, Slovene, Spanish, and Swedish (with variants in Danish and Norwegian). Full editions, when complete, contain 150,000 or more divisions, medium editions 35,000-55,000 divisions, and abridged editions 12,000-18,000 divisions. Special editions are found in about 35 separate fields ranging from agriculture to wood products; several appear in three or four languages, or even, as in the case of building and architecture, in 13 languages.

From all of this it is obvious that the UDC presents a number of special challenges to mechanization (e.g., many alphabets, diacritical marks and special symbols, or varying length of UDC groups). On the other hand, as a complicated system in which each character has special meaning, it is itself a programming language that can be universally applied. Furthermore, it is so dynamic and voluminous that it needs machine processing for efficient storage, retrieval, updating, dissemination, and application in the many languages, countries, and institutions of the major schemes. The UDC is a standard classification system in a number of countries and is used widely in many others; a rough estimate is that it is used in from 100,000 to 300,000 libraries and institutions in the world.

Finally, the UDC is being constantly revised and extended to meet the dynamic changes in special and general fields of knowledge. The revisions made by the international study groups for the separate disciplines are published as "P-Notes," and after acceptance by FID member countries and by the FID/CCC are issued semi-annually in UDC Extensions and Corrections.

Such an involved system is obviously one that could benefit from manipulation and listing by mechanical or electronic methods. Yet many limitations, both technical and economic, have inhibited such applications of automated methods. This report attempts to describe and illustrate a number of experimental and operational applications that have come to our attention in the past decade so that no one need repeat the same painful steps or make the same mistakes.

## History of Mechanized Systems Using UDC

As early as 1948 it had become evident to a number of users of the UDC that a great advantage would be gained through use of mechanical sorting devices such as edge-notched (needle-sort) or punched cards (optical coincidence) for retrieving document surrogates or locators. Furthermore, it was evident that mechanical or electrical tabulators could arrange and list literature or document references according to the UDC as easily as they could arrange and list names or places or any other systematic information.

The main advantages visualized at that time, however, were: (1) the enhanced ability to quickly update or cumulate a growing file in any desired order; and (2) the equally attractive ability to keep a static or dynamic file in random order (i.e., just put back old cards or add new cards without worrying about arrangement), yet to allow selection or retrieval on any given access point or combination of access points.

By 1960, the general impression among documentalists, as expressed at the 26th FID Congress that year, was that the UDC was inherently too complicated for machine processing. Among the many objections raised at that time were:

(1) the variable length and number of code groups assigned to a document prevent the use of the UDC in fixed fields on punched cards;

(2) the several non-conventional auxiliary symbols not found on most key-punch machines or computer chains constitute a formidable obstacle for key-punching, programming, and searching;

(3) the non-standard filing order used in UDC files and listings poses another insuperable obstacle for programming and listing;

(4) computers are intended for use with natural language and not with codes, or they are too "high-powered" for such simple applications. This objection is still being voiced.

## History of FID Subcommittee on Mechanization of UDC

a) Background

At the 28th FID Conference in Scheveningen (The Hague) in September 1962, Prof. Dr. Eric Pietsch, chairman of the FID/MSR (Mechanized Storage and Retrieval) Committee asked Malcolm Rigby to form a subcommittee to study and report on developments and possibilities for use of computers with the UDC.

On the next day, the FID/CCC (Central Classification Commission) approved the committee as a Joint Subcommittee of FID/CCC and FID/MSR. This joint subcommittee was later authorized by the FID Executive Committee and become official as reported in the 1964 FID Yearbook, with Rigby of the USA as chairman and A. L. C. Vicentini of Brazil as secretary. Fifteen countries were represented on the committee by 18 individual members.

The first official meeting was at the 29th FID Conference in Stockholm. The chronology of meetings of the subcommittee on mechanization, including seminars held under its sponsorship, is as follows:

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| Stockholm | 29th FID Conference (Organization) | Oct. 2-6, 1963 |
| The Hague | 30th FID Conference (Open meeting) | Sept. 24, 1964 |
| Washington | 31st FID Conference (Open meeting) | Oct. 7, 1965 |
| The Hague | 32nd FID Conference (Open meeting) | Sept. 20, 1966 |
| Tokyo | 33rd FID Conference (Joint discussion with FID/OM) | Sept. 15, 1967 |
| Copenhagen | 1st Seminar on UDC & Mechanization | Sept. 1-5, 1968 |
| The Hague | 34th FID Conference (Planning meeting) | Dec. 10, 1968 |
| The Hague | CCC meeting (Committee reorganization) | Sept. 8, 1969 |
| Frankfurt | 2nd Seminar on UDC & Mechanization | June 1-5, 1970 |
| Frankfurt | Closed meeting of CCC-M | June 1&5, 1970 |
| Buenos Aires | 35th FID Conference (Open discussion) | Sept. 16, 1970 |
| Herceg Novi, Yugoslavia | International Forum on UDC and Indexing Languages | June 28-July 1, 1971 |

The committee has continued with essentially the same structure and membership until January 1, 1970, when Robert Freeman, chairman of the U.S. National Committee for UDC, became chairman of FID/CCC-M. In September 1973, Rigby was appointed by FID/CCC as Rapporteur for FID/CCC-M. In April 1974 J.-P. Sydler of ETH, Zurich, was appointed chairman of a newly revitalized committee, with the secretariat at the ETHZ Library, Leonhardstrasse 33, CH-8006, Zurich, Switzerland.

b) Purpose

The purpose of the FID/CCC-M subcommittee has been:

(1) to provide a forum for the exchange of ideas and information concerning use of machines or computers of all kinds in connection with UDC development, control, publication, or application;

(2) to advise the CCC and the FID Secretariat about developments in this area, and how such developments might affect or be affected by UDC extensions, corrections, publications, or other changes;

(3) to work with other FID study committees such as FID/CR (Classification Research), FID/OM (Operational Machine Methods), FID/TM (Theory and Methods of Systems), FID/DC (Developing Countries), and FID/SRC (Subject Field Reference Code Working Group) in setting up and carrying on seminars or open forums to demonstrate new techniques, and to advance the state-of-art through research and development projects, discussions, papers, and published proceedings which will disseminate new ideas throughout the world-wide community.

c) Accomplishments

The original joint FID/CCC and FID/MSR Committee on Mechanization of UDC, and its 1969 successor, the FID/CCC-M, have held annual meetings since the 29th FID Congress in Stockholm in 1963. At most meetings an open session of at least half a day was held to permit feedback from those who were interested in the subject but not members of the committee. Closed sessions have also been held in connection with FID/CCC meetings. Brief reports on activities in various countries have been issued periodically.

The most significant accomplishments of the committee, however, have been the sponsorship, in collaboration with FID/CR and FID/OM, of the Copenhagen Seminar (1968) and the Frankfurt Seminar (1970) on Machine Retrieval with UDC, and the joint editing (with FID/CR) of the publication of the Proceedings of the Copenhagen Seminar (pub. 1969) and the Frankfurt Seminar (pub. 1971) in the FID/CR series.

Finally, the FID/CCC-M proposed and participated in an open forum at the 35th FID Congress at Buenos Aires in September 1970, and helped in a "Seminar on UDC in Relation to Other Indexing Languages" at Herceg Novi, Yugoslavia, June 28-July 1, 1971. Proceedings of all of these symposia have been published in one or more languages.

## Applications of Machines to UDC Control and Use

Once it had been demonstrated that the problems of UDC manipulation by tabulators or computers were no more formidable than the problems involved in any other area of machine application if variable length fields are predicated, the next questions to be solved were (1) what specific UDC applications might lend themselves to machine processing [illegible]omics is not a factor, and (2) what are the technol[illegible]l and economic factors that would make such machine appli[illegible]ns more or less practicable under varying circumstances of data base size or complexity, language complexity, or sophistication of indexing or searching.

Already by 1964 seven different applications had been envisioned and experimentally demonstrated as feasible even if not economically justifiable (Rigby 1964b). These applications ranged from thesauri or vocabulary control, using the UDC as a link, and control and display of UDC schedules in one or more languages, to listing of titles of articles or abstracts, preparation of bibliographies and indexes, and finally to selective dissemination systems. Since 1964, several other applications, such as to on-line interactive computer systems, or subject-switching of citations or data among segments of a national or international network, have been suggested and demonstrated to some degree. Further applications will undoubtedly evolve in the coming decade.

In this section the various applications will be discussed according to the type or sub-type as follows:

(1) UDC schedule maintenance and display
(2) Index preparation
(3) Vocabulary, language, or thesaurus control
(4) File maintenance, control, and display for bibliographic citations or abstracts
(5) Selective Dissemination of Information (SDI) systems
(6) On-line interactive retrieval systems
(7) Libraries and library systems
(8) Network switching--national or international
(9) Data or inventory control systems

### UDC Schedule Maintenance and Display

Preparation of UDC schedules for any purpose--whether it be for actual use internationally, nationally, or institutionally, for discussion by study committees and ultimately for presentation to the FID/CCC and Secretariat for issuance as a P-Note and in Extensions and Corrections--is an arduous

task, involving numerous drafts and many revisions. To be accurate, presentable, and systematic, every character must be in exactly the right place in every draft.

This is obviously an operation most logically performed by automatic data processing (ADP) equipment, for the difficult part--i.e., getting the right character in the right place every time--need only be done once with corrections, additions, or changes keyboarded for each subsequent draft. Punched-cards are still one of the best forms of input, for corrections may easily be made by hand at any stage. However, paper or magnetic tape systems (Forster, MT/ST, and others) are now capable of giving good results for those having access to consoles tied in with various editing programs for correction and display in any desired format.

The first attempts at schedule maintenance and display were reported in 1963 by Dan Fink for the ABC Code (Fink, 1964), and by Malcolm Rigby for the meteorology (UDC class 551.5) schedules in English, French, and German for class 55 in up to 13 languages. Both demonstrations used IBM 1401 equipment--at that time the most advanced available for printout, with suppression of repetitive data elements, and for proper formatting--eventually with bold-face for selected headings (Rigby, 1966).

Later, in 1967, Robert Freeman put almost all the English schedules for class 5 in a file that could be displayed either in total or in any selected part on a console or, if desired, in printed form and with almost any type-font (Freeman and Atherton, 1968d). By 1970, the FID Secretariat was key punching new extensions and corrections or P-Notes (on DURA Mach X for input and output) as a routine operation. But the original machine operation envisioned in 1962 by Dake Bull as three-language (English, French, and German) control and by Rigby as control of at least one language at a time, of all FID/UDC files, has not, for economic, personnel, and technical reasons, been achieved. The technical problem is tied in with the fact that none of the official schedules is complete in all three languages.

## Index Preparation

a) Index preparation to UDC editions

Freeman and Atherton (1968d) and others have shown that a crude but useful index or basis for an index to UDC schedules can be prepared automatically by using the Keyword in Context (KWIC), Keyword out of Context (KWOC), or

KWIC/KWOC program modified by tagging keywords to be listed. Rigby (1961) and Karl Fill (1967 and 1969a) demonstrated that this method would give an almost perfect index to a UDC schedule or even a whole edition (such as the German Standard Edition) if modified to allow for (1) hierarchical omission of higher level terms in context of schedules such as annual variations (in temperature) or (in meteorology), and (2) for grammatical changes that occur when a term is taken out of context, as in German when the case endings change if an article or other modifier is added or omitted. Both Fill and Rigby found that these modifications do not present a real problem if the keypuncher or input copy editor is familiar with the language and the subject involved. Most such changes are systematic so that tagging or editing is almost automatic.

b) Indexes to abstracting, or indexing periodicals or book catalogs

The UNIDEK system was designed to list titles of journal articles or other bibliographic references such as in Meteorological and Geoastrophysical Titles or NODC Accessions. Russell and Freeman (1967) modified it to prepare an index to a year's issues of Geo-Science Abstracts, all classified by UDC. Vicentini and Oliveira (1970) made further application to a Bibliography of Botany for Brazil. A similar system was used by Herner and Company (U.S. Department of Commerce, ESSA--1969) in preparing one of the indexes of the combined library holdings in oceanography of the three major ESSA (now NOAA) libraries. Paldi (1970) modified the UNIDEK system, making it more flexible as to general arrangement of major sub-fields. In all of these systems it was necessary to have an introductory index, both alphabetical (with UDC numbers) and systematic (UDC arrangement) as a guide for the user who may not know the UDC by heart. The systematic list may be exhaustive or abridged. The alphabetic list may be more specific than the systematic. Both are easily generated on cards or magnetic tape from the master file that is used to provide headings throughout the body of the systematic listing of bibliographic information. If it is desired that only the important headings (i.e., not down to the last decimal place) be used in the "Contents" listing, then the headings that are desired need merely be tagged (as with an asterisk) to insure proper selection for listing.

## Vocabulary, Language, or Thesaurus Control

In past decades, punched cards, sorters, and tabulators provided efficient means for maintaining many kinds of alphabetical and numerical files such as mailing lists, telephone directories, author indexes, payrolls, inventories, gazetteers, or other place indexes. The fact that the names of people,

places, or things had variable lengths so they could not be confined to a fixed number of columns on one card or even to one card proved to be irrelevant when designing the system for punched card input and control, and even less relevant with growing use of paper or magnetic tape for input.

The main consideration governing use of or non-use of ADP equipment was shown to be the ease of control and updating, the size and complexity of the file, and the availability, sophistication, and cost of the equipment needed to make the use of machines economical--not the number of columns or key-strokes for either the alphabetic or the numerical data involved.

a) Vocabulary control

Starting with the above premises, the American Meteorological Society, Meteorological and Geoastrophysical Abstracts project, and the NWRE of the UKAEA simultaneously (in 1960-1) began using punched cards to create a file of subject-headings with equivalent UDC numbers, and a systematic file of UDC numbers with the subject-headings that fall under the respective classes and sub-classes.

The listing of 20,000 headings accumulated over more than ten years proved much more amenable to reversing (by UDC number), correcting, and updating for subsequent years (with printouts on either a tabulator or on a faster IBM 1401 computer) than the earlier two and one-half, five, and ten year cumulations compiled by hand and laboriously typed and corrected.

The U.S. ICAS Vocabulary (1966) was a later effort that proved the efficacy of computers for handling a similar but controlled and shorter listing of subject-headings chosen by a committee of a dozen government U.S. agency representatives interested in the environmental sciences. This listing was made with upper and lower case characters.

b) Language control

Several languages can easily be handled with the UDC numbers as tagging devices. The only problem is the need for a variety of special characters to achieve high quality printout for German, Polish, Czech, Yugoslav, Hungarian, French, Spanish, Portuguese, Scandinavian languages, etc., and even more important, to have the cyrillic characters on a print chain if Russian is to be handled. Easier scanning can be obtained by indenting each subsequent language term two, three, or five spaces rather than listing in tabular form as is customary.

c) Thesaurus control

A pioneer attempt was made during the preparation of the TEST (engineering) thesaurus to relate subjects through a double reversal (i.e., language term -- UDC -- language term) relating each term in the first reversal to its "relatives" in A/Z order. The result proved bulky and in some cases nonsensical because the programmer did not thoroughly understand the nature of the UDC with respect to colon or other auxiliary "faceting." In most instances, however, a fairly useful A/Z thesaurus with related, broader and narrower terms was obtained. The experimental computer run was used in revising TEST but never reproduced for distribution. Further tests of the efficacy of TEST/UDC thesaurus possibilities have been made by Ohman and Wellisch.

## Titles or Abstract Control

If titles of articles could be automatically indexed by the KWIC (or KWOC) system using the IBM program designed by H. P. Luhn, or later modifications thereof, then it seemed logical that a meaningful supplement could be obtained to a KWIC or KWOC index by adding to the title the UDC numbers or groups assigned to a document and letting the computer list the relevant reference numbers after each successive UDC number from 0.00 .... to 0.999 .... Since all numerical data in a KWIC/KWOC program printout came together in one block after all A/Z terms, then it follows that a separate UDC index could be obtained with no further modifications of the KWIC or KWOC program, merely by tearing off the pages produced in numerical order after the last Z term or non-UDC numerical terms (such as dates or other quantitative numerical groups not having the UDC auxiliary designators).

The UDC auxiliaries themselves, however, if used in such listings, must be arranged in an acceptable UDC order, and in addition to the variable order in differing practical use, the UDC order is not the standard IBM or other computer listing order. Robert Freeman solved this problem in an ingeneous and acceptable manner by substituting for each different auxiliary notation (such as parentheses, quotation marks, colons, and hyphens) a capital letter A, B, C, D, ..., according to the order of listing desired for the particular system. The letters are very simple designators of order since letters, especially by themselves, are not authorized in numerical UDC strings.

Another solution (attempted by several European programmers) was to use numbers with special tags to indicate auxiliary ordering devices, or other programming instructions, not of concern to UDC users but in the ken of all programmers who have such problems every day.

Still another improvement on the original KWIC/KWOC idea of listing reference numbers was to list the complete title itself as well as the reference number, in order to provide easier reference and avoid time-consuming "lookup." This listing by title under UDC numbers also proved extremely valuable in detecting errors either in assigning UDC numbers or in keypunching or computer operations--in fact it obviated all proofing since serious errors would stand out in the UDC context.

A final improvement involved programming for better scanning--omitting repetitive number groups, inserting cards for major and even minor headings, bold-facing by double or even triple overtyping of the same line for major headings, and by line-spacing before each designated significant heading. These simple devices proved such a marked aid to browsing, scanning, proof reading, and mere presentability, when compared with earlier attempts (and even some more recent ones), that this UNIDEK concept of an index arranged by UDC was used in several subsequent systems; it was also used in further modifications to provide readable annual indexes to abstract journals and to listings of abstracts, or in bibliographic or in book-catalogs.

Ruth Paldi (1970), in Israel, modified the program further to allow double coding of UDC headings so an abstracting journal or a bibliography can be arranged by any desired major order or system even when the UDC coding is kept intact for arrangement within each major group.

## Selective Dissemination of Information (SDI) Systems

By 1963, SDI systems were becoming increasingly popular in most technologically advanced countries, although many problems arose in attempting to devise purely automatic selection of material to be disseminated from users' profiles in such systems. Because alphabetic lists of terms or subject headings proved to be inefficient for the user to describe his fields of interest for SDI, those familiar with the major classification systems or other means (such as thesauri) of broadening or narrowing the scope of descriptive terminology to provide the proper balance between inclusiveness and exclusiveness, or relevance and recall, naturally looked to one or other of these approaches to solve all of their problems.

For small or medium-sized systems (2,000-20,000 documents and 500-5,000 terms) in mono-lingual countries (Rigby 1972 a,b), the thesaurus approach seemed the most efficient. The thesaurus, however, must be compiled at great effort and expense before the SDI system can be operational; even then it must be constantly expanded, since a thesaurus is a static and inhospitable tool, no one can visualize all of the fields of interest that will occur in any dynamic system, and every change affects the whole net (or spider-web) of the thesaurus. On the positive side, the thesaurus is more direct and its use more simple than a classed system.

Here, however, we are more concerned with that other large group of users who have either multilingual problems, problems of scale, or systems that are so dynamic that the thesaurus approach soon breaks down for inability to update or expand fields of interest fast enough. In these cases the use of a classification system already in existence in several languages, hospitable to all fields of knowledge, specific enough to identify narrow fields of interest but general enough to bracket broader fields of interest than some might desire, and machineable, provides the best solution. Such systems must have A/Z indexes in the working languages available for the user, and may be used in conjunction with a vocabulary--i.e., the user might select certain categories and natural language terms or subject headings, (SH's), or certain categories excluding natural language. Finally the inclusion or exclusion of references specified by SH's may be done by hand in the usual process of editing the references that have been automatically selected so as to get more relevance (and fewer complaints).

A SDI system along the above lines was designed operationally for the Deutsches Hydrographisches Institut (DHI) in Hamburg by Fritz Model, for the National Oceanographic Data Center (NODC) in Washington, D.C. (Freeman, 1964a), and for the Atomics Weapons Research Agency of the UK (AWRE) (Corbett, 1968). Mercier (1972) in Canada also designed a sophisticated computerized SDI System and Vicentini (1972) in Brazil developed one for the field of law.

The DHI System became operational; it used abridged UDC numbers for the basic selection and even further abridged UDC numbers for related fields, giving two-dimensional coordination and making use of sorting machines and tabulators for manipulation.

The NODC system provided for use of unabridged UDC numbers and auxiliaries of place, etc., but the system was never made operational. It was designed for any computer in use in the late 1960's.

The main thing that these experimental or operational systems demonstrated was the feasibility of using UDC for SDI systems. Products showed a high degree of relevance with a minimum of human intervention (editing). Finally the experiments suggested the further extension of the concept into the just-emerging (in 1967) field of On-Line Interactive Retrieval Systems.

## On-Line Interactive Retrieval Systems

A further application of computers to retrieval of bibliographic references using UDC as the means of selecting material on specific or general subjects (or places), not envisioned in 1963, has been demonstrated as a by-product of the AIP/UDC project (1967/8)--namely the use in on-line interactive retrieval systems (Freeman and Atherton, 1968 b,c).

Numerous systems have been devised where controlled vocabularies are the means of entry. The look-up tables as well as the bibliographic references are on-line and can be queried by the user at the console.

If words can be put into such a system, so can groups of numbers and even their definitions. By requesting material on a given UDC number or series of groups of numbers, one can call forth identification numbers or even the entire citation for any document in the system to which such numbers have been assigned. The experiments proved statistically that in the fields covered (nuclear science and oceanography), retrieval by UDC was as effective with respect to relevance and recall as was retrieval with the use of the Nuclear Science Thesaurus. Sometimes one approach gave slightly better results and sometimes the other. A combination of the two (UDC and natural language) gave even better retrieval. Actually, the user is guided by the system to sharpen his retrieval through helpful suggestions built into the files and controls.

Familiarity with the UDC and depth or specificity of indexing are two major criteria in effectiveness of the system. As in any computerized system, cost is a major consideration toward operational feasibility.

## Libraries and Library Systems

Probably the most widespread use of UDC with ADP equipment will be--if it is not already--the use for subject retrieval or control in large, complex, automated, library or abstracting

and Indexing systems. Examples of such systems with UDC as one, if not the only, means of subject identification is the French GIBUS system still under development, the Swiss Technical University Library (ETH, Zurich), and many national bibliographies now becoming automated along MARC or BNB (British National Bibliography) lines.

The Library of Congress MARC system is, of course, hospitable to UDC coding just as it is to DDC, LCC, or subject headings of any desired system. The code for UDC is in the MARC manual. How many countries or libraries will use MARC with UDC entries will ultimately be determined by the number using UDC--a matter of hundreds, for it has been proven repeatedly that no system need drop UDC because of problems involved in mechanization. A Scandinavian study has concluded, in fact, that the UDC is the best system adapted to library or document mechanization and the ASLIB-Cranfield study, made for UNISIST, concluded that it is the "least objectionable" of the retrieval systems studied (Mölgaard-Hansen, 1968).

## Network Switching--National or International

The Scandinavian and the ASLIB-Cranfield studies concluded that no existing system is any better suited to retrieval or switching on world-wide networks for document or library purposes than is the UDC. This did not, however, guarantee adoption of the UDC for these purposes. Attempts to modify the UDC for general categories led to attempts to develop an SRC code independent of UDC. Neither approach has yet borne fruit but the result of future developments will not alter the conclusion that the UDC can be adapted to world-wide switching, either by discipline or for the universe of science and technology--where UDC is best developed.

As a start, the computerized Guide to World A&I Services being actively built up by the FID and US-nfais has the UDC, as well as subject indexing terms, in English as alternative forms of entry or indexing for the automated data base as well as for the proposed Guide to be published in 1975. This effort is endorsed by UNISIST and partially financed by UNESCO.

## Data or Inventory Control Systems

While bibliographic control naturally poses a challenge for the use of computers, data control can be developed more logically because of the much greater mass of data (raw data files) and the fact that most massive data files are already in machineable form.

One of the most difficult problems in data control is the identification of data by subject, form, place, etc. Large data bases must be categorized if control by subject matter is to be effective.

If a world-wide system for categorizing subject matter in data files is to be effective it must be simple, universal in notation, and hospitable to any or all subjects at any level of generality or specificity. Thus the UDC suggested itself to the World Meteorological Organization as a means of subject-coding material in a world-wide inventory being developed in the past five years. At the suggestion of advisors from the U.K. and USSR the LDC or Local Decimal Classification system was devised, based on the UDC but slightly abridged to shorten the subject code groups.

One of the features of the LDC system is that the same coding can identify subject material in documents or libraries as well as in data files--whether such data are in computerized form, in card-files, or in raw manuscript data files--for the user does not always care what form the data are in but merely what data are available in any form on a given subject or geographic area. Of course the "form" is also coded, either by UDC or other code, so the user can easily determine the form (or other parameters).

The problem of data control using UDC is that most other identifying information can be in fixed fields: if one tries to confine subject coding to fixed fields one loses the capability of the codes becoming more specific as new subject areas expand or the volume of material increases. Counterbalancing this difficulty is the fact that while the data itself must be inputted and stored on millions of cards or their equivalent in tape, a few thousand cards devoted to inventory is only a modest tithe for the benefit of obtaining greater effectiveness in use of the masses of data. Furthermore, personnel engaged in data control are used to complicated codes and specifications and programs required for such data handling so the job of inventory control by this method would not be as staggering as it would be for library personnel unfamiliar with massive data control routines.

## PART II - DESCRIPTION OF INDIVIDUAL PROJECTS AND SYSTEMS
### Table of Systems Described

BELGIUM--1

## Automatic compilation of catalogues and on-line retrieval in the Quetelet library

C. de Saedeleer

The library of the Ministry of Economic Affairs of Belgium (Quetelet library) possesses approximately 600,000 volumes and 6,500 periodicals on economics, sociology, law, statistics and applied sciences; it is open to civil servants, students, professors, etc.

The integrated automation started at the end of 1972 and was practically completed by the end of 1974. The lending service is on a real-time basis. The computer provides for subscription renewals and checks the arrival on time of all issues. It prints the order forms of the Acquisition Department and sticks closely to the administrative processing. It also provides for the transfer of the entries for processed acquisitions from the acquisition file to the bibliographic file.

These realizations are made technically possible thanks to a computer centre, set up in 1972, in the Belgian Ministry of Economic Affairs. At the beginning of 1975 this centre possessed an IBM 370-158 for time-sharing.

Automation of the UDC started in Auguet 1973 and became operational in early 1974. By the end of the year more than 60,000 entries for books and articles (all acquisitions from 1969 onwards) were in the computer, thus making possible the following:

1) Acquisition lists - bimonthly, UDC-classified, computer printouts suitable for photocopying or photo-offsetting

2) Cumulative catalogues on microfiches - author, KWIT (keyword in title), and UDC - according to the COM system - replacing the traditional card catalogues. The UDC catalogue is subdivided first geographically, and only secondly by subject. Literature retrieval is done with the aid of special microfiche readers and an automatic selector system.

3) On-line retrieval (SDI and retrospective searches) utilizes the IBM system STAIRS, permitting searches by author, title-word(s), UDC-code(s) or combinations of these.

BELGIUM--2

As technical basis, various PL/I programs were required for the following conversions:

1) Common processing techniques for STAIRS and catalogues
   a. provision for blanks in appropriate places (for the computer a word is "what stands between two blanks")
   b. uniform notation of country codes e.g. avoidance of the use of (51) alongside (510) for China
   c. insertion of a full stop after / if forgotten

2) Conversions for catalogue and acquisition list
   a. Uniform method of writing entries which use both numerical and alphabetical signs (e.g. biographies)
   b. descriptor combinations: every descriptor consists of a subject code and country code, whose numbers a program must analyse and combine
   c. modification of the computer sorting order in line with the UDC ordering rules

3) Conversions for STAIRS
   a. as for 2.a, but with different optics
   b. identification of (UDC) auxiliaries for persons, to permit retrieval as independent descriptors
   c. explosion program: UDC sequential numbers like 355/388.9 are split up and replaced in the program by 385, 386, 387, 388, 388.9
   d. replacement of special UDC symbols by letters. Signs like ( ), -, ' and = are rejected by STAIRS and are therefore replaced by letters.

These programs, already operational for a year, are giving full satisfaction. More information can be found in: G. de Saedeleer "Principes de base pour le traitement de la CDU. Application au Fonds Quetelet". Bruxelles, Ministère des Affaires Economiques, 1974.

BRAZIL--1

## Brazilian Bibliography of Botany: UNIDEK Index

Brazilian Institute of Bibliography and Documentation (IBBD) (Rio de Janeiro)

A pioneer project for Brazil was carried out in 1968-9 under the direction of Abner L. C. Vicentini, a member of FID/CCC, and Elvia de Andrade Oliveira of the IBBD, using the Brazilian Bibliography of Botany as the data base and the UNIDEK system for the general program (Rigby 1961 and Russell and Freeman 1965).

The work was done on an IBM 1620-II computer at the Centro Brasileiro de Pesquisas Fisicas (Brazilian Center for Physical Research), using COBOL language. Two punched-card decks were maintained--one for the headings (UDC numbers and Portuguese or, in the case of biological species, Latin equivalents) and one for the titles of the articles in the data bank. The UNIDEK (UDC arranged) index with titles and reference numbers, the systematic index of headings used, the alphabetic index of subjects, species, and places, and the bibliography, arranged by sequence number giving authors, title, source, or periodical and UDC numbers, are all illustrated along with flow diagrams for the entire system and a description of the system and its history in a report (in Portuguese) by Vicentini and Oliveira (1970).

A botanical (or zoological) bibliography was a natural subject for such an experiment since the hierarchical nature of biology (taxonomy) and the familiarity of biologists with hierarchical indexing would greatly enhance the practical value of such a system of indexing.

BRAZIL--2

Mechanized Legislative Reference Retrieval System--Project LEMME

Abner L. C. Vicentini et al., Brazilian Ministry of Mines and Energy, Documentation and Information Division (Brasilia, D.F.)

An experimental project for use of computers for processing bibliographic information in botanical science, using the UDC as one of the arrangement or selection criteria, has been outlined by Abner Vicentini (BMME, Brazilia). The UNIDEK system developed in 1961-4 for Meteorological and Geoastrophysical Titles, and used in 1964-6 by Martin Russell for Geo-Science Abstracts, was the approach used for this project.

In 1970, Vicentini, with assistance from IBM experts, developed an operational system along the UNIDEK lines for a legal documentation collection of the Brazilian Ministry of Mines and Energy using the acronym LEMME (Legislative Reference for the Ministry of Mines and Energy) (Vicentini, 1972).

The data are processed on an IBM/360-20 using assembler language. Seven card-types are punched for input, and as several cards may be used for any card type, the system is open-ended in such matters as length and number of UDC numbers or descriptors and length of abstract ("synthesis"). Control and cross-referencing capability is also built in.

Three types of listing (or indexes) may be printed out:

(1) chronological (or sequential) index

(2) KWIC index (rotation of keywords or phrases in "synthesis")

(3) UDC index (for legal categories).

The system is described in detail, flow-charts and examples are included, and card-layouts specified.

BRAZIL--3

## SIPLAN: Information System for the Brazilian Ministry of the Interior

Brazil, Ministry of Interior, Coordinator of Information Documentation and Library Unit (Brasilia, D.F.)

In 1972, the Brazilian Ministry of Interior (MINTER), established in 1967, developed a plan for a computerized information system called SIPLAN, with a subsystem for collection, analysis, storage, retrieval, and dissemination of documents or bibliographic references thereto. This program was comparable to other similar systems, but used the UDC as the language for subject retrieval in an automated mode to serve the regional branches as well as the central unit.

The system, not yet operational early in 1973 (Angela Maria Crespo Queiroz Neves et al., 1973) comprises (1) a cumulative union catalog for MINTER and each participant of SIPLAN, (2) automatic retrieval by means of UDC, (3) possible development of an SDI system, (4) technical support for a network of regional libraries in various parts of the country, and (5) development of a MINTER thesaurus. Of course, alphabetical and numerical indexes to the UDC schedules are part of the plan.

Catalogs and bibliographies that may be generated from the automated data base for the union catalog of MINTER, or for the participating regional libraries, are: (1) systematic (UDC) catalog with up to seven or more compound UDC groups per document, (2) alphabetic list of serials, (3) alphabetic author catalog with titles and UDC numbers, and (4) alphabetic title catalog with authors and UDC numbers.

The organization and operations as well as examples of the above computer produced catalogs (listings) are presented in the Report by Neves et al. (1973).

BRAZIL--4

## Automation of Indexes to the UDC Schedules

Brazilian Institute of Bibliography and Documentation (IBBD)--
Elvia de Andrade Oliveira (Rio de Janeiro)

A comprehensive plan based on a thorough study of previous efforts and advice from international authorities on the UDC schedules and mechanization thereof is presented in a report (Oliveira 1973) intended for obtaining a Master degree in Librarianship and Documentation at the Federal University of Rio de Janeiro. Results could also be extended to other language editions, such as Spanish, in use in Brazil and neighboring Latin American countries.

The equipment used, sources of schedules and programs, results, and possible applications are set forth in the text. Examples of editing procedures which allow terms taken out of hierarchical context of the UDC to be meaningful in the A/Z index, and of resulting computer-produced A/Z indexes in the areas of social sciences (UDC Class 3), physics (53), and home economics (64), as well as the UDC tables themselves for these classes, are presented in the appendices. In addition, the status of the different sections of Portuguese full and medium editions as of 1973 is shown in a detailed table.

Three levels of sophistication were represented by three programs generated over the course of the developments: ELVCDU1, ELVCDU2, and ELVCDU3. The first program was a semi-automatic system for preliminary listing and editing of the tables, the second was a completely automatic system to allow formatting or editing at a low level, and the third was a highly responsive system that produces printable schedules as desired.

Programs were written in SPS-II and SNOBOL-III for an IBM-II computer. PL/I language was used for analysis, editing, and processing the programs. Job Control language of the OS/VS1 operational system with a SORT/MERGE program for an IBM/370 Model 145 computer was also used.

CANADA--1

## Computerized UDC-Based Special Library: Boreal Institute, University of Alberta

D. M. Heaps et al. (Department of Computing Science, University of Alberta, Edmonton)

Beginning in 1967, Prof. D. M. Heaps, with help from systems analysts E. R. MacAllister and L. R. Pallister, undertook a pilot study aimed at automation of the Boreal Institute Library at Edmonton.

This special library consists of 4,000 books, over 5,000 documents, plus reports, serials, maps, etc. on the Arctic regions, especially the Canadian Arctic. Both the shelving of the books and the classed catalog are according to the UDC with supplementary use of the Scott Polar Research Institute geographical (place) numbers which are designated by an asterisk. In the catalog, cards are inserted for all cross-referenced entries. Access to the UDC headings may be either direct or by means of a divided subject/place reference file leading to the proper UDC numbers.

For computerizing, using the local IBM 360/67, two programs were developed, one for Subject Heading UDC cross referencing, and one for access to the records themselves (of the books or documents). The programs are written in Fortran, with direct access storage in disk. However, input and maintenance of the files are by 80-column punched card.

Two modes of access are available to the user--one the interactive search mode using the CP/CMS (Cambridge Monitor System), an on-line time-sharing system available locally, and the other a batch-processing mode which requires more precise specification of the search questions.

Searching may be by author, title, subject, or UDC numbers, or for subject or place by UDC number, or for UDC number by subject or place.

The system is entirely experimental and was intended as a feasibility study, but with further developments intended.

CANADA--2

## The Classification of Management Information through Computer Processing of Machine-Readable Data Bases

D. M. Heaps and Marcel Mercier (Department of Computing Science, University of Alberta, Edmonton)

Increased interest in systems for information storage and retrieval and proposals to combine such systems into networks have led researchers at the University of Alberta to investigate the classification of knowledge and the efficient manipulation of large data bases.

The project (1971-2) dealt with information on water resources management. Existing machine-readable data bases were examined for classification patterns in water resources literature. This information, in turn, will help develop criteria for appropriate classifications. The data bases consist of a water resource thesaurus, the Library of Congress MARC tapes, the UDC schedules, a document base with document surrogates and UDC classifications, and a specially prepared test data base of mixed format.

The Water Resources Thesaurus was used as the test vocabulary and was run against the other bases. The collection of document titles and the classification clumps that were produced from the various bases were compared, and judgments made on the appropriateness of various classifications for retrieval systems whose primary vocabulary would be similar to the thesaurus used.

The project involved investigation of the formats of the data tapes; internal coding of the classification tapes; development of efficient file structures for cross checking, word counting, and word and word-root comparisons; and testing of the results by users as well as indexers. Results obtained were intended for incorporation in an on-line storage and retrieval system for water resource management controlled by an on-line, classification-linked thesaurus. The National Research Council of Canada and the Canada Department of Energy, Mines, and Resources helped support the work.

DENMARK--1

## Computerized ABC--1965 Schedules

Dan Fink (Danish National Centre for Building Documentation, Copenhagen)

In 1963 Dan Fink, head of the Building Technology Center, Copenhagen, produced a very presentable prototype edition of the English Abridged Building Classification Code for 1965 (ABC--1965) using a tabulator and later an IBM 1401 computer with input from punched cards (Fink, 1964).

It was intended that the same punched card system could be used for the other 13 or 14 language editions or for multilingual editions of the ABC. A draft unabridged ABC English edition, typed and processed on Datica 410 LS equipment, was published in 1973. The final updated version is scheduled for publication in 1974. This new edition uses upper and lower case characters for minor headings and upper case for major headings.

In 1968, Fink experimented with the updating of an original data bank of abstracts using tape-typewriter input, and with retrieval of abstracts for bibliographies, working along independent lines. His "data bank" consisted of 450,000 abstracts in English, Danish, and other languages not all in machineable form--only a selection of the most useful references was used.

DENMARK--2

## UDC-Based Library Catalog

B. Barnholdt (Danish Technical University, Copenhagen)

In order to produce a four-part catalog of holdings of the library at the Dansk Tekniske Universitat, IBM developed the system and processed the records on punched cards. The aim was to provide a general purpose library catalog program with UDC.

The catalog contains a listing (index) in UDC array with no substitution of symbols or codes for the common UDC auxiliaries, but with no provision for quotes (" "), equal sign ( = ), or apostrophe ( ' ).

The system was designed for use on an IBM 7094/1401 at Northern Europe University Computing Center, Lyngby, Denmark, but could be adapted to other arrays such as IBM 360, using paper tape input with Fortran IV programming language. The system is described and illustrated in detail in an article by B. Barnholdt (1968). Work was begun in 1967.

**FRANCE--1**

GIBUS (Groupe Informatiste des Bibliothèques Universitaires et Spécialisées)

A number of university and special libraries and documentation centers in France have agreed to develop a mechanized information system that uses UDC as one of the data elements for file-ordering and retrieval (along with natural language terms).

The particular centers concerned with this joint effort are the Aix-Marseille Library, Grenoble University Science Library, National School of Mines Library, Halles Library, Lyon Municipal Library, CNRS--Humanities Documentation, CNRS--Section of Incunabula (ancient books), and the National Foundation of Political Science.

Comparison of a document or book collection with Library of Congress MARC and British National Bibliography (BNB) tapes leaves a residue of uncatalogued books or documents. These are entered in the catalog according to a specified format, which includes UDC numbers as one of two complementary modes of indexing. These two "analytical levels" are: (1) an "encyclopedic" analysis, using UDC for systematic classification at the level of the librarian; and (2) a "specialized" analysis, using the terminology of the engineering and power (energy) economics specialist.

The analyses consist of two steps: (1) the concepts which comprise the main subject or subjects of the work are encoded by UDC, using not over 15 characters for one group; and (2) a concordance, or table of UDC equivalents for natural language terms used, is developed.

The indexer has a cathode-ray terminal that permits him to interrogate the data bank of terms and equivalents already established, and to change, add, or suppress at will these terms at the time of indexing when the book is in hand and the idiom used in the work is fresh in mind. He can also examine the next and second higher order terms in the UDC hierarchy to see whether they are present and expressed idiomatically and, if not, he can add or adjust for the purpose of hierarchical searching.

UDC is used as an internal coding system in hierarchical form (for broad or narrow or related subject display and retrieval) but can be completely suppressed in search, display, or printout if desired. In other words, queries can be addressed entirely in natural language and conversion to and back from UDC can be purely automatic (hidden in

computer program) by means of the table of equivalents mentioned above. Semantic ambiguities are eliminated by interactive (conversational) feedback by or to the user.

The program is geared to the IBM 2260.

Two two-hour demonstrations of the above system were held each day, November 16-27, 1970, at the National Foundation of Political Science in Paris. The system was being tested operationally at the Grenoble University Science Library as of 1974.

## Bibliothèque des Halles (French National Library), Paris*

The Bibliothèque des Halles is scheduled to open for public service some time in 1975 with an automated catalog which can be used with consoles in an interactive mode. The UDC is used both as a coding mechanism for direct retrieval and also for vocabulary control.

The collection of about one million documents is "encyclopedic" in scope and concept, and is aimed at the informed public and the specialist who wishes to become informed in another or a peripheral discipline. Therefore an all-embracing hierarchical structure as well as a specialized thesaurus or lexicon is required. The UDC was selected for hierarchical indexing and for concordance among terms in the controlled vocabulary.

UDC groups are entered and searched as "keywords," i.e., without regard to any fixed order or grammar. Some ambiguities and "noise" are thus generated. These could be eliminated if a complex system of relators (such as Perreault's Relators) were introduced, but this would be costly and confusing to many users.

The library is completely mechanized, using optical text-readers and television screens as far as possible. As with Freeman and Atherton's experimental system, one can start with either the UDC or an alphabetically arranged vocabulary, or with a three-level thesaurus called forth on the cathode-ray screen if desired.

*not yet operational

FRANCE--3

The cumulative lexicon is being developed as both an aid to and a byproduct of the evolving system. To be of more general use for future indexing and retrieval, the concordance, based on actual terms found in indexing, is nevertheless independent of the indexing of particular documents. Furthermore, one keyword can relate to several index numbers, each of which in turn can relate to several keywords or synonyms. Therefore, the meaning of these terms if taken in hierarchical (i.e., UDC) context is quite precise.

Both interactive terminals and computer time are expected to be cheap enough to be readily available for potential users by the time the Library opens for business.

Bibliographie de la France--Grenoble University

UDC is used in French National Bibliography according to MARC system that has a tag for UDC.

CNRS, Paris, Centre de Documentation, Library. PASCAL System

UDC is used in automated library system with IBM 360.

Grenoble University, Project MONOCLE (1970- )

UDC is used in automated book catalog entitled Project MONOCLE (Mise en ordinateur d'une notice de catalogue de libres), starting in 1970 with MARC format using IBM 360/67 and 360/40.

Institut de Verre, Paris

UDC is used in parallel with a thesaurus (Thésaurus Verrier) in the field of glass industry.

GERMANY (Federal Republic)--1

## UDC in a Semi-Automated SDI Service

Fritz Model (Deutsches Hydrographisches Institut, Hamburg)

Fritz Model, one of the pioneers in the practical use of UDC, began in 1963 a semiautomated SDI service in the German Hydrographic Institute, using the UDC as a means of selecting and arranging abstract or bibliographic cards for distribution to subscribers.

A punched card (80-column) was designed to allow a maximum of information on a minimum of space. UDC numbers were abridged to eight digits, with main classes (two digits), detailed subject (four digits), and cross-reference field (two digits). About 4,000 cards per year are thus processed and available for sorting to produce bibliographies or special searches.

The project is still continuing. A total of 30,000 to 40,000 entries had been made up to 1970.

## Geophysical Bibliography of the North Sea and Baltic

Deutsches Hydrographisches Institut (Hamburg)

An exhaustive bibliography of reports and articles on the North Sea and Baltic from 1956 on has been compiled, and in 1963-5 automated for retrieval, listing, and publication. For each document four modes of access--UDC numbers, descriptors, geographic location, and citation index--were available.

Equipment used in 1965 was an IBM 1620 computer and an IBM 447 tabulator-printer. A file of punched cards comprising the meaning of the UDC numbers and keywords, and another file for the title (document number) and year, UDC numbers and descriptors, as well as geographic location, are maintained and cumulated. At most, four UDC numbers and 11 descriptors or keywords can be used. About 5,000 titles a year are handled in this manner. The citation file is tied to the number of the document, providing a check or reference to citations to documents or articles in the bibliography during the eight subsequent years (e.g., for a 1956 paper, the reference continues up to 1964, 1957 up to 1965, etc.).

GERMANY (Federal Republic)--2

German National Bibliography (Deutsche Bibliographie)

Zentralstelle für Maschinelle Dokumentation (Frankfurt)

The Zentralstelle für Maschinelle Dokumentation (ZMD) in Frankfurt am Main has, since January 1966, produced the German National Bibliography by computer. Entries are recorded on paper tape, and all of the indexes are produced therefrom. Keywords are selected manually, but experiments are being made on automatic selection of keywords from titles in machineable form.

The UDC is used as the classification system. As a byproduct the South African National Bibliography (SANB) has been able to employ the same system at Pretoria since 1968, even though they apply Dewey Decimal (DDC) numbers for classification, since rules for sorting and listing by Dewey Decimal coding are the same as for UDC.

The computers were IBM 1460 and IBM 1130 with off-line converters for paper to magnetic tape, and vice-versa, and a Linotron 505 for photo-setting.

Documentatio Geographica, Bad Godesberg

ZMD (Frankfurt)

One of the few operational systems using UDC with computers is used to compile the annual volumes of Documentatio Geographica produced by ZMD (Zentralstelle für Maschinelle Dokumentation in Frankfurt/AM) for the Institut für Landeskunde, Bad Godesberg, Germany, under the direction of Prof. Dr. E. Meynen. Work began with the 1966 yearbook.

The annual volumes include a bibliography volume (called Titelband) containing about 4,000 references to the world's periocical or serial literature in all fields of geography, and a Registerband or index volume, containing author, corporate author, descriptor, UDC regional, and UDC subject indexes.

Each volume consists of 300 or more pages with excellent typography, considering that the plates were made from computer printout. Beginning in 1968 all but the UDC index was done by lithograph (Linotron) with a great variety of typography to facilitate browsing or searching.

GERMANY (Federal Republic)--3

The entries in the bibliography (Titelband) are in approximate ascending **UDC order** beginning with general categories (bibliographies, documentation, conventions, research, serials, textbooks, history, etc.), continuing with scientific geography, physical geography, cultural geography, applied geography, maps, geodesy, cartography, etc., followed by oceans, Europe, Asia, Africa, North America, South America, Oceania, Australia, and the Arctic and Antarctic regions.

Within each category (with bold-face headings inserted) arrangement is by faceted UDC numbers so that all similar concepts or places are closely linked. Full bibliographic information is included and UDC indexing is to considerable "depth"--at times, eight or even ten groups appearing for one time.

The UDC index or Registerband, also arranged in ascending UDC order, with place auxiliaries following the main number array, refers to the item number in the bibliography (e.g., 66-0030). **The term** under which the item is sorted or indexed (e.g., 528.9) is given in KWOC form--that is, it is permuted or isolated from the other terms in the string of numbers and is followed by all of the terms in the order or string established by the classifier. This makes it possible to retrieve with greater precision.

The index is run on an IBM 1460 with a 1403/H printer. Careful and thorough instructions for input-output are elaborated in ZMD-A-21, Schneider and Koch, "The Use of the UDC in the Production of Mechanized Indexes," (English and German editions of ZMD-A-10, May 15, 1970). Both editions include sample pages of portions of the subject and place indexes.

GERMANY (Federal Republic)--4

DK-Handausgabe (German Medium Edition of UDC) Alphabetical Index

DNA (Deutscher Normenausschuss) and ZMD (Frankfurt)

Using a technique similar to that used in preparing a computerized index to the UDC Schedules in Meteorology (551.5) in 1962 (Rigby, 1964a), Dr. Karl Fill and associates, with the help of the Zentralstelle für Maschinelle Dokumentation (ZMD) (Klaus Schneider, director), prepared an elegant edition of the A/Z index to the 1967 German Medium Edition of UDC (DK-Handausgabe) with paper tape input, and printout on an IBM 1460 computer. The index was published early in 1968.

The process consisted of tagging the 43,000 keywords in the text of the systematic (hierarchical) tables, and adding, in parentheses, qualifying words to specify the general area where an ambiguous specific term would be valid for more than one given number, e.g., Erde (Astronomie) 525, Erde (Geographie) 913(100), Erde (Volkswirtschaft) 330.15. A few additional terms not explicit in the tables were also added.

The main criticism of the index was that a few very important high-order terms were neglected, as their absence from the expressed language of the text was overlooked. For instance, 669.1 deals with ferrous metals which subsumes iron and steel, but steel is not included under 669.1, or even under 669.14, where it is more specifically treated.

The index does, however, contain hundreds of useful terms which would not have been included if it had been prepared by conventional methods, and the entire process was sped up by an order of magnitude.

Another possible problem in the DK-Handausgabe arises from the fact that although all grammatical changes in spelling which occur in the German through taking words out of their original context have been handled adequately by the keypunchers, umlauts (ä, ö, and ü) are treated in the simple form, as if the umlaut were not present. Another edition will not have this error in filing order, as the new chains have these umlauts as separate letters.

GERMANY (Federal Republic)--5

The user of the DK-Handausgabe, as published in 1968 by Beuth-Vertrieb, would not be able to tell, by the index's appearance, that it was a product of computer printout. A KWIC index of the text, on the other hand, though more speedily produced than the DK-Handausgabe, is far too ragged and annoying to use, and is wasteful of space. Furthermore, the meaningful context of a UDC table is just as often in the vertical as in the horizontal plane, and the KWIC program is not designed to embrace context at a higher or lower level of the hierarchy.

Allowing for the obvious omissions in the DK-Handausgabe index, it is notable that it was produced and published in good time, whereas the French Medium Edition index took eight years--even a less-than-perfect index is better than none at all.

Bibliography of Literature on Forest and Forest Products

Siegfried Schrader (German Federal Research Institute for Forestry and Forest Products [Bundesforschungsanstalt fur Forst- und Holzwirtschaft], Reinbek)

Beginning with the 1969 volume of the Bibliography of Literature on Forestry and Forest Products, the compilation of the quarterly and cumulative annual issues was done by EDP at the Documentation Center, with cooperation of the Department of Non-Numerical Processes of the DRZ (Deutsches Rechenzentrum) at Darmstadt, using IBM 7094 and IR 440 computers and FORTRAN II and IV language. The classification system used was the Oxford Decimal breakdown (ODC) of UDC 634.0 (forestry).

Information was first edited and punched on paper tape, later converted to magnetic tape. Listing by means of a 120-character chain was by UDC sequence, and subject or geographical indexes were listed by UDC in the KWOC format. Author indexes were also compiled. All four parts are printed with upper and lower case characters and cumulated annually on IBM 1401.

GERMANY (Federal Republic)--6

Before SDI or retrieval services are provided, there must be a thesaurus with UDC equivalents. This is now being compiled in collaboration with the Commonwealth Forestry Bureau at Oxford, which issues Forestry Abstracts.

Examples of high-speed computer printouts of the various indexes are presented in the published report (Schrader, 1971). Problems and advantages of adapting the ODC breakdown to UDC practice are also reviewed in this article. For example, only the /, :, ( ), --, -, and . auxiliaries are used with ODC; thus simplifying computer sorting and listing. Also the 634.0 (forestry as a whole) is omitted.

## Accessions to the Library of the Deutscher Wetterdienst

Deutscher Wetterdienst Bibliothek (Offenbach a/M)

Beginning in 1969, monthly and cumulative accessions to the German Weather Service Library in Offenbach am Main have been keyboarded and put on magnetic tape for storage and retrieval, using an in-house computer to provide service when required. The UDC is the main entry for subject and place retrieval. About 3,000 entries are recorded each year.

HUNGARY

Computer-Based System of Preparing Indexes to UDC Editions in Hungarian (1971- )

OMKDK (Országos Müszaki Konyvtár és Dokumentációs Központ) (Hungarian Central Technical Library and Documentation Centre), Budapest

Computer is being used to prepare indexes to Hungarian UDC editions and for handling, updating, and listing tables and references in Hungarian Full Edition of UDC (Scibor, 1972, p. 27).

Experimental Information Retrieval System in Electronics

OMKDK--Budapest (1971- )

System designed to provide indexes for Electronics (621.37/.38), abstracts and references using MINSK-22. Experiment comprised indexing 5,000 documents classified according to UDC (see p. 75, Scibor, 1972).

ISRAEL--1

## Computer-Produced Regional Bibliography--Eastern Mediterranean, Suez Canal, and Red Sea

Ruth Paldi (Sea Fisheries Research Station, Haifa)

During 1968-9 Ruth Paldi, librarian of the Sea Fisheries Research Station, Haifa, produced a completely automatic, multi-access bibliography of about 800 records on an IBM 360/20. The program was prepared by the staff of IBM, Israel (Paldi, 1970).

The bibliography is divided into three main books--one for each of the three regions. Within each, references are arranged by the UDC according to 30 main categories, which in turn are subdivided into 26 or more sub-categories by the use of one or two letters (A - Z). The system further extends the UNIDEK system, as used in Meteorological and Geoastrophysical Titles and NODC Titles, by supplementing the headings and their UDC equivalents with two-digit and one- or two-letter codes for more flexible and automatic arrangement and insertion of headings. In the NODC Titles, the headings were arranged solely by the natural UDC filing order--in the Paldi bibliography by the equivalent codes or by common indices.

The advantage of the Paldi system is that assignments of codes to articles or references can be made either by use of UDC numbers or the common indices, and the alternative numbers or indices will then be automatically assigned by the computer. The headings will also be automatically inserted in their proper place so that the index, the natural language subject heading, and the equivalent UDC number can be printed out at the head of each section or sub-section.

This system can take care of the need for greater flexibility in the arrangement of bibliography, accessions list, or abstract/index journal, since (1) the common indices are arbitrary and can thus be ordered in any desired way or to any degree of specificity in any subject area; (2) they can be altered at will, i.e., every edition, every year, or every five years, as concepts or scope changes warrant, yet the UDC assignments can remain as stable as desired; and (3) the system will work for any language, alphabet, subject field, or volume of material. The headings, however, must be selected--either by an intellectual process or by some statistical process based on literary warrant or logic or whim.

ISRAEL--2

Other indexes in the bibliography include: subject, chronological, geographical, author, periodical, article number, and concept and key-word. Auxiliary listings include: list of main categories, list of detailed categories, Marsden square list, alphabetical place-name list, and a Marsden square chart of the area included in the bibliography.

The KWIC indexes used in the UNIDEK system are replaced by a concept and key-word index which is intellectually produced. In this respect, the Paldi system is not as automatic as the UNIDEK. However, it is a great practical improvement over the completely automatic arrangement according to UDC which may separate chemistry and chemical engineering, or geodesy and geophysics, for example.

The citations are identified by a unique chronological-sequential code (1883-1968) which uses three numbers for the years (968=1968) and four for the article. e.g., (968-0790). Cross-referencing to multiple areas & multiple subjects is an added feature of the system.

It is hoped that the work can continue, both in the same areas and for other areas of the Mediterranean. Some 150,000 references are involved, of which 2,000 had been processed by 1970.

The system is open-ended; enough elbow room is left in the codes to allow many other subjects, areas, and larger numbers of documents.

Desalination Abstracts (1968- )

Center of Scientific and Technical Information

Computerized system for preparing subject, author, and patent number indexes to abstracts--about 500 per year; with UDC as subject indexing system.

ITALY--1

## Legal Mechanized Retrieval Experiments

Center for Documentation and Automation (Milan University)

Angelo Gallizia and collaborators at the Center for Documentation and Automation, Milan University, carried on, in 1962-3, a detailed experiment and evaluation of the UDC and natural index terms in the field of law, using electronic computers. Work has continued since that date. The UDC was chosen because of the difficulty of translating thesauri into other languages, and the ease of manipulation of digits in machine systems.

Results of the early tests were reported by Gallizia and associates (1963). Statistical results of the evaluations and comparisons are given, as well as details of the program.

Reports on further work under the sponsorship of the UGO Bordoni Foundation, Rome, including placing 6,000 words (index terms) in machineable form in Italian for the Fachausgabe Elektrotechnik (FID 324, 1960), as well as on other studies, were made at the NATO Advanced Institute on Information Retrieval Systems held in The Hague, July 12-13, 1965 (Gallizia and Bardone, 1969).

## Water Research Institute Documentation System

Istituto di Ricerca Sulle Acque, Ufficio Documentazione e Diffusione (Rome)

Since 1968, the Water Research Institute's Office of Documentation and Distribution in Rome, with the help of the staff from their sections in Bari and Milan, have been developing a data base for automated retrieval service, intended to be operational by 1975. The collection of reports on microfilm, books and monographs, articles and abstracts or summaries of periodical literature totalled 100,000 in 1971 and was forecast to total 725,000 by 1975. By 1971, a total of 4,000 had been classified by UDC and by 1975 it was estimated that all 725,000 would be included.

NETHERLANDS--1

## The Integrated Library Administration and Cataloguing System (ILACS)

M. I. Dreese (Library, Unilever, N. V., Rotterdam)

Mechanization of library and documentation work began in 1965, using 80-column punched cards and an IBM 1401. Since 1969 ILACS has used an IBM 360/40 and in 1971 a 360/50 became available. Paper tape has replaced punched cards, using a MOHAWK console to convert to magnetic tape. Programs are in COBOL language. A direct-access disk file is maintained.

Overall and special lists are provided by authors' names, keywords, UDC numbers (specific), or classes corresponding to users' profiles in a SDI system.

Broad classification (limited to one code group of not over six digits) with only 1,500 classes; narrower (more specific) classification to a depth of 2.5 code groups and 10,000 classes referring to the document as a whole (for a systematic union catalog); and a most detailed (20,000 classes) analysis for information retrieval by the Unilever Information Centre are provided in the system.

Combined numbers cannot be reversed but can be truncated in search or retrieval.

Input is punched without a coding sheet, and the system is open-ended so it can be used for information retrieval in a batch-processing or in a real-time or interactive mode.

Format allows for a maximum of four UDC groups of 19 figures each.

Filing order of auxiliaries is slightly different from the generally recommended UDC practice [ / , plain number, ( ), " ", =, .0, _, :, A/Z, a decimal subdivision ] . Plus and apostrophe are not used.

Development of this system began in November 1965 and cost, through 1970, 350,000 fl with another 70,000 fl budgeted for on-line automation in a time-sharing system. Output costs are estimated at .10 fl per printed title and 90,000 fl for central library catalogs and lists (Dreese, 1971).

NETHERLANDS--2

Bronswerk UDC/QUIC System (BUQ) for Selective Dissemination and Retrieval

Central Information Department (Bronswerk-Amersfoort)

The CIA (Centrale Informatie Afdeling) of Bronswerk, N.V., one of seven divisions of VMF/Stork Werkspoor's Group of Companies (with 25,000 employees) has, since 1961, provided selective dissemination or alerting and other bibliographic services for the entire company, which manufactures air conditioning, heating, and air pollution control equipment (van Halm, 1972).

The multi-disciplinary nature of the company's operations requires a ready-made and detailed thesaurus such as is provided by the full editions of the UDC. Since trade names and other non-predictable terms are of great importance in retrieval, a KWIC (QUIC) index and retrieval capability is of considerable value as compared with KWOC or other more restrictive (controlled) retrieval tools. The KWIC program also permits addition of UDC groups of numbers, for which 12-digit spaces can be allowed without altering the program.

The employees' stated "profile of interest" is presented to the CIA staff at the headquarters, where it is translated into UDC code for machine processing and is supplemented by the free terms that may occur in the titles (QUIC searches).

POLAND--1

## Polish Index to Scientific Publications

CIINTE (Central Institute for Scientific, Technical and Economic Information) (Now IINTE), Warsaw

A sample UDC sequenced abstract journal, with a UDC-ordered index to headings and subheadings, and an author index, dated 1968, has been developed by CIINTE (Centralny Instytut Informacji Naukowo-technicznej i Ekonomicznej, 1968).

The entire index was produced by IBM 1440, using an upper case chain. The headings are printed out and set apart to facilitate scanning. UDC numbers and authors are placed on separate lines if there are more than one of either. Printing is two columns to the page (four columns for author index).

In the "index to headings" the major headings are double spaced and underlined by computer, and the subheadings, with UDC equivalents, are listed without underlining or line-spacing.

The sample (cf. Appendix) shows good programming to make the most, from the user's point of view, of a fairly simple punched-card-fed computer. It could as easily be used on an IBM 1401.

Details of the system are set forth by Scibor (1971a), including its design, programs, punched-cards, formats, controls, documentation card, 39 steps in preparing the publication, output format, indexes, advantages and difficulties of the system, and publication details (5,000 abstracts published in 11 issues during 1968, or 600 per month). The system was designed by W. Pirog and T. Markowski of CIINTE, and several programmers from ZOWAR.

## APIN-WASC System

Library and Information Centre of the Technical University at Wroclaw

UDC is used in parallel with keywords and their own hierarchical classification scheme.

POLAND--2

PSIW (Pilotowy System Informacyjna--Wyszukiwawczy--Pilot Information System)

Main Library of the Technical University at Cracow

UDC is used in parallel with keywords and subject headings to test comparative efficiency--using a third generation computer--of these three types of indexing.

ITER: Farm Machinery Information System of Institute of Mechanization and Electrification of Agriculture, Warsaw

UDC used in parallel with a descriptor language based on a thesaurus in the field of farm machinery.. Two programmes for UDC--one for simple and one for complex UDC numbers--have been worked out.

SWITZERLAND--1

## Sulzer Literature Dissemination and Classification System (SULIS)

Sulzer Brothers, Ltd. (Winterthur)

The Sulzer Company has elaborated a detailed program for selective dissemination of abstracts and for automatic updating of technical library card catalogs, using the UDC as the criteria for selection and distribution among subscribers. The system was developed with the help of B. Stüdeli, manager of the Sulzer Brothers Technical Library, and became operational in March 1967.

The program was written by V. Hausherr in COMPASS language for a CDC 3300 computer (32 K words, 24 bits to the word). Equipment consists of a card reader, card punch, printer, and three magnetic tape units, an IBM sorter, and a Xerox copying machine.

The system and program, including a flow chart and samples of cards, are described in detail by A. M. Becker and others (1968a, b).

## Automated Swiss Technical Library Network and Thesaurus

J.-P. Sydler (Eidgenössische Technische Hochschule Bibliothek, Zurich)

With a long-range possibility of developing an automated library network covering several Swiss technical libraries such a ETHZ and ETHL (Lausanne), and the immediate objective of controlling the large and growing collection of 100,000 documents and 6,000 periodicals at ETHZ, Dr. J.-P. Sydler and colleagues Dr. Lutstorf and Dr. Sacchi have put the German UDC schedules (medium and full editions), and as much of the French and the English schedules as were available, together with the descriptors in these three languages, into tape format for searching the main data base of automated library catalog records.

SWITZERLAND--2

The three-language thesaurus contains (1) the basic medium and full editions in classes 5, 6, and 7, (2) other pertinent classes, such as the social sciences and humanities or geography, (3) a number of more detailed subdivisions used at ETHZ but not authorized by FID, and (4) official extensions and corrections authorized through 1972 (as of April 5-6, 1973). It is hoped that this thesaurus can be used throughout Switzerland where several languages are current, for querying a computerized network by UDC.

Problems encountered are incompleteness of three-language schedules at any level of specificity and non-systematic policy of subdivision among the various classes--i.e., some subdivide by direct hierarchical decimal extension and others by "faceting" or use of auxiliaries such as the colon to other fields or common auxiliaries, and some by all of these devices.

Printouts by means of a CDC 6600 computer have been obtained in UDC-subject and in A/Z-UDC order from magnetic tape storage of several hundred thousand entries. The work is proceeding rapidly and will be much more complete by the end of 1974.

UNION OF SOVIET SOCIALIST REPUBLICS--1

Local Decimal Classification (LDC) in Automated Literature and Data Documentation Service for Hydrometeorology

U.S.S.R. Hydrometeorological Data Centre (Obninsk)

Starting in 1969 or earlier, N. K. Kliukin and colleagues at the Hydrometeorological Data Centre in Obninsk, with help from V. B. Tikhonchev and Yu S. Chernov of the Leningrad Scientific and Technical Research Centre on Technical Information and G. A. Sereda of the Hydrometeorological Service, examined the problem of a machine retrieval system for hydrometeorological information and data in any form--books, published reports, journal articles, microfilm, patents, charts, graphs, printed data, tapes, punched cards, or raw observational data.

The UDC, which is the prescribed standard classification system for science and technology in the U.S.S.R., and is used by both VINITI (All Union Institute of Scientific and Technological Information) and the Hydrometeorological Service libraries all over the Soviet Union (as well as in Poland, Bulgaria, Romania, Czechoslovakia, Hungary, and Yugoslavia), was selected for retrieval by subject, place, form of record, and point-of-view. Other codes were devised for other information such as type of data, grid-points, or location of station. The UDC was abridged to save space on the punched cards by assigning the digits 0, 1, 3, and 4 to the four major categories included in the data base, i.e., practical meteorology (551.50), scientific meteorology (551.51/9), hydrology (556), and oceanography (551.46). All other fields are taken directly from the UDC tables provided by VINITI for geology, geophysics, and related sciences (FID #400).

This LDC (Local Decimal Classification) system does not change the official UDC numbers as used in other places, and the abridgements can be automatically converted back to standard UDC notation, either manually or by computer.

Automated Printout and Updating of UDC Schedules in Russian

GPNTB (State Public Scientific and Technical Library), Moscow

Computerized system designed for tables and Extensions and Corrections of Russian UDC editions.

UNITED KINGDOM--1

## Alphabetical Subject Index to the UDC (ASI)

Atomic Weapons Research Establishment (AWRE) Library (Aldermaston)

Beginning late in 1962, the AWRE Library at Aldermaston started placing their index to the UDC (ASI) on punched cards in order to make it more readily available to various departments of their library and to other division or associated libraries. Two or more punched cards were used for each entry where necessary. Lists were run on an IBM 1401 or 1460 computer after experiments on an IBM 42 tabulator proved too restrictive. A data base (list) of 4,000 entries on cards was initially punched. Additions at the rate of roughly 250 entries per quarter were used as a basis for a new, updated printout.

Problems encountered in handling auxiliaries were solved along lines suggested by Robert Freeman in 1964. Costs of punching, printout, and other associated costs are set forth in a 1964 article by Cayless and Ayres. Later extensions of the mechanization to a cataloging and ordering system (AMCOS) were described in 1967 in some detail by Ayres and others. Difficulties and advantages encountered in using UDC are summed up by Lindsay Corbett (1968).

## Aldermaston Mechanized Cataloguing and Ordering System (AMCOS)

AWRE (Aldermaston)

The AMCOS System, developed in 1967 and operational from January 1968, uses an IBM 870 Document Writing (card-typewriter) System, with the UDC for subject access according to the L.C. MARC format and BNB tape system. After the computer-produced catalog was completed, experiments in on-line retrieval were to be attempted.

Periodical holdings have been converted to MARC/BNB format for computer listing, using the UDC.

SDI service using chemical titles and MARC/BNB tapes was also attempted (Corbett, 1968).

UNITED KINGDOM--2

## Admiralty Underwater Weapons Establishment (AUWE) Project

Scientific and Technical Information Centre (Portland, Dorset)

Beginning in 1952, the AUWE, STIC, used the UDC for subject classification in the fields of physics, chemistry, metallurgy, oceanography, and mechanical and electrical engineering. There were about 40,000 reports in the collection as of 1968, with an annual intake of about 5,000. Books are shelved in UDC order.

The system described by H. J. Norris (1969) was a proposed system, embracing data-links, with block-processing at first. It was hoped that display consoles could be used as in the "AUDACIOUS" experiment of Freeman-Atherton. Details of the material to be punched, flow-diagrams, and sample accession lists are included in the Norris report.

Nine computer files are used. Subject indexing by UDC involves the full use of coordinate numbers and auxiliaries.

## Operational UDC-Based Subject Listings and SDI System

British Steel Corporation (Motherwell, Scotland)

A Selective Dissemination of Information (SDI) system intended for managers and scientists has been developed at the British Steel Corporation, Colville Metallurgical Services, Motherwell, Scotland, using the UDC as the basis for user profiles. Punched cards are prepared for all items selected by the information office for notification to clients. Material includes English, translated foreign and foreign technical papers, patents, standards, research reports, and books.

Abstracts are not on cards, but the complete bibliographic data are used for input and run weekly on an ICL 1903 computer at Clydebridge Steelworks, Cambuslang, Scotland. A selection number, author, and a UDC list are produced each week. UDC lists are based on the principle of rotation of numbers (up to five) as are the authors (up to five).

UNITED KINGDOM--3

Monthly cumulation runs, in duplicate, are also produced. Card files were abandoned on October 1, 1968, as the cumulations have proven adequate.

SDI programs were tested and made operational on a trial basis early in 1969. Preliminary results of service using this system proved it to be more accurate than conventional service by even the most experienced information specialist, perhaps because automation arouses much enthusiasm (Hindson, 1969, 1971).

## Computerized UDC Subject Index in a University Library

City University Library, London, England

Starting in 1967 the City University Library extended its automation program to include the subject index to the classified catalog, the authority files and the press clippings subject index (Cowburn and Enright, 1968).

Programs were written by David Hanson of the University Computer Unit. These are described in detail and examples shown in his article (Hanson, 1968).

Use was made of the AWRE Alphabetical Subject index to the UDC (Cayless and Ayres, 1964). Every effort was made to force the computer to do what the librarian wished, so that no modifications need be made to conventional indexing (length, form or number of subject headings, length of UDC codes, use or order of auxiliaries, etc.).

Indexes are in book form, a saving in space over card files. Multiple printouts permit several copies to be made at one pass.

Two files are kept: A/Z and UDC sequence for main subject index and for press-clipping file. Three types of cards--directive cards, A/Z cards, and UDC sequence cards are used for input and six types of output can be generated: UDC or A/Z with main index or with press-clipping file or with both combined. Updating can be as often as is desirable.

UNITED STATES OF AMERICA--1

M&GA Concordance between Subject Headings and UDC Numbers, 1950-1964

American Meteorological Society, Meteorological & Geoastrophysical Abstracts (Washington, D.C.)

In 1960, the American Meteorological Society began keypunching a list of 20,000 subject headings with equivalent UDC numbers. This list had been compiled by hand at the end of two and one-half years, five years, and ten years of publication of Meteorological Abstracts. Only the two and one-half year list of less than 5,000 terms was done in both alphabetical and UDC arrangement--by the time 8,000 or 10,000 terms had accumulated, the manual sorting by UDC became almost hopeless. Hence, the program for doing the ten-year cumulation by tabulator or computer was an attempt to accomplish something which was otherwise impossible--a most cogent argument for use of machines.

Slight technical difficulties arose from lack of certain symbols (e.g., the colon). Further problems arose from "fixed fields" not being sufficient for some of the longest groups of numbers. A very useful computer printout, however, was made in octuplicate for use by the classifiers as well as for experimental use.

Punching was first done on an IBM 026 with interpreter (to indicate at the top of each card what UDC numbers and subject headings were encoded).

In 1961, one of the first IBM 890 Document Writing Systems in the country was installed. This enabled printouts of sections, as well as of additions, annual cumulative additions, up to 1964, special profiles of interest, examples of experimental systems such as the one used for the satellite bibliography (q.v.), and similar products, to be made on the spot in single or multiple copies. Alpha and numerical fields could be reversed.

For larger printouts an IBM 870 tabulator or a 1401 computer was used. The computer editions were made from the single original deck of cards (subject headings and UDC). However, a reversed deck (UDC and S.H.) was made for control and reference purposes. The reversal and inverted printouts proved to be remarkably inexpensive when done by high-speed computers or accessory device

UNITED STATES OF AMERICA--2

Meteorological and Geoastrophysical Titles (M&GT)

American Meteorological Society, M&GA (Washington, D.C.)

The first attempt at arranging titles of articles or reports by computer with the UDC as one of the access points was carried on for two to three years by the American Meteorological Society.

It was suggested late in 1960 that the UDC numbers assigned to an article could be added to the title and used as a "keyword" in context--that is, rotated (or permuted) sequentially in the same way that keywords are rotated and ordered. The numbers would naturally come after all of the alphabetical keywords were listed, and so would not be interspersed. Moreover, UDC numbers are, in general, self-arranging, either manually, by sorter (tabulator), or by computer.

Robert Freeman, in charge of CT (Chemical Titles of the Chemical Abstracts Service), after some experimental programming and wiring of an IBM tabulator, came up with a crude model based on listing only the UDC numbers in one run, and only the Keywords in Context (titles) in another run. The KWIC index was published as the first experimental issue in April 1961, without the UDC index--then in the developmental stage. It was agreed that subsequent developments would involve no changes in the basic IBM-KWIC program and experimentation to achieve the most meaningful array and display of UDC numbers and titles. This was first demonstrated in June 1961.

After the first crude printout it was suggested that several modifications could be made to improve browsability. These included breaking the solid column by leaving a line-space before each main new heading, and adding the subject-heading equivalent of each main heading after the UDC number wherever desirable. The subject headings were determined by literary warrent (i.e., frequency of entries under each) and by their importance in the UDC hierarchy with emphasis on the main fields of interest (the environmental or geophysical sciences).

A separate deck of cards was punched for the headings, with asterisks before each number to insure their coming before rather than within the body of subsidiary references. This proved unnecessary since the fact that no item number code followed the heading on the heading card, and all reference

UNITED STATES OF AMERICA--3

cards had a reference code in certain columns--the "nothing comes before something" principle-insured the heading card preceding other cards with the same UDC number. Another logical modification--yet one which few who use UDC for title listings have been moved to introduce--is the suppression of repetitive UDC numbers or portions of number groups in vertical array.

The program was named UNIDEK, for Universal Decimal Klassification--there being no other similar or related product with that trademark.

Although the first issues of M&GT with the UNIDEK Index were compiled on an IBM 407 tabulator, the program was eventually adapted to allow computation and printing on an IBM 1401, just then available. This sped up production.

In all, 19,000 titles were listed in a dozen issues, from March 1962-January 1964, two of which were cumulative for six-month periods and comprised 5,000 or so titles each.

The only intellectual work required was the addition of the UDC numbers, based on titles alone, at a cost of less than 25¢ per title at that time. Quality of UDC assignments was not as high as for assignments by the same indexer from an abstract or from the article itself, yet evidence from printouts was that it was adequate and far better for retrieval than a random arrangement under major rather than detailed headings.

The program has since been used on a variety of computers for a variety of purposes. Later modifications, such as boldfacing headings (by repeating the same line three times while printing) greatly improved the browsability. Other modifications were made by Freeman, with suggestions from Martin Russell of the American Geological Institute, and Malcolm Rigby, editor of M&GA, M&GT, and NODC Titles. (See under Geo-Science Abstracts and NODC Titles), and by Vicentini in Brazil and Paldi in Israel.

UNITED STATES OF AMERICA--4

## Mechanization of UDC Schedules--Single Language Editions

American Meteorological Society, M&GA, and U.S. National Committee for FID (USNCFID/UDC), Joint Sponsorship (Washington, D.C.)

Several crude attempts were made in 1962-3 to show that UDC schedules could be put into machineable form and printed out in a readable display. Finally a satisfactory sample was produced from punched cards with printout on an IBM 1401 (Rigby, 1964a).

The present example was taken from the full English edition of the 551.5 (meteorology) schedules.

Simple programming eliminated the maze of digits resulting from line after line of solid numbers. Whenever a group of numbers set off by one or two decimal points (e.g., 551. or 551.507., or 551.507.362.) was repeated in a vertical column, the repeated groups were suppressed (i.e., not printed) making a much more readable and presentable display.

More sophisticated computers proved capable of printing boldfaced headings by repeating the same line two or three times, and later still, computer-driven composing machines could vary the type fonts to provide a great variety of hierarchical headings automatically.

## Mechanization of UDC Schedules--Multi-Lingual Presentations

American Meteorological Society, M&GA, and USNCFID/UDC

Since there must be a complete concordance among various language editions issued at any given time--the original P-Notes and extensions giving the definitions of numerical terms in one, two, or three of the official languages (English, French, or German) at the same time--it is obvious that the UDC number itself can serve as a unique code for a concept in any number of languages if it is desirable to have an automatically compiled and printed concordance. Also, it is evident that these "codes" are in general self-arranging or ordering for multi-lingual editions.

UNITED STATES OF AMERICA--5

The first attempt at such a display envisioned equivalents for a term in two or three languages extending across a wide page on the same line. However, no available standard computer-driven printer had a wide enough page to accommodate three or more 80-column cards on the same line. Moreover, it is hard for the eye to follow across a page, even if such long lines could be produced.

So a happy compromise was introduced into the second attempt: the second, third, or $n^{th}$ language equivalent was printed on successive lines, but indented three or five spaces for each additional language. Thus all the terms for a given language are in the same vertical column, yet the eye can more easily go from the number to the term as it is in closer proximity than if extended across the page.

The latest abridged schedules for Class 52 (astronomy and geodesy) and Class 55 (geodesy and geophysics) were put on 80-column punched cards by CEIR, Inc., Washington, D.C., for 13 languages--a total of 40,000 cards. Work was begun in late 1962 and completed in 1964.

The languages encoded were English, French, German, Spanish, Portuguese, Italian, Dutch, Swedish, Polish, Serbo-Croatian, and Russian (transliterated from Cyrillic to Roman characters). Examples (appendix IIIa) were printed out and distributed in three languages (English, French, and German) and five (English, French, German, Italian, and Swedish) languages. A sample giving the equivalents in all 13 languages was also prepared by computer and distributed (June 1964) but all schedules were displayed as single-language rather than multi-lingual format.

The equipment used was an IBM 709C with a 1401 printer. Programming was by CEIR, following instructions from Malcolm Rigby of the American Meteorological Society, chairman of the U.S. National Committee for FID/UDC.

A final report was issued in June 1964 (Rigby, 1964a). It contained all of the examples of printouts of single and multi-lingual editions as appendices and included a great deal of data on relative costs of keypunching material in different languages and of different volumes of material (the really crucial factor in cost). The whole report with appendices can be obtained from the NTIS at Springfield, Va., under No. PB-168,931.

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Satellite Meteorology Bibliography; Multi-Access Indexing System for Abstracts

American Meteorological Society, M&GA (Washington, D.C.)

Using an IBM 7090 computer and an IBM 1401 printer, CEIR, Inc., with guidance from Malcolm Rigby, produced an open-ended, multi-access indexing system for abstracts or titles and demonstrated it with 1,000 items on satellite meteorology. The work was done between January and September 1963.

A dozen types of array or indexing, several levels of abridgement, and many type styles of printing formats were built into the system. Running heads, section headings, pagination, boldfacing, etc., were encompassed.

The UDC index allowed listing in UDC sequence with or without titles of headings. KWIC, subject heading, chronological, author, corporate author, project or grant, journal or serial title, or sequence numbers could be used to select or arrange. Abstracts could be included or omitted at will.

A variety of citation orders or "fullness" could be effected:

UDC number--date--title--item number
UDC number--title--author--item number
UDC number--author--title--item number
Author--title--date--item number
Item number--UDC number--citation--abstract
Author--item number--abstract
UDC number--subject headings--item number

Similar systems have been devised since 1964 by IBM and others, but although UDC numbers can be substituted for subject headings in these packaged programs, the special features of UDC require sub-routines not in the generalized programs.

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## Annual Index to Geo-Science Abstracts

American Geological Institute (AGI) (Washington, D.C.)

Using the basic IBM 1401 UNIDEK program, used in Meteorological and Geoastrophysical Titles (M&GT), Martin Russell of the American Geological Institute (Editor of Geo-Sciences Abstracts), and Robert Freeman (of the American Meteorological Society) made modifications for the indexing of Geo-Sciences Abstracts (Russell and Freeman, 1965).

A sample containing both systematic (UDC) and alphabetic (KWIC) indexes was sent to a broad selection of geologist users for comment (Vol. 6, No. 1, Jan. 1964). The preponderance of those responding favored the systematic approach, which is familiar to geologists and taxonomists in biological sciences, over the keyword-in-context.

On the basis of this response the program was adapted to the annual index for Geo-Sciences Abstracts for 1964 and the same system was continued through the 1965 and 1966 annual indexes. In 1967, the title and scope of the abstracts was changed to Bibliography of Geology Exclusive of North America, with UDC entries assigned to each abstract or title and available for retrieval but not used in the printed indexes. Emphasis on non-American geology gave support to continuing use of the UDC for non-American users as well as subject headings for indexing or retrieval for American users.

## Automated Selection and Indexing of Oceanographic Literature

National Oceanographic Data Center (NODC), and American Meteorological Society, M&GA (Washington, D.C.)

To demonstrate the possibility of selecting articles on a given subject or subject profile from a broader population or data base, such as M&GA, M&GT, or the later NODC Quarterly Accessions, Robert Freeman attempted a semi-automatic "retrieval and display" experiment using the M&GT data base for October-December 1963, on an IBM 1401.(Freeman, 1964a).

In this experiment all punched cards for that period (M&GT 1963:10, 11, and 12), having 551.46 (oceanography) assigned, were sorted out and run with the UNIDEK program (with slight modifications). About 360 items were selected from a total of 2,200 run in M&GT for the three-month period.

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Such a system could be made completely automatic with some programming expenditure (e.g., to re-sequence the identification numbers which, in this case, had large gaps where items were not selected). Further extension of the system towards complete automation for SDI was demonstrated in 1967 by Freeman and Atherton in the "AUDACIOUS" experiment (Freeman and Atherton 1968b, c).

The prototype issue published May 19, 1964, consisted of four parts and a list of subject headings with corresponding UDC numbers. The four parts included: (1) A bibliography, comprising the name of the journal or serial, volume, issue and date, the author or authors, the complete English title, and the inclusive pages, and an identification number (year, month, and item number); (2) a systematic UDC index with equivalent place or subject headings, where appropriate, at the head of each new UDC sequence, and the corresponding identification number; (3) a KWIC index, with reference number; and (4) an author index, with reference number.

The prototype was the only issue prepared. However, it was modified slightly and made operational for two and one-half years as NODC Quarterly Accessions (Rigby, 1966) as a quarterly publication but with monthly printouts in octuplicate.

National Oceanographic Data Center (NODC) Quarterly Accessions

American Meteorological Society, M&GA (Washington, D.C.)

Another adaptation of the UNIDEK system for multiple-access indexing, more like the original Meteorological and Geoastrophysical Titles than the annual index to Geo-Sciences Abstracts, was initiated in January 1966 with programming adaptations by Robert Freeman and input-output on IBM 1401 by CEIR, Inc., of Arlington, Virginia. Records were punched on IBM 80-column punched cards.

The quarterly publication was a by-product of the monthly computer-printouts which were made in eight copies, for the NODC laboratories. These monthly records were cumulated quarterly and printed with UDC, KWIC, and author indexes, and sequentially arranged bibliography for each issue. Annual cumulations were also made and printed out (but not published) and the tapes preserved for searching and further cumulation.

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The total number of entries in the two and one-half years (1966-June 1968) was about 10,000. These were used by Freeman and Pauline Atherton in their AIP/UDC tests of efficiency of the UDC as an indexing language for retrieval (Freeman and Atherton, 1968d).

ICAS Vocabulary

Interdepartmental Committee on Atmospheric Sciences (Washington, D.C.)

A crude attempt at creating a structured vocabulary by computer was made during 1965 by a committee of U.S. government information specialists under the auspices of the Interdepartmental Committee on Atmospheric Sciences (ICAS). Malcolm Rigby of the U.S. Weather Bureau guided the project, with Robert Freeman doing the programming and supervising the keypunching and computer work (IBM 1401 operated by CEIR, Inc.). The costs of keypunching and listings were supported by the National Science Foundation through the U.S. Weather Bureau.

Essentially, the vocabulary was constructed by merging word lists provided by 13 U.S. government agencies. These lists were merged by computer (alphabetically) and refined by the committee of eight or ten experts meeting for a day or two every month or so for three or four months.

After weeding, adding, cross-referencing (see and see also), and smoothing editorially for redundancy or inconsistency of plural forms, etc., the UDC numbers most relevant to the concepts subsumed by the term were supplied by an indexer long experienced with UDC, as well as with subject indexing with natural languages, and with vocabulary control with UDC. It was especially important that the assignment of terms be made by someone who had been constantly using both UDC and descriptors in the atmospheric sciences, with all of the latest schedules available, and with most of the terms already at hand in control lists with corresponding UDC numbers. Otherwise a large proportion of the terms would present insurmountable obstacles, or would be given irrelevant or inaccurate number assignments.

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The vocabulary consisted of four parts:

(1) a list of major categories, (UDC and A/Z arrangement)

(2) a list of terms included, (alphabetical arrangement)

(3) a list of terms with equivalent UDC numbers, and

(4) a list by UDC number with terms which had these numbers assigned.

The last list constituted a crude thesaurus. Programming included suppression of repeated numbers or groups of three, six, or nine digits within numbers, except at the top of a new page. Further programming would eliminate the inconsistencies when colons or brackets separate groups.

A second "reversal" gave an alphabetical thesaurus with all associated higher or lower order terms. Such an experiment was attempted by DDC for Project Lex, but the programmer had little knowledge of UDC, and the results were only partially successful, especially where groups coordinated by a colon, or other auxiliary notation, were used to define a term more precisely than would be possible with a single UDC group. In other words the hierarchically arranged portions of the schedules work almost perfectly for thesaurus production by EDP; the coordinated terms in UDC schedules do not work in special editions, although in an overall edition (covering many disciplines) the pre-coordinated terms would work nicely in creating an automated hierarchy.

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AIP/UDC Project

Robert Freeman and Pauline Atherton (American Institute of Physics, Washington, D.C.)

The most extensive and intensive project ever undertaken for development, testing, and evaluation of the UDC as an indexing language for use with automated systems was commenced in July 1965 by the American Institute of Physics, under grant GN 433 of the U.S. National Science Foundation, with Robert Freeman as project supervisor, Pauline Atherton, as principal investigator, and others as advisors.

Results were far too numerous to specify herein--nine comprehensive reports have emanated from the project (Report Nos. AIP/UDC 1-9, incl., 1965-7), plus a review and extracts from the final report in the Proceedings of the Copenhagen Seminar -- Sept. 2-6, 1968. Briefly, however, the results comprise: (1) development of a machine-readable file of UDC schedules in the English language (about 93% of the English medium edition); (2) a mechanized UDC file maintenance system; (3) experiments with automated alphabetic indexing of UDC schedules; (4) automatic typesetting and composition of UDC schedules; (5) rules for keyboarding UDC schedules; (6) collection of machineable data bases in nuclear science, metallurgy, meteorology, oceanography, etc., for experiments in evaluation and retrieval in both batch-processing and interactive mode (see AUDACIOUS); and (7) statistical evaluation of the UDC as a retrieval system. Moreover, the Copenhagen and Frankfurt seminars were "spinoffs" of the project and resulted in appreciable feedback and further experimentation.

The various AIP/UDC reports give all of the statistical details, including flow charts, illustrations of equipment, tables and graphs of data, input-output specifications, etc. (See Freeman 1965, 1966, 1968 and Freeman and Atherton 1968 a, b, c, d.)

UNITED STA' S OF AMERICA--J2

Project AUDACIOUS--UDC Interactive Retrieval System

Robert Freeman and Pauline Atherton (American Institute of Physics, Washington, D.C.)

Early in 1967, Robert Freeman and Pauline Atherton decided to use some of the data bank which had been developed for the main AIP/UDC project tests and evaluation experiments to demonstrate the capabilities or limitations of the UDC when used for retrieval in an interactive mode by library science students, teachers, and other technical or lay personnel.

The test was run against the more conventional data bank provided by the Atomic Energy Commission from Nuclear Science Abstracts in November 1967. The terminal (display console) was located at the Syracuse University Library School, the computer at Rochester. A standard program (DATRIX) of Xerox Corporation was modified to take care of special UDC characteristics.

The conclusion was that the UDC could be used as easily as natural language for interactive retrieval--in some cases results were better and in other cases results were poorer than with the controlled vocabulary of EURATOM. Further tests of this kind should be made.

Obviously, familiarity with the UDC in one's own field would make for faster and more significant results. A "phone book" or guide to terminology and UDC would also speed up and sharpen retrieval, though this violates the philosophy of interactive retrieval. Knowledge of what is in the data bank, the amount of data in the bank, and the depth of indexing (in either mode) are also significant factors.

Finally, the adeptness of the searcher in use of electronic equipment and in following precise instructions favors the young and machine-oriented as against the older and more verbally-oriented who "blow up" when confronted with the demands of electronic equipment. The field of enquiry is also significant--those habitually thinking in an hierarchical framework (taxonomists, paleontologists, geographers, etc.) would favor the decimal classification approach as would those working in a multi-lingual as contrasted with a mono-lingual environment.

The routine involves asking for UDC numbers corresponding to a given term or terms, requesting the number of items (records) fulfilling the specifications in UDC and/or natural language, broadening or narrowing the search if need be, and finally

seeking a display of citations fitting the tailored situation--hopefully 5 to 20 records. "Answers" may be stored in memory or set aside for further consideration while other requests to modify the original request are tentatively being explored. A permanent record on Xerox can be made of the results of the search at any stage--usually at the end of the process--before going on to another new search or accepting the findings as adequate (Freeman and Atherton, 1968b, c).

## ESSA Library Holdings in Oceanography (1710-1967)

U.S. Environmental Science Services Administration (Washington, D.C.)

In the summer of 1968, Herner & Co. of Washington, D.C., began keypunching, programming, and printing about 3,000 records from the shelf lists of the three major ESSA libraries (Atmospheric-Sciences, Geophysical-Sciences, and Boulder Laboratories), using subject headings and classes as guide lines for selection.

Each library used a different system of classification for shelving (not for real classification) and different vocabularies or subject-heading lists for indexing--in fact, the same library often used more than one system over the 100-150 year period of its existence.

The purpose of the experiment was to make a pilot-type book-catalog with six or seven indexing or access modes, to compare the effectiveness of the various indexes, to evoke serious problems or discover areas where improvements should be made before a larger sample was attempted, and to test it on operating libraries in a field (oceanography and marine meteorology) just coming to the fore, and wherein a new library and institute had just been established (in Miami).

To provide at least one common classification or indexing factor, UDC numbers (two to three per item) were assigned from the shelf-list cards, by Bill Doudnikoff and his consultants.

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The indexes prepared were:

(1) Systematic (UDC)
(2) KWIC
(3) Author
(4) Corporate author
(5) Contract or Grant Number
(6) Subject Heading
(7) Bibliography by library in chronological order.

Printout was in upper and lower case for the first time with this type of system. Input was by IBM MT/ST.

A minimum of editing and tagging was done manually before keypunching; it was correctly assumed that the various listings would bring into bold perspective those areas where manual editing or tagging was most urgent.

Records are all on magnetic tape as well as punched cards, for updating or retrieval if desirable.

About 100 copies were printed in June 1969 for review purposes or comment and for use by the ESSA libraries.

The UDC index is similar in most respects to the UNIDEK indexes--headings are arbitrarily assigned on the basis of frequency counts run from a listing of UDC numbers alone, and the headings are listed in both systematic (UDC) and alphabetical arrangement.

Oceanic Index--Cumulative Annual Index

Evelyn Sinha (Mission Bay Research Foundation, La Jolla, Calif.)

During 1968, Dr. Evelyn Sinha, editor of the Oceanic Index, had UDC numbers assigned to all abstracts and titles in the Oceanic Index and ran a cumulative index by UDC number.

The UDC numbers provided an additional access to the Keytalpha (modified KWIC, using assigned keywords) or author indexes. Listings were without any breaks or suppression of repetitive numbers or insertion of headings, so browsability was low and the index of very little use to anyone unacquainted with the UDC.

The experiment was abandoned for reasons of economy when Dr. Sinha left the project.

UNITED STATES OF AMERICA--15

## Bibliography and Index of Geology (1969-72)

American Geological Institute (Washington, D.C.)

In 1969, the Geological Society of America, with the American Geological Institute, began a mechanized retrieval system for the world's geological literature using the UDC as one of the access points. Natural language subject headings, authors, places, etc., were also used as modes of access.

The system was an outgrowth of the similar but less sophisticated Bibliography and Index of Geology Exclusive of North America (1967-8) which included 12,000-18,000 abstracts a year (with UDC numbers assigned to each abstract). Earlier years issues (1964-6) of Geo-Sciences Abstracts, also published by the American Geological Institute for the Geological Society of America, used the UDC (UNIDEK) for mechanized compilation of the annual indexes.

A total of over 100,000 records was put into machineable form with the UDC as a mode of access. The depth of indexing and philosophy of creating UDC "sentences" or strings was fairly consistent and very specific. The whole system was replaced in 1972 and then dropped for lack of financial support.

## Computerized Data Base for Meteorological and Geoastrophysical Abstracts (M&GA)

American Meteorological Society, M&GA, and National Oceanic and Atmospheric Administration, Environmental Science Information Center, Technical Information Division (Washington, D.C.)

The 14,000 or more abstracts published in Vols. 23 and 24 (1972 and 1973) of M&GA have been put into machineable form (magnetic tape) by Larry Buckland of Infraronics, Inc. This has been done along the lines pioneered in 1963 for the Satellite Meteorology Bibliography of M&GA, but with much more up-to-date methods of input. All bibliographic data, text of abstracts, and subject-headings, as well as UDC numbers for subject, place, form of publication, etc., are available for searching, analyzing, or display in on-line, batch-processing, or normal printing, or for compilation of indexes of any kind. The data base can also be combined with others for the environmental sciences obtained from other national or international abstracting and indexing services that provide tape service for purchase. The tapes should also be valuable for vocabulary control, provided some editing is performed.

INTERNATIONAL ORGANIZATIONS--1

## UDC Guide to WMO Meteorological Vocabulary

World Meteorological Organization Committee on Atmospheric Sciences (WMO/CAS) Working Group on Bibliographic Affairs (Washington, D.C.) Malcolm Rigby, chairman

The World Meteorological Organization has a half interest in the detailed UDC tables for 551.5--meteorology and climatology, having devised the scheme in 1930-35 and promulgated it as a "recommended practice" for all WMO service libraries and publications. It was and is a part of the WMO technical regulations.

The tables for 551.5, however, are far from adequate to classify all or even most books, articles, or works in meteorological libraries, publications, or abstracting services. Hydrology (556), oceanography (551.46), and many cognate subjects figure very heavily in WMO library practice.

Hence, it was proposed in 1964 (WMO/CHy-II - Warsaw) and agreed that after the new scheme for hydrology (556) was devised by a joint WMO-FID committee, the entire profile of interest of WMO (Atmosphere-Hydrosphere) would be the basis for a WMO-UDC Guide with scope notes, and that the terms would be put in machineable form in order to permit more frequent updating and printing.

The work of punching the terms was begun in 1966, so that a readable printout was available in both alphabetic and numeric sequence by the WMO/CHy-III meeting in Geneva in September 1968.

Input was by punched card, with output on an IBM 360 (Computer and Software, Inc., Arlington, Virginia). The punching was done so that printout could be either upper- or lower-case, or all upper-case, depending on equipment available or on requirements. Of course, this makes a more complicated program than all upper-case input.

Funds were made available for substitution of the new 556 scheme for hydrology and for a few minor corrections. Later, a four-language edition will be published (both in UDC and alphabetical order) as part of a revised (second edition) of the WMO International Meteorological Vocabulary.

INTERNATIONAL ORGANIZATIONS--2

## WMO/UNESCO--International Glossary of Hydrology

World Meteorological Organization (Geneva, Switzerland)

During 1968-9, a Joint Committee of UNESCO and the World Meteorological Organization (WMO) compiled a list of 1,300 terms valid for hydrological work, especially relevant for the International Hydrological Decade (IHD).

The terms were put on punched cards at the WMO Headquarters in Geneva. In February 1970, the UDC equivalents for most of the terms were furnished to the WMO for inclusion on the punched cards. UDC numbers assigned to this glossary included those from the new 556 scheme for hydrology which was worked out by a joint WMO-FID working group for hydrology. The second draft of the list was published in four languages (English, French, Russian, and Spanish) in July 1970, and the 393-page definitive (first) edition, comprising 1588 terms in four languages (WMO #385), was published in 1974.

INTERNATIONAL ORGANIZATIONS--

## Storage and Retrieval Service for Global Data Processing System of World Meteorological Organization

World Meteorological Organization, World Weather Watch Planning Committee for Global Data Processing System (Geneva, Switzerland)

Among the recommendations of the planning committee and its experts (J. M. Craddock of the U. K. and N. K. Klyukin of the U.S.S.R.) on automated inventory control for data generated and stored in various forms by the 140-odd members of the WMO, was an elaborate and experimentally tested system for description of the subject, point-of-view, form and place aspects of the raw, as well as published, data or literature containing data in the broadest meaning of the word data.

The system for subject control, the LDC or Local Decimal Classification, is based on the UDC but the code groups are abridged to allow fixed field punch[illegible] (up to six digits). The abridgement is not at the level of greatest detail but at that of "least common generality." For instance, since most locators are in the fields of practical meteorology (551.50), and scientific meteorology (55[illegible].79), then 551.50 would be abridged to "0" (so that 5[illegible]50?.362.2 would be 073.622) and scientific meteorology to 1. Similarly, hydrology (556) becomes 3 and oceanography (551.46), 4, and so on, thus preserving the detail that is essential for data control, while conserving hundreds of thousands of digital spaces, as well as digital or decimal principle (all digits allow some simplification in input, processing, proofing, etc). A computer could be programmed to print out, if desired, the true UDC numbers (i.e., 551.5, 556, or 551.46, etc.) from the initial place 0, 1, 3, 4, ... whenever they occur.

The fields of interest outside of those providing the overwhelming majority of entries (such as geography, economics, mathematics) would not be abridged but taken from the UDC schedules "as is." If abridgement were necessary because of extreme length of code group, the abridgement would be at the end of the group or at the expense of specificity; the number of these items would be relatively few in any category and hence would not require the degree of specificity that would be needed in the major fields of interest represented in the data bank.

INTERNATIONAL ORGANIZATIONS--4

Although this voluminous proposal (cf. World Meteorological Organization, 1970) has not yet been implemented on an international scale, it was suggested that a number of years of experience among those services capable of testing it (such as in the Union of Soviet Socialist Republics where it had been used in an automated system since 1969 by the Data Center of the Hydrometeorological Service at Obninsk) would be valuable before universal acceptance. Suggested codes for all categories such as form, place, etc., are presented in extenso in the above-cited report, along with English translations of early papers on the subject by those who developed the system in the U.S.S.R. (see World Meteorological Organization, 1974, Kliukin, et al., 1969, and Tolmachev, et al., 1969).

## Guide to the World's Abstracting and Indexing Services

International Federation for Documentation (The Hague) and National Federation of Abstracting and Indexing Services (Philadelphia, Pa.)

In 1963 and 1965, the U.S. National Federation of Science Abstracting and Indexing Services (NFSAIS, now nfais) and the International Federation for Documentation (FID) each published guides to A&I services in all countries having such services. The NFSAIS Guide contained about 2,000 references to both abstracting and indexing services, but was confined to science and technology. The FID Guide covered abstracting services only, but embraced services in social sciences and the humanities as well as in science and technology. The FID Guide was revised, enlarged, improved, and updated in 1969. Both guides were keyed to the UDC as one mode of subject identification or access.

In 1972, a joint FID and nfais project was undertaken to build a data base covering all indexing as well as abstracting services in all fields of knowledge. The data base will be in machineable form so that searches can be made by computer in addition to the automatic generation of the several indexes to accompany the published directory. UDC numbers are assigned by FID. Paper tape input is also provided by FID. The paper tape is sent from FID in The Hague to the subcontractor IIT Research Institute for conversion to magnetic tape and programming for machine processing and printing.

INTERNATIONAL ORGANIZATIONS--5

The data base or tapes, consisting of about 3,000 records, are to be retained by both nfais in Philadelphia and FID headquarters in The Hague for searching and both organixations will sell the Guide when published in 1976.

Among the indexes to be generated are country, language, institution, subject, and possibly other indexes. A supplementary file is also being maintained for services that deal in computer products such as tapes, whether a publication results or not. There are about 100 such services.

The intention is that the data base will be continually revised and updated with information on new services, services that cease, or those that change in scope after publication of the 1976 edition. Further editions and supplements will then be possible without redoing the whole publication as has been the case with the original guides of both organizations.

## Summary

The work of the voluntary international Subcommittee on Mechanization of FID/CCC (under various names since its original constitution in 1963 as a Joint Sub-Committee of FID/CCC and MSR) has resulted in several substantial achievements, as demonstrated in this 10-year report. Among these accomplishments have been:

1) Demonstration that the UDC is capable of manipulation in mechanized information systems as effectively (and in some cases more effectively) as any other classification system or any purely verbal system for storage and retrieval

2) Demonstration that the UDC is especially efficient in indexing storage, retrieval, or display of multilingual information, vocabularies, data inventories, etc.

3) Provision of an international forum for exchange of ideas and suggestions for use of computers in a variety of ways to control UDC schedules, vocabularies, or documents that have UDC numbers assigned

4) Provision on an official mechanism for sponsoring, organizing, or conducting periodic open sessions on mechanization and the UDC, and for publishing the proceedings of these seminars (Copenhagen, 1968, Frankfurt, 1970, etc.)

5) Stimulation of publication of articles describing such systems as have been developed experimentally or operationally since 1963. At least 100 such articles or reports are cited in the Bibliography (Part III) and there are undoubtedly a score or more similar papers that have not yet been discovered or citations verified for inclusion in this report.

It is hoped that this report and the future work of the recently re-constituted Sub-Committee (under Prof. Dr. Sydler, of ETH Zurich) will double or treble the efforts and accomplishments along the lines of this report and even more promising along new and unforeseen lines, during the next decade.

Meantime we hope to have any if not all such efforts or published reports called to our attention, either directly or through the FID Secretariat or the Secretariat of the FID/CCC-M Subcommittee.

## COMPUTERS AND THE UDC

## PART III - BIBLIOGRAPHY

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Appendix - I

## Acronyms and Abbreviations

| | |
|---|---|
| A&I Services | Abstracting and Indexing Services |
| ABC | Abridged Building Classification Code for Architects, Builders, and Civil Engineers |
| ADP | Automatic Data Processing (includes use of input devices, tabulators, computers, etc., of all types). |
| AGI | American Geological Institute, Washington, D.C. |
| AGU | American Geophysical Union, Washington, D.C. |
| AIP | American Institute for Physics, New York |
| AMCOS | Aldermaston Mechanized Cataloging and Ordering System (of AWRE, Aldermaston) |
| AMS | American Meteorological Society, Boston, Massachusetts |
| ASI | Alphabetical Subject Indexing (to UDC, part of AMCOS system of AWRE, Aldermaston) |
| ASIS | American Society for Information Sciences |
| AUDACIOUS | Automatic Direct Access to Information with the On-Line UDC System (part of AIP/UDC Project) |
| AUWE | Admiralty Underwater Weapons Establishment, Portland Bill, Dorset, U.K. |
| AWRE | Atomic Weapons Research Establishment, Aldermaston, U.K. |
| BISRA | British Iron and Steel Research Association |
| BNB | British National Bibliography |
| CDC | Control Data Corporation (U.S. Computer manufacturers) |
| CEIR | Computer Processing Corporation for Economic and Industrial Research, Arlington, Virginia |
| CIA | Centrale Informatie Afdeling (Central Information Department) of Bronswerk, Netherlands) |
| CIINTE | Central Institute for Scientific, Technical, and Economical Information, Warsaw (now IINTE) |
| CNRS | Centre Nationale de Recherche Scientifique (Paris) |
| COBOL | Computer Business Oriented Language |
| COMPASS | Computer Language |
| CP/CMS | Cambridge Monitor System |
| CT | Chemical Titles of Chemical Abstracts Service, Columbus, Ohio |
| DATICA | Danish Computer (used in Copenhagen) |
| DDC | Dewey Decimal Classification System |
| DHI | Deutsches Hydrographisches Institut, Hamburg |
| DK | Universal Decimal Classification (as used in Germany) |

| | |
|---|---|
| DNA | Deutscher Normenausschuss (German Standards Institut), Berlin |
| DRZ | Deutsches Rechenzentrum (German Computer Processing Center), Darmstadt |
| EDP | Electronic Data Processing (e.g., by computer) |
| ELVCDU1,2, & 3 | Computer programs used by IBBD, Rio de Janeiro |
| ESIC | Environmental Science Information Center of NOAA |
| ESSA | Environmental Science Services Administration of the U.S. Department of Commerce--1966-1970; merged into NOAA in 1970 |
| ETHL | Eidgenossischen Techniches Hochschule, Lausanne |
| ETHZ | Eidgenossischen Techniches Hochschule, Zurich |
| FID | International Federation for Documentation (Federation Internationale de Documentation), Headquarters: 7 Hofweg, The Hague, Netherlands |
| FID/CCC | Central Classification Committee of FID |
| FID/CCC/M | Subcommittee on Mechanization of UDC of FID/CCC |
| FID/CR | Classification Research Committee of FID |
| FID/MSR | Mechanized Storage and Retrieval Committee of FID |
| GEO-REF | Geological Reference file, American Geological Institute |
| GIBUS | Groupe Informatiste des Bibliothèques Universitaires et Spécialisées (Advisory Group of University and Special Libraries), France |
| GmbH | Gesellschaft mit beschrankter Haftung--German equivalent of Incorporated (Inc.) or Limited (Ltd.) |
| IBBD | Instituto Brasileiro de Bibliografia e Documentacao, Rio de Janeiro (Brasilian Institute of Bibliography and Documentation) |
| IBCC | International Building Classification Committee |
| IBM | International Business Machines Corporation |
| ICAS | Interdepartmental Committee for Atmospheric Sciences (Washington, D.C.) |
| ICSU | International Council of Scientific Unions |
| IFIP | International Federation of Information Processors |
| IHD | International Hydrologic Decade, 1960-70 |

| | |
|---|---|
| IITRI | Illinois Institute of Technology Research Institute |
| ILACS | Integrated Library Administration and Cataloguing System (Netherlands) |
| ISO | International Organization for Standardization |
| KWIC | Keyword In Context system of automated indexing of titles devised by H. P. Luhn of IBM Corporation |
| KWOC | Keyword Out of Context system, a modification of KWIC system |
| LC | U.S. Library of Congress, Washington, D.C. |
| LCC | Library of Congress Classification system |
| LDC | Local Decimal Classification System (abridged code based on UDC) |
| LEMME | Legislative Reference for the Ministry of Mines and Energy, Brasilia |
| M&GA | Meteorological and Geoastrophysical Abstracts published by the American Meteorological Society, Vol. 1-25, 1950-1974 |
| M&GT | Meteorological and Geoastrophysical Titles, Vol. 1, 2, and 3, 1961-3, published by the American Meteorological Society |
| MARC | sometimes called LC-MARC of the Library of Congress |
| MINTER | Ministry of Interior, Brazil, Brasilia |
| MTST | IBM-Magnetic Tape Selectric Typewriter |
| NFAIS | (formerly NFSAIS) - National Federation of (Science) Abstracting and Indexing Services, Philadelphia |
| NOAA | National Oceanic and Atmospheric Administration formed in 1970 from ESSA and other U.S. agencies |
| NODC | National Oceanic Data Center (1960- ) became part of NOAA in 1970 |
| NTIS | National Technical Information Service of the U.S. Department of Commerce (formerly ASTIA) |
| ODC | Oxford Decimal Classification System, an expansion of the UDC Class 634 (Forestry) |
| SANB | South African National Bibliography |
| SDI | Selective Dissemination of Information |
| SH | Subject Headings |

| | |
|---|---|
| SIPLAN | Information system for the Brazilian Ministry of the Interior, Brasilia |
| SMOBOL | Computer language used in Brazil, etc. |
| SPS | Computer language used in Brazil, etc. |
| SRC | Subject-field Reference Code (FID Development for UNISIST World Information System) |
| STIC | Scientific and Technical Information Center |
| SULIS | Sulzer Literature Dissemination and Classification |
| TEST | Engineering Joint Council Thesaurus of Engineering terms |
| UDC | Universal Decimal Classification |
| UDK | Russian equivalent of UDC |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNIDEK | System for computerized indexing of titles of articles with UDC arrangement |
| UNISIST | Developing system for international exchange of scientific information |
| VINITI | Vsesoiuzno Instytut Nauchno i Technichesko Informatsii (All Union Scientific and Technical Information Center), Moscow |
| WATDOC | Water Documentation system of Environment Canada, Ottawa |
| WMO | World Meteorological Organization, Geneva, Switzerland |
| WMO/CAS | World Meteorological Organization, Commission on Atmospheric Sciences |
| WMO/CHy | World Meteorological Organization, Commission on Hydrology |
| WMO/WWW | World Meteorological Organization, World Weather Watch |
| WRSIC | Water Resources Research Scientific Information Center, U.S. Department of Interior, Washington, D.C. |
| ZMD | Zentralstelle für Machinelle Dokumentation, Frankfurt a/m Germany |
| ZOWAR | Polish Computer Processing Center |

## Appendix II a - Multi-lingual UDC schedules

ENGLISH, ITALIAN, PORTUGUESE, SWEDISH, AND YUGOSLAV (ABR)

EA 61 551.511 MECHANICS AND THERMODYNAMICS
IA 62 MECCANICA E TERMODINAMICA
PA 61 MECANICA E TERMODINAMICA
SA 61 ATMOSFARENS MEKANIK OCH TERMODYKAMIK I ALLMANHET
YA 59 MEHANIKA I TERMODINAMIKA

EA 61 .513 GENERAL CIRCULATION OF ATMOSPHERE
IA 62 CIRCOLAZIONE GENERALE DELL'ATMOSFERA
PA 61 CIRCULACAO GERAL DA ATMOSFERA
SA 61 ATMOSFARENS ALLMANNA CIRKULATION
YA 59 OPSTA CIRKULACIJA ATMOSFERE

EA 61 .515 WEATHER, ATMOSPHERIC FORMATIONS AND DISTURBANCES, DEPRESSIONS, STORMS, ANTICYCLONES
IA 62 FORMAZIONI ATMOSFERICHE E PERTURBAZIONI. TEMPO
PA 61 TEMPO, FORMACOES E PERTURBACOES ATMOSFERICAS
SA 61 ATMOSFARISKA BILDNINGAR OCH STORNINGAR
YA 59 ATMOSFERSKE TVOREVINE I POREMECAJI

EA 61 .52 RADIATION, TEMPERATURE OF ATMOSPHERE
IA 62 RADIAZIONE ATMOSFERICA E TEMPERATURA
PA 61 RADIACAO E TEMPERATURA DA ATMOSFERA
SA 61 STRAALNING. TEMPERATUR
YA 59 ZRACENJE. TEMPERATURA

EA 61 .521 RADIATION. CF.550.35
IA 62 RADIAZIONE CF. 550.35
PA 61 RADIACAO. CF. 550.35
SA 61 STRAALNING CF 550
YA 59 ZRACENJE 550.35

EA 61 .524 AIR TEMPERATURE
IA 62 TEMPERATURA DELL'ARIA
PA 61 TEMPERATURA DO AR
SA 61 LUFTTEMPERATUR
YA 59 TEMPERATURA VAZDUHA

EA 61 .525 EARTH OR GROUND TEMPERATURE. CF.551.34
IA 62 TEMPERATURA DEL SUOLO CF. 551.34
PA 61 TEMPERATURA DO SOLO
SA 61 MARKTEMPERATUR. JORDTEMPERATUR

EA 61 .526 WATER SURFACE TEMPERATURE. CF.551.463
IA 62 TEMPERATURA DELLA SUPERFICIE DELLE ACQUE
PA 61 TEMPERATURA DA AGUA SUPERFICIAL. CF. 551.463
SA 61 VATTENTEMPERATUR
YA 59 TEMPERATURA POVRSINE VODE

EA 61 .54 ATMOSPHERIC PRESSURE, ISOBARS, VARIATIONS
IA 62 PRESSIONE ATMOSFERICA. ISOBARE
PA 61 PRESSAO ATMOSFERICA, ISOBARAS, VARIACOES
SA 61 LUFTTRYCK
YA 59 VAZDUSNI PRITISAK. IZOBARE

EA 61 .55 WIND, TURBULENCE, VARIATIONS, TYPES, EFFECTS
IA 62 VENTO
PA 61 VENTO, TURBULENCIA, VARIACOES, TIPOS, EFEITOS
SA 61 VIND
YA 59 VETAR

EA 61 .57 AQUEOUS VAPOUR AND HYDROMETEORS
IA 62 VAPOR ACQUEO E IDROMETEORE
PA 61 VAPOR DE AGUA E HIDROMETEOROS
SA 61 VATTENANGA
YA 59 VODENA PARA. HIDROMETEORI

EA 61 .571 HUMIDITY, DISTRIBUTION, VARIATIONS
IA 62 UMIDITA
PA 61 HUMIDADE, DISTRIBUICAO, VARIACOES
SA 61 FUKTIGHET
YA 59 VLAZNOST

EA 61 .573 EVAPORATION AND EVAPO-TRANSPIRATION
IA 62 EVAPORAZIONE
PA 61 EVAPORACAO E EVAPOTRANSPIRACAO
SA 61 AVDUNSTNING
YA 59 ISPARAVANJE

Appendix II b - UNIDEK Listing by UDC from M&GT
(Meteorological and Geoastrophysical Titles)

| | | |
|---|---|---|
| *553 | ORE AND MINERAL DEPOSITS | |
| 553.52 | DETERMINATION OF RADIUM C, THORIUM C AND POTASSIUM 40 CONTENTS IN HOMOGENEOUS GRANITOIDS ACCORDING TO THE ENERGY DISTRIBUTION OF GAMMA RAYS.= | 62-07-06920 |
| | EXPERIMENTAL DETERMINATION OF THE RAC/, THC,, AND K40 CONTENTS OF HOMOGENEOUS GRANITOIDS FROM THE GAMMA-RAY SPECTRUM.= | 62-11-09433 |
| 553.551 | ELASTIC CONSTANTS OF SOLENHOFEN LIMESTONE AND THEIR DEPENDENCE UPON DENSITY AND SATURATION.= | 62-12-10292 |
| 553.551.1 | METHODS AND RESULTS OF DETERMINATIONS OF THE ELASTIC PROPERTIES OF LIMESTONE UNDER NATURAL CONDITIONS BY THE SEISMIC AND ULTRASONIC METHODS.= | 62-12-10032 |
| 553.611 | ELASTIC PROPERTIES OF ROCK-FORMING MINERALS.= PT. 3. FELDSPARS.= | 62-07-06902 |
| | FELDSPAR DISTRIBUTIONS IN SOUTH PACIFIC PELAGIC SEDIMENTS.= | 62-10-09297 |
| 553.621 | PIEZOELECTRIC EFFECT IN PEGMATITE AND QUARTZ VEINS.= | 62-07-06897 |
| 553.63 | THE FUSION CURVES OF THE ALKALI METALS UP TO 50 KILOBARS.= | 62-08-07716 |
| 553.634.1 | INVESTIGATION OF COLOR CENTERS IN FLUORITE WITH APPLICATION TO GEOLOGIC TIME.= | 62-12-10290 |
| 553.635 | RESULTS OF SOME RESEARCH ON SICILIAN GYPSEOUS-SULPHUR SERIES.= | 62-10-09109 |
| 553.661.2 | RELATIONSHIPS OF LEAD ISOTOPES AMONG GRANITES, PEGMATITES, AND SULFIDE ORES NEAR BALMAT, NEW YORK.= | 62-09-08501 |
| 553.7 | FORMATION OF SOME MINERAL WATERS IN THE CENTRAL CAUCASUS.= | 62-10-09190 |
| | METHOD OF DETERMINING THE TOTAL CONTENT OF CARBONIC ACID IN MINERAL WATERS.= | 62-10-09191 |
| | CARBONATE BALANCE IN MINERAL WATERS OF THE GROUP CAUCASIAN MINERAL WATERS.= | 62-10-09192 |
| | POTASSIUM IN MINERAL WATERS.= | 62-11-09472 |
| 553.982 | PALAEOGEOGRAPHIC LATITUDE OF OIL-FIELDS.= | 62-12-10222 |
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