Information Operations at Esso Research and Engineering Company*

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At Esso Research and Engineering Co., scientific and technical information has been brought to bear on company operations since 1919, first as a major special library, from 1957 to 1967 as a centralized information division, and since late 1967 as a combination of area-based information analysis groups and site-based information service sections. This new arrangement is in accord with the company's "corporate service field unit" management approach, which makes the various information functions directly responsive to the information needs of the functional areas which they serve. It does not reflect a lessened information effort. Within this new context, highlights are presented of the company's unique activities in information analysis, computer-based systems for library journal routing, and company reports distribution, indexing and searching, abstracting services, engineering-information applications, and wide use of microforms.

At Esso Research and Engineering Co., scientific and technical information has been formally brought to bear on company programs for the past 50 years. Indeed, focusing available technical information on its products and processes was one of the four stated motives for the 1919 founding of this major R&E subsidiary of the Standard Oil Co. (N. J.) in the areas of petroleum refining, chemicals, and other manufacturing.

Until 1957, the company was served by a broad-scope special library whose functions included literature and patent abstracting, searching, and report indexing and microfilming. In 1956, however, company management supported a study[9] aimed at improving the management of technical information, and in 1957 a new Technical Information Division (TID) was formed.[1, 15] This division strengthened the functions of the previous special library, but more importantly, it placed strong emphasis on coordination of other aspects of information management—information research, now known more generally as information analysis;[5, 12, 14] publications clearance and meeting arrangements;[7, 8] reader-oriented abstracting;[16, 17] files consolidation;[6] and information systems, with emphasis on economic mechanization.[4, 11] During the next 10 years, this centralized effort was strengthened further by development of some information-analysis centers—groups of subject experts backed by unique collections of documents—and by emphasis on technical liaison—interaction with appropriate departments of universities, government-research groups, and others doing horizon research—and on educational and scientific relations—contacts with and appropriate support for universities and societies.

Table I. Esso Research Technical Information Division, Mid-1967

Information Analysis	Information Processing	Other Functions
Area groups	Technical libraries	Education and scientific relations
Chemicals	Central files	Publications clearance
Petroleum	Literature and patent abstract bulletins and indexes	Meetings arrangements
New areas	Reports indexing and distribution control	Information systems
Engineering		
Patents		
Centers		
Engineering information		
Crude oil assays		
Others		
Technical liaison		

As recently as mid-1967, the functions of the Technical Information Division were basically those in Table I. About 30 professionals were involved, all but two of them technically trained. The information-analysis people were largely of the doctorate level in chemistry or chemical engineering, with many years of company research or engineering experience at highly responsible and senior staff levels. Annual budgets were somewhat over 1% of the company's R&E expenditures.

In October 1967, these information operations were reorganized as a combination of area-based information

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analysis groups and site-based information service sections. This new arrangement is in accord with the company's present management approach for research services, an approach which places emphasis on "corporate service field units" for functional areas of work. The principal result of this change has been to make the information-analysis functions directly responsive to the information needs of the functional areas which they serve.

For the technical information services, a geographical problem existed—engineering information operations had been increasingly centered at the company's Engineering Center at Florham Park, N. J., nearly 20 miles from the site of the Research Center in Linden, N. J., and had been growing rapidly. Thus, while many of the Technical Information Division's centralized information functions remained at Linden, there was also need for a separate, enlarged operation at Florham Park, where the existing Engineering Information Center had previously been founded and operated by the Technical Information Division. For this purpose, a much expanded Engineering Information Center (EIC) was organized within Engineering Corporate Services (ENCS).

At Linden are located two principal information units; namely, the Technical Information Section (TIS) of a consolidated Analytical and Information Division (AID), and a Chemicals and Patent Information unit within Chemical Corporate Services (CCS). The other functions of TID were assigned to staff groups or appropriate research divisions.

This realignment of information-operations management does not reflect a lessened information effort at Esso Research. Instead, it represents a centralization of information groups in functional areas. In an R&E organization as large as Esso Research—nearly 2,000 professionals—"area" groups such as chemicals or engineering are themselves quite large. How information services can best be centralized then becomes a function of top-management philosophy and company organization.

This paper will deal chiefly with unique or interesting phases of present operations within AID's Technical Information Section, ENCS's Engineering Information Center, and CCS's Chemicals and Patent Information operation.

AID TECHNICAL INFORMATION SECTION

TIS Technical Libraries. The Technical Information Section continues to operate, at Linden, a major technical library with a nearby patent section. These afford an extensive (40,000-volume) company-specialized array of journals, books, reference sets, patents, and other information tools. A working collection is also maintained in a nearby building which houses many research chemists.

As Table II attests, reference librarians are available in the technical library to help answer specific questions. Document services include journal routing, in division-approved programs; the loan of books, journals, theses, and patents; the provision of photocopies; and the ordering of translations.

As in other TIS areas, emphasis is being placed on modern microfilm systems as a means of conserving user time and library space. Our 1963–65 cost-effectiveness study[18] on using *Chemical Abstracts* in microfilm cartridges on microfilm reader-printers helped to persuade the Chemical Abstracts Service to make this service generally available. At Esso Research, this user-oriented system has continued to be both popular and economical, saving 50% of user time.

Table II. Present Programs of the AID Technical Information Section

Technical Libraries	Company Reports	Abstract Bulletins, Indexes
Acquisitions	Policy studies	In-house services
Ordering	Distribution control	Agricultural chemicals
Cataloging	Requests center	Iron and steel manufacturing
Circulation	Checklists	API services
Journal routing	Address labels	Refining literature
Reference service	Uniform numbering	Refining patents
Meeting programs	Indexing	Transportation and storage
Announcement Bulletins	Monthly bulletin	Petroleum substitutes
Acquisitions and new company papers	Cumulations	Other services
Tables of contents of translated Russian journals	Microfilming	POST-J
	Reference service	Plasdoc
		Chemical Abstracts Condensates

Spurred by this program, we then joined a few others in successfully persuading major microfilm publishers—including the American Chemical Society—to publish sets of journals on 16-mm. microfilm in cartridges, for use in the same modern equipment. We are currently purchasing these microfilm sets at the rate of some thousands of dollars annually, a program which will long postpone our need for more-costly additional library space.

We are similarly microfilming our current technical-abstract bulletins and buying microfilms of the American Petroleum Institute's bulletins. For access to prior information, we have microfilmed a 1920–63 file of nearly 2,000,000 literature and patent abstract cards. We have also proved the worth of an idea of the Eastman Kodak Co. Research Laboratories for replacing printed "dual dictionaries" in coordinate indexing systems with a microfilm of one copy, from which prints can be made for each keyword, marked in a variety of ways, and kept as a search record. This effort has led the Americal Petroleum Institute to provide a microfilm of its dual dictionary index as a subscriber option, which we have obviously elected.

The TIS Technical Library employs computers extensively in its journal-handling programs.[3] Routing slips are computer-printed monthly for all journal issues expected from among over 1000 subscriptions. The routing slips that remain unused then become signals for the follow subsystem. Subscription orders and renewals are produced by the system, as are binding notices. Checklists are also produced, both alphabetically by journal titles and by the names of the recipients.

Company Reports. The Technical Information Section plays a major role in company communications. It is the focal point for servicing the report-copy needs of groups and individuals in Esso Research affiliates on a contractual "need-to-know" basis, shown as the "Distribution Control" function in Table II. By fiat, TIS receives all requests for copies or series of specific company and

SYNTHESIS-GAS

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ING PROCESS FOR PRODUCING HIGH-PURITY HYDROGEN, TOWN-GAS, SYNTHESIS-GAS, AND OXO-SYNTHESIS-GAS /EAM REFORM SF-79F
AVAILABLE FOR THE A.G.A.- IGT HYDROGASIFICATION PROCESS-- SYNTHESIS-GAS, COAL FUNDS WILL BE SF-64G
L FLAMELESS CONVERSION OF HYDROCARBON GASES WITH OXYGEN-- SYNTHESIS-GAS, FUEL-GAS THE AUTOTHERMA SF-34C
S BY OXYGENOLYSIS WITH STEAM-- THERMODYNAMICS, REFORMING, SYNTHESIS-GAS, HYDROGEN /DROGEN FROM HYDROCARBON SF-28B
/USTION OF NONGASEOUS HYDROCARBON FUELS, E.G., TO PRODUCE SYNTHESIS-GAS-- CARBON-MONOXIDE, HYDROGEN, BLAS/ SF-86G
ORPTION PROCESSES FOR REMOVING IMPURITIES IN SYNTHESIS-GAS-- PURIFICATION, CARBON-DIOXIDE ABS SF-34E
AVERAGED 30,000-B/D SINCE JULY PRODUCTION OF SYNTHETIC CRUDE BY GREAT-CANADIAN-OIL-SANDS HAS SF-78E
DROGENATION OF SHALE-OIL BY THE H-OIL PROCESS-- FUEL-GAS, SYNTHETIC CRUDE, AMMONIA DATA FOR THE HY SF-31
TIMATES FOR CONVERTING COAL-DERIVED OIL INTO HIGH QUALITY SYNTHETIC CRUDE-- FLUID COKING, COED, ISOMAX /ES SF-31G
COAL SYNTHETIC GAS PLANT CONSTRUCTION-- PIPELINE-GAS, SF-6F
COMMERCIAL PRODUCTION OF SHALE-OIL WITHIN 10 YEARS-- SYNTHETIC HYDROCARBON SF-38E
O PRODUCE PETROLEUM AT UP TO 11.5-MILLION-B-PER-D-- COAL, SYNTHETIC HYDROCARBONS, OIL-SHALE, TAR SANDS / T SF-82E
D HYDROCARBON/ MANUFACTURE OF PIPELINE-GAS, RICH GAS, AND SYNTHETIC NATURAL-GAS BY STEAM CRACKING OF LIQUI SF-51G
ROGASIFICATION A SYNTHETIC NATURAL-GAS PILOT-PLANT-- LIGNITE, HYD SF-6E
IN SOUTH AFRICA-- SASOL PRODUCTION OF GAS, SYNTHETIC OIL AND CHEMICALS FROM LOW-GRADE COAL SF-25E
HYDROGASIFICATION THE MANUFACTURE OF SYNTHETIC PIPELINE-GAS FROM COAL-- METHANATION, SF-51B

Figure 1. Augmented-title KWIC index to literature abstracts (page no. in circle)

affiliate reports, and it authorizes servicing of these requests by the (Linden) Reports Room, or the regular mailing of report series.

A versatile computer-based system is presently employed to produce both reports-control checklists and mailing labels for company report series. This system employs separate master tapes for complete addresses and for the recipients of specific report series, combining the contents of these tapes as appropriate for the desired checklist or set of mailing labels. Since the complete address for an individual or group appears on the master address tape only once (in a given form), a single address-update in effect corrects the lists for all report series received. An individual or group can have two separate addresses—internal (showing division and building number) and external (complete). Further, an individual can have two "names"—his own and a functional title.

TIS updates and interprets a uniform numbering system used worldwide for the reports of Esso Research and its affiliates. Attention to this system results in more-complete receipt of all reports by the Reports Room, and for indexing and microfilming.

A "Monthly Technical Reports Index" is produced for alerting purposes, and six-month cumulations are produced for searching. Since 1960, these indexes—and certain special ones—have been prepared by writing as many "synthetic titles" or sentences (about 5 to 7) as are needed to describe each report for identification or recall, putting these sentences into machinable form by Flexowriting and punched-tape-to-card conversion, and producing key-word-in-context (KWIC) indexes under an early, modified version of the Bell Laboratories BEPIP computer program. Our modified program produces 90 lines of 120 characters each per page, and yields highly readable offset-printed indexes (8½ × 11 inches) at a 40% photoreduction. For literature and patent indexing, we employ augmented titles instead of multiple sentences. All our KWIC indexes look much like the one shown in Figure 1.

Our surveys have shown that these KWIC indexes are acceptable to company people—only 6% do not like the format or the reduced computer type, while their utility evokes enthusiasm from over 80%. Thus, we have not yet been inspired to shift to the more-conventional-appearing KWOC (key-word-out-of-context) formats that would increase our printing costs because of the additional lines required for some items.

Incidentally, we have saved considerable index-production time, while still providing reader convenience, by placing an all-embracing "arrow" (see top of Figure 1) over the gutter of each KWIC page. The first keyword on the page and the page number are typed on each sticky-back arrow, and these are then peeled off and affixed. At one time we employed a tint block over the left portion to guide users to the gutter, typed the first keyword in the upper-left or upper-right corner, and typed the page number, centered, at the bottom of each page.

TIS and its predecessors have microfilmed annual or semiannual sets of company and affiliate reports since 1938, for security purposes and for use at other company report centers. We have gone through a progression of 35-mm. reel microfilm, Microcards, 16-mm. reel microfilm and/or standard microfiche, and now 16-mm. reel microfilm in cartridges.

TIS provides "reference service" for the reports collection and indexes—answers technical questions that can be handled quickly and assists laboratory and information researchers in conducting longer searches for themselves.

Correspondence Files. When the Technical Information Division was dissolved in 1967, the Central Files became a function of the Linden Corporate Services Field Unit, but close cooperation with TIS continues. For these files of company correspondence, a mechanized mail-control program[6] is part of the storage and recall procedures. Mail is accession-numbered and logged on a Flexowriter by sender (and organization), receiver (and organization), date, and title; lists are periodically produced by computer for all of these access points. The mail is also microfilmed to prevent loss. Storage for subject access continues to employ file folders under a numerical classification system.

Abstract Bulletins and Indexes. The Technical Information Section and its predecessors have long published or distributed abstract bulletins which contain the highlights of published literature or patents. Personal copies of these bulletins are widely distributed throughout Jersey Stand-

THE YIELD AND QUALITY OF SWEET POTATOES CAN BE INCREASED BY SOIL FUMIGATION OR THE ADDITION OF CERTAIN NEMATOCIDES in some areas of Mississippi. A study of control of root-knot nematode was conducted by the Truck Crops Branch Experiment Station in 1967. In row treatments, the fumigants Vorlex, Dow W-85, or DD significantly increased yields. Vorlex or Dow W-85 should be applied at 2.5 gal/acre and DD at 9-10 gal/acre, 8-10 inches deep in the center of the row. The fumigants must be applied 2 weeks to 30 days prior to planting. All have similar restrictions and precautions which should be followed during application. As regards soil incorporation of new and experimental nematocides, Dasanit and Bayer 68138 showed promise, producing roots that were 98 and 97% free of nematodes.

W. O. Thomas & J. A. Campbell: "Nematode Control in Sweet Potatoes." Mississippi Farm Research 31 #3:7 (Mar. 1968)

Figure 2. "Reader-oriented" ("news-type") informative abstract, which stresses placing findings early in the abstract

ard to help keep technical personnel up to date, and microfilm copies are housed in company libraries for later access through indexes.

As evidenced by the grouping of bulletin titles in the right-hand column of Table II, company philosophy has been not to produce bulletins for ourselves that we can satisfactorily obtain elsewhere. Thus, while TIS once produced abstract bulletins equivalent to all those shown as "API services," it is now among the participating subscribers for these products.

TIS also handles or assists Chemicals and Patent Information with development work on applying within the company such chemical abstracting and indexing services as *Chemical Abstracts Condensates, POST,* and *Plasdoc*. TIS has also worked with the ENCS Engineering Information Center on its needs for *Engineering Index* services. Personnel from Esso Research information operations work actively to improve these and other information services; they serve on working committees and governing bodies of API, CAS, EI, NFSAIS, etc.

We have evolved and demonstrated[16] the value of "reader-oriented" ("news-type") abstracts, as distinct from the conventional ("mystery-story") abstract. Note the *findings*-oriented topical sentence in the abstract in Figure 2, more useful to readers than the usual *subject*-oriented title. Note also that moving the bibliographical data to the end of the abstract does not diminish its availability to those who need this information.

Most of the abstract bulletins which TIS produces or obtains are sponsored by other Esso Research divisions, hence must be highly reader-reactive.[10, 16] Some of these divisions participate in or handle item selection. Readers have been highly cooperative in responding to surveys.

Because we distribute so many thousands of bulletin copies annually at company centers in Linden and Florham Park, we became concerned about the costs of addressing these bulletins and then sorting them. Thousands of dollars annually were subsequently saved by placing colored tabs that match the colors of the covers of bulletins received by specific individuals on the appropriate dividers of mail-delivery carts.[13]

As mentioned, we use augmented-title KWIC indexing for our own abstract bulletins for economic reasons, but have long devoted much attention to computer-based coordinate indexing, especially that now practiced by the API.[2] Our author indexes are produced by using API computer programs.

CHEMICALS AND PATENT INFORMATION

The Chemicals and Patent Information operation of the Chemicals Corporate Services is the largest of the area-oriented groups of the former Technical Information Division; indeed, it is now much larger in scope and number of people than its predecessor group in TID. It has the responsibility of meeting the R&D and patent information needs of the chemical and patent divisions of Esso Research and its worldwide affiliated chemical companies.

This information unit consists of highly experienced people with acknowledged technical abilities. All are chemists, with more than half of the staff at the doctorate level, plus others who are highly knowledgeable in patent matters. The functions of the Chemicals and Patent Information operation are shown in Table III.

A prime function of Chemicals and Patent Information is to encourage the in-depth early use of the literature in planning and carrying out R&D programs. To do this, it is necessary to maintain close ties with R&D personnel and to keep informed of company R&D goals and plans.

Another function is the coordination of all of the company's patent searching, particularly for the Patents and Licenses Division, but not necessarily solely for it. For example, the Chemicals and Patent Information operation has promoted the use of a system for rapid, low-cost patent searching for chemical units within the Jersey Standard family. The information unit also carries out the more-comprehensive validity and infringement searches required by the Patents and Licenses Division. Most of this searching includes an analysis of the search results, so that the resultant report is not merely a compilation of references.

Another area of activity involves matching of new scientific and technological information with the needs of the R&D organization. This involves the early spotting of significant or potentially significant developments, and the channeling of this information to action points within the company and its affiliates. To accomplish this and its other objectives effectively, the Chemicals and Patent Information operation is geared to carry out its functions with a high sensitivity to both the immediate and long-

Table III. Functions of Chemicals and Patent Information

Promote the effective use of available information in meeting Jersey Standard's chemical needs
Match information to Jersey Standard's chemical needs
Prepare in-depth, analytical studies, especially before "expertise" exists in ER&E
Provide analyzed background information, especially for staff, management, and affiliate personnel
Select and channel information on new developments
Provide assistance in information retrieval
Coordinate all patent searching

range information needs of Jersey Standard's chemical R&D units. The members of the information operation attend key company technical meetings, and maximize informal personal contacts with R&D personnel.

Continuous emphasis is placed on maintaining all lines of communication. Visits are paid periodically to the more-distant laboratories, and effort is made to maintain close ties with local R&D personnel. Periodic lists of information reports are sent by Chemicals and Patent Information to key individuals in the Jersey Standard chemical family. The distribution of these lists usually results in numerous requests for report copies, indicating a specific interest in about 60 to 80% of the listed information reports. This feed-back enables the information unit to sharpen its awareness of fields of interest on a worldwide basis.

ENGINEERING INFORMATION CENTER

As shown in Table IV, the ENCS Engineering Information Center at Florham Park includes both information-analysis centers and information-service operations.

Emphasis is placed on information-analysis centers. Typical of these is the Crude Oil Assay Information Service, whose staff advises Jersey Standard affiliates on the needs for and types of new crude oil assays, interprets and critically evaluates assays, provides results on the use of specific assays in different refining operations, suggests appropriate crude oils to match refinery needs, and provides copies of crude oil assays, as needed, from its master collection.

One of the major services provided by EIC is the computer searching of proprietary as well as published information. The proprietary information in the system is a selection from incoming and outgoing documents, based on our decision as to whether or not the documents have long-term technical value. The selected documents are coordinate indexed for searching, either by computer or manually with computer-produced indexes. From 1961 through 1964, however, this searching was done by IBM punched-card sorting.

Since its introduction in 1964, the company has subscribed to the API's indexing service, which makes possible computer searching of the API's abstract bulletins on "Refining Literature" and "Refining Patents." Esso's early experience in coordinate indexing and searching by punched-card sorting supplied substantial background for the development of this API system, whose basic programs we now employ. Thus, we now use an IBM 360 computer to search both the API tapes and those providing access to our proprietary material. Each computer search provides a printout of the titles and other bibliographical data for documents matching the requirements of the search; each item is also accompanied by a list of the descriptors used in indexing the document, and the identifying (accession) number for our document or the API abstract. Both our documents and the API abstracts are stored on microfilm. Acceptance and use of the system have been growing steadily.

Table IV. Present Programs of the ENCS Engineering Information Center

Information Centers	Information Services
Engineering	Engineering library
Information input	Acquisitions
Proprietary documents	Ordering
API abstracts	Cataloging
Searching	Circulation
Computer	Reference service
Dual dictionary	Engineering files
Conventional	Correspondence
Crude oil assays	Design specifications
Preparation	
Consulting	
Coordination	

For simple searches, the dual dictionaries produced by the API system still provide a convenient tool. However, where the number of descriptors is large and a quick answer is needed, there is no substitute for a computer search. Obviously, this type of searching is limited to subject areas which have been appropriately indexed, so it is necessary for us to resort to conventional search tools when our interests first spread to new areas.

The central files in the Engineering Information Center operate largely on a self-service basis. An Acme Visible alphabetical subject index provides the engineer with folder numbers and shelf locations for material related to his problem. At present, this file is maintained entirely as hard copy. The relative merits of microfilm *vs.* hard copy are always under consideration, but for the immediate future we plan to retain hard copy for the bulk of the central files for engineering documents, using active culling to maintain them within reasonable shelf space.

In an organization that is responsible for millions of dollars of construction all over the world, a substantial part of the files must be devoted to current job specifications, as well as to catalogs of completed projects. The latter are used extensively in planning debottlenecking projects or in other follow-up work. These catalogs are bulky relative to the use that they get, however, and offer a fruitful area for future microfilming.

A substantial expansion of the engineering library collection has been started, to provide adequate facilities for reference service and literature searching at Florham Park. However, it is anticipated that substantial use of the technical library in Linden will continue. A union catalog is maintained for the holdings of both libraries. At present, the copy in the engineering library is in microstrip form, but we are considering reel microfilm in cartridges because of their lower cost.

INFORMATION SYSTEMS

Many of the unique information systems employed at Esso Research have already been described. Much of the systems work is still being done by the operating units themselves, but computer work is being increasingly handled by Esso Mathematics and Systems, Inc. (EMSI), a separate Jersey Standard company. Systems guidance, funding, and review are supplied by Esso Research's operations-analysis operation.

STAFFING

In the Esso Research information-analysis groups, emphasis in staffing has long been on advanced knowledge and on company know-how, know-who, and peer acceptance.[5, 12, 14] Thus, as mentioned earlier, the senior information staffs have continued to be at the levels of

the company's senior research (or engineering) associates, or section heads. They are assisted by some doctorate-degree people and by others whose chemical or engineering training also permits interchangeability between information analysis and laboratory work. The senior staffs come from within the company. Outside recruiting, when needed for staff at other levels, places emphasis on technical know-how and training. Information training, if needed, is provided on the job.

The Technical Information Section and the Engineering Information Center also employ technical searchers, librarians, editors, writers, and indexers. Many of these have been trained on the job, and/or through work-study and educational-assistance programs. Recruitment, when needed, places emphasis on the proper scientific or engineering background, related experience, systems approach, empathy to users, and growth potential. We have little experience, as yet, with information-science majors.

We have benefitted materially from descriptions of the work of others in the management and operation of information groups, so we hope that this paper will prove of similar value to some of our colleagues in other organizations. At the least, it is a picture of Esso Research information operations at this point in time.

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