Evaluation of the Unesco/IOC Project on Integrated Library and Information Services at the National Institute of Oceanography, GOA

by L.J. Haravu

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EVALUATION OF THE UNESCO/IOC PROJECT
ON INTEGRATED LIBRARY AND INFORMATION
SERVICES AT THE NATIONAL INSTITUTE
OF OCEANOGRAPHY, GOA

by L.J. Haravu

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Evaluation of a Unesco/IOC project on Integrated Library and Information Services at the National Institute of Oceanography (NIO) in Goa, India and recommendations for the future of the project are presented. The project's bibliographic database, extent of library automation, information services provided, and networking activities were examined. Some NIO scientists were interviewed to find out their views on the services in general and on search services based on the ASFA CD-ROM provided under the Unesco/IOC project.

The training component of the project has achieved its goals of equipping NIO staff with the requisite skills to create and maintain a database and for provision of services to users of oceanographic information in India.

The bibliographic database implemented using the Mini-Micro CDS/ISIS was based on the Common Communications Format (CCF) of Unesco and was compatible with the structure of the Aquatic Sciences and Fisheries Information System (ASFIS). The database was however not adequate to support an integrated library management application.

The project had not been able to implement a pilot integrated library management system since the microcomputer earmarked for the project was not available until quite late in the life of the project. The project did well to establish end-user services based on the ASFA CD-ROM. Notably, the project initiated search services after a well planned drive to sensitize users to the CD-ROM database and computer-based searching. Also, the project encouraged end-user involvement in the search service. This has resulted in widespread use of the search service and a good appreciation of its capabilities. SDI services, however, could not be started by the project and the present mission has addressed this.

Scientists interviewed were generally appreciative of the search and other services provided by the NIO library.

The project had not done much work in network development. However, the Library has been designated as the Indian National ASFIS centre and trial input was begun in 1990.

High priority for network development is recommended and the rationale for NIO to take the initiative is discussed.
Steps to implement a nation-wide SDI service based on the ASFA CD-ROM and the software developed by the consultant during the mission are presented. Wider promotion of the search service and a study of the gaps in coverage of the ASFA database in natural products chemistry and ocean engineering are recommended. Some suggestions on making the database more widely and easily accessible to users are given. The need to improve the Library's document delivery capabilities and suggestions for this are provided.

The feasibility of developing an integrated library management system using Mini-Micro CDS/ISIS is discussed, and the structure of a database and a menu system for an integrated library management system is presented. An estimated budget for implementing the recommendations of the report is presented.
I. INTRODUCTION

1. The mission described in the present report was carried out from 24 January to 2 February 1990 within the framework of the Unesco/IOC project on Integrated Library and Information Services at the National Institute of Oceanography (NIO), Goa (India). The mission was financed by Unesco under its Regular Programme for 1990-91.

2. The terms of reference of the mission were to:

   (a) Evaluate the Unesco/IOC-sponsored Integrated Library and Information Services Project at the National Institute of Oceanography (NIO);

   (b) Advise the staff of NIO on the future development of the Institute's library and information services with a view to developing a fully operational national oceanographic information network;

   (c) Carry out a feasibility study for an integrated library management application (including acquisition control, cataloguing and circulation control) under Mini-Micro CDS/ISIS, taking full account of available international standards and practices with a view to the development of generic system useful to other CDS/ISIS users.

Objectives of the Unesco/IOC Project

3. The broad objective of the project as stated in the contract signed between the Council of Scientific and Industrial Research (CSIR), the parent body of NIO, and Unesco (BOC ref: 400296.6) was to develop within NIO in Goa an integrated, computerized bibliographic information system and network ensuring identification and retrieval of the oceanographic literature produced in India, access to international databases on oceanography and management of the NIO library.

4. The specific tasks that the project was set to achieve were as follows:

   (a) install the microcomputer and software to be provided by Unesco under the contract;

   (b) nominate two information specialists familiar with microcomputer use to receive training under the contract and subsequently be responsible for implementation of the work;

   (c) develop as necessary and adopt a standard bibliographic format for oceanographic information in India and set up an integrated computer application based on it for management, retrieval, dissemination and exchange of bibliographic information as well as library acquisitions, serials control, cataloguing and circulation control;
(d) develop network and input procedures for collection of national bibliographic information in oceanography as well as procedures and services for providing this information to users at the national level, along with original documents when required;

(e) set up a service to provide international bibliographic information within India including both retrospective and SDI components, making use initially of the Aquatic Sciences and Fisheries Abstracts (ASFA) database and CD-ROM technology;

(f) implement the integrated information system on a pilot basis, including services to selected users in oceanographic institutions and agencies other than NIO by 30 June 1987 and submit to Unesco by that date an interim report on the work accomplished;

(g) submit to Unesco by 31 December 1987 a complete report of the work, suitable for wide distribution, including the background of the project, the work plan and accomplishments, an evaluation of the pilot services based on user feed-back and recommendations for future activities including regional and international cooperation.

5. On its part, Unesco agreed to supply microcomputer and related equipment, software, and a subscription to the Aquatic Sciences and Fisheries Abstracts (ASFA) database on CD-ROM apart from supporting the required training of NIO staff.

II. EVALUATION METHODOLOGY

6. The present mission has used the methods given below to evaluate the Unesco/IOC project -- one of the tasks assigned to the mission.

   (a) examination of the bibliographic database developed at NIO, and the format and standards used;

   (b) examination of the extent of library automation implemented and the integration of library management and information retrieval and dissemination functions achieved;

   (c) analysis of data pertaining to services provided;

   (d) discussions with the Documentation Officer (DO), NIO who is in charge of library and documentation services at NIO, and

   (e) interviews with some scientists at NIO.

III. PROJECT EVALUATION

Project chronology

7. It is necessary to delineate the chronology of events in the project in order to better appreciate the extent to which the project has been able to fulfil its objectives. Further, an understanding of the problems faced and gaps in implementation of the project, it is believed, will enable decisions concerning the future course of actions required to further the objectives of the project.
8. The chronology of major events in the project were as follows:

(a) December 1986: The contract detailing the project and its objectives was signed.

(b) January 1987: The Documentation Officer, NIO was deputed to the Asian Institute of Technology (AIT), Bangkok for training in Mini-Micro CDS/ISIS.

(c) August 1987: An IBM-PC/AT ordered by Unesco was received at NIO. However, the key to the system was not received and the system could not be used. Attempts to obtain one locally began.


(e) January 1988: Two staff members of NIO, one from the Library and Documentation Services and one from the Data Services Division were deputed to the Food and Agriculture Organization (FAO), Rome for training in the methodologies of the Aquatic Sciences and Fisheries Information System (ASFIS) of the FAO.

(f) April 1988: A Philips CM-100 CD-ROM reader ordered by Unesco was received at NIO. Unesco also paid for the backfiles of the Aquatic Sciences and Fisheries Abstracts (ASFA) on CD-ROM, and a subscription to this product for 1986 and 1987.

(g) May 1988: The defective IBM-PC/AT was returned to Unesco, Paris after failure to get it repaired in India.

(h) August 1988: The CD-ROM player was commissioned using an IBM-PC/AT compatible computer in one of the scientific divisions of NIO.

(i) August - September 1988: User-awareness of the new facility was generated through lectures and demonstration of the ASFA database on CD-ROM, and provision of trial search outputs. Formal service to users in NIO and elsewhere began soon after using the microcomputer and CD-ROM installed in one of the scientific divisions of NIO.

(j) November 1989: The defective IBM-PC/AT was returned by Unesco to NIO after due repairs. The microcomputer was installed in the NIO library and the CD-ROM player was moved to the library and installed to work with the IBM-PC/AT received.

(k) November 1989 and thereafter: an in-house database using Micro CDS/ISIS database was established.

9. The chronology presented clearly shows that a key piece of equipment, viz., the microcomputer, became available after more than two years of the actual procurement and dispatch to NIO by Unesco. This was a serious setback for the project in reaching its full potential. In spite of this, however, the project has been able to make good progress in meeting its objectives of providing service to end-users of oceanographic information. In what follows is given the
details of the accomplishments of the project and gaps in meeting some of the objectives of the project.

**Training**

10. Three professionals were trained under the project. Two of the three trainees were from the NIO’s library while the third was drawn from the Data Services Division of NIO. The Documentation Officer (DO) who is in charge of the Library and Documentation services at NIO was trained in Mini-Micro CDS/ISIS. This training clearly has been a valuable input into the project. The skills learnt as a result of the training have been well utilized in the development of a database at NIO. A good understanding of the functional end-user modules of CDS/ISIS as well as that of the Database Manager modules was evident in the discussions that the consultant had with the Documentation Officer. The present mission did provide some inputs in furthering the skills in using the Advanced Programming Services facility of Mini-Micro CDS/ISIS. This was provided mainly by associating the DO in the design and later in the programming for the development of a general purpose CDS/ISIS Pascal program for the provision of SDI outputs using any CDS/ISIS database.

11. Of the two staff members who were trained in ASFIS methodologies, the staff member from the library is able to utilize the skills learnt in bibliographic description and indexing in preparing data for locally generated input. This training will no doubt stand in good stead when NIO formally becomes a national input centre to ASFIS. The other staff member from the Data Services Division who was also trained in ASFIS methodologies has in fact left the NIO headquarters in Goa and is now posted to NIO’s regional office in Vishakapatnam. It is unlikely that the ASFIS training received by him would be of much use in the Regional Office of NIO since he is not expected to provide any input to the library’s database.

12. The training component in the Project may be said to have achieved its goals of equipping NIO staff with the requisite skills to create and maintain a database and for the provision of services to users of oceanographic information. More importantly, the presence of well trained staff in the NIO library will go a long way in enabling the building of a national oceanographic information network.

**Bibliographic database**

13. As already mentioned, a bibliographic database has been defined and implemented using Mini-Micro CDS/ISIS since Nov. 1989. The database has used Unesco’s Common Communications Format (CCF) as the source for the identification of mandatory and optional data-elements and sub-elements. The database as structured has also taken into account the ASFIS structure. Further, rules of ASFIS have been adopted for the bibliographic description of local input. An implementation of CDS/ISIS by ASFIS called ASFISIS is under consideration. The idea is to enable ASFIS input centres to contribute their input as CDS/ISIS ISO-2709 files and at the same time enable local databases to be built using the ASFISIS structure. Except for minor variations, the in-house database at NIO is
convertible to the ASFISIS structure. Data elements required to
describe theses and dissertations which were missing in the data
definition were added during the present mission.

14. The present structure of the database and the rules that are
being followed will enable the NIO to provide Indian input into ASFIS
without any re-keyboarding. However, it would be necessary to write a
conversion program to take care of the minor variations that exist
between the structure of the in-house database and that of ASFISIS,
assuming that the ASFISIS as it stands today will be accepted as such
for the provision of input from national or regional centres.
Similarly, it would be necessary to write a special program to put the
data from the in-house database into the CCF if it is decided that CCF
is to be used as the exchange format among participating centres in
India or when NIO needs to exchange its data with other centres
outside India. However, it would be quite simple to exchange data in
the present ISO-2709 format supported by Mini-Micro CDS/ISIS.

15. The database at present comprises mainly bibliographic data on
books and other monographs added to the NIO library. Input of articles
in marine and brackish water sciences selected from Indian journals
has recently been started. If this kind of literature is regularly
added to the database, it was estimated that an input of 120 to 130
items would result each month. Of this about 75 to 80 records are for
monographs in the NIO library (mostly past acquisitions) and about 45
to 50 will be for articles from journals. Items being input to the
CDS/ISIS database are being indexed using the ASFA thesaurus. The need
to capture information on nonconventional literature of Indian origin
(e.g. conference publications, theses) was stressed, and the need to
add selected analytics from monographs, particularly conference
documents, and locally generated information, in addition to journal
literature was highlighted during discussions with the DO. It was
pointed out that the addition of such data to the in-house database
constituted the value-added component of the database.

16. At the time of the mission, the NIO CDS/ISIS database structure
was not adequate to support an integrated application, i.e. an
application which will enable automation of library housekeeping (book
acquisitions, cataloguing, circulation, etc.), in addition to
information retrieval and dissemination functions. The former
functions had been implemented on another incompatible computer system
as described in the next section. One very promising approach to
achieving an integrated application would be to use CDS/ISIS as the
applications software as discussed elsewhere in this report. This
approach, discussed with the DO, would, however require additional
resources in terms of computer and staff time during the design and
set-up phases.

Library Automation

17. The fact that the microcomputer earmarked for the project did not
become available until November 1989 (i.e. until 2 months before the
present mission) was no doubt a handicap for the project in achieving
the objective of developing a pilot integrated system. Under the
circumstances, the project did well to give higher priority to
establishing end-user services than to the development of an integrated system. However, even before the Unesco project was initiated, the NIO library had acquired a Tandy TRS-80 microcomputer. This was used to automate library housekeeping functions such as book acquisitions, cataloguing, printing of book cards, and production of the hard copy of the library’s New Arrivals Bulletin. Programs in dBase II were written for this purpose. The application did achieve a good measure of integration across the above-mentioned functions of the library. The system was still operational at the time of the present mission. However, the winchester drive of the TRS-80 had crashed, considerably reducing the usefulness of the equipment. Also, the floppy drives were causing some concern. Spare parts and maintenance support for this machine is poor and there is no doubt that it would be in the best interests of the library to replace the TRS-80 with a newer model microcomputer. The DO is aware of this problem and has begun to implement essential library automation functions such as acquisitions control using CDS/ISIS PASCAL. A complementary, stop-gap solution suggested to the DO was to convert the application on the TRS-80 to run under dBase III+ so that the application could be run on the IBM-PC/AT supplied by Unesco, until the full fledged development of an integrated system using CDS/ISIS becomes possible.

18. The TRS-80 was also used to create a bibliographic database of articles selected from journals received in the NIO library. The database was being used for on-demand searches by users from NIO and other organizations. The data collected for input to the TRS-80 database was also being used to produce a fortnightly current-awareness indexing journal called Aquatitles. Aquatitles was a highly valued service by NIO scientists and other users from outside NIO as was gleaned from discussions with a few of them. However, the scanning of journals received in the library for input to the TRS-80 database was stopped with the arrival of the ASFA database on CD-ROM since this is a much more comprehensive source for searches than the TRS-80 database which was restricted to items available in the NIO library.

19. All the effort that has gone into the creation of the bibliographic database on the TRS-80 unfortunately seems to have been irretrievably lost since the hard disk on the TRS-80 has crashed. The back-up files for some reason also seem to have become corrupted. The vulnerability of files on microcomputer hard disks and the need to insure against hard disk failures by the keeping of at least three generations of back-up copies was highlighted during the mission.

20. Although the NIO’s mainframe computer, a ND-570, is not hard wired to the library, and hence file transfers between the library’s microcomputer and the mainframe are not possible, it is recommended that the library should, in the long run, be connected to the ND-570 or any other powerful computer that NIO may acquire both for application development and for the safe archiving of valuable data files. It was found that the Data Services Division makes good use of the ND-570 both for end-use as well as to archive its data although this division is also not hard wired to the ND-570.
Information services

21. An important objective of the project was to establish services having both retrospective and SDI components using the ASFA database on CD-ROM. Although the project did not have access to its microcomputer until November 1989, it did well to establish a search service using the ASFA database on CD-ROM almost as soon as the CD-ROM drive and the ASFA database became available, i.e. September 1988. This was done by installing the CD-ROM player and the ASFA database and software on a microcomputer available in one of the scientific divisions of NIO. The fact that the DO was already computer-proficient, and was well trained in computer-based searching, enabled the facility to be exploited quickly.

22. Notably, the project initiated search services based on the ASFA database after a well planned drive to sensitize users to the capabilities of the new product. The sensitization took the form of an audio-visual presentation followed by demonstration of the facility. It is clear that the strategy paid rich dividends as there is today greater awareness at NIO of the capabilities of computer-based searching and of the CD-ROM. More importantly, scientists have become more information conscious, and this is in no small measure due to the quick response that is possible to be provided with a search facility that is microcomputer-based, having access to a large database such as the ASFA.

23. A total of 558 searches of the ASFA database were conducted for various users during October 1988 to February 1 1990. Of these, 396 searches or 70% were for NIO users and 162 or 30% were for users from other centres in India. Searches conducted were also categorized by broad subject areas and included physical, chemical, geological and geophysical, and biological sciences, and on instrumentation engineering. In addition there were searches on specific oceanic areas. Searches on biological oceanographic topics predominated and accounted for over 40% of all the searches. Users from outside NIO were from 25 institutions, mainly from university departments. However, there were users also from other agencies such as the Nuclear Thermal Power Corporation, Indira Gandhi Reactor Centre, and the Oil and Natural Gas Commission.

24. A noteworthy feature of the search service provided to NIO users was the fact that end-user searching was encouraged. Wherever possible, the end-user was encouraged to either do the search himself or sit with the information professional when the search was being done so that the user could intervene in a meaningful manner while the search was being formulated, look at the intermediate results, and assure himself that he was getting the best possible result. This strategy was undoubtedly beneficial as some of the users were found to have become quite knowledgeable about the facility and more importantly, were able to better appreciate the strengths and limitations of computer-based searching. Also, such users became active votaries of the service, spreading the benefits of the facility more widely than perhaps otherwise achievable.

25. As a result of the involvement of end-users in the searching process, the microcomputer was almost completely dedicated to the
search service, leaving very little time for other applications and developmental work. The microcomputer was already showing signs of wear and tear due to the heavy use to which it was being put. One sign was that it was becoming heated in spite of the air-conditioning in the room in which it was installed. At least one more microcomputer and CD-ROM player is strongly recommended so that the load on the existing machine is shared, new applications are possible to be developed, and in the event of the failure of one of the hardware components (Microcomputer or CD-ROM player), the search service will not come to a standstill.

26. The search service was highly valued by NIO scientists and has undoubtedly contributed to better utilization of information in research planning, problem-solving, and current-awareness in NIO.

27. The provision of a SDI service was also envisaged as one of the objectives of the Project. However, given the time that the microcomputer was available to the project and the fact that the search service more than fully occupied the capacity of the microcomputer, the project had not been able to set up an SDI service. Also, the software that is used to access the ASFA CD-ROM does not provide the capabilities to produce SDI outputs based on stored profiles. This mission has addressed the need for the NIO library to be able to utilize the ASFA CD-ROM for SDI service. This is described elsewhere in the report.

28. It must however be said that the suspension of a useful current-awareness service viz., Aquatitles subsequent to the arrival of the CD-ROM facility was probably not in the best interests of users. This service was being used by a number of users not only in NIO but also outside mainly in the departments of Marine sciences in different universities and was obviously a useful service since some of them were willing even to pay for the service.

29. Aquatitles was being produced with the input being derived from journals received in the NIO library. The items identified as useful to oceanography and marine science information users in the country were grouped by broad topics, stencil duplicated and circulated to users all over the country. The reason why Aquatitles was suspended was because it was not possible to cut duplicating stencils on the microcomputer printer, and there was no offset duplicating facility in NIO which could have been used to produce paper or metal masters from computer output, and later several copies for distribution. Apparently the DO did not get enough support from the NIO management to a proposal to get Aquatitles produced using an outside offset printing agency.

30. The reason why Aquatitles was valued is not difficult to see. Most of its users were from universities in the country, where marine and oceanographic sciences departments are one of several departments competing for limited resources. University libraries obviously cannot subscribe to more than a few titles in marine sciences. Aquatitles provided awareness of the contents of a fairly wide spectrum of sources in these subjects. Further, users were able to request copies of documents available in NIO.
31. While the search service enables efficient access to retrospective information, it cannot substitute for a broad current-awareness service such as Aquatitles. Further, in the absence of a SDI service, there is no doubt that the suspension of Aquatitles must have been a loss for non-NIO users. Even if a SDI service is begun, it is believed that there is scope for a current-awareness service such as Aquatitles, since all users (e.g. post-graduate students), do not have well-defined interests that would enable them to benefit from a SDI service.

32. It is recommended that the NIO should explore the possibility of providing a current-awareness service using the ASFA CD-ROM for the benefit of users in India. Instead of providing a broad-based service such as that provided by Aquatitles, it is suggested that the service should be broken down into narrower subjects, e.g. physical oceanography, chemical oceanography, etc. Such a service could be a quarterly one to coincide with the updates of the ASFA CD-ROM. One approach to the production of current-awareness lists in areas listed above would be to first download relevant ASFA database records into the CDS/ISIS database, after which the printing and sorting facility of CDS/ISIS can be used to generate the hard copy of current-awareness lists in specified areas.

Networking

33. One of the objectives of the Project was to develop network and input procedures for collection of national bibliographic information in oceanographic sciences, and the provision of accessibility to such information and document delivery services. The Project has not done much work in fulfilling this objective. This will undoubtedly require to be done in the future in order that the users all over the country are enabled easier and wider access to information generated within the country, and so that such information is input into an international database such as ASFA.

34. There are a handful of primary journals of Indian origin in oceanography and marine sciences and the NIO library is already obtaining these. Input from such sources is planned to be entered into the CDS/ISIS database being built. However, effort to obtain input from other sources including nonconventional literature needs to be organized and this is discussed under the section of this report dealing with the future directions that the NIO library should take in furthering the Project objectives.

35. Unesco had sponsored the visit of the DO to the ASFIS headquarters in Rome in October 1989 to attend the ASFA editorial staff meeting. During this visit, discussions were held with the Chief of Fishery Information, Data and Statistics Service of FAO on the question of Indian input to ASFIS and the NIO library was given the status of Indian National ASFIS Centre on a trial basis for one year (over 125 records have been sent and more than 200 are in preparation). A formal request to NIO to become the Indian national input centre to ASFIS was awaited. Once there is approval from the management of NIO for the library to provide such input, it would be
necessary for the library to establish firm contacts with centres of oceanographic research in the country to enable better capture of such information for input to the ASFA database.

**Interviews with NIO scientists**

36. Two afternoons were set aside to meet with a few scientists of NIO mainly to find out their views on the services of the NIO library, and particularly about the search services based on the ASFA CD-ROM. Their reactions to the provision of an SDI service based on local input and that obtained from the ASFA database was also sought to be ascertained. Further, their opinion on the extent to which users outside NIO had access to oceanographic and marine science and related information, and on whether the NIO library should help in providing better access to information for non-NIO users was also discussed. Lastly, their views on expert systems and geographic information systems and the applicability of such systems at NIO and for users of oceanographic information was discussed.

37. Four scientists were met (Appendix I). In addition the Director of NIO was also briefly met. All of the scientists met expressed great appreciation of the effort being put by the library to provide rapid and comprehensive access to information required by them from time to time. All of them were quite unanimous that the CD-ROM facility had indeed contributed significantly to the library’s capability to respond effectively to demands for information. One of the scientists pointed out however, that the ASFA database does not cover information on the chemistry of natural products, instrumentation and some aspects of ocean engineering sufficiently comprehensively. It is not surprising that a specialized database such as ASFA is not able to cover the literature of interdisciplinary fields such as natural products chemistry or instrumentation adequately enough. There is definite need to examine the extent to which other sources, e.g. Chemical Abstracts, BIOSIS, INSPEC, COMPENDEX, can supplement needs of the engineers and scientists working in some of the interdisciplinary areas at NIO, and the alternatives that are available to the NIO library to access such sources.

38. The scope and purpose of an automated SDI service was explained to the scientists who were met, and they were asked for their opinion about the usefulness of such a service not only to them and their colleagues, but also to users of oceanographic information outside NIO. All the scientists interviewed were quite enthusiastic in their support to the idea of an SDI service based on the data derived from ASFA as well as locally input data. All the scientists met were also quite unanimous in their view that the NIO library with its superior facilities and comparative advantages should provide its information services to users of marine science and oceanographic information outside NIO (mainly in the universities), since many such organizations lacked the kind of information resources, infrastructure, and skills that NIO had.

39. All the scientists met expressed the view that Aquaticles was a
useful service, particularly for those outside NIO. One of the scientists had carefully preserved his back copies of Aquatitles and welcomed the idea of its revival. Two of the scientists did not think that one or more narrowly focused current-awareness services of a type similar to Aquatitles would be more useful than the broad-based Aquatitles. They were afraid that the capability to browse through interdisciplinary areas possible in a broad-based service would be lost. It was pointed out that such a lacuna could be overcome by an SDI service which was capable of pulling in literature from across disciplines since a user's profile could be tailored to suit his interests.

40. The idea of building expert systems in marine and oceanographic sciences and related areas was welcomed by the scientists interviewed. One of the scientists felt, for instance, that an expert system on Water Pollution Control and Monitoring together with a diagnostic kit for monitoring such pollution would be useful to different water and fisheries authorities in India. The scientist was confident that his team, given the proper assistance, could provide the necessary inputs in the development of such an expert system.

41. The concept of geographic information systems (GIS) and thematic mapping was briefly explained to the scientists interviewed. They were unanimous in the view that it would be useful to explore this concept further. They felt that the potential for GIS at NIO in enabling a better understanding of interactions of different phenomena on oceanographic processes -- physical, chemical, and biological -- was indeed good. A literature search on GIS and its application to oceanography was requested by one of the scientists.

42. One of the scientists expressed concern about document delivery at NIO. He felt that a central reprography facility would be useful. Further, funds for the efficient acquisition of required documents that were not held by the NIO library, it was felt, were not adequate.

43. The overall impression gained out of the interviews with the scientists was that there was widespread appreciation of the information services being provided by the NIO library, and that the CD-ROM facility had indeed been well exploited for the benefit of users at NIO. The NIO library was definitely seen as contributing significantly to the work of NIO.

IV. FUTURE DIRECTIONS

Network development

44. The NIO library is probably the largest special library in marine sciences and oceanography in India. The Unesco/IOC Project on the development of an integrated bibliographic information system at NIO has enabled the development of new skills at NIO, the acquisition of new hardware and software, and valuable experience of providing information services to marine science users all over the country. The results achieved by the project so far indicate that the investment of resources and effort both by Unesco and NIO have indeed
been fruitful as the services provided have been found useful and are valued by the user community. There is no doubt that NIO with its advanced scientific facilities, an excellent library, well trained information staff, and its commitment to excellence in oceanographic research can also play a lead role in the provision of access to scientific and technical information for users of oceanographic and marine science information in India.

45. Information system development in India under the overall framework of the National Information System for Science and Technology (NISSAT) of the Department of Science and Technology, Government of India, emphasizes the development of specialized information facilities in different disciplines/missions to act as national information centres. Such centres in leather technology, drugs and pharmaceuticals, food science and technology, and aeronautics are already operational. Each of these national centres is expected to develop databases, exploit external databases, provide specialized services, and generally provide the leadership in developing sub-networks of libraries/information centres working for or in the discipline/mission.

46. The fact that the NIO library is already involved in database development, and in providing information services to oceanography and marine science users in India, shows that it is already doing, at least partly, the envisaged function of a national information centre for Marine Sciences and Oceanography under the NISSAT. The building of capabilities for the provision of a nation-wide SDI service, equipping it with the capabilities to access external databases, technical support to enable it to move into new areas of information management, and explicit sanction by NIO management to enable it to involve itself in network development will enable the NIO library to realize its full potential in contributing to research, development, and problem-solving in projects and programmes for ocean development, fisheries, etc.

47. Priority needs to be given to the development of a network of libraries/information centres in institutions working for oceanography/marine sciences and closely related areas, and for the promotion of NIO library's information services. The NIO should play a coordinating role in network development. Specifically, NIO should work towards achieving the following goals:

- develop and maintain union catalogues, especially of serials, and make available such tools in hard-copy as well as machine-readable forms to other centres of oceanography/marine sciences/fisheries in India and elsewhere.

- develop and maintain a national database of information relevant to national programmes on ocean development and R & D in these areas.

- enable the exploitation of external databases for those facilities that do not have the resources and/or skills for such exploitation.

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- promote the use of international standards in information handling.
- advise on hardware/software acquisition.
- provide referral services.
- provide training in computer-based methods, use of microcomputers, database design, online searching, etc.
- develop generic software or applications based on generic software, e.g. Mini-Micro CDS/ISIS, for distribution to local centres.
- distribute the national database on microcomputer media initially, and later via telecommunication networks and/or on optical media such as CD-ROM.
- assist in conducting user needs studies and user-awareness programmes, and generally promote/market information services of network participants.
- develop input procedures to ensure that Indian literature on oceanography/marine sciences/fisheries is captured for input to the national database on these subjects and for contribution to a global database such as the ASFA.
- liaise with other national, regional and international centres for mutual benefit.

48. It is recommended that the initiative for network development should come from NIO. The reason for suggesting this is the fact that except for one other institution, viz., the Naval Physical Oceanographic Laboratory (NPOL) in Cochin which is itself restricted to the broad area of physical oceanography, all other centres of research in marine/oceanography sciences are either in the universities or in research centres working in specific areas of marine sciences (e.g. fisheries, marine chemicals, marine geology). On the other hand, NIO's scope covers virtually all the branches of oceanography and marine sciences. Further, as already stated, NIO's information collection, its infrastructure, and its skilled manpower in information science as well as in several branches of oceanography, make it the obvious choice for leadership in network development.

49. The first step in network development would be to survey the information infrastructure, resources, skills, and user communities in at least the most important centres of research and education in oceanography/marine science areas. A list of such centres is provided in Appendix II. It is recommended that the DO should travel to these centres in order to collect information, and meet with the heads of these libraries/information centres and potential end-users. Following the visits, the DO should submit a detailed report discussing his findings and focusing attention on what short-term and long-term goals networking can and should address. The focus should
be not only on information resources but equally on how networking can enable easier and wider access to information for the end-user.

50. The DO's visit to the different centres should also be used to increase awareness of information personnel and end-users in these centres to the resources and services of the NIO library. Audio-visual presentations and demonstration of the search service using the CD-ROM or microcomputer database and the SDI service should be thought of in promoting the services and in sensitizing end-users.

51. Following the survey and consideration of the findings of the survey, a planning meeting of all heads of libraries and information centres and selected end-users should be called. The meeting should clearly spell out the advantages of closer cooperation among such centres, and the mutual benefits that can accrue both to information facilities and end-users, as a result of the sharing and exchange of resources, information, databases, equipment, and expertise. The agenda for the meeting should be drawn up based on the findings of the survey.

52. It is recommended that the call for the meeting should be given by the Director of NIO to the heads of the other centres. Such a step would establish NIO's commitment to and concern for improving access to information for researchers and teachers in oceanography and marine sciences.

53. The meeting should have as its objective, the clear identification of priorities for networking and cooperation, and should spell out action programmes that are required, and wherever possible, it should identify specific centres with specific responsibilities.

54. The meeting might also bring to attention the need for infrastructure development, skill building, etc., in one or more centres. Projects to meet such needs based on priorities identified during the meeting could then be formulated and funding or other support sought in filling these gaps.

55. An important objective of the meeting should also be to ensure that input procedures and responsibilities are agreed upon so that useful conventional and nonconventional literature is garnered for input to the national database as well for entry into a global database such as the ASFA. It is recommended that the NIO library be permitted by the management of NIO to act as the official national input centre for publicly accessible information on marine and brackish water science literature into the ASFA database. For information on fresh water sciences and fisheries, the NIO should identify a suitable centre in India to undertake the task of contributing Indian input into ASFA. The NIO library may provide training and advice to such a centre to enable it to satisfy the input norms and standards of ASFA.

56. Two divisions of NIO are concerned with data and information. These are the Library and Data Services Division. The library has the responsibility for bibliographic information and services based on
such information. The Data Services Division, on the other hand, has responsibility for scientific data storage, retrieval and dissemination services, e.g. ensuring that data in scientific missions are properly collected, collated, archived, interpreted, and made available to researchers within and outside NIO, on demand. Although the two divisions are dealing with different categories of data and information, there is scope for mutual support of each others' activities, and for the sharing of each others' resources, expertise, software, and databases. For example, the Library could play a valuable role in ensuring that the referral databases presently being maintained by the Data Services Division (DSD) are kept up-to-date with new input accessed by the library. Similarly, searches made by the library could in some cases benefit if they are supplemented with a search of the database being created by the DSD. The extent to which the two divisions can use common search software should be examined. In the long run when all databases could be mounted on NIO's mainframe computer, it would be advantageous to think of providing end-users a single interface for use of the bibliographic and scientific data resources of the Institute.

SDI Service

57. As already pointed out, although one of the objectives of the Unesco/IOC project was the establishment of an SDI service, the project could not achieve this objective. The present mission has addressed the need for the NIO library to be able to utilize the ASFA database on CD-ROM and locally added input for the provision of a nation-wide SDI service.

58. The following software was developed during the mission in enabling the provision of a nation-wide SDI service in future:

(a) A program in Turbo Pascal to convert ASCII output from the ASFA database on CD-ROM into an ISO-2709 file, and
(b) A program in Mini-Micro CDS/ISIS Pascal to search the inhouse database under CDS/ISIS to produce SDI outputs based on stored user profiles.

59. The first of the programs developed uses a subset of the ASFA database on CD-ROM (resulting from a search) in ASCII as an input file. Such a file is possible to be created as a standard output file by using the Cambridge retrieval software supplied with the ASFA CD-ROM. A second input file required is a parameter table, i.e. a conversion table giving the equivalence between the ASFA fields and that of the Mini-Micro CDS/ISIS database. Given these two input files, the Turbo Pascal program developed converts the ASFA data into an ISO-2709 file using the equivalent tags taken from the parameter table. The ISO-2709 file can then be imported into the in-house database.

60. The Mini-Micro CDS/ISIS Pascal program developed during the mission to produce SDI outputs based on stored user profiles has the following features:

- User profiles can be created using any standard text editor. However user profiles need to conform to a specific structure. The structure does not impose any constraints on the number
and type of search expressions that each profile may have. A profile may have any search expression that is allowed by the CDS/ISIS search language.

The program allows any predefined CDS/ISIS display format to be used in generating the SDI outputs.

All SDI outputs during a SDI run are accumulated to a disk file which can then be printed offline. In effect the program runs in batch mode requiring no intervention from the operator. Further, the program allows the run to begin from any given profile, identified by an unique code.

Since SDI is a current-awareness service, the program allows the SDI outputs to be restricted to records entered into the database on or after a given date of data entry. If this facility is used the program assumes that there is a field for date of data entry and that this field is indexed.

SDI outputs can be formatted as single or two-column outputs. The two-column output has a user copy and a feedback copy part. The latter part is identical to the former except that it also has two questions after each item that the user needs to answer as feedback to the operators of the service. The user is expected to detach the feedback copy after answering the two questions and return it to the library/information centre.

61. The above two programs will provide the capability to utilize the ASFA database on CD-ROM together with local input to offer a nationwide SDI service to users of oceanography and marine science information.

62. The capability to download information selected from the ASFA database on CD-ROM into a Mini-Micro CDS/ISIS database will enable the creation of a value-added in-house database, i.e. a database that incorporates locally generated input, Indian literature on oceanography, data on books added to the library, and other nonconventional literature accessed by the NIO library. Such a database together with fields required for housekeeping operations, e.g. book acquisitions and cataloguing, can be the basis of an integrated library and information storage and retrieval system.

63. It is recommended that the NIO library take the following steps in introducing a nationwide SDI service for oceanography and marine science users.

(a) Announce the availability of the service through letters to potential users, at meetings in which potential users participate, and through insertions in appropriate journals and newsletters.

(b) Provide a well-designed SDI service request form to users. The form should enable the user to articulate his needs as elaborately as required so that the library gets a good understanding of his ongoing and current interests.
(c) Develop user profiles using the search language of CDS/ISIS and taking the help of NIO scientists if required.

(d) Develop a macro profile or search expression reflecting national interests in oceanography/marine sciences/fisheries and related areas. This search expression is used to create a subset of the quarterly update CD-ROM of the ASFA.

(e) Run the Turbo Pascal program to create a ISO-2709 file from the ASFA subset. The ISO-2709 file is then imported into the in-house database.

(f) Run the SDI program to produce outputs for the different users whose profiles have been created and stored.

(g) analyze feedback regularly and take corrective actions as required.

(h) Maintain an ongoing dialogue with users including a periodic evaluation of how the service was found useful by recipients.

64. As already stated, in addition to an SDI service, there is scope also for one or more current-awareness services, i.e. documentation lists. Such lists could also be produced using the data imported from ASFA and that added locally.

Search services

65. The search service that has already been established should obviously be continued. However, the service needs to be promoted more widely. Several ways of doing so are possible and a few are suggested below:

- Prepare a leaflet describing the search and SDI services, the databases being used, kinds of uses to which the search service can be put (e.g. problem-solving), scope and purpose of the SDI service, and how to obtain or enrol in the services.

- Make presentations in meetings where marine scientists gather using audio-visuals describing the scope, nature, etc. of the services.

- Mount a permanent exhibition of charts, photographs, displays, and examples of information products and services. The foyer in the NIO building already has a permanent exhibition of NIO's activities and it should not be difficult to add one or two panels about the information services of the NIO library.

66. In addition to continuing the present search services, the library should make a systematic study of the extent to which literature on natural products chemistry, ocean engineering and instrumentation is covered by ASFA. Such a study would establish the need or otherwise to access other sources (e.g. INSPEC) in order to
fill gaps in coverage, if any.

67. New information products are being produced in CD-ROM form. Two of them which seem particularly relevant to NIO's interest are: BIOSIS and COMPENDEX. The extent to which these are useful to NIO should be examined and if necessary these should be acquired. The examination of the usefulness or otherwise of these products may be made by doing a few online searches of these databases on carefully chosen topics of interest to scientists either directly by the NIO library or using the facility at the National Aeronautical Laboratory (NAL), Bangalore. The results of such searches may be compared with searches on the same topics of the ASFA database.

68. In addition to bibliographic databases, other kinds of databases are also being produced on CD-ROM. These include directory-oriented databases and product information, e.g. on pesticides. The NIO library should keep track of such new products for possible acquisition and use in enlarging the information source base of the library.

Database distribution and accessibility

69. At present the in-house database is a CDS/ISIS database and is used mainly in single-user mode by the library staff. In the long run however, it will be necessary to consider how the database can be made directly accessible to the end-user at NIO, viz., the scientist and engineer working on research projects. One obvious choice is to mount the database parallelly also on the ND-570 minicomputer, terminals to which are planned to be provided to the different departments at NIO. At present the ND-570 machine at NIO does not have any information retrieval software that can be used to mount the library's database. The Database Management software available on the ND-570, CIBOS, is not considered to be suitable for bibliographic applications. Several organizations in India now have the ND family of computers. Effort should be made to find out if any other organization has implemented information retrieval on this machine. Alternatively, the manufacturer should be asked for advice on availability of IR software on this family of computers.

70. There is no doubt that as other centres of marine science education, training, and research become more information conscious, the need for better information retrieval in such centres will be felt. The NIO library should consider offering its microcomputer database or subsets of it to other centres, and training to enable the effective use of the database, including training for the provision of input to NIO in machine-readable form. This activity of the NIO library should be considered to be an integral part of the objective of improving access to information on marine sciences/oceanography for users in India, and in promoting networking.

Document delivery

71. The starting of a nation-wide SDI service, and wider promotion and provision of search and SDI services, will undoubtedly generate more requests for copies of documents that users find useful. It
would be necessary to gear up the document delivery service of the library so that it is an efficient back stop to the retrieval and dissemination service.

72. Several steps to improve NIO's document delivery capabilities are possible and some of them are listed below:

- Special funding for the provision of document delivery service may be provided so that the library may use efficient sources, e.g. The British Library, for the procurement of copies required urgently.

- Explore exchange and bilateral relationships with other ASFA input centres and major special libraries in oceanography/marine sciences in the West to enable mutual access to collections, databases, search services, and document delivery services. Even if free exchange of document delivery services may not always be possible, the cost of such services would probably be considerably less than that of commercial services.

- Charge commercial users for SDI and search services, and use the revenue gained from such charges towards document delivery costs. However, such a step would probably be able to offset only a small portion of the total expenses required for document delivery.

- Prepare a Union Catalog of Serials holdings of journals in oceanography, marine sciences, and closely related areas in the country, and make available such a tool to users and libraries all over the country to enable more predictable access to collections in the country. The feasibility of creating a subset of INSDOC's National Union Catalogue of Scientific Serials in India (NUCSSI) for serials of interest to the community of oceanography and marine sciences users in India may be explored.

73. At present the library does not have its own photocopier and was dependent on a machine in another department. It is recommended that the library should be equipped with a heavy duty plain paper copier as early as possible to enable it to meet requests for copies efficiently for its users. The DO was concerned about the difficulty faced in the maintenance of equipment in NIO due to the fact that suppliers usually need to come from Bombay, and generally are not interested in small volume maintenance contracts. This problem will need to be addressed on an institute-wide basis for all its equipment. One of the reasons why the Unesco microcomputer had to be returned all the way to Paris for repairs was because of inadequate maintenance support within NIO or within Goa.

74. Although the potential for knowledge-based expert systems and GIS at NIO is there, the present staff strength of the library is not adequate enough to experiment with such systems either on their own or in association with scientists. In fact the library will do well to concentrate on network development, establishment of a nation-wide SDI
service, active promotion of retrieval and dissemination services, and development of an integrated system for library management. However, a healthy interest in expert systems and GIS should be cultivated, and information about such systems should be made available to scientists at NIO. At an appropriate time a special project may be thought of in which the library may be involved in association with other divisions of NIO in the development of knowledge-based systems and GIS.

V. FEASIBILITY of DEVELOPING an INTEGRATED LIBRARY MANAGEMENT SYSTEM USING Mini-Micro CDS/ISIS

75. Mini-Micro CDS/ISIS is conceptually similar to the package of the same name developed during the 1970's for use with the IBM 360 and 370 family of mainframe computers. The important features of CDS/ISIS that have made it eminently suitable for bibliographic applications are capabilities that enable:

- the handling of variable length, repeatable, and sub-fielded fields;
- flexible formatting of outputs both for display and as printed products;
- the definition of the manner in which a field or subfield will become searchable, i.e. become an entry in a file called the inverted file.
- Boolean expressions, truncated terms, free-text terms, or any combination of one or more of the above in search statements, and the capability to execute the search statement globally or in one or more selected fields;
- data-entry and editing through well defined screen forms with full screen editing features including scrolling, some amount of block operations, and limited validation; and
- export or import data via ISO-2709 files.

76. The package has two sets of modules - one meant for end-users and the other for Database Managers. The formal part of the package is its Print Formatting Language.

77. Use of the package is directed through a series of menus, enabling professional staff of libraries to add or edit records, search, etc. without necessarily having an in-depth knowledge of the database designers conception of the database and its structure. However, an occasional end-user (e.g. a scientist at NIO) would need to learn the search language of CDS/ISIS in order to make effective use of a database. In its present form, the package does not provide help and tutorial features which are considered essential for the effective use of information retrieval packages by the occasional end-user.

78. Version 2.3 of the package released in 1989 added a number of new
features. The print formatting language was expanded to include logical comparison and conditional clauses (if-then-else). Synthesis of data from more than one physical record of a database became possible using the formatting language. Computation also became possible.

79. The kernel modules of CDS/ISIS do not on their own permit the use of programming-like constructs (except in a display/print format) in order to process data required in the management and control of library or other operations, e.g. book acquisition. The addition of a Pascal programming interface in version 2.3 of the package has provided the means for performing data processing tasks not possible to be done with the kernel modules of CDS/ISIS.

80. A version of Pascal called CDS/ISIS Pascal, available in version 2.3, provides the capability for application programmers to write stand-alone programs to access database records, CDS/ISIS modules, (e.g. the retrieval, data-entry modules), and the use of external files of data for various data processing purposes.

81. In addition to stand-alone programs, it is possible to write user-exit programs in CDS/ISIS Pascal to be used from within the CDS/ISIS menu system. These are called Menu-exits. Similarly, Format exits allow the calling of CDS/ISIS Pascal programs from CDS/ISIS modules to perform print or display formatting tasks not possible with the kernel modules of the package.

82. An important feature of CDS/ISIS Pascal is the availability of predefined procedures and functions for access to database records or fields of records, access to CDS/ISIS modules, string manipulation, etc. An application program can incorporate calls to the predefined procedures in addition to user-defined procedures in performing tasks required say in library housekeeping operations, e.g. circulation or serials control. The availability of predefined procedures provides considerable power to an application programmer.

83. The above-mentioned features of CDS/ISIS enable it to be used in building an integrated library management system comprising acquisition, cataloguing, circulation, serials, etc. Further it is possible to build a good user interface to enable the occasional user to be able to negotiate his way in searching a database.

84. Some preliminary work on the design of an integrated library management system using CDS/ISIS was done by the consultant in his organization as well as during the mission, and the results of this work are briefly reported in what follows.

85. Conceptually, CDS/ISIS uses a single physical Master file to store database records unlike more recent database management system (DBMS) packages, where a logical file may be stored in several physical files (e.g. in relational databases). In CDS/ISIS a secondary key index called the Inverted file (organized as a B-Tree) provides rapid access to database records by search keys. It is theoretically possible to include all the fields of a record in the inverted file although this is not usually done. In this respect
CDS/ISIS is similar to a DBMS.

86. In order to develop an integrated system, the approach taken is to define a single physical record to contain several logical records. The record structure envisaged consists of six logical records: acquisition, catalogue, circulation, vendor, patron, and fund. Each of the above logical records is identified by a field called the record type. Further, a data element may be shared by more than one logical record type. For instance, the field called Person Associated with Record is shared between the Acquisition, Catalogue, and Circulation records. Similarly, the field Vendor Code is shared between the Acquisition and Vendor records. However, some fields are unique to a particular type of logical record. The structure of the record in the proposed integrated database is given in Appendix-III.

87. In designing the structure of the record proposed to be used in the integrated system, the following guidelines have been used:

(a) The CCF has been used to identify mandatory data elements to describe different bibliographic entities at different bibliographic levels. Some optional elements have also been included.

(b) The eight volume publication of James E Rush Associates entitled Library Systems Evaluation Guidelines has been used to identify desirable features of the proposed automated library systems. The set of volumes takes a comprehensive view of library operations and is useful both in the evaluation of software and in the design of new software for library automation.

88. The latter volumes have been used to conceptually identify functions, sub-functions, searchability, and output products that could be built into an integrated system.

89. Finally an attempt has been made using a top-down approach to work out a possible menu system for an integrated system. This is presented in Appendix IV. The objective is to enable the development to be as modular as possible and to enable work to be shared among several programmers, if necessary, and for better maintainability of the programs.

90. The conceptualization has excluded serials management since it was felt that this function does not share its data elements with those of the other functions and in view of the distinctness of this area of library management, there is no particular advantage of integrating this function.

91. Automation of circulation control would require to be based on data collection devices such as Bar Code readers interfaced to microcomputers. Such devices usually produce transaction records on disc. It would be necessary to write special programs to convert/import such transaction records into the database. This will need to be done only after the Bar Code reading equipment is
92. Given the above discussed approach, it would be necessary to:

(a) Define the field definition and select tables (FDT and FST) of the integrated database,

(b) Define the different worksheets required for the different functions (e.g. for Acquisitions records),

(c) Define display formats, and print/sort worksheets required for different output products (e.g. Purchase Orders), and

(d) Write CDS/ISIS Pascal programs to implement the different functions and sub-functions of the integrated system given in the sample menu system in Appendix IV, and for the production of different products and services envisaged. One of the products, viz., the production of SDI outputs under the Information Retrieval subsystem of the integrated system proposed was written during the mission.

93. One disadvantage of developing an integrated system on microcomputers with CDS/ISIS as the application software is that at present CDS/ISIS does not support multiple users. In other words all activities will need to be managed on one machine on which the integrated database is mounted. This may not make for efficient work organization except in the smallest of libraries. Alternatively, each function could have its own subset of the integrated database. Each function adds transactions to its own subset and at the end of the day the integrated database is updated with inputs from all the functional subsystems. This method, however, would defeat the purpose of integration, viz. access to and sharing of the data and files of different subsystems. Once CDS/ISIS becomes available for use on a local area network, it would be possible to truly integrate the functions in the sense of multiple access to the integrated database making for effective sharing of data and records between functions and efficient management of the different functions. The present approach, however, could already be applied, for large information centres, to CDS/ISIS running under the VAX or Micro Vax family of computers with VMS as the operating system.

VI RECOMMENDATIONS

94. This section of the report recapitulates the different recommendations made in the report. Some background to each of the recommendations is however provided to enable this section to stand on its own.

95. The microcomputer provided by Unesco under the project has almost completely been dedicated to the search service using the ASFA CD-ROM. Further, as a result of heavy use of the microcomputer for the search service, it is already showing signs of wear and tear. Also, the fact that the library has only one machine to work on has not enabled it to
develop other applications. At least one more microcomputer and CD-ROM player are strongly recommended so that the load on the existing machine is shared, new applications can be developed, and in the event of the failure of one of the present hardware components (microcomputer or CD-ROM player), the search service will not come to a standstill.

96. The NIO's mainframe computer is not hard-wired to the library at present, and hence file transfers between the library's microcomputer and the mainframe are not possible. It is recommended that the library should, in the long run, be connected to the ND-570 or any other powerful computer that NIO may acquire both for application development and for the safe archiving of valuable data files.

97. The National Institute of Oceanography (NIO) is a premier Institute in oceanography and related sciences not only in India but in the region. NIO with its advanced scientific facilities, excellent library, well trained information staff, and its commitment to excellence in oceanographic research can also play a lead role in the provision of easy and wide access to scientific and technical information for users of oceanographic and marine science information in India and the South Asian region. The NIO library is already involved in database development, and in providing information services to users in India. However, it is essential that the information handling capabilities of other centres of oceanography research and education in the country are also strengthened so that such centres may also benefit from the wider and easier accessibility to information in their R&D, training, planning, and problem-solving activities. This is possible by adopting a network approach. Given the fact that NIO library is already ahead of other oceanography centres, it is recommended that the initiative for network development should come from NIO and that the NIO library should play a coordinating role in network development. The specific goals of such a role are given in paragraph 47 of this report.

98. The first step in network development would be to survey the information infrastructure, information resources, skills and user communities in at least the most important centres of research and education in oceanography/marine sciences. It is recommended that the Documentation officer (DO) of the NIO Library should travel to these centres in order to collect information, and meet with end-users and information personnel with the objective of determining the short-term and long-term goals that networking should address. A detailed report should be submitted with focus on actions that would enable easier and wider access to oceanography information for users in India.

99. Following the survey and consideration of the findings of the survey, it is recommended that a planning meeting involving all heads of relevant libraries/information centres and selected end-users should be called. The meeting should have as its objectives, the clear identification of priorities for networking and cooperation, and of specific action programmes that are required, wherever possible identifying specific centres with specific responsibilities. It is further recommended that the Director of NIO should initiate the call for the meeting with the heads of the other centres of oceanographic
research. Such a step would establish NIO's commitment to and concern for improving access to information for researchers and teachers in oceanography and marine sciences.

100. An important objective of the meeting should also be to ensure that input procedures and responsibilities are agreed upon so that useful conventional and nonconventional literature of Indian origin is garnered for input to a national database as well as for entry into a global database such as the ASFA. Given the preeminent position of the NIO in oceanographic research, it is recommended that the NIO library should be permitted to act as the Indian national centre for input of publicly accessible information on marine and brackish water science literature into the ASFA database. For information on fresh water sciences and fisheries, the NIO should identify a suitable centre in India to undertake the task of contributing Indian input into the ASFA database. The NIO library may provide training and advice to such a centre to enable it to satisfy the input norms and standards of ASFA.

101. It is recommended that the NIO library should take steps to initiate a nation-wide SDI service to users of oceanography and marine science information using the software developed during the present mission. Details of the steps required are given in paragraph 63 of this report.

102. The search service that has already been established should be continued. However, the service needs to be promoted more widely, and several ways of doing so are given in paragraph 65 of this report. The need to fill gaps in coverage of information on natural products chemistry, ocean engineering, and instrumentation by accessing other information products including CD-ROM databases is recommended. Details of potentially useful products are provided in paragraphs 67 and 68 of this report.

103. At present the in-house database is used mainly in single-user mode by the staff of the library. In the long run, however, it would be necessary to consider how the database can be made directly accessible to the end-user at NIO. One obvious choice is to mount the database in parallel on the ND-570, terminals to which are planned to be provided to the different departments at NIO. At present, however, there is no suitable information retrieval software available on the ND-570 at NIO. It is recommended that effort should be made to find out if any other organization in India or abroad has implemented information retrieval on the ND-500 series of minicomputers, and if software is available for this purpose.

104. The starting of a nation-wide SDI service, and wider promotion and provision of search services will undoubtedly generate more requests for copies of documents from users. It would be necessary to gear up the document delivery service of the library so that it could effectively backstop its retrieval and dissemination services. Steps recommended to improve document delivery are given in paragraph 72 of this report. Also, at present the library does not have its own photocopier and is dependent on a facility in another department. In the interest of ensuring efficient document delivery, is is
recommended that the library should be equipped with a heavy duty plain paper copier as early as possible.

105. An estimate of the budgetary requirements to implement the present recommendations is given in Appendix V. This budget does not include additional staff costs which the consultant feels can be properly evaluated by NIO itself; it should be noted, however, that the present staff is just able to cope with the routine activities of the library, and a reinforcement will be required if the recommendations of this report in terms of networking and new services are to be actively pursued.
APPENDIX-I

List of Scientists Interviewed

1. Dr. M.V.M. Wafar, Biological Oceanography Divn.
2. Dr. D. Chandramohan, Biological Oceanography Divn.
3. Dr. A. Rajendran, Chemical Oceanography Divn.
4. Dr. S.R. Shetye, Physical Oceanography Divn.
APPENDIX II

Potential participants in a Library and Information Network for Marine Sciences and Oceanography in India

1. Andhra University, Waltair.
2. Annamalai University, Parangipettai (Porto Novo).
3. Central Institute of Fisheries Education, Bombay.
4. Central Institute of Fisheries Technology, Cochin.
5. Central Marine Fisheries Research Institute, Cochin.
6. Central Salt and Marine Chemicals Research Institute, Bhavanagar.
7. Central Water and Power Research Station, Pune.
8. Cochin University, Cochin.
10. Kerala Agricultural University, College of Fisheries, Cochin.
11. Naval Chemical and Metallurgical Laboratory, Bombay.
12. Naval Physical Oceanographic Laboratory, Cochin.
13. University of Agricultural Sciences, College of Fisheries, Mangalore.
APPENDIX III

RECORD STRUCTURE
FOR INTEGRATED DATABASE USING CDS/ISIS

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34
| CCF TAG | FIELD NAME (- Subfield) | R | M | ACQ | CAT | CIR | VEN | FUN | PAT |
|---------|-------------------------|---|---|-----|-----|-----|-----|-----|-----|-----|
|         | PATRON NAME             | Y |   | Y   |     |     |     |     |     |     |
|         | PATRON TYPE             | Y |   | Y   |     |     |     |     |     |     |
|         | PATRON STATUS           | N |   | Y   |     |     |     |     |     |     |
|         | PATRON IDENTIFICATION NUMBER | Y |   | Y   |     |     |     |     |     |     |
|         | MAILING ADDRESS         | Y |   | Y   |     |     |     |     |     |     |
|         | REGISTRATION DATE       | Y |   | Y   |     |     |     |     |     |     |
|         | MEMBERSHIP EXPIRATION DATE | Y |   | Y   |     |     |     |     |     |     |
|         | PSEUDOPATRON            | Y |   | Y   |     |     |     |     |     |     |
|         | PSEUDOPATRON DEPT.     | Y |   | Y   |     |     |     |     |     |     |
|         | ITEM NO (Accession Number) | Y | Y | Y   | Y   |     |     |     |     |     |
|         | LIMITS                  | N |   | Y   |     |     |     |     |     |     |
|         | ISSUE DATE              | Y |   | Y   |     |     |     |     |     |     |
|         | DATE-DUE                | Y |   | Y   |     |     |     |     |     |     |
|         | LOAN PERIOD             | N |   | Y   |     |     |     |     |     |     |
|         | FINE AMT/DAY            | N |   | Y   |     |     |     |     |     |     |
|         | OVERDUES                | N |   | Y   | Y   |   |     |     |     |     |
|         | HOLD ITEM NO            | Y |   | Y   |     |     |     |     |     |     |
|         | HOLD TIME PERIOD        | N |   | Y   |     |     |     |     |     |     |
|         | PATRON QUEUE            | Y |   | N   |     |     |     |     |     |     |
|         | RECALL ITEM NO.         | Y |   | Y   |     |     |     |     |     |     |
|         | PATRON QUEUE            | Y |   | Y   |     |     |     |     |     |     |

**NOTE:**
- R = Repeatability; M = Mandatory; ACQ = Acquisition; CAT = Catalogue; CIR = Circulation; VEN = Vendor; FUN = Fund; PAT = Patron; N = No; Y = Yes
APPENDIX IV

Menu System for the proposed Integrated Library Management System Using CDS/ISIS

Opening menu

You may work with the following modules

1. Book Acquisitions
2. Cataloguing/Database creation
3. Circulation
4. Information retrieval and dissemination

H Help on the different Modules, or
Q Quit the integrated system

Your choice [ ]

Menu 1

---

Book Acquisitions Module

Main Menu

You may work with the following files

1. On order
2. Fund
3. Vendor

H Help on the Acquisitions Module, or
X Return to Opening Menu

Your choice [ ]

Menu 1.1
Book Acquisitions Module

On Order File Functions

1 Add new records to the on order file
2 Receive books ordered
3 Search the on order file
4 Edit on order records
5 Produce printed products, or
X Return to Acquisitions Main Menu

Your choice [ ]

Menu 1.1.1

Book Acquisitions Module

On Order File - Search Options

1 Search by author
2 Search by title words
3 Search by author/title
4 Search by Program/Dept/Fund
5 Search by Requester
6 Search by Purchase order No., or
X Return to On Order file functions

Your choice [ ]

Menu 1.1.1.3

Book Acquisitions Module

On Order Print Products - Options

1 Print Purchase Orders
2 Print On order cards
3 Print Followup reminders
4 Print Statistics, or
X Return to On Order file functions

Your choice [ ]

Menu 1.1.1.5
APPENDIX IV (CONT'D.)

Book Acquisitions Module

Cataloguing/Database Maintenance Module

Cataloguing Functions - Options

1. Edit Acquisitions records for input to database
2. Add new Catalogue/Database records
3. Edit Catalogue records
4. Print Catalogue Cards
5. Print Accessions Register
6. Print Accessions Bulletin
7. Generate Statistics, or
X Return to the Opening Menu

Your choice [ ]
APPENDIX IV (CONT'D.)

Circulation Module

Main Menu

1  Circulation Functions
2  Patron Functions

H  Help on Circulation Functions, or
X  Return to the Opening Menu

Your choice [ ]

Menu 1.3

Circulation Module

Circulation Functions

1  Charge/Issue Books
2  Discharge Books
3  Reserve Books
4  Print Overdue Notices, or
X  Return to Circulation Main Menu

Your choice [ ]

Menu 1.3.1

Circulation Module

Patron Functions

1  Add new Patron
2  Amend/Edit Patron Record
3  Search Patron Records, or
X  Return to the Circulation Menu

Your choice [ ]

Menu 1.3.2
APPENDIX IV (CONTD.)

Information Retrieval Module

Main Menu

1 Retrieval Functions
2 User Profile Functions
3 Dissemination Functions

H Help on Retrieval/Dissemination, or
X Return to the Opening Menu

Your choice [ ]

Menu 1.4

Information Retrieval Module

Retrieval Options

1 Search the Database
2 Save Search Result
3 Print Search Result
4 Export Database/Subset
5 Import Database/Subset
H Help on Information Retrieval, or
X Return to the Information Retrieval Main Menu

Your choice [ ]

Menu 1.4.1

Information Retrieval Module

User Profile Functions

1 Add New User Profile
2 Edit User Profiles
3 Print User Profiles
H Help on User Profile, or
X Return to the Information Retrieval Main Menu

Your Choice [ ]

Menu 1.4.2

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Information Retrieval Module

Dissemination Functions

1. Run SDI
2. Generate Current Awareness lists

H Help on Dissemination Functions, or
X Return to the Information Retrieval Main Menu

Your Choice [ ]
APPENDIX V

Budget estimates to implement recommendations suggested in the report

I. Hardware

1. A IBM-PC/AT or compatible microcomputer with 1024 KB RAM; two floppy drives (one of 1.2 MB and another of 360 KB); monochrome monitor; 40 MB winchester disk drive; 108 key keyboard; associated operating system software (MS-DOS version 3.3 or above).
   Rupees 45000.00

2. A laser printer*
   Rupees 40000.00

3. CD-ROM player*
   Rupees 60000.00

4. Heavy duty plain paper copier
   Rupees 150000.00

Sub total
   Rupees 295000.00

II. Travel

1. Travel of the Documentation Officer to centres of oceanographic research and education in India.
   Rupees 10000.00

III. Organization and conduct of Planning Meeting on networking

Rupees 5000.00

IV. Study of potentially useful databases for literature on natural products chemistry, ocean engineering, instrumentation, i.e. commissioning of on-line searches.

Rupees 3000.00

Grand Total
   Rupees 313000.00

* Imported equipment. Cost provided includes import duty component.