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THE INFORMATION RETRIEVAL SYSTEM ISPRS-IRS
FOR LITERATURE AND FACTUAL DATA

(Report of Working Group VI - 4)

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A B S T R A C T

The feasibility as well as the present state of international exchange of information in our field through publications including grey literature is analysed. Available retrieval systems are reviewed regarding database producers, hosts, reliability, access, costs and efficiency. Endeavours of WG VI - 4 for implementing an appropriate information retrieval system are reported. Detailed specifications have been established. The Sister Societies FIG, IAG, ICA, ISM and ISPRS agreed to co-operate. Financing as a joint venture of European countries has been initiated. It is anticipated that ISPRS - IRS is available online and free - of - charge by post card approach. The report covers the period October 1982 - March 1984.

Content

- 1 Feasibility of literature retrieval
 - 2 Present state of literature documentation in our field
 - 2.1 Non - computerized systems
 - 2.2 Systems with computerized online retrieval
 - 2.3 Summary of the present state
 - 3 Structure of computerized information retrieval
 - 3.1 Database
 - 3.2 Host
 - 3.3 Telecommunication from user to host
 - 3.4 User's hardware
 - 3.5 Costs for users
 - 3.6 Acquiring full documents
 - 4 The Information Retrieval System ISPRS - IRS on literature and factual data
 - 4.1 Preliminaries
 - 4.2 Some features of ISPRS - IRS
 - 4.3 Financing of ISPRS - IRS
 - 5 Literature references
- Appendix : Specifications ISPRS - IRS

1 Feasibility of literature retrieval

Compared with many other disciplines, a property of our field is that a relative small number of scientists in any country are engaged in promoting photogrammetry and remote sensing. As a consequence, international exchange of information through publications is indispensable particularly in our field.

The ultimate objective of publishing is that the content be read for a twofold benefit, firstly that research findings will be applied by users, and secondly that follow-up research work will be more efficient. However, the quantity of published material is ever increasing according to an exponential law (HOTHMER 1982a and 1983). Yet, the capacity of readers is limited. Efficient capabilities for selecting relevant literature can be considered as an escape from this dilemma.

Bibliographies are a well known tool to allocate appropriate literature sources. The author started 1954 at the ITC with a literature card indexing system what evolved into the 'ITC International Bibliography of Photogrammetry'. This type of literature documentation ceased to exist due to lack of demand. Abstract journals are another mode to register literature. Yet, this type as well as card indexing bibliographies have the inherent disadvantage that literature retrieval for several specific keywords is hardly possible. As an example, the query "Analysing stressed trees in a tropical urban environment" requires entries under several headings which in itself is a most tedious and time consuming undertaking. Even more important is that those literature documents can not be retrieved which combine all keywords, and that is what actually is required. This demand can be accomplished by applying electronic data processing.

It is, therefore, not a surprise that quite some scientific disciplines have meanwhile switched to computerized literature retrieval. The use of this technology is growing very fast. As an example, I quote the sale of online literature retrieval in the FR Germany: 1980 DM 3 mio, 1983 DM 42 mio, and 1985 DM 110 mio. The chemistry specialists dispose, meanwhile, on a database comprising about 6 mio literature documents. There have been 1981 in USA 112 and in Europe 109 literature databases.

2 Present state of literature documentation in our field

Hereunder, an attempt is made to review several well known sources. Although any care has been taken to be comprehensive, omissions can not be excluded.

2.1 Non-computerized systems

- + Zeitschrift für Vermessungswesen, FR Germany, publishes as from 1875 once a year (July issue) about 2 600 literature documents (without abstracts). Photogrammetry and remote sensing as well as the wide field of surveying and mapping are covered. 200 periodicals and series publications of all continents originating from 14 different languages are evaluated.
- + The Chinese Society of Geodesy, Photogrammetry and Cartography publishes a trimonthly abstract journal covering their field including remote sensing. 63 periodicals and series publications of all continents originating from six different languages are evaluated.
- + VINITI, USSR, publishes as from 1954 the abstract journal GEODESIA Y AEROFOTOSJEMKA covering geodesy, photogrammetry and remote sensing. VINITI is an institution with a staff of 10 000 being engaged in literature searches for all fields including translations into Russian.

- + GEO Abstracts, Norwich - UK, publishes bimonthly different issues of an abstract journal for different disciplines. Their main concern is geography. Issue G includes also remote sensing, with quite some subheadings, yet photogrammetry, surveying and mapping are less covered. Free copies of periodicals and books are abstracted. Grey literature is covered occasionally; as an example, some 1 000 pages of papers on remote sensing presented at the XIV ISPRS Congress are omitted (ten HAAKEN 1982). Online retrieval is envisaged.

2.2 Systems with computerized online retrieval

- + RESORS, Canada, is a database with host capabilities concentrating on remote sensing. Photogrammetry, surveying and mapping are included only insofar as related to remote sensing (e.g. aerial photography). No abstracts. English and French are first choices for a system based in Canada. Some 110 journals and 30 newsletters are evaluated. Grey literature is not covered comprehensively. Available for any interested party earthwide. Online access on a limited basis via the DATAPAC network.
- + The NASA database, USA, includes some documents on photogrammetry and remote sensing with a coverage of 30% for journal articles and of 50% for grey literature. The same holds for the PASCAL database, France, with a coverage of 50% for journals and of 1% for grey literature (ten HAAKEN 1982).
- + The AGRIS database, FAO Italy, is on agriculture and includes some documents on remote sensing. Abstracts are available for some articles.
- + The GEOLINE database, FR Germany, covers the wide scope of geosciences with documents on german publications in surveying and mapping including remote sensing. INKA - Karlsruhe is the host (see NOWAK 1982).
- + The AIDOS database, Germany DR, is specialized in surveying and mapping including remote sensing (PESCHEL 1983). It includes also documents in German on publications in European socialistic countries.
- + A branch of the Smithsonian Institute, USA, is maintaining computerized information on 200 000 (US) ongoing research projects which it sells to users all around the globe (PERS 1454/1981).

A review of available European databases and hosts for all fields was published by VAJOU 1983.

2.3 Summary of the present state

- + Bibliographies without computerized retrieval are not very useful and can be considered obsolete.
- + Valuable literature documents in our field are scattered over many databases. Most of them include little information on the grey literature and nearly no factual data.
- + Abstracts are considered to be an essential feature in any database on literature. RESORS, unfortunately, does not include abstracts.
- + Access to databases via online retrieval requires hard currency and is, hence, available only for a privileged group of users excluding developing countries.
- + The reliability of most databases for our field is not known. A test on the reliability of NASA, PASCAL and GEO Abstracts has been conducted by ten HAAKEN 1982. We quote his conclusion: "The results achieved indicate that the investigated databases do not constitute a fully reliable retrieval system for scientists working in the field of photogrammetry and remote sensing".

3 Structure of computerized information retrieval

The structure of information retrieval is shown in figure 1. Essential elements are database, host, telecommunication link, and the user.

3.1 Database

The chore of any information system is the database. Any retrieval can be just as good as is the database. Consequently, the staff for establishing and maintaining a database for a specific field should be professionals in that discipline. As they have to analyse the relevancy of any literature document, they may be called Analysts.

A database producer must dispose on hardware. A medium size computer with appropriate storage capacity is considered to be a suitable equipment. Any Analyst should dispose on a terminal to key in documents. All inputs are transferred weekly or monthly to the host, online or by mailing a magnetic tape.

Database producers license potential hosts as online vendors. Hence, one database may be available at several hosts.

Valuable background material on implementing databases is provided in UNESCO publications of DIERICKS 1981 and of GRIFFITHS 1981.

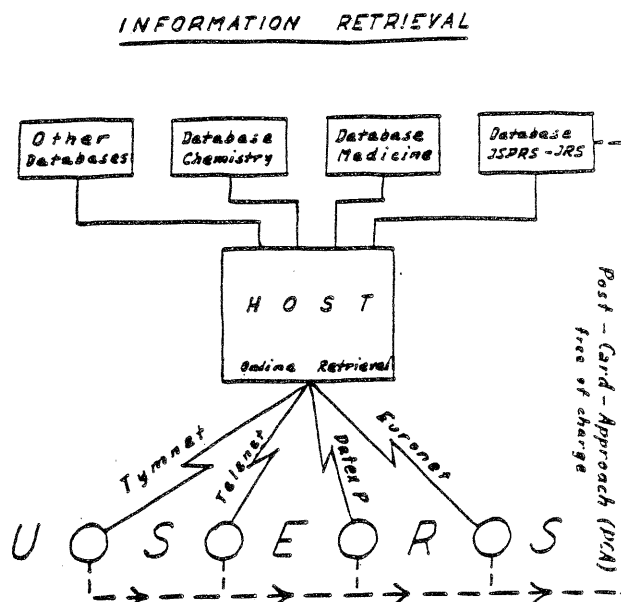
3.2 Host

To allow for efficient retrieval, a host must dispose (BAUER 1982) on a powerful computer with a very short cpu time, and on sophisticated software. As both are very expensive, including various peripheral units for the benefit of users, it is feasible that one host accommodates many databases.

Online access can be done with a telephone link. In some countries the telephone network is not always reliable with the effect that a word gets sometimes lost in oral communication. This has little significance as the redundancy in speaking is considerable. It is, however, completely different for online retrieval. If a single bit gets lost then the computer may produce odd results. Hence, a practical point of quite some importance for users is that the host is linked to a technically most reliable telephone network.

3.3 Telecommunication from user to host

Various links such as Tymnet, Telenet, Euronet and Datex P are available as is shown in figure 1. Besides, the interactive videotex is developing rapidly. As this system will allow communication round the clock "from the armchair at home" with any remote computer using the TV set, we will provide some details.



No 1902

Figure 1

Videotex services were launched in Europe : PRESTEL in the UK 1979, VIDITEL in the Netherlands 1980, and in 1981 BILDSCHIRMTEXT in the FR Germany and TELETEL in France. Experiments are under way also in Canada, Japan and USA.

Three videotex standards are presently in global use :

- + CEPT, an alphanumeric standard used throughout Europe on the basis of an agreement of the Comité Européenne de la Poste et Télégraphie providing interchange of videotex systems of European countries. Quite some achievement within CEPT was the condition set by FR Germany to standardize joints of all hardware manufacturers providing compatibility also with external computers, thus enabling users to access any computer via videotex.
- + TELIDON, an alphageometric standard developed in Canada.
- + CAPTAIN, an alphaphotographic standard developed in Japan being specifically adaptable for the japanese characters of writing.

A transmission speed of 1 200 bps (bits per second) is quite suitable. However, a higher transmission speed can be more economic when transferring many pages results of a retrieval. We can report that, quite recently, the Comité Consultatif International Télégraphique et Téléphonique (CCITT), being responsible for international standardization, has set the transmission speed on 64 000 bps within the Integrated Service Digital Network (ISDN) allowing to transfer at the same instant telephone calls, telex, telefax, electronic texts and videotex. This outlook into the future, in conjunction with optical fibre cable and storage on optical discs, gives rise to expect that the last problem of information retrieval on literature will technically be solved : Supply of full texts of documents immediately after the retrieval.

3.4 User's hardware

The user needs for online retrieval a telephone, a modem, and a terminal being teletype compatible, thus applying the ACSII transmission code. A minicomputer can be added for having an 'intelligent terminal' for more efficiency. An intelligent terminal for videotex sells for DM 2 500.

A modem (modulator - demodulator) is a device which translates digital data, being sent from the terminal, into a frequency signal which can be transmitted over a telephone line to the host. Modems are built according to the transmission speed, eg 300 bps or 1 200 bps (videotex). CCITT standards for modems have been adopted globally.

BAUER 1982 provides more details on user's hardware including costs.

3.5 Costs for users

The costs for online retrieval have three components :

- + telecommunication charges to access the host;
- + charges for the services of the host, and
- + fees for the database, normally being included in the invoice of the host who transfers this license fee to the database producers.

The costs depend, obviously, on the time consumption. A very rough figure for one online retrieval is DM 150 excluding telephone charges.

3.6 Acquiring full documents

The ultimate objective of literature retrieval is to dispose on the full text of relevant publications. It does not make much sense to accomplish retrieval within minutes whilst having to wait half a year for obtaining the full document. To counteract this dilemma, an indispensable requirement for efficient retrieval should be that the database includes information on where the full document is available, and that the software of the host facilitates ordering.

A valuable outline of the present state of full document delivery including an outlook into the future, and with practical hints and prices, has been published by TEHNZEN 1982.

4 The Information Retrieval System ISPRS - IRS on literature and factual data

4.1 Preliminaries

The foregoing reveals that in our field no adequate and reliable literature retrieval system does exist in any country earthwide. Therefore, ISPRS embarked to fill this gap.

Basic policies of ISPRS - IRS have been presented by HOTHMER 1982b at the Symposium of Commission VI ISPRS. Further work to prepare implementation of ISPRS - IRS was conducted concurring with the recommendations as set by this Symposium.

A first draft of the Specifications ISPRS - IRS was available in June 1983, and has been widely circulated requesting comments. Fortunately, there was quite some response from all continents. The subject has been particularly discussed in June 1983 in Sofia with FIG Commission II, in July 1983 with ICA, in August 1983 in Hamburg with IAG Commission VI, and 19 - 20 September 1983 in Paris by a group of french experts. All comments have been merged into the final draft of the Specifications ISPRS - IRS which is attached to this paper.

Co-operation with the Sister Societies

- + International Society for Photogrammetry and Remote Sensing (ISPRS),
- + International Cartographic Association (ICA),
- + International Association of Geodesy (IAG), and
- + International Federation of Surveyors (FIG)

was settled at a joint board meeting in June 1983 in Sofia. The Presidents of the Sister Society assigned this writer as Convener ISPRS - IRS.

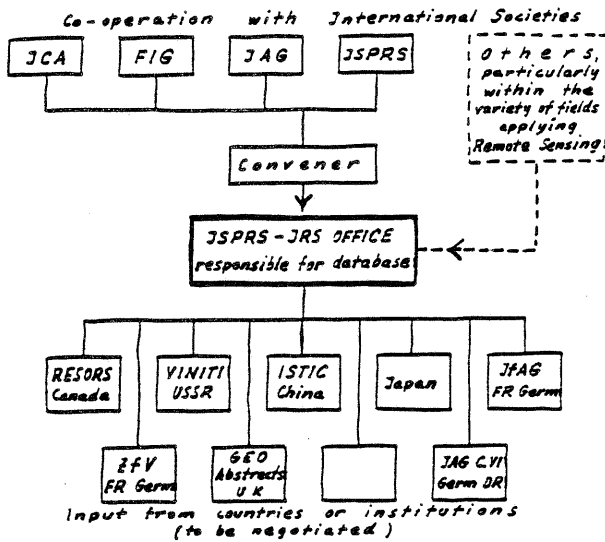
4.2 Some features of ISPRS - IRS

Hereunder, some properties of ISPRS - IRS are summarized. Numbers in parenthesis refer to paragraphs of the Specifications ISPRS - IRS, being appended, for more details.

- a) Any achievement of our International Society should be available to all Member Countries. Bearing in mind that most online retrieval requires payment in hard currency, and envisaging that quite some Member Countries, particularly developing nations, can not afford spending hard currency for this purpose, ISPRS - IRS has been designed so as to allow a free - of - charge access via the 'Post - Card - Approach' (PCA), see figure 1.
- b) The range of subject fields shall comprehend surveying and mapping including remote sensing, thus the fields covered by the Sister Societies ISPRS, FIG, IAG and ICA, as is delineated in figure 2. Some few commentators proposed

to consider implementing a separate database for remote sensing, as this technology serves many different scientific disciplines. Being aware that most results of remote sensing require presentation in a thematic map, the outcome was that remote sensing may best be served within the ISPRS - IRS Database. Obviously, adequate co-operation with international societies covering the variety of fields applying remote sensing need to be established as is shown in figure 2. Proposals are welcome.

SUBSTANTIVE SUPPORT FOR JSPRS-JRS

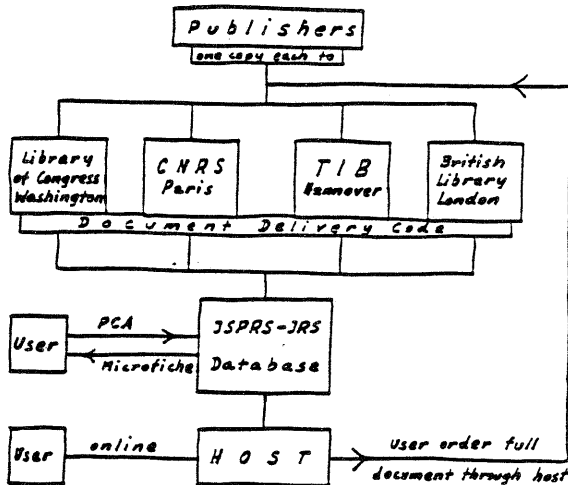


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Figure 2

- c) The content of the ISPRS - IRS Database shall include bibliographical data being subsumed from conventional and from grey literature (3.1.2.1), as well as factual data (3.1.2.1).
- d) Full document delivery will be provided according to the outline presented in figure 3.
- e) Input selection is anticipated to prevent that users be submerged by too many computer outputs. The procedure is delineated in figure 4.
- f) Documents in all three official ISPRS languages English, French and German will be stored in the database. Although automatic translation is approaching the operational stage (LUCKHARDT 1982), the hybrid solution as outlined in figure 5 is considered to be more practicable. Based on the Multilingual Dictionary (LINDIG 1982), being part of the software for

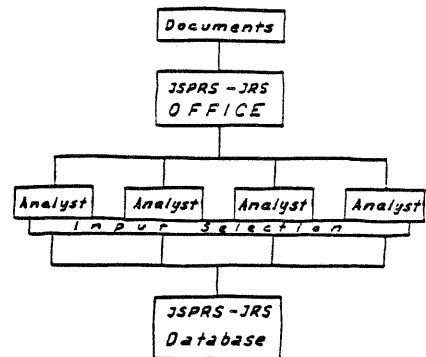
FULL DOCUMENT DELIVERY WITHIN JSPRS-JRS



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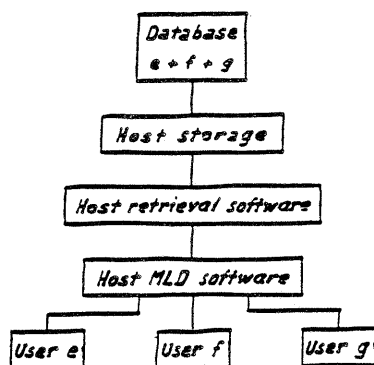
Figure 3

INPUT SELECTION TO PREVENT THAT USERS BE SUBMERGED by too many computer outputs



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Figure 4

FINANCIAL SUPPORT FOR ISPRS - IRSAUTOMATIC TRANSLATION OF TERMSEnglish - French - German

MLD = Multilingual Dictionary

Figure 5

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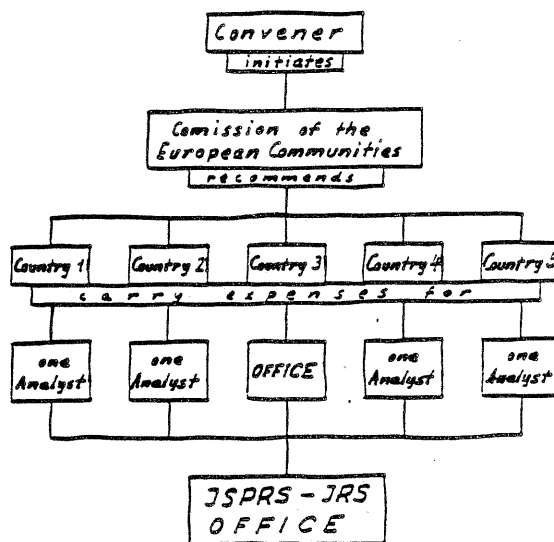


Figure 6

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retrieval, any query put forward for retrieval for instance in English will, nevertheless, have outputs on relevant literature in all three languages (see figure 5). The same technology can be applied, however on national level with an intelligent terminal, for other languages such as Chinese, Japanese, or Russian.

- g) Computer output on microfiche (COM) shall be available for speeding up delivery at reduced mailing charges (GLENDINNING 1982) (see figure 3).

4.3 Financing of ISPRS - IRS

There are, inter alia, two different modes for implementing and maintaining the ISPRS - IRS Database. The first and easiest mode would be to have it done by a database producer in Europe or America on commercial grounds. As an outcome, any user would have to pay in dollars. All the more, the database would not be established by professionals in our field, and that will be another inherent disadvantage.

More practicable appears to be a second mode with financial support from one country allowing both, online access to a host computer, and a free-of-charge post card approach. Financial constraints of governments of many countries are, however and at least in Europe, such that one country can hardly carry the burden alone. Therefore, a joint venture of European countries has been envisaged to be channeled through the Commission of the European Communities (CEC). A first meeting on this subject was held in Luxembourg in June 1983, and an official request has been forwarded to CEC on 15 November 1983.

Being aware that many other scientific disciplines would also approach governments to support information retrieval systems for their fields, our request to European countries via the CEC has been based on two reasonings :

- + In contrast to e.g. chemistry and medicine, being commercially structured resp. financially self supporting, a particular feature of surveying and mapping is that the great majority of users of an information retrieval system are government employees not disposing on funds to utilize ISPRS - IRS. Consequently, implementing ISPRS - IRS on commercial grounds (first mode) would require altering the budgets of all government organizations engaged in surveying and mapping (including e.g. local cadastral offices) so as to allow the use of ISPRS - IRS. This altering of budgets of many institutions is certainly a tedious undertaking. Instead, it will be more efficient if five governments share expenses for the ISPRS - IRS Office.
- + Surveying and mapping, and particularly remote sensing, have quite an impact on developing countries. Hence, financing ISPRS - IRS as a joint venture will be a substantive contribution for technical co-operation for development.

The structure of financial support is outlined in figure 6. A ISPRS - IRS Office carries responsibility for establishing and maintaining the database, and responds to PCA queries. Four Analysts are required to do the work. One country each is expected to carry expenses for one Analyst. A fifth country carries expenses for office expenditures, hardware and software, and for a director. All four Analysts are working in the ISPRS - IRS Office to be established in the supporting country.

In pursuance with requests having been put forward at the Symposium Mainz 1982, ESA - IRS, Rome, (see PROCA 1982) and INKA, Karlsruhe, have been asked whether they would be prepared to negotiate on the grounds of the Specifications to host the ISPRS - IRS Database. Their positive reply was received in September 1983.

ISPRS - IRS does not envisage doing anything by itself but seeks co-operation and input into the database from as many countries and institutions as is possible (see lower portion of figure 2). Affirmative statements were made as yet by IAG Commission VI, GDTA France, and the PR China. This country would eventually even consider to support all the staff for the ISPRS - IRS Office. A statement of the USSR is expected to be received within some months.

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COMMISSION VI

Economics, Professional Aspects, Education, Periodicals, Terminology, Bibliography, History, International Exchange of Information

8311

ISPRS Information Retrieval System (ISPRS-IRS)
on literature and factual data

S P E C I F I C A T I O N S

- 1 Objectives
- 2 Standards
- 3 Database
 - 3.1 Range and content
 - 3.2 Format
 - 3.3 Languages
 - 3.4 ISPRS - IRS Office
 - 3.5 Co-operation
- 4 Host
 - 4.1 Preference
 - 4.2 Capabilities
 - 4.3 Languages
 - 4.4 Searchable fields
 - 4.5 Output
 - 4.6 Full document delivery
- 5 Accessibility
 - 5.1 Modes
 - 5.2 Cost for users

1 Objectives

The ultimate objective of publishing is that the content be read. The quantity of published material increases continuously in our era. As a consequence, locating relevant literature can hardly be accomplished anymore without electronic data processing. Yet, a modern and reliable bibliographic retrieval system for our field is not available in any country. The scope of ISPRS - IRS is to fill this gap.

2 Standards

Throughout ISPRS - IRS, the ISO - UNESCO Standards shall be given preference compared to national standards.

-2-

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TO: Anybody concerned SUBJECT: ISPRS - IRS Specifications DATE: 8311

3 Database

3.1 Range and content

3.1.1 Range of subject fields

3.1.1.1 The range of subject fields shall comprehend geodesy and cartography including remote sensing earthwide, thus the fields covered by

- + International Society for Photogrammetry and Remote Sensing (ISPRS),
- + International Federation of Surveyors (FIG),
- + International Association of Geodesy (IAG),
- + International Cartographic Association (ICA),
- + International Society of Mining Surveyors (ISM).

3.1.1.2 The coverage shall contain previous references as far as is substantially justified.

3.1.2 Content

3.1.2.1 The content shall comprehend bibliographical and factual data. Bibliographical data are subsumed from conventional and grey literature.

Examples of conventional literature are :

- + books and
- + periodicals.

Grey (or non - conventional) literature refers to documents which are issued informally in limited amounts and which are not available through normal bookselling channels. Therefore, they are difficult to identify and to obtain. Examples of grey literature are :

- + scientific and research reports,
- + theses,
- + proceedings,
- + translations,
- + technical notes,
- + equipment brochures,
- + internal reports,
- + private communications,
- + recommendations,
- + official documents,
- + university newsletters.

Factual data subsume all information deemed necessary for successful professional operations, with emphasis on research activities and on transferring achievements of research into operational mode earth-wide. Factual data supplement bibliographical information. Examples are :

- + current research projects,
- + facts on financial support for research projects,
- + approved projects of bilateral and multilateral projects of technical co-operation,
- + forthcoming symposia, seminars, conferences, etc.



TO: Anybody concerned SUBJECT: ISPRS - IRS Specifications DATE: 8311

3.1.2.2 Input selection, particularly for bibliographic data, shall be applied for preventing that users of ISPRS - IRS will be submerged by too many computer outputs. Guidelines need to be formulated.

3.1.2.3 The total annual number of entries is estimated to be about 5 000.

3.2 Format

The format of the ISPRS - IRS Database shall be

1. Document or accession number,
2. Author,
3. Title,
4. Bibliographic reference,
5. Abstract;
limited to 120 words,
6. Keywords;
to be derived automatically from the title and the abstract, taking into account a vocabulary of non-significant words,
7. Code for delivery of the full document;
 - + special care shall be taken to secure that retrieved documents can easily and quickly be acquired in full text;
 - + the producer of any publication shall be urged to deposite one copy each at appropriate institutions such as TIB - Hannover, BLLD - London, CNRS - Paris, Library of Congress - Washington, and possibly otherones;
 - + the code for delivery denotes where the full text of a document can be ordered.

3.3 Language

Documents will be recorded within the ISPRS - IRS Database preferably in English, however, they can be recorded instead also in German or French (official ISPRS languages).

3.4 ISPRS - IRS Office

- 3.4.1 A substantive database is the core of any retrieval system. Establishing and maintaining the ISPRS - IRS Database should be done by professionals (Master graduates) in the fields denoted in paragraph 3.1.1.1. These Analysts (four) are to be located at the "ISPRS - IRS Office" to be established in one country.
- 3.4.2 The ISPRS - IRS Office will have to handle the Post - Card - Approach (PCA) queries (see paragraphs 5.1 and 5.2.2).
- 3.4.3 Financing of the ISPRS - IRS Office is supposed to be achieved through a joint venture of some countries (see also paragraph 5.2.2).

3.5 Co-operation

Some database suppliers cover partly the range of subject fields of ISPRS - IRS, yet sometimes not on an earthwide basis, and sometimes without abstracts. For preventing duplication, ISPRS - IRS seeks co-operation with, inter alia:



TO: Anybody concerned

SUBJECT: ISPRS - IRS Specifications

DATE: 8311

- + Bibliographia Geodetica, Dresden
- + GEOABSTRACT, Norwich
- + VINITI, Moscow
- + Bibliographia Cartographica, München
- + RESORS, Ottawa
- + AGRIS, Roma
- + PASCAL, Paris
- + Zeitschrift für Vermessungswesen (July issue), Stuttgart
- + NASA, Washington.

Some references in these databases may need repackaging to the format of ISPRS - IRS.

ISPRS - IRS cooperates with FIG, IAG, ICA and ISM. Further, ISPRS - IRS is prepared to co-operate with any international Society having a branch of remote sensing.

4 Host

4.1 Selection of host

ISPRS - IRS will join that host offering best service potentials earthwide. One such example is ESRIN of the European Space Agency.

4.2 Capabilities of the host

- 4.2.1 The host must guarantee that ISPRS - IRS will be available to all our 68 Member Countries in all continents, without any restriction whatsoever.
- 4.2.2 Online communication at any speed between 50 bits per second and 1 200 bps must be provided at response time not exceeding 10 seconds, including batch processing under low computer time and reduced communication rates for outputs of larger quantities of references.
- 4.2.3 The host computer shall be accessible through a videotex terminal.
- 4.2.4 Expenses of the host shall be covered by charging online users, yet excluding the office handling PCA queries (see section 5.2.2).

4.3 Languages

- 4.3.1 A multilingual dictionary for the three official ISPRS languages (English, French and German) shall be used as software input allowing successful retrieval also for data in languages other than the query. The output will be in that language in which the document has been stored.
- 4.3.2 Automatic translation of abstracts shall be implemented as soon as appropriate software is operational.

4.4 Searchable fields

- Searchable fields shall be :
- + document or accession number,
 - + author,
 - + keywords,
 - + year of publication.



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SUBJECT: ISPRS - IRS Specifications

DATE: 8311

4.5 Output

4.5.1 Output capabilities of ISPRS - IRS shall be :

1. Accession number
2. Accession number + title
3. Accession number + title + author
4. Accession number + title + author + bibliographic reference
5. Accession number + title + author + bibliographic reference
+ abstract + document delivery code

4.5.2 Ranking according to documents relevance shall be available.

4.5.3 COM (Computer Output on Microfiche) shall be provided for speeding up delivery to overseas users.

4.5.4 Graphic output is desirable.

4.6 Full document delivery

The host shall render assistance for delivery of the full text of retrieved documents. Telefax as well as microfiche service should be envisaged.

One possibility to comply with this demand can be a link to ARTEMIS (Automatic Retrieval of Text from Europe's Multinational Information Service).

5 Accessibility

5.1 Modes

Access to ISPRS - IRS is online and via the Post - Card - Approach (PCA). For PCA, the user mails a post card with his keywords. He will receive a computer printout on relevant literature existing anywhere. Queries via PCA may be handled by the ISPRS - IRS Office.

5.2 Cost for users

5.2.1 Charges for online service will be paid to the host.

5.2.2 The main products of our professional field are topographic / thematic maps and cadastral data, both ranging in nearly all countries under government budgets. Therefore, most professionals in geodesy, cartography, photogrammetry and remote sensing are government employees not disposing on funds for retrieval. Further, developing countries do often not dispose on foreign currency for literature for retrieval, hence they will be excluded from using ISPRS - IRS when being charged. Exclusion of developing countries can not be justified at all. As a consequence, the Post - Card - Approach (PCA) must be free of charge.

6 Reference is made to the following background material :

Hothmer, J. ed. : Proceedings of the Symposium on Facing the Future of Scientific Communication, Education and Professional Aspects including Research and Development in Photogrammetry and Remote Sensing. International Archive of Photogrammetry, Vol. 24, Part VI, pages 12 - 94 (Information Retrieval), Mainz 1982.

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