TOWARD AN ISPRS BIBLIOGRAPHIC INFORMATION RETRIEVAL SYSTEM

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ABSTRACT: In 1984 the ISPRS General Assembly approved a Bibliography Resolution recommending that an ISPRS-Information Retrieval System (IRS) be established.   Aggressive pursuit in establishment of an ISPRS-IRS will provide access to the world's R&D results and activities for photogrammetric and remote sensing (P&RS) scientists and engineers. This is a specialized capability that is presently unavailable.

The requirements for establishment of an IRS such as timeliness, free access, media, and costs, are discussed. Results of investigation into existing mechanisms available for ISPRS members are presented.   These include modifications/extensions of information services now provided by a variety of existing international groups such as: 1) DIALOG, which provides on-line computer access to hundreds of databases; 2) the ISPRS journal Photogrammetria, which provides peer-reviewed research results in articles quarterly; (its role could be broadened to convey current bibliographies); 3) NTIS, which provides a database and publications of technical literature, especially grey literature, resulting from government sponsored research worldwide.

A unified ISPRS approach is summarized. It combines existing specialized services of international groups and relies on NTIS to provide a comprehensive database for current publications and research in progress throughout the world. The generation of periodic IRS newsletters of P&RS holdings from a spectrum of international information service databases can be included as well.   The investigation confirmed that existing bibliographies of leading international information services do not key on P&RS.

I. INTRODUCTION

It has been recognized by the ISPRS that an Information Retrieval System is needed to provide a ready source of photogrammetric and remote sensing literature to sustain general scientific and technological advancement throughout the world. This need is most apparent in the developing countries of the world where significant social and economic benefits can be realized by their increased utilization of photogrammetric and remote sensing techniques.   The awareness and access to international research and development and applications of photogrammetry and remote sensing (P&RS) can

serve to promote further improved data quality and information products for all nations. In light of the above, the ISPRS General Assembly approved a resolution at its XV General Assembly at Rio de Janeiro, Brazil, for Commission VI, Working Group VI/6 to pursue the following tasks:

a) to establish an ISPRS Information Retrieval System;
b) to guarantee IRS access to all ISPRS members;
c) to provide IRS access free of charge to developing countries and other countries providing input to the database.

The task is formidable and will require financial support for its implementation: However, the goals are worthy and achievable if ISPRS takes advantage of many existing worldwide mechanisms. It is noted that a specialized capability will be needed to aggregate the existing sources of photogrammetric and remote sensing literature into a dedicated P&RS database. To develop the P&RS IRS requires a clear understanding of the following five primary user needs and system requirements: a) content; b) context; c) timeliness; d) accessibility and media; e) cost/"free" access.

II. USER NEEDS AND SYSTEM REQUIREMENTS

A. CONTENTS

Defining the specific needs of ISPRS users can be approached through a model based on the user's ultimate need for answers to enable a decision...perhaps deciding on the best theory to explain an observation, the right choice of measurement conditions, or simply which publication should be read next. Thus, ISPRS users of information systems enter information retrieval systems with questions they want answered: who, what, where, when, why or how. A simple model of the user's behavior would have three elements:

- _awareness_ of the information system's existence and its contents,
- _answers_ derived by the user from the system, and
- _action_ based on the answers the user derived from the system.

Ideally, a bibliographic information system would contain all of the answers that an ISPRS member would possibly need on a subject. In practice, bibliographic systems usually contain only that information which is essential to most users, i.e., a full bibliographic citation: title, author, organization name and address, abstract and key words.

These bibliographic information elements will ultimately point the user to some publication. Access to the full text of the publication may then be necessary. Just as the bibliographic information may have been accessed electronically, or in paper or microfiche form, the full text of the publication might be available in one or more of these forms.

Information databases have been established to serve several scientific and engineering needs. In addition to bibliographic databases are databases of software and databases of numerical data. Currently P&RS software programs and numerical data sets are of quite limited availability in existing information systems whereas P&RS bibliographic holdings are quite common albeit scattered. We assume that eventually, given a larger market demand, the ISPRS IRS could address the holding of relevant software programs and computerized data sets.

B. CONTEXT

Photogrammetry and remote sensing are specialized fields of science and engineering with a broad constituency of users and practitioners in related disciplines such as cartography, surveying, geodesy and image processing. The applications of P&RS are expanding further into the fields of medicine and quality engineering for industry because of its noncontact information gathering capabilities.

To address this broad field with a P&RS information system will require the development of an access taxonomy and a set of keywords that will serve as the lexicon for an IRS user. Currently few scientific and technical databases identify P&RS as a primary subject area. Instead these databases contain P&RS information in a variety of subtopics of primary subject areas such as: Space technology; photography and recording devices; natural resources and earth sciences; computers, control and information theory; etc.

An initial taxonomy could divide P&RS into subtopics of:

1. Sensors
2. Recording and storage
3. Processors
4. Graphics and reproduction

Each of these subtopics could be further subcategorized into:

a. Applications (by disciplinary field)
b. Research and Development
c. Education and training

We suggest that a Commission VI Working Group be formed comprised of P&RS subject matter experts. It would develop the overall taxonomy to aggregate a specialized subject area for P&RS and the accompanying set of keywords. This activity will create the bounds for an ISPRS IRS.

Properly identified, keywords and specific combinations of keywords will open the vast stores of existing information systems to provide P&RS information uncluttered with similar but irrelevant topics. For example, the singular use of the keywords GIS (Geographic Information Systems) will access thousands of documents of which few actually identify any relevance or dependence on P&RS. However, the keywords combination of GIS and Remote Sensing will isolate the ISPRS relevant documents readily.

C. TIMELINESS OF INPUT AND OUTPUT

Ideally, input to the ISPRS information system would be accomplished the instant that the publication is completed. Similarly, access to the system and its output would be immediately available worldwide. Such an ideal system is possible in today's "information age" by the use of computers and telecommunications. Barriers to its establishment lie in its cost and in our human frailties.

In practice, most systems are updated daily, weekly, monthly, quarterly or annually. The frequency of updates is determined primarily by user needs and the availability of resources.

Newsletters are often published weekly or monthly in order to keep users aware of new information. Computerized bibliographic systems and technical

journals are often updated monthly or quarterly. Annual updates are common with directories, cumulative indices and such basic bibliographic references.

Speediest access and delivery of information is by electronic means. Physical records in paper or microfiche must be delivered by mail, so delivery time is measured in days, weeks, or sometimes in months. In some systems, access to information is by electronic means, and an order can be placed electronically for the full text of a publication which is then delivered by airmail. This balances cost and speed in a way that is attractive to many users. Likewise, since telephones are common in most parts of the world, a telephone call to an author is sometimes a very quick and relatively inexpensive way to share the details of the latest technical information.

D. ACCESSIBILITY

For the most part, scientific information flows freely worldwide. On the other hand, engineering and technological information is sometimes subject to restricted flow, because of its commercial or proprietary nature, or because of patent or copyright restrictions, or because of its classification as vital to national security and defense. We assume that the ISPRS system will not contain proprietary or classified information. We also assume that the system will provide for protection of intellectual property rights, especially copyright.

Significant barriers to access and use may also be presented by language differences. Languages that can be expressed in common alpha-numeric characters are readily computerized, and thus readily accessible through many systems. European and English languages share this advantage. Asian languages such as Japanese, Chinese and Korean share many common characters, but like German, French, Spanish and English are not all readily understood by many scientists and engineers. A partial solution to this problem has been instituted by international vendors of technical information by standardizing on the one language used by most of their customers: English. For example, the new Science and Technology Network, STN International, has operating nodes in Germany, Japan and the United States, and its "Messenger" software uses English-language commands to provide access to dozens of English-language (and some European-language) databases from all 3 nations.

E. COST

The resources to establish, maintain and improve the ISPRS system might come from governments, private companies and/or from users of the system. Minimizing costs to the users of the system should ensure worldwide use by virtually all interested members of ISPRS. If non-members of ISPRS will be allowed to use the system, consideration should be given to charging them a higher fee. Given sufficient subsidies, perhaps through UN support of the newly formed International Union for Surveys and Mapping (IUSM), a low or free fee structure could be instituted to assist developing nations in accessing the system. Regardless of well meaning desires, a healthy and useful ISPRS IRS will require sustained resources to remain internationally viable.

The work necessary to develop the ISPRS-IRS will probably require seed funding by interested parties. A special Working Group of ISPRS is recommended to investigate not only the cost, but also the other issues noted above.

III. EXISTING MECHANISMS

A. COMPUTERIZED INFORMATION SERVICES ON-LINE

Many bibliographic information needs of ISPRS members are being met today by existing mechanisms. Some of the major computerized systems in use by ISPRS members are Bibliographic Retrieval Services (BRS), Data-Star, DIALOG, Orbit and STN International.

For example, DIALOG is a comprehensive, computer-based on-line system giving instant access to summaries of reports and articles, detailed financial data and directory listings on companies, statistics, full-text articles and newswires...from a pool of over 100 million items. With over 300 databases on virtually every subject, DIALOG is frequently used by experts and professionals in many fields. The system provides instant response to individual queries. Information is supplied on the questioner's computer terminal...on the screen or printed at your terminal. You pay for the time you are connected to the DIALOG computer and for search results ("hits"). Charges average about $1 U.S. per minute and a typical search is completed in less than 10 minutes. The most common method for access is through a local telephone call to a data communications network, such as Dialnet, Uninet, Tymnet or Telenet. Throughout the world, local or time-shared telecommunications connections can be arranged through local government telecommunications networks or through Dialnet in London. In addition to these networks, access can be achieved through TWX and international Telex. Some databases of interest to ISPRS members that are accessible through DIALOG are:

Agricola - Index to worldwide research on agriculture and nutrition.

Compendex - Abstracts of engineering and technology literature including water, mining, industrial, metal, pollution, computer, electronic and civil engineering.

Conference Papers Index - Centralized index to papers presented at scientific and technical conferences around the world.

Engineering Information Inc. - International journals, articles and reports on research and applications in engineering.

Federal Research In Progress - Summaries of current ongoing research sponsored by U.S. government agencies.

Geo Archive - Index of publications in geophysics, geochemistry, geology, paleontology.

Geo Ref - Surveys of worldwide technical literature on geological, geophysical and petrological research.

IAA - International Aerospace Abstracts of worldwide articles in aerospace research and technology and allied sciences.

INSPEC - Abstracts of research in physics, electrical engineering, electronics, computers and engineering.

Meteorological and GeoAstrophysical Abstracts - Synopses of worldwide research in these subjects.

NTIS - Abstracts of U.S. and other government-sponsored research, development and engineering.

Oceanic Abstracts - Summaries of worldwide research on oceanography and marine science.

PTO - Index of US Patent and Trademark Office's patent bibliographic database with exemplary claims.

SPIN - Abstracts of current American and Soviet research in physics, astronomy and geophysics.

Environmental information is available from the U.S. National Environmental Data Referral Service (NEDRES), from a database which is computer-searchable from anywhere in the world. NEDRES also produces printed catalogs with references to selected environmental information and data.

B.   COMPUTERIZED RETROSPECTIVE SEARCHES

When a new set of questions is being researched, it is good practice to begin by searching the technical literature comprehensively for relevant information and data. Such searches are most effectively done today with computer assistance.

For example, NTIS provides "Published Searches" which give current bibliographic citations on a specific topic in many general subject categories such as: Cameras; display systems; image processing; land use; LANDSAT; mapping; photogrammetry; photography; radar; remote sensing; scene analysis; etc. from the NTIS database, or from some 20 others from the U.S., U.K. and Western Europe. Citations include title, author's name, sponsor, and a summary of the research cited. They are regularly prepared for subject areas of current high interest. For example, under the subject category "Image Processing" specific topic searches relevant to ISPRS members include:

Source Data Base	Topic	Period of Coverage	No. of Abstracts in Search
INSPEC	Digital Image Processing Algorithms	1975-10/86	140
PTO	Image Processing	1970-2/86	84
INSPEC	Photogrammetry: Equipment and Image Processing	1975-2/86	310
IAA	Synthetic Aperture Radars: Spaceborne & Airborne Land & Sea Observation Systems	1978-86	167

A bibliographic database that concentrates on P&RS literature is REmote Sensing On-line Retrieval System (RESORS) maintained and funded by the Candaian government through the Canada Center for Remote Sensing (CCRS). RESORS maintains a free access to references relating to the techniques, instrumentation, and applications of remote sensing, photogrammetry and image analysis literature, primarily in English and French.

As of November 1986, over 53,000 documents have been entered into RESORS. Updates are kept current by CCRS approximately twice a year. Specific literature searches are conducted free using the over 1,800 keywords in the RESORS dictionary. A special feature is that the entire database and keyword search software is available on optical disk for about $750 CDN.

Subsets of the NTIS database are similarly available on optical disk (CD/ROM). DIALOG, Silver Platter, OCIC, and other companies have joint ventures with NTIS to identify special groups, such as ISPRS, whose needs for NTIS information are best met by use of this new medium. This is worthy of special exploration by ISPRS.

C. "PHOTOGRAMMETRIA"

This official journal of the ISPRS is a potential vehicle for publication of current bibliographies of P&RS information. A special editor for bibliographies could be enlisted to solicit, receive and categorize citations of current P&RS articles and documents produced or identified by ISPRS members. At a minimum the printed citation would include title, author, organization name and address, date and length. Space permitting, abstracts could also be published.

Currently this type service to ISPRS is provided by volunteer book reviewers, staffed by a Book Review Editor, and by voluntary reporters on Conferences and Meetings, staffed by a Reports Editor. The expansion of the role of Photogrammetria can enhance its role of communicating P&RS science and engineering information in a timely fashion to ISPRS members. It also serves as a free access window on current P&RS information for developing nations.

D. DEDICATED NEWSLETTERS

Many researchers stay aware of current research and publications of special interest to them by subscribing to periodic newsletters.

For example, NTIS alerts thousands of researchers every week of new reports that have just entered the NTIS collection. Each newsletter (26 separate ones are prepared weekly) gives the full bibliographic citations of the results of recent R&D activity. These 4- to 10-page publications cover topics of interest to ISPRS members such as:

- Agriculture & Food
- Civil Engineering
- Communication (Graphics)
- Computers, Control & Information Theory (Pattern Recognition & Image Processing)
- Government Inventions for Licensing (Instruments)
- Manufacturing Technology (CAD/CAM, Robotics)
- Natural Resources & Earth Sciences (Cartography)
- Ocean Technology & Engineering
- Physics (Optics)

NTIS is committed to providing such newsletters and similar information products to scientists and engineers in the way that is most useful. An open invitation has been extended to ISPRS management by NTIS management to cooperate in a joint venture to meet the pressing information needs of ISPRS members.

A new example of a dedicated newsletter of interest to ISPRS is the "Update on Commercial Remote Sensing" published every other month by the Technology Application Center of the University of New Mexico in the U.S. This current awareness product contains reviews and abstracts of technical information on selected new developments in space remote sensing.

E. RESEARCH IN PROGRESS

Before any technical reports or journal articles are published, information is usually available within the research community about certain research that is in progress by one or more investigators. In recent years, a few databases have been produced containing essential information on such ongoing research.

The Japan Information Center for Science & Technology (JICST) produces a database on Current Science & Technology Research in Japan. This Japanese language file is accessible online through the JICST Online Information System. Information in this file is developed by JICST through survey research. Approximately 17,000 research projects underway in 600 institutions are covered. The types of organizations covered include government and semi-government research institutions and public technical laboratories, but exclude universities.

Similarly, the Federal Research in Progress (FEDRIP) Database produced by NTIS lets you access details of over 75,000 going research projects funded by the U.S. Government in physical sciences, engineering and life sciences. The database, accessible on-line worldwide through DIALOG, is updated quarterly. Project descriptions include project title, start date, estimated completion date, principal investigator, sponsoring agency, performing institution, summary, progress report and keywords. In addition to being available on-line, retrospective searches of the database are available from NERAC Incorporated.

Another database, the British Expertise in Science and Technology (B.E.S.T.) Database, was created several years ago with the goal of providing a comprehensive map of who is doing what in British science. Developed by Longman Cartermill Ltd., but supported by a national steering committee comprised of members from government, business and university research establishments, this national database provides access to research expenditure exceeding 2 billion pounds annually.

The B.E.S.T. database contains two primary types of records: expertise and services. The more than 14,000 expertise records focus on individual researchers and provide detailed information regarding their relevant positions held, expertise and current research, duration, amount and title of current project funding and patents. Service records provide full details of the services and facilities available in UK universities, polytechnics and government research establishments. The scope and diversity of information held on B.E.S.T. makes the service as relevant to small companies as to large organizations.

The Federal Applied Technology Database (FATD) produced by NTIS takes a slightly different approach to information on current R&D activities. This database of 12,000 citations is unique in that it identifies selected new and practical U.S. Government technologies offering the best opportunities for commercial applications. Three types of information are provided:

1. Federal laboratory resources: Descriptions of facilities, equipment and experts available for sharing and special services.

2. Technology fact sheets: Summaries covering know-how selected as having better-than-average commercial potential.

3. New product opportunities through licensable U.S. Government-owned inventions.

Complete descriptions and contact points to the U.S. Government's technical information centers are also included. This database is accessible online through BRS and is updated twice a month. It is also available directly from NTIS in paper-copy as the annual Federal Technology Catalogs, the annual Catalogs of Government Inventions Available for Licensing, and the biannual Directory of Federal Laboratory and Technology Resources.

IV. CONCLUSIONS - A UNIFIED IRS APPROACH

Comparing user needs and system requirements with existing IRS mechanisms provides the basis for developing a unified IRS approach for ISPRS. From the above discussions it is our recommendation that the IRS should provide the following services for ISPRS members:

A. Comprehensive literature search in specific P&RS topic areas. NTIS appears to be best suited to provide this capability for grey literature.

B. Current awareness products in the form of citations and abstracts of new publications including: books, journals, grey literature, dissertations, conferences proceedings, etc. We recommend a broadening of the scope of the ISPRS journal _Photogrammetria_ to serve this newsletter function.

C. Published articles in the form of full text. This is the function of a central clearinghouse/IRS producer that is yet to be identified.

D. Free access to all of the above services. The IRS producer must be nondiscriminatory to ISPRS members.

Issues still to be addressed by ISPRS include:

A. Development of a P&RS taxonomy and supporting keywords.

B. Identification of the IRS producer, e.g., ISPRS, existing publishers, or a new entity.

C. Selection of a fund raising mechanism to sustain the IRS, e.g., ISPRS, IUSM, governments, private organizations, user fees.

We recommend an ISPRS Working Group be tasked to address these issues.