ISPRS ON THE INTERNET –PRESENCE AND PROSPECTS

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ABSTRACT

The Internet has great potential for the exchange and dissemination of data, software, information and expertise not only in the field of photogrammetry and remote sensing. The Internet, which is simply an international network consisting of individual computers and computer networks that are all interconnected by many paths, is becoming the repository of all we have accomplished as a society. It invites and facilitates multiple points of view and dialog in ways not feasible by the traditional, one-way, mass media. This paper deals with the Internet from three different points of view. First a general overview over the Internet and its different services, the relation between Internet and the World Wide Web, the growth and the usage of the Internet and general strategies in order to find information on the Internet are presented. Then it is described how the ISPRS is presented on the Internet and what initiatives are taken to develop this presentation. And finally an outlook to the future of this medium is sketched. However, it should mentioned that beside any technological development, which will or might come in the future, the main sources for the Internet are we, the people who are using the Internet and who are contributing to it.

1 INTRODUCTION

The Internet has become a world-wide phenomenon and will be a major and vital, data sharing system for humankind in the 21st Century. It is proving to be one of the most powerful amplifiers of speech ever invented. It offers a global megaphone for voices that might otherwise be heard only feebly, if at all. It invites and facilitates multiple points of view and dialog in ways not feasible by the traditional, one-way, mass media. The Internet is becoming the repository of all we have accomplished as a society. Shared databases on the Internet are acting to accelerate the pace of research progress, thanks to online access to commonly accessible repositories.

To address all aspects of the Internet and how the ISPRS can benefit from the development of the Internet can be is far beyond the scope of a single paper. However, this paper concentrates on a few aspects of this subject in more detail. In the second section a general overview over the Internet and its different services, the relation between Internet and the World Wide Web, the growth and usage of the Internet and general strategies in order to find information on the Internet are presented. The following section gives an overview on how the ISPRS is presented on the Internet and what initiatives are taken to develop this presentation. In the finale section an outlook to the future of this medium is sketched.

2 THE INTERNET AND THE WORLD WIDE WEB

The Internet is simply an international network consisting of individual computers and computer networks that are all interconnected by many paths. As this definition is quite big in late 1995, the Federal Networking Council (FNC) unanimously passed a resolution defining the term Internet (FNC, 1995).

" Internet refers to the global information system that --

1. *is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons;*
2. *is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols; and*
3. *provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein."*

Despite its definition, the Internet does differ from a Local Area Network (LAN), which is a system consisting of one server and many clients, which access stored information on the server. On the Internet, there is no central server. Instead, there are thousands of host machines, which can both send and receive information to and from other hosts. In this way, each host on the Internet behaves as both a server and a client.

The actual physical network of the Internet consists of a network of transmission lines, each line capable of transferring a specified amount of data. This network is designed so that information from any site can reach its destination using thousands of different possible paths. When information is sent over this network, it is split into tiny packets. Each packet of information travels to its destination using a different route. When all of the packets reach their destination, the packets are regrouped to form the original piece of information. If one or more of the packets doesn't successfully make its destination, the receiving site simply asks for another copy of those packets.

The Internet is quite unique due to the fact, that it is not run by one particular government or commercial agency, that it is not really owned by anyone, and that there are no official rules that govern its use. Instead, the Internet is kept up and running by the collective efforts of every organisation with computer or network connected to the Internet, each forming a vital part of the Internet infrastructure. However, there are organisations, such as the Internet Society (http://www.isoc.org) and the World Wide Web Consortium (http://www.w3.org), who try to assure the open development, evolution, interoperability and use of the Internet for the benefit of all people throughout the world.

2.1   Services on the Internet

Since 1969, when the history of the Internet began, a number of different services have developed to facilitate the sharing of information between the many sites on the Internet. Because the Internet was originally research-oriented, many of these services were hard to use and poorly documented. Now that the Internet has been opened to commercial and private sites, new services are being developed that are easier to use, and new interfaces to the older services make them more friendly. In the following the main services on the Internet are shortly presented.

2.1.1   Electronic Mail

In its simplest form, an electronic mail (e-mail) is an electronic message sent from one computer to another. E-mail is probably the most widely used communication tool on the Internet. E-mail has many advantages over conventional mail. It is fast and asynchronous, which means that information can be exchanged fast and without the participants having to interact at the same time. Eliminating the need to communicate in "real time" speeds up the flow of information.

2.1.2   Mailing Lists

In the case of a mailing list, an e-mail message is simultaneously sent to a large number of people. Mailing-list messages can be read by anyone who can receive e-mail. Since sending messages to large numbers of people by hand is a laborious business, an automated sending system is usually employed. Most mailing lists are small in size and are usually more controlled when compared to Usenet newsgroups (see section 2.2.6). An image processing and remote sensing list gateway is IMAGRS-L. For assistance in searching the right mailing list amongst thousands of mailing lists sites like Tilenet (http://www.tile.net/listserv) can be recommended.

2.1.3   File Transfer Protocol

The File Transfer Protocol (FTP) is a protocol used to transfer files between two computers on the Internet. The primary function of FTP on the Internet is in the use of anonymous FTP sites, which are simply Internet sites accessed via FTP that have a large number of files available for downloading. The FTP sites vary from small sites, consisting of only a dozen or so files related to a specific topic, to huge shareware archives with thousands of files. To search for information on FTP sites, services like Archie or Tilenet (http://www.tile.net/ftp) are available.

2.1.4   Gopher

Gopher is an Internet protocol that organises information on the Internet into an easy-to-use interconnected menu system. Within a single Gopher server, Gopher menus are hierarchical. Menu items usually lead to another Gopher menu or a text file, but can also connect to another Gopher server, access an FTP file, or initiate a Telnet session. The large network formed by interconnected Gopher servers is called Gopherspace. With the increasing popularity of the World Wide Web, Gopher is not used quite as much as it used to be. However, it still has its advantages. Many organisations and governmental organisations host on-line libraries or reference systems on Gopher servers, because Gopher menus present text information in a convenient fashion.

2.1.5   Telnet

Telnet is an Internet application that allows connecting to remote Internet sites. The protocol enables to log on a remote computer, and access its resources (hard disks, printers etc.) just as sitting in front of it. At this point, the user can browse through the contents of the remote Internet site or, depending on the user (security) level, manipulate the files and/or directories on that site.

2.1.6   Usenet

Usenet is an international network of newsgroups, which are discussion forums that each features a specific topic. The Internet has more than 20,000 different newsgroups, which have been brought together in a structure in which they each have their own name (e.g. .sci for scientific subjects). Groups dealing with Geographic Information Systems

(comp.infosystems.gis), NASA's Earth Observation System (sci.geo.eos), or scientific image processing and analysis (sci.image.processing) can be found. A specified list of the different newsgroups can be found at Tilenet (http://www.tile.net/news/) and Neosoft (http://www.neosoft.com).

In an attempt to reduce the number of repeated questions, most Usenet newsgroups maintain a list of Frequently Asked Questions (FAQ). The purpose of FAQ's is that people who are unfamiliar with a newsgroup, but need to ask a question that would definitely fall into the topic of the newsgroup should check the FAQ first to make sure the question is not already answered. In addition FAQ's often state the posting policies for their newsgroup, which can be a valuable source before start posting to the newsgroup.

2.1.7 The World Wide Web

The World Wide Web (WWW or Web or W3) is an Internet client-server hypertext distributed information retrieval system, which originated from the CERN High-Energy Physics laboratories in Geneva, Switzerland in the early 90's. The Web is one of the newest additions to the Internet and the Internet owes its great popularity in the recent years to this application.

Within the Web, it is possible to make integrated use of Gopher, FTP, telnet and e-mail, as well as making different types of documents available (i.e. text, images, sound, or software). Technically speaking, the Web is an information retrieval system consisting of an international network of computers that are all interconnected using hypertext links. In addition the Web makes it possible to go directly from one document to the other.

In context with the web quite a number of new terms came into everyday life, some thereof are introduced in the following.

Figure 1: Visualization and analysis of Internet traffic flows. Source: Stephen Eick, Bell Laboratories (http://www.bell-labs.com/user/eick/NetworkVis.html).

Hypertext is a form of multimedia document incorporating text, graphics, annotated voice, special programs, links to other documents and other special features. It is a generic term describing any media format as such and is not specific to the Internet, but it is what makes the Web so valuable. A **hyperlink** (or hypertext link) is a series of characters or graphic image, that when clicked on by a mouse takes the browser to a new location or 'page'. The **Hypertext Transfer Protocol** (HTTP) is designed for moving hypertext files across the Internet. It requires a HTTP client program on one end, and a HTTP server program on the other end. The **Hypertext Markup Language** (HTML) is the coding language used to create Hypertext documents for use on the Web. HTML looks a lot like old-fashioned typesetting code, where a block of text is surrounded with codes that indicate how it should appear. Additionally, in HTML hyperlinks can be specified.

A **Web browser** is a Web client program that views Web pages on a user's computer. While Web browsers are also capable of accessing gopher directories, downloading FTP files, and sending e-mail, it makes them so useful when using the Internet. With a single application, one can access practically everything on the Net. The **Uniform Resource Locator** (URL) is a standard way of identifying information on the Internet according to the type of service required to access this item, their location on an Internet host and their file or item name on that machine. URL's consist of a protocol prefix, a domain name, a path, and a filename. The protocol prefix tells the web browser what type of document is being accessed and which protocol it should use to access that document (e.g. http to access HTML documents, ftp to connect to a FTP site).

One of the most exciting features of the World Wide Web is the ability to include **graphics and sound** in web pages. Graphics can be in the forms of icons, coloured lines, backgrounds, or photographs. Although sound is rarely heard on the Web, some Web pages do contain sound clips, usually lasting a couple seconds or minutes. Whether one can experience the full multimedia effect of the Web depends primarily on the local web browser, as well as on the local computer.

Java is an Internet Web Page Programming Language, which can be used to create special effects and advanced programming within Web pages. It was introduced by SUN Microsystems in 1995 to create new interactive possibilities on the Web and has since then become accepted by all major operating system developers. For special effects JavaScript, an interpreted script language, is often used instead of Java. JavaScript code can be imbedded in HTML pages and interpreted by the Web browser. It is used in Web site development to do such things as automatically change a formatted date on a Web page, cause a linked page to appear in a popup window, cause text or a graphic image to change during a mouse over event
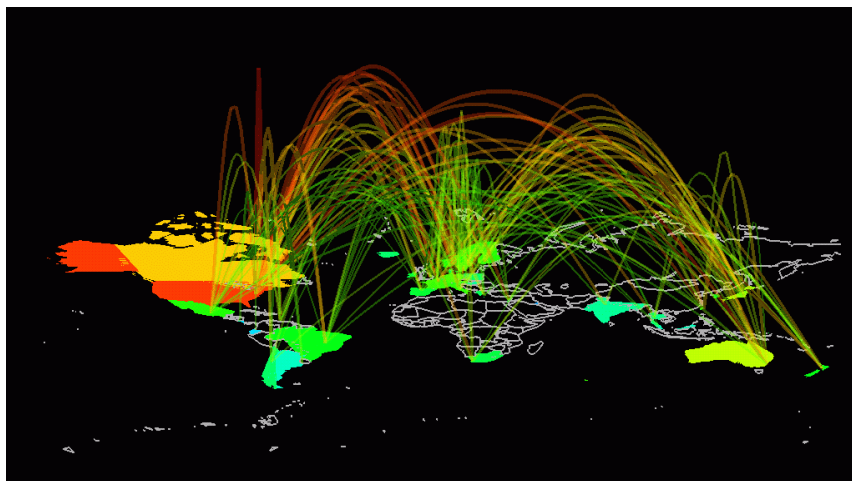
Plug-in applications are programs that extend the capabilities of Web browsers to interactively play sound or motion video stored in downloadable files with the specific plug-in format. In earlier versions of web browsers these programs were known as "helper applications" which could only function in a separate window. A plug-in application is recognised automatically and can operate as an integrated part within the main HTML-file. Currently there are more than 100 plug-in applications available, such as Adobe Acrobat Reader (view Adobe PDF documents), Apple QuickTime (interactive animation and sound player), Macromedia Shockwave (interactive animation and sound player) and various VRML-viewers (Virtual Reality Modelling Language for interactive 3D navigation).

2.2 Internet Growth and Usage Statistics

The Internet is constantly growing at a breathtaking speed (10 years of annual doubling since 1990), this with respect to the amount of information available on the Internet as well as to the number of users. The growth of the amount of information available can be estimated from the number of registered hosts, which form the Internet. The number of registered hosts by the Internet Society (ISOC, 2000) state 376,000 hosts in January 1991, 4.8 million in January 1995 and 124 million in January 2000 (see Figure 2).
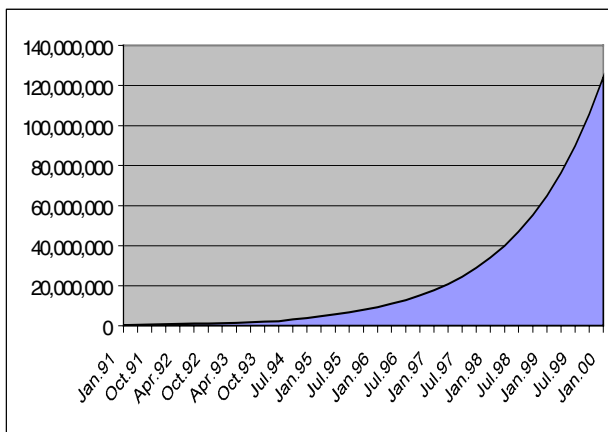

Figure 2: Internet growth by number of hosts. Source: (ftp://ftp.isoc.org/isoc/charts2/growth/90s-host.txt)

Figure 3: Internet growth by number of users. Source: (http://www.nua.ie/surveys/)

At the same time the number of Internet users around the world is constantly growing. As of February 2000 there is, according to Nua Internet Survey (Nua, 2000), a total number of 275.5 million users online, which is app. 5.5% of the world population (see Figure 3). The Computer Industry Almanac (CIA, 2000) is even more optimistic. They reported that by the year 2002, 490 million people around the world will have Internet access (7.9% of the world population), and 11.8% by year-end 2005. Despite the fact, that it is not easy to estimate the on-line population, it is widely expected that the enormous growth of the Internet will continue at least for the next couple of years.

On the other side the penetration of Internet around the world is currently unbalanced. The top 15 countries account for nearly 82 percent of the world-wide Internet users (including business, educational, and home Internet users). By the year 2000 there are 'just' 25 countries, where over 10 percent of the population will have Internet access (Nua, 2000).

The average activity for an Internet user for the month February 2000 user is reported by the Nielsen/NetRatings service (Nielsen, 2000). According to their report the average user has 18 Internet sessions per month, visits thereby 10 unique sites, and spends 55 minutes per site. The average time a user spends per month for surfing on the Internet is 9h20min, with an average surfing session of 31min. Thereby the user views a page in average for about 53 seconds.

The GVU's World Wide Web User Survey (Kehoe et al, 1999) gives a more complex list of information about the demographics of Internet users. According to their survey the average user is currently 37.6 years old, with an increasing trend. The percentage of female users on the Internet is about 33.6%, whereby new users (those who have been online for less than a year) are still quite gender-balanced with 48.5% being female and 51.5% being male.

The educational attainment of the users is quite high, with 87.8% having at least some college experience and 59.3% having obtained at least one degree. The majority of users (92.2%) cite English as their primary language (i.e. the one they speak most of the time, regardless of whether it is their "native" language). After English, German (1.5%), French (0.8%), and Dutch (0.8%) were the most commonly used languages on the Internet.

The survey shows an interesting fact regarding the amount of time spent searching before the first useful information was reached. This ranged, on average, from less than 5 minutes (34% of the users) to 10 minutes (33.3%). Users aged 21-25 took longer, on average, spending 20-30 minutes before reaching useful information (25%). For novices the average time spent was between 10-20 minutes (28.6% of users) or 30-60 minutes (28.6% of users). Experts, on the other hand, found useful information in less than 5 minutes (42.3% of experts) or 5-10 minutes (40.4% of experts). Another important factor is the time user spends on the Internet before they give up looking for information. On

average, users were spending 10-30 minutes searching before giving up if they were unable to find what they were looking for (10-20 minutes 31.8% and 20-30 minutes 23.4%).

2.3 Finding Information on the Internet

One of the most common problems all Internet users face is the fact, that it can be quite difficult and time-consuming to find what one is looking for on the Internet. This is primarily because there is no central 'main menu' that users can access to navigate through the Internet. Although there might not be an official menu, there are several resources available that make 'surfing the net' easier, such as 'yellow page' books, on-line directories, search engines, hot lists and link pages.

2.3.1 Internet "Yellow Page" Books

These books list Internet sites (primarily Web pages) and their URL's by categories (in alphabetical order). They can be found at computer stores and at most bookstores.

2.3.2 On-line Internet Directories

Internet directories are on-line Web sites that place Web pages into one or more categories. The pages are usually listed with a brief description and their URL. Depending on the Internet directory a search engine may also be available. While some directories manually review sites first, others automatically add submitted sites to their directory. In particular useful are subject-oriented gateways like the WWW Virtual Library (http://www.vlib.org). There links to the Virtual Library on Remote Sensing (http://www.vtt.fi/aut/rs/virtual/) and to related fields like Aerospace, Cartography, Earth Sciences, Environment, Forestry, Geophysics, Meteorology, Oceanography, and Surveying can be found.

2.3.3 Internet Search Engines

There are a few different types of search engines out there, but regardless of the way they work, all behave pretty much the same way. Most search engines take one or more words entered by the user, search the contents of every Web page stored in their databases and display the results. In most cases, the resulting pages are given a score (determined by the number of times the search criteria is met in each page), and are ordered from the highest score to the lowest. Some of the most popular search engines are Infoseek (http://www.infoseek.com), Excite (http://www.excite.com), Alta Vista (http://www.altavista.com), Lycos (http://www.lycos.com), Yahoo (http://www.yahoo.com), or HotBot (http://www.hotbot.com). In addition there are sites that provide access to multiple search engines such as the Search Engine Guide (http://www.searchengineguide.com) or SE Colossus (http://www.searchenginecolossus.com).

Beside the advantages there are specific drawbacks that have to be taken into account when using search engines:

- *Small search engine coverage*. Search engines usually don't index more than about 16% of the estimated size of the publicly indexable web. (Note that many queries can be satisfied with a relatively small database).
- *Unequal access*. Search engines are typically more likely to index sites that have more links to them (more 'popular' sites). They are also typically more likely to index US sites than non-US sites, and more likely to index commercial sites than educational sites.
- *Out of date*. Indexing of new or modified pages by just one of the major search engines can take months.

2.3.4 Internet Hot Lists and Link Pages

There is certainly no shortage of hot lists on the Internet, ranging from professionally constructed lists of Internet sites to personal link pages. These 'hot lists' are simply lists of Internet sites whose creators think one should visit. Their reasoning behind adding sites to hot lists can vary. Sites can be added because the list maintainer thinks they are 'cool', because they have neat graphics, for 'political' reasons, or for commercial advertisement. Although hot lists do not typically help Internet users search the Internet for a desired piece of information, they can sometimes lead the user to some of the more interesting or controversial places on the Web.

3 THE ISPRS ON THE INTERNET

In this section the various representations of the International Society of Photogrammetry and Remote Sensing on the Internet will be discussed. This with respect to the ISPRS homepage, the web pages of member organisations, technical commissions and working groups, the publications related to ISPRS, the educational resources for photogrammetry and remote sensing and the employment opportunities.

3.1 ISPRS Homepage

The ISPRS Homepage (http://www.isprs.org) serves as an umbrella web page or starting point for the ISPRS in order to provide up-to-date information and link lists for the various activities of ISPRS. Beside this the Homepage is a repository for the central data of the society, such as the actual list of the council, members, addresses and pointers as well as the minutes of meetings, the guidelines and the events calendar.

The international reservation of the domain name '**isprs.org**' for ISPRS serves two needs. On the one hand the site and its information and links can be found at a meaningful URL, on the other hand that any Internet address ending on the suffix 'isprs.org' can be released for all different kinds of ISPRS activities on the Web.

As of March 2000 there are about 520 HTML documents with some 220'000 lines of information available on the ISPRS Homepage itself, despite the fact that much information related to the activities of ISPRS is offered on the web pages of its technical commissions, working groups and members.

The main entrance page of the ISPRS web server consists of three sections containing the breaking news, an ordered list of links to the main destinations and a table of contents. The documents on the web server are assigned to the following major sections:

- The society (e.g. objectives and activities, historical background, interorganisational activities, management structure);
- Members (e.g. ordinary members, associate members, regional members, sustaining members, honorary members and application forms for the different types of membership);
- Technical Commissions and Working Groups;
- Documents and Publications (e.g. Statutes, Bylaws, Guidelines, Awards, Minutes of Meetings, International Archives of Photogrammetry and Remote Sensing, ISPRS Journal of Photogrammetry and Remote Sensing, ISPRS Highlights, ISPRS Annual Reports, ISPRS Organisation and Programs, ISPRS Member List);
- Information and announcements (e.g. ISPRS events calendar, ISPRS employment opportunity archive)
- Tools (e.g. News, ISPRS related links, ISPRS sample pages)

The ISPRS Homepage shows in the five years of its existence an increasing interest to the community. In first three months of the year 2000 a total number of about 119'400 web page hits from 10'400 unique visitors could be monitored. This is an average of about 40'000 requests per month, 1'300 requests per day or one request every minute. In average 100 unique visitors per day are visiting the ISPRS server. A monthly statistic for the number of requests from the ISPRS server is available since January 1995 (see Figure 4). The steady increase of the use of ISPRS documents over the last 5 years and especially over the last six months, since the domain name isprs.org is registered, is obvious. At the present time the ISPRS server answers about 45'500 requests per month. Thereby in average 9 MB of data is transferred per day to the users.
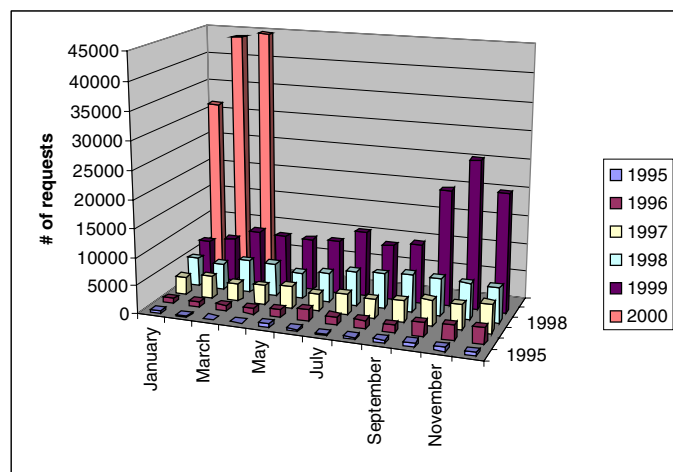
Figure 4: Number of HTML requests on ISPRS server per month (January 1995 - March 2000)

3.2 WebPages of Member Organisations, Technical Commissions and Working Groups

All ISPRS Member Organisations, Technical Commissions and Working Groups are asked to use Internet WebPage media to promote their work related to their area of expertise. In order to assist this task, ISPRS created guidelines for the preparation and maintenance of ISPRS WebPages (Chen and Felkner, 1998). As additional support a downloadable WebPage, that can be used as a basic template upon which WebPages can be built, and the official ISPRS logo are provided at the ISPRS Homepage (http://www.isprs.org/samples.html). As a few minimum requirements all ISPRS WebPages should include the following:

- a reference to the ISPRS and the function of the Member Organisation, Technical Commission or Working Group must be stated clearly at the front of the WebPage,
- the name and address of the Web Master, as well as the date of the last update to the WebPage,
- the official ISPRS logo clearly and prominently displayed, and
- hypertext links to the ISPRS Homepage.

Beside the fact, that fundamental information of all Member Organisations, Technical Commissions and Working Groups is provided on the ISPRS Homepage, currently already about 75% of the Technical Commissions and Working Groups and 25% of the Member Organisations provide information on their own WebPages.

3.3 Publications

On the Internet a large variety of scientific and general electronic journals can be found. Thereby a large proportion of the electronic magazines contains the same text and pictures as the paper version of the same magazine. Often, they

contain nothing new in comparison with the paper version, except for the occasional hyperlink with related documents. The main advantage of electronic journals is especially their quick dissemination and the simple method of storage. Real electronic journals can profit from the advantages of the Web by using communication and audio-visual information. Unlike the above-mentioned category of electronic magazines, these e-zines or e-journals per definition have no paper equivalent. E-zines and e-journals on the Internet are not always free.

The publications of ISPRS are in the seven categories: International Archives of Photogrammetry and Remote Sensing, ISPRS Journal of Photogrammetry and Remote Sensing, ISPRS Highlights, ISPRS Annual Report, ISPRS Organisation and Programs (Silver Book), ISPRS Member List (Blue Book), and ISPRS Brochure. With the exception of the first, where only the information about the issue of the Archives is online, and the last, which is intentionally meant to be a printed publication, all other publications of ISPRS can be reached via the ISPRS homepage. Access to the full text of most of these publications is free of charge. For the ISPRS Journal of Photogrammetry and Remote Sensing access will be limited in the near future to users that are affiliated to a library that subscribes to the print edition of the journal. Examples for related online journals and pointers to journals are:

- Photogrammetric Engineering & Remote Sensing (http://www.asprs.org/asprs/publications/pe&rs/index.htm),
- The Photogrammetric Journal of Finland (http://foto.hut.fi/seura/pjf.html),
- GIM International (http://www.gim-international.com/),
- TCG - Tables of contents for selected journals in geodesy (http://www2.geod.nrcan.gc.ca/~craymer/tcg/),
- Remote Sensing in Canada On-Line (http://www.ccrs.nrcan.gc.ca/ccrs/comvnts/rsic/rsicinde.html).
- IEEE Transactions on Geoscience and Remote Sensing (http://www.ieee.org).

A problem that has to be faced, is that documents published on the Internet are transient in nature, being subject to rapid change and unpredictable removal. This means that they are highly susceptible to loss from the permanent record. Documents on paper or parchment can remain legible for hundreds of years without any special equipment or preservation treatment. This is not the case with electronic documents, they cannot be read without the hardware and software and knowledge of the technical environment in which they were created. Hence, a long term preservation of Internet publications requires timely and active intervention at all stages. In order to ensure long term access to Internet publications we need to identify items to be archived in a timely manner, so that they can be captured before they disappear. This is mandatory for all levels of activities.

3.4 Educational Resources

There is quite a variety of educational material and computer software for Photogrammetry and Remote Sensing available on the Internet. Without claiming for completeness a few examples are given in the following chapters.

3.4.1 Arpenteur

Arpenteur (ARchitectural PhotogrammEtry Network Tool for EdUcation and Research) is a simple photogrammetric software package dedicated to stereoplotting and modelling (Drap and Grussenmeyer, 2000). It is particularly dedicated to applications based on small format images. Arpenteur is a Web based tool since photogrammetric concepts are embedded in Web technology and Java programming language. Therefore it can be easily used from anywhere all over the world and with whatever operating system is used. Two servers located in Marseilles and Strasbourg are available to manage project data. Different solutions for the adjustment of the photogrammetric model are available as well as a measurement method based on image correlation. Examples are available for education and personal projects can be stored on the servers' database. Arpenteur is freely accessible via the Internet at www.arpenteur.net, where models of different data sets are available by an anonymous login.

3.4.2 CATCON

CATCON is the name of a software contest organised by the ISPRS WG VI/2 on Computer Assisted Teaching (CAT). The main objective of the contest is to promote the development and dissemination of good/user-friendly software packages, videos as well as data sets for computer assisted teaching. In general, the software or dataset is preferably to be non-commercial and preferably to be provided to the users on free of charge. The winners of the first contest at the ISPRS Vienna Congress in 1996 are:

- Joachim Höhle, Denmark, for the development of computer assisted teaching software LDIP and ORTO for photogrammetry (http://www.i4.auc.dk/jh).
- Nguyen Dinh Duong, Vietnam, for the development of the remote sensing software WinASEAN (ftp://ftp.tric.u-tokai.ac.jp/outgoing/catbin/WinASEAN).
- Gong Jianya, China, for the development of the GIS software GeoStar.
- RADARSAT International, Canada, for the development of the RADARSAT Sample Images CD-ROM.

3.4.3 Education, training, research and fellowship opportunities in Remote Sensing, GIS and its applications

This Educational Directory (http://www.ltid.inpe.br/dsr/tania/RSdir) has been developed as a task of ISPRS WG VI/1 on education and as part of the ISPRS Educational Opportunities Program initiated in 1996. It is a first attempt to providing a comprehensive directory of education and training services in the remote sensing and spatial information information sciences. In this directory it is possible to get information from all members states that are involved in Space Science. The information contained in this directory for each institution includes its areas of specialisation, the

educational and research programmes offered, the facilities available, the prerequisite qualifications, financial information, fellowship opportunities and opportunities for international co-operation. Addresses and contact points for further information are also included. 108 Institutions in 49 countries are listed.

3.4.4 Academic Sites for Geomatic Engineering

A link list to academic sites for geomatic engineering is compiled and maintained by Robert Kauper (http://www.lrz-muenchen.de/~t583101/WWW/Links.html). The list consists of links to academic institutions, which provide education in the fields of Geodesy, Surveying, Photogrammetry, Cartography, and GIS, as well as links to international and regional organisations.

3.4.5 Educational Resources in Remote Sensing

Amongst the quite large number of educational resources in Remote Sensing, at this place just a few are mentioned explicitly.

- NASA's Remote Sensing Tutorial (http://rst.gsfc.nasa.gov) - A very nice and comprehensive tutorial on fundamentals and applications of remote sensing.
- CEOS CD-ROM (http://ceos.cnes.fr:8100/) - Includes some good explanations on fundamentals of remote sensing as well as applications and datasets.
- NASA Observatorium Education (http://observe.ivv.nasa.gov/nasa/education/reference/main.html) - Contains some more basics and links to other tutorials.
- ASPRS educational resources (http://research.umbc.edu/~tbenja1): A remote sensing curriculum provided by the American Society of Photogrammetry and Remote Sensing.
- Berkeley lecture (http://www.cnr.berkeley.edu/~gong/textbook). A remote sensing lecture at the University of California at Berkeley.
- NASA's Mission to Planet Earth (http://www.earth.nasa.gov/)

3.5 ISPRS Employment Opportunities Archive

This jobs listing (http://www.sli.unimelb.edu.au/isprs/mail-archives/index.html) is provided by ISPRS as a service to the photogrammetric, remote sensing and spatial information industry. The listing is intended to be a register of opportunities for persons who are seeking employment. Employers are encouraged to submit advertisements, which are appropriate and relevant to these disciplines. To advertise, employers simply send an email to the address isprsjobs@sunrise.sli.unimelb.edu.au and the advertisement will appear automatically.

4 OUTLOOK

The Internet is constantly growing at an enormous speed. Currently there are over 120 million hosts on the Internet and an estimated 275 million users, world-wide. By the year 2007, the Internet is likely to exceed the size of the global telephone network, if it has not by that time become the telephone network by virtue of IP telephony. Moreover, much more Internet-enabled appliances will have joined traditional servers, desktops and laptops as part of the Internet family. Pagers, cell phones and personal digital assistants may well have merged to become the new telecommunications tool of the new decade. But even at the scale of the telephone system one has to realise that only half the population of earth has ever made a telephone call.

As high bandwidth access becomes the norm, through digital subscriber loops, cable modems and digital terrestrial and satellite radio links, the convergence of media available on the Internet will become obvious. Television, radio, telephony and the traditional print media will find counterparts on the Internet - and will be changed in profound ways by the presence of software that transforms the one-way media into interactive resources, shareable by many.

The web is beginning to transform society, with the use of search engines as an important part of the process. The web and search engines represent a significant improvement for communication, providing efficient access to an increasing amount of information. 85% of users use search engines to find information (Kehoe et al., 1999). Consumers use search engines to locate and buy goods or to research many decisions (e.g. choosing a vacation destination, medical treatment). However, the search engines are currently lacking in comprehensive and timeliness, and do not index sites equally. The current state of search engines can be compared to a phone book, which is updated irregularly, is biased toward listing more popular information, and has most of the pages ripped out.

The Internet can facilitate democratic practices in unexpected ways. For example proxy voting for stock shareholders is now commonly supported on the Internet. As access to the Internet increases, additional ways are thinkable in order to simplify and expand the voting franchise in other domains, including the political.

The Internet is becoming the repository of all we have accomplished as a society. However, it is not sufficient to just create archives of publications or data. Users must be able to discover what is in it and to gain access to it. Archive managers must be able to maintain the archives, to add new data or versions, to store and access software needed to operate them, to compress and decompress them, to manage access rights and conditions, to migrate them from superseded formats and from obsolescent technologies. While a lot of work has been done on metadata, the emphasis

has been on resource discovery rather than preservation and administrative metadata. Widely adopted metadata that conforms to set standards for purposes including both resource discovery and for recording preservation information is needed. The different kinds of metadata must be able to interrelate with each other and to be interoperable across systems.

However, it should mentioned that beside any technological development, which will or might come in the future, the main sources for the Internet are we, the people who are using and contributing to the Internet. It has become meanwhile a trend, that more and more unsalaried people produce online contents with promising results. This development, known as "open source", is expected to play a comparable role with the assembly-line during the age of industrial development. Successful examples for this trend are the Oxford English Dictionary (www.oed.com) or the Open Directory Project (www.dmoz.org). Just a year after its start, the Open Directory Project counts already over 23'000 editors maintaining 250'000 categories with more than 1.6 million sites. Without the Internet, such a huge number of volunteers distributed over the whole world contributing in a constructive manner to a common project would simply be impossible. The benefit for the volunteers, similar to the academic world, is their reputation. A similar trend could be seen earlier in the development of the computer operating system Linux. Hence, the goal is not only to find enough volunteers but also to acknowledge their work, in order to build up databases and metadata of information for the benefit of all.

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