[DRAFT]
INTERNATIONAL SOCIETY FOR DIGITAL EARTH

PROCEEDINGS OF THE FIRST INTERNATIONAL DIGITAL EARTH WORKSHOP

BEIJING, CHINA

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Institute of Remote Sensing Applications
Chinese Academy of Sciences

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Beijing, China, 11-14 2002

ORIGIN

This document was prepared by the International Digital Earth Geobrowser Working Group (IDEGWG) for the International Digital Earth Workshop of the International Society for Digital Earth, which consist of:

Timothy W. Foresman, ICRSE, workshop Co-Chair
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Locations
ESRI – Environmental Systems Research Institute
GTCI – Georgia Tech Research Institute
ICRSE – International Center for Remote Sensing Education
IRSA – Institute of Remote Sensing Applications, Chinese Academy of Sciences
USC – University of South Carolina

ACKNOWLEDGEMENTS

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SUMMARY OF CONTENTS

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARP	Academic Resource Planning
CAS	Chinese Academy of Sciences
CNIC	Computer Network Information Center
DB	Database
DBM	Database Management
DE	Digital Earth
DEPS	Digital Earth Prototype System
DERM	Digital Earth Reference Model
DWG	Design Working Group
ESRI	Environmental Systems Research Institute
GIS	Geographic Information Systems
GTRI	Georgia Tech Research Institute, Georgia Institute of Technology, USA
ICRSE	International Center for Remote Sensing Education
IDEGWG	International Digital Earth Working Group
IRSA	Institute for Remote Sensing Applications
ISDE	International Society for Digital Earth
KIP	Knowledge Innovation Program
LDES	Laboratory for Digital Earth Sciences
NCSA	National Center for Supercomputing Applications
NGO	Non-Governmental Organization
PWG	Programming Working Group
RS	Remote Sensing
SDK	Software Development Kit
SOK	State of Knowledge
3D	Three Dimensional
SQL	Structured Query Language
USC	University of South Carolina, USA
UN	United Nations
UNEP	United Nations Environment Programme
UWG	User Working Group
WG	Working Group
XML	Extensible Markup Language

NOTE: In keeping with the principles of the ISDE, the official language for the workshop was English. However, all major United Nations (UN) languages will be promoted by the ISDE for the widest distribution of Digital Earth information.

EXECUTIVE SUMMARY

The International Society for Digital Earth convened the First International Digital Earth Workshop, from 11 to 14 December at the Institute for Remote Sensing Applications in Beijing, China. The workshop, which was attended by nearly 80 international participants, provided a forum for reviewing the status of Digital Earth development and implementation around the world. The participants included Chinese, Japanese, Russian, and American representatives from academic, governmental, industrial, and the non-profit sectors. A key feature of the workshop was the initiation of the Digital Earth Geobrowser functional user documentation. The workshop also served as a developmental component for the Third International Symposium on Digital Earth, to be held in September 2003 in Brno, Czech Republic.

The International Society for Digital Earth (ISDE) is a non-political, non-governmental and not-for-profit international organization, principally for promotion of academic exchange, science and technology innovation, education, and international collaboration. The primary purpose of the Society is to promote international cooperation on the Digital Earth vision, and enable the Digital Earth technology to play key roles *inter alia*, in economic and social sustainable development, environmental protection, disaster mitigation, natural resources conservation and improvement of human beings' living standard.

The first day of the workshop was devoted to a series of technical presentations that highlighted the growing number of Digital Earth applications and technologies across the world. Specific foci including three-dimensional (3D) effects, file compression, programming elements, and high performance networks were presented. Numerous, existing applications were reviewed in addition to some prototype demonstrations. The spectrum of application scales became evident as presentations were made addressing, global, national, regional, and local issues.

The initial day of the workshop also included the keynote address by Dr. Chen Shupeng entitled "Digital Earth is Going Forward." Dr. Chen's remarks captured the spirit of the workshop in suggesting that Digital Earth has moved beyond the conceptual stage and is being implemented by an increasing number of societies and in myriad application areas around the world.

The final three days of the workshop were dominated by the working group sessions, including design, programming, and user requirements. The working groups addressed the growing need to develop a mandate to promote harmonized development of geobrowsers, the key delivery mechanism for Digital Earth applications to citizens and scientists. Participants were united in seeking practical and transferable solutions, through the Digital Earth Vision, to meet the challenges expressed through sustainable development.

The workshop culminated with an executive summary session wherein the Secretariat members outlined the final documents that would serve as the permanent record for the workshop, and discussed ideas for future opportunities to promote and sustain the Digital Earth vision.

INTERNATIONAL SOCIETY FOR DIGITAL EARTH

FIRST INTERNATIONAL DIGITAL EARTH WORKSHOP

Beijing, China, 11-14 December 2002

PROCEEDINGS

Day 1 (11 December 2002)

INTRODUCTION

[1] An assembly of international experts was convened in Beijing as continuation of the process to maintain international communications regarding the underlying technologies and application advances within the international Digital Earth community. This assembly also initiated the first international workshop on Digital Earth geobrowsers

[2] This plenary style workshop brought together experts from four nations to address the status and requirements for documenting the functional user needs for three-dimensional (3D) graphic user interfaces, or geobrowsers. The objectives targeted defining the process for identifying key stakeholders and their range of applications for the Digital Earth vision. In addition, preliminary definitions of the basic functions and components of 3D geobrowsers were developed and reviewed.

[3] This document records the primary plenary session presentations. Results of the working group sessions and copies of all the presentations are captured on the accompanied CDROM as hyperlinked documents

OPENING AND ORIENTATION

[4] The four-day International Digital Earth Workshop, hosted by the ISDE Secretariat and the Chinese Academy of Sciences (CAS), began with welcoming remarks by convening session co-chairs Dr. Timothy W. Foresman and Dr. Shao Yun. The 80-plus participants, guests, and dignitaries were welcomed to Beijing and specifically to the Laboratory for Digital Earth Sciences (LDES) within the Institute for Remote Sensing Applications (IRSA). Local and national reporters including representatives from Science News recorded the initial proceedings and opening remarks.

[5] Professor Guo Huadong, of the Chinese Academy of Sciences and workshop co-chair, was introduced by Dr. Shao and provided some additional welcoming remarks on behalf of the CAS. Professor Guo continued his comments by recalling past DE workshops, including one initiated in Beijing in 1999. Professor Guo also thanked the participants for attending the workshop and expressed his hope that the vision of Digital Earth would continue to be realized in myriad applications worldwide.

[6] Professor Guo then introduced Dr. Wang Chao, the Deputy Director for the IRSA, who welcomed all the participants and guests. Dr. Wang highlighted the principal research application areas within the IRSA and noted the participation of numerous nations including representatives from China, Japan, Russia, and the United States. Dr. Wang expressed his enthusiasm for the momentum that exists already for Digital Earth applications, and recalled the "digital gap" between regions of the world, and within individual nations.

OPENING PERSPECTIVES

[7] Workshop co-chair Dr. Timothy W. Foresman delivered a presentation that focused on the history of digital environmental information events and influences. Dr. Foresman recalled the First International Symposium on Digital Earth, held in Beijing, China (29 Nov – 2 Dec 1999). That initial symposium included over 500 delegates, representing 27 nations who met to discuss the purpose of Digital Earth. Dr. Foresman highlighted the potential for Digital Earth and new 3D geobrowsers to address the challenges of sustainability and improving conditions for humankind.

[8] Workshop co-chair Dr. Shao Yun introduced the distinguished keynote speaker, Dr. Chen Shupeng of the CAS. Dr. Chen Shupeng delivered a speech entitled "Digital Earth is Going Forward" that traced the history of DE influences and highlighted the "localization" of DE within China. Dr. Chen's remarks captured the spirit of the workshop in suggesting that Digital Earth has moved beyond the conceptual stage and is being implemented in an increasing number of places and applications areas. Furthermore, he suggested that DE technology could be used to reduce the "digital gap" which is increasing around the world. [See Appendix 2 for speech text].

[9] The aforementioned series of opening remarks were followed by a series of technical presentations that highlighted current and prototype Digital Earth applications being developed by the workshop participants. Particular attention was focused on the state of knowledge (SOK) of current 3D geobrowsers and the challenges that still remain in integrating true 3D technology with web-accessible applications.

TECHNICAL PRESENTATIONS

[10] Professor Guo Huadong was reintroduced by workshop co-chair Dr. Timothy W. Foresman. Professor Guo gave a brief set of remarks to introduce the DE Prototype System (DEPS) that is being developed by the IRSA. Professor Guo delivered his remarks in front of the full-wall

wraparound 3D screen that is part of the LDES visualization studio. A highlight of the presentation was a virtual 3D video of Beijing with a model of the proposed Olympic Park (currently under construction). Professor Guo mentioned the use of this "Digital Beijing" database by the organizing committee in preparing their bid to the International Olympic Committee for the 2008 Olympics.

[11] Professor Guo continued his presentation by profiling current CAS research on DE and Earth observation. The visual presentation included an excellent integration of English/Chinese languages – a key consideration for worldwide web accessibility. One of the 3D images displayed was a model of a human being with Earth representing the human brain – effectively conveying the concept of humankind's knowledge of Earth.

[12] Professor Guo continued his presentation by suggesting some fundamental technical requirements for DE geobrowsers. While a continuing series of virtual models were displayed behind him to illustrate his comments, Professor Guo specifically mentioned:

- High Performance Computing
- Database Storage Capacity
- Data Management//Metadata
- Data Fusion
- Visualization
- Data Compression and Retrieval
- Web Access and Interoperability

[13] Professor Guo reiterated the observation that specific application fields are critical to defining technical requirements. He reviewed a series of applications, based in remote sensing technologies, to illustrate this point, including:

- Atmospheric modeling (Global Meteorological Satellite)
- Vegetation discrimination (RADARSAT)
- Dynamic Land Cover assessment (MODIS)
- Archaeological investigations (using radar data)
- Flood modeling and monitoring (using topographic and multispectral data)
- Urban modeling of dust storm impacts

Professor Guo displayed a 1:100,000 scale Digital Elevation Model (in 3D perspective) view of the entire nation of China and noted the requirement of accurate, current data to develop critical foundation layers for DE geobrowser applications.

[14] Professor Guo concluded his presentation by addressing the future DE research needs, including:

- Social needs drive development
- Monitoring systems integration
- Cooperative Management/Use of resources
- Localization (e.g., Digital City --> Digital Region --> Digital Country --> Digital Earth)

- Distributed network implementation

[15] Professor. Nick Faust from the Georgia Institute of Technology (Atlanta, GA, USA) delivered a technical presentation that focused on advances in visualization techniques and tools. Professor Faust recalled meeting with Dr. Fang Yi from the CAS in the United States during 1979, and conducting research at IRSA for five weeks in 1984.

[16] Professor Faust recalled the evolution of RS/GIS/Visualization and the integration of these tools in developing "Augmented Reality" applications. He also noted the utility of these tools in monitoring of the environment for habitat characterization, storm modeling. Professor Faust displayed images from the mobile, PC-based automated visualization environment (known as the "NAVE") and remarked on the data integration and visualization efforts being conducted within his research laboratory at Georgia Tech. He also stressed the importance of integrating dynamic temporal elements into 3D geobrowsers.

[17] Dr. Yan Baoping, Director of the Computer Network Information Center (CNIC) for the CAS, was introduced by workshop co-chair Dr. Shao Yun. Dr. Yan delivered a technical presentation on the development and implementation of "E-Science" in China. Dr. Yan mentioned the CAS's Knowledge Innovation Program (KIP) that was initiated in 1998, and the hierarchical implementation of the Academic Resource Planning (ARP).

[18] Dr. Yan reviewed the backbone computing systems that were being implemented through the plan developed by the CNIC. He also highlighted the importance of cataloguing "academic thought and research." D. Yan continued by identifying broadband networks as the top priority as defined by the KIP. In addition, he mentioned supercomputing capacity, the development of scientific data centers, and implementation of video conferencing as the next major tasks for the CNIC. The estimated cost for this implementation was 350M RMB Yuan ($40M US).

[19] Dr. Yan continued by highlighting the cross-discipline, multi-scale research needs of the CAS (and others around the world). He recalled a three-step model that described the evolution of science. This model includes, Empirical, Theoretical, and Computational steps and "open" discipline collaboration for "grid-style" applications worldwide. Dr. Yan concluded his presentation by outlining the milestones of E-Science at CAS and the acknowledgment of similar implementation schemes by others, such as the Korean Information System Technology Institute (KISTI). Dr. Yan stressed that the enhancement of the scientific research environment is evolving and that E-Science must evolve with academic and traditional scientific communities.

[20] Workshop co-chair Dr. Foresman introduced Dr. Greg Cole, the Associate Director of High Performance Strategic Networking Initiatives and Dr. Natasha Burashova, the Director of High Performance International Networking Initiatives at the National Center for Supercomputing Applications (NCSA) in Arlington, VA, USA. Both Dr. Cole and Dr. Burashova were affiliated with the University of Illinois at Urbana-Champaign.

[21] Dr. Cole delivered a technical presentation on the strategic initiatives between Russia and the United States to address supercomputing infrastructure challenges. Dr. Cole stressed the importance of maintaining and upgrading the high performance systems that form the backbone of international computing collaborations. He noted that these systems would help to deliver the data being delivered by 3D geobrowsers in support of numerous applications worldwide.

[22] Following Dr. Cole's presentation, Dr. Natasha Burashova delivered a comprehensive overview of Russian-American high performance infrastructure integration. She highlighted the U.S.-Russian Broadband Network (NAWKA-NET), and reminded the participants about the security issues that will be encountered while implementing substantial international efforts.
Dr. Burashova concluded her presentation by highlighting some of the key applications that are being facilitated by the NCSA including; non-proliferation, weapons issues, and major scientific applications, and suggested key aspects in defining the future of high performance networking.

SPECIAL REMARKS ON DIGITAL EARTH COLLABORATION

[23] Workshop co-chair Dr. Shao Yun introduced Dr. Chen Yun-tai and Dr. Chen Yong, from the CAS. Both of these distinguished science guests welcomed the participants and thanked the contributors for furthering the implementation of Digital Earth concepts and applications. They also both offered praise for those groups, corporations, and institutions that were pursuing the DE vision through collaborative efforts.

SUMMARY COMMENTS OF MORNING PLENARY AND STRATEGIC VISION

[24] In preparation for the midday workshop adjournment, Dr. Foresman and Professor Guo provided summary comments on the presentations from the Day 1 morning session. Additionally, Drs. Guo and Foresman noted that the Day 2 afternoon sessions would focus on examples of existing and prototype geobrowsers. The agenda was reviewed for Days 2-4 and Dr. Foresman reiterated the objective of defining functional requirements for web-accessible, 3D geobrowsers. Dr. Foresman recognized that an international Digital Earth "culture of harmonization" could be realized through the culmination of local applications. Professor Guo remarked that there had to be a commitment to raising the expectations and realizations of a cooperative research agenda. Drs. Foresman and Guo concluded by suggesting that a series of "milestone metrics" were the logical next step in forming a "common vision" regarding Digital Earth and related 3D geobrowsers.

AFTERNOON PLENARY

[25] Workshop co-chair Dr. Timothy Foresman initiated the Day 1 afternoon session with some brief remarks and again reminded the participants of the workshop objectives.

CONTINUATION OF TECHNICAL PRESENTATIONS

[26] Dr. Foresman introduced Mr. Jim Fournier of Planetwork, Inc. (San Francisco, CA, USA). Mr. Fournier delivered a presentation behalf of Mr. Chuck Stein, the President of GeoFusion, Inc.™ (San Francisco, CA, USA). Mr. Fournier demonstrated the Geomatrics(R) software

application, a dynamic, 3D, multi-scale, data integration and visualization toolkit. Mr. Fournier noted that the Environmental Systems Research Institute (ESRI)(R) (Redlands, CA, USA) have successfully integrated this software into the ArcGlobe software to enhance its effectiveness. He also reminded the audience of the current requirements for enhanced video graphics cards to use the Geomatrics(R) software. Mr. Fournier concluded by highlighting the flexibility of the Geomatrics(R) toolkit that permits the development of user defined Digital Earth applications.

[27] Dr. Foresman introduced Ms. Yumi Nishiyama, from the Fukui Geo-informatics Laboratory at the Keio University (Tokyo, Japan). Ms. Nishiyama showed a prototype geobrowser that is being developed by the Geo-informatics Laboratory. She displayed a 3-layer model to use as a gateway link between real and virtual worlds. Ms. Nishiyama the concept of geoinformatics and outlined a process from "Real Feature --> Entity --> Feature --> GeoObject." She also outlined the concept of database architecture that included "wrapped" elements.

[28] Ms. Nishiyama continued by demonstrating a prototype for Digital Asia a collaborative effort between Thailand, Japan, and NASDA (the National Space Development Agency of Japan). The Digital Asia application permits digital monitoring and modeling of regional. Ms. Nishiyama concluded her presentation by highlighting the value of integrating existing tools, such as IMS technologies, spatial database management systems, and XML programming language to provide efficient "user-services" throughout the Digital Earth community.

[29] Workshop co-chair Dr. Shao Yun introduced Dr. Wu Bingfang, Director of the Unit of Resources and Environment within the IRSA. Dr. Wu delivered a technical presentation on spatial database management and the value of incorporating responsible DBM techniques in DE applications. Dr. Wu demonstrated an application that integrated ESRI's ArcSDE(R) and Oracle/SQL database management systems to address agricultural and natural disaster issues. Dr. Wu noted the power of effective database management systems and noted that this aspect of the Digital Earth vision is no longer the significant problem that it was in the past.

[30] Mr. Joseph Skopek from Earthscope, Inc. (New York, NY, USA) then delivered a technical presentation on the proactive solutions that have been developed by the Buckminster Fuller Institute (Sebastopol, CA, USA). Mr. Skopek displayed a dynamic time series application that demonstrated the value of advanced visualization tools. The example showed two different approaches toward stewardship of Earth resources and compared the impacts of maintaining the *status quo* (unsustainable growth) and adopting a new model (sustainable development).

[31] Mr. Skopek illustrated that visualization tools, including 3D geobrowsers can serve a valuable role in helping to educate the citizens of the world about sustainable practices and the condition of the ecosystems upon which mankind depends. He further suggested that the use of custom projections and the integration of global-to-local applications could help to illustrate the interrelatedness of world. Mr. Skopek concluded by restating the philosophical underpinnings espoused by Buckminster Fuller on responsible stewardship of the Earth, and by reiterating that geobrowsers can effectively illustrate how activities impact non-adjacent areas across globe.

[32] Dr. Yang Chonjun, from the IRSA, delivered a presentation on Web Services, Grid, and Digital Earth. Dr. Yang discussed the evolution of the Global Spatial Data Infrastructure and the potential for future worldwide web changes that would incorporate the concept of "great global grids." He described "grids" as a dependable, consistent, and persuasive mechanism for utilizing geographically distributed data. Dr. Yang further noted that the development of common layers within a grid system promotes connectivity and interoperability, and enhances the opportunity for collaborative Digital Earth projects.

[33] Dr. Yang demonstrated some current grid applications including the Chinese National High Performance Computing Network (NHPLE), and the Chinese Spatial Information Grid (i.e., the 863 Program). Dr. Yang concluded by discussing the need for intelligent geographic information retrieval and demonstrating some of the dynamic directional tools that are available for web-enabled applications.

[34] Mr. Jim Fournier, representing the Planetwork Consortium, articulated a vision for empowering networks of small non-governmental organizations (NGOs) to promote and teach the Digital Earth vision. Mr. Fournier described Planetwork as an organization intent on developing software for citizens of Earth. He noted the Earth Charter, a universal declaration for sustainable principles, as "common ground" for citizens across the globe. Mr. Fournier outlined the value of Open-Source Applications relative to Prototype Proprietary Applications.

[35] Mr. Fournier continued by suggesting that social and technical questions need a combination of social scientific communication. He noted that such an approach balances the usability and functionality elements of a project. Mr. Fournier suggested that a spectrum of technical options (i.e., geobrowsers vs. stand-alone applications) would enable the involvement of substantially more people in the Digital Earth community, due to the spectrum of user abilities and varying levels of access to technical infrastructure. He noted the consistent need for balancing fundamental geobrowser elements such as bandwidth, speed, storage capacity, and graphics sophistication. Mr. Fournier concluded his presentation by discussing the benefits and obstacles associated with using a distributed architecture.

[36] Dr. Xue Yong delivered a very comprehensive presentation on the principal elements to consider in geocomputation. Dr. Xue noted that geographic information systems (GIS), artificial intelligence (AI), high performance computing (HPC), and telecommunications all serve key roles in the realization of geocomputation applications. He clearly articulated an excellent overview of how geocomputation benefits DE efforts, and suggested some current examples to reinforce his comments.

[37] Dr. Xue proposed the adoption of a "Geo-Middleware" bridge to enhance communication between computer scientists and physical scientists. He referred to this new "discipline" as telegeoprocessing (TGP), and suggested that the efforts to realize this concept would ultimately

yield real-time spatial databases capable of providing near universal Decision Support (DS) to the Digital Earth community.

[38] Dr. Ma Jianmen delivered the final technical presentation of the Day 1 afternoon session. Dr. Ma discussed the process of data mining and how this process is integral to the Digital Earth vision. He provided an excellent overview of intelligent spatial data processing, including the use of back propagation automated neural networks (ANN) for assimilation calculations. Dr. Ma used the example of surface temperature mapping to illustrate some of the basic elements involved in neural network analysis.

[39] Dr. Ma continued by discussing self-organized networks and introducing the concept of the I2 Miner for intelligent, integrated mining of data and imagery. He noted that the dynamic nature of many Digital Earth applications actually enhances the power and utility of ANNs. Dr. Ma suggested the need to recall historical work in analytical calculations, and to provide and store documentation. He highlighted three core steps within the data mining process; on-board processing, post-acquisition processing, and knowledge generation, and concluded by suggesting that 3D cluster analysis could prove invaluable in helping to develop DE geobrowser technology.

CONCLUDING REMARKS FOR DAY 1 PLENARY

[40] The co-chairs (Drs. Shao and Foresman) provided some brief summary remarks, outlined the agenda for the remainder of the workshop (i.e., Days 2-4) and then officially adjourned the plenary session.

DAY 2-4 GEOBROWSER WORKING GROUP

Day 2 (12 December 2002)

OVERVIEW

[41] Under the co-Chairs, Drs. Shao Yun and Tim Foresman, approximately two-dozen workshop participants reviewed the perspectives of the DE vision and the various definitions that predominate within the numerous user sectors. A range of perspectives was offered from the participants through a series of presentations regarding their institutions and colleagues' activities. Common agreement allowed that the DE provided the only vision for united these diverse views and activities. Goals of the workshop were reiterated regarding development of a document for functional user requirements for universal DE geobrowsers.

[42] Consensus was developed that the UN model of having all things available at all times was too comprehensive for many individual users however, the three level model which allowed for different domains or communities such as, agriculture, health, humanitarian, etc., could each be supported using similar user interfaces. The principle for uniting functional user requirements appears to be linked to ensuring that each community values their uniqueness, not as multidisciplinary, but as special domains of knowledge. Furthermore, that the concept that "content is king" is paramount in recognizing value of each sector or domain to document and publish results (that is data, information, as well as application tools) for their community.

[43] The working group deliberated on projections for the next 10-20 years, regarding the evolution of database management, 3D technologies, and the Internet along with other IT trajectories, to assess the alignment of geobrowsers utility with sustainable development. Visualization, navigation, and the ability to harness knowledge management through quality and objective agents were deemed imperative under any future's scenario. The need for a constantly maintained Digital Earth Reference Model, or DERM, was evident to all as the numerous advances and developments within any technical sector surpassed any individual's knowledge. It was agreed that the ISDE had a vested interest in reviving the DERM and ensuring its maintenance.

[44] Agreement was reached that the actual development to geobrowsers was not the mandate for ISDE, but rather the assessment of the needs and promotion of the common need for performances to support a global network of data providers and users. Geobrowsers would evolve to a public infrastructure related to other efforts such as, GeoData Alliance, and the Global Spatial Data Infrastructure. From this common understanding the workgroup members reviewed the fundamental elements of system design engineering to enable clarity in the documentation of functional user requirements.

[45] Dr. Wang Changlin presented a thorough review of existing geobrowsers as had been identified and located on the Internet. This state of knowledge provided a look at the various on-line tools and services available. Further expansion of the concept that linked geobrowsers to DE included examples of Chinese Digital Earth, Digital Regions, and Digital Rivers.

[46] Members were divided into three breakout groups to further develop a listing of the geobrowser functions and parts based on three development schemas; design schema, programming schema, and user schema. Each group filled the remainder of the day generating list and logic behind definitions for present these perspectives for functional requirements, methods of classification, and development growth plans.

Day 3 (13 December 2002)

DELIBERATIONS AND FINDINGS

[47] Results of the three breakout groups were presented covering a range of issues related to functional requirements, classification methods, and development plans. The three breakout lists of functional requirements were closely aligned and covered the basics for 3D navigation and Internet access, along with specialized knowledge management as expressed through domains of real estate, tourism, Earth science, planning, and human services. Classification methods were based on experience with various vendor and industry components, which raised questions regarding modes of operations ranging from stand-along, to temporal imaging, to dynamic analysis. Scenarios for development plans incorporated issues such as, bandwidth performance related to pyramid versus non-pyramid architectures, zoom-level performance, and multiple window dynamics.

[48] Members were regrouped into two breakout groups for the remainder of the day. A design group worked to further refine the matrix for geobrowser components and the document group to manage the collection of written inputs from the breakout groups for final documentation. Results from these breakout groups provided the outline materials and references for preparing the follow-on document on geobrowser functional requirements.

Day 4 (14 December 2002)

FINALIZING RESULTS

[49] Working group members occupied the morning session in plenary to integrate the results of the breakout groups. A preliminary matrix was created to examine comparisons on 10 leading visualization/geobrowser systems using 15 different technology/performance characteristics. The group then reviewed in detail the documentation record from the first three days of the workshop and the organization used to capture the numerous presentations and discussion of their deliberations.

[50] Recommendations were generated during the afternoon plenary session for follow up activities. Inputs were centered on identification of missing gaps in knowledge and representation of the extended user community. Agreement was made to recommend a second focused workshop on the matrix components in the company of leading technology experts and vendors to further develop the matrix for the final geobrowser requirements document. The outline for the "Mandate for Digital Earth Geobrowsers: Status and Recommendations" was examined and tuned. Assignments for following activities were agreed upon and general discussion of developments over the near future was explored. The goal for publication was targeted for the 3rd International Symposium for Digital Earth, scheduled for September 2003 in Brno, Czech Republic. Dr. Foresman was assigned as lead author.

Appendix 1 – Workshop Agenda

International Workshop on Digital Earth
Beijing, China
11-14 December 2002

Co-Chairs: Guo Huadong, Tim Foresman

Day 1, December 11, Wednesday

Morning:
09:00 Convene (Co-Chairs: Dr. Foresman and Dr. Shao Yun)
Welcome Address by CAS Leader (Prof. Guo Hunadong)
Welcome Address by IRSA Director (Dr. Wang Chao)
09:10 History and perspectives of DE (Dr. Foresman)
09:25 Digital Earth is going forward (Dr. Chen Shupeng)
09:35 Introduction of DEPS at CAS (Prof. Guo Hunadong)
10:15 Break (Group Photo)
10:30 Advances in visualization (Prof. Faust)
10:50 E-Science (Prof. Yan Baoping)
11:10 High Performance Network Application (Dr. Greg Cole and Dr. Natasha Bulashova)
11:30 Special Comments
Optimism for Collaboration (Dr. Chen Yun Tai)
Potential Applications are Exciting (Dr. Chen Yong)
11:40 Summary (Prof. Guo Huadong and Dr. Foresman
12:00 Lunch

Afternoon: Technical Session (Co-chairs: Dr. Shao Yun and Dr. Foresman)
14:00 GeoFusion's GeoMatrix™ SDK (Chuck Stein, presented by James Fournier)
14:15 Towards the Digital Asia Network- Prototype of Digital Earth Browser and its applications in Keio University (Yumi Nishiyama)
14:30 Spatial Database and Management (Dr. Wu Bingfang)
14:45 Buckminster Fuller Institute's EARTHscope™ (Joe Skopek)
15:00 Break
15:15 WEB Service and GRID (Dr. Yank Chongjun)
15:30 Software for citizens of Earth (James Fournier)
15:45 GeoComputation (Dr. Xue Yong)
16:00 Data Mining – Spatial data intelligent processing (Dr. Ma Jianwen)
16:15 Workshop tasking (Dr. Shao Yun and Dr. Foresman)
16:30 Adjourn

Day 2 (Thursday, 12 December 2002)
09:00 Breakout groups document design, review and comment
09:30 Breakout groups drafting sessions
12:30 Lunch
14:00 Breakout groups reconvene
17:30 Plenary review of progress & issues
18:00 Adjourn

Day 3 (Friday, 13 December 2002)

09:00 Review of progress, cross linkages
09:30 Breakout groups drafting
12:30 Lunch
13:00 Review matrix and outlines
17:30 Plenary review of collation materials
18:00 Adjourn

Day 4 (Saturday, 14 December 2002)

09:00 Inputs from Review of draft document
12:30 Lunch
1300 Comments, review and approval of outline draft
17:00 Review follow up actions and responsibilities
18:00 Adjourn

Appendix 2 – Keynote Address

Digital Earth is Going Forward

Dr. CHEN Shupeng

1. Growing up of information society in Eastern Asia

When the computer festival of America was over in Las Vegas, and just when the foamy economy of information technology (IT) industry came to the nadir, the profit of Samsung Electronics Co., Ltd. in Korea still reached 1.41 billion dollars, going beyond Intel Co. (.0.69 billion dollars) and Nokia Co. (0.59 billion dollars). In Korea, sixty-five percent (65%) of families have computers, sixty-one percent (61%) of people have mobile phones, there are 2.6 million people who often use Internet, and the average time of accessing Internet is 19 hours per week, whereas the access time is only 6 hours in France. Also in Korea, 8 million families have taken advantages of light cable, among which, 5 million families use the wide band connection of Asymmetrical Digital Subscriber Loop (ADSL) to access Internet, being twenty-five percent (25%) of global users of ADSL. At present, sixty-four percent (64%) of total Internet citizens in this country access the Internet via Wide Band connection, which is larger that that of Singapore and Japan. In 2001, national trade through Internet reached 89.6 billion Euros, increasing ninety-three percent (93%) in comparison with the previous year. The rapid growing up of Korea makes herself a good example in informalization in Asia.

China is building a Well-off Society in an all-round way and endeavoring to improve informalization and modernization. In the end of 2001, the users of China Telecom Co., reached 179 million, mobile phone users 144.8 million and Internet user 30 million. The telecommunication market of China is opening step by step: till the end of September in 2002, in the market of fixed phone, China Telecom Co., has a share of 62.1 % China Mobile Co., 36.8%; in the market of mobile phones, China Mobile Co., occupy a share of 70%, while the remaining part belongs to China Union (Economy Daily, pg.2, Nov.26, 2002).

2. The Localization of Digital Earth in China

In November 1999, International Symposium on Digital Earth (ISDE) was held in Beijing, and the "Beijing Declaration on Digital Earth," was published. Since then, Chinese central government and local governments have taken active actions to promote the localization of Digital Earth. An incomplete statistics indicated that about 100 cities have proposed their "Digital City," plan by the end of 2002, which means every one of six big/medium cities in China. Besides Digital Cities project, district-based projects such as "Digital Zhongguancun," "Digital Wangfujing," in Beijing are also being developed. More than 16 provinces, which accounts for about half of all provinces and municipalities in China, have put forward "Digital Province" projects. Digital River Basins projects like "Digital Yangtze River Basin," "Digital Yellow River Basin," and "Digital Haihe River Basin," et al., which serve the objective of integrative administration and management, have already been on schedule. All these projects have provided and will continue to provide information service for resources development, environment protection and regional sustainable development.

On the basis of the localization of "Digital Earth," Digital China will commit itself to the promotion of internationalization, being a link between the preceding and the following. China DEM database based on international standard of 1 to 1 million was issued openly in 1999. Meteorological grid database of 1km x 1km supported by FY series satellite is exchanged through Internet according to the specification of WMO. With the support of homemade MAP/GIS software, geological database (1:500,000) has been accomplished. Land Use/ Land Coverage Change (LUCC) database, earthquake database, grassland resource database and soil database, which are continuously updated by Remote Sensing data such as CBERS, have all been available to users. Ministry of Science and Technology is organizing scientific and technological forces to study and develop public platform of scientific data sharing and related methods and standards.

3. Digital Earth and Knowledge Innovation

Meteorological satellites, oceanic satellites and series of resources satellites launched by China, with other telecommunications satellites and positioning satellites of Asian and Pacific region together, have provided a wealth of information for global change and global mapping programs. China is contributing a lot to international cooperation on science and technology on many aspects.

Let us take the yield estimation via satellite remote sensing as an example. Through such a task, which has been extended from food crop yield estimation to that of economic crop, the need of domestic departments of agriculture decision has been satisfied, and integrated system composed of satellites, ground sampling, and spatial-temporal analysis model has been established accordingly. China's cooperation with USA and European Ally has been promoted.

In the field of the monitoring of atmosphere quality, the world universal model has been modified on the calibration of ground surface parameters and validation methods. The improved models have been popularized over 200 cities all over China. Now we can successfully monitor and forecast the eco-environment in Beijing and neighbor areas.

Many studies have been conducted intensively such as the effect of ozone hole over the Tibet Plateau, the influence of South Oscillation and El Nino on the flooding and droughts in China, the relationship between the west wind and the occurrence of sandstorm and forest fire, the discharge and diffusion of CO_2 and recycling of Carbon, as well as the assessment on primary productivity and environmental capacity. In addition, wide international cooperation should be carried out based on series of projects, including CEO, IGBP on terrestrial heat study, geochemistry mapping, oceanic deep drilling, etc.

4. Co-construction and sharing each other in aim to reduce the "Digital Gap"

Kofi A. Annan, Secretary-general of the United Nations, pointed out that digital gap was enlarged rather than reduced. Countries and regions occupying rich information resources will become richer, whereas, those countries losing the informalization opportunity will become poorer. Therefore, a panel section called Digital APEC was set up during APEC meeting in Shanghai to promote scientific and technical cooperation and information exchange in Asia-Pacific Region to meet the new needs of economy globalization resources re-allocation and the development of multi-corporations.

As a developing country, China shows her great desire and demands on informalization and modernization, and has a very deep thinking on how to reduce the digital gap both in our homeland and abroad. Since joining WTO, China has a more profound understanding, on Nouth-South Cooperation, co-richness, and how to pave her sustainable development way.
The Earth Village is becoming smaller and smaller, and the new generation of Internet will come into being in the near future. We appeal to safeguard the earth, encourage construction and sharing of digital earth with each other, which consequently, can serve for the sustainable development of all countries and regions in the world.

Appendix 3 – List of Participants

International Workshop on Digital Earth
Beijing, China 11-14 December 2002

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Appendix 4 – CD-ROM of Proceedings and Presentations