

TAB 8: U.S. GEOLOGICAL SURVEY

U.S. GEOLOGICAL SURVEY ACTIVITIES UNDER THE U.S. - CHINA SCIENCE AND TECHNOLOGY AGREEMENT, 2000-2003

The U.S. Geological Survey (USGS) has cooperative activities described in four (4) protocols in the fields of Earth Sciences, Earthquakes, Surveying and Mapping, and Water Resources.

The Earth Sciences Protocol was originally signed on January 24, 1980, with the then Chinese Ministry of Geology. It has been renewed at approximate five (5) year intervals, and remains in force until April 25, 2006. The implementing Chinese organization has changed several times since 1980, from the Chinese Ministry of Geology to the Ministry of Geology and Mineral Resources to, most recently, the Ministry of Land and Resources.

The objectives of this Protocol are: 1) exchange of scientists, specialists, delegations, and scientific and technical information; 2) exchange of specimens and standard samples; 3) cooperative research on subjects of mutual interest including the development of instruments and equipment; 4) joint organization of scientific conferences, symposia and lectures; and 5) other forms of cooperation as are mutually agreed. Earth science fields covered by this protocol include mineral resources, energy resources, ground water resources, engineering geology, marine geology, geotectonics, stratigraphy, paleontology, geophysics and geochemistry. All data and information used in these cooperative activities are publicly available, and in many cases, the scientific results have been published in internationally refereed scientific journals.

Most recently, there are four Project Annexes (PA) in force under this Protocol. They include:

1. Studies of the Sediment-Hosted Gold Deposits of the U.S. and China. The objectives of this PA are 1) to compile, synthesize, interpret, and publish a comprehensive data base on the sediment hosted gold resources, metallogenesis, geologic framework, and tectonics of sediment hosted gold deposits; 2) organize scientific and technical exchanges between interested segments of the earth-science communities and private sectors of the U.S. and China; and 3) perform, in conjunction with U.S. and Chinese Universities investigators, detailed studies of specific minerals deposits, such as the Great Wall deposit in Hebei Province, and Dian-Qian-Gui, Northwestern Sichuan metallogenic belts for mineral deposit development. Project Leaders are Dr. Stephen G. Peters for the USGS and Dr. Huang Jiazhan, Tianjin Geological Institute of China. Data gathered and shared by both organizations have been, or are being published, in the open scientific literature. This project was completed in 2002.

2. Collaborative Studies of the Major Mineral Deposits, Metallogenesis, and Tectonics of Northeast China. The objectives of this PA are 1) compile, synthesize, interpret, and publish a comprehensive data base on the mineral resources, metallogenesis, geologic framework, and tectonics of the region; 2) organize scientific and technical exchanges between interested segments of the earth-science communities and private sectors in the U.S. and Eastern Asia; and 3) perform, in conjunction with U.S. university investigators, detailed studies of specific mineral deposits and metallogenic belts for mineral deposit development.

The Project Leaders are Dr. Warren Nokleberg for USGS and Drs. Yu Baoziang and Yan Hongquan, both of the Changchun University of Science and Technology. Voluminous amounts of publicly available mineral data have been compiled, interpreted, and published through the USGS publication system. This project was completed in 2002.

3. Collaborative Studies of the Human Health Impacts of Domestic Coal Use in China and the United States. The objectives of this PA are 1) systematically collect and thoroughly analyze coal samples from areas in China where domestic coal combustion has contributed to the occurrence of endemic arsenism, fluorosis, selenosis, iodine deficiency, and other endemic diseases; 2) collaborate with biomedical researchers in China, and in the U.S., to study the epidemiologic effects of domestic coal combustion; 3) systematically collect and analyze coal samples from the major coal producing areas in China and U.S.; and 4) jointly publish the results of these studies and organize scientific and technical meetings to publicize the results. Project Leaders are Dr. Robert Finkelman for USGS, and Dr. Baoshan Zheng, Institute of Geochemistry, Chinese Academy of Sciences. Data and information from this study are in the process of being published in publicly available literature. This project is on going.

4. Global Mineral Resources Assessment. The objectives are to: a) exchange information concerning the collection, storing, and dissemination of national and international mineral data; b) investigated the changing patterns of global mineral production and consumption and the implications of increasing mineral consumption for mineral supply, recycling, and environmental impacts; c) review the role of mineral statistics in public decision-making and the types of analysis that are undertaken in support of that activity; d) compile, synthesize, interpret, and publish comprehensive assessment of identified and undiscovered mineral resources of China and the United States, with an initial emphasis on copper, platinum-group metals, zinc, lead, chromium, manganese, and potash; e) compile, synthesis, interpret, and publish a regional metallogenic, geologic, and tectonic analysis. Project leaders are Dr. Warren Nokleberg for USGS and Dr. Peng Qiming of the China Geological Survey.

The Earthquake Studies Protocol between the U.S. National Science Foundation and the United States Geological Survey (USGS) on the U.S. side, and the State Seismological Bureau of China on the Chinese side, was originally signed on January 24, 1980. It has subsequently been renewed four (4) times at approximately five (5) year intervals, with the last renewal on January 24, 2000. The name of the State Seismological Bureau, now the China Earthquake Administration, was changed to the China Seismological Bureau and a new Chinese party was added, the National Natural Science Foundation of China. Thus, there are now four parties to this Protocol.

The objectives of joint research activities include: 1) acquisition, interpretation, and evaluation of geological and geophysical data; 2) installation and operation of geophysical instruments and the processing and interpretation of data therefrom for the study of earthquakes; 3) application of geological and geophysical techniques, including geologic mapping and tectonic analysis, to the study of faults, earthquake source zones, and geologic conditions that affect the propagation of seismic waves; 4) installation and

operation of instrumentation for the study of strong ground shaking required for progress in earthquake engineering; 5) laboratory, theoretical, and numerical studies of the geologic and physical processes preceding, accompanying and following earthquakes; 6) post-earthquake damage surveys; 7) theoretical, analytical, numerical and experimental (both laboratory and in-situ) studies of structural and soil responses during earthquake excitation; 8) fundamental studies directed at a thorough understanding of the natural phenomena involved; and 9) other areas of mutual interest.

Presently, the following Project Annexes (PA) are in force under this Protocol:

Annex 1. Cooperation in Earthquake Studies: Investigations of Premonitory Phenomena and Techniques for Earthquake Prediction.

Annex 2. Cooperation in Earthquake Studies: Investigations of Intra-plate Active Faults and Earthquakes.

Annex 3. Cooperation in Earthquake Studies: Cooperative Research on Earthquake Engineering and Hazards Mitigation.

Annex 4. Cooperation in Earthquake Studies: Cooperative Research Projects on Deep Crustal Structure.

Annex 5. Cooperation in Earthquake Studies: Cooperative Research Projects on Laboratory Studies in Rock Mechanics.

Annex 6. Cooperation in Earthquake Studies: Deployment of Very Long Period Seismograph Stations (IDDA) and Cooperative Research.

Annex 7. Cooperation in Earthquake Studies: Exchange of Data and Films of Seismograms.

The Project Leaders are Dr. Walter Mooney (USGS-Menlo Park); Dr. Leonard Johnson (U.S. National Science Foundation-Washington, DC); Dr. Chen Zhangli (China Seismological Bureau-Beijing), and Dr. Wang Jie (National Natural Science Foundation of China-Beijing). All data and information gathered during the implementation of the various PA's have been and are published in national and international scientific bulletins and periodicals, and is publicly available.

The Protocol for Scientific and Technical Cooperation in Surveying and Mapping Studies was originally signed on April 16, 1985, between the USGS and the Chinese National Bureau of Surveying and Mapping. This Protocol has been renewed or extended four (4) times, and will expire on April 25, 2006. The renewal on April 25, 2001, changed the name of the Chinese organization from the National Bureau of Surveying and Mapping to the State Bureau of Surveying and Mapping (SBSM) of the People's Republic of China (PRC).

The objectives of this Protocol are: 1) development of geographical information systems; 2) application of remote sensing information to cartography; 3) exchange of scientists, specialists, technical consultants, delegations, and of scientific and technical information; 4) joint basic research and applications projects that engage the core scientific and technical capabilities of SBSM and USGS in areas of mutual interest to the USA and PRC; 5) exchange of technical results, and other appropriate materials, such as maps and geodetic control to assist in this protocol and other protocols under the Science and Technology Agreement; and 6) joint organization of scientific conferences, symposia and lectures or attendance at such meetings organized by one party.

During the period 2001-2006, there are four (4) Project Annexes in force under this Protocol. They include:

1. Scientific and Technical Cooperation in Developing Geographic Information Systems (GIS).
2. Scientific and Technical Cooperation in the Application of Remote Sensing Information to Cartography.
3. Scientific and Technical Cooperation in the Management and Technology of Surveying and Mapping Production.
4. Scientific and Technical Cooperation in the Application of Geodetic and Geophysical Data to Mapping, Charting, and Geodetic Programs. There are two (2) cooperative activities under this annex, namely: a) Development of an Accurate Earth Gravity Model and b) Cooperation in Global Positioning System Surveys (GPS). This project is under the leadership of Mr. Sam Adamczyk, The National Geospatial Agency, International and Policy Office, Washington, DC.

During 2003-2006, the mapping protocol will emphasize cooperative research in the areas of geospatial applications for invasive species research, land cover mapping research and applications, and mapping support for the 2008 Beijing Olympics.

Activities conducted under the Protocol are managed through a Joint Working Group (JWG), co-chaired by representatives of the USGS and SBSM. The JWG meets periodically to review accomplishments and develop annual and longer-range programs of work. Principal contacts for the mapping protocol are the co-chairs of the JWG: Ms. Kari Craun, Chief, Mid-Continent Mapping Center, Acting Co-Chair for USGS; and Dr. Wang Chunfeng, Deputy Director General, Co-Chair for SBSM.

Due to budget constraints and travel reservations, there were no scientific exchanges or JWG meetings during calendar year 2003. A joint Annex III visit to the United States by three (3) SBSM scientists is planned in early calendar 2004. The SBSM delegation will pay its own in-country expenses. Also planned in calendar 2004 is a visit to China by three (3) USGS mapping and remote sensing scientists to conduct field work related to joint land cover mapping and invasive species research, and to participate in a June 8-11 international conference in Beijing on the economic and environmental threats posed by invasive species.

The Surface-Water Hydrology Protocol between the U.S. Geological Survey (USGS) and the Chinese Ministry of Water Conservancy was signed on October 17, 1981 and the fourth extension of the Protocol was signed by both sides and in effect by January 2003. The purpose of the Protocol is to promote scientific and technical cooperation in the fields of basic and applied studies of water resources. On the Chinese side, an amended name change to the Protocol took place with the third renewal in 1991. This name change was from the Ministry of Water Conservancy to the Department of Hydrology, Ministry of Water Resources. This Protocol continues to focus primarily on the surface-water discipline, while ground-water cooperative activities between USGS and scientific agencies within China are carried out under the Earth Sciences Protocol.

The objectives of this Protocol are:

- a. Exchange of scientists, specialists, delegations, and scientific and technical information.
- b. Cooperative research on subjects of mutual interest, including devising and installing of instruments and equipment and the analysis of data.
- c. Cooperative research in the design and operation of data collection networks, automated storage and retrieval of hydrologic data, techniques of hydrologic and hydraulic analysis, hydrological forecasting, and the application of space technology to hydrology and water resources.
- d. Joint organization of scientific conferences, symposia and lectures.

Data and information gathered and exchanged under this Protocol are publicly published or are made available through jointly published reports and scientific journal articles.

Seven project annexes are supported under the Surface Water Hydrology Protocol:

Annex 1: Interchange of Scientific and Technical Information on Hydrology and Analytical Techniques of Water Resources Study.

Annex 2: Hydrologic Measurement Procedures, Instruments, and Equipment.

Annex 3: Cooperative Project on Hydrologic Extremes.

Annex 4: Cooperative Project on Sediment Transport. Annex 4 was established in 1983 as a vehicle to facilitate research on China's sediment-laden rivers. Projects have included a study of a) total sediment transport, b) debris flows and hyper concentrated flows, and c) geomorphic and hydrologic processes in upland areas.

The USGS is co-signer of an agreement establishing the Sino-US Centers for Soil and Water Conservation and Environmental Protection, located at the Northwest Sci-Tech University for Agriculture and Forestry in Yangling, Shaanxi Province, and the University of Arizona in Tucson (see <http://www.ispe.arizona.edu/sino/>). A proposed initial project under the auspices of the Centers is formation of an International Watershed Research Network (IWRN). Neither the Centers, nor the IWRN are currently supported under the U.S.-P.R.C. Surface Water Hydrology Protocol. Dr. John Gray, USGS, Reston, is the current USGS leader for this project.

Informal activities under this annex include:

- 1) Analysis of the Yellow River's aggrading bed with comparisons to US rivers: Published, copy at: <http://water.usgs.gov/osw/techniques/hazard-mitigation.pdf>
- 2) Collaboration on field-testing new technologies for monitoring suspended-sediment transport (see: http://water.usgs.gov/osw/techniques/yrcc_surrogates.pdf)

- 3) Collaboration on lab-testing YRCC and USGS sediment laboratory technologies.
- 4) Collaboration on an International Watershed Research Network (see <http://water.usgs.gov/osw/techniques/china.pdf>)
- 5) Collaboration on a Bedload Research International Cooperative.
- 6) Comparison of YRCC and USHS hydrologic-data collection techniques.

Annex 5: Flood Forecasting. Annex 5 facilitated the National Weather Service (NWS), NOAA, and cooperation with the Ministry of Water Resources.

Annex 6: Cold Regions Hydrology. This annex was developed with the Lanzhou Institute of Glaciology and Geocryology, Academia Sinica, Lanzhou. It currently is inactive.

Annex 7: Water Quality. Annex 7 has become the major focus of activity under the Protocol. The most recent activity resulted in publication of Professional Paper 1647 "Comparative Water-Quality Assessment of the Hai He River Basin in the People's Republic of China and Three Similar Basins in the United States." The publication was prepared in cooperation with the Hai He River Water Conservancy Commission, the Tangshan Water Resources Bureau, and the Ministry of Water Resources of the PRC, in cooperation with the USGS National Water-Quality Assessment Program.

Following the completion of this study, scientists of the Hai He River Water Conservancy Commission, led by Annex leader Lin Chao and the USGS Annex leader, Joseph Domagalski, initiated plans to launch a joint study of reservoir eutrophication. The plan was to select a reservoir in the early stages of eutrophication, and to determine the sources of nutrients, and what reduction in nutrient load, primarily phosphorus, is required to bring the reservoir water to the desired level of quality as a source for drinking water.

The study was formally started in 2001 with water samples collected for chemistry, isotopes, and algae community composition. One final year of sampling, to be completed in September of 2003, is planned. In addition to the USGS and the Hai He River Commission, two professors and their graduate students from Tsinghua University, located in Beijing are involved. Upon completion of the chemical, isotopic, and loading studies, a plan will be developed by the Hai He River Commission to reduce the loadings of nutrients to the reservoir through a series of land use changes or regulatory actions. The study is planned to be a model effort at understanding watershed loadings of nutrients or other contaminants, and the development of strategies to reduce those loads in order to restore the planned beneficial uses of surface water systems. Findings will be jointly published.

1.1

**HISTORY OF COOPERATION IN SURVEYING AND MAPPING STUDIES
BETWEEN THE
STATE BUREAU OF SURVEYING AND MAPPING OF CHINA
AND THE
UNITED STATES GEOLOGICAL SURVEY**

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1.1.1.1 Abstract

Since 1985, the State Bureau of Surveying and Mapping of China and the U.S. Geological Survey have exchanged technology and ideas under the Protocol for Scientific and Technical Cooperation in Surveying and Mapping Studies. The Protocol was implemented under the 1979 Agreement on Cooperation in Science and Technology between the United States and the People's Republic of China. Protocol activities include reciprocal technical exchanges by scientists and managers, participation in cooperative research and applications projects, and jointly authored technical reports documenting the results of cooperative mapping and remote sensing projects. Areas of cooperation include digital cartography, geodesy, satellite remote sensing research and applications, geographic information systems (GIS) research and applications, data archiving and dissemination, and program management. Both the United States and China have gained knowledge and technical expertise by participating in cooperative mapping, GIS, and satellite mapping projects and by sharing information on the management and technical development of their mapping programs. Under the Protocol, the United States and China have achieved a significant degree of harmonization in their respective civilian mapping programs, providing an excellent example of constructive Sino-U.S. engagement that has proven to be beneficial to both nations.

1.2 Introduction

1.3 In the early 1980s, the U.S. Geological Survey (USGS) began cooperating with counterpart organizations in China through a series of agreements for scientific and technical cooperation in the areas of seismology, earth sciences, and surface water hydrology. At about the same time, the former National Bureau of Surveying and Mapping of China (hereafter referred to by its present designation, the State Bureau of Surveying and Mapping, or SBSM) sought to enhance its capabilities in the areas of digital mapping and geographic information systems (GIS). Several letters and visits were exchanged during the period 1982-83 with regard to establishing a formal agreement between the United States and China for cooperation in the mapping sciences.

In September 1984, a delegation from the SBSM traveled to the United States to visit governmental mapping authorities, to investigate geographic information systems development, and to discuss possible technological cooperation in mapping, charting, and geodetic activities. The delegation visited the Bureau of the Census, the Defense Mapping Agency, the National Geodetic Service, and the USGS, as well as State agencies and commercial vendors. In early 1985, the SBSM sent a communication to the U.S. Embassy in Beijing suggesting that the mapping activities of the USGS of the Department of the Interior were most closely in line with SBSM's needs and objectives and that the SBSM would like to enter into a scientific and technical exchange with the USGS. This message was transmitted to the U.S. Department of State in Washington, D.C., and relayed from there to the USGS.

1.3.1 Developing the Protocol

Although the U.S. Government has no specific law defining the responsibilities of the various departments and agencies for mapping, charting, and geodesy, the U.S. Congress' budget appropriations place the primary responsibility for these functions in several Federal departments. The Department of Commerce has the primary responsibility for the national geodetic networks, both horizontal and vertical. The Department of Defense has the responsibility for large-scale mapping outside the continental boundaries of the United States. The Department of the Interior, through the USGS, has the primary responsibility for domestic base mapping programs, for producing small-scale maps of selected themes internationally, and for coordinating digital cartographic data standards throughout the Federal Government.

Because of these divisions of responsibility, the U.S. Department of State held a meeting in early 1985 to discuss the SBSM proposal with representatives from the Defense, Commerce, and Interior Departments. It was agreed that the USGS, under the purview of the State Department, would further explore developing and implementing a surveying and mapping protocol between China and the United States. It was agreed that this protocol would be implemented under the existing Sino-U.S. Agreement on Cooperation in Science and Technology (S&T Agreement) that was signed by President Jimmy Carter and Vice-Premier Deng Xiaoping for their respective nations on January 31, 1979.

In April 1985, a delegate from the USGS attended the Third Conference of the Chinese Society of Geodesy, Cartography, and Photogrammetry held in Wuxi, China, and then met with authorities from the SBSM in Beijing to discuss in further detail what the proposed surveying and mapping protocol would encompass. They agreed to develop a protocol that would initially address two major subject areas: geographic information systems/digital cartography and remote sensing. Details of such an agreement would be documented during a visit by a delegation from the USGS to the SBSM after the inclusion of appropriate language from the enabling U.S./China S&T Agreement. This was accomplished in the Protocol for Scientific and Technical Cooperation in Surveying and Mapping Studies between the USGS and the SBSM signed in Washington, D.C., on April 16, 1985. The signed Protocol included an addendum, Annex I, that addressed several legal and administrative issues that are required to be in any agreement between

the United States and other nations, such as intellectual property, rights in data and publications, and funding contingencies.

1.3.2 Operating the Protocol

In August 1985, a five-person delegation from the USGS met with SBSM representatives in Beijing to develop and document the methodology to accomplish the objectives of the Protocol and to establish the oversight group required under the provisions of the Protocol. It was agreed that all activities conducted under the Protocol would be managed through a Joint Working Group (JWG), co-chaired by representatives of the SBSM and the USGS, with membership to include experts from the respective mapping disciplines. As a way to measure progress and accomplishments, it was agreed that reports of the activities of each Protocol project annex would be shared at annual JWG meetings to be held alternately in China and the United States. At the annual JWG meetings, the parties would develop work plans to implement objectives in the specific discipline areas for work to be accomplished in the coming year.

The newly formed JWG then agreed upon a number of research projects and technical exchanges that would constitute the initial 1985-86 program of work. The initial working parts of the Protocol were adopted as project Annex II for GIS/digital cartography and Annex III for remote sensing. Project Annex IV (1988) and Annex V (1994) were later adopted to address program and technical management issues and to facilitate the exchange of geodetic data, respectively. The results of the August 1985 meeting were recorded as Minutes of the First Meeting of the Joint Working Group. Chen Junyong, Director General of the SBSM, and Rupert B. Southard, Chief of the USGS National Mapping Division, signed the Minutes, and the formal program of cooperation began.

The development of this agreement required a significant amount of effort on the part of both parties, and it has been proved over time that a significant document resulted from those efforts. The Protocol has been consistently extended at 5-year intervals and has remained essentially unchanged since its inception, now more than 16 years ago. From 1985 to 2000, 13 JWG meetings were held between the USGS and the SBSM, either in China or in the United States, for reviewing the implementation of cooperative projects and developing new work plans.

The USGS and SBSM jointly develop and implement a program of work to be reviewed and approved at the annual JWG meetings. Work is performed under project annexes, each of which has both a USGS and an SBSM coordinator to ensure that the annual program of work for that annex is carried out. In a typical year, a delegation representing each project annex visits the other cooperating organization to work with counterpart scientists and program managers for a period of 2 or 3 weeks. The annex visits include topical seminars and briefings, technical discussions and demonstrations, and hands-on research. The traveling delegation usually visits multiple work sites of the hosting organization, and there are also frequent visits to areas of scenic and cultural interest. The annex coordinators manage the work performed under the project annexes and report results and accomplishments at the next JWG meeting.

1.3.3 Accomplishments

1.4

1.5 A summary of the project annexes and the cooperative work accomplished under them follows, with a more detailed listing, including selected joint publications, appearing in the appendix to this document.

Annex II - Developing Geographic Information Systems. The parties agreed to cooperate in developing GIS applications for such purposes as land planning, agriculture, and environmental protection. Cooperative investigations were to include digital cartographic data collection, spatial data management systems, digital terrain modeling, land use mapping, techniques of digital map revision, and GIS applications.

The work under Annex II essentially follows the evolution of the GIS field over the same period. Early work focused on digitizing techniques, coding standards, data validation, and quality assurance issues. This was followed by work on spatial database design, data management procedures, and data standards. Work on product generation at various scales, data generalization, and data revision came next. As each of the technical themes evolved, so did a concern with the standards and protocols required for wider use and application of the data. Work on spatial data transfer standards grew into looking at the spatial data infrastructure, the development of framework data sets, and the establishment of clearinghouse nodes. Current Annex II activities include working toward national spatial data standards compatible with evolving global standards, working to improve data access and dissemination by means of the Internet, improving data integration and quality assessment, and demonstrating GIS applications for resource management, disaster relief, urban modeling, and human health concerns.

Annex III - Application of Remote Sensing Information to Cartography. The parties agreed to cooperate to promote the development of remote sensing techniques and their application to surveying and mapping. Cooperative investigations were to include geometric and radiometric rectification of remote sensing data, including satellite and radar data; enhancement, classification, and interpretation of remote sensing data; and application of remote sensing data to map revision, thematic mapping, and land use mapping.

Cooperative activities under Annex III have included using Landsat, AVHRR, and SPOT data for image mapping and for vegetation and land cover mapping, using SBSM data to help build global data sets, and using satellite images for urban and regional change analysis in the United States and China. Scientists from the USGS and the SBSM have jointly authored technical reports (see appendix) documenting satellite remote sensing research conducted under the Protocol. Current Annex III activities include using high-resolution satellite data to monitor urban and regional change dynamics, evaluating Landsat 7 and NASA/Terra satellite data for use in restoring ecological landscapes, using satellite Radar data for terrain modeling and map revision, and exchanging technical information on Landsat 7 data acquisition, processing, management, and dissemination.

Annex IV - Management and Technology of Surveying and Mapping Production.

At the third JWG meeting in 1988, the parties agreed to a proposal by SBSM to add an additional project annex (Annex IV) to the Protocol. This was done to help address the management of surveying and mapping programs that were incorporating new digital technologies. The Chinese had recognized that putting new technology in the workplace meant that new management skills were required. The parties agreed to cooperate and exchange information on topics such as organizational structures, laws, regulations, and guidelines for surveying and mapping production; methods for planning, organizing, and managing surveying and mapping production; financial management; and utilizing new technologies in modernizing surveying and mapping programs.

Cooperative activities under Annex IV have included exchanges on production organization, program and data management systems, modernization of mapping and data production, and evolving government and industry roles in national technical programs. The parties have conducted evaluations of USGS and SBSM mapping software and have presented seminars on evolving mapping, remote sensing, product generation, and data management techniques. Current Annex IV topics include mapping contract management and quality assurance, licensing arrangements for commercial satellite data, improvement of data archiving and dissemination techniques, and exchanges on coordinating multiple agency requirements and building data partnerships with other organizations.

Annex V - Application of Geodetic and Geophysical Data to Mapping, Charting, and Geodetic Programs. At the seventh JWG meeting in 1994, the parties agreed to cooperate in the collection, processing, and exchange of geodetic and geophysical data and in their application to surveying and mapping programs. Accomplishments to date include joint operation of a global positioning system (GPS) tracking station near Beijing, completion of a project to collect and process absolute gravimetry (AG) data for seven ground stations in China in support of an improved earth gravity model and geoid, and technical training in installing, operating and maintaining GPS and AG equipment.

Benefits of the Protocol

The Protocol has provided both tangible and intangible benefits to the participants. The United States has acquired maps and geographic data from China that have now been used for global and regional mapping and environmental applications. The United States has also gained access to advanced digital mapping software produced by SBSM and China's technical universities. China has received assistance in enhancing its mapping and geographic data programs and has gained expertise in GIS applications and in managing large geographic data sets. Both parties have benefited from participation in cooperative satellite mapping and land characterization projects, from cooperation in developing geographic data standards, from joint research to improve data access by means of the Internet, and from sharing information on the management and technical development of their respective mapping programs.

One of the intangible benefits of the Protocol has been the opportunity for reciprocal visits to field offices in our respective nations to see the different perspectives of the counterpart organization. Early in the Protocol, the SBSM began to focus on what were referred to as “the three S’s,” geographic information systems (GIS), global positioning systems (GPS), and remote sensing (RS). They began to view these three critical technologies as integral components of a national mapping program. To their U.S. counterparts, who had seen each of these disciplines evolve from different roots and only begin to converge late in their development, this synergistic view of related mapping technologies from a national mapping perspective was a visionary concept.

A similar realization emerged after several years of Protocol exchanges when both the SBSM and the USGS began referring to “the four D’s,” whether the conversation was in Chinese or English. This was in reference to digital elevation models (DEM), digital line graphs (DLG), digital orthophoto quadrangles (DOQ), and digital raster graphics (DRG). Both agencies had now evolved a common terminology regarding their essential geographic data themes used for mapping and GIS applications. This harmonizing of organizing principles and basic data themes within our respective civilian mapping programs has encouraged the ongoing exchange of ideas and technical information as our programs, and the technologies behind them, continue to evolve.

1.5.1 Conclusion

Both tangible and intangible benefits have resulted from this historic exchange. Perhaps the best measure of its success is its longevity. The USGS and the SBSM extended the Protocol for another 5-year period, from 2001 to 2006, and developed general objectives of cooperative activities for the next 5 years. While SBSM is anxious to renew and reinvigorate exchanges under this protocol, current financial constraints are forcing USGS to take a slower, more cautious approach towards future cooperation.

Informal Present and Future Activities

- 1) The USGS has ongoing discussions with the Chinese Academy of Sciences on the development of a Biological Resources protocol between the two organizations. Project Annexes under such a protocol would include, for example, invasive species, GAP analysis, biodiversity monitoring, and sustainable development of biological resources in the southwestern China provinces.
- 2) Joint invitation with US Forest Service to Wetlands Officials in China
The USGS National Wetlands Research Center and the U.S. Forest Service invited Mrs. Yin Hong and Mr. Daming Bao of the Chinese Forestry Administration to visit the United States and exchange information relating to wetland inventory, management and restoration.

China Contact:

Honorable Yin Hong
Deputy Director General
Department Wildlife Conservation
State Forestry Administration, China

U.S. Forest Service Contact:

Dr. Carl Terttin, Director
Center for Bottomland Hardwood Research
Charleston, South Carolina

U.S. Geological Survey contact:

Dr. Robert Stewart, Director
National Wetlands Research Center
Lafayette, Louisiana

- 3) The USGS was invited to participate in a China/U.S. Relations conference hosted by Texas A&M University from November 5-8, 2003. The stated purpose of the conference was to “investigate areas of common interest between our two countries and to develop lasting collaborations and partnerships to explore solutions to common dilemmas”. A white paper prepared and presented by the USGS for this conference suggested 4 potential areas of collaboration: invasive species, ecosystem modeling, wetland inventory and monitoring, and coastal monitoring assessments. The last topic matched very well with the research and information needs identified in the white paper prepared by officials from the China Geological Survey’s Research Center for Coastal Geology.

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- 4) Workshop at Qingdao Institute of Marine Geology, August, 2004. Following-up on the China/U.S. Relations Conference of 2003, the China Geological Survey has invited scientists from the USGS, the U.S. National Science Foundation, and Texas A&M University to participate in a workshop in Qingdao on topics of mutual interest relating to coastal and riverine systems. The workshop will be hosted by the Qingdao Institute and will consist of invited scientific papers and facilitated planning sessions.

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Dr. He Qixiang
China Geological Survey
Director , Research Center for Coastal Geology
Qingdao, China

- 5) Cooperative research on the pink heelsplitter mussel. This is an informal cooperative activity that seeks to determine if the heelsplitter pearly mussel is a suitable species for pearl culture. Contacts are Dr. Richard Neves (USGS) and Dr. Hua Dan, Freshwater Fisheries Research Center (FFRC) of the Chinese Academy of Fishery Sciences, Wuxi, China.
- 6) Assistance in controlling Avian Botulism in Taiwan. The USGS National Wildlife Health Center is assisting Dr. Chris Weng, Agriculture Bureau, Tainan County, Taiwan, in the control of an outbreak of avian botulism that occurred during late 2002 to early 2003 among the endangered black-faced spoonbills. USGS contact is Dr. Dionne Bertz.
- 7) Studies on Yangtze River Chinese Sturgeon: Spawning at Gezhouba Dam, and abundance of adults and yearlings. USGS leader is Dr. Boyd Kynard; the Chinese leader is Dr. Wei Qiwei, Yangtze River Fisheries Research Institute in Shanghai.
- 8) Beijing Symposium on Bioinvasions. USGS will be a co-sponsor of this symposium to be held in Beijing, June 8-11, 2004. USGS leader is Dr. William Gregg. The Chinese host will be the Chinese Academy of Sciences, Institute of Botany.
- 9) Discussions have also been held by USGS scientists and potential Chinese human health and Pacific coral reefs. Hundreds of millions of tons of soil-derived dust are transported annually from the Gobi and Takla Makan deserts across northern

China, Korea, Japan, and the northern Pacific, periodically reaching North America. Living microorganisms and chemical contaminants, predicted to be carried with the fine dust may be adversely affecting the health of humans and coral reefs. The objectives are: 1) collaborate to systematically collect air samples during dust and non-dust conditions from China source regions, near the coast of China, Midway Island, Hawaii, and the west coast of the U.S.; 2) analyze the samples for chemical contaminants and identify microorganisms; 3) collaborate with coral reef and microbiology researchers in China and the U.S. to study the effects of identified microorganisms and chemical contaminants on coral reefs; and 4) collaborate in China and the U.S. (asthma, respiratory disease, chemical sensitivities, etc.) A pilot project of a similar study (African dust) has recently been initiated in West Africa and U.S. Caribbean.

Potential Project Leaders: Ginger Garrison for USGS; Dr. and Prof. Liu Lianyou, China Center of Desert Research at Beijing Normal University, Institute of Resources Science, Beijing Normal University, Beijing; Dr. and Prof. Xiao Yan Li, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, Water and Land Resources Division, Lanzhou, Gansu Province.

- 10) USGS and China Geological Survey (CGS) signed a Letter-of-Intent on March 3, 2002, in Reston, Va., to jointly plan future cooperative activities in environmental and hydrogeologic mapping, establishment of geologic databases and ecogeological studies.

USGS anticipates that the overall level of cooperative activities under the US-China S&T Agreement will vacillate somewhat over the next 5 years because USGS participation in such cooperative activities are driven mostly from the bottom (scientific researcher level) upward through the USGS system, by the availability of funding for such scientific cooperative projects, and by the fact that cooperative activities that USGS undertakes with the Chinese must clearly demonstrate that they support the USGS domestic programs in earth sciences, earthquakes, surveying and mapping, and water resources. The USGS anticipates renewal of the existing Protocols upon their current expiration, and the USGS also anticipates negotiating an additional Protocol with the Chinese Academy of Sciences in the discipline of biology.

USGS estimated total costs for all protocols for 2003 is \$50,000.

The Point of Contact for the USGS US-China S&T activities is Dr. Jack Medlin, International Programs: Tele: 703-648-6446; Fax 703-648-4227; or E-Mail: jmedlin@usgs.gov. The USGS does not conduct S&T cooperation with China outside of the S&T Agreement or the Protocols.