Geologic Hazard Assessments Subactivity

Subactivity	FY 2000 Estimate	Uncontrol. & Related Changes	Program Changes	FY 2001 Budget Request	Change from FY 2000
Earthquake Hazards	43,893	+867	+2,600	47,360	+3,467
Volcano Hazards	17,181	+284	+250	17,715	+534
Landslide Hazards	2,580	+48	0	2,628	+48
Global Seismographic Network	3,464	+33	0	3,497	+33
Geomagnetism	**1,993**	**+43**	**0**	**2,036**	**+43**
Total Requirements $000	69,111	+1,275	+2,850	73,236	+4,125

Geomagnetism

Current Program Highlights

Magnetic Observatories -- Geomagnetic storms, induced by solar activity, pose significant hazards to satellites, electrical power distribution systems, radio communications, navigation, and geophysical surveys. Strong storms can also expose astronauts and crews of high-flying aircraft to dangerous levels of radiation. Over the past few years, such space weather hazards have caused crippling damage to communication satellites and power utility grids around the world. Economic losses from recent geomagnetic storms have run into hundreds of millions of dollars. The USGS Geomagnetism Program operates a network of geomagnetic observatories, which monitor the onset of solar-induced storms and give warnings that help diminish losses to military and commercial operations and facilities. The USGS maintains a network of 13 magnetic observatories in the conterminous United States, Alaska, Guam, Puerto Rico, and Hawaii. These observatories provide nationwide coverage, continuously measure the Earth's magnetic field, and carry out periodic observations for precise determination of the geomagnetic field to calibrate the continuous measurements. The data gathered by these observatories form the backbone of the program. Magnetic field variations are tracked continuously, and the data are made available to clients in a variety of time frames ranging from near real-time to five-year summary information, depending on clients' needs and requirements. Most of these observatories are fully instrumented (no onsite personnel) and the last few staffed observatories are in the process of being converted to unmanned operations. A program objective is to have all observatories in full, automatic operation during the next maximum of solar activity expected during 2000-2001.

Data Management and Satellite Operations -- USGS geomagnetic observatories use satellite transmission links to send data at 12-minute intervals to the USGS Geomagnetic Data Management Center in Golden, Colorado. This Center also operates as an international geomagnetic information node, which is connected with similar installations worldwide for the distribution of geomagnetic data via satellite. These near real-time data are used by the U.S. Air Force and NOAA’s Space Environment Center (SEC) for hazard mitigation by warning of potential satellite failures, communication disruptions, power grid failures, and other problems caused by intense geomagnetic storms.

National Geomagnetic Information Center -- This center serves as the U.S. clearinghouse and information hub for products and services related to the Earth's magnetic field. The center produces CD-ROM's that contain definitive data from the USGS magnetic observatories, operates an online dial-up and WWW service (**http://geomag.usgs.gov/**) that allows users to obtain values of the Earth's magnetic field for any date, location, and elevation, and provides educational materials for teachers and the general public.

Modeling and Charting – Because of gradual but significant changes in the Earth's magnetic field, the USGS produces new magnetic field charts every five years and disseminates these charts to the user community worldwide. This user community includes all branches of the Armed Forces and other DOD agencies, the navigation and transportation infrastructure, and mineral and oil exploration industries. The charts graphically show the values of the magnetic field and its projected changes over time. The sophisticated mathematical models used to create the charts take into consideration all of the components of the Earth's magnetic field and their actual and forecast variations. The final models are used to calculate the Earth's complete magnetic field at any time and location.

Applications Research -- The USGS conducts geomagnetic research to achieve a better understanding of basic geomagnetic processes and their effects on our physical and social environments. For example, developing new models of the behavior of the ionosphere and magnetosphere enables us to make better predictions of the duration and end times of geomagnetic storms.

Recent Accomplishments

2000 Epoch World Magnetic Model -- A new World Magnetic Model (WMM) for the epoch 2000-2005 was completed in FY2000. This mathematical model of the Earth’s magnetic field depicts the current field strength and direction and predicts the secular variation of the field five years into the future. The model was based on data from USGS geomagnetic observatories and satellite observations. The new model has many applications in navigation, spatial orientation, surveying, and research. The model has been provided to the National Imagery and Mapping Agency (NIMA) for Department of Defense proposes. NIMA will redistribute the model to NATO countries. The model has also been provided to the GPS-NAVSTAR Program Office for distribution to government and private GPS interests. This magnetic field model is incorporated in every GPS receiver used by the Department of Defense.

Improvements in Real-time Geomagnetic Data Capability -- The USGS is in the process of upgrading its geomagnetic data collection, communications, and data management capability. Rapid access to data from geomagnetic observatories is necessary for timely warnings of magnetic storms. A new generation of data collection platforms (DCPs) is being installed at each of the observatories to replace 15-year old equipment. The new DCPs will be based on personal computer technology and have the ability for: recording one-second data samples, perform numerical filtering, synchronization to GPS time, satellite data transmission, on site data display, and remote system administration. The new DCP systems are improving the quality, quantity, and reliability of data collected from the observatories, thereby reducing labor-intensive efforts required for data processing and management.