A GOLD MINE OF INFORMATION:

Independence Mining Company Chooses GeoLink
For GPS/GIS Mapping

When Independence Mining Company (IMC) of Nevada, one of the largest gold mines in the United States, proposed to expand their exploration and development operations on 5,000 additional acres, they received a predictable response: "The U.S. Department of Agriculture, Forest Service (FS), in consultation with the U.S. Department of the Interior, Bureau of Land Management (collectively referred to as the Agencies) have determined that an Environmental Impact Statement (EIS) is required for approval of a plan of operations...The EIS must be defendable through the Forest Service Administrative Appeal process, the FS Administrative Protest Process, in court, or all of these."

In a time of growing environmental concern, government agencies are pursuing their role as protectors of public lands more aggressively than ever before. As a result, natural resource companies such as IMC, are discovering that fulfilling the requirements of a legally defensible EIS can be an expensive and rigorous undertaking. In fact, the process of creating a defensible EIS can have as many hidden pitfalls as the land which they hope to explore. In order to run the gamut of Agency requirements, IMC will hire a slew of experts in mapping, air and water quality, soils, vegetation, and wildlife biology.

During the EIS process, IMC may never be quite sure when information is deemed accurate and reliable. Even at the end of the EIS process, they will wonder whether Agency approval will actually protect them from future liability. It's a sign of the times that companies are exploring unknown territory in more ways than one, never secure in their findings, never free from suspicion. Worst of all, they are working within an almost crippling lack of federal agency or public consensus about environmental standards and guidelines. Natural resource industries, which prided themselves on successfully operating in the harshest of environments, under permafrost conditions, in rugged mountains or beneath the ocean floor, may have finally met their nemesis—the United States regulatory environment.

The mining industry, in particular, is facing formidable public outcry against their most basic article of faith, the 1872 Mining Law. This was the law that historically opened public lands to private development, allowing prospectors to claim public lands in return for privately financing exploration and development of mineral deposits. Still a powerful developmental force, the 1872 Mining Law gives individuals and companies the right to mine the land and develop the mineral resources that provide jobs and resources for America. However, even given these historical protections, miners are discovering that a profitable mining industry may depend as much on a favorable regulatory climate as on favorable geology.
The stakes for miners are high, perhaps higher than they've ever been before. The search for gold and other minerals has greatly intensified in the last fifteen years, driven in part by sharp increases in market price for gold (from a low of $50 an ounce in the 1960's to $370 an ounce today), and in part by new techniques which enable miners to retrieve far more gold from a given land area. The United States remains the second largest producer of gold in the world. Mining companies such as IMC, which employ 700 people and produce about 370,000 ounces of gold a year, are not likely to pull up stakes and shut down.

However, pragmatists that they are, they are likely to change. Miners are responding to public hostility in two ways. First, they are increasing their sensitivity to environmental concerns. IMC's Big Springs Mine, for instance, has been designated as the first National Mining Showcase for its commitment to extracting minerals in an environmentally sound manner. Mill sitings, roads, and dumps were designed to minimize the mine's impact on designated threatened species such as the Lahontan cutthroat trout. As a further mitigation effort, IMC also constructed a recreational campground to offset possible recreational losses from the Big Springs Mine. For IMC, the life-of-mine cost for environmental mitigation will be between $10 and $20 million.

IMC's second response to public demand for greater accountability has been to accumulate ever more data about the actual impact of their operations. IMC is in the process of creating a highly detailed Cumulative Effects Analysis (CEA) which they hope will counter public perception with hard facts. John Bokich, Manager of IMC's Environmental Resources, considers a CEA "a tool to try to quantify cumulative effects, and to move away from qualitative assessments." It is also a critical component in the National Environmental Protection Agency's (NEPA) requirements for an EIS. A CEA will provide a baseline for environmental norms before the mine expansion and carefully monitor changes in the total environment during mine operations. The refined information in IMC's CEA will then be entered into a Geographic Information System (GIS) for storage, analysis, and cartographic display.

In their quest for precise data, IMC is also dramatically changing the way they collect information destined for their CEA. They want to ensure that the field data collected has enough accuracy and detail to base development plans. From past experience in field data collection, Bokich was doubtful that the use of aerial photography and survey crews would provide the accuracy, refined to one acre or larger, required for NEPA review. Deducing vegetation types from aerial photographs can be risky. Whole tree stands believed to be snowbush had been ground-truthed as aspen. Small stands of less than 1/10 of an acre were missed entirely on aerial photos. Multiplied over a scale of four thousand acres, errors such as these could give a significantly distorted view of vegetative cover and, therefore, of the type and quantity of wildlife species at the mine site. Likewise, survey crews could achieve very precise information, but the time and labor costs were so high that IMC could realistically only map small portions of the detailed study area. The transfer of survey data into the GIS would also be time-consuming as it would require manual digitizing and separate entry. Along the way, a great deal of accuracy would be lost. Meanwhile, the GIS would only be as useful as the field data supporting it.
After surveying the options, IMC chose GeoLink, a computerized GPS/GIS mapping system for its greater cartographic precision and efficiency. GeoLink provided the missing link between field data collection and GIS map creation. The GPS-based system would accept coordinate positions and descriptive data and automatically format them for IMC's GIS. It would save time and increase the precision of data collection. Bokich says, "The project we are doing with GPS/GIS mapping is cutting edge for our industry. Basically, it quantifies ecological and other mine information and puts it all into a GIS."

How does it work? The GeoLink GPS/GIS system uses a GPS receiver to feed coordinate positions directly into a laptop computer. Field personnel tag descriptive information to that position directly in the field using the laptop computer's keyboard. A background map of the area is displayed on the computer's screen for orientation. Personnel can also view their mapping progress directly on the screen to be certain they have covered the right territory. The mapping software then automatically formats the information for entry into GIS files avoiding the inaccuracies and time-consuming aspects of manual digitizing.

For IMC, GPS/GIS mapping with GeoLink has a lot of advantages over other mapping techniques. Maps are made directly in the field and to any level of detail desired. The location of an eagle's nest, the contours of a wetlands area, or the exact size of a stand of aspen can be directly mapped. Knowing these precise locations and dimensions, makes planning mine development and exploration much more efficient. It's also easier to map wetlands or sensitive plant species accurately and therefore plan appropriate mitigation. GPS/GIS mapping makes the collection of these feature locations very feasible.

IMC also has contracted GeoResearch, Inc., the creator of the GeoLink GPS/GIS mapping system, to collect data for many aspects of their CEA and EIS, including one or two they hadn't anticipated at the beginning of the project. The computerized mapping system is being used to update forest service maps and ground-truth aerial photographs for the location of any threatened, endangered, sensitive (TES) plant and animal species. Previously unidentified rare species will also be documented. GPS/GIS is being used to refine vegetation type boundaries for a more accurate picture of wildlife habitat. Wetlands areas were also inventoried and perimeters mapped. Soils and hydrology information obtained during the wetlands inventory will also be incorporated into the GIS base.

Cultural resources were included in the surface inventory. Any historical or archeological sites and artifacts were recorded using GPS/GIS mapping. Tom Lyman, Field Project Manager for GeoResearch, discovered that there were some advantages besides time and accuracy in using GPS-based mapping. "Usually archaeologists will go through an area and stake points of interest. Sometimes when they return, the stakes are gone and the artifacts have been poached. The beauty of this kind of mapping is that it's non-invasive. You don't have to touch anything but your laptop computer".
Using GPS/GIS mapping, the GeoResearch field crew was able to map 5,000 acres of detailed study area and 40,000 acres of general study area in approximately two weeks. Lyman reported that conditions for GPS reception were ideal and that there were very few multipath problems. With most of the NAVSTAR Global Positioning satellites now in place, coordinate locations could be rapidly fixed to within 1-3 meters, a dramatic improvement over LandSat's 30-meter pixels. GPS/GIS mapping also had the advantage of being entirely portable. "The ruggedness of the area meant that most of the mapping had to be done on foot. We came up with some techniques that produced beautiful results. To map ravines on steep slopes, we would have a driver take us up the exploration roads and drop two of us off. Each of us would walk down a side of the ravine, get picked up and head for the next spot. We joined the files by correlating points of time when we got back to the office and they fit perfectly".

The level of detail obtained by GPS-based mapping can be seen by comparing a typical GIS coverage with a GPS/GIS map. The generic oblong patches are replaced by detailed borders. At a greater scale, the detail remains enabling the user to precisely visualize a given area. A wildlife biologist who knows, for instance, that hawks only nest in groups of aspen of 5 acres or more, can easily locate appropriate habitat. The refined data enables the Forest Service to assess the support habitat for wildlife much more confidently and accurately. GeoResearch staff found that corrections to Forest Service maps were needed about 25% of the time. "Updating Forest Service maps with GPS/GIS is simple," says Lyman. "You just check your observations against the USGS Quad background map on your screen and punch in the changes".

GPS/GIS mapping with GeoLink was also used for unexpected lightening fires which occurred during the summer season. The Saval and Wheeler Mountain fires swept quickly through the high, arid terrain of the Basin Range region, radically altering previously surveyed areas. With GPS/GIS, IMC quickly assessed the area of the fires by walking their perimeters. The Forest Service estimate of damage was about 2,300 acres. Actual mapping showed where the fire lines were, helping the Forest Service to manage the fire. GPS/GIS mapping also revealed that fire damage was closer to 1,200 acres. GPS/GIS mapping produces good legal documentation, as files are time-tagged and satellite positions are recorded for reference. Because of the quick production and clear cartographic production, it is ideal for emergency mapping and damage assessment.

In the search for the perfect balance between the environment and private industry, another kind of balance is being sought--that between perception and fact. In this quest, both public and private agencies are turning to the latest GPS technology to deliver precision at an acceptable cost. The technology has arrived and its proven ability to accurately map and inventory our environment may finally produce the refined database essential to intelligent assessment. Both public and private interests can only be served by a greater knowledge of our actual impact on our environment.