New Life for a Historic Mine

Trimble solutions help the National Park Service preserve an Alaskan treasure.

Surveying and scanning provide precise data to safeguard the Kennecott Mines National Historic Landmark.

Solution

Trimble SX10 Scanning Total Station
- Precise surveying plus high-performance scanning in one instrument.

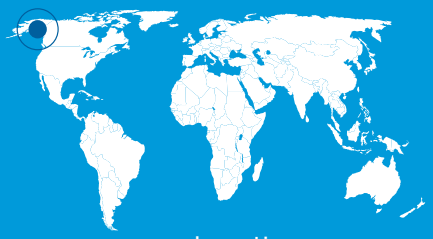
Trimble TX8 3D Scanner
- Long range, high speed solution for consistent accuracy and results

Trimble Business Center Software
- Integrated environment for surveying, scanning and data visualization.

Find out more at Geospatial.Trimble.com

overview

The site of Kennecott Mines in eastern Alaska is a prime example of America's rapid industrial growth in the early 20th century. Operated for nearly 30 years, the mines employed thousands of workers and produced some 600 thousand tons of copper from a difficult, remote location. Today the U.S. National Park Service is charged with preservation, stabilization and restoration of the historic site's buildings, power plant and massive mill.



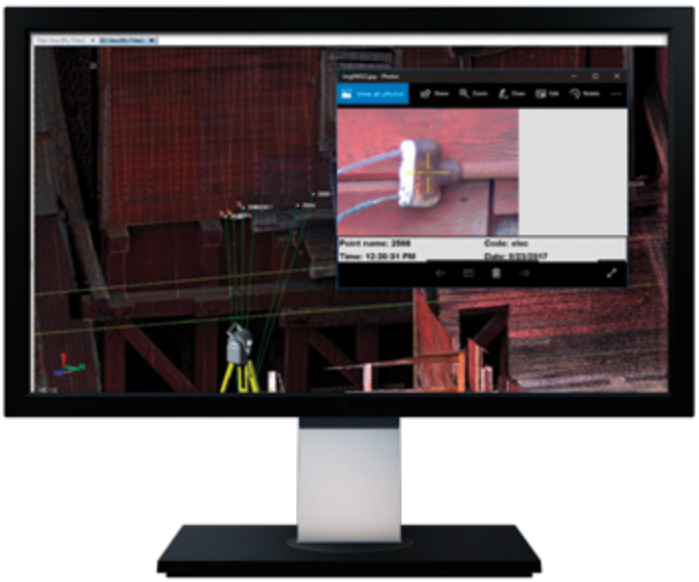
Location
McCarthy, ALASKA

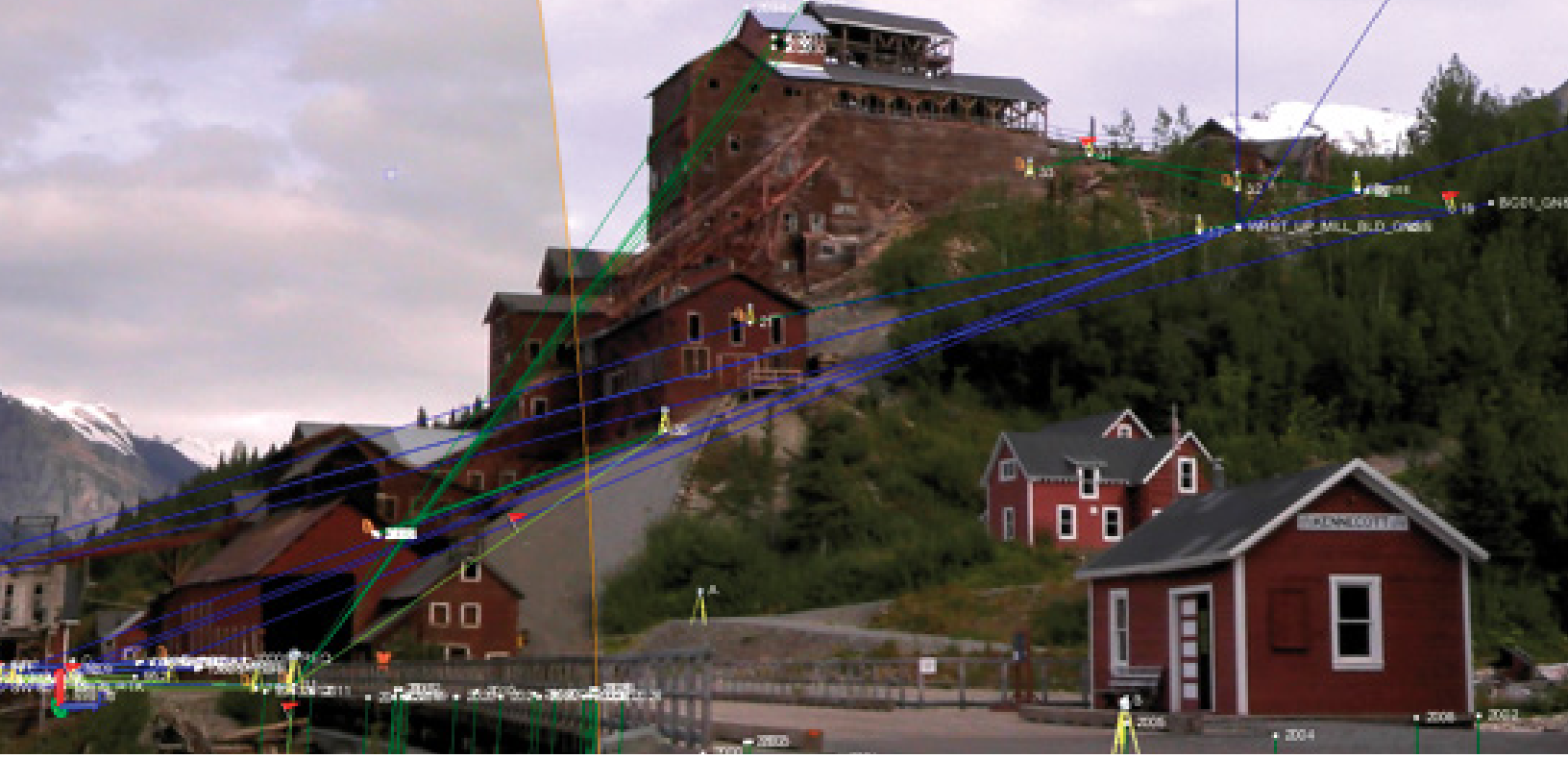
When the last trainload of copper pulled out of Kennecott in 1938, it left behind a community that had supported one of the most productive copper mines in the world. With its rich ore deposits depleted, Kennecott was no longer profitable. The community fell victim to the boom-and-bust cycle experienced by many other Alaskan mines. The once-bustling mill town was abandoned and left to decay.

Located near the town of McCarthy in Wrangell-St. Elias National Park and Preserve, Kennecott was declared a U.S. National Historic Landmark in 1987. When the National Park Service (NPS) acquired Kennecott in 1998, it began the lengthy effort to preserve the site and determine which buildings should be stabilized or rehabilitated. Nearly 80 years of neglect and Alaska weather had taken a toll on the town, and NPS historical architects and archaeologists needed accurate information on the structures that remained.

Archaeologists worked to map the site in 1999 and 2000, said Greg Biddle, Cultural Resources Management Specialist for Wrangell-St. Elias. The teams needed an entire summer just to survey the site's iconic mill—a 14-story structure that received raw ore delivered by aerial trams from mine entrances in the mountainside above and delivered processed copper to railcars at the base of the structure. The original sketches, pen and ink drawings and photographs with details on the structures, still remain. "The traditional mapping techniques worked, but they couldn't capture the important small details," Biddle said.

Today the NPS is gathering additional data as part of a project to stabilize the upper seven stories of the mill, which remains one of the largest wooden structures in North America. The effort will involve replacing deteriorated structural beams and columns, many of which are out of plumb or lack structural integrity. Biddle noted that the data from 2000 lacks the detail and accuracy needed to plan the work. He and his colleague, GIS specialist Joel Cusick, knew that 3D laser scanning could provide the needed precision. But while NPS had previously used scanning, it had never tackled such a large site with dozens of complex, sometimes crumbling structures.





HIGH PERFORMANCE SOLUTION

To gather the highest quality information possible, NPS worked with their local Trimble Geospatial partner, Frontier Precision, Inc. The team planned to demonstrate how modern geospatial solutions could quickly produce a comprehensive model of Kennecott's mill. In addition to creating an accurate 3D dataset, Cusick needed to connect the data to on-site geodetic control as well as existing surveys and property boundaries previously established by the Bureau of Land Management. "There are a number of private inholdings around the mine," he said. "We needed to be sure we weren't scanning someone else's property."

The team selected the Trimble® SX10 scanning total station for the bulk of the work. In addition to handling the 3D scanning, the SX10 could tie to existing control points and use traverse or resection functions to establish georeferenced 3D positions on each setup point. The team also used Trimble R8 and R10 GNSS receivers to extend control throughout the site.

The SX10 took scanning measurements from more than 20 locations around the mill and collected 70 GB of data. From setup points on steep hillsides the SX10 could capture top-down views and data on inaccessible features. Technicians used the instrument's overview and primary cameras to collect "big picture" photos and its telecamera to capture high-resolution images of critical details. The SX10 scanning even captured the overhead tram cables running into the mill as well as inaccessible structural components.

In addition to scanning, the Trimble SX10 used direct reflex (DR) measurements to capture individual points on the building. These points could identify key features and then be compared to the point cloud for quality assurance. In one instance, they used DR measurements to capture slope distance to a window more than 330 feet from the instrument.

"The ability to keep our feet on the ground and safely measure remote objects is an important benefit of this technology," Cusick said.

The team also used the SX10 to capture long-range scanning data on the Kennicott Glacier passing adjacent to the mine site. They hope to combine the 3D data and images with historic photos to study the glacier's shrinkage over recent decades.

While the SX10 team focused on the mill, a second group used a Trimble TX8 scanner to collect high-resolution data interior and exterior data on the power plant. The interior scans were tied to other structures and control points outside the buildings, enabling the team to produce on-grid coordinates inside and outside the structures.

FLEXIBLE DELIVERABLES SUPPORT MANY USES

The technicians processed data using Trimble Business Center software (TBC). TBC combined the traverse and GNSS results and then went to work on the scanning data from the SX10. They used the survey workflow in Trimble RealWorks® to process the TX8 data to project coordinates. Because the scans were tightly georeferenced in the field, registration and processing moved rapidly. Multiple scans could be merged quickly and the teams created colorized point clouds for visualization and checking at the end of each work day. At the end of the 3-day project, the technicians delivered to NPS a single TBC dataset containing all the point clouds, images and survey data.

Biddle said the scanning data can be used for more than stabilizing and rehabilitating the buildings. Results can be shared with NPS cultural resources teams to improve visitor access to and understanding of Kennecott's important sites. "The interpretive staff is very interested in this," he said. "We can use 3D scanning to provide virtual access and walkthroughs for people with visual or access limitations." The Trimble solution is helping NPS preserve our national heritage in both the natural and cultural environments.

"A long-range terrestrial scanner provides advantages including high accuracy and cost efficiency. The SX10 makes it easy to bring scan data into a GIS or other Earth-referenced frameworks."

Joel Cusick,
U.S. National Park Service

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