

# Technology News

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## Sensors Warn of Hazards During Mine Hoisting

### Objective

Develop a method to warn of hazardous conditions and enhance safety during operation and inspection of vertical mine shafts and hoists.

### Background

Mine hoisting is the most critical and potentially the most dangerous operation in underground mining. Many hazards are related to falls of miners and materials, ground instability, and malfunction or lack of safety devices. All have the potential to cause a catastrophic accident. A condition known as "slack rope" is particularly dangerous, especially if it occurs without the operator's awareness. The most common occurrence of slack rope is in metal or nonmetal mines that have a history of ground control problems near the shaft.

### Approach

Studies of hoist safety features and Mine Safety and Health Administration (MSHA) accident statistics suggests a need to measure wire rope tension, conveyance speed and position, and shaft guide misalignment. The most accurate data are obtained directly from the conveyance. Such data could warn of potentially dangerous situations during hoisting operations, as well as during inspections, maintenance, and lowering of large equipment. Figure 1 shows the concept for monitoring wire rope tension, conveyance position, and guide displacement.

### Progress to Date

A conveyance-mounted system has been developed that monitors rope tension; hoist conveyance position, speed, and load; and shaft guide misalignment. A "flex-beam" load sensor mounted just above the conveyance protects against slack and tight rope. The measurements are transmitted 60 times a second via wireless equipment from the conveyance to the hoist room. An encoder mounted on the conveyance eliminates the need to correct the position because of rope stretch. Figure 2 shows the encoder wheel and guide displacement sensors being mounted on a cage inspection deck. A potentiometer monitors misalignment of the shaft guides during inspections. Information about the cage or skip can be acquired by the shaft inspector using a hand-held indicator. Inspection can also be conducted remotely from a station or hoist room using the wireless link to a laptop computer. Figure 3 shows test results from a simulated slack rope condition.

### Patent Status

NIOSH has a patent pending on this device entitled "Cable-Load-Sensing Device."

### For More Information

NIOSH is seeking cooperators to assist in further tests of this technology to improve hoisting safety. Additional information can be obtained by contacting Michael J. Beus, Steven Iverson, or Elaine Cullen, Technology Transfer Officer, NIOSH, Spokane Research Laboratory, Spokane, WA 99207 at (509) 354-8000.



**U.S. Department of Health and Human Services**

Public Health Service  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health



Mention of any company name or product does not constitute endorsement by the National Institute for Occupational Safety and Health.

To receive additional information about mining issues or other occupational safety and health problems, call **1-800-35-NIOSH (1-800-356-4674)**, or visit the NIOSH Home Page on the World Wide Web at <http://www.cdc.gov/niosh/homepage.html>

As of October 1996 the safety and health research functions of the former U.S. Bureau of Mines are now located in the National Institute for Occupational Safety and Health (NIOSH).



Figure 2.—Encoder mounted on shaft guide.

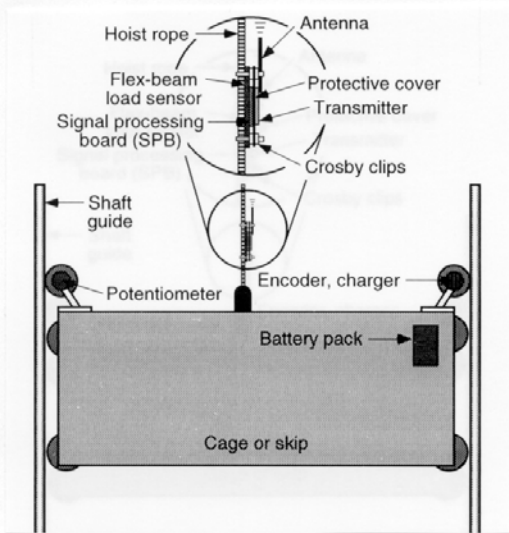


Figure 1.—Slack rope detection system.

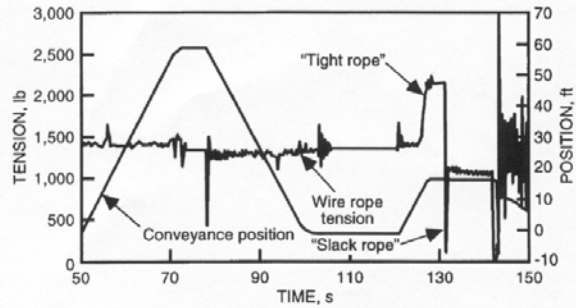


Figure 3.—Results of tests simulating a slack rope condition.