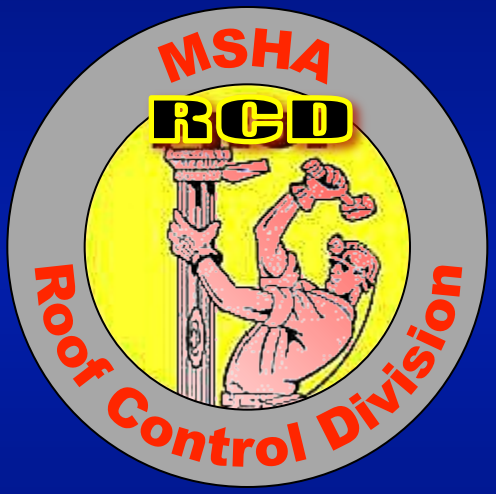
MSHA TECHNICAL SUPPORT ROOF CONTROL DIVISION



Pittsburgh Safety & Health Technology Center

August 2013

MSHA Technical Support
What We Can Do For You

Provide technical services to the mining industry for the resolution of ground control issues.

RCD Geologist Mapping A Geologic Feature

RCD PERSONNEL

- Division Chief
- Office Automation Asst.
- 4 Engineers
- 3 Geologists

MAJOR WORK AREAS

- Evaluation of Ground Support Products
- Field Investigations
- Canopies and ATRS Systems
- Mine Stress Analysis and Design
- Remote Sensing/Lineament Analysis
- Standards and Regulations
- ASTM Specifications
- Training

EVALUATION OF GROUND SUPPORT PRODUCTS

- Lab testing for conformance with accepted standards
- Field evaluations of product performance under actual mining conditions
- Meetings with manufacturers and MSHA personnel regarding application of products

Roof Support Testing Lab - Universal Testing Machine

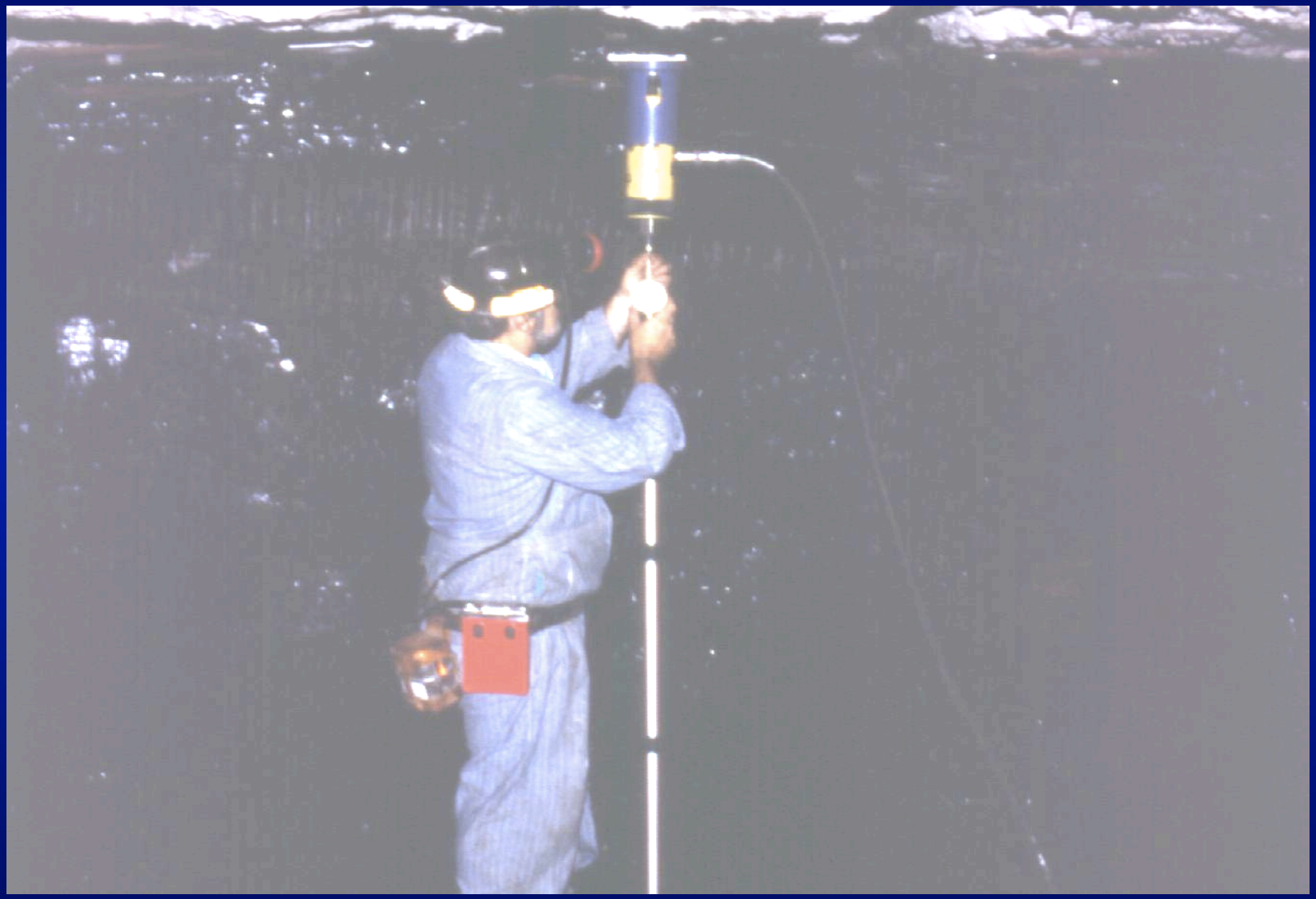
Resin Anchorage Test

PRODUCTS TESTED

- Roof/Rock Bolts
- Mechanical Anchors
- Resin
- Bearing and Header Plates
- Metal Straps and Wood Planks

Omega Block Specimen from Sago Mine Seals

IN-MINE EVALUATION OF GROUND CONTROL PRODUCTS



RCD Engineer Conducting Roof Bolt Anchorage Test

IN-MINE EVALUATION OF GROUND CONTROL PRODUCTS

RCD Engineer Checking Installed Roof Bolt Load

FALLING OBJECT PROTECTIVE STRUCTURES (FOPS OR CANOPIES)

- Tech Support conducted tests and established strength criteria for canopies
- Criteria incorporated into MSHA canopy regulations (75.1710)
- Over 250 documented canopy saves

CANOPY OVER OPERATOR'S COMPARTMENT

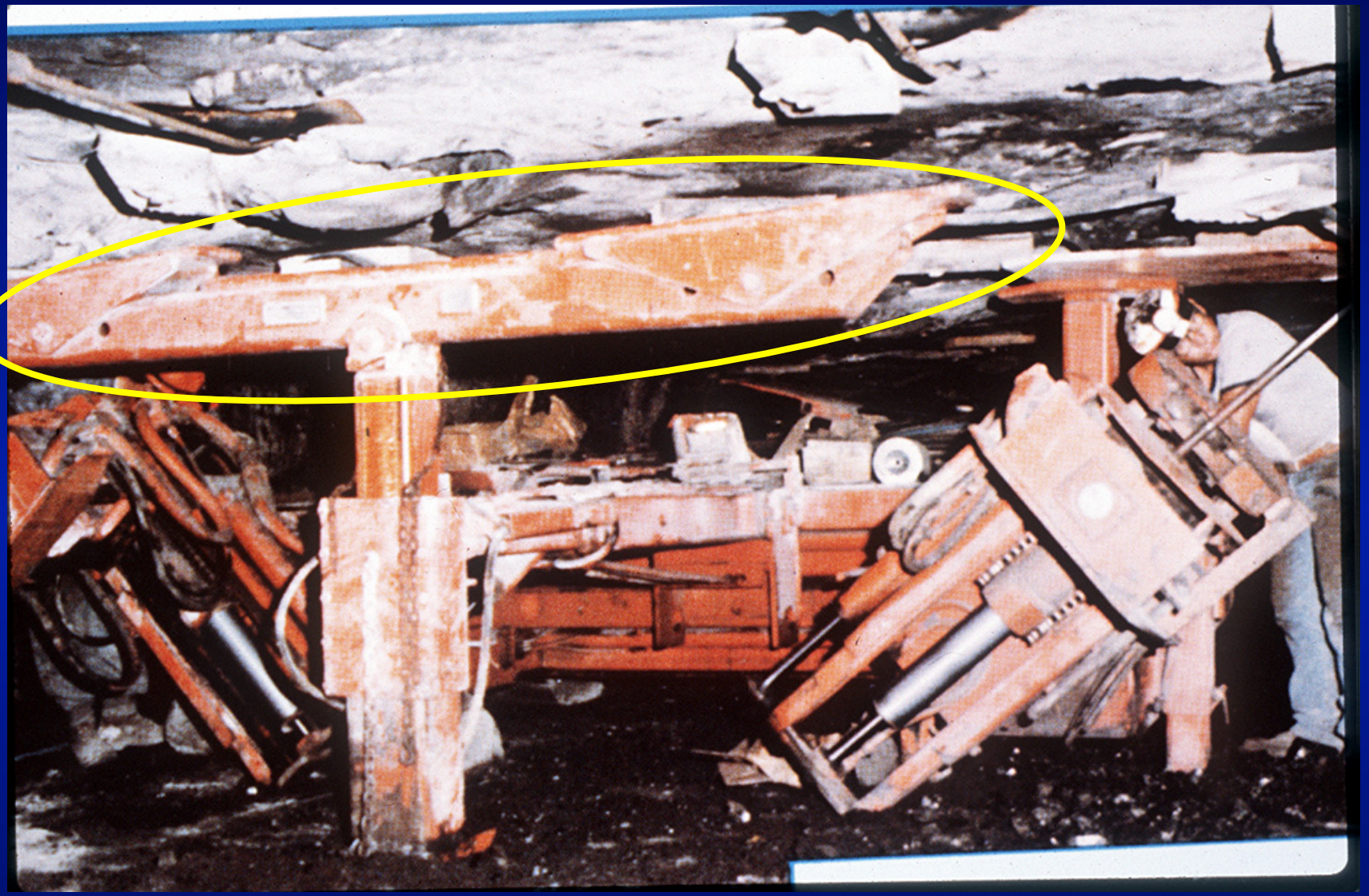
TRAM STATION CANOPY
ON LOW-COAL ROOF BOLTING MACHINE

Tramming from Place to Place

An Accident Waiting to Happen

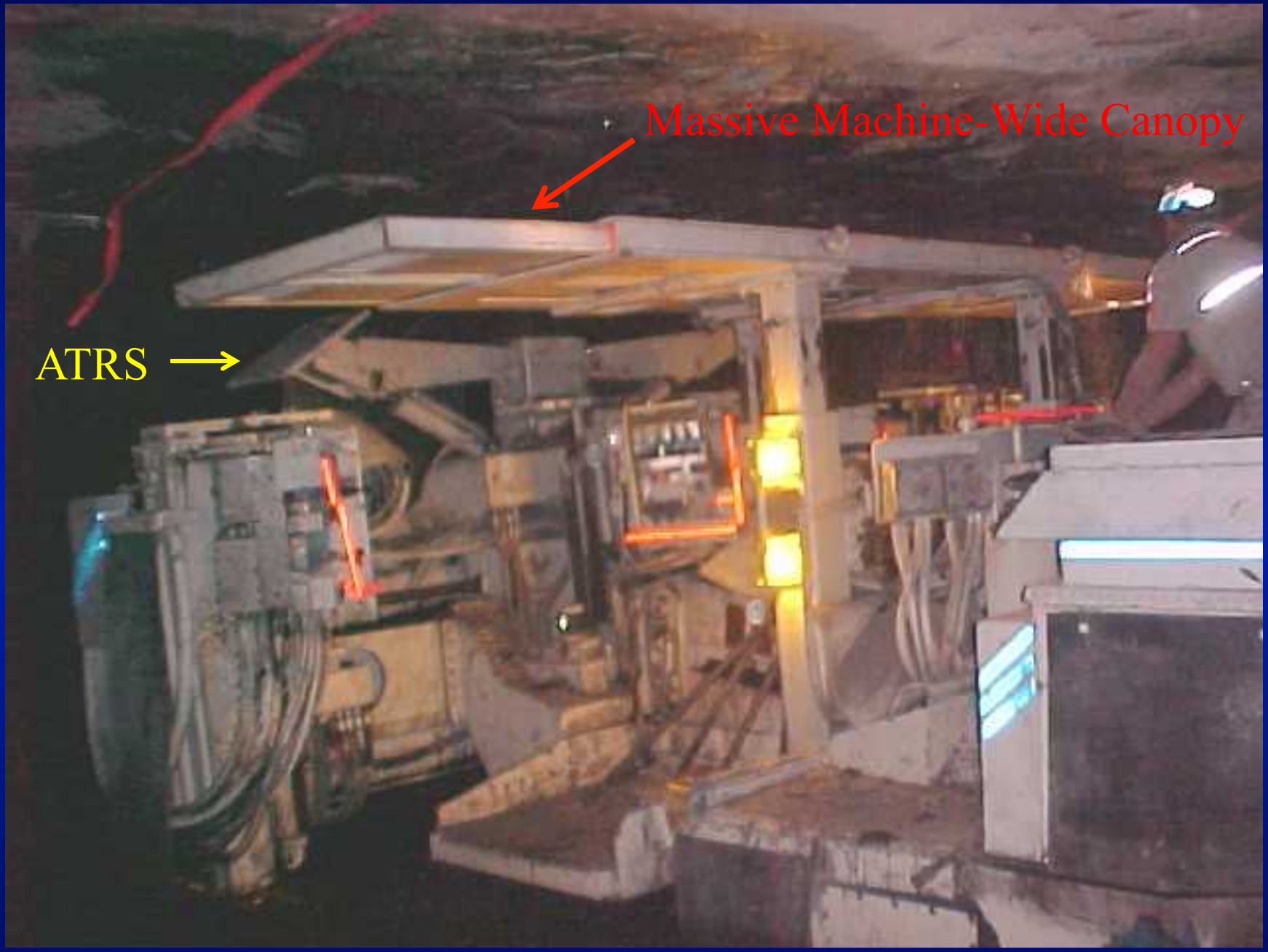
AUTOMATED TEMPORARY ROOF SUPPORT (ATRS) SYSTEM EVALUATIONS

- Tech Support established strength criteria and operational guidelines
- Criteria and guidelines incorporated into the MSHA roof control regulations (75.209)



SINGLE BAR ATRS SYSTEM

Safety-Arm ATRS system



Prototype ARO 4-Head Platform Roof Bolter

JOY 14ED MINER-BOLTER – LEFT SIDE BOLTING STATION

FIELD INVESTIGATIONS

- At the request of
  - MSHA personnel
  - mine officials
  - labor representatives
- Engineering and geologic studies conducted to resolve a variety of ground control problems

ROOF FALL INVESTIGATION

FATAL RIB ROLL ACCIDENT INVESTIGATION

Remote Control Continuous Miner Operator Position


Zeigler #11, IL


Prosperity Mine, IN


Highland #11 Mine, KY

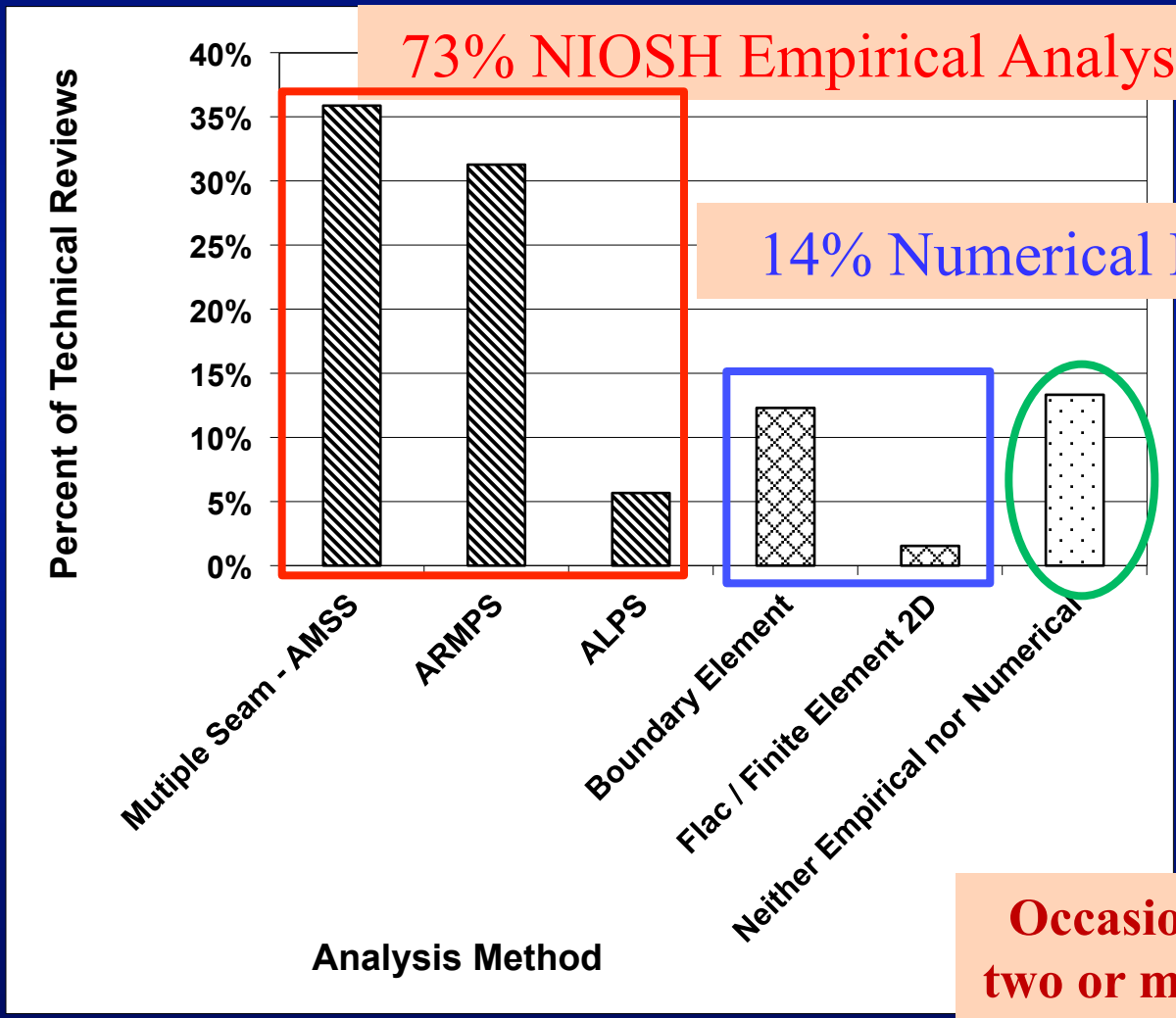
MINE STRESS ANALYSIS AND DESIGN

- Evaluation of proposed mining methods is often very complex (e.g., Crandall Canyon)
- RCD assistance is provided through:
  - Review of complex or unique roof control plans and amendments
  - Computer simulation of specific designs to assess their stability

MINE STRESS ANALYSIS AND DESIGN

- **Software used by RCD personnel**
  - **ARMPS**
  - **AMSS**
  - **ALPS**
  - **LaModel**
  - **RocScience Phase^2**

RCD Technical Review of Roof Control Plans Analysis Methods

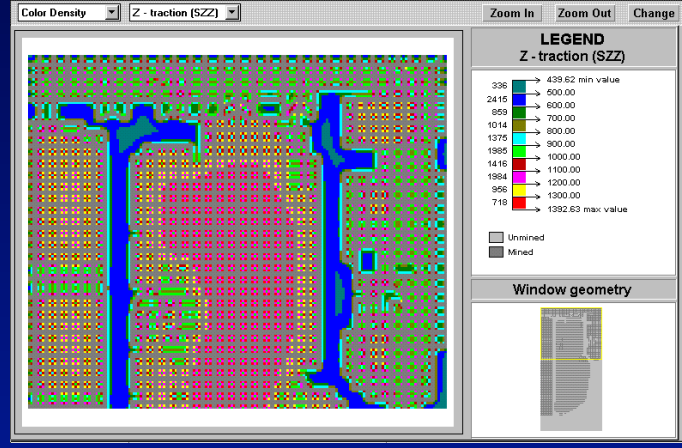


Other includes:

Ground support
Geologic hazards
Coal burst mitigation
etc.

Occasionally submittal has two or more analysis methods

Mine Design Related Field Investigation
Squeeze in a PA Coal Mine

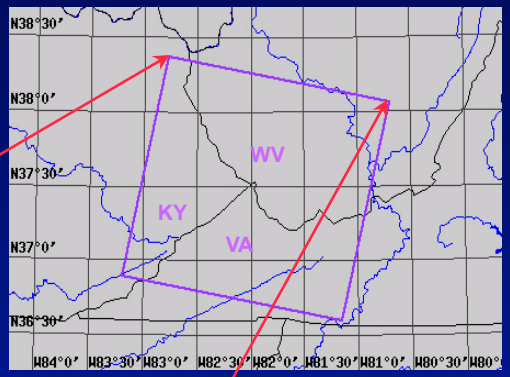


REMOTE SENSING

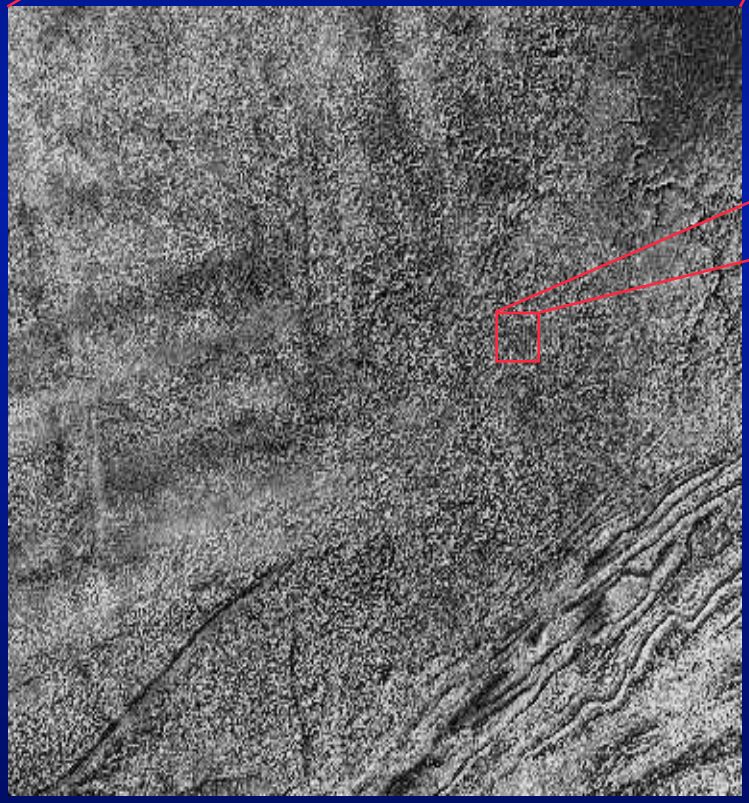
- Analysis of satellite imagery to detect lineament features
- Used to identify areas in mines which may encounter ground control problems
- Over 800 lineament analyses conducted

Software: ERDAS Imagine *8.4*

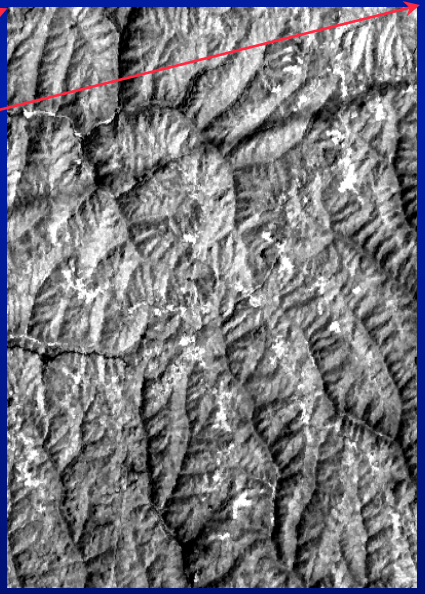
Imagery: USGS CD - ROM



Location of Landsat TM Band 4 Image

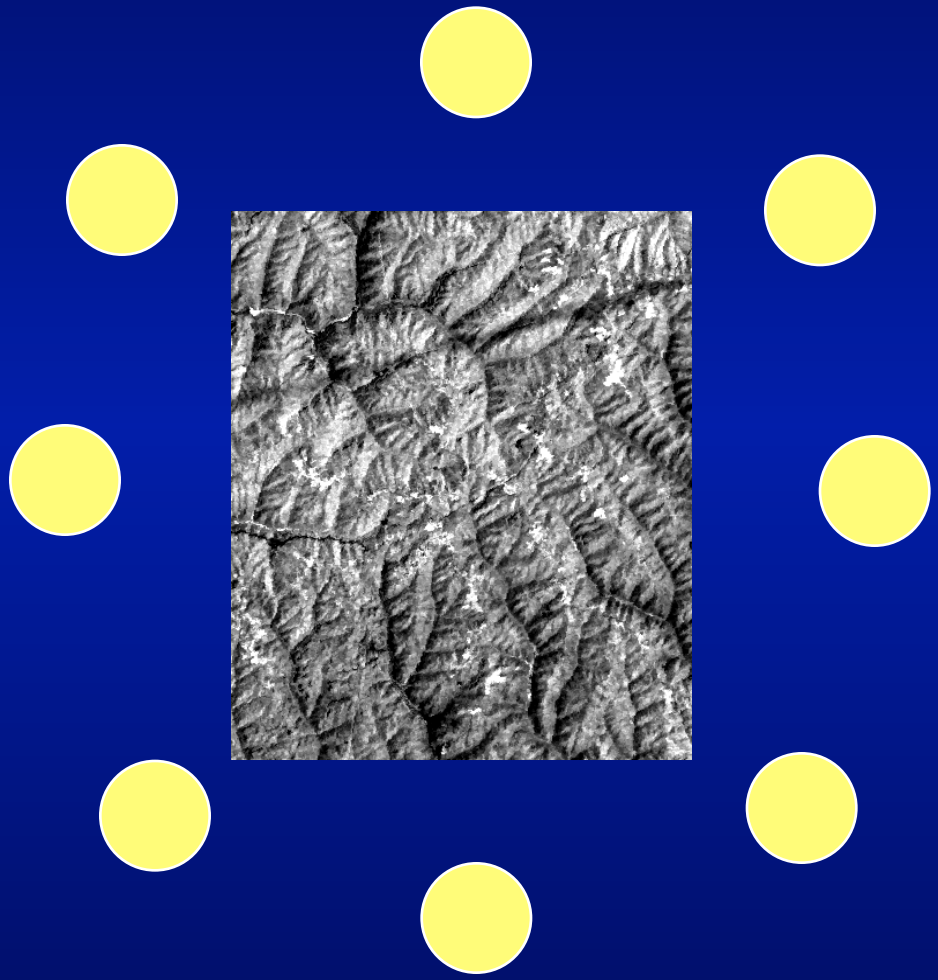


Landsat TM Band 4 Image



Area to be analyzed

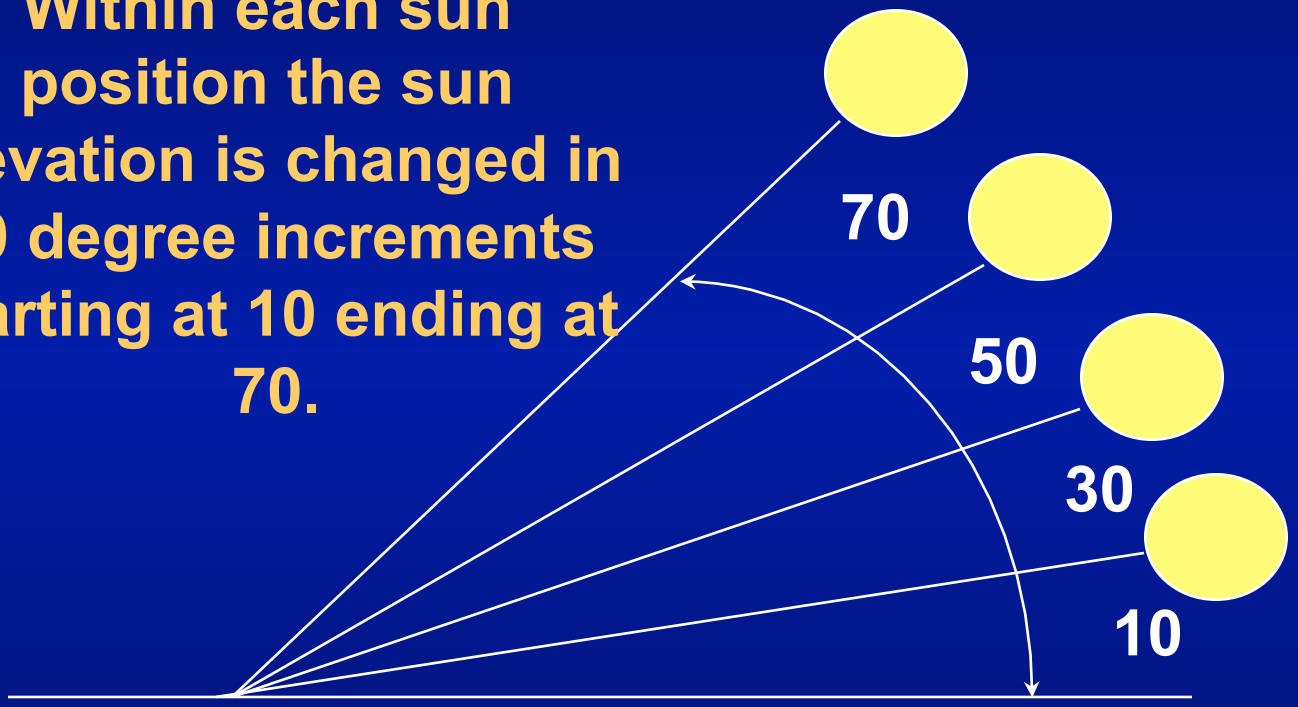
Generating Shaded Relief Images



The Sun is positioned in 45 degree increments around the image starting at 0 and continuing to 315.

Generating Shaded Relief Images

Within each sun position the sun elevation is changed in 20 degree increments starting at 10 ending at 70.



8 sun azimuth positions + 4 sun elevations positions within each azimuth position = 32 separate files for each analysis.

Shaded Relief Images

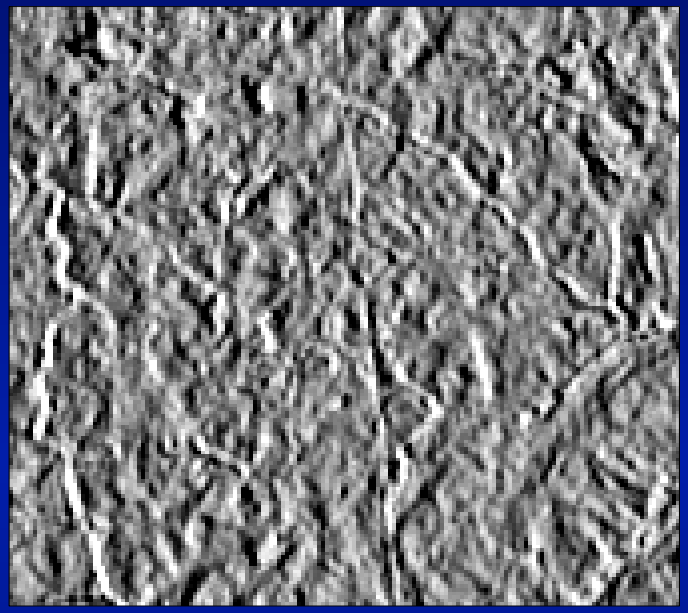


Image A

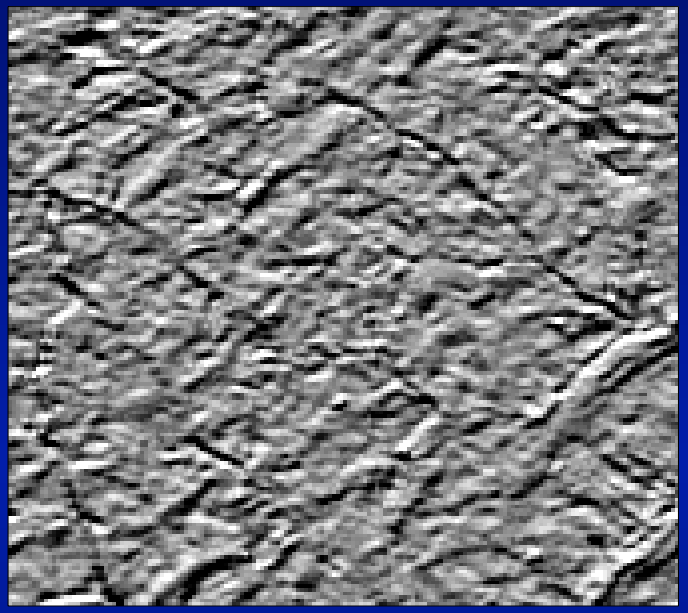


Image B

Images A & B are the same subset of a Landsat TM Band 4 image. Image A was illuminated at an azimuth of 90 degrees; Image B at 180 degrees. Note the clearly visible linear feature trending North-South through the center of Image A.

Shaded Relief Images

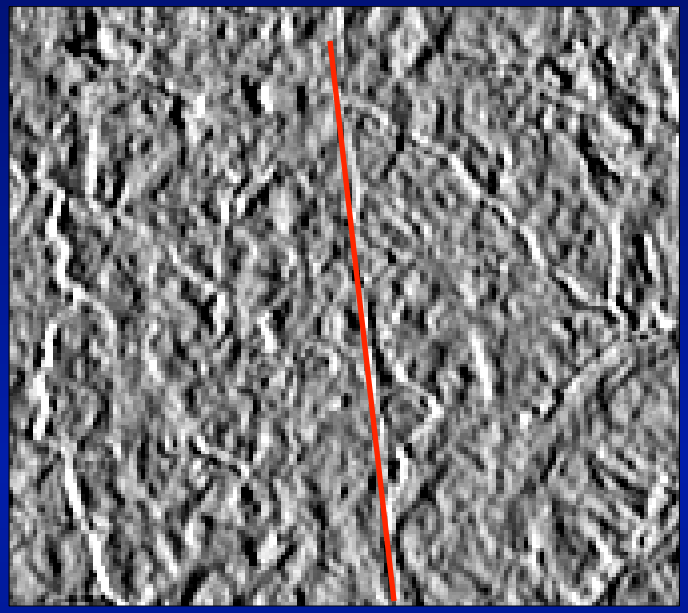


Image A

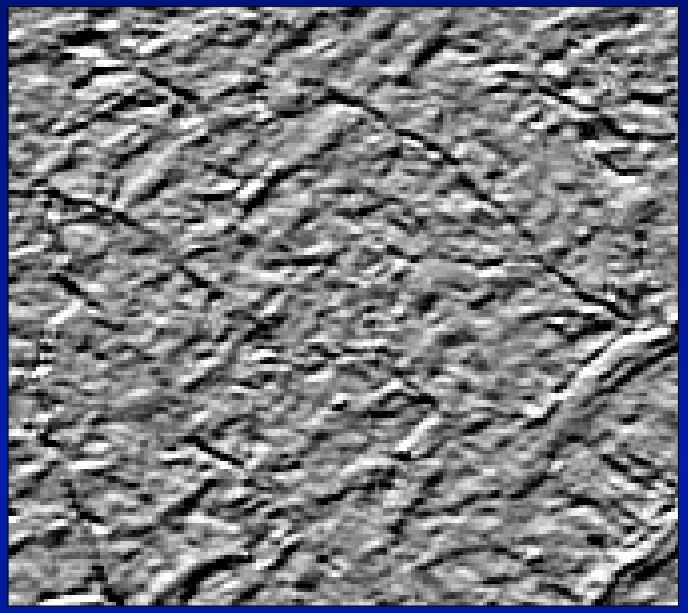
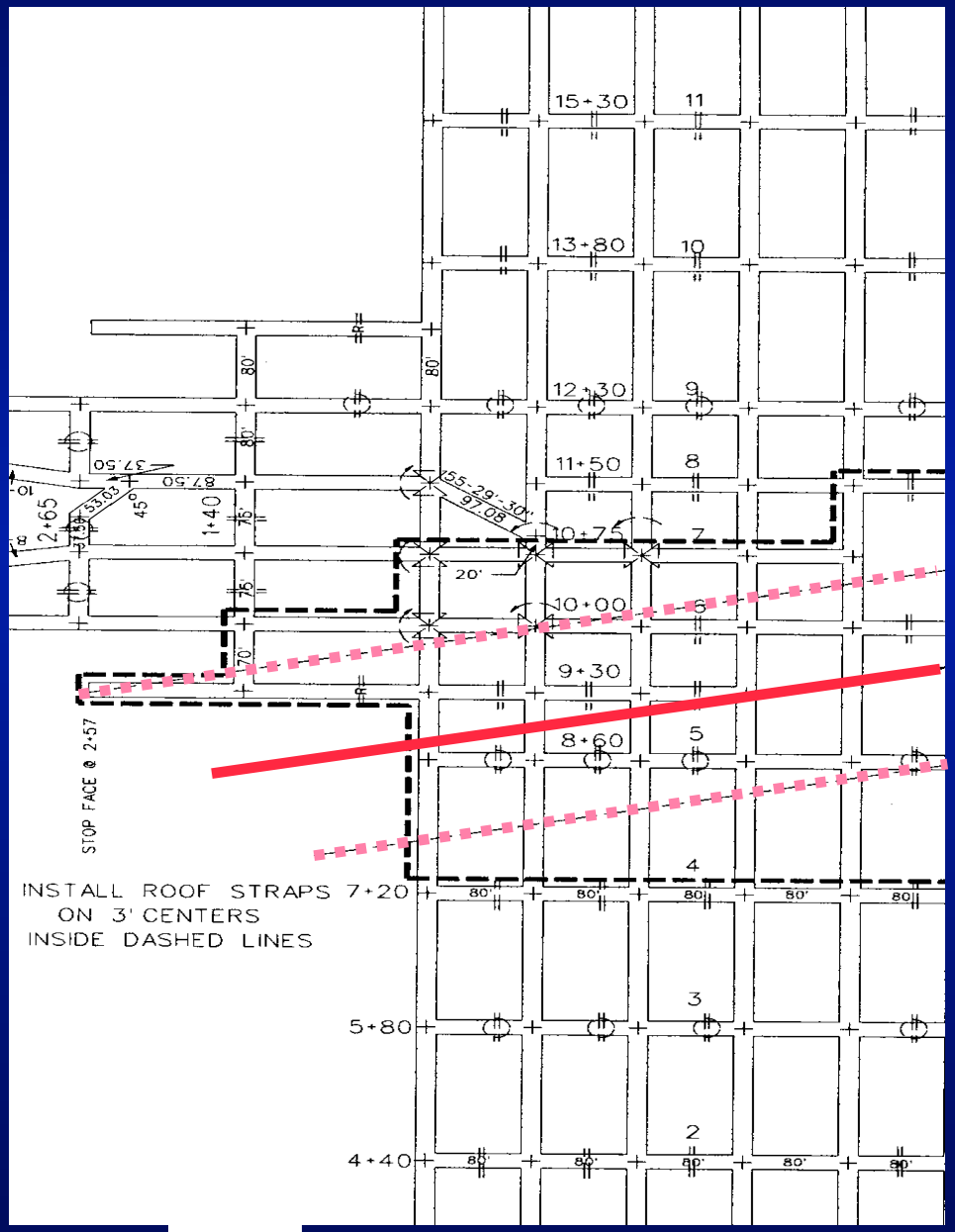


Image B

Images A & B are the same subset of a Landsat TM Band 4 image. Image A was illuminated at an azimuth of 80 degrees; Image B at 165 degrees. Note the clearly visible linear feature trending North-South through the center of Image A.

Mine Map with Lineament Location



Lineament location solid red

100- ft. on each side dashed red

MSHA ROOF CONTROL REGULATIONS

- 30 CFR - Part 75 – Underground Coal
  - Roof Support: 75.200
  - Canopies: 75.1710

SPECIFICATIONS FOR ROOF AND ROCK BOLTS AND ACCESSORIES

- Work with all facets of the industry to achieve high standards for products
- Participate on industry committees to help develop realistic specifications for roof support materials (ASTM F432)

GROUND CONTROL RELATED TRAINING

- Preventative Roof/Rib Outreach Program (PROP)
- MSHA District-wide Programs
  - NIOSH Ground Control Software (ARMPS, AMSS, and ALPS)
- Company or Mine Specific Training
  - Able to address issues at the mine/ company level

Questions or Comments?

ROOF CONTROL DIVISION

Division Chief: Joe Cybulski

(412) 386-6920