

# *Applications of Closed Loop “Feedback” Controls in Rock Drilling and Bolting*

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# Remote Controlled Roof Bolting Equipment



ARR-D

1988



Remote HDDR

1990

# Automated Roof Bolting Equipment



Auto-Bolt Module

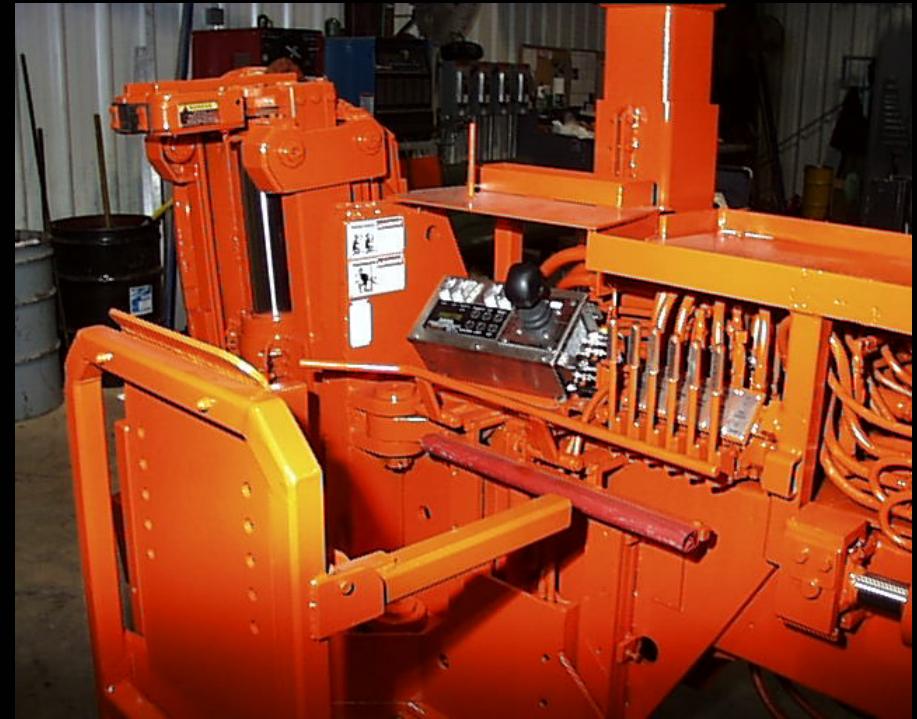


Quad Auto-Bolter

# Semi-Automated with Feedback



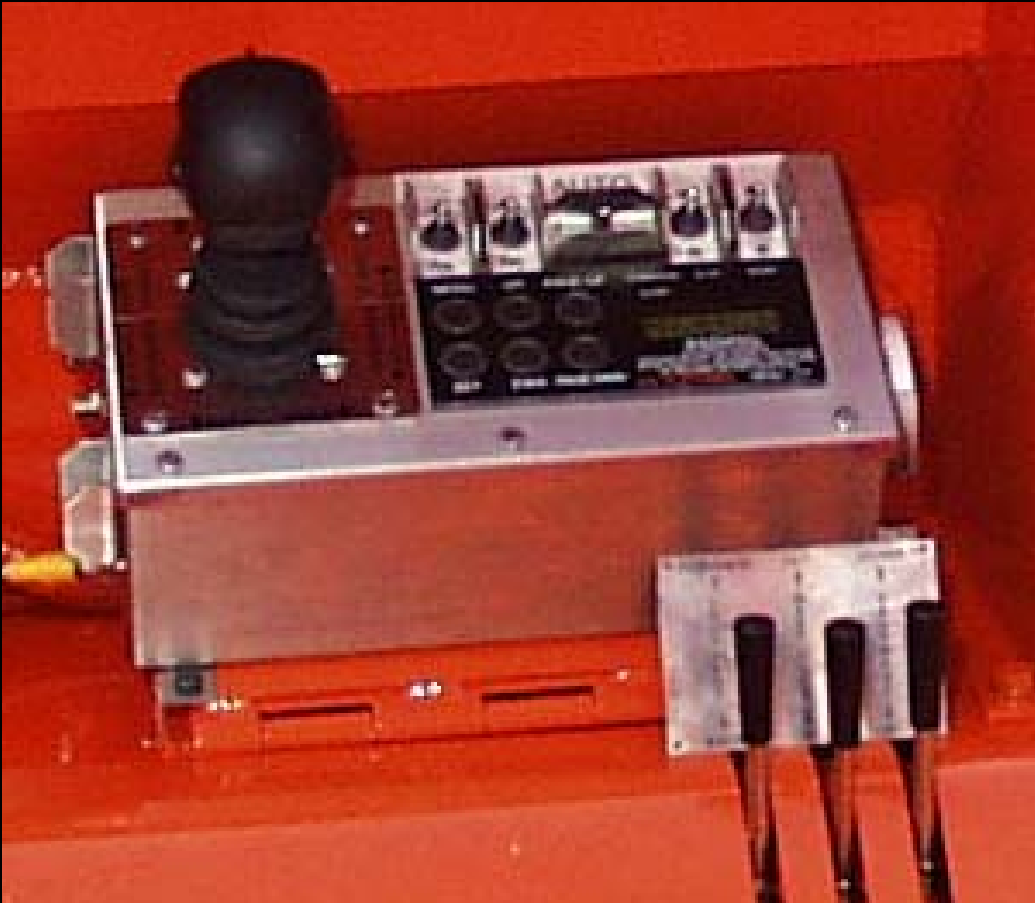
Roof Ranger  
2000



HDDR  
boom retrofit

# Features of the Feedback Control System

## Electric Controls:



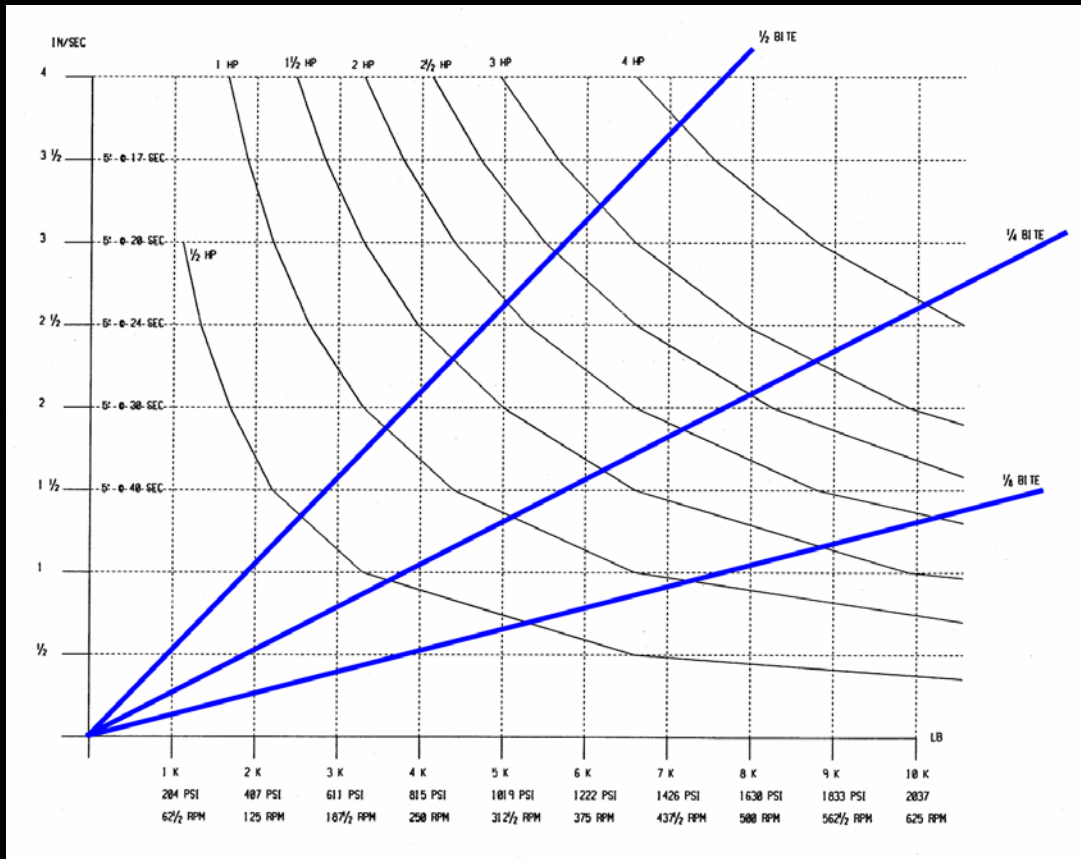
- \*Simplify Controls and Hydraulics

- \* Reduce Operator Fatigue

- \* Enhance Safe Operation

# Features of the Feedback Control System

## Optimized Drilling:



\* Provides Drill Energy Management

\* Reduces Need for Experienced Operators

\* Decreases Noise and Respirable Dust Generation

Feed Horsepower and Bite Control  
(patent pending)

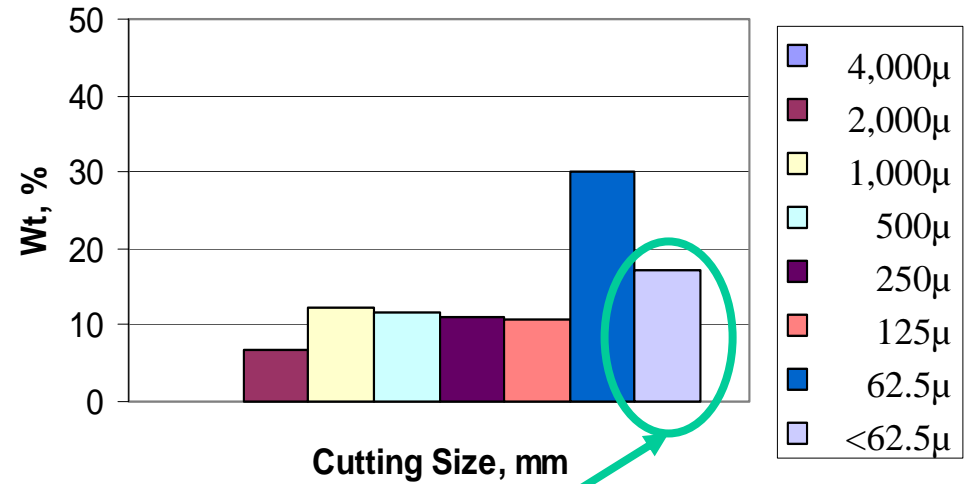


\* Dravo Lime:  
25-28 ksi comp  
1.03" dia. X 6'  
50 seconds

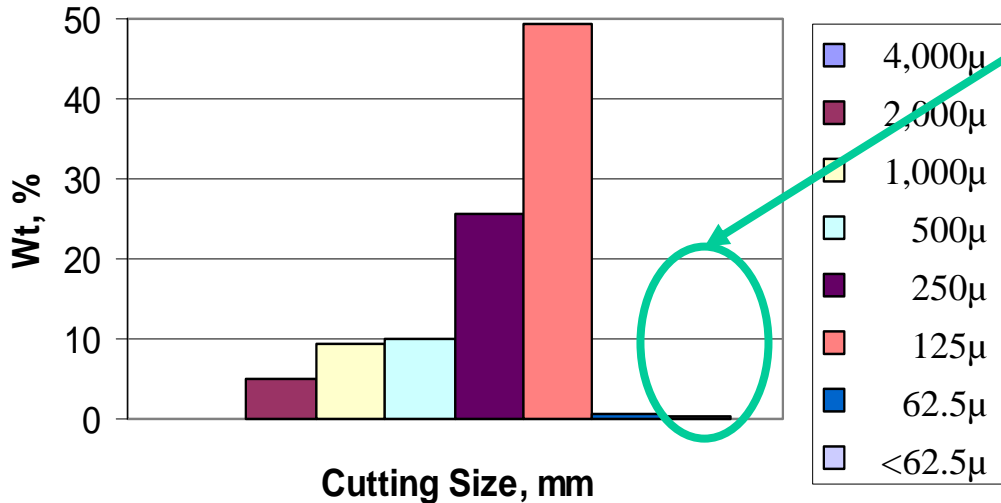
\* Commercial  
Stone:  
30-35 ksi comp  
1.03" dia. X 8'  
55 to 58 seconds

# Decreased Respirable Dust

## Test 1 – Manual Control



## Test 2 – Feedback Control



- \* Cutting Size Control
- \* Collection Feedback (patented)

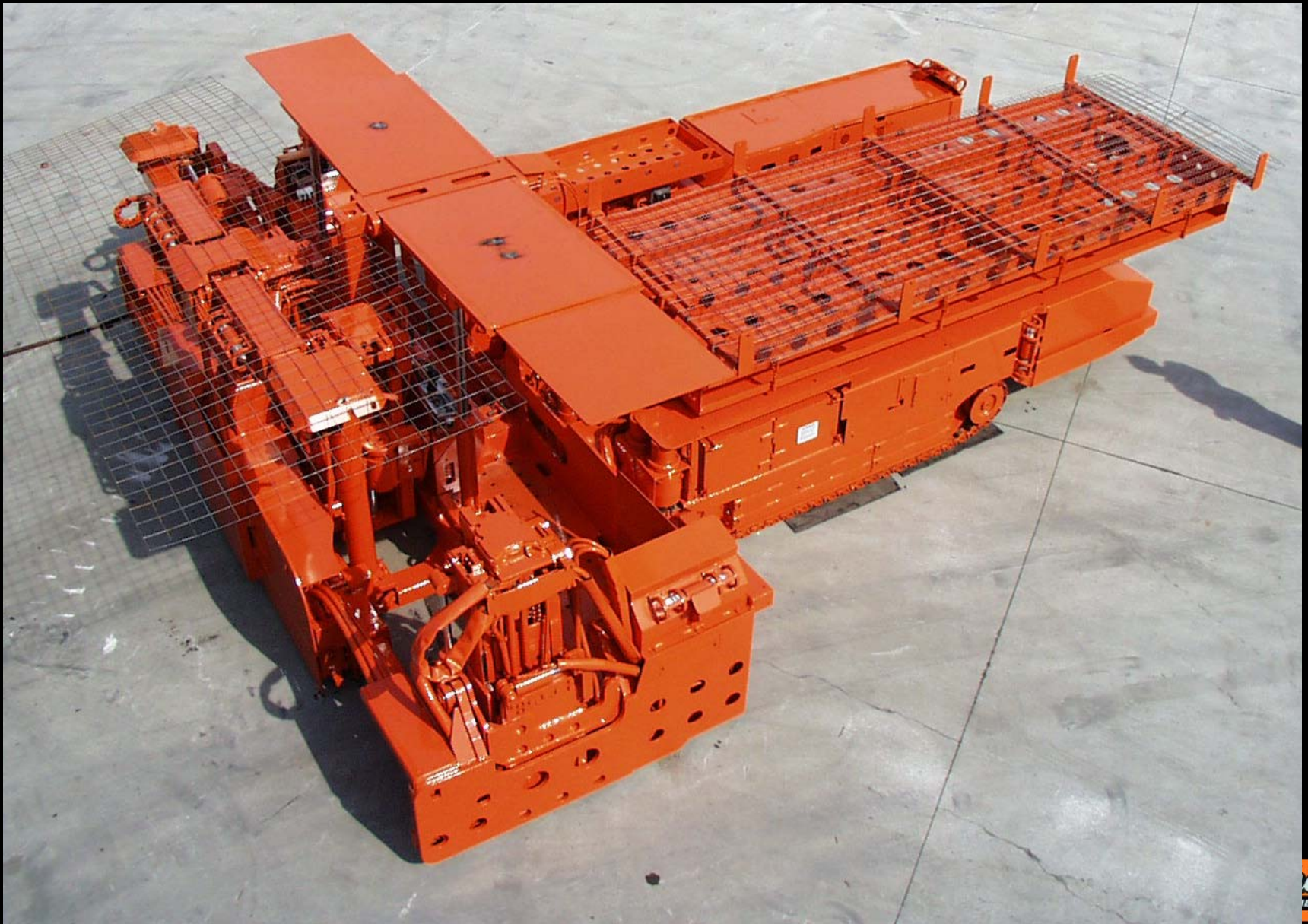
# Features of the Feedback Control System

## Programmable Drilling Parameters



- \* Maximum Feed Force
- \* Hole Collaring Limits
- \* Hole Depth
- \* Free Running Limits, Both Directions
- \* Safety Interlocks

# Fletcher Quad-Ranger

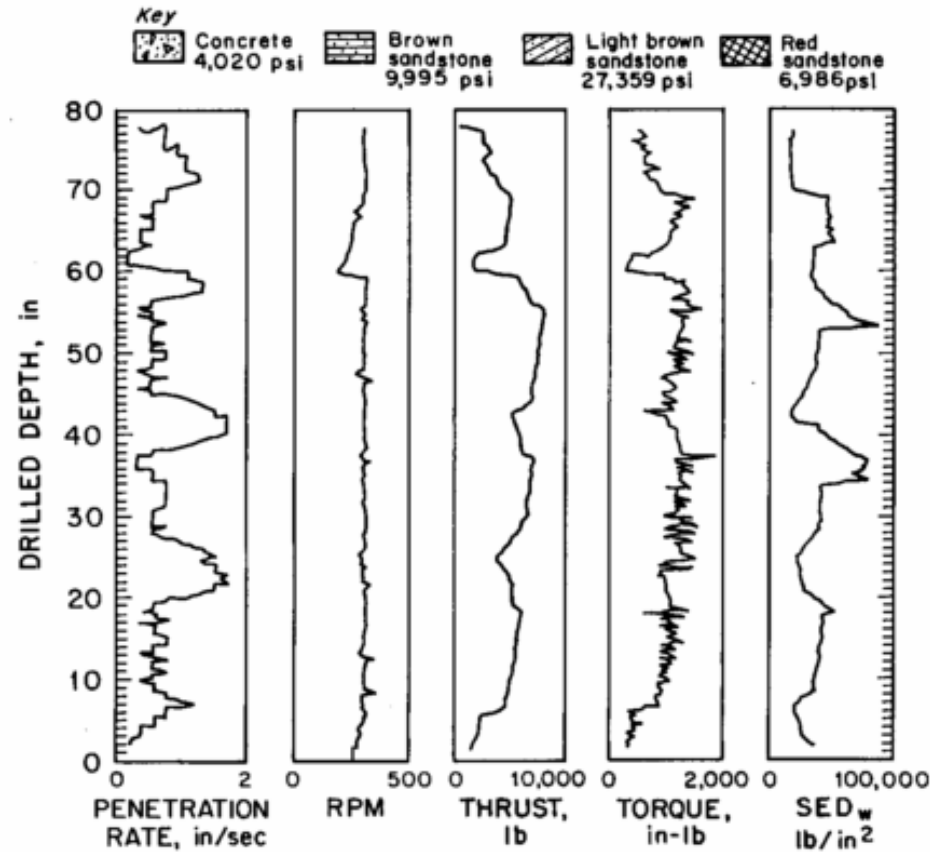




## Fletcher ARR-D

# Features of the Feedback Control System

## Collection of Drill Data



Provides Immediate Void  
Detection and Information  
to Generate...

Drill Data



Roof Support  
Design  
Methodology

Mine Map of  
Roof Lithology



*“Our goal is to manufacture equipment for underground mining that increases safety and production through engineering innovation, quality control, experienced service and ownership stability”*

*- J. Robert Fletcher  
Chairman*



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