

Automation & Emerging Technologies H&S Partnership



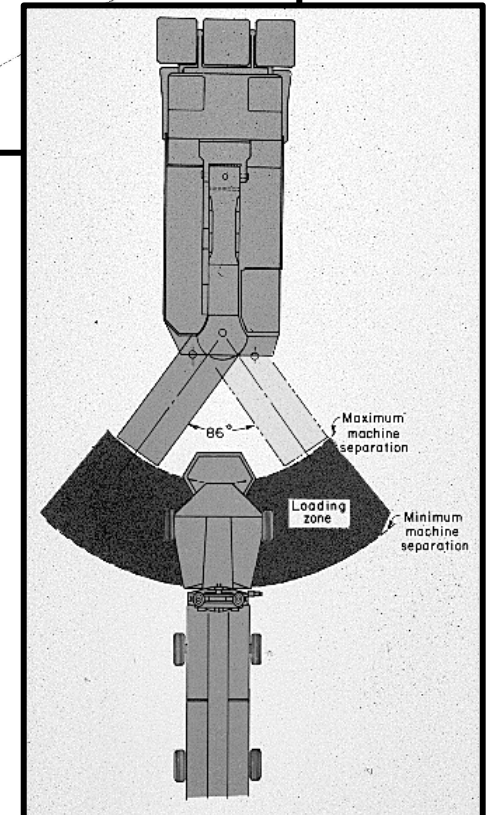
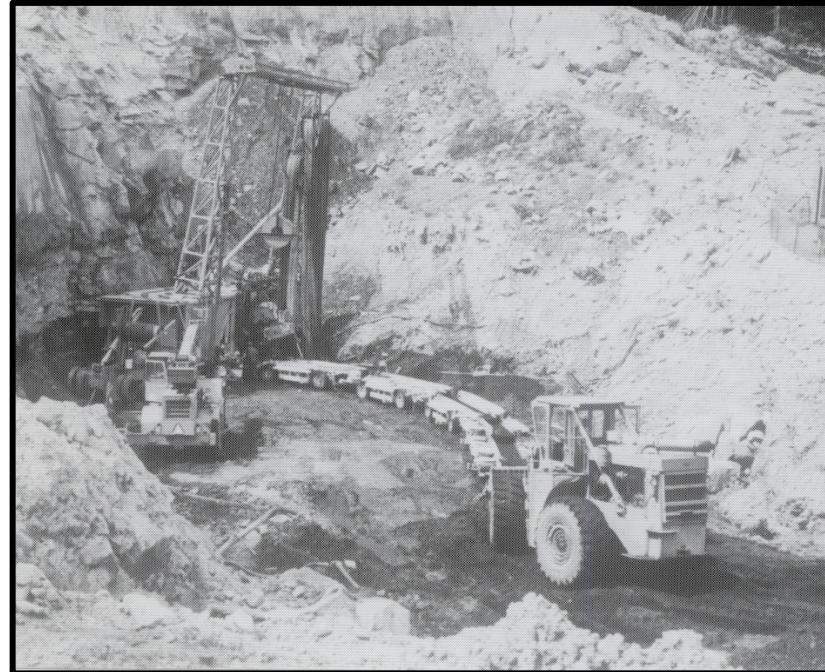
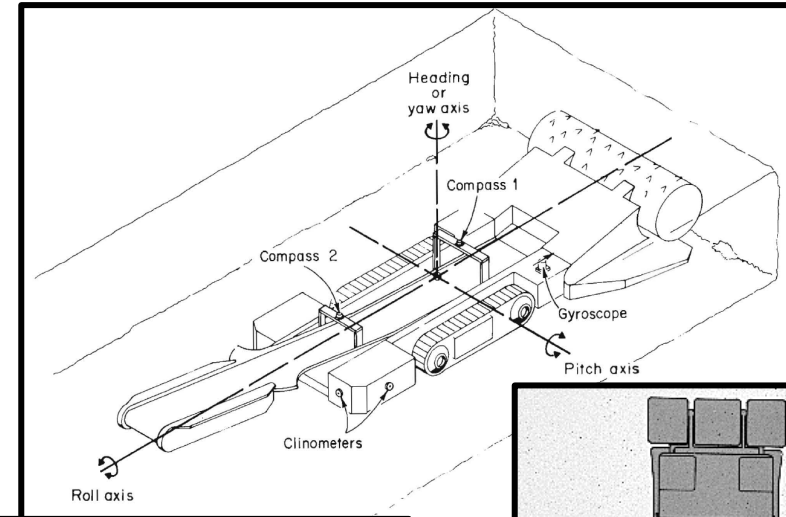
George Luxbacher PE, PhD
Deputy Associate Director for Mining
NIOSH Office of the Director

September 20-21, 2023
Automation & Emerging Technologies H&S
Partnership Meeting

The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the National Institute for Occupational Safety and Health.

U.S. Bureau of Mines Reduced Exposure Mining System (REMS) 1985-97 - Underground Coal Mining Equipment

- Continuous mining machine automation
 - Teleoperation of mining equipment
- Continuous haulage guidance systems
 - Sensor-based docking with a near infrared (IR) sensor
- Roof bolter sensors/automation
- Machine navigation
 - Laser-based alignment control
 - Inertial navigation
- Coal-rock interface detection
 - Gamma; GPR; SDR; Infrared

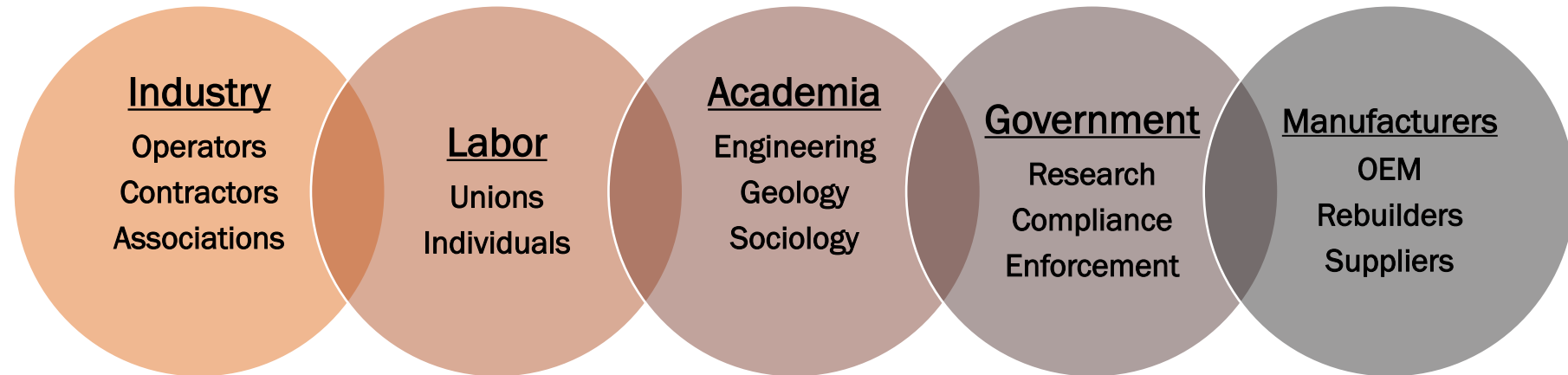


Our Partnership Model for Research

- NIOSH Automation & Emerging Technologies H&S Partnership
- *NIOSH Miner Health Partnership*
- NIOSH-MSHA Respirable Mine Dust Partnership
- MSHA-NIOSH Diesel Exhaust Health Effects Partnership
- NIOSH Rock Dust Partnership
- NIOSH Breathing Air Supply Partnership
- NIOSH Refuge Alternative Partnership (completed)
- NIOSH Proximity Detection Partnership (completed)



“Mining research is most effective when it has been done in cooperation with the ultimate users of the research.”



In Memoriam - Dr. Jessica Elzea Kogel



1959 - 2023

Associate Director for Mining, NIOSH 2016-2022
Director, Office of Mine Safety and Health Research

In Memoriam - Dr. Jessica Elzea Kogel



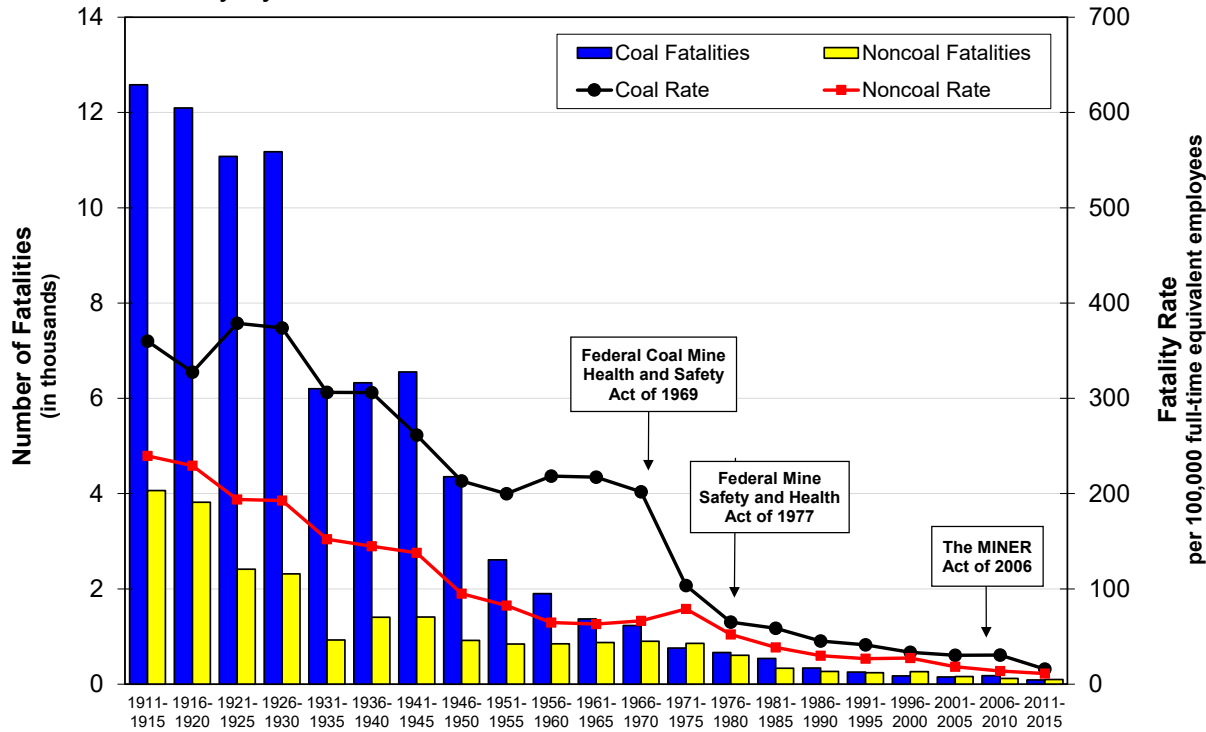
Jessica's Direction

Mine of the Future 2018
UP Contract 2018
MSHRAC Workgroup 5/18
FRN 3/18/2019
Workgroup Report 11/19
Partnership 10/20
Strategic Plan 2021

1959 - 2023

Associate Director for Mining, NIOSH 2016-2022
Director, Office of Mine Safety and Health Research

Number of fatalities and fatality rates (5-year aggregates) in the mining industry by sector, 1911-2015



NOTE: Excludes office employees. Noncoal includes metal, nonmetal, stone, and sand & gravel operations. Sand & gravel miners included starting in 1958. Hours for 1911-1923 computed on assumption that weighted average length of workday was 9.36 hours. Full-time equivalent employees (2,000 hours = 1 FTE employee). Data source: USBM and MSHA

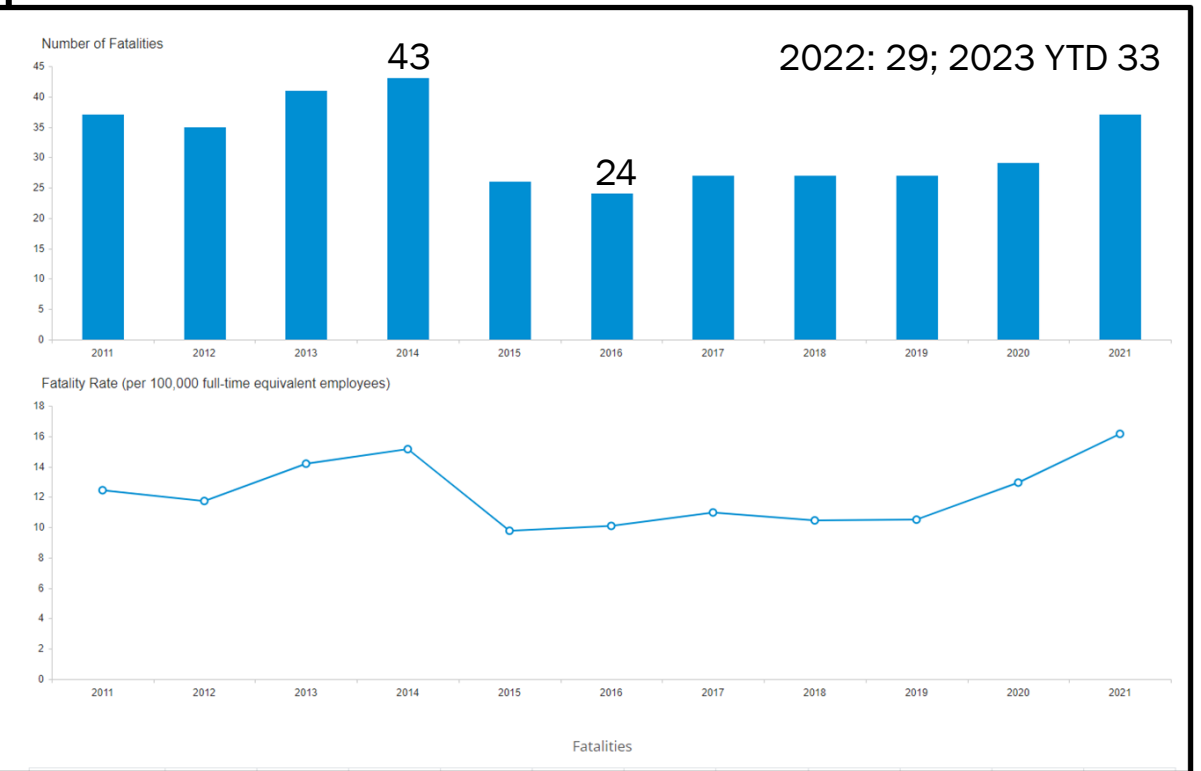
1911-2015 Fatalities

Coal

Noncoal

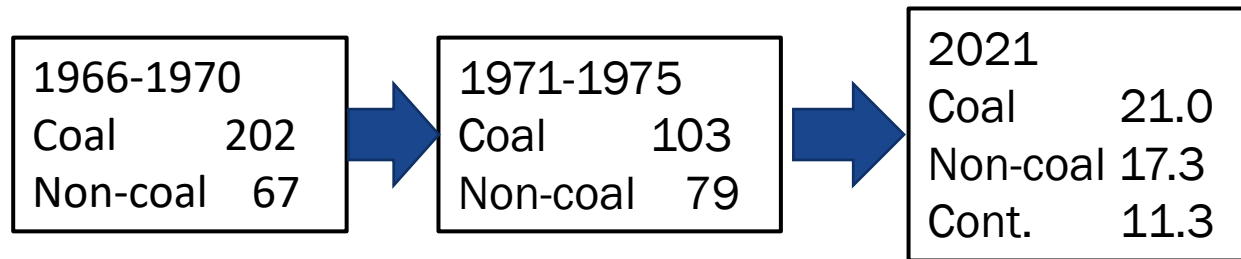
2011-2021 Fatalities - All Mining

NIOSH Data



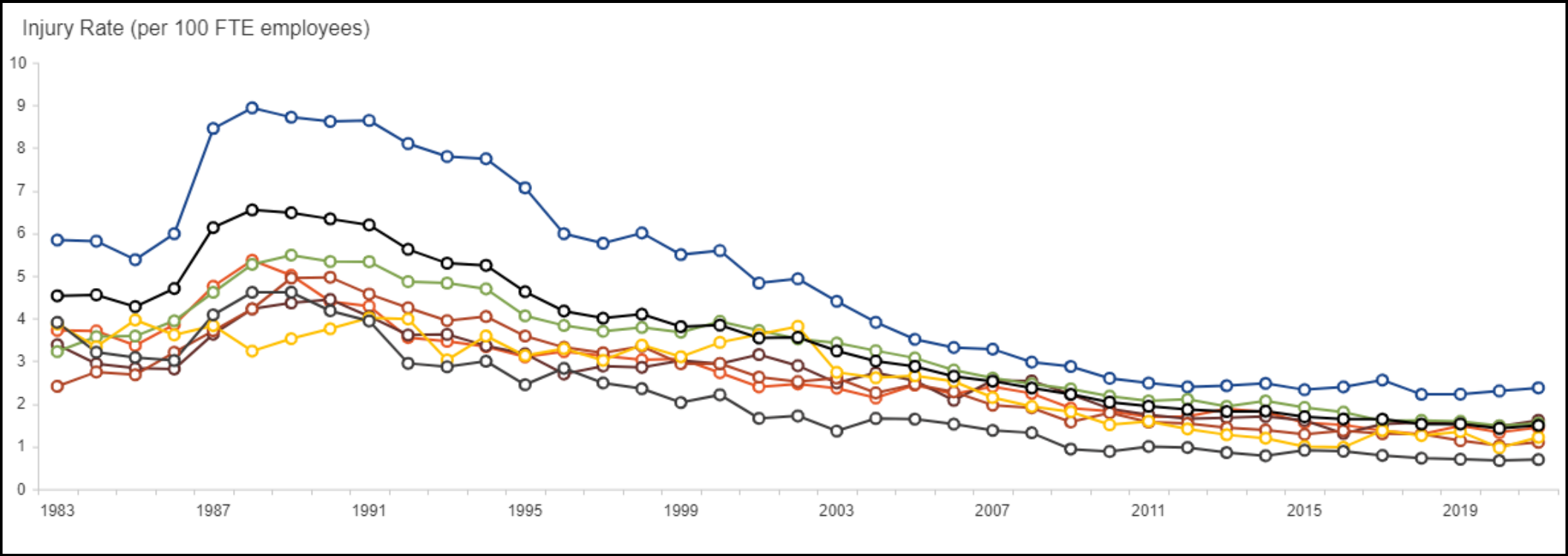
(Fatality Rate per 100,000 FTEs; excludes office workers)

Rates



All Industries 3.6

Industry Injury Rate (per 100 FTEs) 1983 – 2021



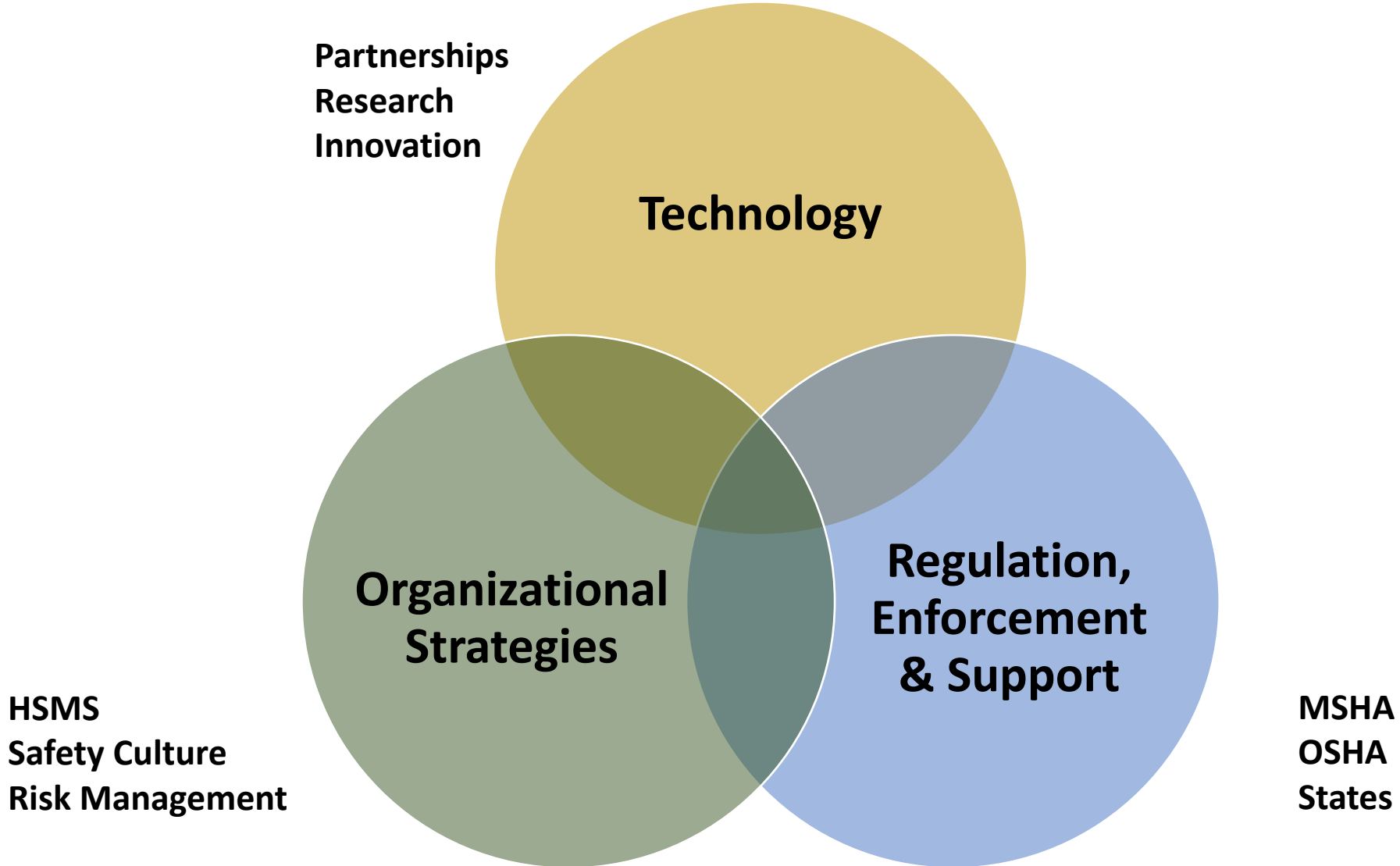
NIOSH Mine and Mine Worker Charts
 NIOSH Data, Excludes office workers

All Industries 2.7

Coal rate	2.37
Metal rate	1.44
Nonmetal rate	1.61
Stone rate	1.54
Sand & gravel rate	1.10
Coal contractor rate	1.22
Noncoal contractor rate	0.69
All mining rate	1.49

2021 Rate

Addressing Industry Health and Safety through the Automation & Emerging Technologies H&S Partnership



Partnerships
Research
Innovation

Technology

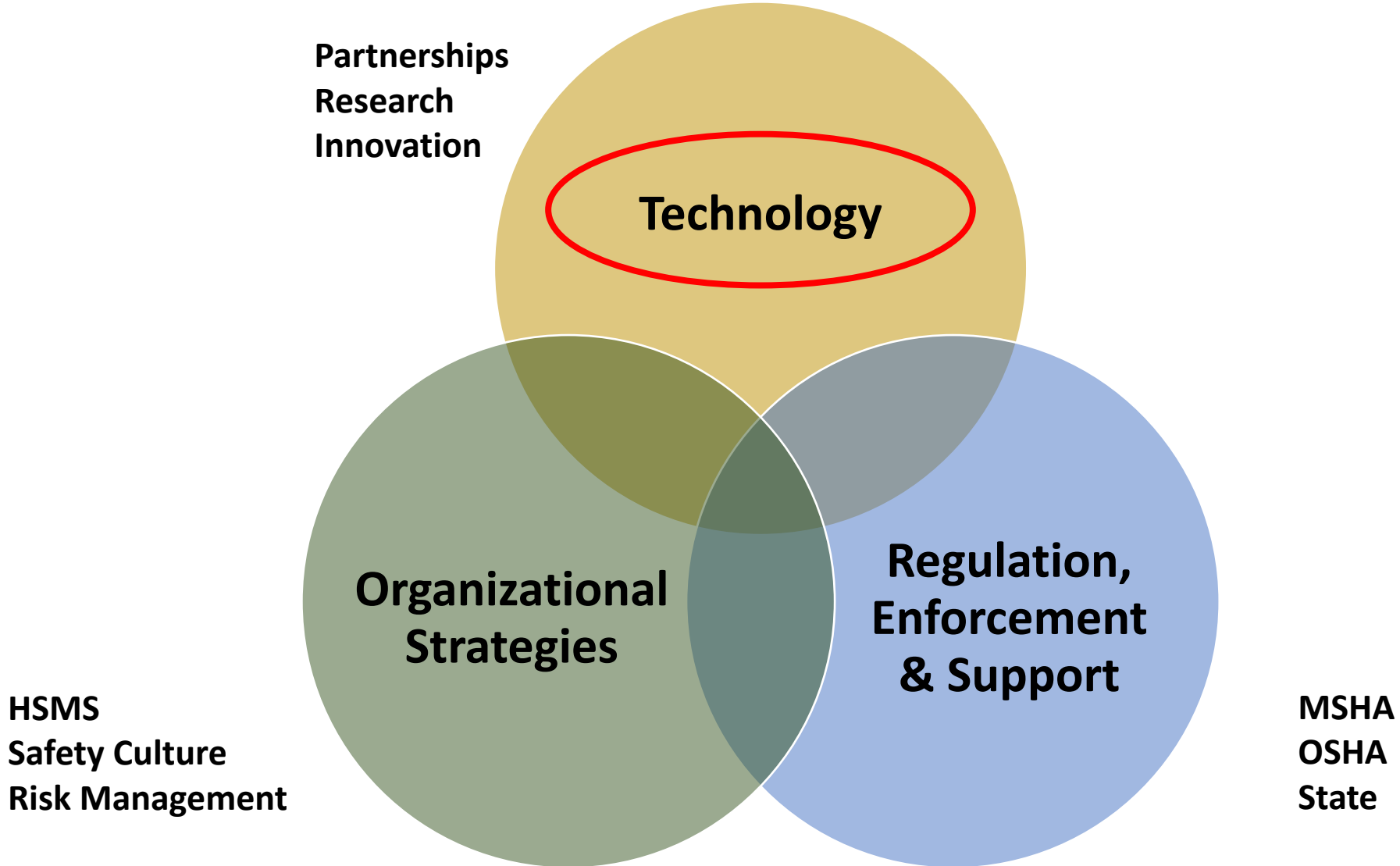
Organizational
Strategies

Regulation,
Enforcement
& Support

HSMS
Safety Culture
Risk Management

MSHA
OSHA
States

Addressing Industry Health and Safety through the Automation & Emerging Technologies H&S Partnership



NIOSH Mine Safety and Health Technology Innovations Awards

Initiated in 2012

Sectors:

Metal (NMA)

Coal (NMA)

Industrial Minerals (EMA)

Stone, Sand & Gravel (NSSGA)

*For submission information go
to the NIOSH Mining webpage*



NIOSH Mining Program Extramural Program

- **Grants**

- Western Mining Safety and Health Training
- Underground Mine Evacuation Technologies and Human Factors Research
- **Robotic and Intelligent Mining Technology and Workplace Safety Research**

- **Contracts (MINER Act; 2007 forward)**

- **143 contracts executed**; Proposals from **210+ companies** and 40 universities

- **Contracts (OSHA Capacity Build)**

- 34 contracts, 12 universities

- **Interagency Agreements**

- National labs (Sandia)
- Government (NASA KSC, JPL; NSWC)



Grants

- Robotic and Intelligent Mining Technology and Workplace Safety Research U-60 Collaborative Grant
- Grantee: Missouri University of Science and Technology – Mining and Explosives Engineering Department
- \$2 million/year
- Grant runs from 9/1/23 through 8/31/27, subject to continued annual Congressional funding
- If interested in participating, please reach out to Dr. Samuel Frimpong or Dr. Kwame Awuah-Offei

Extramural Contracts

- Total: 143 technology contracts, 34 capacity build contracts
- FY23 active portfolio – 33 technology contracts, 7 capacity build contracts
- Initiated by MINER Act in 2006 – formalized OMSHR
 - *(A) award competitive grants to institutions and private entities to encourage the development and manufacture of mine safety equipment;*
 - *(B) award contracts to educational institutions or private laboratories for the performance of product testing or related work with respect to new mine technology and equipment;*
- Broad Agency Announcement (BAA) solicitation used as mechanism – contractor identifies the issue and their proposed solution
- BAA posted on SAM.GOV & NIOSH Mining webpage in November-December
- Focus areas cited but any proposal related to H&S considered (and funded)
- Maximum funding up to \$650,000 over a period up to 5 years
- Awards typically \$3-400,000 over 3 years, although we do fund to \$650,000

Extramural Contracts Related to Automation/Emerging Technology

Contractor	Title	Start	End
Rand Corporation	Assessing the Market for Electronic Technology for Underground Coal Mine Safety and Health Applications	2019	2023
University of Kentucky w/ SRI International	Autonomous Docking of Face Haulage Mining Machinery in GPS-Denied Environments	2020	2022
University of Pittsburgh	Automation Experience with a Global Perspective – An Assessment of the Automation Impact on Worker Safety and Health	2020	2023
Joy Global Underground Mining LLC (Komatsu)	Improved Longwall Automation by Utilizing Sensors to Detect the Rock Coal Interface	2021	2024
J. H. Fletcher & Co.	Remote Blast Hole Location Detection for Powder Loader Automation	2021	2023
Colorado School of Mines	Machine Learning Enhanced Perception for Automated or Remote Roof Bolting Operations in Underground Mining	2021	2024
Society for Mining, Metallurgy & Exploration	Eliminating Barriers for the Implementation of Automation in the Mining Industry	2022	2024
University of Nevada, Reno	AutonoDES: A discrete Event Simulation Platform for Safety Scrutiny of Autonomous Mining Systems	2022	2024

Excludes contracts related to autonomous drones, ground control assessment, mine rescue, etc.

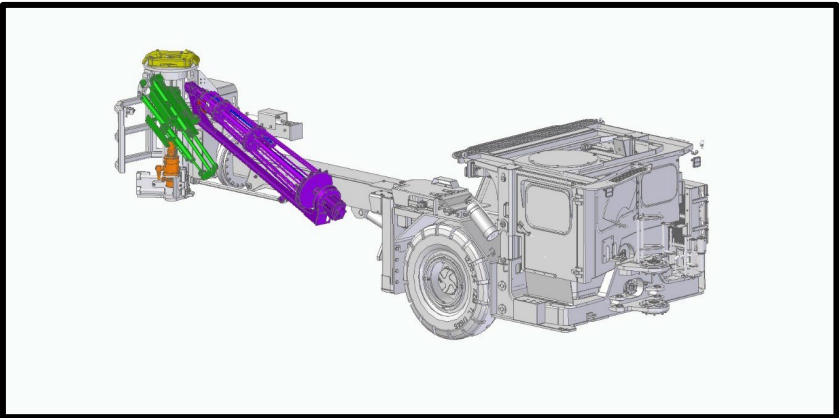
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Extramural Contracts Related to Automation/Emerging Technology

Contractor	Title	Start	End
JH Fletcher	Design and Manufacture of an Outby, Single Module, Electric, Automated, Roof Bolter	2023	2025
University of Kentucky w/ SRI International	In-Mine Underground Collision Avoidance Information System	2023	2024



Plus 2 additional contracts under negotiation for FY23

Excludes contracts related to autonomous drones, ground control assessment, mine rescue, etc.

Extramural Contracts Related to Automation/Emerging Technology

University Capacity-Build Contracts

University	Title	Start	End
Colorado School of Mines	Improving Health and Safety of Mining Operations Through Development of the Smart Bit Concept for Automation of Mechanical Rock Excavation Units and Dust Mitigation	2019	2024
University of Nevada, Reno	Capacity Building in Artificially Intelligent Mining Systems (AIMS) for Safer and Healthier Automated Operations	2019	2024

Extramural Contracts

- Initiated by the MINER Act in 2006 – formalized OMSHR *“to enhance the development of new mine safety technology and technological applications and to expedite the commercial availability and implementation of such technology in mining environments” with the authority to:*
 - *“(A) award competitive grants to institutions and private entities to encourage the development and manufacture of mine safety equipment;*
 - *(B) award contracts to educational institutions or private laboratories for the performance of product testing or related work with respect to new mine technology and equipment;”*
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“Mac” – circa 1950s

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NIOSH Mining Program
www.cdc.gov/niosh/mining

