93905AU - Design of Proximity Systems for Underground Mobile Equipment

Project Start-End Dates: 10/01/2015 - 09/30/2018
Lead/Initiating Office: OMSHR

FY 2016

Project Staff

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6.65 FTEs Total

Keywords

- injury prevention
- mining
- traumatic injuries

Strategic Objectives/Project Classification

Sector Programs

Mining, 100%

Cross-Sector Health Outcome Programs

Traumatic Injury, 100%

Cross-Sector Other Programs

Engineering Controls, 100%

Project Categories

Intervention Research, 60%

Non-Intervention Research, 40%

Ethnic/Racial Population Breakout

American Indian or Alaska Native, 5%

Asian, 5%

Black or African American, 10%

Hispanic or Latino, 5%

White, 75%

Special Population Groups

50 and Over, 40%

Women, 10%

State

Alabama

Illinois

Kentucky

Ohio

Pennsylvania

Virginia

West Virginia

Partners: External

Joy Mining Machinery Inc. - Research Collaborator

Mine Safety and Health Administration (MSHA) - Evaluator

Strata Products Worldwide, LLC - Research Collaborator

United Mine Workers of America (UMWA) - Research Collaborator

Technology Transfer

Binding Partnership Agreement

AB78-COMM-22-1

An External Peer Review is Required for this Project

Date of Review	Type of Review
10/01/2015	Three external reviewers will provide written comments

Is this a feasibility (pilot) Project?	No
Is this a basic science, methods development, or risk assessment project?	Yes
Is this a Program Portfolio Implementation Project?	No
Will this project utilize Human Subjects?	Yes
Will this project utilize any radioactive materials, including sealed sources?	No

NIOSH Program Portfolio Goals

LIST OF GOALS SELECTED:

Sector Programs

Mining

09PPMINSG4	Reduce the risk of traumatic injuries in the mining workplace.
13PPMINIG4.2	Introduce new technologies and recommended practices that will reduce accidents involving powered haulage equipment and machinery.

Cross-Sector Health Outcome Programs

Traumatic Injury

09PPTRISG4	Reduce Occupational Injuries and Deaths due to Machines and Industrial Vehicles
10PPTRIIG4b.1	Government agencies, equipment manufacturers, and industry groups will work together in a PtD effort to decrease pedestrians being struck by mobile machinery and industrial vehicles. The PtD effort will include costs and return on investment for all proposed safety controls.

10PPTRIAOG4b.1.2 Work with mining industry partners to develop cost-effective interventions for preventing injuries related to machine safety and powered haulage equipment.

Cross-Sector Other Programs

Engineering Controls

10PPENGSG3	Reduce Occupational illness and injuries by providing expert advice and consultation to our partners (government regulatory agencies, consensus standard bodies, employers, unions, health and safety professionals, etc.) in the application of engineering controls for hazard prevention.
10PPENGIG3.3	Reduce exposures in the Mining Sector with Engineering Controls

Intermediate Outcomes and Outputs

Is this project proceeding on schedule? **Yes**

Year	Complete	NIOSHTIC #	Intermediate Outcomes and Outputs
2016	**No**		**INTERMEDIATE OUTCOME: MSHA adopts NIOSH recommendations on Proximity Detection system into the proposed rule for Proximity Detection systems for mobile equipment, as evidence by MSHA referencing NIOSH research in the proposed rule**
			INTERMEDIATE OUTCOME CLASSIFICATION: Adoption/change in policies, practices, and procedures, etc.
2016	No		Journal Article: Causal factors and root causes of underground mobile equipment accidents OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2016	No		Conference Paper: Non-magnetic proximity detection technologies applicable to underground mining equipment OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2016	No		Trade Publication: Mining industry adoption of proximity detection systems OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2018	**No**		**INTERMEDIATE OUTCOME: MSHA adopts NIOSH recommendations on Proximity Detection system into the final rule for Proximity Detection systems for mobile equipment, as evidence by MSHA referencing NIOSH research in final rule**
			INTERMEDIATE OUTCOME CLASSIFICATION: Adoption/change in policies, practices, and procedures, etc.
2017	No		Conference Paper: Robustness of proximity detection systems with respect to environmental interference OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2017	No		Journal Article: Laboratory evaluation of novel proximity detection technologies OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2018	No		Journal Article: Minimum detection range for proximity detection systems on underground equipment OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2019	**No**		**INTERMEDIATE OUTCOME: Commercial vendors (such as Strata, Matrix and Joy Mining Machinery) adopt in their products, NIOSH design guidelines and methods based from project outputs.**
			INTERMEDIATE OUTCOME CLASSIFICATION: Adoption/change in policies, practices, and procedures, etc.
2018	No		NIOSH Numbered Publication: Recommended criteria for underground mobile equipment proximity detection systems OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions
2018	No		Journal Article: Training recommendations for proximity detection systems in mining OUTPUT CLASSIFICATION: Publications TARGET AUDIENCES: policymakers, industry leaders, labor unions

Narrative Information

MISSION RELEVANCE:

Describe the problems or needs and why they are important to address.

Coal mining deaths, for surface and underground mining combined, dropped from 20 in 2013 to 16 in 2014, the lowest number of coal mining deaths ever recorded annually in the United States. Of those 16, the majority (10) occurred in underground coal. Six of those occurred when the miner was either struck or pinned by mobile haulage equipment. According to 2010-2014 data from the Mine Safety and Health Administration (MSHA), there are an average of 6.2 fatal accidents per year of this type. In each of the previous five years, underground mobile haulage equipment was the source of the majority of fatalities in underground coal mining.

Identify surveillance system or other information (published reports, literature citations, etc.) used to define the occupational safety or health problem in order to conceptualize and design your project.

Surveillance data from the Mine Safety and Health Administration, along with input from stakeholders, defined the need for design guidelines to develop advanced proximity systems for mobile equipment.

Describe how the project will address the problems or needs stated above.

This project will provide guidance and information to MSHA and proximity system manufacturers to improve proximity detection systems for the protection of underground personnel from accidents and fatalities caused by underground mobile haulage equipment.

DESCRIPTION:

Describe the purpose or hypothesis of the project, including the goals/aims.

This research will develop guidelines that the industry and regulatory agencies could use in the design and implementation of proximity detection technology for mobile haulage equipment in underground coal mines. These guidelines will focus on the following design considerations: (1) detection range required to prevent an accident, (2) deceleration rates required to prevent injury to equipment operators, and (3) effectiveness of in-cab and other warnings. The newly published information developed in this project will provide an improvement to the safety of underground coal miners who operate or work near underground mobile haulage equipment. The project specific aims are:
1. How should proximity warning systems for mobile haulage equipment be designed to provide protection for underground workers while insuring they cause no additional risk of injury to the operator?
2. Are other proximity detection technologies besides electromagnetic based needed on proximity systems for mobile underground haulage equipment to provide protection? Would technologies such as sonar, radar, RFID-based and other sensor technology apply to underground mobile haulage equipment and what additional protections would these technologies provide?

Describe the project's major activities, including a time frame for completing each one.

There are five major tasks that compromise the projects anticipated research:
Task 1: Examine and validate the results and findings of the current pilot project "Applicability of Proximity Detection to Mobile Underground Coal Equipment" using virtual reality and computer simulation. Determine if previously acquired human motion capture studies contain sufficient information on escapeability for the purposes of this project. If not, it will be required to design and conduct additional human subject motion capture tests. This research will start at the beginning of FY16 and should be complete by mid-FY17. Task 2: Conduct an analysis of fatal accidents from the MSHA database involving underground mobile haulage equipment to determine what capabilities a proximity system would need to prevent the accident. This analysis will determine operational and procedural information to be included in the development of design guidelines. Completion of this task is expected in FY16. Task 3:Determine the rate at which a proximity system can cause mobile equipment to decelerate before causing risk of injury to the operator. Also determine how effective are in-cab warnings and what would be required to optimize their effectiveness. It is anticipated that this research will be complete by the end of FY17. Task 4: Analyze data collected in Tasks 2 and 3 to determine design and performance parameters of proximity detection systems on underground mobile haulage equipment. Evaluate any MSHA-approved proximity systems for this equipment in laboratory settings and through field evaluations. This task will be completed by mid-FY18. Task 5: Disseminate research findings through traditional means such as publications in conference proceedings and journals. Conduct workshops and demonstrations to promote R2P with stakeholders. Promote the adoption of advanced technology such as selective shutdown of machine functions through contracts. Intermediate outcomes will be the adoption of recommendations and developed technology by MSHA and the mining industry. The research in this task will be complete by the end of FY18.

SHORT SUMMARY:

A statement of purpose for the project.

This research will develop guidelines that the industry and regulatory agencies could use in the design and implementation of proximity detection technology for mobile haulage equipment in underground coal mines.

Identify which area(s) this project is contributing to (e.g. state specific NIOSH program, earmark, etc.)

Mining Program, Traumatic Injuries.

Provide a summary of the major outputs and intermediate outcomes.

Publications, presentations, web-based documents, workshops, and demonstrations will be the primary outputs. Intermediate outcomes will include the adoption of recommendations by MSHA and the mining industry, and the availability of new interventions.

Strategic Dissemination/Impact Evaluation Plan:

Disseminate & Transfer-What channels/means will be used to disseminate and transfer poroject outputs to target audiences(s).

NIOSH efforts to disseminate the research will include traditional means such as conference proceedings and journal articles. It is also expected that workshops and demonstrations will be given in order to achieve one-on one contact with stakeholders such as MSHA, mine equipment manufacturers, and mine operators. The project will address r2p by involving stakeholders and technical experts with project planning, execution, and assessment so that the research can be effectively translated to the workplace with new safety interventions commercialized and available to the mining industry.

Impact-How will the impact of the project's outputs be measured.

MSHA's use of resulting recommendations, equipment manufacturers adapting the interventions, and mine operations implementing the new interventions are the key measures of impact.