Collision Avoidance & Proximity Detection Systems

Cameras – Lights – Proximity Detection

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Who We Are

- PROVIX Inc. is a Canadian company specialising in the implementation of safety systems for mobile equipment operating in mining, aggregates and construction industries.
- Established in 1987.
- PROVIX is Professional Vision Enhancement, enabling the ability to see where you couldn’t before.
- Offers Professional Installation, consultation and system configuration.
- PROVIX has the ISO 9001 certification and has met the prerequisites for inclusion on approved wireless radio vendor list.
Situation

- Multiple blind spots on Heavy Equipment
- Visibility restricted in dark environments
- Environmental and Equipment noise lead to Pedestrian danger
- Hazardous areas require Vision Enhancement
- Restricted vision leads to lower productivity and unsafe conditions
Objectives

- Reduce or eliminate risks associated with heavy equipment operating in areas where pedestrians and workers may be present.
- Reduce or eliminate risk associated with heavy equipment collisions with mobile or stationary objects.
- Provide enhanced sight lines to heavy equipment operators.
- Increase Operators visibility through enhanced lighting, cameras and situational awareness.
- Implement integrated safety systems to aid in collision avoidance.
The Solution: **Enhanced Vision**

- Implement on board video cameras to reduce blind spots
- Deploy enhanced lighting for effective illumination
- Install white noise back up alarms for reversing equipment
- Provide active audio and visual alerts to warn equipment operators of the presence of other vehicles, equipment, personnel, and stationary objects.
- Utilize smart sensing systems such as radar, sonar and ultrasonic detection to enhance situational awareness.
- Establish no go zones to keep pedestrians away from mobile equipment.
- Consider RFID tags to identify workers presence to heavy equipment operators.
Solution: Increase Visibility with Cameras

- Camera systems provide operators with enhanced vision through expanded sight lines.
- Camera systems are not intended to encourage operators to drive more quickly.
- Operators who have expanded vision and heightened situational awareness do not have to reduce speed as often.
- Decreased travel and trip times, as well as safer operations are the result.
- Increased productivity with enhanced safety = a Win-Win scenario.
PROVIX Academic Collaboration

- PROVIX has collaborated with Laurentian University’s CROSH department, to have LOS (line of sight) analysis completed on a variety of types of heavy equipment.

- The purpose of the studies is to reduce operator blind spots by identifying appropriate camera positioning for specific makes/models of equipment.

- Cameras are positioned to increase sight lines and maximize the operators field of view around heavy equipment.

- Line of sight studies clearly demonstrate enhanced operator vision through strategic camera deployment.
Toro 1400 Blind Spots

Dark Blue = Blind Spots
Light Blue = Partially Obstructed View
Statistics

2014
• 41% Contact with object or equipment injuries (Including struck by rocks, crushed by stone, contact with equipment machinery)
• 11% Transportation Incidents (Majority are non-highway incidents, e.g. Fall from or struck by moving vehicle or mobile equipment)

2015
• 24% Contact with objects or equipment injuries
• 6% Transportation Incidents

2016
• 35% Contact with objects or equipment injuries
• 17% All Others (Categories expanded to include other causes such as explosions, allergens, temperature extreme and other)
Results of Camera Systems Implementation

Line of sight to ground level has been improved from values of 40m to <4m around the perimeter of the machine when the bucket is lowered.

Line of sight to a standing operator in front of the machine when operating with a full bucket have been reduced from +60m to <20m.

Line of sight to a standing operator height is excellent for the entire 1m testing boundary around the machine.
Solution: Enhanced Vision with onboard Video Cameras

- Camera systems can be tailored to meet any specification or application
- Many Variations available: PTZ (pan/tilt/zoom), 360° / Aerial View, Heated, Waterproof, On screen distance markers, Thermal Imaging, Wide Angle, arrow field of view, multiple cameras, split screen viewing, automated operation requires no user intervention, etc.
- Cameras combined with detection systems offer active notifications to operators instead of passive reliance on viewing the on-screen display.
The 360 or Aerial View camera system is relatively new technology that has increased safety around vehicles and equipment by providing a birds-eye view.

Using 4 cameras and onboard computer processor, the system takes video images from each camera and stitches them together to make a compiled image, much in the same manner as a panoramic photo.

In conjunction with the Aerial View photo, a split screen monitor displays the camera image corresponding to the direction of travel.

While not prevalent on mining equipment at this time we have successfully deployed this type of system on personnel carriers to provide a birds-eye view to the operator.
PROVIX 360/ Aerial View Camera System

Aerial View

Reverse View
PROVIX Camera Installs
PROVIX Camera Installs
Thermal Imaging Camera Systems

• The Thermal Imaging Camera System provides the operators with enhanced visual acuity in dense steam, fog and darkness, allowing them to confidently operate heavy equipment once they can see to do so.

• Thermal imaging cameras can be deployed on underground equipment to detect personnel, vehicles and other equipment.

• Anything with a heat signature will appear on-screen. If people or vehicles are detected, the operator can be alerted with both an audible alarm and a visual reference on the in cab monitor.

• We are currently equipping bulldozers with dual thermal imaging cameras in the oil sands to enable the operators to see through steam.

• The program has been so effective that it has spread from ESSO to Suncor to Syncrude and now to CNRL.
Thermal Imaging at Work in Dusty Conditions

- This video shows the thermal camera display as mounted on a front end loader operating in an open pit mine with extremely dusty conditions.

- As you watch the video you will see what the operator sees out the windshield behind the display monitor.

- The thermal camera creates a video image based on the relative temperature of anything within the field of view of the camera.
What is Proximity Detection?

• Proximity detection uses various types of technology to detect vehicles, equipment, personnel, or other stationary objects.

• Utilizes smart sensing systems such as radar, sonar and ultrasonic detection to enhance situational awareness and alert equipment operators to the presence of anything listed above.

• RFID tags can be uses to identify, locate and alert both personnel and heavy equipment operators of each others presence once in proximity to the detection system.

• Proximity detection is an integral part of an effective collision avoidance system as it’s primary goal is to ensure that heavy equipment do not come in contact with personnel.

• Proximity detection when combined with onboard cameras ensures that operators have the ability to validate what has been detected.
Proximity Detection

- Various types of proximity detection equipment are available depending on the application and the work environment.

- Radar Proximity Detection Alerts within a user definable area around operating equipment. All four faces of equipment can be outfitted with radar and will warn the operator of ANYTHING within proximity of the vehicle.
Radar

• PROVIX offers a Radar Sensor Proximity Detection system that provides a visual and audible alert to the operator when any stationary or moving object is detected.

• They detect ANYTHING - stationary and moving objects such as heavy equipment, personnel and obstacles.

• When the sensor identifies anything in the pre-detection area, it will light up with an LED light showing colours green, yellow or red, based on the distance of the object identified.

• The sensor has a programmable detection area and can be installed on any vehicle. It can be programmed to detect anything from 3-30m away, this is configured dependent on the vehicle it is being installed on.

• Works in partnership with camera systems to allow operator to detect, alert and react before accidents occur.

• Radar systems increase situational awareness and reduce accidents
PROVIX Proximity Detection Installs
RFID Proximity Detection tags

- RFID tags are assigned to personnel vehicles and equipment and stationary objects and hazards can also be tagged.

- RFID Tag readers are installed in mobile heavy equipment and will detect any tags within a predefined radius.

- RFID Tags are rechargeable and need to be recharged on a predetermined schedule. [daily] RFID tags are low power transmitters and only work effectively when within range of the detection units.

- RFID tags and detection systems are effective proximity detection safety systems, when used in conjunction with alternate safety systems such as onboard cameras.

- RFID tags offer an advantage when implemented mine wide, as they can be used for asset and personnel tracking.
What is Collision Avoidance?

- Collision Avoidance is accident prevention using various types of safety systems that have been established specifically for the purpose of reducing work place accidents.

- All of the types of systems that we have reviewed today contribute to Collision Avoidance.

- Specific types of safety systems are applicable to different vehicles, equipment and work environment.

- Various systems can be combined to establish a more effective collision avoidance program.

- The end result of any collision avoidance program is to eliminate interactions between vehicles, equipment and personnel completely.
The Solution: Enhanced Vision

- PROVIX – Now I can see!
- PROVIX – provides visibility solutions all across North America.
- PROVIX – enhances vision through the deployment of advanced camera systems.
- PROVIX – cameras can be integrated with Proximity Detection to provide a complete collision avoidance system that includes audible and visual alarms with real time video imaging.
- LED Lights aid in vision enhancement
Broadband White Noise Back-Up Alarms

SAFETY – Much Greater Safety

- **Their sound is locatable**
  The location of a broadband sound source is instantly recognisable and immediately identifiable as to location. Personnel can readily identify which vehicle or machine is or will be reversing. Conventional tonal alarms are liable to give false directional clues which leads to an inability to determine where or what the source of the alarm is.

- **Sound is localised within hazard area**
  Familiarity breeds contempt. Workers tend to ignore tonal alarms due to their proliferation and because they can be heard outside the hazard area. The sound from Broadband White Noise alarms does not travel outside the hazard area and increase safety for that reason.

- **PROVIX broadband back-up alarms have a life time guarantee**
Conclusion

All heavy equipment that is operating in areas where other vehicles, equipment and personnel are working should have at least one type of proximity detection system.

The type of proximity detection system that is best suited for a particular vehicle or type of equipment will be determined by the work environment and the application or task associated with that equipment.

Operating heavy equipment without some type of proximity detection system is an invitation to danger to your personnel.

An effective proximity detection system that may include any of the various types discussed will lead to a safer operation.

Combining proximity detection and onboard video will lead to both safer and more productive operations: a Win-Win for everyone concerned.
PROVIX In Your Operation?

Safety and remote video systems for mining operations.
Camera System Accessories

- RAM Mount
- Quick Disconnect
- Camera Guard
- Pedestal Mount
- Camera Wash
- Wireless Option
- Monitor Rock Guard
- DVR Monitor
- Remote Viewing Station
- PROVIX Remote Control System
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