INTRODUCTION

CCC’s excellence in construction is accompanied by an equivalent excellence in the preservation and enhancement of the groups Health, Safety, and Environment approach in a manner that protects and promotes the health and well-being of the individual (CCC Family) and the environment.

CCC’s HSE statistics over the past 10 years (Refer to Table below) including accident investigation outcomes, CCC noted “Heavy Machinery Accidents” contributed significantly in raising the number of Lost Time Incidents (LTI’s) and Fatalities (FAT) which deterred CCC from achieving its ultimate HSE goal of zero accidents. The number of heavy machinery accidents noticeably increased in the years of 2014 & 2015.
In order to reduce the accidents resulting from heavy equipment striking and colliding, a new technology solution was studied and tested to improve the safety related to working in the vicinity of mobile equipment. CCC has equipped some heavy equipment with an efficient technology manufactured in USA known as “Preview Radar System Devices” that assist operators in monitoring blind areas and prevent collision with machines, humans or objects while reversing.

This radar system uses pulsed microwave signal technology to detect an object in the radar beam. It consists of a radar antenna and processing electronics, an alarm display and cables. No motion of the object or vehicle is needed for detection. The alarm display indicates distance in 1-m increments using a series of LED’s. An audible alarm that changes in frequency as the distance to an object changes is generated.

The radar system is designed to monitor the rear blind area and is activated when the vehicle is in reverse. This model has no user-adjustable settings. Also the rear camera view is made available to the driver on a video monitor in the cab of the rear blind area.
System Specification

- Detection Range up to 20ft/6m, with the ability to set detection zone as low as 10ft/3m
- Connects to reverse lights for power
- Operating Temp: -40 F/ +185 F (-40 C to +85 C)
- Sensor Dimensions: 4.4”H x 10.5”W x 1.4”D
- Display Dimensions: 1.0”H x 2.3”W x 2.0”D
- Ability to customize detection zone onsite with PrecoNet Service Tool
- Built to meet rugged J1455 Specs
- Utilizes standard CAN communication protocols

Exterior: Rear Camera, Radar Sensor
Interior: Monitor connected to Rear Camera
System Highlights

Objects in blind Areas are easily detected to prevent collision and striking:

The fitted rear camera and radar sensor help the operators to better detect the objects while reversing especially in the blind spots. The picture below is an example of system detection for objects and individuals with an indication of the distance in-between. Also the area spotted in the system can substitute and dispense the use of the side mirrors as a full landscape is visible.

Combination Camera and Radar sensor:

The alarm function of the radar system also provides an audible and visual warning in case the operator approaches to close to certain objects while reversing. The function of the camera and alarm combined is to make operators more alert and easily bring their attention to the screen to observe the detected objects. It also helps them to observe the distances in between and how closely they can approach objects. The combination approved to be effective and enabled smooth operations and movement of heavy machinery.

User Friendly System:

The system overall is easy and simple to use and it doesn’t require any training to operate the devices or adjust it settings. It also activates automatically once the key is placed in the ignition.
Initial Implementation - Project Case Study

Three sets of devices were fitted on Heavy vehicles in the Project. The details are same as below

Komatsu WA470-3 Wheel Loader
Operator: (Age: 45) 19 yrs experience

Mercedes Tipper Truck 3331K/39
Operator: (Age: 43) 4 yrs experience

Caterpillar Grader 14M
Operator: (Age: 50) 26 yrs experience

The three vehicles were equipped with rear cameras, radar sensors and video screens.
Findings (1) - Project Case Study

- Increase of backing collision avoidance by reducing Blind areas
  The fitted Rear camera and Radar sensor help the operators to detect objectives while moving back through reducing the blind area of the equipment. Also while interviewed the vehicle operators, they testified that the devices help to detect objective in back. Not only testimonials but also many studies in the world verified the benefits of rear camera and sensor already.

Comparison of Rear View from Side Mirror and Rear Camera

<table>
<thead>
<tr>
<th>Rear view from Right side Mirror</th>
<th>Screen of video from rear camera view</th>
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<tbody>
<tr>
<td>Not available to scan the objectives</td>
<td>Available to scan the objectives</td>
</tr>
</tbody>
</table>
Findings (2) - Project Case Study

- Combination of Camera and Radar sensor
  - The alarm function of the system provides a warning to the driver and are a more positive method of monitoring
  - Camera system is a more passive technology, much like mirrors. Using the two devices in combination on the same truck may have many advantages. The camera system provides an actual view of the blind area near the heavy vehicle and provides a method to check the source of any alarms. At the same time, the sensor provides an alarm that prompts the driver to check the video monitor so that the potential for a collision does not go unnoticed.

- User Friendly
  - When the engine of the vehicle turns on, the system will work automatically which means any operator can use the device easily.
Findings (3) - Project Case Study

- Limitation of the monitor mounting position in cab
  
  Even the audible alarm and rear screen are provided, the avoidance of incident depends on the operator himself. If the operator does not react in proper time, incident can’t be prevented. He shall respond properly to avoid any backing incident. To increase the recognition of an objective, the monitor should be mounted in location easy to see not only monitor screen but also side mirrors.

- Some monitors are installed on dashboard of the equipment where the operators have to lower their heads. It is recommended to add various types of the mount which can provide the monitor on user-friendly location in cab.

Monitor on dashboard
Operator has to nod down to see the monitor
Findings (4) - Project Case Study

- Low contrast and brightness of the monitor
  - Due to the distinct characteristics of the area, proper contrast and brightness are required for high visibility of the monitor is required. Current monitor is not providing clear vision to operator even a hood is installed on the monitor due to dazzling sunshine.

- No Auto Video recording function
  - Replaced by CCC IVMS system (Record Location, Speed, Date/time, break and harsh brake, etc.)

- Limitation of the Radar system
  - The system is not Fool-Proof Engineering Design. It means the system does not prevent backing incident by itself. Obviously the system helps the operator to recognize the objectives in rear area.
ACHIEVEMENTS

It’s worth mentioning that CCC has achieved “Zero Heavy Machinery Accidents” in the year 2016 after the use of the Radar System. The Radar system in addition to numerous HSE practices have assisted CCC to overcome the increase in accidents resulting from collisions with machinery. The use of this technology has noticeably improved HSE performance.
CONCLUSION

The Preview Radar System has significantly proven its effectiveness through “Safe Interface” among objects and individuals in the workplace. It has also assisted operators to observe object in blind spots and thus facilitates their mission in safely operating heavy machinery.

CCC will proceed with installing the system for all heavy machinery and equipment in different areas and projects as it has eliminated the risk of colliding and striking accidents on a project that recorded two serious accidents due to heavy machinery movements. The system has achieved the desired goals which were:

- Prevent Property Damage resulting from colliding with objects while reversing.
- Improve the Safe Machine to Machine Interface.
- Improve the Safety of Man-Machine Interface