

# Cat<sup>®</sup> Detect

## for Surface Mining Applications



# Enhance Your Site's Safety through Increased Operator Awareness

*Configurable to suit your operation's needs, Cat® MineStar™ System is the industry's broadest suite of integrated mine operations and mobile equipment management technologies.*

*Detect enhances safety at your operation by helping increase operator awareness. It includes a range of capabilities designed to assist the operator with areas of limited visibility.*

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**Operators in the cabs of large mining equipment often cannot see if another machine or vehicle is too close for safe operation. Detect helps alleviate this potential safety hazard and can also be configured to provide valuable information about site conditions and other assets working in the area.**

# Detect Overview

Meet your business needs with a scalable system.



At the most basic level, Detect enhances your operators' awareness of the immediate environment around their equipment through a simple camera and touch screen display system, called Vision. This system is scalable, allowing radars to be added that provide alerts to operators when objects have entered critical areas near the machine. The system allows a quick visual check of these areas whenever needed by the operator.

Additional capability packages enable Detect to alert the operator to pre-programmed avoidance zones, known site hazards and assets. Positional information from Detect can also provide valuable feedback to central office systems and mine site managers.

Object Detection is a scalable system that combines cameras, radars and an in-cab display. With both audible and visual indications of a detected object, the system helps prevent collisions, damage to machines and work area injuries caused by limited awareness.

Proximity Awareness provides added protection by utilizing medium precision GNSS receivers to warn operators of nearby equipment and light vehicles whenever the machine is in operation. The on-board system, coupled with the office software, enables mine management to recognize hazards, define avoidance and speed limit zones, and capture events for future playback in the office.



# Object Detection Overview

Enhanced visibility around large equipment.



Object Detection aids awareness around large equipment and can help prevent contact between machines and other objects through the use of camera and radar technology. It's available for certain models of Cat Off-Highway Trucks, large and medium Wheel Loaders and Wheel Dozers and large Motor Graders.

The system is configured with zones around the equipment and objects in those zones trigger various levels of alarms. The radar information, processed by the on-board display, provides visual confirmation of detected objects, enabling operators to make informed decisions when moving large machines. The cameras supplement the radar alerts display the appropriate view based on detection zone.

Caterpillar continues to develop Object Detection kits for additional models of Cat machines along with equipment from other manufacturers. Your Cat dealer can provide you with a list of specific machine models and configurations.

This technology can be an integral part of a site's safe operation. The system is used in various mining applications to alert the operator of large objects near the machine however, it does not replace the basic safety practices at your site.

Radar wash is an optional feature available on all field and factory installed large off-highway trucks, small off-highway trucks and non Cat trucks with Object Detection systems. It provides customers with a simple and effective method for cleaning radars and cameras without leaving the cab. The feature is highly configurable and can be installed on the front and/or rear of the truck as well as one or both sides.



# Object Detection Features and Benefits

## Enhancing site safety.

Object Detection is designed for specific machine configuration to optimize radar and camera coverage. The system is calibrated to provide appropriate fields of view and range. Object Detection couples a simple, intuitive interface with both audible and visual warnings that enable operators to make informed decisions when moving machines. It alerts the the operator when an object is in close proximity so they can decide if action needs to be taken to avoid it.

- Cameras allow the operator to quickly identify objects detected by radar without leaving the cab of the machine.
- Configurable for continuous or discrete alarming plus distance or speed-based standby modes providing flexibility based on site requirements.
- Display automatically switches to the camera view where the object is located when the machine is in gear and moving toward the detected object.
- Minimizes nuisance audible alarms enabling the operator to focus on the task at hand.
- Configurable for one, two or four sides of the machine depending on the model to provide optimal coverage.
- System uses visual and audible means to alert operator.
- Multiple warning levels help operator assess distance to detected object.
- Camera view occupies 90% of the main screen maximizing the viewing range.
- Camera views available at all times enhancing awareness around equipment.
- Brightness level is stored and returns to the last setting when day or night mode is activated.
- Night mode operation sets screen brightness to the lowest setting.
- Robust components designed and tested to work in off-road applications.
- Off-board infrastructure is not required.
- On-board diagnostics monitor system health and alert operator to any issues.



# Object Detection Functionality

A simple system to protect your operators and equipment.



Object Detection is powered on during machine start-up and locates objects in close proximity to the machine at initial movement and during slow speed travel. When the system is active and the machine is in gear moving toward the detected object, the display will automatically switch to the camera view where the object is located. Depending on proximity, a visual alert will be displayed to the operator along with an audible alarm, increasing in frequency as the machine moves closer to the object. In the event of multiple detections, logic is built into the system to determine which detection is the most critical in priority.

# Object Detection Configuration

Specific machine configuration for the best coverage.



Object Detection is configurable for alarming and radar standby modes providing flexibility based on site requirements. Continuous mode generates alarms for detections further from the machine and more frequently while discrete mode generates alarms for detections closer to the machine and less frequently. Radars are active based on two configurable modes, speed or distance. Distance-based mode activates system standby after traveling a predetermined distance, while speed-based mode prompts system standby when the machine exceeds a defined speed limit. Caterpillar recommends that the settings for each site are consistent across all machines in order to avoid operator confusion. Icons on the display indicate whether the system is active or standby mode. When the radars are in standby, detections will not occur but the cameras remain active.

## Camera and Radar Configurations

Large trucks are equipped with eight radars, four cameras and an in-cab display. Two configurations are available for small off-highway trucks, including complete coverage with radars and cameras on each side, or only front and rear coverage. For wheel loaders, wheel dozers and motor graders, Object Detection is a rear only system consisting of a single camera and one to three radars depending on the machine model. The radars will only be active while the machine is in reverse.



# Proximity Awareness Overview

Adds GNSS for path of travel, avoidance zone and speed limit warnings.



Proximity Awareness is a GNSS based system that tracks machines and light vehicles, allowing operators to view other machine locations and provide proximity based alarming.

On-board, the in-cab display shows a mine map indicating the machine's position in relation to others nearby. Zones are displayed on the map and operators are notified when they enter restricted areas or exceed specified speed limits. The display shows when two or more machines' projected paths of travel intersect providing warning of a potential collision.

When used in conjunction with Object Detection, Proximity Awareness provides added protection. While Object Detection alerts the equipment operator if an object is detected around the machine during start up or slow speed operation, Proximity Awareness is active whenever the machine is in operation providing complete operational coverage.

Proximity Awareness and Fleet share common on-board components when using mid precision GNSS receivers. This minimizes your hardware and installation costs by only needing to add software to enable the other system.

# Proximity Awareness Features and Benefits

Protect your operators by providing real-time information.

With better site awareness, operators are able to run their equipment with more confidence. Also, cycle times can improve when operators know that loading and dump areas are clear as they get ready to pull away, allowing them to work more smoothly and efficiently.

Features include:

- Allows machine operators to see locations of nearby machines in a map view on the in-cab display.
- Ability to define machine body and avoidance zones creating a boundary around the machine used for warnings when other machines are too close.
- Provides several types of configurable zones, such as hazard, avoidance and speed limits visible in the office and on-board to alert operators of caution or potentially dangerous areas around the mine site. All zones can be specific to machine class.
- Allows map creation manually through the office software or importing .dxf and .tif files.
- Ability to define parameters and provides visual and audible alarms when machines come in close proximity or projected paths of travel intersect to warn the operator of potential collisions.
- Allows operators to mark hazards in the mine, warning others to avoid the area or proceed with caution. Hazards can be converted into zones in the office and managed accordingly.
- Mayday notifications can be sent from the machine during non-critical situations where the operator requires assistance from office personnel. Due to the nature of wireless communications, the mayday message is not ensured to reach the office in a timely manner.
- Text messages can be sent to operators based on zone infractions providing vital information or corrective actions that need to occur.
- Office users can personalize screen layouts to view information that is most important to them.
- Incident Management feature provides office notification, tracking, capture and viewing of various incidents.



## Proximity Awareness Functionality

Configure the system based on your site and fleet needs.



### Office Functionality

The office application provides system administrative functionality such as the creation and maintenance of operators, machines, zones, hazards, and speed limits. Users can create personal desktop views to see information that is specific to their job. Incident Management captures important events that can be played back, used for training or incident reconstruction.

# Detect On-Board Components

Rugged components are designed for harsh mining environments.

## Display

The high resolution display provides operators with vital information at a glance, enabling the user to switch between screens and configure, monitor or view system data. The touch screen display is designed for reliable performance in extreme operating conditions. Built to withstand shock and vibration, it is also sealed against dust and moisture. A single display is required for Detect and can also be used for Fleet.

## Cameras

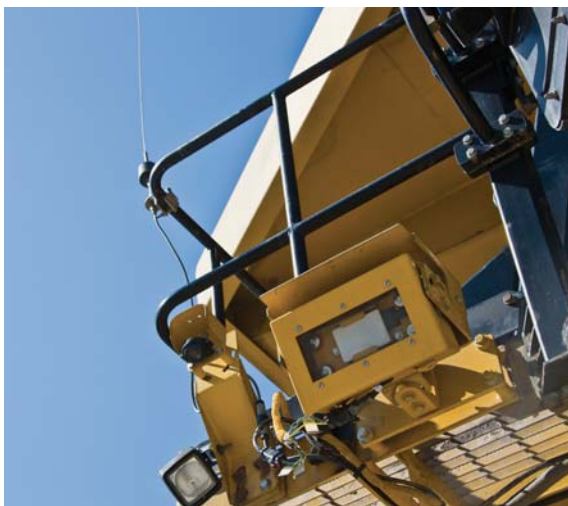
Camera views on one, two or four sides of the machine aid in object identification. The operator can choose to toggle camera views on systems with more than one camera. When the machine is in gear and moving toward the detected object, the display will automatically switch to the camera view where the object is located. Cameras are required for Object Detection and optional for Proximity Awareness.

## GNSS Receiver

The medium precision GNSS receiver provides sub-meter accuracy while continuing to meet Caterpillar's standards for rugged applications. The receiver supports the newest GPS and GLONASS signals, faster system initialization times, better tracking and accuracy characteristics, and leverages increased satellite availability for mines with deep pits or locations in the far northern and southern hemispheres. The same medium precision GNSS receiver can be used for both Fleet and Proximity Awareness reducing hardware component cost and installation.

## Communications Radio

A ruggedized Ethernet port on the touch screen display is available for easy connection to third party radios. Third party radios will transmit and receive real-time data, send position data to the office, and position data, configuration files, zones and messages. An approved radio network is required for Proximity Awareness and Fleet.



## Radars

Radars provide vital range information to the Object Detection system. Using medium range radars, the Ultra Wide Band 24 GHz carrier frequency is ideal for a multitude of applications. The robust radars are weather resistant and have been configured on each machine model to provide optimal coverage. Radars are required for Object Detection and optional for Proximity Awareness.



## Support

Unmatched global support.

For more than 25 years Caterpillar has been providing electronic components and systems for your mining and earthmoving applications – real world technology solutions that enhance the value of Cat products, making customers more productive and profitable. Your Cat dealer is ready to assist you with knowledgeable support and technology systems to enhance job site safety.

## Touch Screen Display

Display screen	165 mm (6.5 in) LCD display, 640 × 480 transfective color VGA	
Electrical input	9 to 32V DC	
Operator switches	Four illuminated push buttons with tactile feedback one 4-way rocker switch	
Video input	Four video inputs, support NTSC video inputs	
Audible alarm	Integral audible alarm located on the front face. Two outputs for external alarm.	
Operating temperature	-20° to 70° C	-4° to 158° F
Storage temperature	-40° to 85° C	-40° to 185° F
Humidity	100%	
Height	157 mm	6.18 in
Width	229 mm	9.02 in
Depth	80 mm	3.15 in
Weight	1.81 kg	3.99 lb

## Object Detection Radar

Type	Ultra Wide Band (UWB) Continuous Wave	
Carrier wave frequency	24 GHz	
Range (maximum)	20 m	65.6 ft
Voltage	9 to 16V regulated	
Weight	190 grams	6.7 oz
Dimensions	95 mm L × 63 mm H × 21 mm D	3.74" L × 2.48" H × 0.81" D
Sealing	± 35 kPa	± 5 psi
Operating temperature	-40° to 85° C	-40° to 185° F

## Vision and Object Detection Camera

Type	24V NTSC 115 degrees	
Active pixels	640 H × 480 V	
Light sensitivity	<2.5 lux	
Ingress protection	IP69k	
Weight	0.21 kg	0.46 lb
Dimensions	95 mm L × 63 mm H × 21 mm D	3.74" L × 2.48" H × 0.81" D
Operating temperature	-40° to 85° C	-40° to 185° F

## Proximity Awareness GNSS Receiver

Accuracy	< 1 m*	
Connector	One 12-pin Deutsch, one antenna TNC	
Electrical input	9 to 32V DC 120 mA @ 24V DC	
Operating temperature	-40° to 70° C	-40° to 158° F
Storage temperature	-50° to 85° C	-58° to 185° F
Humidity	100%	
Height	187 mm	7.36 in
Width	86 mm	3.38 in
Depth	57 mm	2.24 in
Weight	0.8 kg	1.76 lb

\*With base station corrections.





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