CATERPILLAR VISITORS CENTER

PEORIA, ILLINOIS

Educator Resource Guide

---------- 2014 ----------

CATERPILLAR VISITORS CENTER
PEORIA, ILLINOIS

Illinois Common Core Standards College and Career Readiness Skills
Self-Guided Tour for Teachers and Chaperones

12 English/Language Arts Standards Met

The Caterpillar Visitors Center is committed to energizing students in the areas of Science, Technology, Engineering and Mathematics. Below you will find curriculum that is aligned to the Illinois Common Core Standards.

- Common Core Standards are addressed through self-guided tours of the Caterpillar Visitors Center.
- Caterpillar Visitors Center hosts are available throughout the galleries to answer questions and help guide students and chaperones.
- Standard fulfillment may be reached by visiting multiple galleries.
- Teachers are encouraged to ask students to bring a pencil and paper or print an activity booklet for students, prior to visit.

CCS.K-12.SL Comprehension and Collaboration

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively and orally.
3. Evaluate the speaker's point of view, reasoning and use of evidence and rhetoric.

CCS.K-12.SL Presentation of Knowledge and Ideas

4. Present information, findings and supporting evidence such that listeners can follow the line of reasoning and the organization, development and style are appropriate to task, purpose and audience.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

CCS.K-12.L Vocabulary Acquisition and Use

3. Apply knowledge of language to understand how language functions in different contexts to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
5. Demonstrate understanding of word relationships and nuances in word meanings.
6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

CCS.K-12.R Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

CCS.K-12.R Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

CCS.K-12.R Range of Reading and Level of Text Complexity

10. Read and comprehend complex literary and informational texts independently and proficiently.

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Please use this resource guide to plan your visit. There are several interactive activities for students, complete with questions to engage students throughout your self-guided tour.

---------- Lobby ----------

CRITICAL THINKING - The globe structure in the center of the lobby holds the Caterpillar time capsule. Ask students what kind of items they think may be in the time capsule and what they would place in a time capsule of their own.

STUDENT INTERACTIVE – Ask students to identify all the continents located on the globe.

- This building has the LEED Gold status for its sustainable features. Those include 6 solar panels located on the roof of the parking deck next to us, which may provide up to 75% of the energy for this building, on a sunny day. That, paired with the on-site rainwater retention and high efficiency irrigation for the drought-tolerant native plants, will reduce our greenhouse gas emissions by about 80 metric tons per year. Will all of those features, the Caterpillar Visitors Center uses almost 35% less energy than a typical 50,000 ft² building.

CRITICAL THINKING – What are some of the benefits to these energy-efficient efforts?

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---------- 797F Theater ----------

- Students will begin their tour with a 10-minute video in the bed of a Cat® 797F Mining Truck. This truck is the world's largest utility truck, standing more than 2 stories tall and carrying up to 400 tons of materials.

CRITICAL THINKING – Have students discuss the different job sites they saw in the theater.

- ***What types of goods or materials are produced from the various work sites?***
- ***Why is it important for operators to have reliable equipment?***

---------- Heritage Gallery ----------

- Caterpillar got its start in the late 1890s from two separate but similar organizations; Holt Manufacturing Company and Best Tractor Company. The two organizations joined in 1925 to make Caterpillar Inc., as we know today.
- Over the past 85 years, Caterpillar has grown from a company specializing in track-type tractors to one that includes track-type tractors, engine systems, electric power and rail systems – to name a few.
- Caterpillar came to Peoria in 1910 from San Leandro, California for several reasons.
  - There was a greater steel supply in the Midwest.
  - They could ship to and service both sides of the United States in a more efficient and cost-effective way.

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STUDENT INTERACTIVE - D8 Tractor Simulator – Have students take turns pulling the levers on the D8 tractor model.

- This is a 1930s tractor used mostly for agricultural and road work purposes. It weighed 33,000 lbs. and moved at 3-4 miles an hour.
- Operators would spend up to 10 hours a day on this tractor, plowing and planting in their fields.

CRITICAL THINKING – What differences can you identify between this 1930s model and current track-type tractor models? Discuss improvements in technology. Compare to the technology in the family car.

- **Major Projects –** This wall depicts many of the major global projects that Caterpillar equipment and power systems have been a part of.

STUDENT INTERACTIVE – Have students select a major project displayed on the wall to research at home or school and present to the class later in the week.

---------- Product Development ----------

- Over the years, Caterpillar has served as an innovator across many of the industries we serve.
- Caterpillar uses a variety of technologies to develop the highest quality of products for our dealer and customers. Caterpillar first began using virtual technology in the 1970s. Virtual reality technology is used for all stages of product development, from the initial product design to the layout of the assembly line in the production facility.

STUDENT INTERACTIVE - Ergonomics - Have students take turns testing out the joysticks and the ergonomic chair.

- Caterpillar operators spend their days working from the cab of Caterpillar equipment, rather than an office. It is important that those operators are comfortable in their seats for several reasons:

    - **Reduced fatigue –** In order for meet daily goals, operators must be alert. An ergonomic chair and comfortable hand gears are essential in maintaining a high level of accuracy.
    - **Safety**- When operators are comfortable in their seats, there is reduced risk of accidents or personal injury.
    - **Productivity** – Operators are more efficient and productive when they have a comfortable work environment.

STUDENT INTERACTIVE - 3D Glasses – Have students take turns looking through the 3D glasses to show the Immersive visualization (3D) technology that is used in new product development at Caterpillar.

- Caterpillar has used computer simulation to design machines since the 1970s and was an early adapter of Immersive Visualization (virtual reality) technology in the 1990s.
- Caterpillar uses immersive visualization to evaluate product designs for safety, serviceability, quality and manufacturability.
- Immersive visualization allows human operators, engineers and technicians to interact with a life-sized virtual product model.
- The user is surrounded with projection screens and his/her head and hand are precisely tracked as they interact in a virtual environment with a machine, subsystem, facility or assembly line.

STUDENT INTERACTIVE - Design Your Own Cat Interactive – Have students take turns designing their own Cat machine on the interactive touch-screens.

- As students build their machine, they will see many of the applications that are available for dealers and customers, to ensure that they have a machine that will work on their job site.
- Students can then Email their machine design to their Email account (if applicable).

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---------- Caterpillar Production Systems ----------

- Caterpillar has more than 23,000 suppliers in more than 90 countries.
- The Caterpillar Production System (CPS) continuously improves processes through waste elimination. By making CPS part of how business is done, Caterpillar delivers superior value to customers, shareholders and employees.

- *Caterpillar Robotics and Automation* - Caterpillar was one of the first companies in the United States to use an industrial robot for manufacturing in the 1970s.
- Today, there are a wide range of robots in use, primarily in four areas**: material handling, assembly, arc welding and painting**. The speed, reliability and efficiency that industrial robots provide allow Caterpillar to improve safety, increase productivity and quality while reducing costs.

CRITICAL THINKING – Ask students what kinds of skills they think it would take to operate these robotic systems? Why do we use robots? (Have them list back the main reasons)

STUDENT INTERACTIVE - Time-lapse videos – Invite students to watch one of the 4 time-lapse assembly videos. Videos note the product as well as the manufacturing location.

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---------- Caterpillar People at Work ----------

- Attracting and developing the best team possible enables Caterpillar to maintain its position as an industry leader and serve its customers in diverse environmental, political and cultural landscapes.

STUDENT INTERACTIVE - Invite students to look through the careers listed in the kiosks while discussing students' career interests. Find people/positions that match their interest and using the map image on the kiosk, ask students to find the listed location on the global map carpet. Students can see more specific job titles on the gray wall, which lists more than 1,000 job titles at Caterpillar.

---------- Power Systems ----------

- As you enter the Power Systems gallery, please note that the engine mural where you enter is a true-to-size image of a MaK engine. These engines are typically found in the largest marine vessels.
- Caterpillar is an industry leader in the following power systems:
    - Industrial Engines and Power Solutions
    - Railway Solutions
    - Marine Power Systems
    - Gas Turbine Technology
    - Oil and Gas Power Solutions
    - Global Electric Power Systems

STUDENT INTERACTIVE – Global Electric Power Systems – Invite students to press the green button on the Global Electric Power Systems and watch how the backup power generation turns on.

- All of our dealers take on the responsibility of making backup power generation plans with their local communities in case of a power outage. When the green button is pressed, a mass power outage is simulated. Note that the hospital power remains on while the other buildings regain power in order of importance. Ask students what they think about the order in which the buildings turn on. Why would the hospital regain power before the soccer field?

CRITICAL THINKING - Ask students if they have ever lost power at home. Do they know where flashlights are located in their house? What can they do to pass the time?

Tier 4 Technology

Caterpillar equips every Tier 4 Interim/Stage IIIB engine with ACERT™ technology with an ideal combination of electronic, fuel, air and aftertreatment components, based on engine size, the type of application and the geographic location in which it will work. Applying technologies systematically and strategically optimizes them to meet our customers' high expectations for productivity, fuel efficiency, reliability and service life. The right technology fine-tuned for the right application results in:

- **IMPROVED FUEL EFFICIENCY** up to 5 percent improvement in fuel efficiency
- **POWER AND PERFORMANCE** integrated design boosts power and performance across applications
- **RELIABILITY** through commonality and simplicity of design
- **MAXIMIZED UPTIME AND REDUCED COST** with world-class support from the Cat dealer network
- **LONG LIFE** Cat durability and long life to overhaul
- **MINIMIZED IMPACT** of service and maintenance on operating costs
- **SMOOTH TRANSITION TO TIER 4 FINAL** design and modular aftertreatment pave the way for a smooth transition to Tier 4 Final/Stage IV solution. No additional space required.
- **REDUCED EMISSIONS** up to 90 percent reduction in particulate matter (PM) and 50 percent reduction in oxides of nitrogen (NOx)

Aftertreatment Technologies

To meet Tier 4 interim/Stage IIIB emissions standards and beyond, Cat aftertreatment components have been designed to match application needs.

Cat aftertreatment components include:

- **Diesel Oxidation Catalyst (DOC)**
  The DOC uses a chemical process to transform pollutants in the exhaust stream into less harmful components.

- **Diesel Particulate Filter (DPF)**
  A DPF traps additional particulate matter that's carried in the exhaust stream, preventing it from being released into the atmosphere.
- **Passive Regeneration System (C4.4 ACERT, C6.6 ACERT**)
  All Cat Tier 4 Interim/Stage IIIB engines use a passive regeneration system that continually regenerates at a slow rate, during normal machine operation, using the heat from the engine's exhaust gas.
- **Cat Regeneration System (C7.1 ACERT –C18 ACERT**
  The Cat Regeneration System (CRS), is an active regeneration system used in engines rated130–560 bkW (175–750 bhp) when supplemental regeneration is needed. CRS elevates exhaust gas temperatures to promote oxidation and burn off soot in the DPF.

---------- Dealer Network ----------

STUDENT INTERACTIVE – Have students sit and watch the Cat dealer video. Caterpillar has 53 dealers in the United States and more than 180 dealers world-wide.

- Discuss with students the places noted in the video.
- Review the services depicted in the video – engines, power generation and equipment.

STUDENT INTERACTIVE - Global Dealer Locater – Show students how many Cat dealerships and service centers there are around the world.

- Double-tap with one finger to zoom in on an area.
- Tap on the yellow flag to reveal the name and location of the Cat dealer.
- Tap "Reset" in the upper right corner to reset the map.

<u>Cat Certified Rebuild/Cat Reman & Components</u>

- Caterpillar provides a unique service to customers that enable them to take an end-of-life piece of equipment and submit it for a **Cat Certified Rebuild** which is basically the complete rebuild of the machine. After its entire disassembly, it is rebuilt according to the quality standards of CCR. Through the CCR program, customers receive a renewed product at a fraction of the cost of the new machine.

- The CCR process takes 6 to 12 weeks to complete. The repair requires the replacement of and reconditioning of approximately 7,000 parts. Also, thorough inspections are performed to restore every component to pristine condition. Each machine is completely repainted and receives new graphics, including a new CCR product identification number that entitles customers to a like-new warranty.
- Caterpillar designs and builds products for more than one service life. **Remanufacturing** is the process of returning end-of-life products to same-as-when-new condition in a manufacturing environment.
- Cat Reman parts are remanufactured to strict quality standards and carry a same-as-new Cat parts warranty. Our components have proven themselves in demanding applications delivering the reliability, performance and long-service life equal to new Cat parts.

CRITICAL THINKING – Ask students to name benefits of these two programs offered by Cat. Ask them to think about items they/their families own that have a warranty (video game consoles, TVs, vehicles)

---------- Caterpillar Jobsite Theater ----------

- Students can choose from 6 videos that showcase more about Caterpillar's history, technology and the services we provide our dealers and customers. Videos are controlled by a touch-screen panel on the back wall of the theater.
  - Caterpillar Brand Heritage
  - Product Link™
  - Accugrade™
  - Cat® Grade Control
  - Around the World, Around the Clock
  - Cat Construction Rocks

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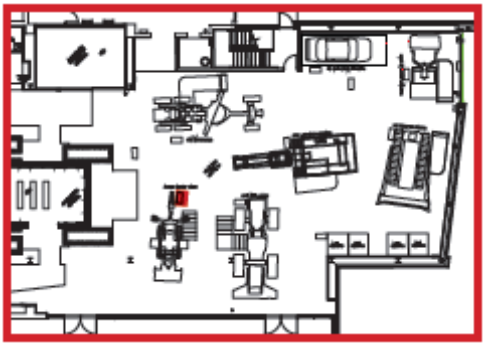
---------- Cat Product Floor ----------

- There are 5 pieces of Cat equipment on the product floor for students to explore and can even sit in the cab! We also have Jeff Burton's NASCAR on display. Please instruct students to walk in the product floor area and warn them against climbing anywhere other than the designated staircases leading up to the cab of the machine. Please allow one student in the cab of a machine at one time. There are gallery hosts to help children up and down the stairs.
- We suggest chaperones keep their students in groups and allow them to take turns sitting in the cab of each piece of equipment.

420F IT Backhoe Loader – the 420F Backhoe loader is typically found in residential and commercial work, highway and infrastructure jobs and larger landscape work.



- The machine's backhoe quick coupler allows the operator to easily change from bucket to compactor, auger or hammer for expanded versatility. This machine is typically used in the handling of heavy construction material loads, trenching, compacting, sweeping and truck loading.
- The 420F meets U.S. EPA Tier 4 Interim/EU Stage IIIB emission standards.

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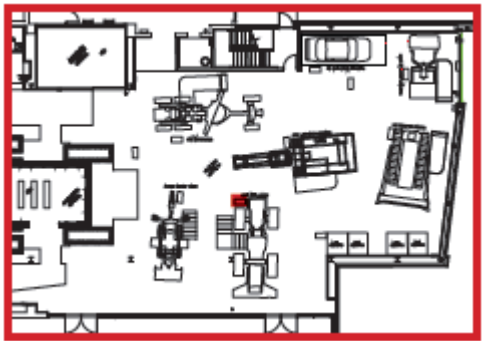
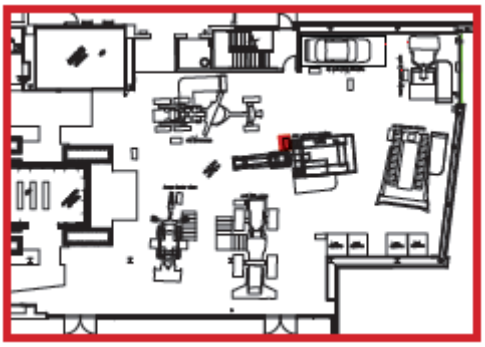
966K Wheel Loader – The 966K Wheel Loader was designed to improve performance and productivity. From truck loading and worksite clearing to logging, the Cat® 966K Wheel Loader is designed for a large number of applications.



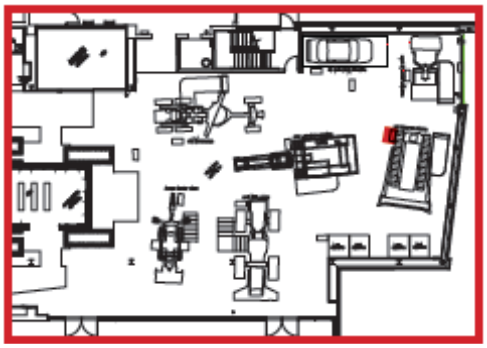
- The 966K has been integrated as a system; from the linkage and work tool carrying the payload, to the engine, transmission and torque converter moving the machine, the system has been optimized to achieve the lowest cost per ton.
- Unmatched, revolutionary world-class cab creates a comfortable, efficient, safe and productive operator environment. The 966K is better built to meet customer needs.

318E Hydraulic Excavator – Since its introduction in the 1990s, the 300 Series family of excavators has become the industry standard for production and performance. The Cat® 318E Hydraulic Excavator offers power and versatility. It delivers more lift, breakout force and production with larger bucket options than a 16-ton machine.



- The 318E is a purpose-built machine that is ideal for customers seeking a fuel-efficient, easy-to-transport excavator capable of taking on many common utility applications.
- Its multiple boom, stick, counterweight and work tool offerings allow for precise and efficient digging, loading, hammering, cutting and lifting capabilities.
- The 320E meets U.S. EPA Tier 4 Interim/EU Stage IIIB emission standards.

D6T Track-Type Tractor - The Cat® D6T has earned a reputation for best-in-class versatility, productivity and resale value. Because it excels across a wide range of jobs, customers choose the D6T for everything from dozing and ripping to scraper work and finish grading. The versatile D6T is a top choice for land clearing, highway and road construction, building oil/gas/wind farm pads and working landfills.



- The D6T meets U.S. EPA Tier 4 Interim/EU Stage IIIB emission standards.

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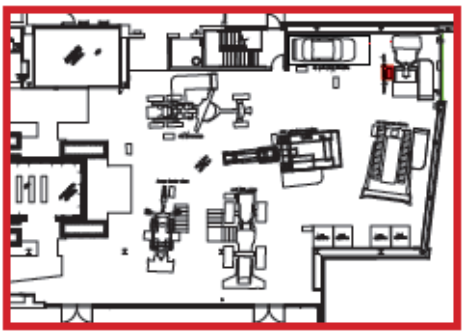
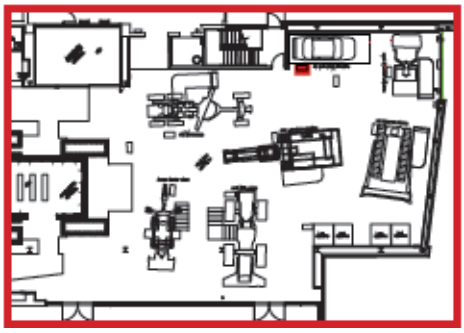


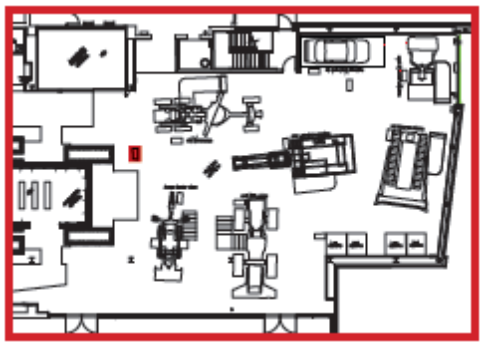
CT660 Vocational Truck – The Cat® CT660 Vocational Truck is the first in a full line of vocational trucks built for a wide array of applications. This rugged Class 8 truck redefines heavy-duty while delivering power, performance and productivity.

- Loaded with features and options for the toughest jobs, the CT660 is the ideal truck for applications such as concrete mixers, dump trucks, water trucks, waste carriers or heavy haulers.
- Designed with extensive customer input, it is a natural extension of the rugged Cat product line and is built for unparalleled driver satisfaction, maximum payloads, unprecedented uptime and low cost of ownership.
- The CT660 meets EPS 2010 emission standards.



Chevrolet Impala Race Car – In 1993, Caterpillar entered the world of NASCAR racing as an associate sponsor in the Sprint Cup Series. Today, Caterpillar is the primary sponsor of the No. 31 car, driven by Jeff Burton.

- Since the early days of NASCAR, Cat machines have aided in mining and necessary materials for building the cars, as well as participated in the paving, construction, maintenance and renovation of NASCAR tracks.
- As a sponsor, Caterpillar has won races like the Daytona 500, while also providing the on-site power for NASCAR TV broadcasts through Cat Entertainment Services.
- The top speed of this car is 200mph or 322 kph.



797F Mining Truck – Standing 5 stories tall with the body raised, the 797F Mining Truck is the largest ultra-class mechanical drive truck in the world.

- Manufactured in Decatur, IL, this truck leaves the factory on 13 separate trucks for delivery and assembly on the jobsite. The tires and bed of the truck are shipped separately to the jobsite.
- This truck is primarily used for hauling materials such as copper, coal, iron ore, gold, oil sand and overburden, the 797F is matched with the advanced engine technology of the Cat C175-20 that contributes fewer emissions to the environment while maintaining fuel efficiency and horsepower.
- It takes 25 gallons of Cat Yellow paint to cover this truck.
- The 797F body has enough volume to place 19 Honda CRVs plus 1 SMART Car inside it.
- The 797F meets U.S. EPA Tier 2 emission standards.

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---------- Cat Simulators ----------

- Investing in Cat equipment pays even greater dividends when the equipment is put to skillful and safe use. Virtual simulators, as a part of an integrated operator training program, enable operators to practice without risk to themselves of their equipment.
    - Simulators use no fuel, save wear and tear on machines and provide a safe environment to learn the basics of equipment operation.

STUDENT INTERACTIVE – Have students take turns on the excavator and bulldozer simulator. Instruction on how to operate the simulator will play and the simulation will begin by pressing the horn.

*****The excavator simulator is handicap accessible.***

---------- Future Theater ----------

Caterpillar consistently improves the way the world works, while focusing on the potential of the environment in which Caterpillar customers operate. Partnering with industry, government and academic institutions allows Caterpillar engineers to leverage expertise, increase the speed of progress and look ahead to the possibilities of new ideas and continuous development of the planet.

Autonomy
Combining the Fleet, Terrain, Detect and Health capabilities of Cat® MineStar™System, Command enables you to implement remote control, semi-autonomous or fully autonomous mining equipment systems—offering unprecedented improvements in operator safety, equipment availability and site productivity.

- **Command for drilling** enables fully autonomous drilling to enhance safety, increase drill pattern accuracy and improve the overall efficiency of drilling operations. The system executes drill plans more safely, keeping operators out of the pit and away from areas where explosives are being used.

- A fully autonomous system, **Command for hauling** takes advantage of the most sophisticated perception and on-board intelligence technologies available, enabling Cat trucks to work safely and productively without human operators in the cab.

- A remote control system, **Command for dozing** is available for Cat D10T and D11T Track-Type Tractors. Mining applications include stockpile feeding, leach pad construction, high wall and edge operation. An over-the-shoulder line-of-sight operator console enables control of the machine from a safe distance away from the working area.

- A semi-autonomous system, **Command for underground** automates the tramming function of Cat Load Haul Dump (LHD) machines. The operator has the ability to control the machine from an office or remote location away from the hazards of the underground mine. One or more machines can be controlled at once, enhancing operator safety and optimizing production between multiple machines.

CRITICAL THINKING – Ask students to list reasons why Caterpillar Mining is moving towards autonomy. What remote control or autonomous objects do have they worked with?

---------- Caterpillar Foundation ----------

Caterpillar supports the philanthropic efforts of the Caterpillar Foundation. Founded in 1952, the Foundation has contributed more than $500 million to help make sustainable progress possible around the world by providing program support in the areas of environmental sustainability, education, basic human needs and disaster relief.

STUDENT INTERACTIVE – Ask students to name causes they think they Cat Foundation would support. Use the photos and captions to discuss areas that could benefit from the monetary donations Caterpillar makes.