UNITED STATES MARINE CORPS
ENGINEER EQUIPMENT INSTRUCTION COMPANY
MARINE CORPS DETACHMENT
686 MINNESOTA AVE
FORT LEONARD WOOD, MISSOURI 65473-5850

LESSON PLAN

GCS900 GRADE CONTROL SYSTEM

NCOO-B02

ENGINEER EQUIPMENT OPERATOR NCO

A16ACX1

REVISED 10/30/2013

APPROVED BY _____ **DATE** _____

INTRODUCTION **(15 MIN)**

(ON SLIDE # 1)

1. **GAIN ATTENTION:** As a Heavy Equipment Operators there will be times where you will be required to perform blade operations, requiring very accurate and precise end states. The purpose of the Marine Corps Grade Control System (GCS900) is to achieve a quick and expeditionary means to accomplish precise horizontal construction. Implementation of an efficient operator and the GCS900 will enhance the capability of a unit's ability to support horizontal construction efforts, by providing vertical, or vertical& horizontal instruction of where the blade needs to go to get to grade. This period of instruction will provide you with safe and efficient engineer equipment operations.

_____

_____

_____

_____

(ON SLIDE # 2)

2. **OVERVIEW:** Good morning/afternoon, my name is _____. The purpose of this period of instruction is to provide you with the knowledge, skills, ability to operate and employ the GCS900.

INSTRUCTOR NOTE
Introduce learning objectives.

(ON SLIDE # 3)

3. **LEARNING OBJECTIVE(S):**

a. TERMINAL LEARNING OBJECTIVE:

(1) Provided an engineer equipment requirement and references, operate equipment with a Grade Control System, To safely meet operational requirements with no injury to personnel or damage to the equipment. (1345-HEOP-2006)

b. **ENABLING LEARNING OBJECTIVE(S):**

(1) Provided a Grade Control System 900 Laser and GPS system, 120M Motor Grader, 850JR MCT and references, install the GCS 900 Laser system and GPS system, per the TM 11907B-OR/1. (1315-HEOP-2006a)

(2) Provided a Grade Control System 900 Laser and GPS system, 120M Motor Grader, 850JR MCT and references, perform the measure up for the 120M and 850JR MCT with the GCS 900 Laser system and GPS system, per the TM 11907B-OR/1. (1315-HEOP-2006b)

(3) Provided a Grade Control System 900 Laser and GPS system, 120M Motor Grader, 850JR MCT and references, perform calibration of the GCS 900 Laser system and GPS system, per the TM 11907B-OR/1. (1315-HEOP-2006c)

(4) Provided a Grade Control System 900 Laser and GPS system, 120M Motor Grader, 850JR MCT and references, perform site set up of the GCS 900 Laser system and GPS system, per the TM 11907B-OR/1. (1315-HEOP-2006d)

(5) Provided a Grade Control System 900 Laser and GPS system, 120M Motor Grader, 850JR MCT and references, perform leveling operations, per the TM 11907B-OR/1. (1315-HEOP-2006e)

(ON SLIDE # 4)

4. **METHOD/MEDIA:** This lesson will be taught by using the lecture method with the aid of computer aided graphics, video clips, computer generated simulator, Instructor Demonstrations, and Practical Applications.

INSTRUCTOR NOTE

Explain Instructional Rating Forms to the students.

(ON SLIDE # 5)

5. **EVALUATION:** You will be evaluated by a written exam and a practical application exam at the times indicated on the training schedule.

(ON SLIDE # 6)

6. **SAFETY/CEASE TRAINING (CT) BRIEF:** All instructors and students will use caution when walking around the equipment lot during equipment operations. Sun block should be used to avoid sunburn. Issue students bug spray if required. Encourage students to stay hydrated as temperatures can reach 100 degrees plus during the summer months. In the event of a casualty, emergency services (911) will be called and all students will move to the classroom and await further instruction.

TRANSITION: Are there any questions on what we will be covering or how you will be evaluated? Then let's first discuss the GSC900 Grade Control System Overview.

BODY: **(39 Hours 40 Min)**

INSTRUCTOR NOTE:
Have the students get out their filed reference guide and go over it briefly with them.

(ON SLIDE # 7)

1. **GCS900 GRADE CONTROL SYSTEM OVERVIEW:** **(50 Mins)**

a. GCS900 is a system designed to aid the operator in an array of construction and grading operation. The system provides both vertical or vertical and horizontal instruction of where the blade needs to go to be at grade. This can be displayed as directional lights for manual adjustments to be made by the operator. Or it can also be sent to a hydraulic valve to move the blade automatically.

(ON SLIDE # 8)

b. The utilization of grade control can improve production by increasing the accuracy; thus minimizing the number of passes required to get to grade; also reducing fuel consumption and machine wear.

c. The system gives the operator the ability to run the machine in manual assist or auto blade control, while

monitoring project design progress on the control box in front of them. Grade Control System is just as effective in either day or night operations.

(ON SLIDE # 9)

d. There are many different grade control applications such as Runway/Taxiways, Aircraft parking aprons, Landing zones, HLZ's, Road and route missions, Building pads, Vehicle parking lots and facilities, General grading and drainage.

(ON SLIDE # 10)

e. The GCS900 is designed for the Marine Corp's 120M grader and 850JR MCT dozer. The 120M is capable of slope only, sonic, laser and GPS operations. The MCT is only capable of laser and GPS operations.

(ON SLIDE # 11)

f. The GCS900 uses electronic components such as rotation, slope, sonic, laser and GPS sensors to provide accurate blade positioning and automatic blade control. These sensors need to be calibrated by the operator in order to be accurate.

(1) **Rotation, slope, and sonic sensors:** These sensors all work together measuring each component separately and using algorithms to calculate the exact blade location.

(a) Rotation Sensor: The rotation sensor is mounted to the circle components for the blade of the 120M. There is no rotation sensor on the MCT. This sensor measures the rotation angle of the blade, allowing the operator full function of rotating the blade while operating.

(b) Slope Sensor: The slope sensor measures the slope of a component on the tractor. The same sensor can be mounted to various components. It has arrows on it which indicate the direction of the measurement. The 120M utilizes three of these sensors. One will be mounted to the mainframe of the tractor which measures the main fall slope. Another sensor is mounted to the circle of the blade which measures the slope of the blade. The third slope sensor is added to the blade itself on a bracket between the mast bracket and riser. This sensor measure blade

pitch/roll, which allows the operator more control of his blade while operating. The MCT only uses one sensor to measure the slope of the blade while operating.

(c) Sonic Tracer: The sonic tracer sensor is used to provide elevation control. The system is designed for use on motor graders for tracing string line, curbs and previous pass. It also has lights that indicate whether the blade is on or off grade. This sensor allows the operator to easily extend an existing surface, cut or fill to desired depths, or create new surfaces with more consistent slopes for drainage.

(2) **Laser:** Consist of the GL722 laser transmitter, machine laser receiver and rod receiver.

(a) The GL722 projects a level or sloping plane of laser light above the job site area. Using a laser receiver mounted to the blade the operator can grade the surface to match level or sloping plane.

(b) The machine laser receiver guides the operator on grade by providing adjustment either up or down. This receiver can be used manually, but with low accuracy. It is also utilized automatically which allows the tractor to adjust the blade for the operator keeping the laser in the middle of the receivers range improving accuracy.

(c) The rod receiver allows the operator or a supervisor to check the accuracy of the machine on a job site. The laser and receiver can be as accurate as 1/16 of an inch or about the width of a pen tip. This receiver can also be used to plan and estimate a jobsite by measuring cuts and fills. The grade rod reads in tenths of a foot commonly known as survey feet. To help better understand this type of measurement, know that by dividing 12 inches by 10 tenths equals 1.2 inches per tenth. Example: 3 tenths of a foot equals 3.6 inches.

(3) **Global Positioning Sensors (GPS):** Consist of base station/radio and machine receiver/radio. The system uses more than 50 satellites orbiting in space to calculate the machine vertical and horizontal location on earth.

(a) The base station, receiver and radio, is set up over a hub. A hub is a point with known location such as northing, easting, and elevation. Setting up the base station over a known hub allows for more consistent work for multiple day projects. The radio is used to communicate to the machine radio for more accurate positioning of the

machine. The accuracy for the GPS is one tenth of a foot. This is equivalent to the width of a golf ball. Most vehicle and hand held GPS devices, including cell phones, are only accurate to within 32 feet.

(b) The machine receiver and radio are used to calculate the position of the machine by receiving its own GPS coordinates and relaying them back to the base station for corrections.

(ON SLIDE # 12)

(4) Using the on board control box the operator can create common designs such as HLZ, runways, pads and V-ditches. If a mission requires, this allows the operator to construct projects without the external help of surveyors. The GCS-900 can be used manually by the operator following the guidance of the provided adjustment lights. Or, the operator can select automatic mode which allows the tractor to control horizontal movement of the blade. When time permits or a complicated design needs to be created by surveyors, the design can be loaded into the control box. This allows for the construction of complex designs such as roads with multiple turns and slopes and even one design with multiple pads or sites.

(ON SLIDE # 13)

2. **How it Works:** Historically, the first laser system was developed and implemented into the construction world in 1965. The conventional method required numerous stakes and man hours to prepare a work site. Unavoidably resulting in a congested construction site. By utilizing the grade control system all the congestion is eliminated, by the use of the onboard control box. The control box displays the projected target instate with the guidance to go from current grade to projected grade.

(ON SLIDE # 14)

(a) "Slope only" refers to the three sensors on the machine that calculate the actual position of the blade. The operator can input the desired cross slope into the control box. Once the input is loaded the control box calculates the difference from the operator input and the actual position of the blade. From there corrections are sent to the hydraulic valve to move the blade to the correct position, in order to achieve the desired grade slope.

(ON SLIDE # 15)

The slope and sonic sensor: Conventionally, one way to do what the sonic tracer does, is to run a string between two points and mark with grade stakes the cuts and fills. **(ON SLIDE # 17)** The sonic tracer was introduced later in the mid 1980's. This allowed the operator to extend an existing surface and cut/fill more accurately and faster. This saves both time and money.

(ON SLIDE # 16)

(b) "Sonic tracer" is positioned over a reference such as a curb or string-line.

(ON SLIDE # 19)

The operator then presses the reset (bench) on the control box. A sound wave then travels down to the target and back to the tracer. The tracer now knows its distance from the target based on the amount of time sound waves took to reflect back; and then maintains this distance from the target until it is reset.

(ON SLIDE # 17-21)

(c) **Laser System:**

(1) A laser beam is shaped using optics to hold a small diameter spot over distances. The laser beam is then rotated at 600 RPM which creates 360 degree plane of light above the work site. The laser beam must then strike the center of the laser receiver for the blade to be on grade. If the beam strikes high or low the blade will automatically raise or lower to get on grade.

(ON SLIDE # 22)

(d) **GPS Grade control (3D):** In 1999 the first designs for GPS guidance where being introduced. **(ON SLIDE # 26)** Before GPS was introduced surveyors relied on, and still utilize, robotics to survey an area. This technology was introduced for machine control but GPS proved more advantages to a wider variety of projects. The conventional method of robotics only allows for one machine to be controlled by one total station.

(ON SLIDE # 23)

GPS grade control method allows for multiple tractors to work simultaneously to together on a project. These tractors can even be working at different elevations from rough cutting/filling with a scraper or dozer to final passes on grade with a grader or compactor.

(ON SLIDE # 24)

(a) The system uses more than 50 satellites orbiting in space to calculate the vertical and horizontal location of the blade within +/-.1'.

(ON SLIDE # 25)

(b) A DTM or digital terrain model is designed on a computer and then uploaded to the control box.

(ON SLIDE #26)

The DTM is designed by surveyors for multiple slope projects. This design can be loaded into multiple tractors and each tractor can work on the project at the same time.

(ON SLIDE # 27-29)

(c) The GPS receiver calculates where you are on earth.

(d) The control box determines the difference between where you are (using GPS coordinates) and where you want to be on the project design (DTM).

(e) A signal is sent to the hydraulic valves to move the blade to match the project design.

(ON SLIDE # 30)

(e) **Field Reference guide:** Is an operators quick reference tool designed to assist the operator in the field. It provides a check list for all critical task which are required to get the system up and running. The field reference guide is continually updated; therefore the operator should ensure that he has the latest available version. Currently the Marine Corps has both Version V11 and V12.

INSTRUCTOR NOTE: Have the students get out their filed reference guide and go over it briefly with them.

(ON SLIDE # 31)

(f) **CB430 Control Box:** Is a the machines on board computer, which consist of a display and keyboard in one box, and is mounted in front of the operators chair. The system is used to configure, calibrate and operate the system. It has the ability to store and transfer information about multiple machines. The operator has the ability to design projects on the screen and it displays the blade and machine positions in real-time in relation to the designed project.

(ON SLIDE # 32)

TRANSISTION: Now that we talked about what and how the Grade Control System is and works, are there any questions at this point? I have some for you.

_____

_____

_____

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS:

2. QUESTIONS TO THE CLASS:

a. **What does the Slope sensors measure?**

The cross slope of the blade.

b. **What is one type of design an operator can create on the control box?**

HLZ pad, runway, v-ditch.

(ON SLIDE # 37)

c. **"Slope only" refers to what?**

It refers to the three sensors on the machine that calculate the actual position of the blade.

d. **What is a DTM?**

Digital terrain model.

(10 Min. Break)

(ON SLIDE # 33)

TRANSITION: We have just the covered how the GCS900 Grade Control System works. Are there any questions? If there are no further questions, let's take a ten minute break before we move on to the Installation, Configuration and Calibration.

(ON SLIDE # 34)

2. **Installation, Configuration, and Calibration(50 Minutes)**

A. **Grader component installation:** Is the process of installing the GCS Main components to the Machine.

(ON SLIDE # 35)

USMC tractors are pre-installed from the manufacturer with internal wiring and external brackets.
"Blade Slope Sensor" attaches to bracket on the back of the circle

(ON SLIDE # 36)

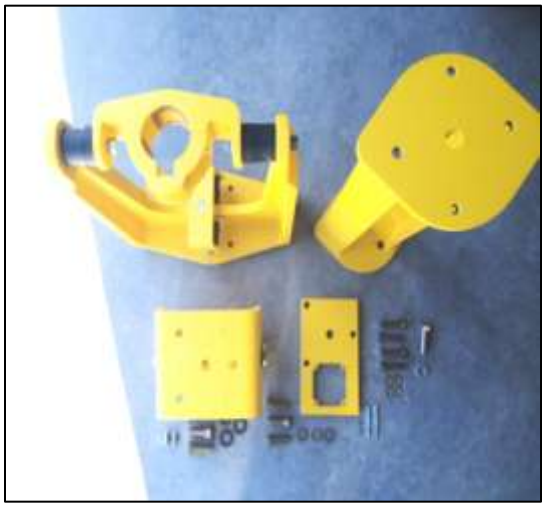
(1) Mount **"Main-fall Slope Sensor"** to bracket under goose-neck

(ON SLIDE # 37)

(2) Mount **"Radio"** on the back of the cab

(ON SLIDE # 38)

(3) Attach the " **Mast Mount"** to the left side of the blade



Note: *¾" tap may be required to remove excess paint*

(ON SLIDE # 39)

(4) Attach **"Mast Riser"** and **"Blade Roll Bracket"** to **"Mast Mount"**

(ON SLIDE # 40)

(5) Mount **"Blade Roll Sensor"** to mast bracket (bolt from bottom of sensor)

Note: Connector must face toward the left blade tip

(ON SLIDE # 41)

(6) Attach **"Electric Mast"** to the **"Shock Mount"**

(ON SLIDE # 42)

(7) Attach Control Box Brackets and Place in Dash Mount

(ON SLIDE # 43)

INSTRUCTOR NOTE:
Play 120M Install Video.

(ON SLIDE # 44)

a. **Dozer component installation:**

(ON SLIDE # 45)

(1) **"Blade Slope Sensor"** to bracket on the back of blade

(ON SLIDE # 46)

(2) Mount **"Radio"** on the back of the cab

(ON SLIDE # 47)

(3) Attach the **"Mast Mount"** on the Center Mast Plate

Note: ***10mm tap may be required to remove excess paint***

(ON SLIDE # 48)

(4) Attach **"Control Box"** to bracket

INTERIM TRANSITION: Are there any questions on what we just covered? If not let's move onto the video of the component installation.

(ON SLIDE # 49)

INSTRUCTOR NOTE
Instructor will play MCT installation video.

(ON SLIDE # 50)

INTERIM TRANSITION: Are there any questions before we move on to the demonstration?

INSTRUCTOR NOTE

Perform the following demonstration.

1. DEMONSTRATION: (30 min) The purpose of this demonstration is to show the students how to conduct component installation. Before the demonstration the Instructor will have a MCT, 120M components and all tools layed out. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the equipment with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to install the GCS900 components on the MCT and 120M.

1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.

2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Introduction to the components and required tools and hardware.
(2) Install components.
(3) Remove components.

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

INTERIM TRANSITION: Are there any questions on the demonstration that we have just covered? If not let's move onto the Practical Application for component installation.

INSTRUCTOR NOTE

Perform the following Practical Applications. Allow students to take breaks as needed. For more hands on time the instructor can have the students remove the components at the end of every day and re-install every morning.

1. PRACTICAL APPLICATION: (1 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice installing GSC900 components. Before the practical application the Instructor will have (1) MCT, (1) 120M, components, tools and hardware laid out. One instructor is required.

PRACTICE: Student will be broken down into two groups and assigned a piece of equipment to install the GSC900 components on; additional student will be assigned as the tool custodian. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Identify GCS900 components
(2) Install GSC900 components on the MCT
(3) Install GSC900 components on the 120M
(4) Remove the components

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly installing the GCS900 components.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.

2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The Instructor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

(ON SLIDE # 51)

INTERIM TRANSITION: Are there any questions on the Practical applications of component installation? If not then we will move on to Machine Configuration.

(ON SLIDE # 52)

B. **Machine configuration:**

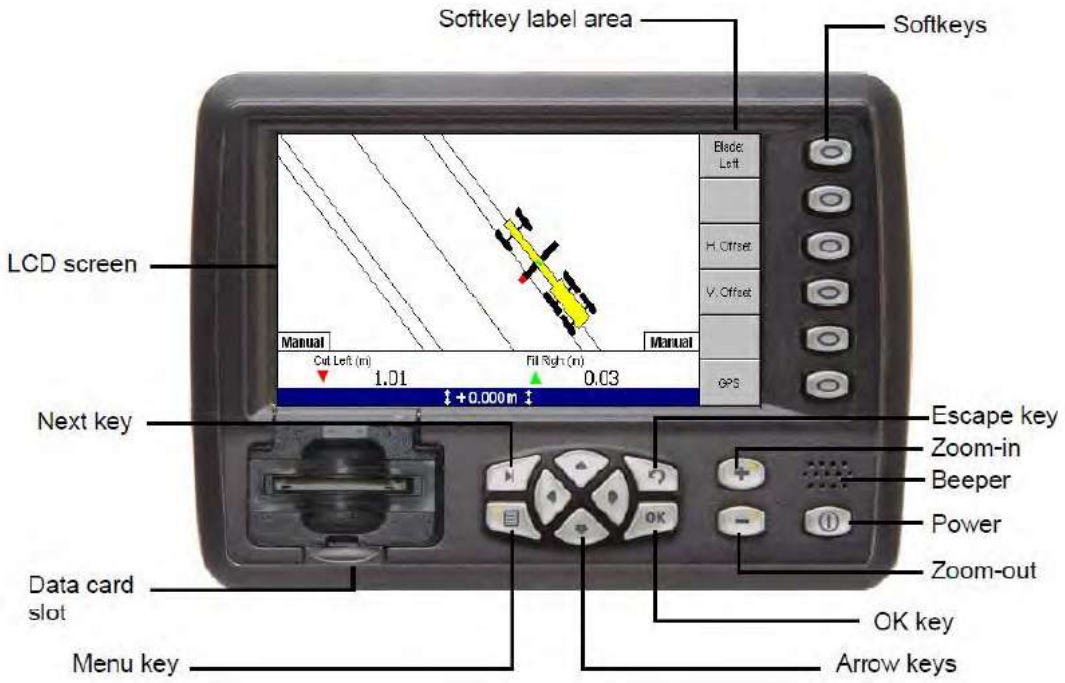
Machine configuration is the input of information, which tells the control box what type of machine is being utilized and which GCS is being installed. The configuration information identifies the equipment type, serial number, project information (i.e. Name) and type of GCS installed.

(ON SLIDE # 53)

INSTRUCTOR NOTE

Instructor will introduce the emulator to the student's; this program will be run on the Trimble laptop.

CB430 Control Box



INSTRUCTOR NOTE

NOTE: The control box must be in manager's mode to change display settings.

- Turn **"OFF"** box
- Press and Hold **"OK"**
- Press **"POWER"** once
- Release **"OK"** when screen changes

INSTUCTOR NOTE

Instructor should utilise the the cursor to press the correct keys on the simulator, do not demomstate in mouse click mode. Also note the steps listed below are general in nature and may change with version updates.

a. **120M configuration:**

(1) Press **"Installation"** Soft-key

(2) Select **"Machine Settings"** and Press **"OK"**

(3) Press **"F6"** Soft key to **Edit Machine**

(4) Enter **"Machine Name"** such as **120M SR# 612849**

(5) Press **"F6"** Soft-Key

(6) **Machine Type** Select **"Grader"** and Press **"F6"** Soft-Key

(7) **Machine Model** Select **"Default"** and press **"F6"** Soft-Key

(8) Select **Mast Positions** and Press **"F6"** Soft-Key

(9) Select **"Mast Type"** and Press **"F6"** Soft-Key

(10) Select **"NO"** for **Support ATS600** and Press **"F6"** Soft-Key

(11) Select **"Fixed Sensors"** and Press **"F6"** Soft-Key

INSTRUCTOR NOTE

Ensure a check is applied for desired selections.

(12) Select **"Mainfall Sensor Mounting"** position and Press **"F6"** Soft-Key

(13) Select **"NO"** for **Third Party Radio** and Press **"F6"** Soft-Key

(14) Select **"SNRxxx"** for **Wireless Comms type** and Press **"F6"** Soft-Key

(15) Select **"Auto-Lift"** for Grade Control and Press **"F6"** Soft-Key

(16) Select **"Caterpilliar A4:M1" Lift Valve Module** and Press **"OK"**

(17) Enter **"0.66ft." Auto Controls Range Limits** and Press **"OK"**

INSTRUCTOR NOTE

Auto control range limit is a safety device which kick the auto off when blade is moved out of the predetermined range.

(18) Select **"External" Light bar** and Press **"F6"** Soft-Key

(19) Press **"F6"** Soft-Key for **Finished**

(20) Press **"ESC"** to return to main **MENU**

(21) Go to **"Grader Measure-up"** Field Referance Guide

INSTRUCTOR NOTE
Ensure to ESC to the main screen prior to moving on to the measure up.

b. **850JR Dozer Configuration:**

(1) Press **"MENU"**

(2) Press **"Installation"** Soft-key

(3) Select **"Machine Settings"** and Press **"OK"**

(4) Press **"Edit Machine"** Soft-Key

(5) Enter **"Machine Name"** such as **850JR SR# 612849**

(6) Press **"OK"**

(7) Select **"Machine Type" and Press "OK"**

(8) Select **"John Deer D850JR"** Machine Model and Press **"OK"**

(9) Select **Mast Positions** and Press **"OK"**

(10) Select **"Mast Type"** and Press **"OK"**

(11) Select **"Fixed Sensors"** and Press **"OK"**

INSTRUCTOR NOTE
Ensure a check is spplied for desired selection.

(12) Select **"SNRxx"** Positioning Radio Type and Press **"OK"**

(13) Select **"NO Wireless Communications"** and Press **"OK"**

(14) Select **"Auto-Lift/Tilt" Grade Control and Press "OK"**

(15) Select **"VM420"** Lift Valve Module and Press **"OK"**

(16) Select **"Pilot Series ll"** Lift Valve Type and Press **"OK"**

(17) Select **"0.66 ft"** Auto Controls Range Limits and Press **"OK"**

INSTRUCTOR NOTE
Auto control range limit is a safety device which kick the auto off when blade is moved out of the pre determined range.

(18) Select **"External"** Lightbar and Press **"OK"**

(19) Press **"Finished"**

(20) Press **"ESC"**

(21) Go to **"Dozer Measure-up"** Field Referance Guide

INSTRUCTOR NOTE
Ensure to ESC to the main screen prior to moving on to the measure up.

(ON SLIDE # 54)

INTERIM TRANSITION: Are there any questions on what we just covered? If not let's move onto the demonstration of the configuring the 120M and MCT.

INSTRUCTOR NOTE

Perform the following demonstration.

2. <u>DEMONSTRATION</u>: (30 min) The purpose of this demonstration is to show the students how to configure the 120M and MCT. Before the demonstration the Instructor will have (1) 120M and (1) MCT and (2) CB430 control boxes laid out. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the equipment with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to configure the 120M and MCT.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Introduction to the control box.
(2) Configuration of the 120M.
(3) Configuration of the MCT

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

INTERIM TRANSITION: Are there any questions on the demonstration that we have just covered? If not let's move onto the Practical Application for configuring the CB430 control box.

_____

_____

_____

INSTRUCTOR NOTE

Perform the following Practical Applications. Allow students to take breaks as needed

2. PRACTICAL APPLICATION: (1 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice configuring the CB430 for the 120M and MCT. Before the practical application the Instructor will have (1) 120M and (1) MCT and (2) CB430 control boxes laid out. One instructor is required.

PRACTICE: Student will be broken down into two groups and assigned a piece of equipment to configure the CB430 control box; an additional student will be assigned as the tool custodian. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Identify the control box.
(2) Configure the 120M.
(3) Configure the MCT

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly configuring each piece of equipment.

1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.

2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The In-

structor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

INTERIM TRANSITION: Are there any questions on the Practical applications of machine configuration? If not lets move on to Machine measure up.

_____

_____

_____

(ON SLIDE # 55-56)

C. **DISPLAY SETTINGS, SENSOR CALIBRATION & VALVE CALIBRATION:** The following steps are required in order to ensure accurate guidance information is generated.

(ON SLIDE # 57)

a. **Grader and Dozer Display Settings:** are a precursor for the both the sensor calibration and the valve calibration.

INSTRUCTOR NOTE

Instructor will utilize the Trimble laptop walk the students thru the display settings, and both calibrations.

(1) Press **"Menu"**

(2) Press **"Mode: 3D"**

(3) Select **"Increment switch Adjustment"** and press **"ok"**

(4) Change **Vertical offset increment: For the 120M set to .02 meters and the 850J to .05 meters.**

(5) Select **"Text Item"** and Press **"OK"**

(6) Select **"Cut/Fill Left", "Offline(3D)"** and **"Cut/Fill Right"** in this order

(7) Press **"Cross-Section"** Soft-key

(8) Select **"Cut/Fill Left", "Offline(3D)"** and **"Cut/Fill Right"** in this order

(9) Press **"Profile View"** Soft-key

(10) Select **"Cut/Fill Left", "Offline(3D)"** and **"Cut/Fill Right"** in this order

(11) Press **"Text View 1"** Soft-key

(12) Unlock All Items

(13) Select **"Heading(3D)", "Main-fall"** and **"Cross Slope"** in this order

(14) Press **"Text View2"** Soft-key

(15) Select **"Northing(3D)", "Easting (3D)", "Elevation(3D)", "Station(3D)", "MA Offset(3D)"** in this order

(16) Press **"OK"**

(17) Go to **"Sensor Calibration"** Field Reference Guide

(ON SLIDE #58-62)

b. **120M Grader Sensor Calibration:**

INSTRUCTOR NOTE
Measure ups must be complete and entered into the control box prior to conducting calibrations.

(1) Press **"Menu"**

(2) Select **"Blade Roll"** and Press **"OK"** (if not installed skip to #4)

(3) Select **"Yes"** and Press **"OK"**

(4) Select **"Calibration Sensors"** and Press **"OK"**

(5) Select **"Main fall, Blade slope, Rotation Sensor"** and Press **"OK"** Read the **Sensors Calibration Screen**

(6) **Position** and **Mark Position** of the Grader

(7) Follow the instruction on the screen

(8) Press **"Finished"** when complete

(9) Select **"Blade Pitch Sensor"** and Press **"OK"** (If not installed skip to #12)

(10) Press **"OK"** to caliber and Press **"Finished"** when completed

(11) Select **"Electric Mast (S)"** and Press **"OK"**

(12) Press **"OK"** to calibrate and Press "Finished" when completed

(13) Press **"ESC"** to return to main Menu

(14) Go to **"Valve Calibration"** Field Reference Guide

c. **850 JR Dozer Sensor Calibration:**

(1) Press "Menu"

(2) Select "Calibrate Sensors" and Press "OK"

(3) Select "Blade Slope Sensors and Press "OK"

(4) Level the blade with a water level

(5) Enter "0.00%" in Measure blade slope and Press "Calibrate"

(6) Press "ESC" twice to return to main Menu

(7) Go to "Valve Calibration" Field Reference Guide

d. **120M Grader Valve Calibration:**

(1) Press **"Menu"**

(2) Press **"Installation"** and Press **"OK"**

(3) Select **"Valve Calibration"** and Press **"OK"**

(4) Select **"Left"** valve and Press **"OK"**

(5) Read the **"Left Valve Calibration Setup"** instructions and Press **"OK"**

(6) Follow the instructions on each screen

(7) Press **"Finished"** when complete

(8) Select **"Right"** Valve and Press **"OK"**

(9) Read the "**Right Valve Calibration Setup**" instructions and Press **"OK"**

(10) Follow the instructions on each screen

(11) Press **"Finished"** when Complete

(12) Select **"Save Settings"** and Press **"OK"**

(13) Select "**Display Settings**" and Press **"OK"**

(14) Enter **"Name"** of Grader such as **"120M Grader 7548"** and Press **"OK"**

(15) Select **"Machine Settings"** and Press **"OK"**

(16) Enter **"Name"** of Grader such as **"120M Grader 7548"** and Press **"OK"**

(17) Press **"OK"** to return to the main menu and Press **"ESC"** to return to Operation Screen

e. **850JR Dozer Valve Calibration:**

(1) Press **"Menu"**

(2) Press **"Installation"** Soft-key

(3) Select **"Valve Calibration/Valve Tune**" and Press **"OK"**

(4) Select **"Valve Calibration**" and Press **"OK"**

(5) Select **"Lift" valve** and Press **"OK"**

(6) Mount Slope Sensor so the connector is toward the left while sitting in the seat

(7) Follow the instructions on each screen

(8) Select **"Tilt"** valve and Press **"OK"**

(9) Mount Slope Sensor so the connector is toward the Cab

(10) Follow the instructions on each screen

(11) Press **"Finished"** when complete

(12) Select **"Electric Mast(s)** and Press **"OK" (skip to step 14 if using SR300)**

(13) Press **"OK"** to calibrate and Press **"Finished"** when completed

(14) Select **"Save Settings"** and Press **"OK"**

(15) Select **"Display Settings"** and Press **"OK"**

(16) Enter **"Name"** of the Dozer such as **"850JR 7548"** and Press **"OK"**

(17) Select **"Machine Settings"** and Press **"OK"**

(18) Enter **"Name"** of the Dozer such as **"850JR 7548"** and Press **"OK"**

(19) Press **"OK"** to return to Main Menu and Press **"ESC"** to return to Operation Screen

(ON SLIDE # 63)

INTERIM TRANSITION: Are there any questions on what we just covered? If not let's move onto the demonstration of the display settings and calibrations.

INSTRUCTOR NOTE
Perform the following demonstration.

3. DEMONSTRATION: (30 mins) The purpose of this demonstration is to show the students how to Set the display settings, sensor calibration and valve calibration for the 120M and the MCT. Before the demonstration the Instructor will prepare (1) 120M and (1) MCT. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the equipment with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to, set the display settings, and conduct both sensor calibration and valve calibration for the 120M and the MCT.

1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.

2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Reintroduce the CB 430 control box.
(2) Set display settings for the 120M
(3) Set display settings for the MCT
(4) Conduct sensor calibration for the 120M
(5) Conduct sensor calibration for the MCT
(6) Conduct valve calibration for the 120M
(7) Conduct valve calibration for the MCT

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

INTERIM TRANSITION: Are there any questions on the demonstration that we have just covered? If not let's move onto the Practical Application for setting the display settings, sensor calibration and valve calibration on the 120M and the MCT.

INSTRUCTOR NOTE

Perform the following Practical Applications. Allow students to take breaks as needed

3. PRACTICAL APPLICATION: (2 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice setting the display settings, and conducting sensor calibration and valve calibration for the 120M and the MCT. Before the demonstration the Instructor will prepare (1) 120M and (1) MCT. One instructor is required.

PRACTICE: Students will be broken down into two groups and assigned a piece of equipment to set the display settings, and conduct sensor calibration and valve calibration for the 120M and the MCT. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Setting display settings for the 120M
(2) Setting display settings for the MCT
(3) Conduct sensor calibration for the 120M
(4) Conduct sensor calibration for the MCT
(5) Conduct valve calibration for the 120M
(6) Conduct valve calibration for the MCT

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly configuring and conducting measure up/input on the MCT.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of

mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The Instructor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

(ON SLIDE # 64)

TRANSITION: Are there any questions on the Practical applications of Setting display settings, or conducting sensor calibration and valve calibration for the 120M and the MCT? If not I have some for you, before moving on to Laser Operation.

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

A. What are the two required calibration types?

Valve Calibration and Sensor Calibration.

B. What is required prior to conducting any calibrations?

Measure up entered into the control box

C. **The MCT's, blade Slope Sensor is located where on the blade?**

On the back of blade.

D. **The 120M's, blade slope sensor is located where on the 120?**

On the bracket on the back of circle.

(ON SLIDE # 65)

E. What is the CB430?

Control Box

F. **Machine configuration is the input of information, which tells the control box what?**

What type of machine is being utilized and which GCS components are being installed.

(10 MIN BREAK)

TRANSITION: Are there any further questions before we move on to Laser Operation.

_____
_____
_____

(ON SLIDE # 66)

3. **Slope Only and sonic Operation: (20 MIN)**

1. **Grade Control System Slope Only:** The AS400 Slope Sensor is mounted on the circle behind the blade, and measures the slope across the blade. The Rotation Sensor is mounted on the turn table and measures the rotation of the blade from perpendicular. The Main-fall Sensor is mounted on the goose neck and measures the slope of the machine in the direction of travel. The three sensors on the machine calculates the actual position of the blade on the project. The operator inputs the design cross slope into the control box. The operator then controls the elevation on one side (typically the toe). The control box then calculates the difference from the design slope and actual slope of the blade. Corrections are sent to the hydraulic valve to automatically move the blade to the design slope.

(ON SLIDE # 67-68)

Slope-Only Components in the Machine: Slope only operation is (Referenced in the field Reference Guide). Operator in puts the slope of the project, then selects which side of the blade will be controlled by the slope sensor.

(ON SLIDE # 69)

2.**CB430 Sonic Tracer:** Sonics are used in conjunction with slope control for dual control. This allows the grader to trace an existing surface, such as a runway or fixed pad to extend the surface.

a. **Sonic Components and Operations:** The Sonic tracer is positioned over a surface to trace string line, curb, existing hard ball, ect. The operator lowers the cutting edge to the desired elevation and presses the reset on the Control Box. A sound wave travel down to the target and back to the tracer, the tracer now knows the distance from the target based on the amount of time the sound wave took to reflect back. The Tracer will maintain this distance from the target until it is reset by the operator.

b.**Slope only:** Slope only allows the operator to enter a cross slope value into the control box to automatically control one side of the grader blade.

(1) Press **"F1"** Soft-key until **"Slope"** symbols is displayed on the Right side

(2) Press **"Menu"**

(3) Select **"Vertical Setup"** and Press **"OK"**

(4) Input **Target Cross Slope** or Press **"Level"** for Flat Pads and Press **"OK"**

(5) Select **Automatic swap "No"** and Press **"OK"**

(6) Press **"ESC"** to return to main **Menu**

(7) Manually control the Left Side Blade

(8) To switch Sides Press **"F1"** Soft-key until **"Slope"** symbol is displayed on the left side

(ON SLIDE # 70)

c. **Sonic Tracer machine Setup:** The operator will positions the blade to a finished grade elevation, then position the Sonic Tracer over the target area to be traced. The operator will input the target slope of the

project. Finally the operator will bench the sonic sensor prior operation.

(ON SLIDE # 71, 72)

(1) Press **"F1"** Soft-key until **"Slope"** symbols is displayed on the Right side

(2) Press **"Menu"**

(3) Select "Vertical Setup" and Press "OK"

(4) Input Target Cross Slope or Press "Level" for Flat pads and Press "OK"

(5) Select **Automatic swap "No"** and Press **"OK"**

(6) Press **"ESC"** to return to main **Menu**

(7) Select **"Bench"** and Press **"OK"**

(8) **Place Blade in working position**

(9) **Position Right Blade Tip to desired elevation**

(10) **Level left blade tip until "Current Cross Slope" reads desired slope**

(11) **Check Right Blade Tip elevation**

(12) **Place Sonic Tracer over Target**

(13) Enter **"Reference elevation"** example **"1.00ft"**

(14) Press **"OK"** to Bench

(15) Press **"ESC"** to return to operation Screen

(16) Use **"V. Offset"** Soft-key to **Offset Elevation** above or below **Bench Elevation**

(ON SLIDE # 73)

TRANSITION: Are there any questions on what we just covered? If not I have some for you and then we will move onto Laser Operations.

A. **When using slope only, which side of th blade is controlled by the operator?**

The Operator decides which side for automatic mode and manual depending on the situation. The operator must select the desired side for automatic cross slope in the control box.

(ON SLIDE # 74)

4. **GL722 LASER OPERATION: (1 HRS 45 Mins)**

Is a self leveling laser transmitter that is capable of transmitting a 360 degrees laser plane in two axes. The two axes are identified by an open wedge ◿ and a closed wedge ◢ printed on the top of the GL722. These wedges indicate the direction the laser plane is sloping in each axis

INSTRUCTOR NOTE
Instructor will cover the following in classroom utilizing the following components.

(ON SLIDE # 75-77)

a. **Laser Transmitter Components:**

(1) **GL722 Grade Laser:**

(2) **Tripod Adapter:**

(3) **Tripod:**

(4) **Remote:**

(5) **Charger:**

(6) **Grade Rod and Bipod:**

(7) **CR Rod Receiver:**

b. **Machine Laser Components:**

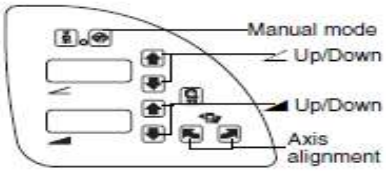
(1) **SR300 Laser Receiver:** three foot tall, 360 degree laser receiver designed for machines

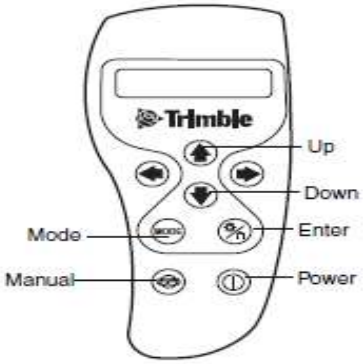
(2) **EM400 Electric Mast:** four foot telescoping mast used in conjunction with the LR400 laser receiver

(3) **LR400 Laser Receiver:** ten inch 360 degree laser receiver, is the new machine receiver

(ON SLIDE # 78-79)

c. **Keyboard Lay-out:**





d. **Mount GL722 to Tripod:**

(ON SLIDE # 80-81)

e. **Demonstrate the Laser Planes**:

INSTRUCTOR NOTE
The instructor will demonstrate Laser plane in the class room. 1 Set the GL722 on the tripod 2 Turn the light off in the room (dark as possible) 3 Turn the laser on to show the students the 360 degree beam of light. 4 Configure the GL722 with a single slope applied 5 Configure the GL722 with a dual slope applied 6 Set up and explain axis alignment 7 Set up and explain grade match

(ON SLIDE # 82)

(1) **Level Surface:** Flat plane with no sloping surface (building pad).

(a) Locate an area at the same level or slightly higher than the elevation of the work site

(b) Move the Grader close to the tripod to determine the proper height

(c) Raise tripod legs before raising the elevation column

(d) Attach the GL722 to the Tripod using the quick release handle

(e) Raise Antenna

(f) Press "Power" and verify the "Battery Level" and "RPMs" during start-up

(g) Power on "Remote" verify the slope in the "Open Wedge" is "0.00"

(h) Press "Mode" and verify Close Wedge is "0.00"

(i) Raise Elevating Column so the Laser clears the Cab of the Grader

(j) Verify Tripod Legs are tied-down or sand-bagged and tighten Elevating Column

(ON SLIDE # 83)

(2) **Single Slope Surface:** Is surface that slopes in only one direction (HLZ pad).

(a) Locate an area at the same level or slightly higher than the elevation of the work site

(b) Move the Grader close to the Tripod to deter-mine proper height

(c) Raise Tripod Legs before raising the Elevating Column

(d) Attach the GL722 to the Tripod using the Quick Release handle

(e) Press "Power" and verify the "Battery Level", "RPMs" and "Axis Alignment"

(f) Press both Right and Left "Axis Alignment" Buttons at the same time for 3 seconds

(g) Rotate Laser so Closed Wedge slope direction is aligned in the proper direction

(h) Manually aim the using the Sights on top of the GL722

(i) Power on "Remote"

(j) Input Slope in "Closed Wedge"

(k) Verify Tripod Legs are tied –down or sandbagged and tighten Elevating Column

(ON SLIDE # 84)

(3) **Dual Slope Surface:** A surface that slopes in two directions. (The slope of the center line of a runway is one direction and the cross fall left or right is the second direction.

(a) Place Tripod on at one end of the Center-Line

(b) Move the Grader close to the Tripod to determine proper height

(c) Raise Tripod Legs before raising the Elevating Column

(d) Attach the GL722 to the Tripod using the Quick Release handle

(e) Press "Power" and verify the "RPMs", "Axis Alignment" and "Battery Level"

(f) Press both Right and Left "Axis Alignment" Buttons at the same time for 3 seconds

(g) Rotate Laser so Open Wedge slope direction is aligned to Center-Line

(h) Manually aim the Laser using the Sights on top of the GL722

(i) Power on "Remote"

(j) Input Slope in "Open Wedge"

(k) Press "Mode" to change to Open Wedge

(l) Input Slope

(m) Press "Mode" to change to Closed Wedge

(n) Input Slope

(o) Verify Tripod Legs are tied –down or sand-bagged and tighten Elevating Column

INTERIM TRANSITION: Are there any questions before we take a break?

(ON SLIDE # 85)

(10 Min. Break)

INTERIM TRANSITION: Are there any more questions before we talk about axis alignment?

(ON SLIDE # 86-87)

(4) **Axis Alignment:** allows the operator to automatically sight the GL722 laser accurately along the sloping surface grade line.

(a) Power on Grade Rod Laser Receiver and Remote

(b) Attach Laser Receiver to Grade Rod

(c) Attach Coil Cord to Remote and Laser Receiver

(d) Move Grade Rod to within 3-5′ of the GL722 Transmitter

(e) Raise Grade Rod until Laser On-Grade is de-tected, lock

(f) Grade Rod Height

(g) Move Grade Rod 250-500’ along the axis to be aligned

(h) Stabilize Grade Rod with Bipod

(i) Press “Mode” on Remote until “Axis Align”, Press “Up Arrow” to select Open or Closed Wedge

(k) Press “E” for Enter Screen will say “Please Wait” until “Complete”

(ON SLIDE # 88-89)

(5) **Grade Match:** Automatically adjust the grade of the selected axis to match an unknown grade. The laser searches vertically until the grade rod receiver detects the laser beam.

(a) Power on Grade Rod Laser Receiver and Remote

(b) Attach Laser Receiver to Grade Rod

(c) Attach Coil Cord to Remote and Laser Receiver

(d) Move Grade Rod to within 3-5’ of the GL722 Transmitter

(e) Raise Grade Rod until Laser On-Grade is detected, lock grade Rod Height

(f) Move Grade Rod to the surface to be matched

(g) Stabilize Grade Rod with Bipod

(h) Press “Mode” on Remote until “Grade Match”, Press “Up Arrow” to select Open or Closed Wedge

(i) Press “E” for Enter Screen will say “Please Wait” until “Complete”

(ON SLIDE # 90-91)

(6) **Grade Reverse:** Used on dual slope surfaces grade reverse allows the operator to reverse the cross slope, from the cab utilizing the GL722 remote control. (for

example: when building a crowned surface I.E. runway or road)

Note: Grade Reverse controls the Closed Axis only

(a) Power on Grade Rod Laser Receiver and Remote

(b) Attach Laser Receiver to Grade Rod

(c) Attach Coil Cord to Remote and Laser Receiver

(d) Move Grade Rod to within 3-5’ of the GL722 Transmitter

(e) Raise Grade Rod until Laser On-Grade is detected, lock Grade Rod Height

(f) Move Grade Rod to the surface to be matched

(g) Stabilize Grade Rod with Bipod

(h) Press “Mode” on Remote until “Grade Reverse”

(i) Press “E” for Enter Screen will say “Please Wait” until “Complete”

(ON SLIDE # 92)

f. **Laser Setup on the Machine:** The operator must input the slope of the project, set the Laser Receiver height using a benchmark (this referred to as “bench or benching”). The Operator will then input any offset between the benchmark and the project surface.

(ON SLIDE # 93)

g. **Laser System Operation:**

(1) Laser Receiver: controls lift function and elevation accuracy

(2) Slope Sensors: controls tilt function and accounts for blade pitch

(3) Operator must drive parallel to the slope in the Lasers line of site.

(4) The machine should be moving and the blade near grade before enabling the Automatics (within an inch or two

of grade) Failure to reach the desired depth may result in tractor bog and an inaccurate final grade

(5) If the machine begins to bog down under a heavy load the Operator can assist by raising the blade while in Auto

h . **SR300 Laser Setup:**

(1) Press **"F1"** Soft-key until both **"Laser and Slope"** symbols are displayed

(2) Press **"Menu"**

(3) Select **"Vertical Setup"** and Press **"OK"**

(4) Input **Target Cross Slope** or Press **"Level"** for Flat Pads and Press **"OK"**

(5) Select **Automatic swap "No"** and Press **"OK"**

(6) Press **"ESC"** to return to main **Menu**

(7) Select **"Bench"** and Press **"OK"**

(8) Place **Blade Tip on Bench Mark**

(9) **Plumb Mast, Level Right Blade Tip** until **Current Cross Slope** reads **"0.00"**

(10) Press **"OK"** to **Bench**

(11) Press **"ESC"** to return to main **Menu**

(12) Press **"Menu"** and Select **"Bench"**

(13) Verify Current and Target Blade Slope match Press **"OK"** to Bench

(14) Press **"ESC"** to return to Operation Screen

Use **"V. Offset"** Soft-key to **Offset Elevation** above or below **Bench Elevation**

INTERIM TRANSITION: Are there any questions on the GL722 Laser Operation? If there are none we will move on to demonstration of the slope, sonic and laser operations.

_____

_____

INSTRUCTOR NOTE

Perform the following demonstration. Allow students to take breaks as needed.

4. <u>DEMONSTRATION</u>: (1.5 HRS) The purpose of this demonstration is to show the students how to conduct slope only, sonic tracer, and laser operations. Before the demonstration the Instructor will have the slope sensors, sonic tracer, GL722 laser and accessories and (1)120M, and/or (1) MCT with CB460's installed and staged. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the laser base station and machines; with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to conduct slope, sonic and Gl722 laser setup /operations and CB460 laser operation.

1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.

2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Introduction to the Gl722 Laser accessories and components.
(2) Tool and battery requirements.
(3) Set up of the GL722 Laser.
(4) Configurations of the GL722 laser for operation.
(5) Conduct operation of the GL722 and CB430 control box, laser operation.
(6) Utilization of the FRG (field reference guide)

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

INTERIM TRANSITION: Are there any questions on the demonstration that we have just covered? If not let's move onto the Practical Application for slope only, sonic tracer, and laser operation.

INSTRUCTOR NOTE

Perform the following Practical Application. Allow students to take breaks as needed

4. PRACTICAL APPLICATION: (12 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice conducting GL722 laser operation and CB430 operation set up and operation. Before the practical application the Instructor will have the GL722 laser/components, (1)120M, (1)MCT with CB430's installed staged. One instructor is required.

PRACTICE: Students will be broken down into two groups to conduct the GL722 laser operation and CB430 operation set up and operation; an additional student will be assigned as a ground guide for the student operating. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Identify the Gl722 Laser accessories and components.
(2) Identify tool and battery requirements.
(3) Set up of the GL722 Laser.
(4) Configure the GL722 laser for operation.
(5) Conduct operation of the GL722 and CB430 control box, laser operation.
(6) Utilization of the FRG (field reference guide)

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly operating the equipment.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The Instructor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

(ON SLIDE # 94)

TRANSITION: Are there any questions on the Practical applications of GL722 laser operation, CB430 operation set up and operation? If not I have some for you, then we will move on to Machine units and Measure UP.

(ON SLIDE # 95)

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

A. Give an example of a Single Slope Surface?

A surface that slopes in only one direction (HLZ pad).

B. Describe Grade Match in your own words?

Automatically adjust the grade of the selected axis to match an unknown grade. The laser searches vertically until the grade rod receiver detects the laser beam.

C. **What are two Laser Transmitter Components?**

(1) GL722 Grade Laser (2) Tripod Adapter

(3) Tripod (4) Remote (5) Charger

(6) Grade Rod and Bipod (7) CR Rod Receiver

D. **Where should you locate the Gl722 in relation to the work site?**

Locate an area at the same level or slightly higher than the elevation of the work site

E. **What is one machine laser component?**

(1) SR300 Laser Receiver

(2) EM400 Electric Mast

(3) LR400 Laser Receiver

(10 MIN BREAK)

TRANSITION: Are there any further questions before we move on to Machine units and Measure UP.

_____
_____
_____
_____

(ON SLIDE # 96-97)

5. **Machine units and Measure UP: (1 Hour)**
Measure up identifies the exact locations of the sensors and the exact dimensions of the machine.

(ON SLIDE # 98)

INSTUCTOR NOTE

Instructor will play the 120M and 850JR MCT measure up videos.

a. **120M Grader Measure-Up:**

(1) Press **"Menu"**

(2) Press **"Installation"** second Soft-Key

(3) Select **"Units"** and Press **"OK"**

(4) Select the units for each item on the list, use up- down and right arrows

Distance	**"Metric"**
Speed	**"MPH"**
Grade	**"Percentage"**
Cross Slope	**"Percentage"**
Station Format	**"10+00.00"**
UTC Offset	"**Based on your location**" or leave **0**

(5) Press "OK"

(6) Select **"Machine Dimensions"** and Press **"OK"**

(7) Select **"Mast Measurements"** and Press **"OK"**

INSTRUCTOR NOTE
All measurements must be made in metric, use x.xxx format (meter. cm-mm)

(8) Read Wizard instructions and press **"OK"**

(9) Select each **"Bolt Hole Number"** to be measured and Press **"OK"** (count holes 1-7 from front to rear of Machine)

(10) At bottom of screen use Down Arrow to select **"Measure-up Tool"**

(11) Press "F2" down arrow to **"Back from cutting edge bolts"**

(12) Enter measurements and press **"F2"** down arrow to **"Above cutting edge bolts"**

(13) Enter measurements and press **"F2"** down arrow **"In from blade tip"**

(14) Enter measurement and press **"F6"**

(15) Press **"Finished"**

(16) Select **"Machine Dimensions"** and press **"OK"**

(17) Enter **"Blade Height"** press **"Next"**

(18) Enter **"Blade width between tips"** press **"Next"**

(19) Enter **"Distance Between lift arms"** press **"Next"**

(20) Enter **"A-Frame Distance"**

Note: A-Frame distance: Measure from the center of the draft ball, at the head of the A-Frame to the center of the rotation sensor, on top of the hydra swivel.

(21) Press **"Cutting Edge"** Soft-key

(22) Enter **"Measure Bolt Hole"** (same as above) Press **"Next"**

(23) Enter **"Cutting Edge Horizontal distance" Press "Next"**

(24) Enter **"Cutting Edge Dimension"** and press "Ripper" Soft-key

(25) Enter **"0"** for **"Ripper Dimensions"** and press **"Machine Body"** Soft-key

(26) Enter **"Distance from the front of the machine to the cutting edge"** and press **"Next"**

(27) Enter **"Distance from the back of the machine to the cutting edge"** and press **"ESC"**

(28) Press **"ESC"** and select Units and Press **"OK"**

(29) Select the units for each item on the list, use up-down and right arrows

Distance **"Us Survey Feet (FT)"**

Speed **"MPH"**

Grade **"Percentage"**

Cross Slope **"Percentage"**

Station Format **"10+00.00"**

UTC Offset **"Based on your location"** **(CB460 only)**

(30) Press "ok" and Press "ESC" to Main Screen

(31) Go to "Display Settings" Field reference Guide

b. <u>850JR Dozer Measure-Up:</u>

(1) Press **"Menu"**

(2) Press **"Installation"** Soft-Key

(3) Select **"Units"** and Press **"OK"**

(4) Select the units for each item on the list, use up and down arrows

Distance **"Metric"**

Speed **"MPH"**

Grade **"Percentage"**

Cross Slope **"Percentage"**

Station Format **"10+00.00"**

UTC Offset **"Based on your location"** **(CB460 only)**

(5) Press **"OK"**

(6) Select **"Machine Dimensions"** and Press **"OK"**

(7) Select **"Mast Measurements"** and Press **"OK"**

INSTRUCTOR NOTE

All measurements must be made in metric, use x.xxx format (meter. cm-mm)

(8) Read Wizard instructions and press **"OK"**

(9) Select **"Measure height to"** method of **"Mast Measurements"**

(10) Enter measurements for each Mast Position required and press **"OK"**

(11) Press **"Finished"**

(12) Select **"Machine Dimensions"**

(13) Enter **"Blade Dimensions"** and Press **"Ripper"** Soft-key

(14) Enter **"Ripper Dimensions"** and Press **"Machine Body"** Soft-key

(15) Enter **"Machine Body Dimensions"** and Press **"OK"**

(16) Press **"ESC"** twice to main menu
Sec **"Units"** and press **"OK"**

(ON SLIDE # 99-102)

NOTE:

Metric system:

- **1 Meter = 1.000**
- **10 Centimeters = 0.100**
- **1 Centimeter = 0.010**
- **1 Millimeter = 0.001**

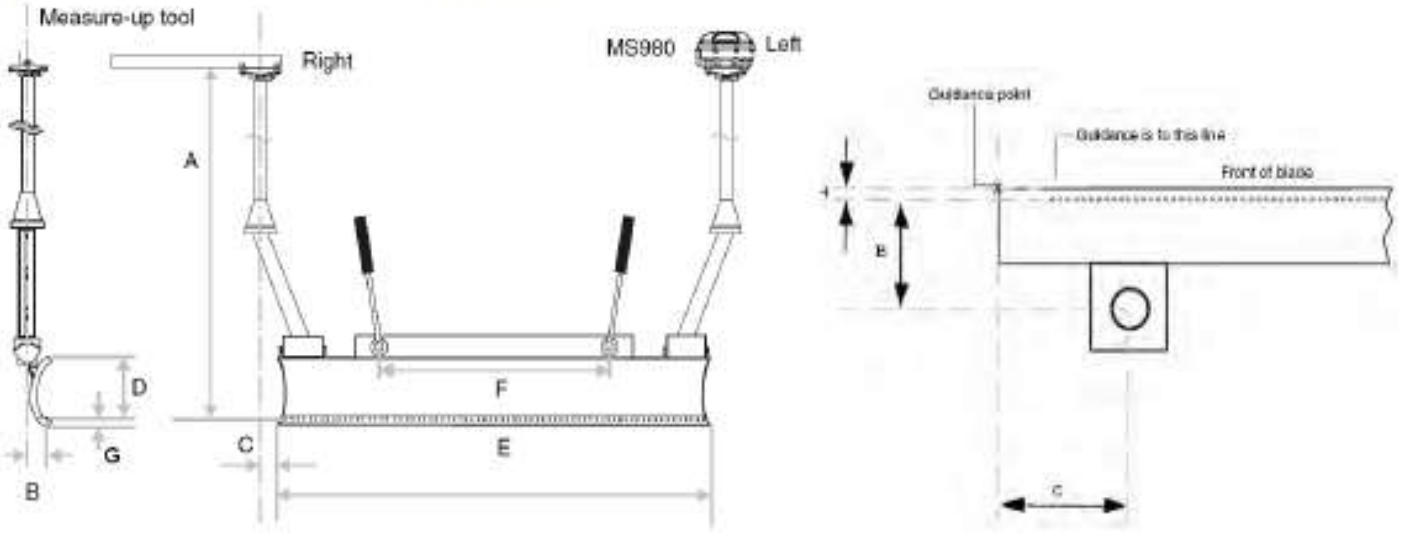
GCS 900 Grader Measure Up Record

Customer: _____ Date: _____

Contact: _____ Phone: _____

Make/Model: _____ Units: ☐ Meters ☐ Feet

S/N: _____ Installer: _____



Left	Right	Mast
		A: Height above cutting edge bolts
		B: Distance back from cutting edge bolts
		C: Distance in from blade tip
		Mast Bolt Hole Position (#7 Closest to Cab)

Blade
D: Blade height
E: Blade width
F: Distance between lift ram balls
G: Cutting edge vertical
H: Cutting edge horizontal

Machine
I: Cutting edge bolts to front of machine

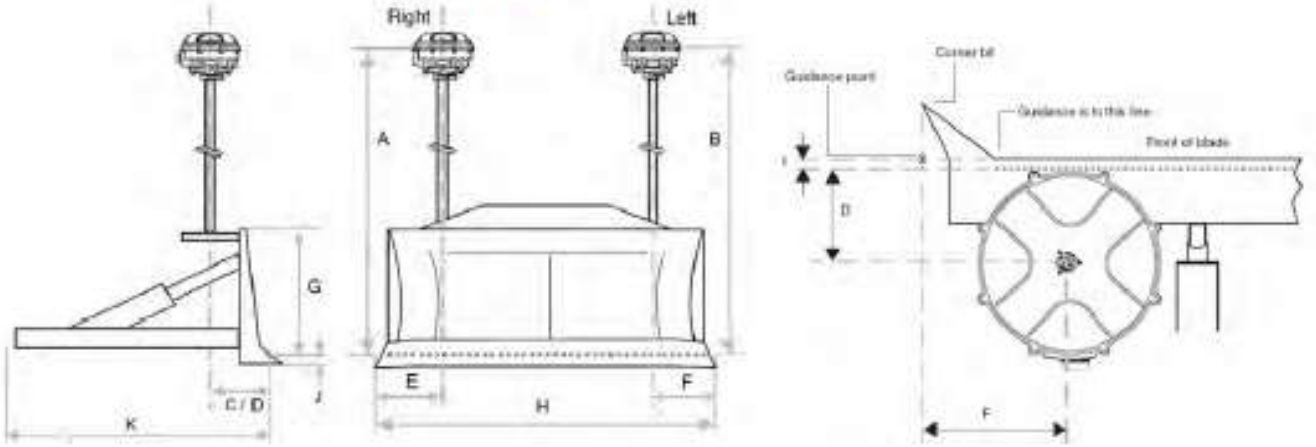
GCS 900 Dozer Measure Up Record

Customer: _____ Date: _____

Contact: _____ Phone: _____

Make/Model: _____ Units: ☐ Meters ☐ Feet

S/N: _____ Installer: _____



Left Antenna
B: Height above cutting edge bolts
D: Distance back from cutting edge bolts
F: Distance in from blade tip

Right Antenna
A: Height of above cutting edge bolts
C: Distance back from cutting edge bolts
E: Distance in from blade tip

Blade
G: Blade height
H: Blade width
I: Cutting edge horizontal
J: Cutting edge vertical

Machine
I: Cutting edge bolts to front of machine
J: Cutting edge bolts to back of machine

(ON SLIDE # 63-66)

(ON SLIDE # 103)

INTERIM TRANSITION: Are there any questions on what we just covered? If not let's move onto the demonstration of machine units and measure up.

_____

_____

_____

INSTRUCTOR NOTE

Perform the following demonstration.

5. DEMONSTRATION: (1 HRS) The purpose of this demonstration is to show the students how to conduct measure up for the 120M and MCT. Before the demonstration the Instructor will have a 120M, MCT prepared, and measure up tools laid out. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the equipment with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to measure up the 120M and MCT.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Introduction to the required measure up tools.
(2) Conduct measure up for the 120M.
(3) Conduct measure up for the MCT.
(4) Inputting the measurements into the CB430 control box.

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall

feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

INTERIM TRANSITION: Are there any questions on either of the demonstrations that we have just covered? If not let's move onto the Practical Application for measure up.

_____

_____

_____

INSTRUCTOR NOTE

Perform the following Practical Applications. Allow students to take breaks as needed

5. PRACTICAL APPLICATION: (4 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice conducting measure up for the 120M and MCT. Before the practical application the Instructor will have (1) 120M, (1) MCT prepared and measure up tool laid out. One instructor is required.

PRACTICE: Student will be broken down into two groups and assigned a piece of equipment to conduct measure up; an additional student will be assigned as the tool custodian. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Identify the required measure up tools.
(2) Conduct measure up for the 120M.
(3) Conduct measure up for the MCT.
(4) Inputting the measurements into the CB430 control box.

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly conducting measure up.

1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The Instructor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

TRANSITION: Are there any questions on the Practical applications of machine units and measure up? If not then I have some for you, before moving on to display settings and calibration.

_____

_____

_____

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS:

2. QUESTIONS TO THE CLASS:

(ON SLIDE # 104)

a. **Measure up identifies the exact locations of the what?**

The sensors and the exact dimensions of the machine.

b. **What is done with the measurements from the measure up?**

There uploaded to the CB430 control box.

(10 MIN BREAK)

TRANSITION: Are there any further questions on the Practical applications of machine units and measure up? If not let's move on to display settings and calibration.

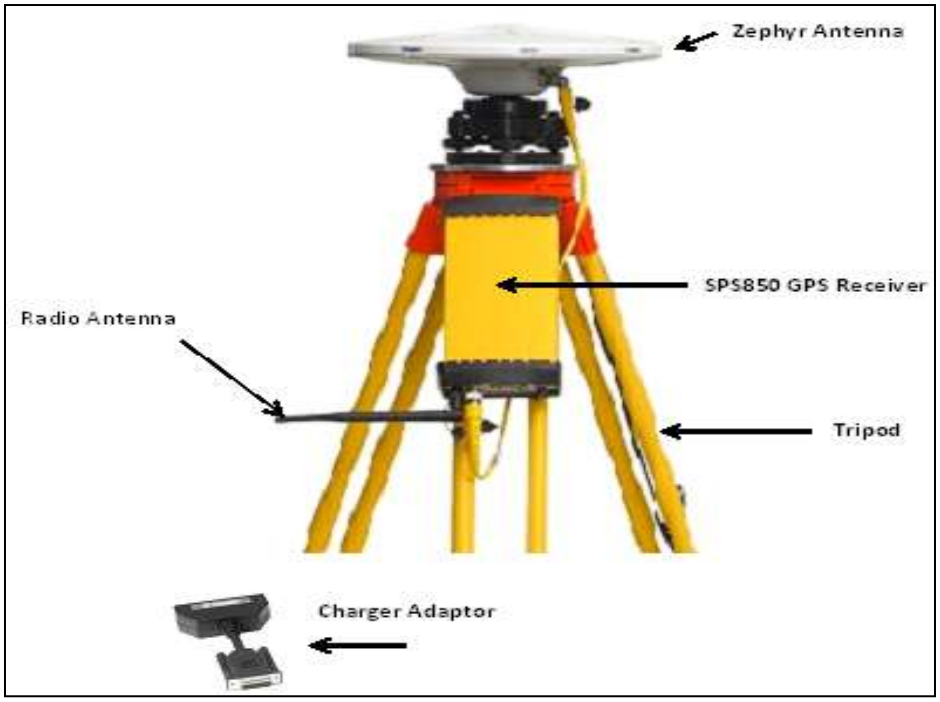
(ON SLIDE # 105-106)

6. **GPS BASE STATION: (30 MIN)**

Choosing an optimal location for the base station is very important for a few reasons. The Base station must be at location where there are minimal obstructions to the sky, it should be on a elevated area if possible. It should also be placed at a location that can be utilized throughout the project without having to relocate; a safe stand off from the working project is a must. Always ensure that the battery is fully charged the day before intended use.

(ON SLIDE # 107-108)

a. **GPS Components:** The GPS base station is a GPS receiver placed over a permanent fixed point on or near the job site. Its internal radio transmits position correction information to the operating equipment on the job site.



(ON SLIDE # 109)

GPS Base Station Set-up:

(1) Press **"Power"** 1 time to start Base Station Receiver

(2) Wait until at least "SV8" (8 satellites) appear on the display

(3) Press "Enter" 3 times until **"Base Station"** with **"Edit Current"** below it is displayed

(4) Press **"Right"** 1 time until **"Edit Current"** begins to flash

(5) Press **"down"** 1 time until **"New Base (Here)"** is displayed

(6) Press **"Enter"** 1 time to accept change and **"Base Name"** is displayed

(7) Press **"Right"** 1 time, the first character of the **"Base Name"** begins to flash

(8) Use "Up or Down Arrow" to change the character. Press "Right arrow" to move the cursor to the next character

(9) Press **"Enter"** 1 time to accept the change and Base Code" (description) is displayed

(10) Press **"Right"** 1 time, the first character of the **"Base Code"** begins to flash

(11) Use "Up or Down Arrows to change the character, Press "Right arrow" to move the cursor to the next character

(12) Press **"Enter"** 1 time to accept change and "Base Latitude" is displayed

(13) Press **"Enter"** 1 time to accept **"Latitude"**

(14) Press **"Enter"** 1 time to accept **"Longitude"**

(15) Press **"Enter"** 1 time to accept **"Point Height"**

(16) Press **"Enter"** until **"Antenna Type"** is displayed

(17) **"Zephyr GEO Mdl2"** should be displayed Press **"Right Arrow"** to edit

(18) Press **"Enter"** to accept

(19) Press **"Enter"** until **"Measured To"** is displayed

(20) Press **"Right Arrow"** until cursor is flashing

(21) Press **"Down Arrow"** until **"Bottom of the Antenna Mount"** is displayed

(22) Press **"Enter"** 1 time to accept change and **"Antenna Height"** is displayed

(23) Press **"Right Arrow"** to select number to edit **"Point Height"**

(24) Use **"Up or Down Arrow"** to change to **"2.000 Meters"** Press **"Enter"** to change

(25) Press **"Enter"** and **"Port Format"** is displayed

(26) Press **"Right Arrow"** and use **"Up or Down Arrow"** to change PORT to **"Radio"** Press **"Enter"**

(27) Press **"Down Arrow"** and Press **"Right Arrow"** to change Format to **"RTK CMR+"**

(28) Press **"Enter"** to accept

(29) Press **"Enter"** to go to **"Radio Network"** on the Machines Press **"Enter"**

(30) Verify **"Radio Network"** matches the **"Radio Network"** on the Machines Press **"Enter"**

(31) Press **"Power"** 1 time to return to the Home Screen

(ON SLIDE # 110)

INTERIM TRANSISTION: Now that we discussed the GPS base station. Are there any questions at this point? Let's move on to the demonstration.

INSTRUCTOR NOTE

Perform the following demonstration.

6. DEMONSTRATION: (.5 HRS) The purpose of this demonstration is to show the students how to identify and set up the GPS base station. The Instructor will have the GPS base station staged. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the GPS bastion with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to conduct GPS base station set up.

1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.

2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Introduction to the GPS base station components.
(2) Tool requirements and battery requirements.
(3) Set up of the GPS base station.

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

INTERIM TRANSITION: Are there any questions on the demonstration that we have just covered? If not let's move onto the Practical Application for the GPS base station set up.

_____

_____

_____

INSTRUCTOR NOTE

Perform the following Practical Application. Allow students to take breaks as needed

6. PRACTICAL APPLICATION: (4 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice conducting GPS base station set up. Before the practical application the Instructor will have the GPS base station staged. One instructor is required.

PRACTICE: Students will be broken down into two groups to conduct the GPs base station set up. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Identify GPS base station components.
(2) Identify tool and battery requirements.
(3) Set up of the GPS base station.

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly operating the equipment.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of

mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The Instructor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

TRANSITION: Are there any questions on what we just covered? Then I have a few for you, then move on to GPS Operation.

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS:

2. QUESTIONS TO THE CLASS:

(ON SLIDE # 111)

a. **The Base station must be at location where there are minimal obstructions to the what?**

Sky

b. **When should you charge the base station?**

Always ensure that the battery is fully charged the day before intended use.

(10 MIN BREAK)

TRANSITION: Are there any further questions? If not let's move onto the GPS operation.

(ON SLIDE # 112-113)

7. **GPS Operation: (25 Mins)**

Switch between GPS 3D and Laser 2D: Before you can use 3d mode you must first convert your control box. The following steps are how to do this.

(1) Press **"Menu"**

(2) Press **"Mode: 3D 1x GPS"** to change to **"Mode: 2D"**

(3) Press **"Mode: 2D"** change to **"Mode: 3D 1x GPS"**

Press **"Esc"** to return to Operation Screen

a. **Machine Components:**

(6) **MS992 Machine GPS Receiver:** Is a GPS receiver mounted to the blade of the machine and provides the actual location of the blade on the job site to the control box.

(7) **SNR900 Machine Radio:** Receives correction information from the base station to improve the machines accuracy.

(ON SLIDE # 114)

b. **Machine Operation:** When utilizing the GPS system the operator has the ability to create a design on the fly; within the CB430 control box or the operator can upload a Digital Terrain Model (DTM).

INSTRUCTOR NOTE:
Instructor will now utilize the emulator to load operations from thier field reference guides.

(1) **Create a level surface:**

(a) Establish permanent **Bench Point** at the beginning, near the new surface

(b) Place blade tip on the **Bench Point**

(c) Press **"Menu"** and **"Select Design:"** will be highlighted

(d) Press **"OK"**

(e) Press **"New Level"** (first soft-key)

(f) Select **"Auto create on load"** for UTM Coordination System Press **"OK"**

(g) Press **"Blade:"** to select which Tip **"Right or Left"** is on Bench Mark (first soft-key

(h) Press **"Here"** (fifth soft-key) Elevation will be established

(i) Press **"OK"**

(j) Enter **"Name"** of New Level Surface Press **"OK"**

(k) New Level Surface Name will be highlighted Press **"OK"** to Load new design

(l) Press **"ESC"** to return to main operator screen

(2) **Create a 120X120 HLZ (2% Slope one Direction):**

(a) Establish Point 1 at corner on high side of Pad

(b) Drive to Point 2 corner on the high side (Note the Heading on Text Screen)

(c) Place blade tip on Point 1

(d) Press "Menu" and :Select Design" will be highlighted

(e) Press "OK"

(f) Press "New Slope" (second soft-key)

(g) Select UTM Coordinate System form list or Press "Used last" Press "OK" (CB460 Only)

(h) Press "Method: 2 Point" 9last (soft-key) until "Method: Pt/Dir" is displayed

(g) Press "Blade:" to select whish Tip "Right or Left" is on Point 1 (fourth soft-key)

(i) Press "Here" Northing, Easting and Elevation will be established

(j) Press "Direction" Enter Heading

(a) Press "Next"

(b) Enter "0.00" Grade for the slope of Point1 and Point 2 on the High Side of Pad

(c) Press "Cross Slope"

(d) Enter "2%" Left Select Slope Direction and Press "Next"

(e) Enter "2%" Right Select Slope Direction and Press "Next"

(f) Press "OK"

(g) Enter "Name" of New Slope Surface Press "OK"

(h) New Slope Surface Name will be Highlighted Press "OK" to load new design

(i) Press "ESC to return to main operator screen

(j) Press "H. Offset"

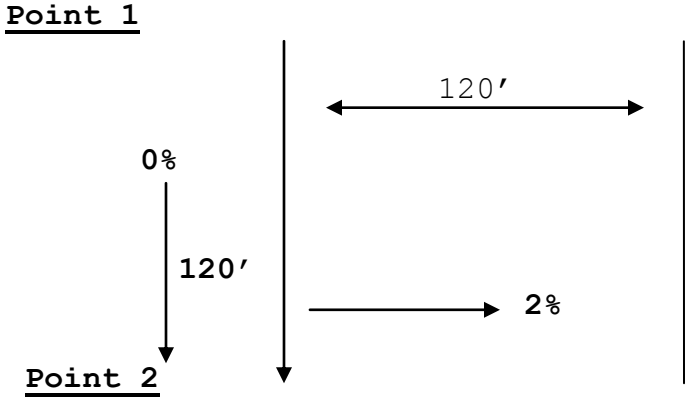
(k) Press "Alignment"

(l) Select "Master Alignment" and press "OK"

(m) Enter "120"

(n) Select "Left/Right" toward low side of Pad (- is Left and +is Right)

(y) Press "OK"



INSTRUCTOR NOTE

NOTE: Measure and Stake both Point 1 and Point 2.

(8) **Runway Extension PT/DIR Method:**

(a) Establish a permanent bench point on the crown line of the existing runway

(b) Drive parallel to the centerline of the runway with the tip on the crown line

(c) Note the Heading, Main-fall (Grade) and Cross Slope on the existing runway

(d) Place blade tip on Bench Point

(e) Press **"Menu"**

(f) **"Select Design"** will be highlighted Pres **"OK"**

(g) Press **"New Slope"** (second soft-key)

(h) Select **"Auto create on load"** for UTM Coordinate System Press **"OK"**

(i) Press **"Method: 2 Points"** (last soft-key) until **"Method: Pt/Dir"** is displayed

(j) Press **"Blade"** to select which Tip **"Right or Left"** is on the Bench Mark (forth soft-key)

(k) Press **"Here"** (fifth soft-key) Northing, Easting and Elevation will be established

(l) Press **"Direction"** Enter Heading

(m) Press **"Next"**

(n) Enter **"Grade"** (-Negative number for down slope)

(o) Press **"Cross Slope"**

(p) Enter **"Left Slope"** and Press **"Next"**

(q) Enter **"Right Slope"** and press **"OK"**

(r) Enter **"Name"** of New Slope Surface Press **"OK"**

(s) New Slope Surface Name will be highlighted Press **"OK"** to load new design

(t) Press **"ESC"** to return to main operator screen

(9) **V-Ditching:**

(a) Establish permanent Bench Point at beginning and of Ditch

(b) Place blade tip on Bench Point

(c) Press "Menu" and "Select Design:" will be highlighted

(d) Press "OK"

(e) Press "New Slope" (second soft-key)

(f) Press "Blade:" to select which Blade Tip "Right or Left" is on Bench Mark (fourth soft-key)

(g) Press "Here" (fifth soft-key) Northing, Easting and Elevation will be displayed

(h) Drive to end of Ditch place blade tip on Bench Point

(i) Press "Point 2" and Press "Here" Northing, Easting and Elevation will be displayed

(j) Press "Cross Slope"

(k) Enter "left Slope" and "Slope Direction"

 to invert Left

(l) Press "Next"

(m) Enter "Right Slope" and "Slope Direction"

 to invert Right

(n) Press "OK"

(o) Enter "Name" of New Slope Surface Press "OK"

(p) New Slope Surface Name will be highlighted Press "OK" to load new design

(q) Press "ESC" to return to main operator screen

(10) **Sloping surface:**

(a) Establish permanent Bench Point at beginning of Crown Line

(b) Place blade tip on Bench Point

(c) Press **"Menu"** and **"Select Design:"** will be highlighted

(d) Press **"OK"**

(e) Press **"New Slope"** (second soft-key)

(f) Select UTM Coordinate System from list or Press **"Used last"** Press **"OK"**

(g) Press **"Blade:"** to select which Blade Tip **"Right or Left"** is on Bench Mark (fourth soft-key)

(h) Press **"Here"** (fifth soft-key) Northing, Easting and Elevation will be established for **"Point 1"**

(i) Drive to second point place blade tip on Bench Point

(j) Press **"Point 2"** and Press **"Here"** Northing, Easting and Elevation will be established for **"Point 2"**

(k) Press **"Cross Slope"**

(l) Enter **"left Slope"** and Press **"Next"**

(m) Enter **"Right Slope"** and Press **"OK"**

(n) Enter **"Name"** of New Slope Surface Press **"OK"**

(o) New Slope Surface Name will be highlighted Press **"OK"** to load new design

(p) Press **"ESC"** to return to main operator screen

(11) **Cut and Fill mapping:**

(a) Establish Start Point of Site

(b) Place blade tip on Start Point

(c) Press **"Menu"** and **"Select Design:"** will be highlighted

(d) Press **"OK"**

(e) Press **"New Level"** (first soft-key)

(f) Press **"Blade:"** to select which Tip **"Right or Left"** is on Start Point (first soft-key)

(g) Press **"Here"** (fifth soft-key) Elevation will be established and Press **"OK"**

(h) Enter **"Name"** of New Level Surface Press **"OK"**

(i) New Level Surface Name will be highlighted Press **"OK"** to load new design

(j) Select **"Map Recording"**

(k) Select **"Cut and Fill"**

(l) Press **"Ok"**

(m) Press **"Esc"** to Main Screen

(n) Use **"C/F Mapping"** Soft-key to turn On and Off

(ON SLIDE # 115)

INTERIM TRANSITION: Are there any questions on what we just covered? If not let's move on to the demonstration for GPS operation.

INSTRUCTOR NOTE
Perform the following demonstration.

7. <u>DEMONSTRATION</u>: (.5 HRS) The purpose of this demonstration is to show the students how to conduct GPS operation. Before the demonstration the Instructor will have the GPS base station, (1) 120M and (1) MCT staged. One instructor is required for this demonstration.

STUDENT ROLE: The students will gather around the instructor; with student handouts and observe the instructors demonstration. Students will be encouraged to ask questions.

INSTRUCTOR(S) ROLE: The instructor will conduct a detailed demonstration of how to conduct GPS operation.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: The instructor will demonstrate the following.

(1) Introduction to the GPS operation.
(2) Set ups for various GPS operations.
(3) Operation of the GPS base station.

3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the demonstration.

INSTRUCTOR NOTE

Instructor will reiterate the safety brief prior to the students Practical Application.

<u>INTERIM TRANSITION:</u> Are there any questions on the demonstration that we have just covered? If not let’s moe onto the Practical Application for the GPS operation.

INSTRUCTOR NOTE

Perform the following Practical Application. Allow students to take breaks as needed

7. PRACTICAL APPLICATION: (4 HRS) The purpose of this Practical Application is to allow the students the opportunity to practice conducting GPS operations. Before the practical application the Instructor will have the GPS base station, (1)120M, (1) MCT prepared. One instructor is required.

PRACTICE: Students will be broken down into two groups to conduct the GPs operation; an additional student will be assigned to each piece of equipment as a ground guide for the student operating. Students are allowed to use hand outs and ask questions. The students will practice the following task.

(1) Identify GPS operation.
(2) Set ups for various GPS operations.

PROVIDE-HELP: The Instructor will assist students throughout the practical application and will ensure the students are properly operating the equipment.
1. Safety Brief: Instructor will cover ORAW. Hard hats will be worn while on the lot. Each student and Instructor will have hearing protection. Ensure all personnel are clear of the equipment prior to starting or moving the equipment. Ground guides will be utilized when necessary. In case of mishap students will move to the classroom and instructor will call emergency personnel.
2. Supervision and Guidance: Brief the students of their responsibilities during the practical application. The Instructor will be on the lot observing operations, assisting students and answering questions.
3. Debrief: Allow students the opportunity to comment on what they experienced and/or observed. Provide overall feedback, guidance on any misconceptions, and review the learning points of the Practical Application.

(ON SLIDE # 116)

TRANSITION: Now that we have covered the GCS900 in detail are there any further questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS:

2. QUESTIONS TO THE CLASS:

a. **What is the MS992?**

Is a GPS receiver mounted to the blade of the machine and provides the actual location of the blade on the job site to the control box.

b. **What is the SNR900?**

It is the machines radio that receives correction information from the base station to improve the machines accuracy.

(ON SLIDE # 117)

SUMMARY **(5 MIN)**

During this period of instruction we have covered all the equipment and a variety of the utilizations of the GCS900. Although as a 1345 Engineer Equipment Operator you may not always have access to this System, there is a high probability that you may be responsible for the training and employment at some point during your career. This lesson has given you a basic understanding of how to best utilize the GCS900 and incorporate it into your unit's mission.

(10 MIN BREAK)

INSTRUCTOR NOTE
Ensure to collect all IRF's and safety questionnaires hand-ed out.

REFRENCES:

TM 11907B-OR/1 -OPERATOR'S AND FIELD MAINTENANCE MANUAL WITH REPAIR PARTS AND SPECIAL TOOLS LISTING