Introduction of 3D Technology & Machine Control Systems

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Introduction

- De-mystify 3D Machine Control
- Highlight areas where 3D Machine Control is used and how these projects benefited
- How to analyze which tool will help you meet or exceed project specifications
- A look at some new, high tech grade control tools that are changing the way grading is being done.

Jones Bros., Inc. GPS Project List

PROJECT	D.O.T.	COUNTY	CITY
INTERSTATE 840 7 mile 4-lane rock subgrade / I-65 Interchange	Tennessee	Williamson	Franklin
HIGHWAY 452 6 mile subgrade / I-840 Interchange	Tennessee	Wilson	Lebanon
HIGHWAY 153 A. 4-Lane, 5 mile 1. Lack of radio signal 2. Poor plans elevation 3. Poor JBI training	Tennessee	Hamilton	Chattanooga
JOE B. JACKSON PARKWAY 4 mile subgrade / I-24 Interchange	Tennessee	Rutherford	Murfreesboro
EASTGATE BLVD. Access road for industrial park	Tennessee	Wilson	Lebanon
PRIMARY 29 A. 14 miles 1. Soil cement subgrade 2. Base cement in rock cuts	Virginia	Amherst	Amherst
FM 1187 4-lane, 7 mile subgrade; lime treated subgrade	Texas		Fort Worth
US 71 / 59 INTERCHANGE 6 mile subgrade, select fills	Texas		Texarkana
INTERSTATE 4 / MEMORIAL BLVD.	Florida		Lakeland
CORRIDOR H (Two Projects) 10 mile; 200 ft cuts and fills; boxed cuts; select fills	West Virginia	Hardy	

Introduction

- **3D Systems require a set “Process” to be followed**
- **3D Machine Control Systems are not “Plug and Play” products**
  I. Key Points for successful 3D operations
  II. Trouble shooting techniques that apply to all 3D systems

“Stakeless” Grade Control

BladePro 3D-ATS

SiteVision GPS

What is “Stakeless” Grade Control ?
How does the ‘process’ work?

3D Begins
Data Flow Process

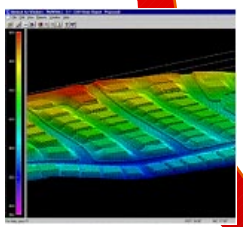
TOTAL SOLUTION

SURVEY

SiteVision

3D Project Data

BladePro 3D

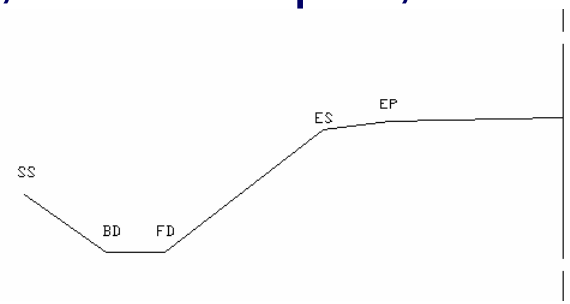


ENGINEERING

Quality Control

Data Preparation

- **What is required for the field?**
  - Finish grade or sub-grade?
    - Site – finish grade
    - Road – finish grade, top of rock, dirt
  - Pre-calculated points for field layout
    - Structures
    - Drainage structures
    - Edge of pavement, edge of shoulder
  - Road data with special coding, toe of slopes, ROW, or template breaks



To create a Digital Terrain Mode

Applications of 3D Machine Control and GPS Survey Systems

- **BladePro 3D (BP3D)- Total Station Based**
  1. Finishing Subgrade
  2. Knockdown and placing of materials in various zones
  3. Finish Grading
  4. Phased Construction
  5. Erosion Control
  6. Bridge Structures
  7. Drainage
  8. Signs, Guardrail

What is BladePro 3D?

- A Fine Grading tool operating on a Motor Grader.
- BP3D uses a Geodimeter Automatic Tracking System (ATS) measuring to a sensor mounted on the Motor Grader blade.
- One ATS Base runs one Motor Grader. Multiple Motor Graders cannot share one ATS.
- Accuracy +-.02 foot

Applications of 3D Machine Control Systems

- **Blade-Pro 3D (BP3D) – Motorgrader**

The Components

ATS600

- ATS Robotic Total Station Tracks the Position Of The Machine
- Transfers Position Information Via Radio To Operator Interface

Considerations when using ATS

Advantages

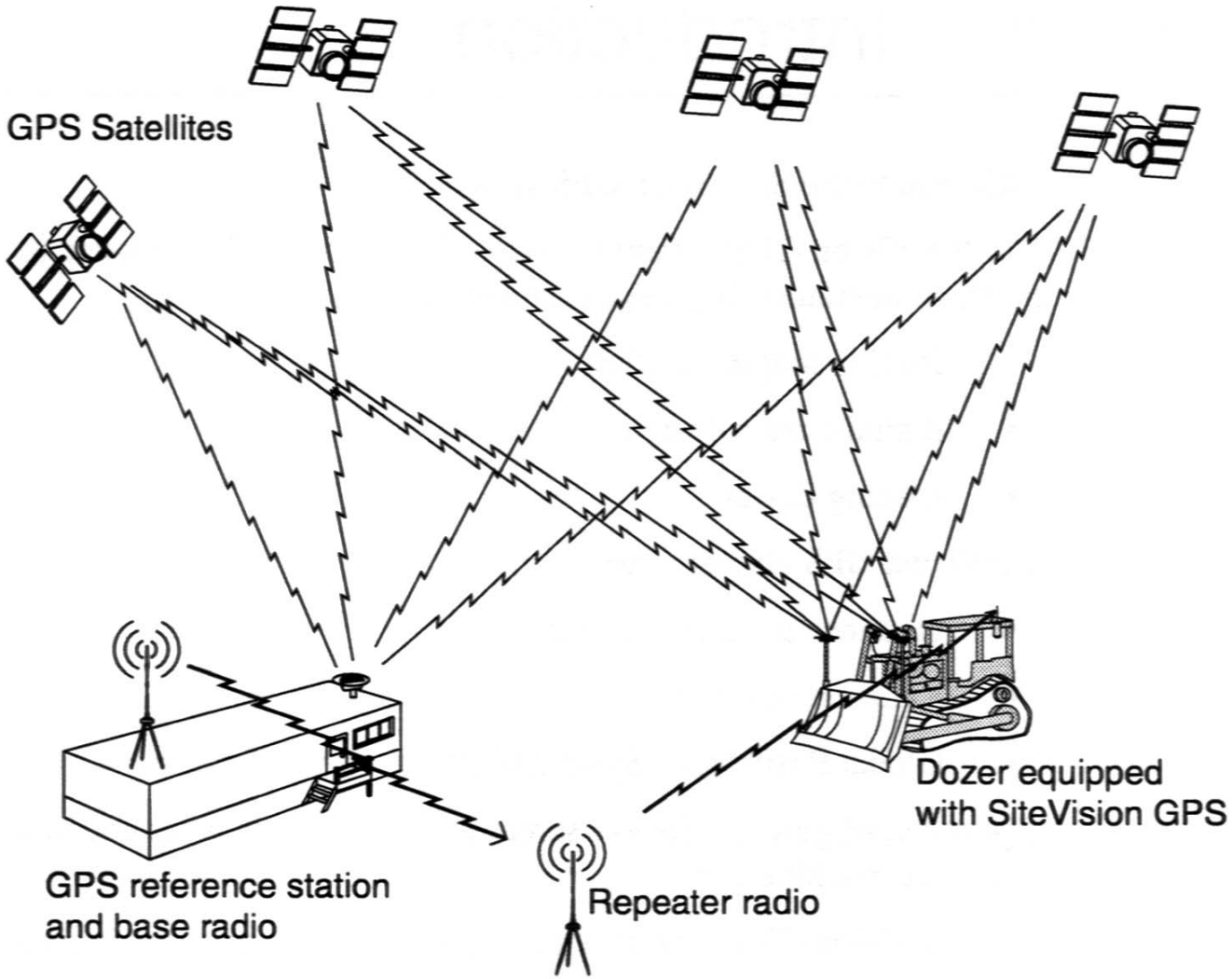
- Accurate results in the range of 0.0'/.02'
- 1000' to and from instrument for 2000' total with one instrument set up
- Easily upgraded to BladePro 3D-GPS, single antenna variant

Disadvantages

- Must be line of sight to the machine
- Controls only ONE machine
- Gun must be protected from being run over
- Requires a .PRO file format from Terramodel
- Range is effected by fog, dust, snow or heavy rain

SiteVision GPS

Real Time Kinemetic GPS

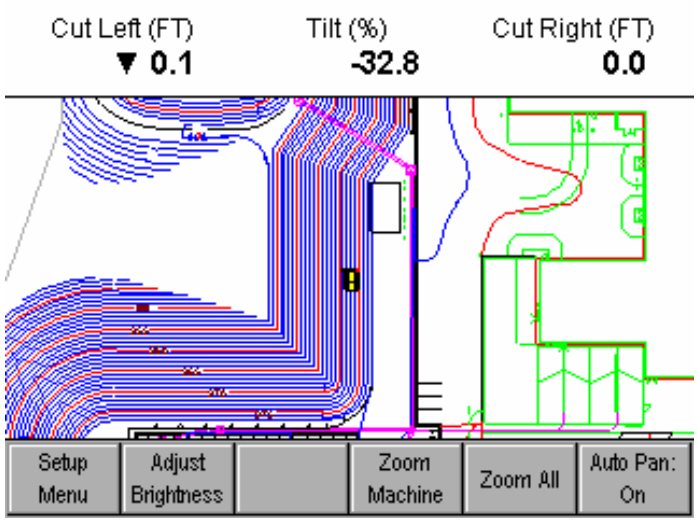


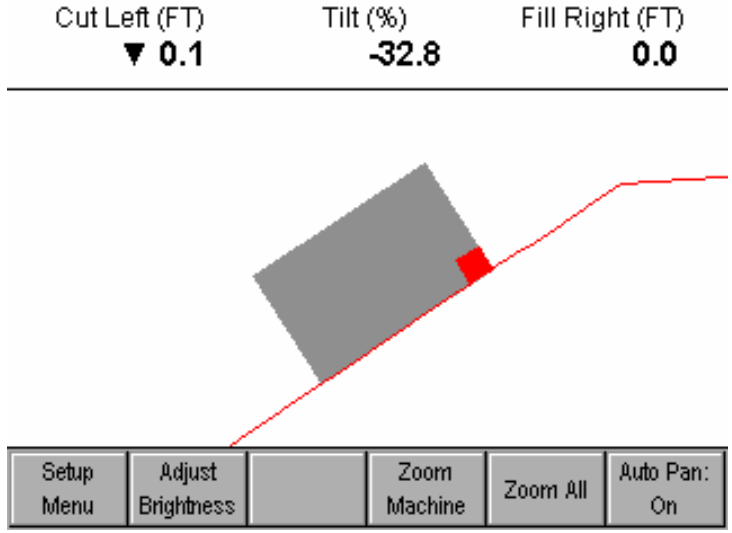
Repeater for difficult terrain

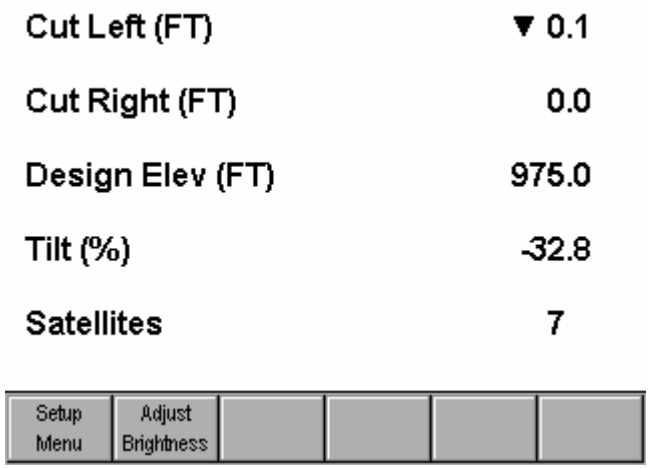
The Global Positioning System (GPS) is used to...

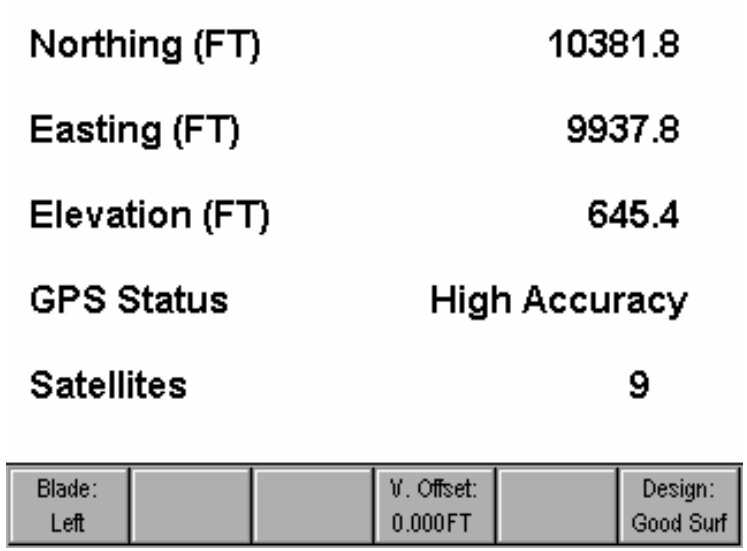
- **Accurately position the grading machine BLADE , on the 3D digital model of the project**
  - Within 1cm in X and Y
  - Within 1-3 cm in Z = 1.18 of an inch
  - Old school one tenth = 1.2 of an inch
- **This puts the blade on the design, precisely located in 3D**

Four screens available to the operator

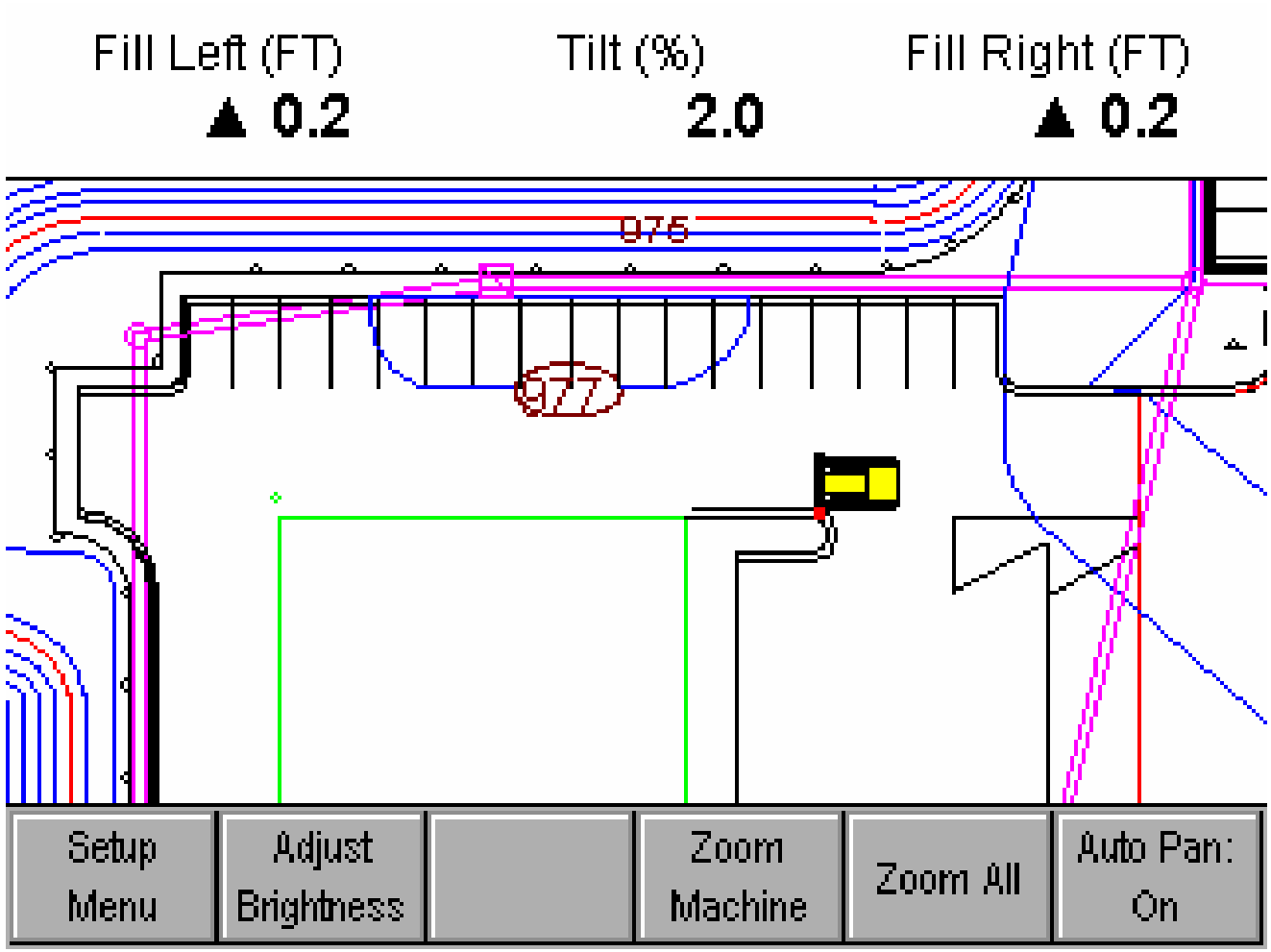




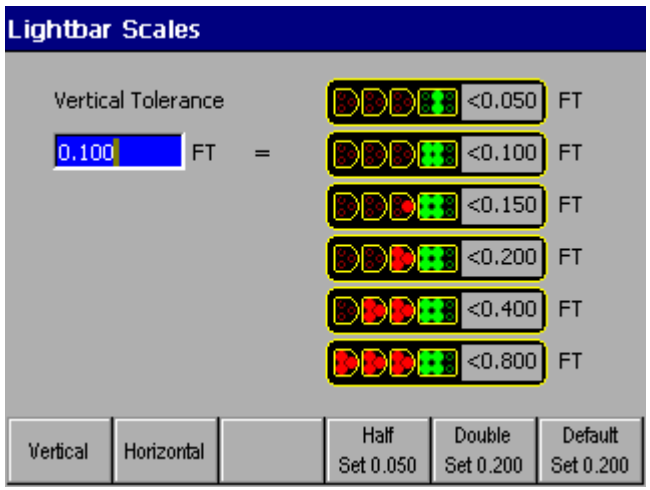




Guidance to Any plan Line



Scaleable Lightbars



Two 13” GPS antennas

Why Two GPS Antennas?

Summary - Two Antennas

Gives You:

- Most Accurate Solution!
- Cuts/Fills calculated along the entire blade cutting edge, from the right tip all the way to the left tip (no matter how the blade is tilted or rotated)
- Always know which way the machine is facing and moving. (operator must tell the system which direction with single antenna)
- No need for rotation or tilt sensors that are affected by vibration (especially on dozers)
- No daily/weekly/monthly calibration of sensors

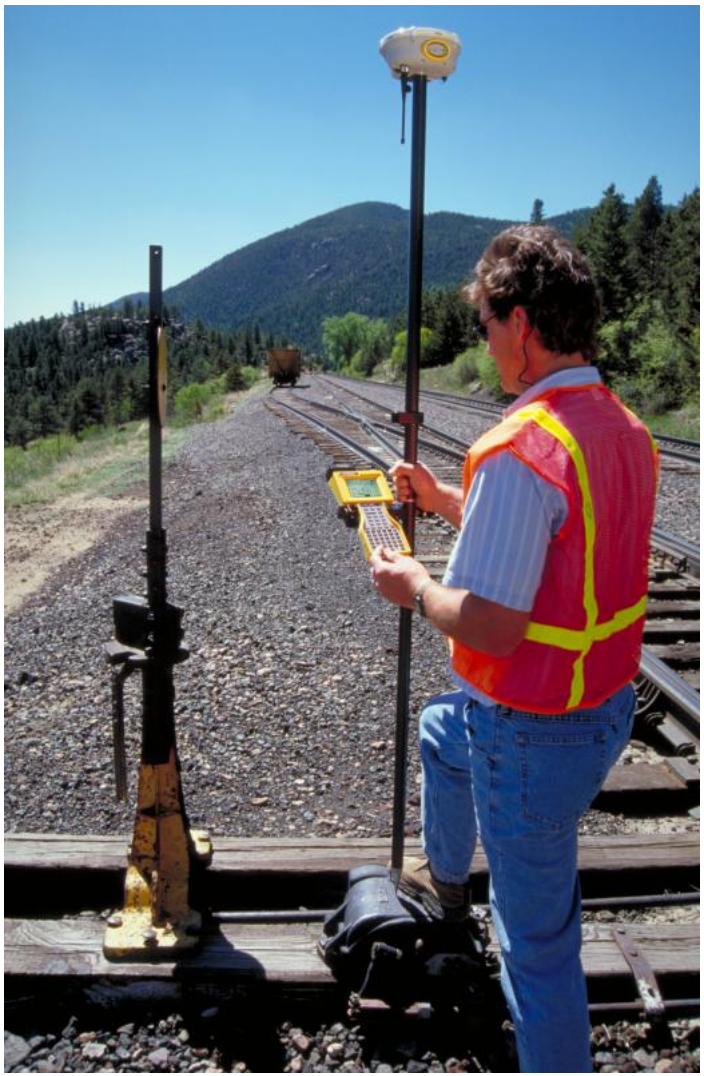
TWO ANTENNA'S

Dozers D3-D11 manual and automatic

Blades-manual and automatic

Grade checker's rover

GPS Rover



Considerations when using GPS Technology

Advantages

- **Places the design in front of the operator.**
- **Unlimited machines possible on one base**
- **Line of sight not required**
- **Dramatically increases production**
- **Dramatically reduces labor costs-layout,stakes**
- **Not effected by fog, dust etc.**
- **Operators love to use it!**

Disadvantages

- **You need a clear view of the sky**
  - Tree canopy
  - Tall buildings
  - Blocking terrain
- **Requires a local "champion" to manage-**
  - Data and site Cal
  - Radio coverage
  - Proper application requiring attention
  - PDOP issues

GPS Technology Gains Construction Phase

GPS technology	Compared with	Estimated savings
Grade Checking	Manual method	Up to 66%
Reduction or Elimination of Stakes	Using stakes	Up to 85%
Improved material yields/select fills/undercutting	Overruns using manual methods	3% to 6% in volume
Un-interrupted earth moving production under any weather conditions (24/7)	Daytime / fine weather operation only/night work	30% to 50%
RTK, robotics stakeout	Traditional survey stakeout	More than 100% in speed and 66% in staffing

- **Other savings from:**
  - Improved utilization of equipment/30%
  - Lower skill level required
  - **Erosion control as you go**

Process of 3D Machine Control Systems

- **Know your contract specifications and tolerances**
  I. BP3D tolerances are ±0.02’ (@ 750’ from the total station) and ±0.10’ (@ 1000’ from the total station)
  II. GPS tolerances are ± 0.10’ (Horizontal and Vertical on the machine)

Process of 3D Machine Control Systems

- **What is your plus / minus grade and elevation tolerances?**
  I. How do you meet or exceed these tolerances?
  II. Can 3D Machine Control systems compliment this task?
- **Trained foreman and supporting cast**
- **Increased efficiency and cost reduction results from improving the overall process**

Process of 3D Machine Control Systems

- **How to get up and running faster**
  1. Fully committed to the process
  2. Draw upon experienced resources
  3. Stay the course and be willing to follow through the learning curve
  4. Job planning
  5. Do not panic!

QUESTIONS ?