

Integrating Autoguidance into Your Farming Operation



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Overview

- Cost benefits of guidance systems
- GPS technology
 - Levels of accuracy
 - Correction services + costs
- Guidance Systems
 - Terrain compensation
 - Case examples
 - Options
 - Costs
- Purchase considerations

Savings for PA Technologies

Technology	Percent Savings
GPS-based Guidance	10%
Variable-Rate Application	7%
Automatic Section Control	5%

1. Quality of life (happier as day's end)
2. Will not go back

Choosing the Right Solution




Understanding GPS Classes

Levels of Correction

- Sub-meter
- Decimeter
- Centimeter (RTK)

Number Required

- GPS: 4 satellites
- RTK: 5 satellites

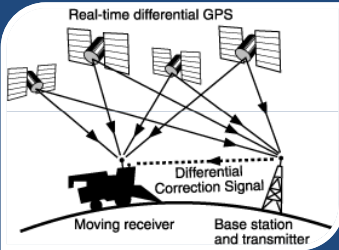



Image courtesy of University of Kentucky

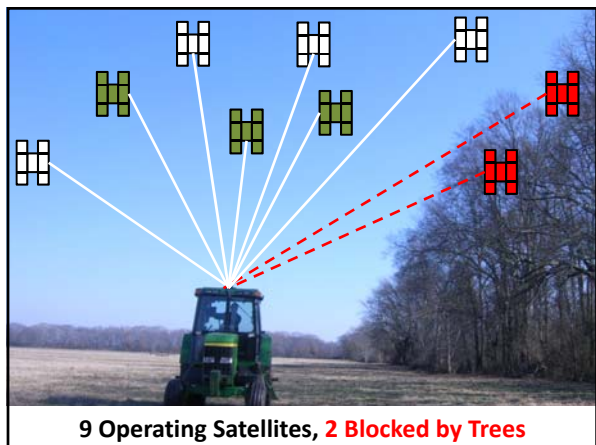
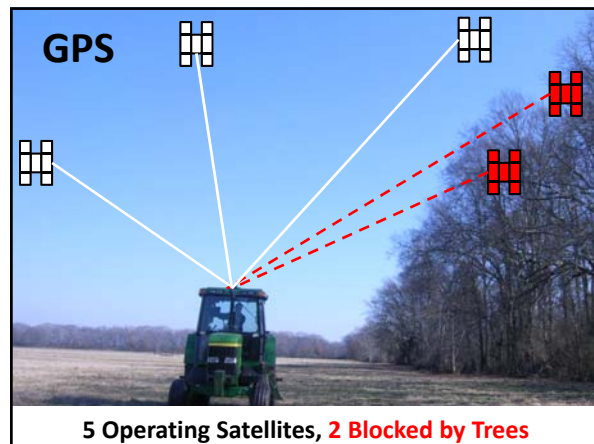
Sources of GPS Correction

Type	Broadcast Method	Examples
WAAS	Satellite	---
Single Frequency	Satellite	John Deere SF1 OmniStar XP & G2
Dual Frequency	Satellite	John Deere SF2 OmniStar XP
RTK	Radio or Cellular	Several



Correction Service	Pass-to-Pass Accuracy	Potential Range of Drift
WAAS	± 6 to 13 inches	± 4.7 ft
Sub-meter	± 6 to 13 inches	± 2.3 ft
Decimeter	± 2 to 4 inches	± 1.7 ft
RTK	± 1 inch	± 1 inch

**Selection of GPS Accuracy
Pass-to-Pass vs. Long-Term**



**More Satellites
=
More Operational Time**

GPS Solution	GNSS Solution (GPS+GLONASS)
<ul style="list-style-type: none"> • Best Case: 8 - 9 Satellites • Near Trees: 5 - 6 Satellites • May lose correction or ability of receiver provide a position (down-time) 	<ul style="list-style-type: none"> • Best Case: 14 - 15 Satellites • Near Trees: 8 - 10 Satellites • Improved reliability (continues to work!)

GPS Correction Costs (non-RTK)

- **WAAS:** Free
- **Single Frequency:**
 - OmniStar XP - \$800/yr
 - OmniStar G2 - \$800/yr (GNSS)
 - John Deere SF1 - Free
- **Dual Frequency:**
 - John Deere SF2 - \$800/yr
 - OmniStar HP - \$1500/yr

Example RTK Correction Costs

RTK fees:

- Trimble VRS: \$1500/yr*
- CORS in AL: free*
- John Deere: \$2000/yr

*May require cellular data plan + modem

Levels of Guidance Systems

1. Lightbar
2. Assisted steering
3. Auto-guidance

Terrain Compensation (Roll, Pitch, & Yaw)

Inertial Sensors – combination of accelerometers and gyroscopes

Company Offerings...

Manufacturer	Terrain Compensation System	Correction		
		Roll	Pitch	Yaw
Autofarm	ParaDyme™	X	X	X
John Deere	iTC; Terrain Compensation Module	X		X
Raven	3D Terrain Compensation	X	X	X
Tee-Jet	Tilt Compensation	X		
	Tilt Gyro	X	X	X
Topcon	150 System	X	X	
	AGI-3 Receiver	X	X	X
Trimble	T2	X		X
	T3	X	X	X

Case Examples

- Older model tractor
 - Lightbars using WAAS
 - Assisted steering option
- Guidance-Ready Tractor
 - Non-RTK option
 - RTK using CORS or Real-time Network

Example 1

NOT "Guidance-ready" tractor

Example 1a - Lightbar

Teejet Martix Pro

- \$1,758: 5.7" display
- \$2,500: 8.4" display
 - Display
 - External GPS antenna
 - WAAS correction
 - Cables



- Comments:
 - Application Control
 - \$225 for camera kit
 - \$860 for Tilt Module

Example 1b - Lightbar

Trimble CFX 750 (installed)

- \$3,500
 - 750 Display
 - GPS Receiver
 - WAAS correction
 - Cables + Brackets



- Comments:
 - Application Control
 - GNSS receiver upgradeable (\$)

Example 1c – Assisted Steering

Trimble EZ-Steer (installed)

- \$7,000
 - EZ-Steer + 750 Display
 - GPS Receiver
 - WAAS correction
 - Cables + Brackets



- Comments:
 - Bracket specific to tractor!
 - Check about compatibility with your model tractor



Example 2



Example 2a (Non-RTK)

John Deere Greenstar AutoTrac System

- \$11,800
 - 2630 Display with AutoTrac unlock
 - SF3000 Receiver with iTC (GNSS + terrain compensation)
- Totally integrated solution
- Application control capabilities



Images courtesy of John Deere




Example 2c (RTK)

Trimble CFX AutoPilot

- \$19,800
 - FMX Display
 - GNSS Receiver
 - Wiring Harness + Brackets
 - Modem / bridge
- Subscription fee + cellular data plan
- Application control capabilities



GPS Selection vs. Operation



- Sub-meter
 - Scouting
 - Yield mapping
 - Soil sampling
 - Variable-rate
- Decimeter* and RTK
 - Planting
 - Strip-tillage
 - Auto-swath
 - Peanut digging

Purchase Considerations

- Select the right guidance system for your operation
 - Lightbar vs. Autoguidance
 - Determine **required accuracy** (WAAS vs. RTK)
 - **Source of GPS correction**
 - Use **GNSS (GPS+GLONASS)** receivers
- **Terrain Compensation**
 - Add-on component
 - Included with purchase
- **Capabilities beyond guidance** (application control)
- **System easily upgradeable** with new firmware
- **Documentation data** (as-applied maps + reports)
- System **service** or support

Thanks!



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