

Precision Agriculture

Precision Guidance: How do I choose?

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No guidance at work here ...



Presentation Overview

- Benefits of guidance
- Overview of guidance systems
- *Differential correction services
- Purchase considerations
- Final comments

Benefits of Guidance

- Extends operational hours
- Minimizes driver fatigue
- Improves field efficiency:
 - Reduce overlap and skips
 - Cover more acres with fewer operating hours
 - Minimize driver errors (guessing)
 - Operate at faster field speeds
 - Reduce per acre fuel consumption
- More accurate placement of agronomic inputs
- Adoption of new and innovative field practices



Courtesy of John Deere

Ability to work accurately at night

Guidance Usage

- Spraying
- Spreader/applicators
- Tillage
- Bed preparation
- Cultivation
- Planting
- Harvesting
- Forage



Guidance Systems



AutoGuidance



Lightbar mounted on hood for easy visualization.

Lightbar or Parallel Tracking

Aftermarket Products



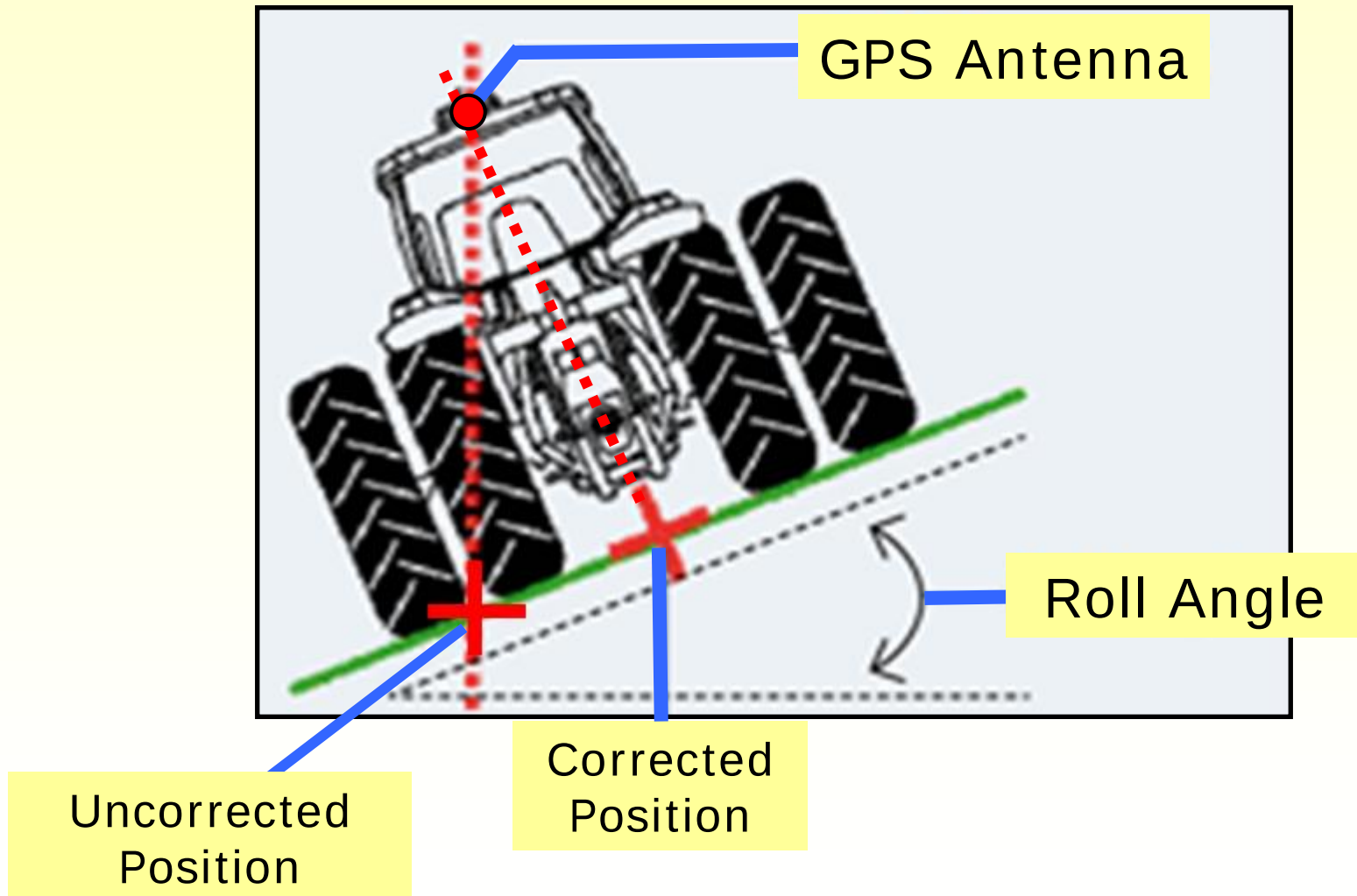
Trimble's EZ-Steer

John Deere's Auto-Trac Universal



Check compatibility of
older model equipment
with manufacturer.

Terrain Compensation



GPS Receiver Performance

Low-Cost	Sub-Meter	Sub-Foot	RTK
\$80-300	\$1k – 4k	\$5k-10k	>\$35k
3-15 ft.	< 3 ft.	< 6 in.	< 1 in.
WAAS	Various	Omnistar HP Starfire2	Need Base Station

Autosteering Guidance System Classes

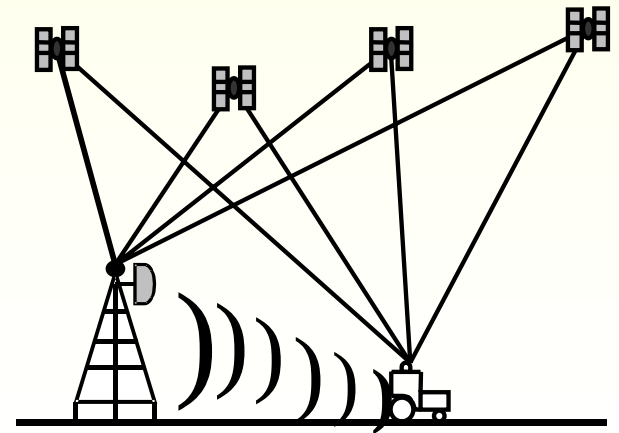
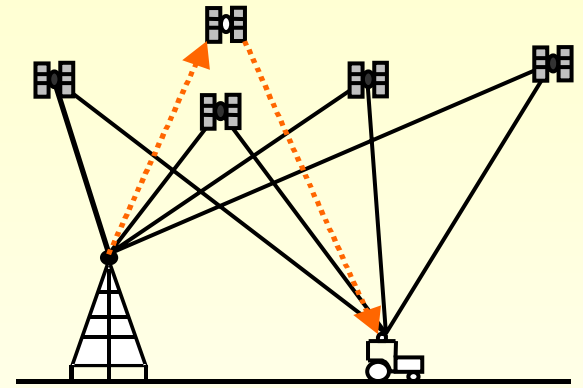
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graph TD; A[Autosteering Guidance System Classes] --> B[RTK-based Autosteering Systems]; A --> C[DGPS-based Autosteering Systems];
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RTK-based
Autosteering Systems

DGPS-based
Autosteering Systems

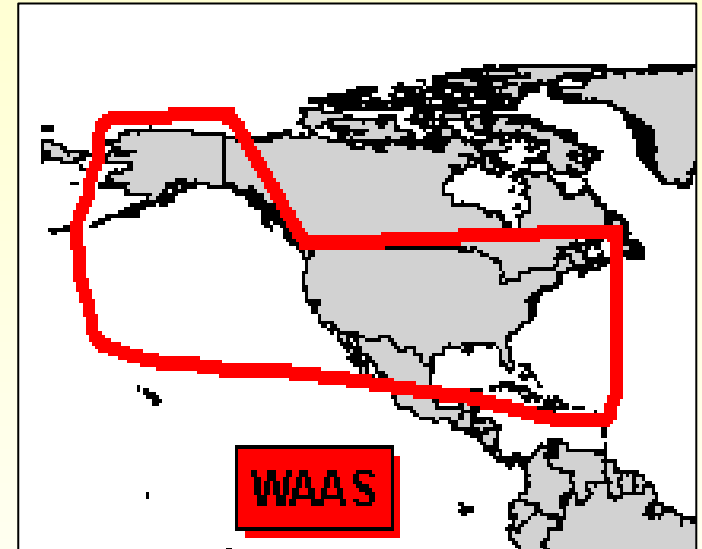
Sources of Real-Time Correction

- Satellite-based differential correction (wide-area)
 - WAAS - free
 - Commercial services (OmniStar)
 - John Deere Starfire
- Local Area differential correction
 - US Coast Guard beacon - free
 - RTK
 - CORS - free
 - Networks



Wide Area Augmentation System (WAAS)

- Developed by FAA
- Coverage
 - Entire US
 - Parts of Canada and Mexico
- 3 to 5 meter (free)
- Broadcast at 1575.42 MHz or same frequency as the L1 GPS signal.
 - Only 1 antenna required for GPS and WAAS signals



OmniStar and John Deere

- Subscription services
- Receiver must be compatible
- OmniStar
 - VBS: sub-meter (\$800 / year)
 - XP: 20 cm (\$800 / year)
 - HP: 10 cm (\$1500 / year)
- John Deere Starfire System
 - SF1: 1 meter (free)
 - SF2: 10 cm (\$800 / year)



Courtesy of Trimble

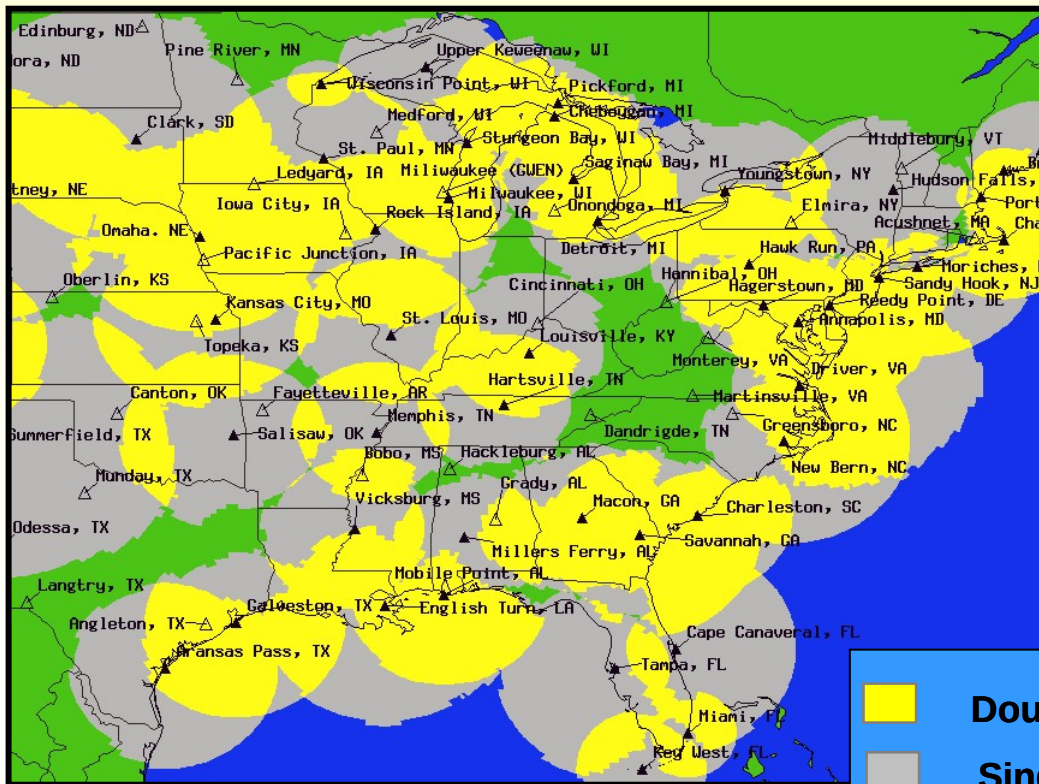


Courtesy of John Deere

Local Area Services

USGS Coast Guard Beacon

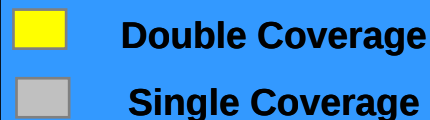
- Free real-time correction service
- Sub-AM band radio signal
- Around 2 meter accuracy



Courtesy of USCG

Disadvantages

- US not fully covered
- Towers positioned around navigable waterways
- Terrain and thunderstorms can interfere.



RTK-Based Autoguidance



Autosteer Tractor



RTK Base Station with radio

Advantages

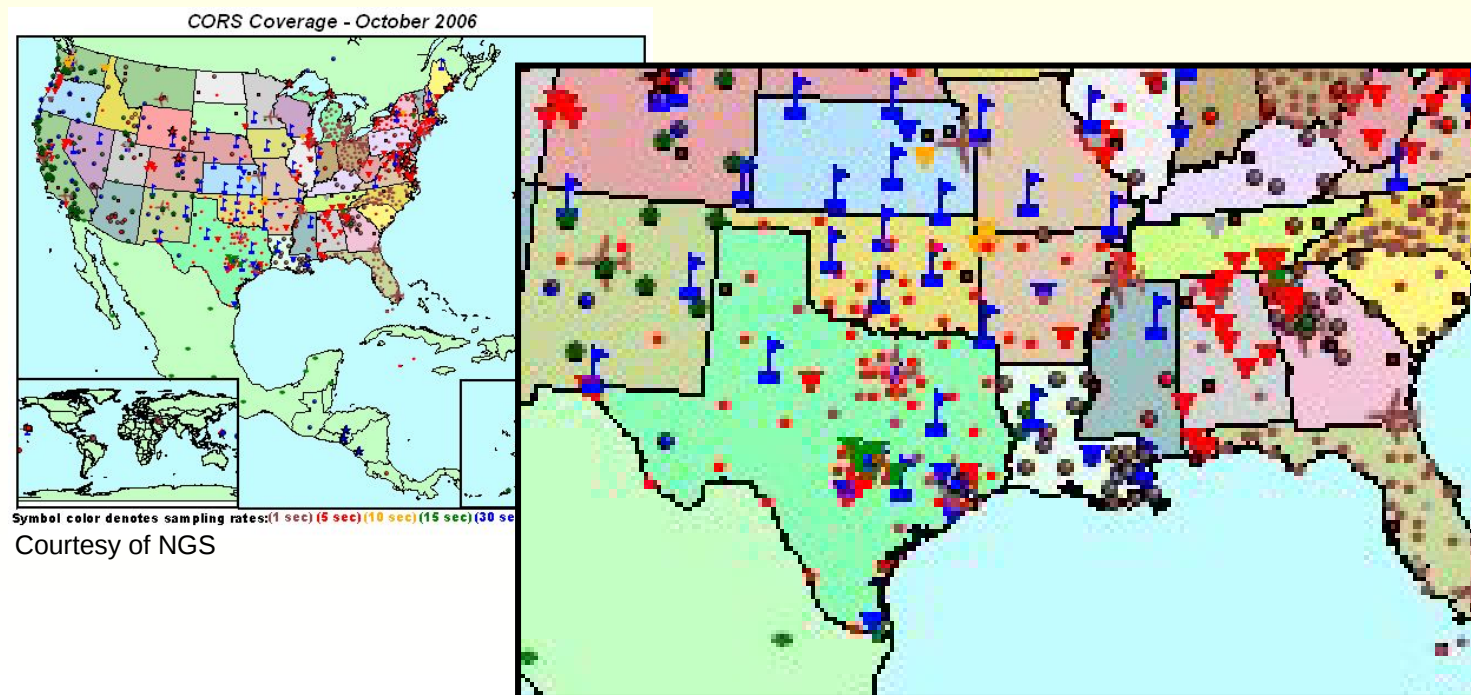
- Inch level accuracy
 - Planting, cultivating, harvest
- No drift over time
- Operate multiple rovers

Disadvantages

- 2 to 6 mile coverage limitation (line of sight) – repeaters
- Need to move base station
- Tree lines, buildings and structures
- Costs (\$35K to >\$40k)

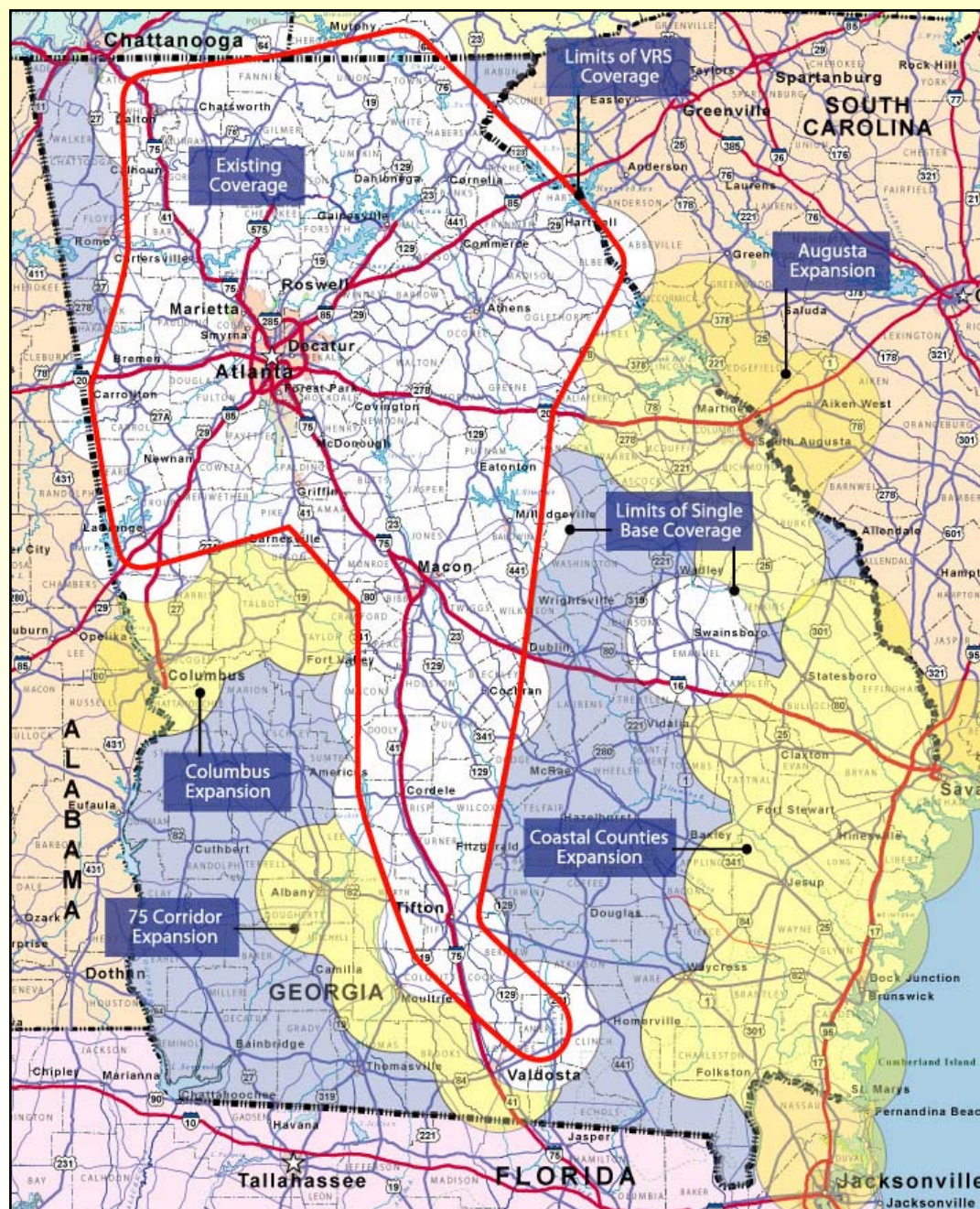
CORS Coverage

- Eliminates need for a personal base station
- Hundreds of sites nationwide – increasing
- Cellular modem communication
- 2 – 4 inch accuracy up to 25 miles (Auburn Research)



RTK Networks

- Allow for expanded operating range of RTK enabled equipment.
- Reduced investment cost for RTK applications.
- Prevent producers from dealing with maintenance and upkeep of base station equipment.
- Subscription fee required



RTK Applications

- Controlled Traffic
- Planting
- Precision strip tillage and fertilization
- Automatic sprayer boom section / nozzle control
- Precise seeding and fertilization



Purchase Considerations

- Application - [planting, spraying, etc.](#)
- Type of differential correction
[\(desired accuracy for operation\)](#)
- Guidance paths
 - Straight
 - Contour and Straight
- Shift track capabilities [\(GPS Drift adjustments\)](#)
- Terrain compensation [\(necessary for rolling terrain\)](#)
- Upgradeable

Final Note

- “Farming by the Inch” --- does it make a difference to the crop?
- Cotton strip-tillage research at USDA-NSDL, Auburn, AL
 - Yield decreased
 - 6% when row 2-inches off center
 - >30% when row 9-inches off center

Minimize Guess Work?



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