BALES Biomass Alliance for Logistics Efficiency and Specifications

High Level Overview of DOE Biomass Logistics II Project Activities

Biomass 2014: Growing the Future Bioeconomy

Washington, DC

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Presentation Objectives

- Provide high level review of DOE Logistics I project results

- Provide high level overview of DOE Logistics II project plans, activities, and objectives

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Advanced Logistics Project #1

- Key equipment development
  - –Improved Industrial Grade Baler
  - –Bale Picking Truck
  - –Self Loading Trailer
  - –Single-pass Harvest Systems
  - –Improved Header for Heavy Crops

Self-Propelled Baler

Bale Picking Truck (BPT)

Heavy Crop Header

Single Pass Baling

Self-Loading Trailer (SLT)

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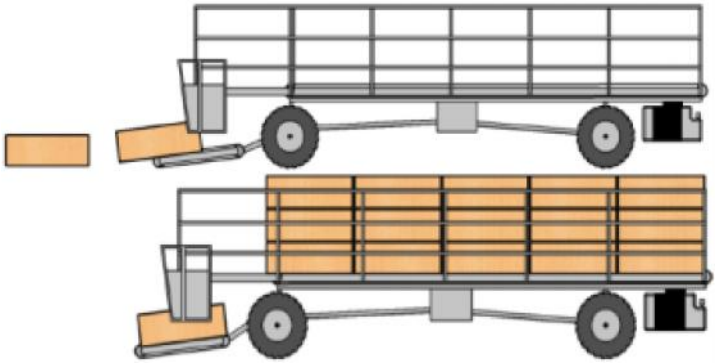
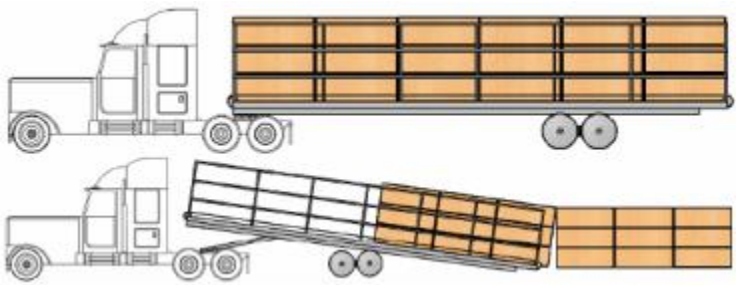
Advanced Logistics Project #1 Results





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Project Summary

- 3 Year Development and Demonstration Project, began Sept 2013
- Develop and demonstrate new and improved harvest and processing technologies that will reduce biomass supply chain costs while meeting quality specifications of biomass end users

FDC Enterprises Grasslands Services

POET Energy inspired.

ANTARES Group Incorporated

Vermeer

kelderman

CLARIANT

B Hames Consulting

Pellet technology

MacDon

ADM

MONSANTO

AGSOLVER

Biomass Toolbox

Biomass Market Access Standards (BMAS) Group

FEEDSTOX

IOWA FARM BUREAU PEOPLE. PROGRESS. PRIDE.

IOWA CORN

INL Idaho National Laboratory

ASD Inc.

VT

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Project Objectives

- Lower overall feedstock supply costs
  - Square and round bale supply chains
  - Full supply chain (harvest to "reactor throat")
  - DOE Program Goal is $50/DT (CHST + processing)
    - Overall DOE Program Goal is $80/DT (CHST + processing + grower payment)
- Improve feedstock quality
  - Corn stover and switchgrass/warm season grasses (WSG)
  - Focus on dirt reduction in field and processing line
  - Develop and demonstrate new NIR-based tools
- Validate improvements & identify remaining gaps
  - Field testing, data collection & analysis, reporting
- Address key sustainability-related issues associated with biomass harvest & delivery

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Key Project Tasks

- Task A. Harvest Equipment Development
- Task B. Process Equipment Development
- Task C. Go/No-Go Review Meeting
- Task D. Harvest Equipment Demonstration
- Task E. Process Equipment Demonstration
- Task F. Feedstock Quality Monitoring & Improvement
- Task G. Performance Evaluation & Baseline Development
- Task H. Sustainability Assessment and Data Collection
- Task I. Project Management & Reporting

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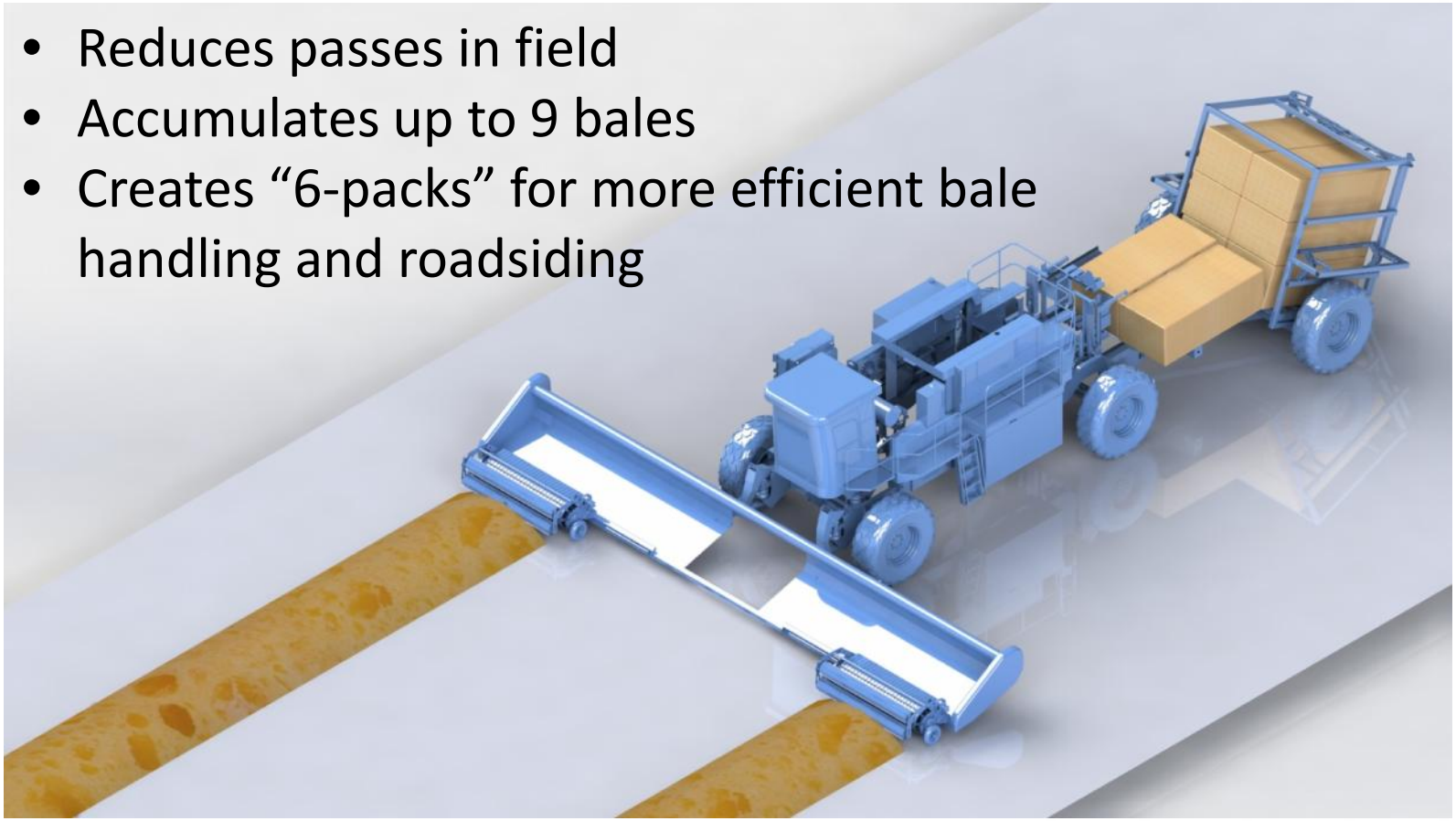
Kelderman Bale Merger and 6-packer Accumulator

- Reduces passes in field
- Accumulates up to 9 bales
- Creates “6-packs” for more efficient bale handling and roadsiding



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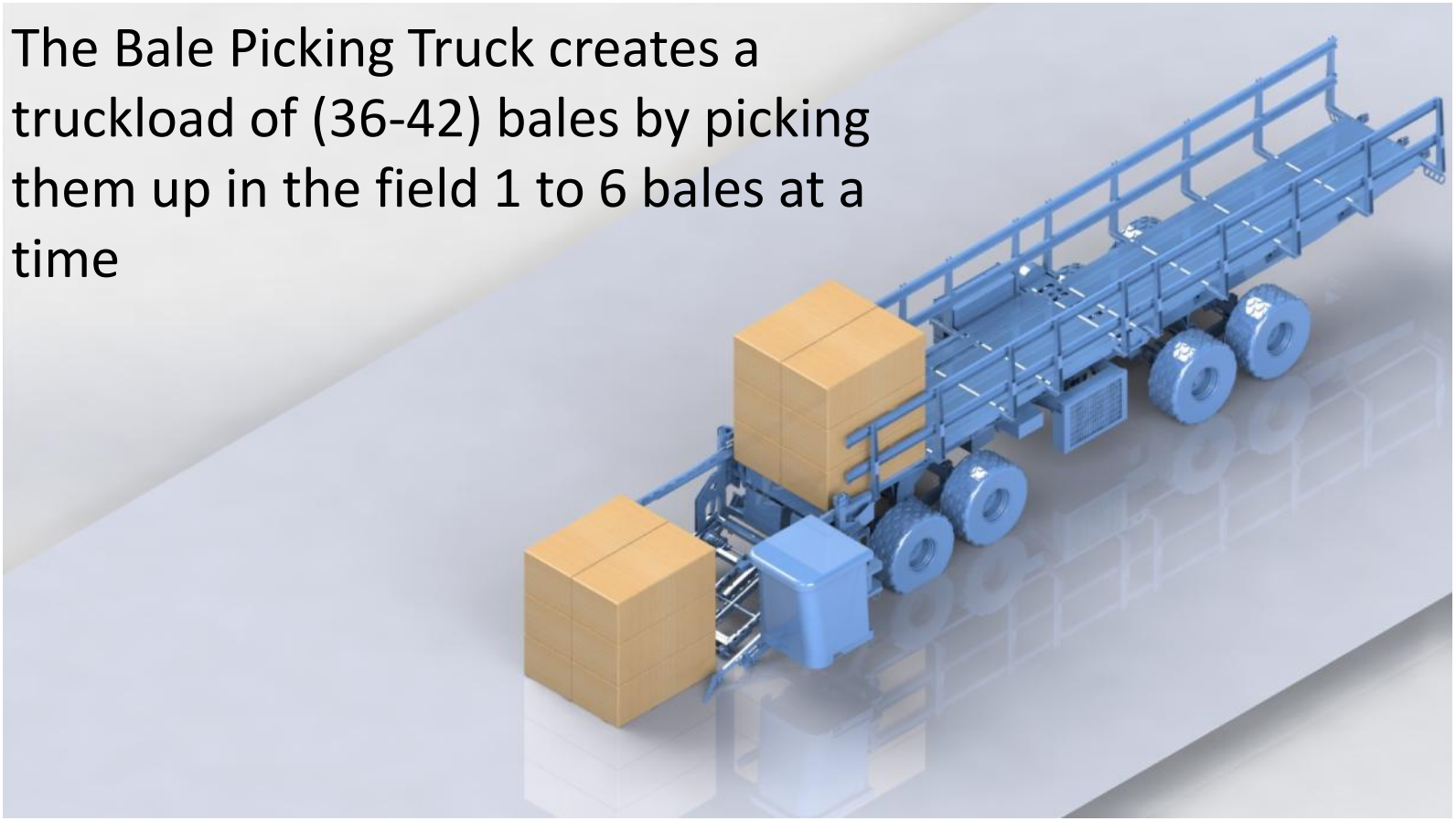
Kelderman Bale Picking Truck

The Bale Picking Truck creates a truckload of (36-42) bales by picking them up in the field 1 to 6 bales at a time



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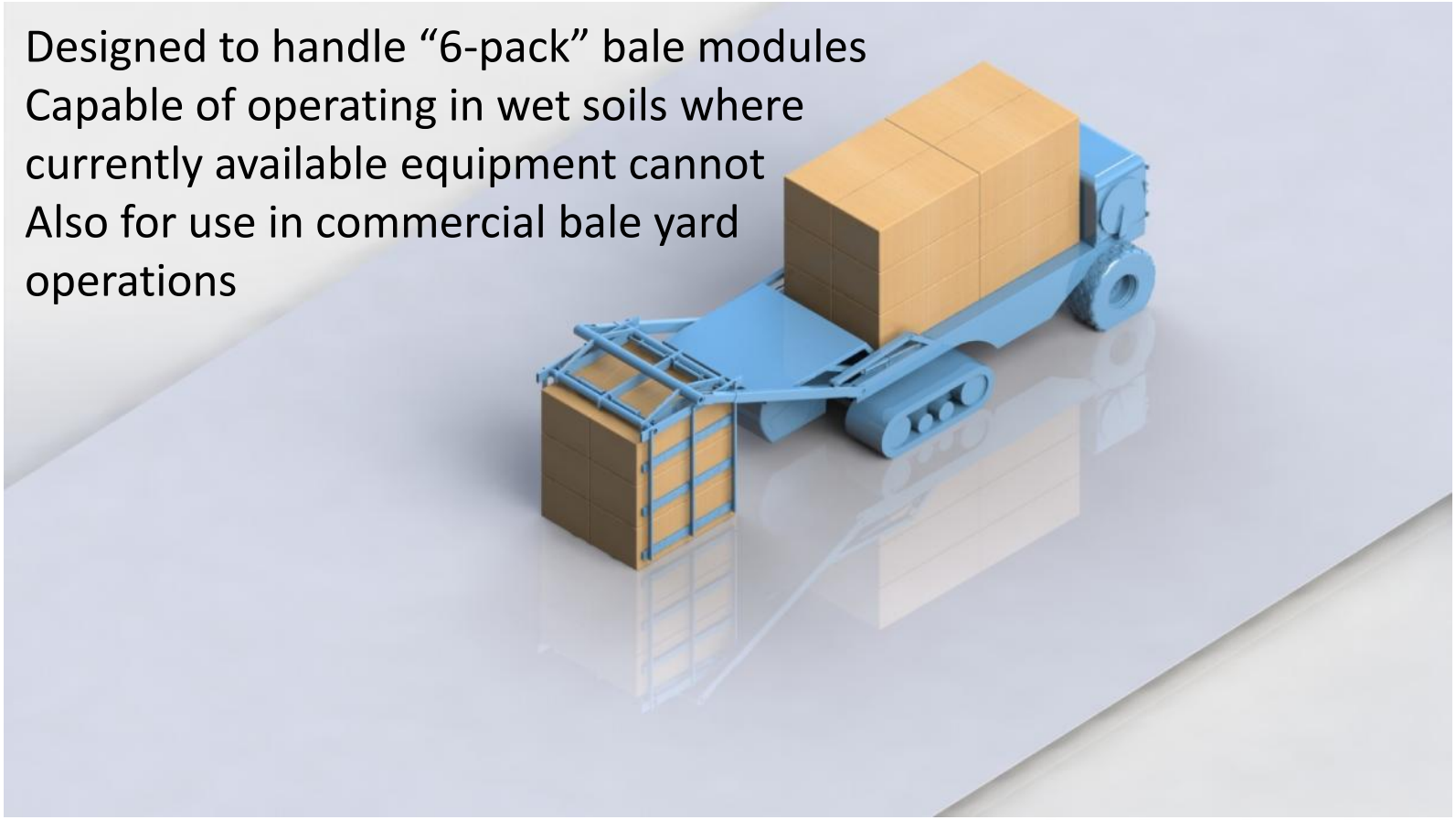
Kelderman Bale Pre-Loader

- Designed to handle “6-pack” bale modules
- Capable of operating in wet soils where currently available equipment cannot
- Also for use in commercial bale yard operations



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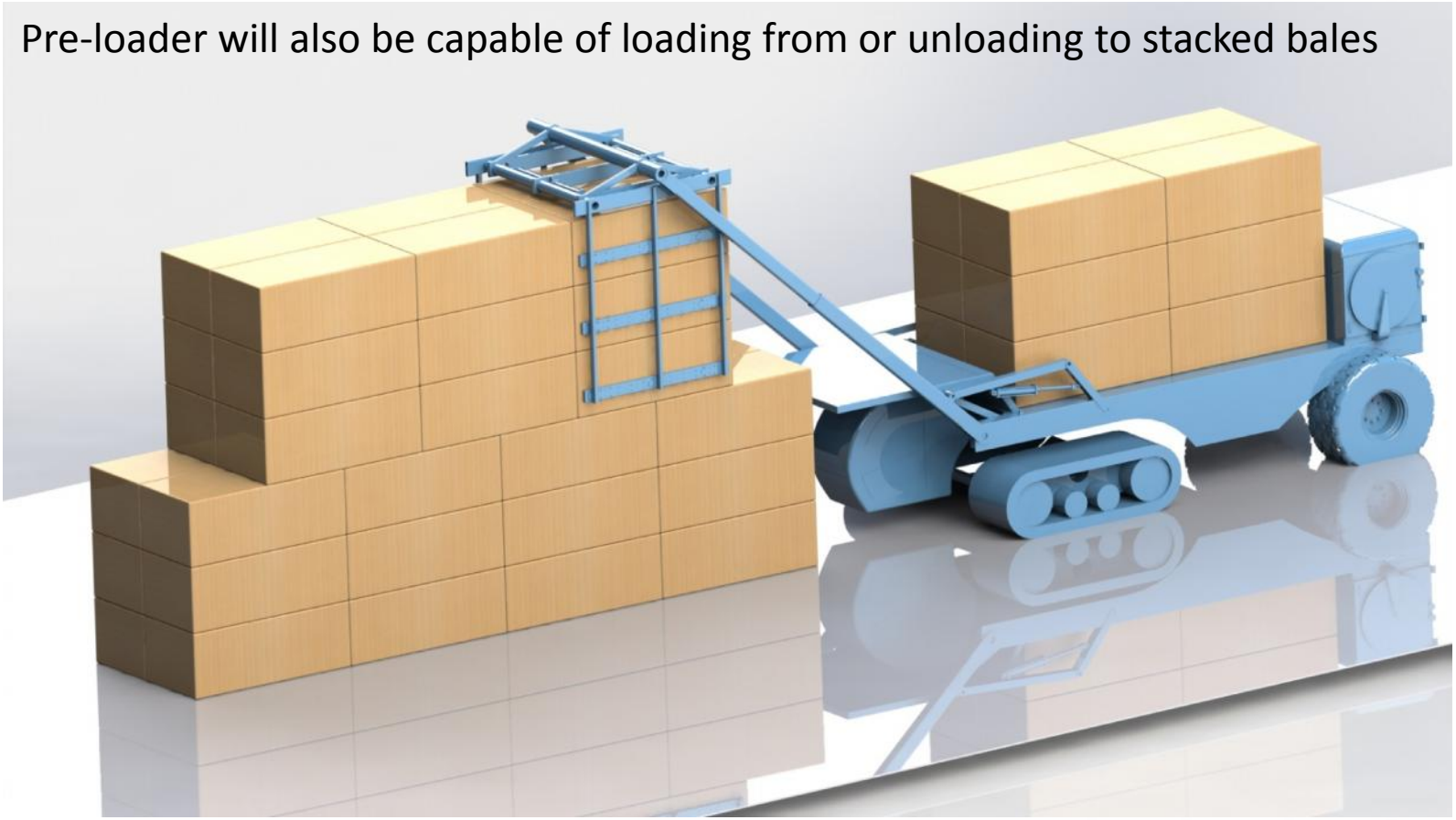
Kelderman Bale Pre-Loader

Pre-loader will also be capable of loading from or unloading to stacked bales



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Kelderman Bale Pre-Loader and 3rd Generation Self Loading Trailer

Pre-loader can load directly onto 3rd generation *Self Loading Trailer*

Kelderman manufacturing

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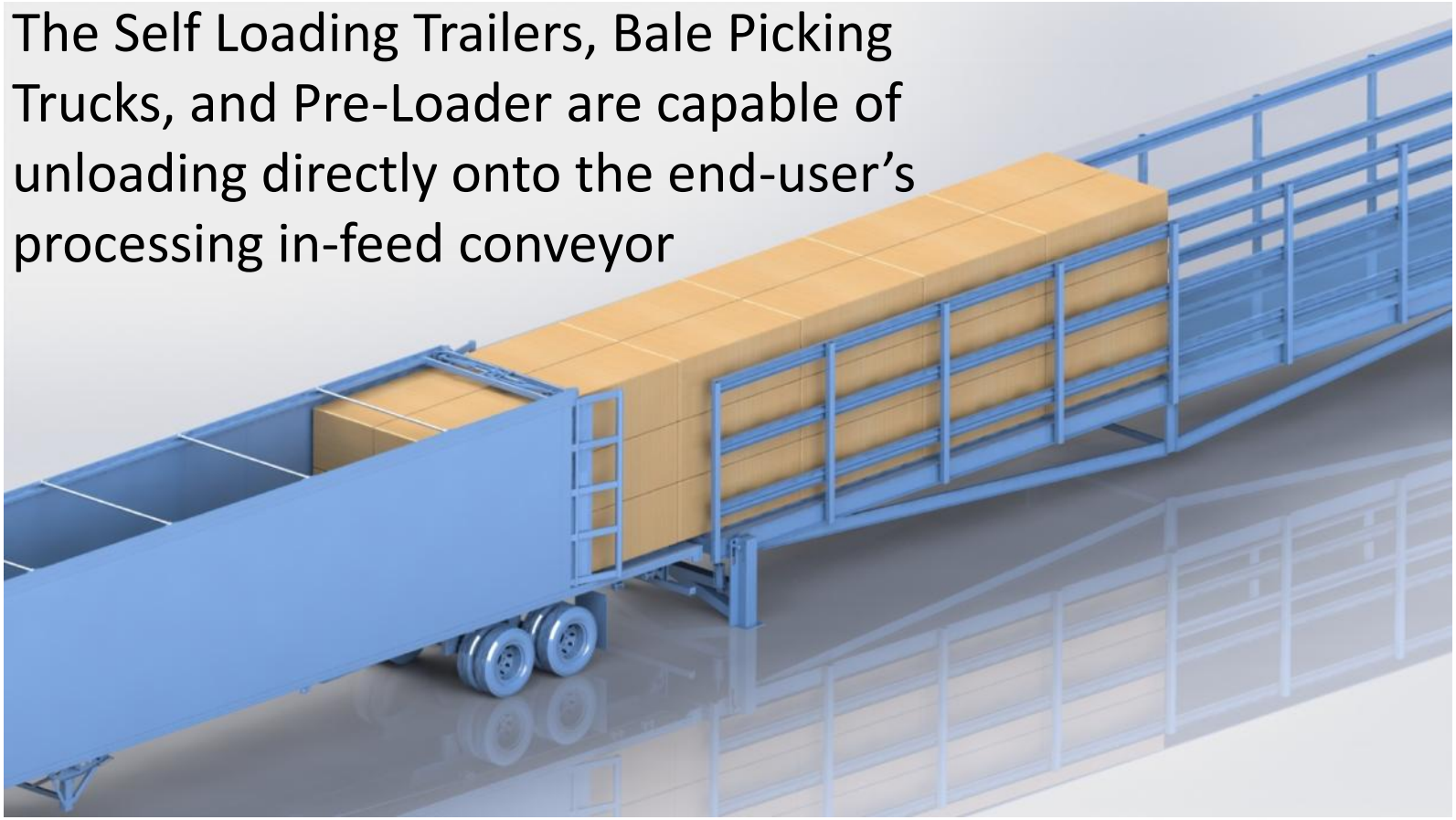
Directly Unload at Processing Facility

The Self Loading Trailers, Bale Picking Trucks, and Pre-Loader are capable of unloading directly onto the end-user's processing in-feed conveyor



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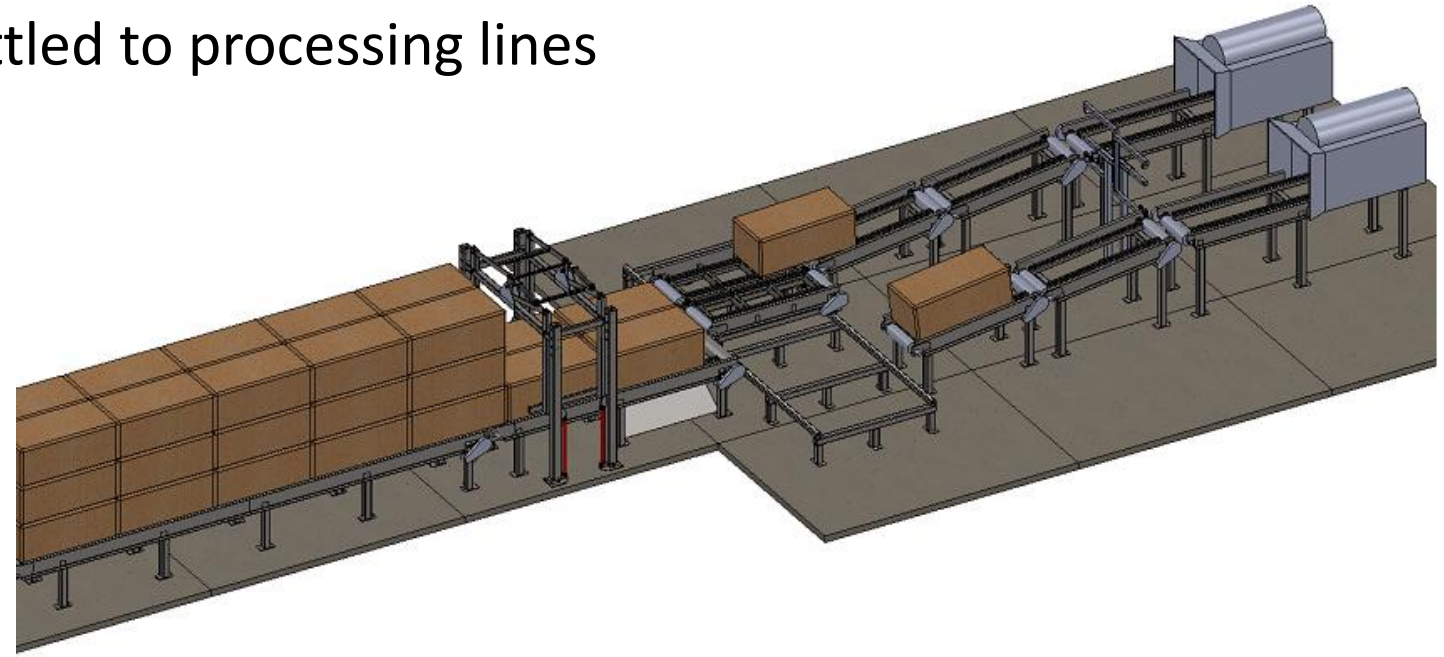
Infeed Conveyor, Automatic De-stacker, and Shuttle Conveyor System

Bales are automatically de-stacked and shuttled to processing lines



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Round Bale System Development Activities

- Improved Round Baler Development
  - –Increased bale density
  - –Improved durability/lifetime
  - –Reduced maintenance/downtime
  - –Improved dirt reduction

- Improved Biomass Processing Equipment
  - –Automated De-baler/Net Wrap Removal
  - –Improved Biomass Grinding

- Advanced Round Bale Transportation
  - –Advanced Round Bale Trailer

NIR in the INL Biomass Feedstock National User Facility (BFNUF)

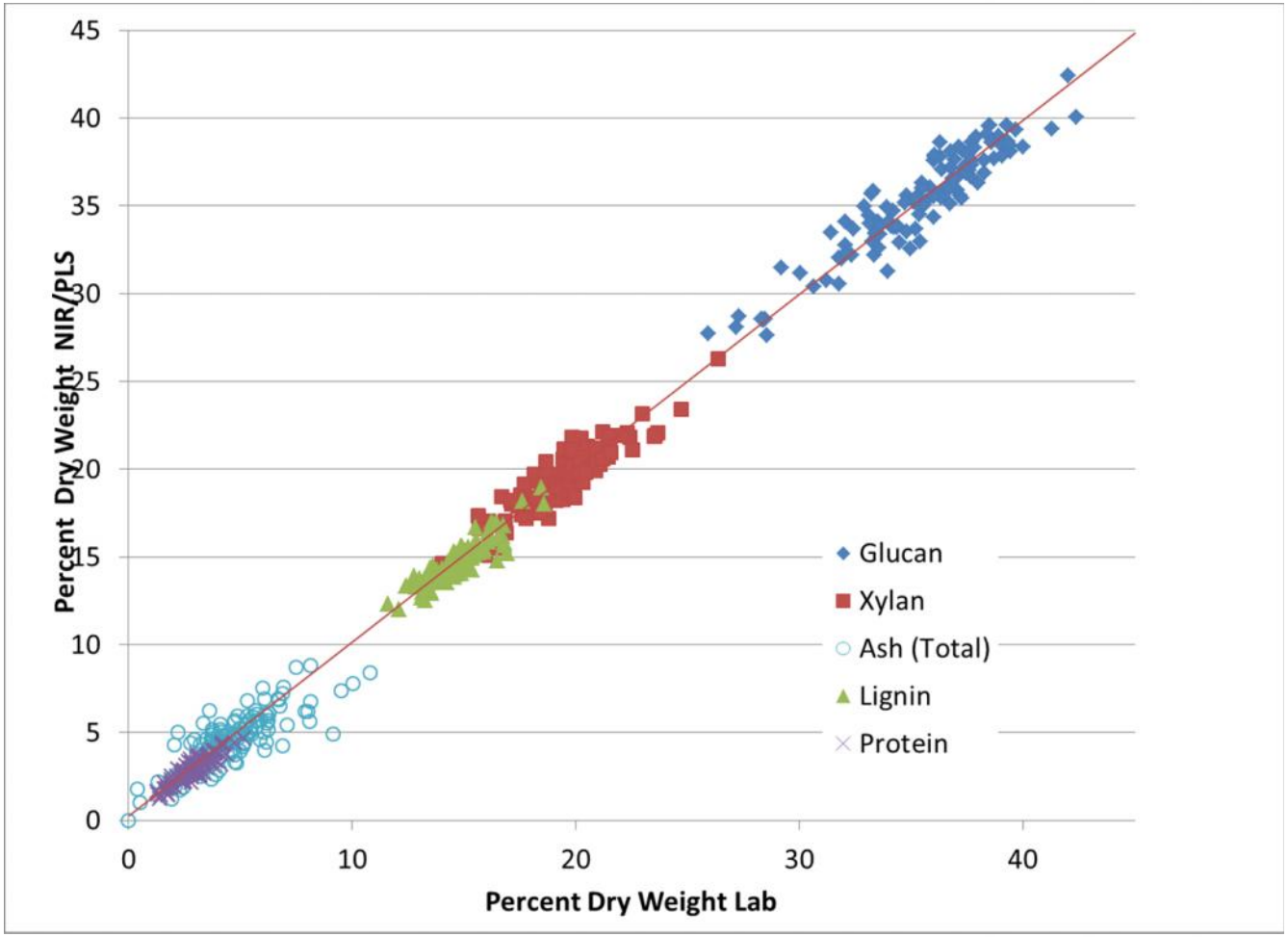
- Mobile Spectrometer
- Dual Illuminators
- Turntable
- Modular Configurations
- Multiple Sample Holders
- Hand-Held Probe for contact measurements
- NIR Bale probe will be tested in Fall 2014

ASD Inc.

INL Idaho National Laboratory

B Hames Consulting

NIR/PLS Method Transfer from NREL



INL model Full Cross Validation Results

B Hames Consulting

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Early Commercial Success from DOE Logistics I Project

Dozens of unit orders pending

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Closing Remarks

- Broad spectrum of new agricultural biomass logistics tools and equipment is under development
  - Round and square bale systems
  - Processing equipment
  - Quality analysis tools (NIR based)
  - Sustainability verification and tracking
- Largest demonstration operations to date (from this team) planned for Fall 2014
  - Round and square bale harvest equipment
  - NIR-based bale probe and methods
- Extensive performance and cost data collection being performed
- Not possible without DOE investments and significant cost-share from team members

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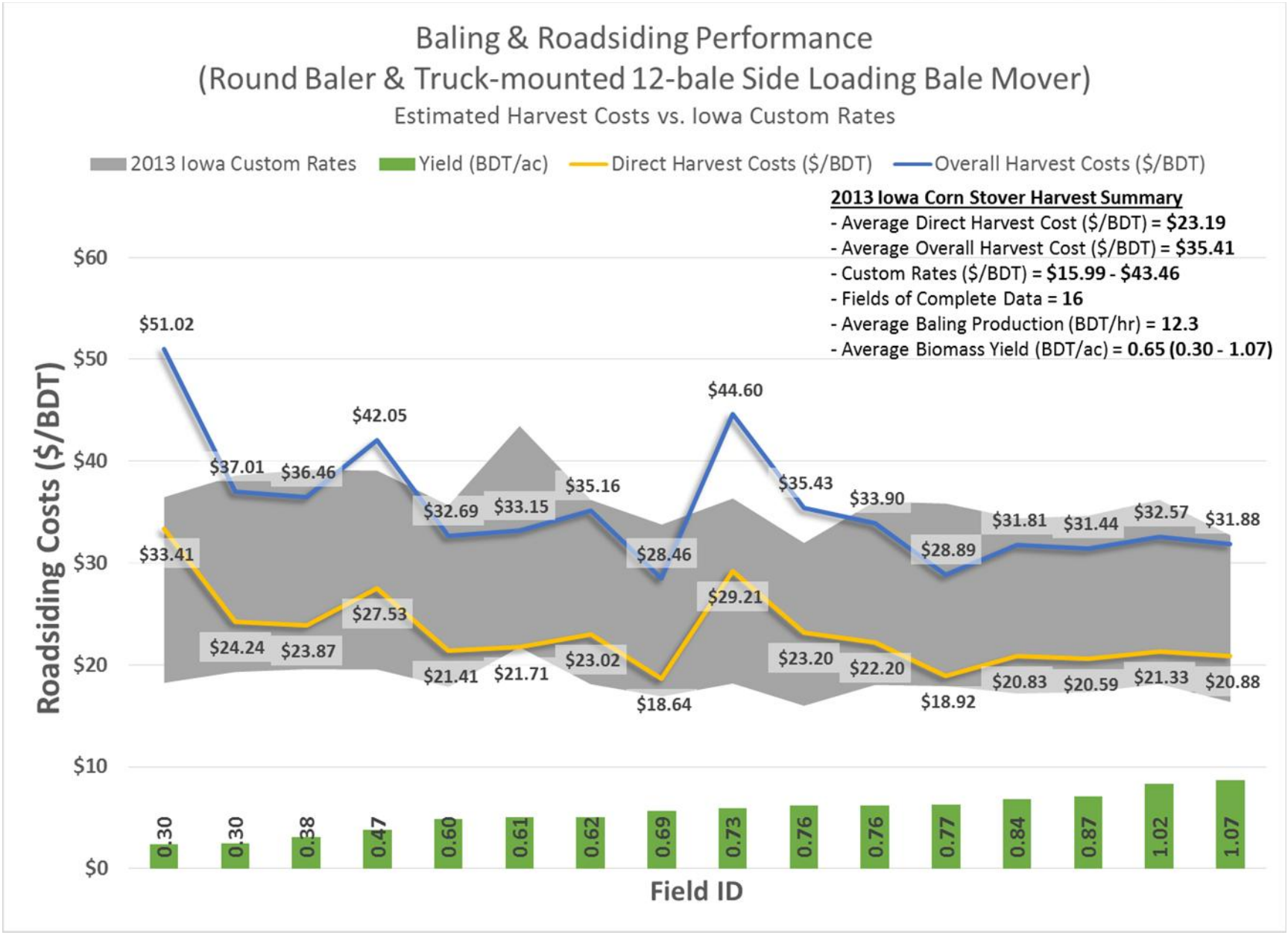
JCB Tractors with Vermeer 605 SM Round Balers

Sample Field Tracks

- Data Summary from ~2,080 acres
  - 21.4 bales/hr
  - 19.9 acres/hr
  - 12.3 BDT/hr
    - Based on measured data from 2013 CS Harvest:
    - 1,135 lb/bale
    - 11.8% moisture content


Baling & Roadsiding Performance
(Round Baler & Truck-mounted 12-bale Side Loading Bale Mover)
Estimated Harvest Costs vs. Iowa Custom Rates
2013 Iowa Custom Rates
Yield (BDT/ac)
Direct Harvest Costs ($/BDT)
Overall Harvest Costs ($/BDT)
2013 Iowa Corn Stover Harvest Summary
- Average Direct Harvest Cost ($/BDT) = $23.19
- Average Overall Harvest Cost ($/BDT) = $35.41
- Custom Rates ($/BDT) = $15.99 - $43.46
- Fields of Complete Data = 16
- Average Baling Production (BDT/hr) = 12.3
- Average Biomass Yield (BDT/ac) = 0.65 (0.30 - 1.07)
Roadsiding Costs ($/BDT)
$60
$50
$40
$30
$20
$10
$0
$51.02
$37.01
$36.46
$42.05
$32.69
$33.15
$35.16
$28.46
$44.60
$35.43
$33.90
$28.89
$31.81
$31.44
$32.57
$31.88
$33.41
$24.24
$23.87
$27.53
$21.41
$21.71
$23.02
$18.64
$29.21
$23.20
$22.20
$18.92
$20.83
$20.59
$21.33
$20.88
0.30
0.30
0.38
0.47
0.60
0.61
0.62
0.69
0.73
0.76
0.76
0.77
0.84
0.87
1.02
1.07
Field ID

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