WCC Goods Movement Webinar, June 2, 2015

Overhead Catenary System Demonstration Concept Overview
Agenda

• Overview of Catenary Demonstration
• Project Status
• Questions & Discussion
Catenary Hybrid-Electric Truck

- Catenary hybrid-electric trucks can provide zero-emission cargo movement
- Limited all-electric range off catenary provides for zero-emission near-dock drayage
- Natural gas or diesel hybrid configurations can provide zero-emissions operation along catenary and low-emissions operation away from the ports
- Siemens technology allows for smooth connection and disconnection from system while truck in motion

**Zero Emissions:** When connected to catenary, Truck is powered by overhead electric wires through pantograph connection

**Sub-2010 EPA Emissions:** When not connected to catenary, Truck is driven by hybrid electric engine
An Expandable System

- Near term needs for zero-emissions drayage at ports can be addressed with modest infrastructure
- System can be expanded to regional levels - port system forms basis for extension into I-710 clean truck corridor, a 24 mile route that exceeds 40,000 truck trips per day
- Trucks ability to ingress and egress catenary allow for non-continuous system

1. Regional Electric Container Mover System described by Port of Long Beach in its 2008 Request for Concepts and Solutions for a Zero Emission Container Movement System.
Siemens Demonstration Project

- Designed to prove catenary truck concept in real-world drayage operations

- Catenary system
  - One mile length, both directions
  - Pole spacing similar to street lights (possibility of dual-use poles, but not existing poles)
  - DC power substation with remote monitoring
  - Test track for software & hardware adjustments

- Four demonstration trucks
  - Diesel hybrid, CNG hybrid, Battery-electric, and Future TBD platform
Catenary Truck Platforms

1. Volvo Diesel Hybrid
   - Major OEM partnering through existing DOE diesel hybrid development project
   - All-electric range capability (off catenary)

2. TransPower CNG Hybrid
   - Major OEM chassis
   - Project partners are OEM and local integrators

3. TransPower Battery-electric
   - Leveraging local integrator’s current technology development

4. BAE Kenworth CNG Hybrid
   - Leveraging DOE project with catenary accessible hybrid
Catenary Demonstration Sites

- Site requirements include:
  - 1 mile continuous length
  - Sufficient ROW both sides
  - Space for substation
  - Avoid bridges, trees, shops
  - Available utility service

- Considered numerous sites:
  - Santa Fe Ave, Carson
  - Alameda St, Wilmington
  - TI Freeway – South
  - Sepulveda, Wilmington
  - Alameda St, Carson
  - Navy Way, POLA
  - TI Freeway – North
Demonstration Location

- Approximately one mile along Alameda Street in the city of Carson
- Current route for north-bound trucks to warehouses and 405
Infrastructure consists of:

- Poles and supports for catenary lines in each direction
- Lanes can be shared with other vehicle traffic
- Sub Stations, approximately one per mile
Infrastructure

- DC Substation with ~750 VDC output
- Self-contained and portable
- Designs approved and in use by LADWP and SCE
- 1.5 MVA capacity more than sufficient for demo
- Can be remotely monitored
### Project Timeline

#### Infrastructure
- **2013:** Design
- **2014:** Permitting (CEQA)
- **2015:** Construction
- **2016:** Demonstration

#### Volvo Trucks
- **2013:** Vehicle Pantograph Integration
- **2014:** Development & Testing
- **2015:** Demonstration
- **2016:** Demonstration

#### TransPower Trucks
- **2013:** Component & System Design
- **2014:** Vehicle Build
- **2015:** Testing
- **2016:** Demonstration

### Catenary system development
- **Design:** Completed
- **CEQA:** Completed, permitting in progress
- **Construction:** Ground breaking started in March 2015
- **Vehicles:** Vehicles are being designed and modified in parallel with system construction

### One year demonstration and data collection begins
**November, 2015** (completed in 2016)
## Siemens Project Costs

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Project Goals & Objectives

• Promote the implementation of zero emission goods movement technology
• Demonstrate the most viable technology for future regional zero emission corridor
• Prove out:
  – Catenary system and truck interface using various system architectures operating on the catenary
  – Vehicle regenerative braking and battery charging through the catenary
  – Vehicle and system electrical loads
Project Goals & Objectives

• Determine costs
  – Catenary system construction costs/mile
  – Operating costs
  – Integration of pantograph per truck costs
  – Electric fuel - kWh/mile costs
• Determine system owner and operator
  – Establish business case
    • Identify business drivers and financial metrics
    • Analysis of costs, benefits and risks
Project Status: June 2015

- Traction Power Supply/Substation
- Equipment manufacturer complete
- All major equipment installed in the substation
- Completed final wiring interconnections
- Completed factory acceptance testing
- TPS being shipped to site
Project Status: June 2015

• OCL

• Manufacturing of assemblies and components continues

• First assemblies ready for shipment and starting deliveries to the site

• First set of poles delivered to site
Project Status: June 2015

- Pantograph
- Assembly of the first PAN completed
- Software programming successfully tested in Gross Dolln
- Engineered and ordered the mechanical blocker for pantograph
- Shipped truck cabin components for the first TransPower truck
- Volvo truck shipped, en route, from US to Sweden
Project Status: June 2015

• **Civil Works**
• Test track paved
• CCTV installed at Central Test Facility
• Test track and mainline OCS foundations potholed
• Ready to drill and pour test track OCS foundations
• Ready to drill and pour mainline OCS foundations
• Confirmed Alameda median demolition requirements with Carson inspector
Future Project Milestones

• Test track completed in August 2015
• TransPower trucks use test track for final development work
• Demonstration on Alameda begins November 2015
• Volvo truck completed March 2016
• Demonstration complete November 2016
QUESTIONS - DISCUSSION