





Neptec Technologies Corp.

Improving Shovel-Truck Spotting

OPAL

3DRî

Overview



- Neptec Background
- Key Technology Differentiators
- OPAL Applications
- Spot Assist System
- Future Tasks

Who are we?

- We sell innovative 3D robot vision products for intelligent automation applications in harsh environments
- Commercializing <u>proven</u> technologies developed for NASA's Space Shuttle over the past 20 years and representing \$100M of investment in technology innovation
- Spin-out of Neptec Design Group, an award-winning Space technology company and NASA Prime Contractor







Products

Apps









OPAL-360





OPAL = Obscurant Penetrating Auto-synchronous LiDAR 3DRi = 3D Real-time intelligence 3DRi SDK

OPAL-360 3D Laser Scanner

Eye-safe 1540nm laser

360° x 60° FOV 200,000 points/sec 400m to 2.7km range options

> Rugged cast-Alu ______ housing (IP67)





Patent-pending spinning prism design

Penetrates obscurants

like dust, smoke, fog

Vibration & shock tolerant

Size: 61cm x 23cm x 36cm Weight: 53lbs

Harsh environment ready!!

3DRi Software Development Toolkit





OPAL Dust Performance Testing DRDC Valcartier → Summer 2012





OPAL and 3DRi for Intelligent Automation in Harsh Environment Applications





3D imaging in dust (problem)



Amount of "dust" filtered by OPAL



OPAL penetrates dust

Applications:

- Autonomous haul truck guidance
- Automation in the loading area
- Monitoring in harsh environments



3DRi identifies objects in real-time



Obscurant Conditions in Mining



Designed for harsh environments





OPAL on a shovel at Teck's Fording River mine (September 2014)

- -40 C to +65 C operating temperature
- Rugged packaging specifically designed for tough environments like mining
- Designed for significant vibration and shock environments
- Can be "power washed"!

3DRi Excavator Suite



- 3DRi Bench Mapper
- 3DRi Bench Profiler
- 3DRi Fragmentation
- 3DRi Spot Assist (in development)
- Common platform with remote management via web client
- On-demand data products
- Compatible with 3rd party mine planning and survey software packages
- At point-of-collection processing (no back office post-processing)
- Minimizes WiFi network bandwidth for data offloading

3DRi Stockpiles App



Fully Automated Volume and Fragmentation Reporting System

Mobile equipment or Semi-fixed installations

- Remote management via web client
- On-demand data products
- Compatible with 3rd party mine planning and survey software packages
- At point-of-collection processing (no back office post-processing)
- Minimizes WiFi network bandwidth for data offloading

3DRi Spot Assist: Proof-of-concept testing (September 2014, Fording River Coal Mine)





Key Features



- Identifying and Tracking haul trucks in real-time through obscurant conditions
- Dynamically guiding truck operators to the loading location using visual cues
- Alarm operators of obstructions in their path to the loading location
- Optimizing the loading location placement to minimize shovel swing angle while avoiding haul truck tire degradation on the active face
- Improves spotting times by minimizing re-spotting and improving operator confidence
- 24/7 operation through all weather conditions

Truck GUI





Raw Data



Disable

3DRi Spot Assist Application Right Raw Vide esting at Teck's Fording River Mine

SPOTTING

> 4.4m ^ 29.2m A: 72°

Disable

Report Issue

Tests Performed



- Two weeks of activities at Teck's Fording River Operation from September 8th to 19th
- Two OPAL-360 scanners mounted on electric cable shovels
- Tests included:
 - Hardware and Comms
 - 3DRi Core & Advanced Plugins
 - 3DRi Spot Assist Plugins
 - Shovel and Truck Displays

- Error Handling
- System Transitions
- Performance
- Various pit scenarios

Object Detection

Light Vehicles

Cable Arches

320

Personnel

Ē













Contour Points







3DRi Spot Assist Application Testing at Teck's Fording River Mine



Next Steps



- Human interface design
 improvements
- Operator buy-in on machine simulators
- Extended testing and qualification at multiple locations to identify exception cases
- Implement -> Test -> Identify -> Improve -> Repeat



Conclusions



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