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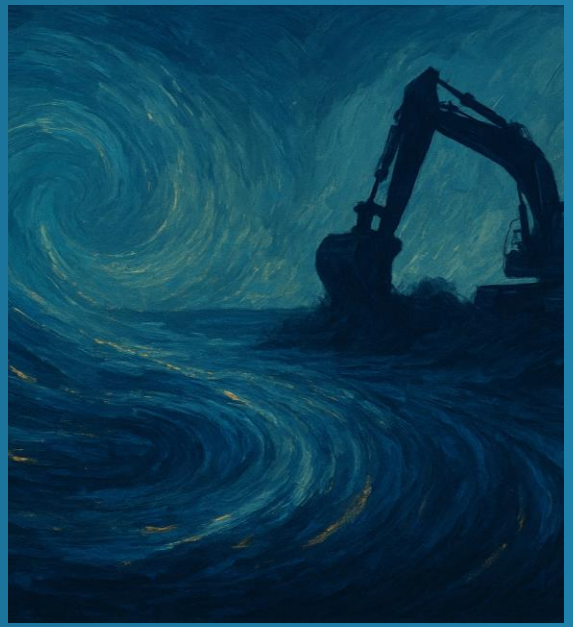
Improving Dredging Operations Through Data



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Agenda

Pain Points

Challenges & Maturity

Technologies

Solutions

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Operational Pain Points

Inconsistent Operations

Different operators and shift crews produce variable results
Lack of standard procedures makes problems hard to diagnose

Inadequate Planning

Assumptions about readiness often fail mid-project
Critical equipment issues and timeline gaps emerge too late

Poor Visibility & Communication

Limited real-time insight into what happens between surveys
Remote managers receive delayed or incomplete information

Training & Knowledge Transfer

Historical data isn’t reused to train new operators
Mistakes repeat and tribal knowledge remains siloed

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Data & Management Pain Points

Lack of Central Oversight

Multiple dredges operate independently without coordination
Issues are discovered weeks after they occur

Fragmented & Manual Tools

Paper logs and spreadsheets lose critical data
No continuity across teams or shifts

Difficulty Evaluating Equipment

Investments are made without measuring performance
ROI remains unclear without before-after analytics

Environmental & Logistics Costs

Inefficient dredging wastes fuel, time and increases emissions
Moving and repositioning equipment inefficiently

Challenges & Maturity

Key Challenges

- Cultural resistance to data-driven decisions
- Fragmented tools and processes
- Delayed feedback loops
- Lack of standardization

Level 1: Reactive

No structured data collection
Experience-based decisions

Level 2: Basic Awareness

Limited metrics collected on site
Some reporting but shallow insights

Level 3: Informed Adjustment

Regular data collection & analysis
Dashboards guide adjustments

Level 4: Optimization

Integrated data across fleets
Continuous improvement & role-based insights

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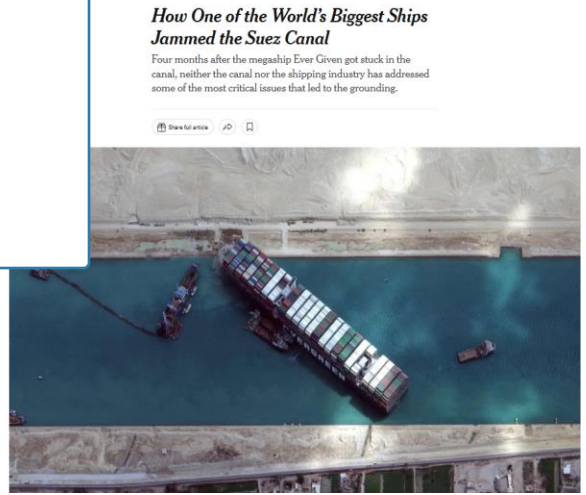
WHY IT MATTERS

Economies run off waterways

- Limited funds for projects
- Time sensitive
- Remote areas
- Expensive mistakes



Technologies to Improve Operations

Data Capture

- Sensors (GNSS, angle, pressure, density)
- Digital lever log

Data Management

- Local database
- Cloud data sync
- Logical data organization

Visualization & Summarization

- Dashboards
- Big data architecture

Analytics & Intelligence

- Forecasting & simulation
- Machine learning / AI

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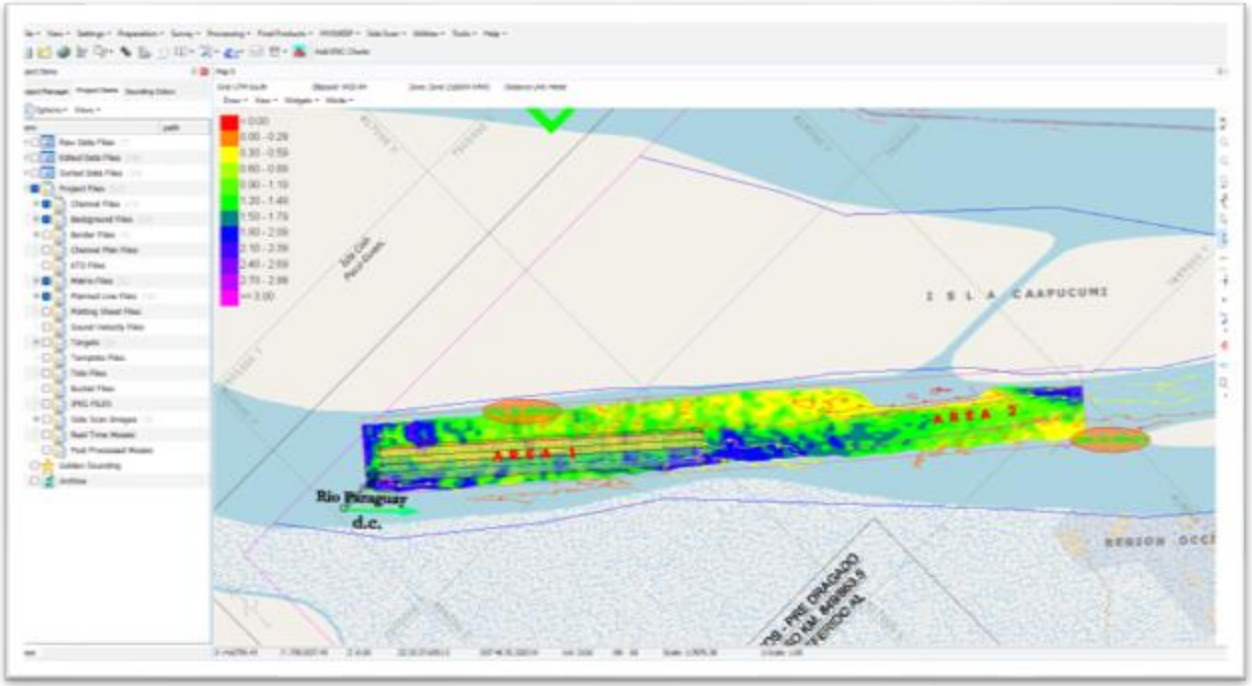
Paso Progreso Project - Rio Paraguay

Cutter Suction Dredge
- 100m long
- 27m ladder

Area 1
- 1000m long
- 100m wide
- 25 m wide cuts



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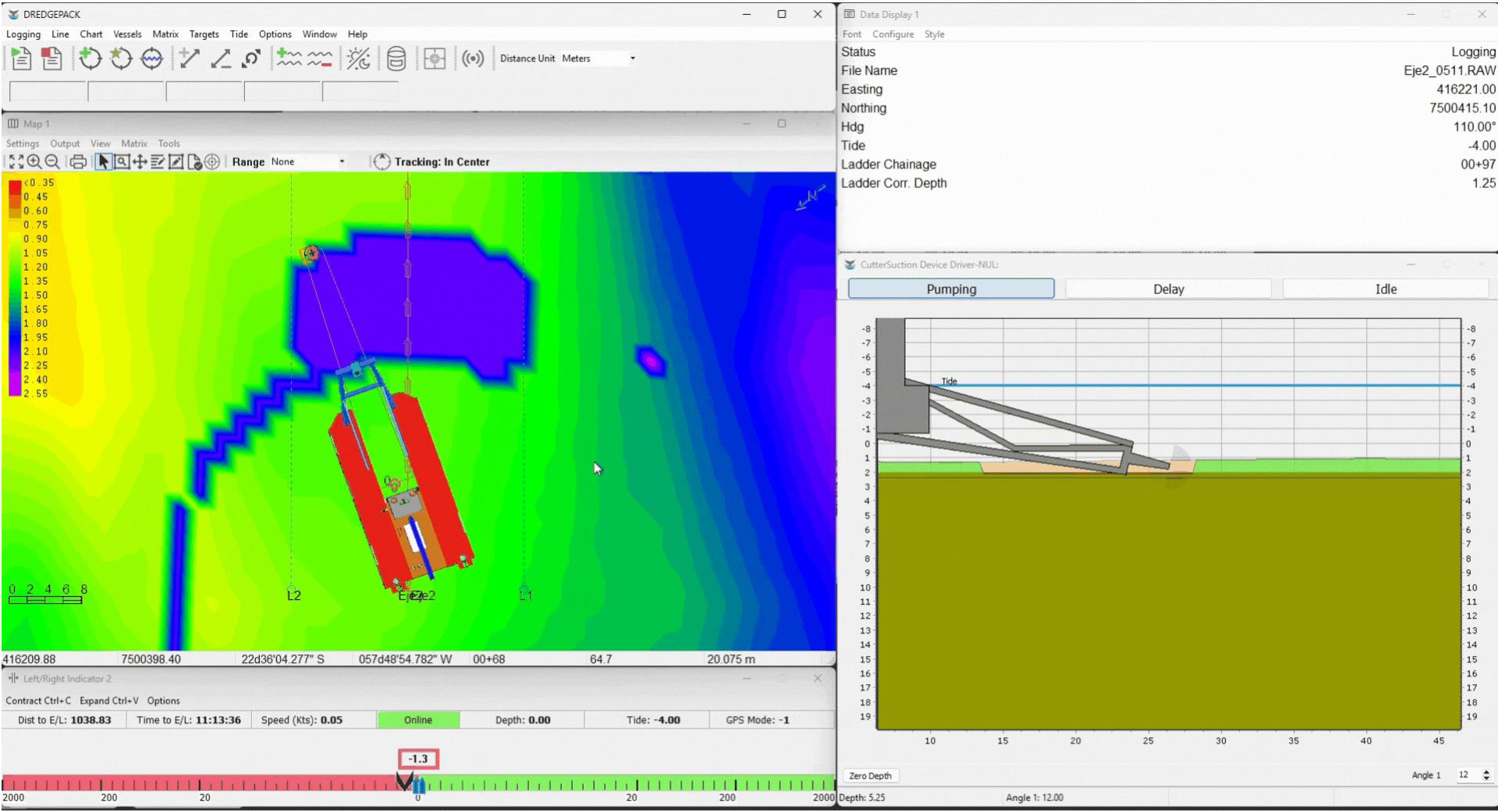

DREDGEPACK
Logging Line Chart Vessels Matrix Targets Tide Options Window Help
Distance Unit Meters
Map 1
Settings Output View Matrix Tools
Range None
Tracking: In Center
<0.35
0.45
0.60
0.75
0.90
1.05
1.20
1.35
1.50
1.65
1.80
1.95
2.10
2.25
2.40
2.55
0 2 4 6 8
L2
Eje2
L1
416209.88 7500398.40 22d36'04.277" S 057d48'54.782" W 00+68 64.7 20.075 m
Left/Right Indicator 2
Contract Ctrl+C Expand Ctrl+V Options
Dist to E/L: 1038.83 Time to E/L: 11:13:36 Speed (Kts): 0.05 Online Depth: 0.00 Tide: -4.00 GPS Mode: -1
-1.3
2000 200 20 0 20 200 2000
Data Display 1
Font Configure Style
Status Logging
File Name Eje2_0511.RAW
Easting 416221.00
Northing 7500415.10
Hdg 110.00°
Tide -4.00
Ladder Chainage 00+97
Ladder Corr. Depth 1.25
CutterSuction Device Driver-NUL:
Pumping Delay Idle
Tide
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
10 15 20 25 30 35 40 45
Zero Depth
Angle 1 12
Depth: 5.25
Angle 1: 12.00

CURRENT PROJECT

PASO PROGRESO

DREDGE

DRAGON 1

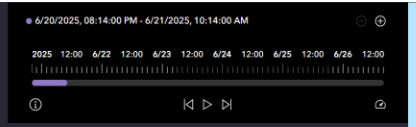
LAST STATUS REPORTED

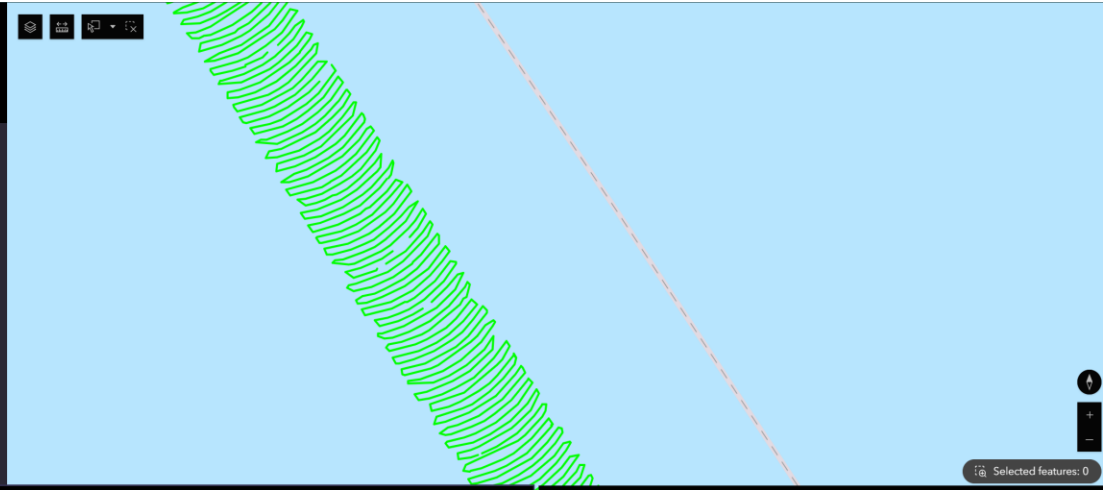
PUMPING

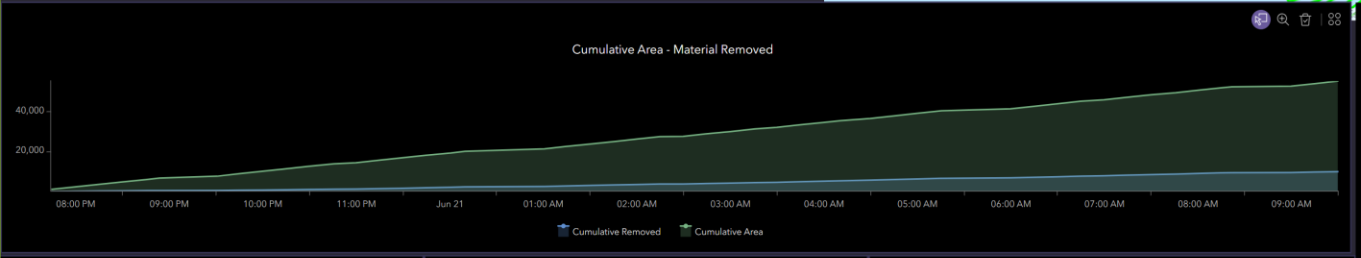
Total Material Removed in range: 10,178.181
Total Area Covered in range: 55,550

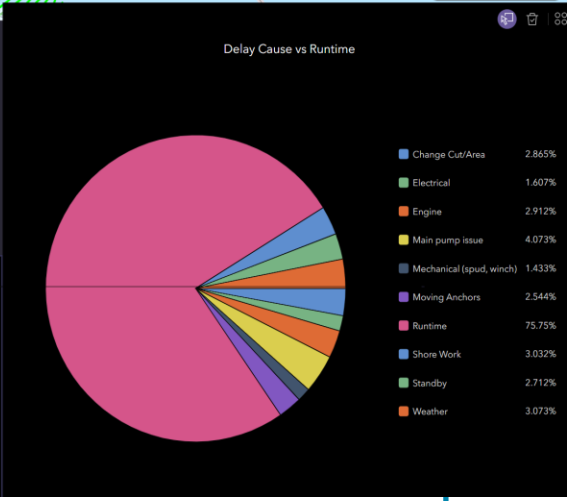
AVG Speed: 0.46
Min Volume in range: 420.658

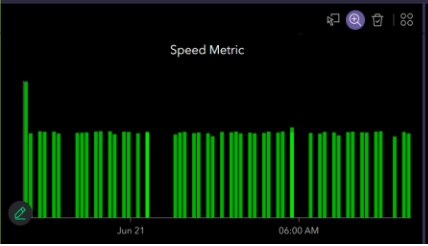
Estimated days remaining: 25

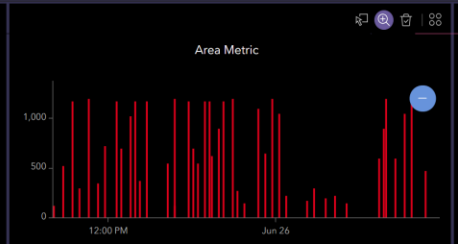


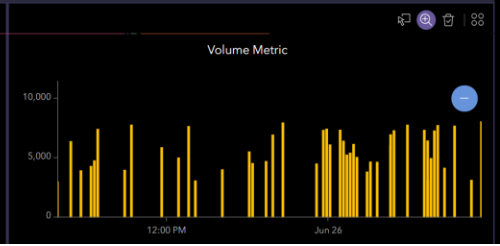












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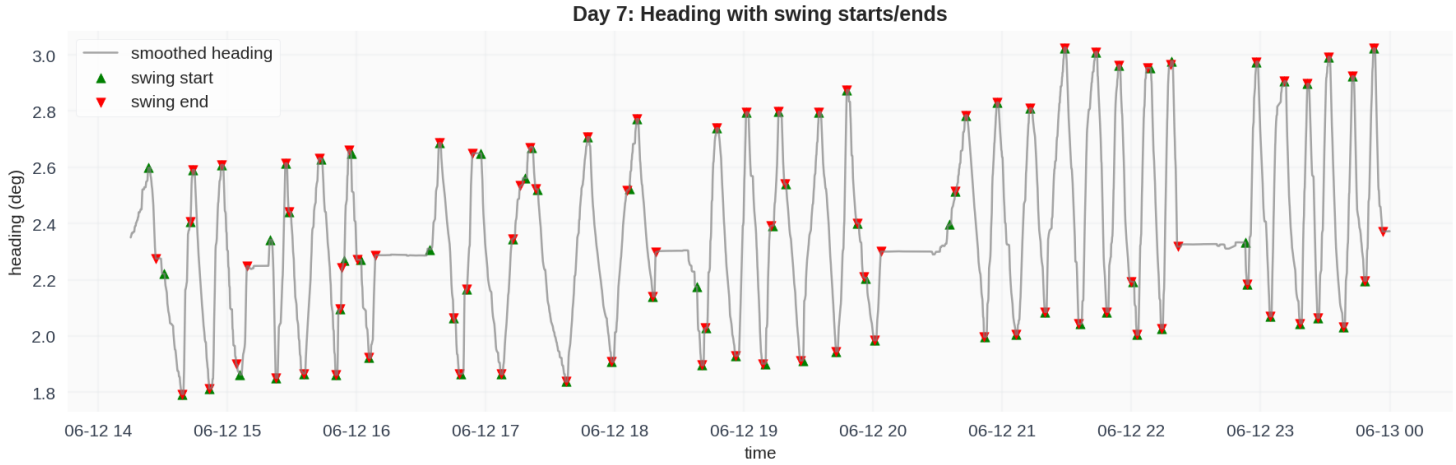

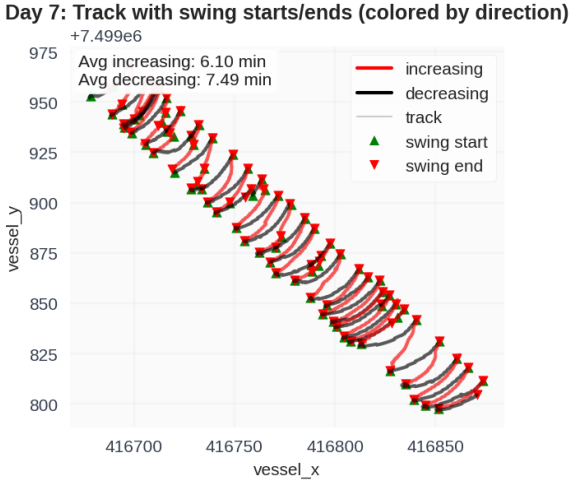

Data Insights

- Inconsistent Pattern
- Slow Swing Times

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Turn Data Into Decisions

Add Booster
Adjust Dig Plan

- How is Runtime Effected
- How is Production Effected

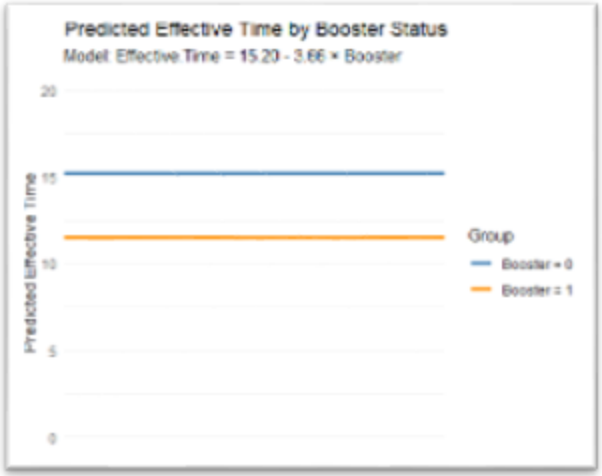
```
> mod.4 <- lm(Effective.Time~Booster, data = Dredge_Data)
> summary(mod.4)

Call:
lm(formula = Effective.Time ~ Booster, data = Dredge_Data)

Residuals:
     Min       1Q   Median       3Q      Max
-14.7843  -2.7029   0.9638   3.1304   8.7138

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  15.2009     0.3545  42.881  < 2e-16 ***
BoosterYes   -3.6647     0.5200  -7.047  1.3e-11 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 4.47 on 295 degrees of freedom
Multiple R-squared:  0.1441,    Adjusted R-squared:  0.1412
F-statistic: 49.66 on 1 and 295 DF,  p-value: 1.297e-11
```



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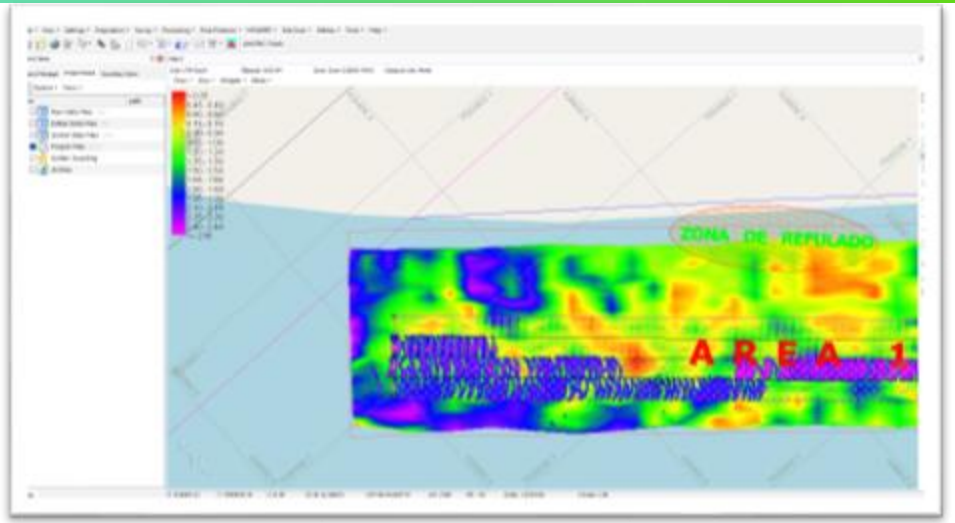
Turn Data Into Decisions

Adjust Swing Pattern

- Can we reduce the number of cuts
- Can we finish the job faster



Simulation Scenarios

Cycle Time 25 m	7.50
Cycle Time 33 m	9.90
Estimated Advance hr 25 m	24.00
Estimated Advance hr 33 m	16.16
Daily Advance 25 m	249.45
Daily Advance 33 m	160.96
Days per cut 25 m	4.21
Days per cut 33 m	5.56
Days to complete 25 m	16.84
Days to complete 33 m	16.67
Transit time/Change cut time	4.2
Total Days to complete 25 m	**17.365**
Total Days to complete 33 m	**17.02**

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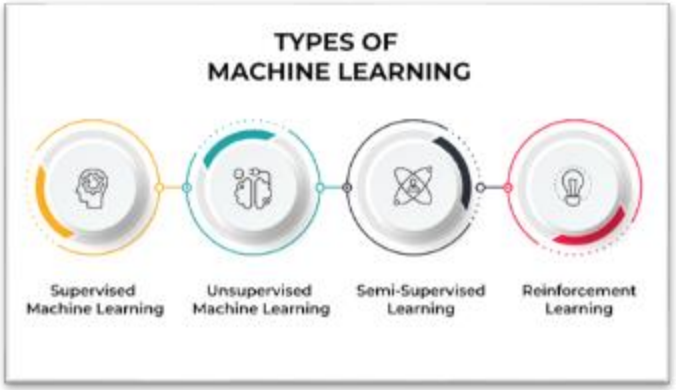
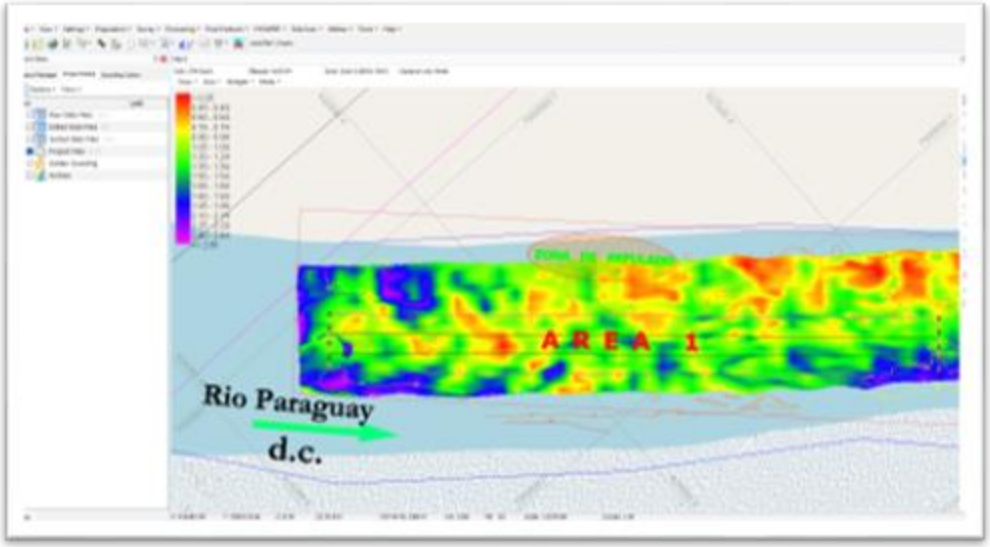
Next Steps

- Implement Additional sensors
- Predictive Modeling
- Feedback
- Improve Maturity Level





Thank You!

Questions & Discussion

Thelen Pumford
Technical Support
337-465-1316

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