

Military to Mining – Lessons in Visualizing Data

From the OSIsoft Team
(Rob Neitzel Barrick Digital Customer Relations and
Frank Carr AuOps Superintendent)

Objectives (Audience Choice)

Option 1: 73 Slides that go on, and on, and on about things you likely don't really care about, but you politely listen anyway.

Option 2: NOT 73 Slides – but a candid conversation with visuals about some hard lessons I learned in both the Military and Mining and WE talk about how this relates to Data – People – Process and Technology

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A Perspective

Leadership and Understanding The Operational Environment

AFGHANISTAN

RC East - 2007



- 6 x US Army Brigades ~ 21,000
- 2 x Afghan Army Corps ~ 40,000
- 1 x US Airforce Wing
- X US Special Operations Teams
- OGA
- 13 x Provincial Reconstruction Teams

HUBRIS

Noun: Excessive pride or self confidence

Synonyms: Arrogance, Conceit, Egotism, Superiority

"I am a seasoned professional, I got this"



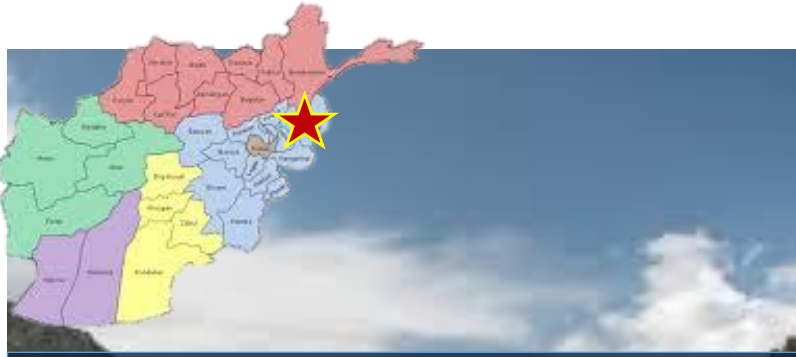
That Guy





VS





Haqqani – Haqqani Network,
Taliban, Al Qaeda – Bad Dude

Birth Valley – Facilitation
of all things **Not** good in Nuristan

November 11 2007



TF-Chosen – Conduct a village engagement
before winter conditions set in to provide
radios, and confirm we will support.

14 U.S. Soldiers from TF – Chosen
14 Afghan Soldiers



“Help” - “This is C16R”



“Help” - “This is C16R”

Seconds Add Up To Minutes, Minutes Add Up To
Someone's Life



Seconds add up to minutes, minutes is someone's life



10 Assets leveraged to help change the outcome

I did NOT effectively communicate.

I did NOT use data and technology

I did NOT understand the situation

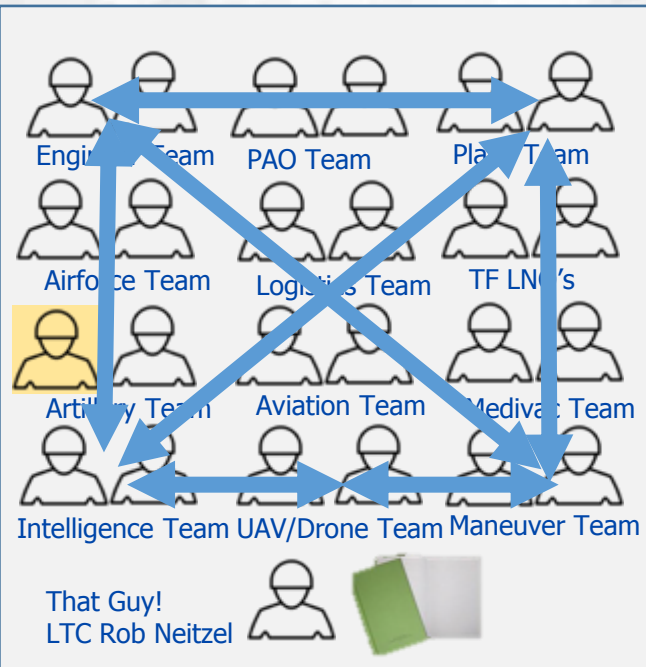
MY TEAM DID

Data and a Common Picture

UAV - Drones

Quick Reaction Force

Seconds add up to minutes, minutes is someone's life



10 Assets leveraged to help change the outcome

Know you team and assets

- **People + Process + Technology**
- **Know the capabilities and limitations of your systems + equipment**
- **Visualize the Information – Let others think and act**
- **A team will understand all of the problem – let visuals help you solve the problem**

Mining

How does this relate to mining or other industries?

Seconds

Seconds still add up to minutes

Minutes add up to revenue
(Protect and Enhance)

Leveraging the varied forms of mining data

The Analytics and Unified Operations Center leverages data and technology to empower our people at the mine sites

CHALLENGE

How do we see and adapt to variances in the mine plan?

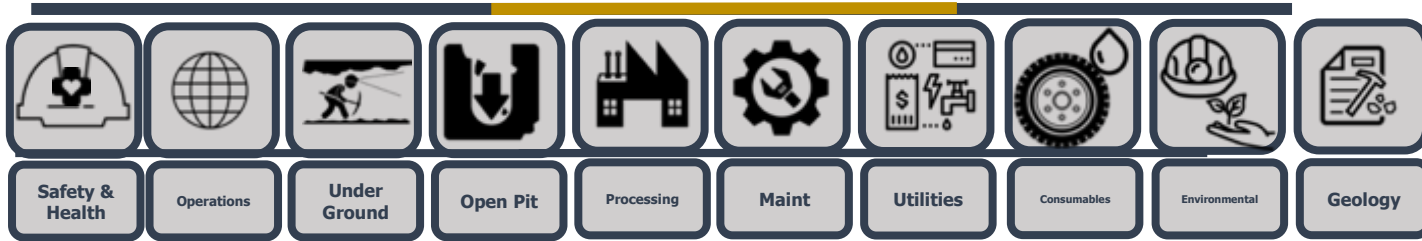
SOLUTION

Analytics. Provides the capacity to ***leverage our varied forms of data*** to ***inform our business decisions*** in terms of **risk and opportunity**. With improved access to data we can enable informed decisions by the right people at the right time.

RESULTS

Unified Operations. Provides a complete understanding to the entire business functions of the mine enabling a collective action vs sequential operations and reactions to the variations of the mine plan.

AuOps Overview – The Challenge – Know the Business



Higher TCM Values Slow Roaster Throughput

Low Haul Truck Availability

UG missing tons due to "hot holes"



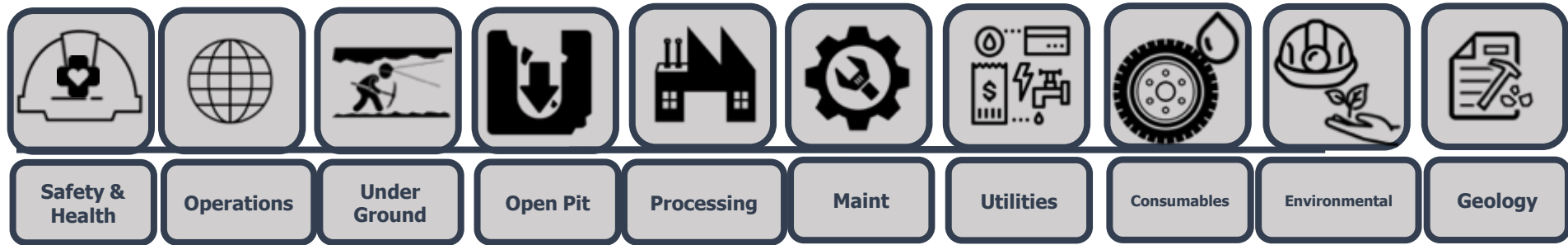
Mine Plan –
Execution Measured in
Terms of Days/Weeks

Variance

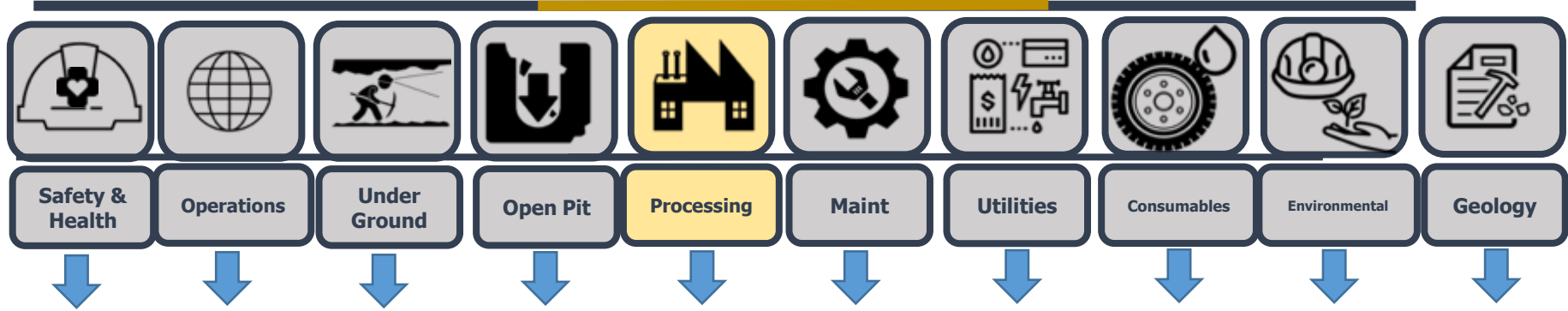


Sequential-siloed reactions to variances = Lost Time + \$

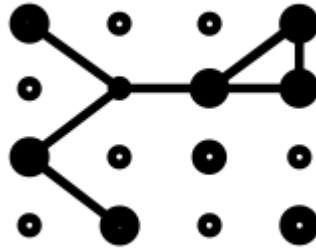
Commitment. The AuOps project is committed to providing impact to the business focused on data visualization that informs decisions.



AuOps Update – Challenge “Perception of Data and Availability”



Hyper Link

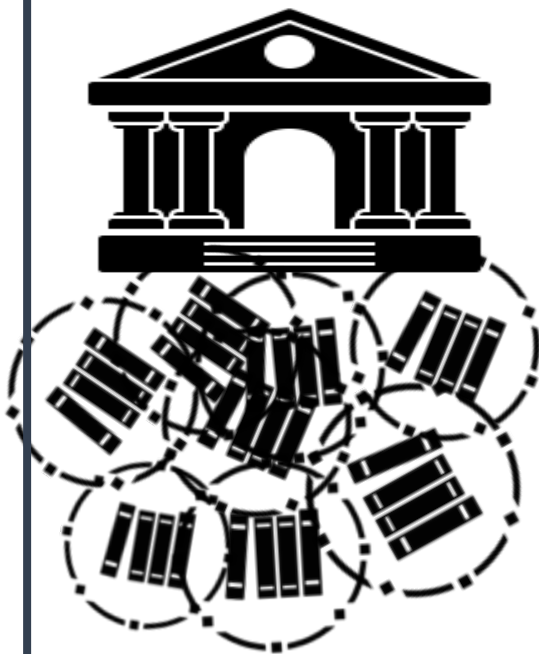


AuOps Overview – Challenge - Data

Raw
Data

BDF – The Library

BARRICK DATA FABRIC



Joint Development Environment

Enable Vendor
Partners to create
the "Instances"
and data pulls to
interface

Requires:
"A Standard"

Requires "Data
Grade Process"

Enables interface
of data to
visualization

Enables our
mining team to
protect areas of
risk and enhance
areas of
opportunity

API

APPLICATION
PROGRAM
INTERFACE

Visuals





Sounds good – So What?





RISKNET		EVENTS	REPORTING	LINE NUMBER	DESCRIPTION	DETAILS										SUMMARY												
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AuOps – (Value Stream) Support to the Mine Plan



Open Pit



Shovels



Trucks



Conveyor



Permits



Stock Piles



Processing



2018 – Production
Goals

2018 Value Stream Support (Protect + Enhance)



- This dashboard utilized the MineWare database to display production data for SH342
- Designed for Cortez Open Pit
- Highlights SH342 tons per shift and cycle time metrics
- Requested feedback for improvements, visual adjustments, predicted usage.
- Beneficial to AU Ops for future analytical exploration
- Valuable to Cortez Open Pit to provide quick overview of SH342 production performance

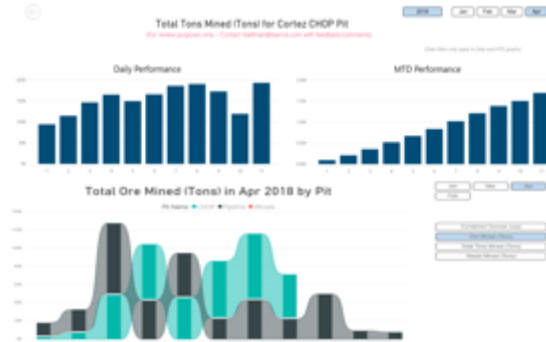
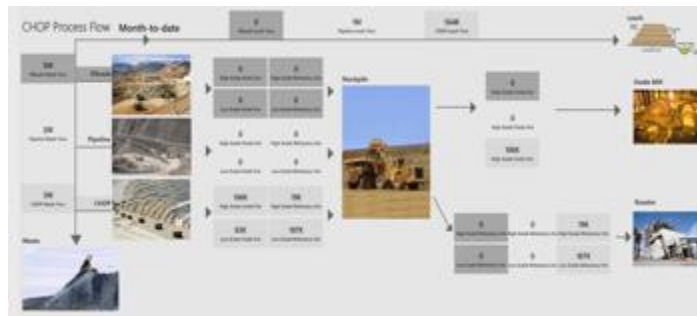


- This dashboard utilized the MineWare database to display production data for SH342 by operator
- Designed for Cortez Open Pit
- Highlights SH342 operator excellence metrics and performance
- Requested feedback for improvements, visual adjustments, predicted usage.
- Beneficial to AU Ops for future analytical exploration
- Valuable to Cortez Open Pit to provide quick overview of SH342 operator performance

AU Ops– Operation Readiness Summary

User Story #1-5 – Enhance & Protect

Value Driver Stream at Cortez (CHOP, X-roads, Pipeline)



[Daily display of production, shovel, and truck related KPIs](#)

- Uses ribbon charts to display changes in mining efforts

The value stream expectation is to monitor tonnage movement from the pit to process – key areas in the stream where delays have a negative impact on free cash flow.

The tool can display the location in the stream where downtime is exceeding forecast. It can also display the top reasons that negatively impact cash flow.

Various open pits available as a BPR report now.

Ongoing work includes adding the cost information and real time Mineware information to the reporting systems, and developing a Monte Carlo system that identifies risks to meeting the FCF estimates in 2018



- Truck queue time exceeds forecast but shovel non-productive time is below forecast. Implies that more trucks are assigned to the shovel than necessary
 - If fewer trucks were assigned to the Shovel the truck queue time would decrease and the shovel non productive time would increase. This would better balance overall service
 - If appropriate, such balancing would allow trucks to be reassigned to other areas or parked
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AU Ops– Operation Readiness Summary



Shovel

- Comparison of Sensor data to Dispatch data
- Operating History: Pareto Defects & Value Drivers
- Future Predictive Analytics

WEEKLY ANALYST WORK

Visualization of Shovel Location:

- to assist with ore routing
- Geospatial analysis.
- Photogrammetry-Cortez survey

Implement Statistical Analysis of Performance Metrics

- Utilization of R with Power BI to detail descriptive and other statistical metrics

Integrate maintenance plans for forecast through maintenance software

- Merge with Jigsaw (Power BI & Tableau)

Import production forecast data from Deswik

- Detailed forecast by shovel/pit/material type

Generate more dashboard in hierarchy of least detailed -> most detailed

- Requested from Chris Cavin of Cortez

Work with Mineware to have Ore Control/3D Modeling

- Pending installation on all other shovels
- Continue to improve on Mineware Power BI dashboard
- Geology for ore movement (pending completion geospatial plotting)

After shovel dashboards are generated -> trucks -> drills

Stockpile and Ore Blend Management at Roaster



Ore Routing and Stockpile Management

- Ore Routing & Tracking
- Tonnage and Grade Tracking
- Delivery Status
- Ore Blend Management
- Consumption & Prediction



AU Ops– Mineral Processing



Process Plant: Live Data Streaming

- Crushing: Three (3) Gyratory and Two (2) Jaw
- Grinding: Three (2) Wet Mills & Two (2) Dry Grind
- Oxidation: Two (2) Roasters & Five (5) Autoclave
- Leaching: 1-CIL, 2-RIL, & 2-Heap Leach
- Tailings: 3 Facilities
- Elution's/Refinery:
- Reagent Tracking, Delivery and Consumption

AU Ops– Operation Readiness Summary`



Roaster Reagents

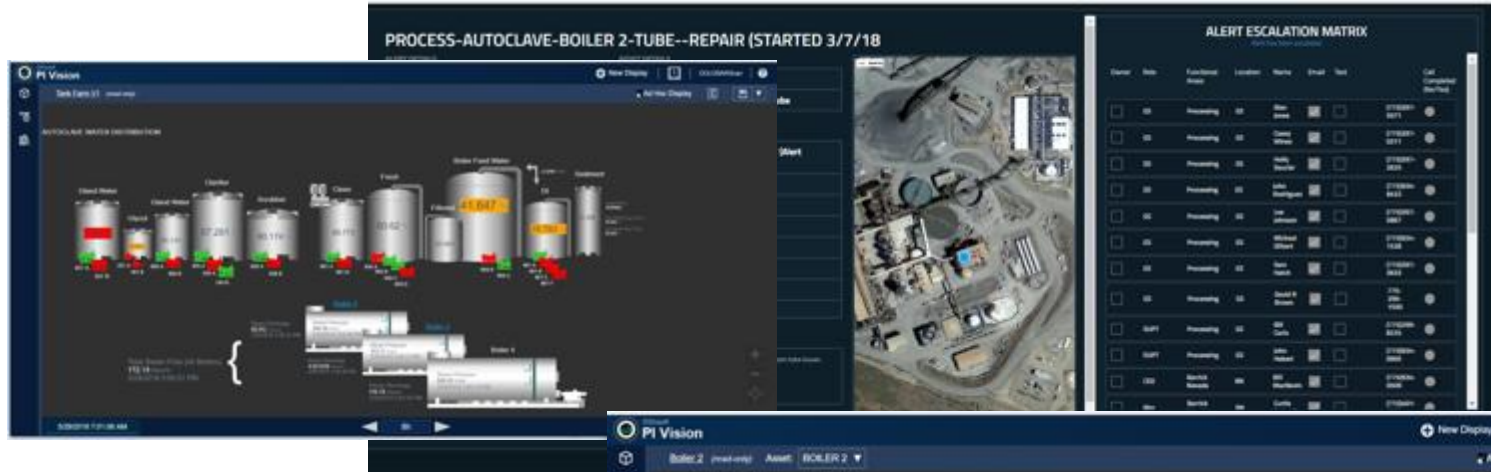
- Capacity and Levels
- Consumption Rates and Estimates
- Environmental Monitoring
- Delivery Tracker (Google Maps, GPS & ETA's)
- Notifications and Alerts
- TPOH Impacts related to Blends and Level

Roaster Monthly Consumption Report

- Modeled Consumption Data vs Actual Data – Lime, Sulfur, and Grind Media for Monthly Totals
- Weekly Rates and Estimates
- Daily Estimates based on Tonnage
- Future Predictive Analytics



AU Ops– Operation Readiness Summary`



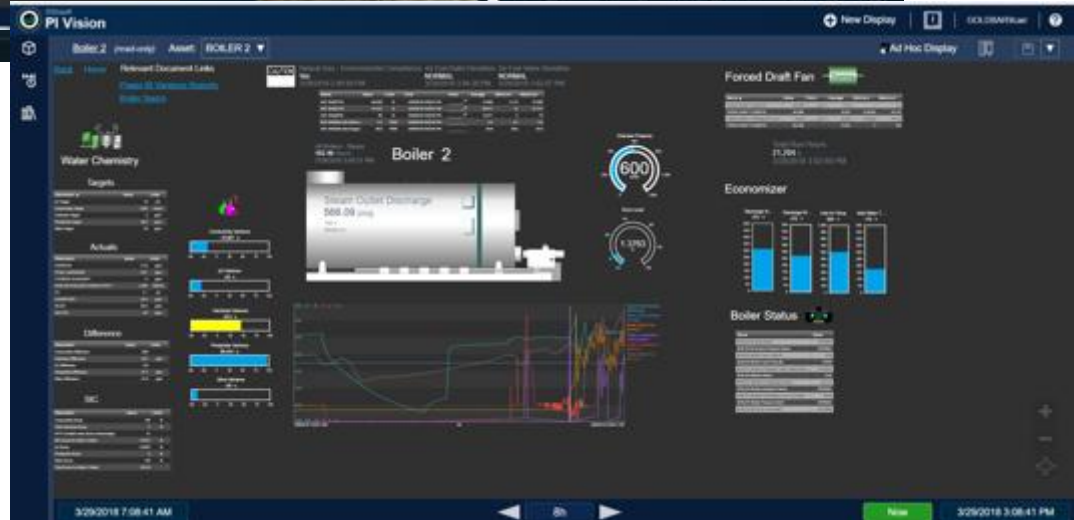
Boiler Tube Failures-Escalation

- Oracle eAM Work Orders
- Chemistry Rate of Change Alert
- Operating History
- Future Predictive Analytics

WEEKLY ANALYST WORK

Workshops w/site SME:

- Rate-of-Change for alarms and alerts.
- eAM + Ops History + Alarms
- Predictive Analytics with integration of other data (BDF).



Summary

Seconds always add up to minutes

Minutes is Revenue \$

Data is crucial

Data must be visualized, managed, and verified

AuOps Team

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 - Barrick Nevada
- **Rob Neitzel**
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 - Digital Relations Management
 - Barrick Gold Corp