Vertical Openings Inspection System [VOIS] Development and Applications for Mining

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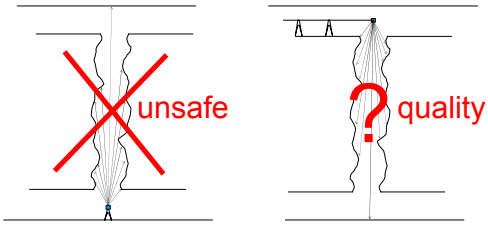
VOIS Development - Requirement

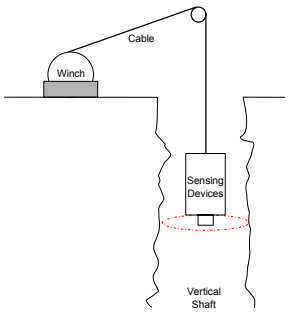
Underground mining operations frequently require vertical (or near vertical) shafts to allow movement of rock (passage of ore) or ventilation between different levels. In most cases these shafts are not safely accessible. A reliable and safe method of monitoring is required.



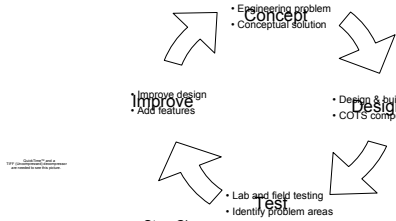
Problem: Inspect and survey vertical openings in mines in a safe manner

VOIS Development - Conceptual Solution

Deploy a dynamically stabilised platform lowered via cable into the vertical shaft. Mount sensing devices on the platform, such as video, laser scanning, and geophysical instruments.



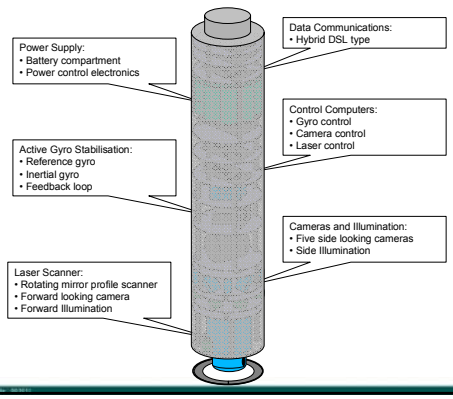
VOIS Development - Step Changes



Step Changes:

- Wire line cable deployment
- 360º panoramic digital video
- Active gyro stabilisation
- Pod decoupling from cable
- Digital control of winch
- Laser profile scanning

VOIS Design - Assembled Components



VOIS Development - Platform Stabilisation

Non Stabilised

Stabilised

Shaft Bottom Panoramic

VOIS Development - Success Through Research

Field Proven Design:

- Steel wire line cable, crane, and electric winch
- Digital “smart” winch control (depth computer and VFD drive)
- Active gyro stabilisation system and platform decoupled slip ring assembly
- Laser scanning using OEM laser profile scanner
- Hybrid DSL combination of deterministic (IDSL) and non-deterministic (VDSL)
- Distributed control processing design aiding rapid development

VOIS Applications for Mining

Tool

Stabilised platform to capture video images (inspection) and laser data (survey) for vertical openings:

- Ore passes
- Ventilations shafts
- Access shafts

Applications

- Visual inspection of vertical shafts to observe condition and assess stability
- Laser survey of vertical shafts to compare as built to engineering design
- Inspect and survey vertical shafts (ore passes) at timed intervals during production periods to assess condition

VOIS Application - Ore Pass Inspection

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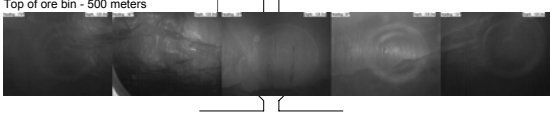
Ore Pass

- 600 meter vertical raise bore shaft

Ore pass walls - 412 meters

Top of ore bin - 500 meters



VOIS Application - Ventilation Shaft Inspection

- Damaged services located at -90 meters showing water ingress
- Location and source of problem is now known
- Mine site resolved issue with grouted ring to stop flow

Liner wall and services -40 meters

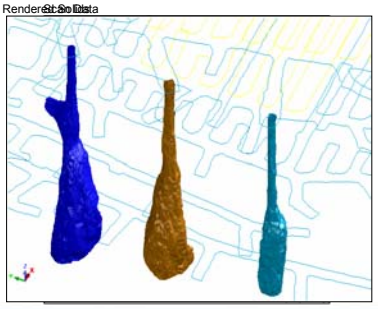
Liner wall and services

Vent shaft walls -110 m

VOIS Application - Ore Pass Survey

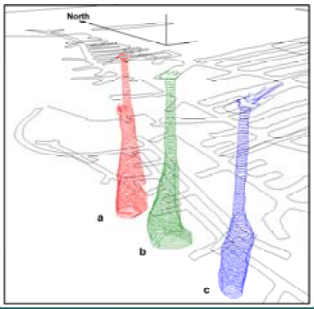
- Production ore passes at Western Australian mine site
- State unknown? Drawn tons exceeding design capacity
- Accurate 3D laser scan required to assess the condition of passes

Rendered Solid Data



VOIS Application - Ore Pass Survey

- Accurate 3D representation of ore pass in mine plans +/- 5cm
- Assessment of ore pass state after production interval
- Is more information hiding in the data ?????



VOIS Development - Forward

Conclusions

- Development of viable tool for inspection and survey of vertical shafts
- The tool allows us to carry out inspections and surveys in safe manner
- Deliver accurate data sets from dangerous areas direct to professionals
- Prototype tested in a mining environment with real world applications

Future Research

- Design and construction of a production unit
- Step change in data interpretation with fusion of video and DTM data
- Virtual representation of data sets in mine plans

Thank You

WASM

DaDextram Condibas