

# Leica Jps



# Leica Jps

## Performance Results for Jps

Mr Dave Goddard  
Leica Geosystems Mining

Jigsaw 

- when it has to be right

**Leica**  
Geosystems

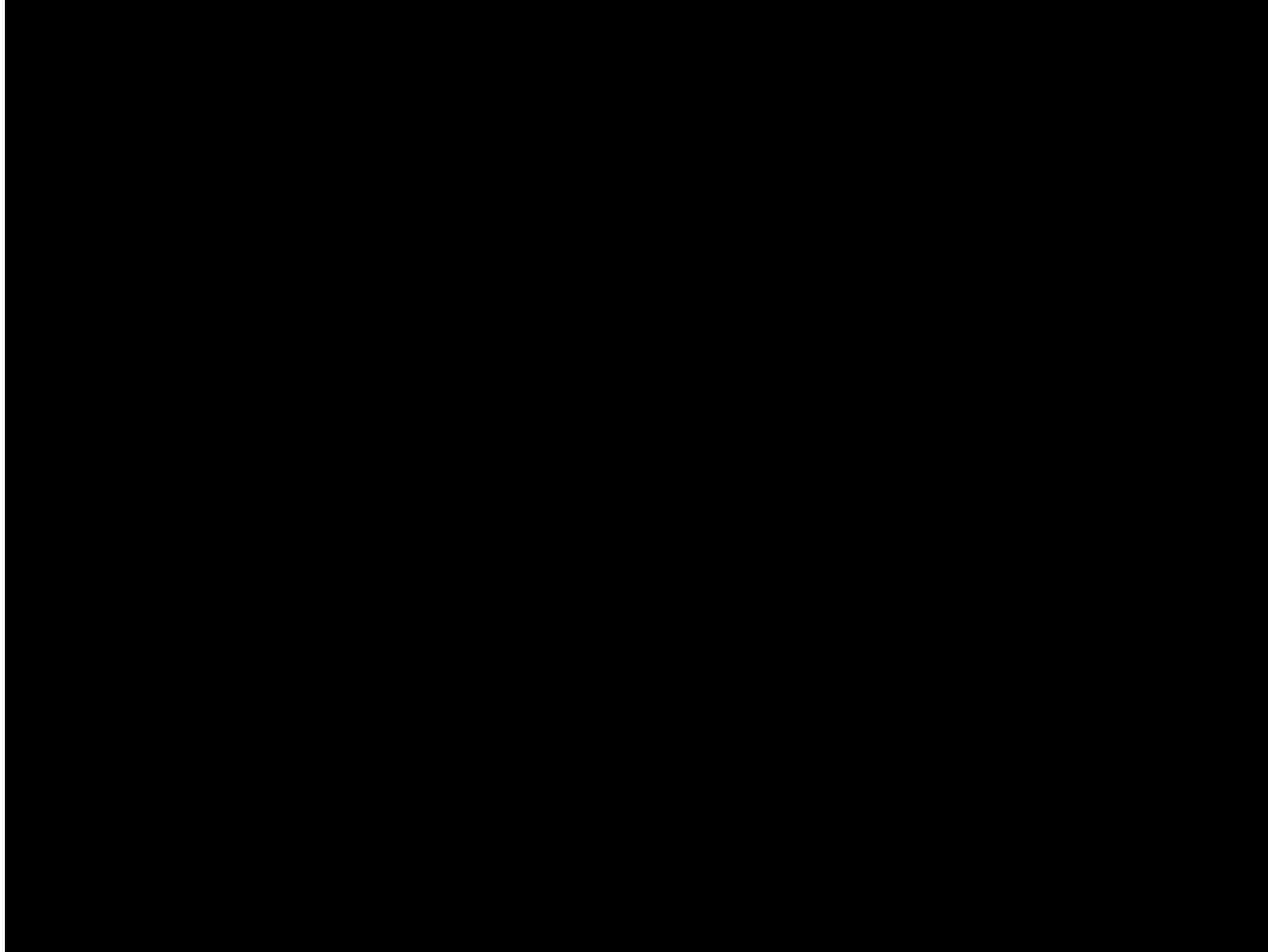
# Leica Jps

## Presentation Contents

- Problem with using GPS for Positioning in Mines
- The Solution – Leica Jps
- What / Who is Locata?
- How does Jps work?
- Components and Features of the Product
- Integration into Leica Jigsaw Products
- Performance Results
- Summary and Questions

# Leica Jps

## The Problem



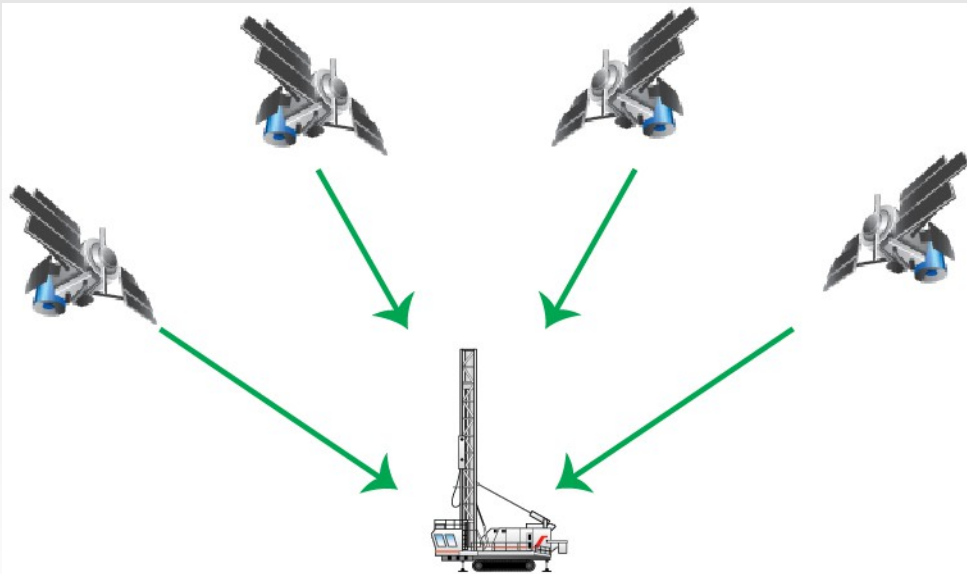
- when it has to be **right**



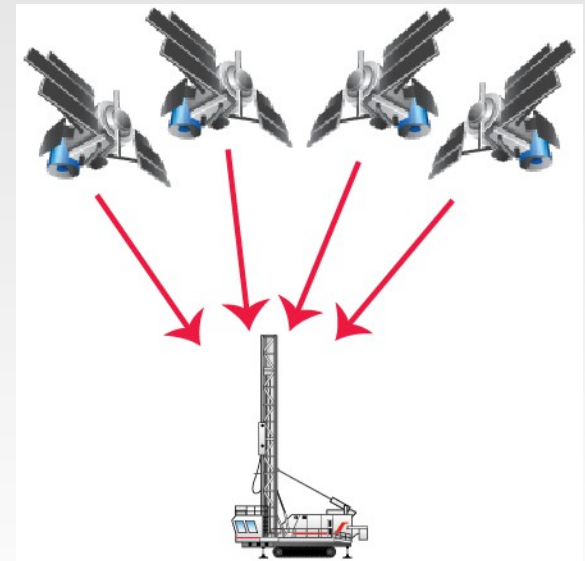
# Leica Jps

## The Problem with GPS Positioning

Need at least 4 satellites **AND** good DOP (Dilution of Precision) to solve for X, Y, Z and TIME



Good (Low) DOP  
Good Positioning



Poor (High) DOP  
Poor Positioning

## Other Approaches to the Problem

- ❧ More Satellite systems (Glonass, Galileo, BeiDou)
- ❧ Total Station
  - Limited by visibility (Dust, rain)
  - Only positions one machine at a time
- ❧ IMU (Inertial Measurement Unit)
  - Drifts with time and loses accuracy
  - Sensitive to vibration
- ❧ Augmentation systems (Locata)

# Leica Jps

## What/Who is Locata?



Locata Corporation ([locatacorp.com](http://locatacorp.com)) is based in Canberra, Australia.

- Invented the world's first radiolocation technology which replicates GPS in a 'local', rather than a 'global', area – hence GPS 2.0
- Granted 94 patents around their core IP – TimeLoc™
- Enabling local-area ultra high-precision time synchronization of LocataLite transceivers to within  $\pm 3$  nanoseconds.
- Locata ICD is in the public domain

# Leica Jps

## What/Who is Locata?

powered by

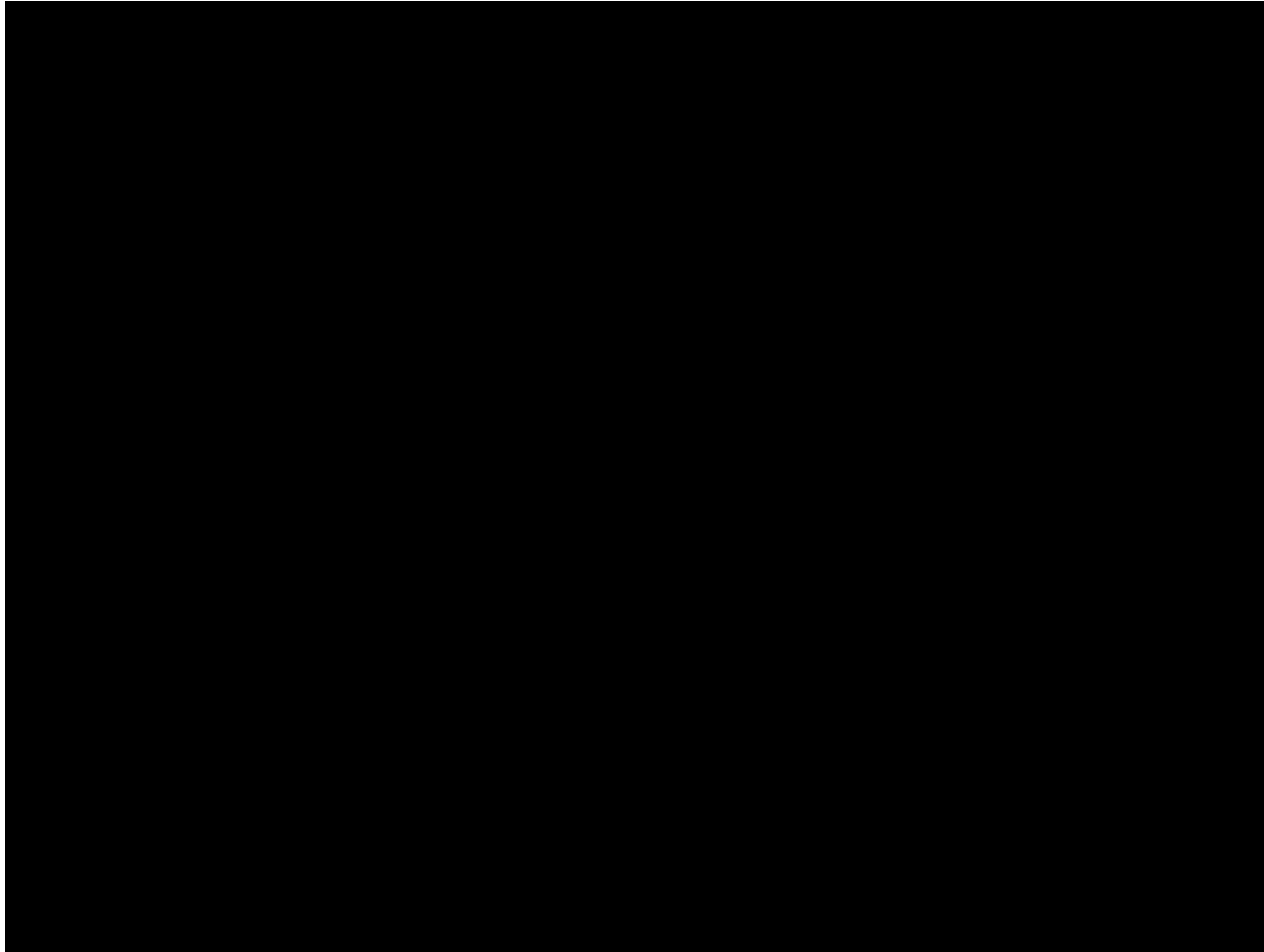


- ❧ Leica Geosystems has partnered with Locata to deliver augmentation products exclusively to the mining industry to at least October 2014.
- ❧ Locata have been awarded a sole-source contract with the USAF to equip, install and support their UHARS (Ultra High Accuracy Reference System) – a truth system to test GPS.



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How does it work?

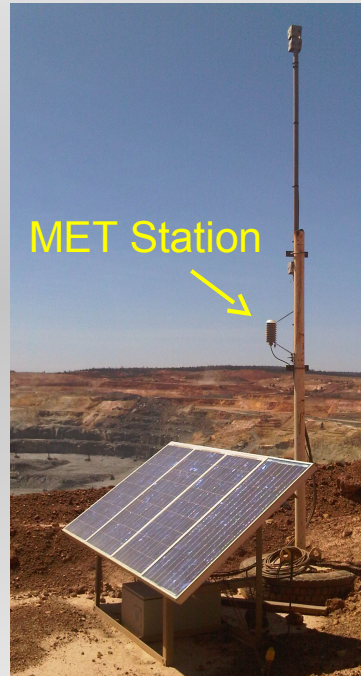




# Leica Jps Product Components



Mobile Jps LocataLite



Fixed (Master) Jps  
LocataLite

## Jps LocataNet



Jps LocataLite  
Module

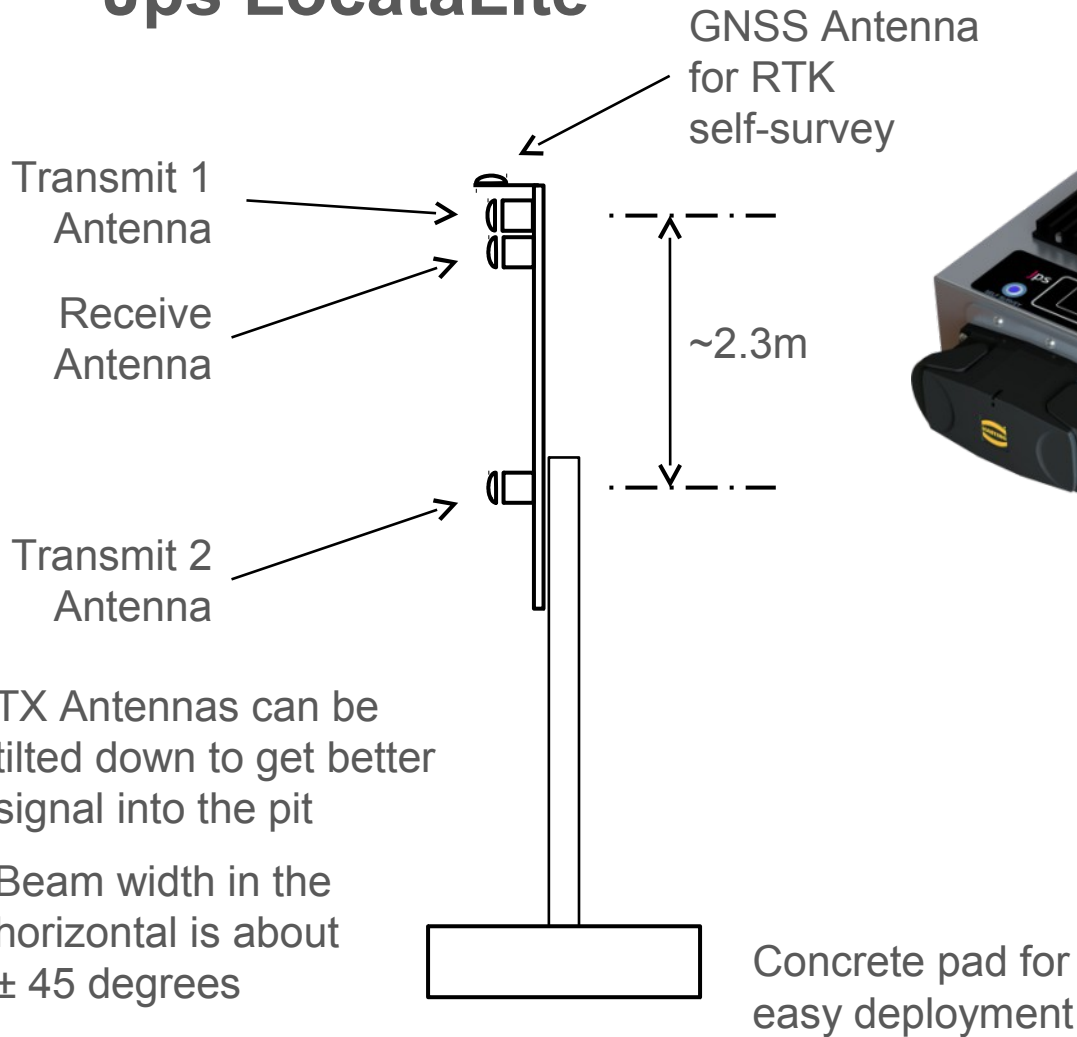


Jps  
Antenna



Dual  
Jps Receiver

# Leica Jps Jps LocataLite

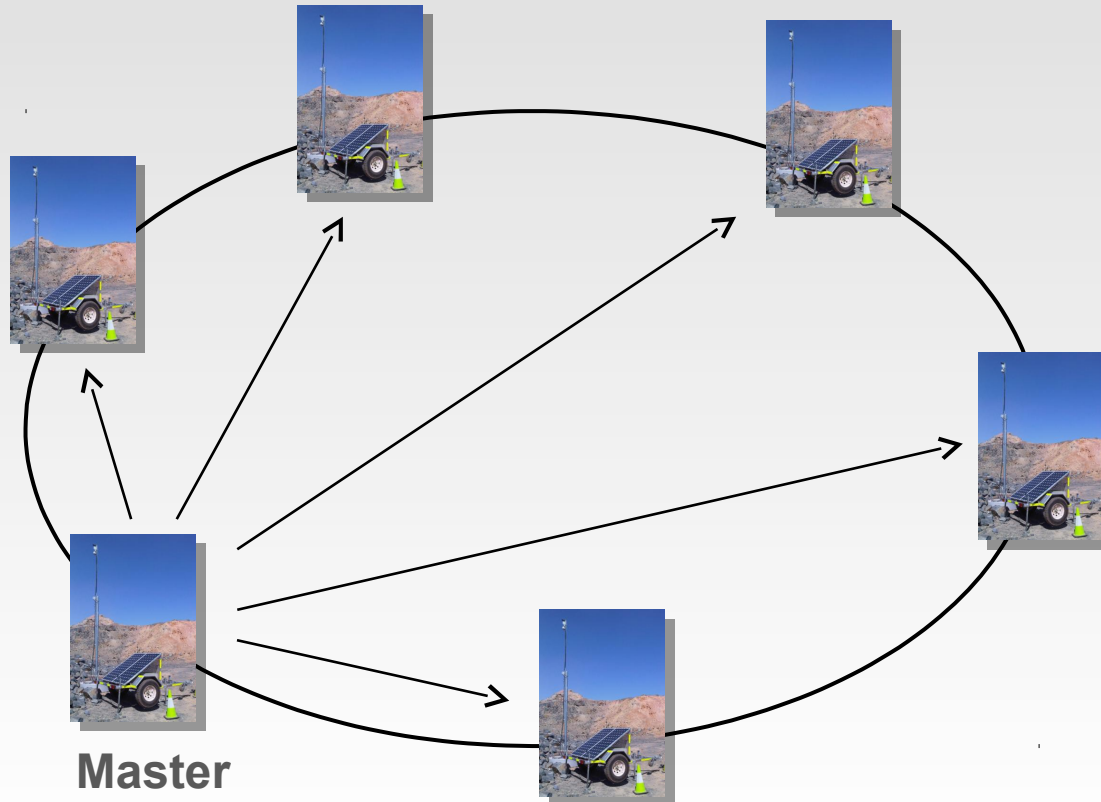


### Designing a Network

- Where are the areas with GPS availability issues?
- Signals must be line of sight, so shape of the pit needs to be considered
- One or more pits?
- Consider pit edge obstructions
- LocataLites need to be above the receivers
- Location of antennas on the machine or mast need to be considered



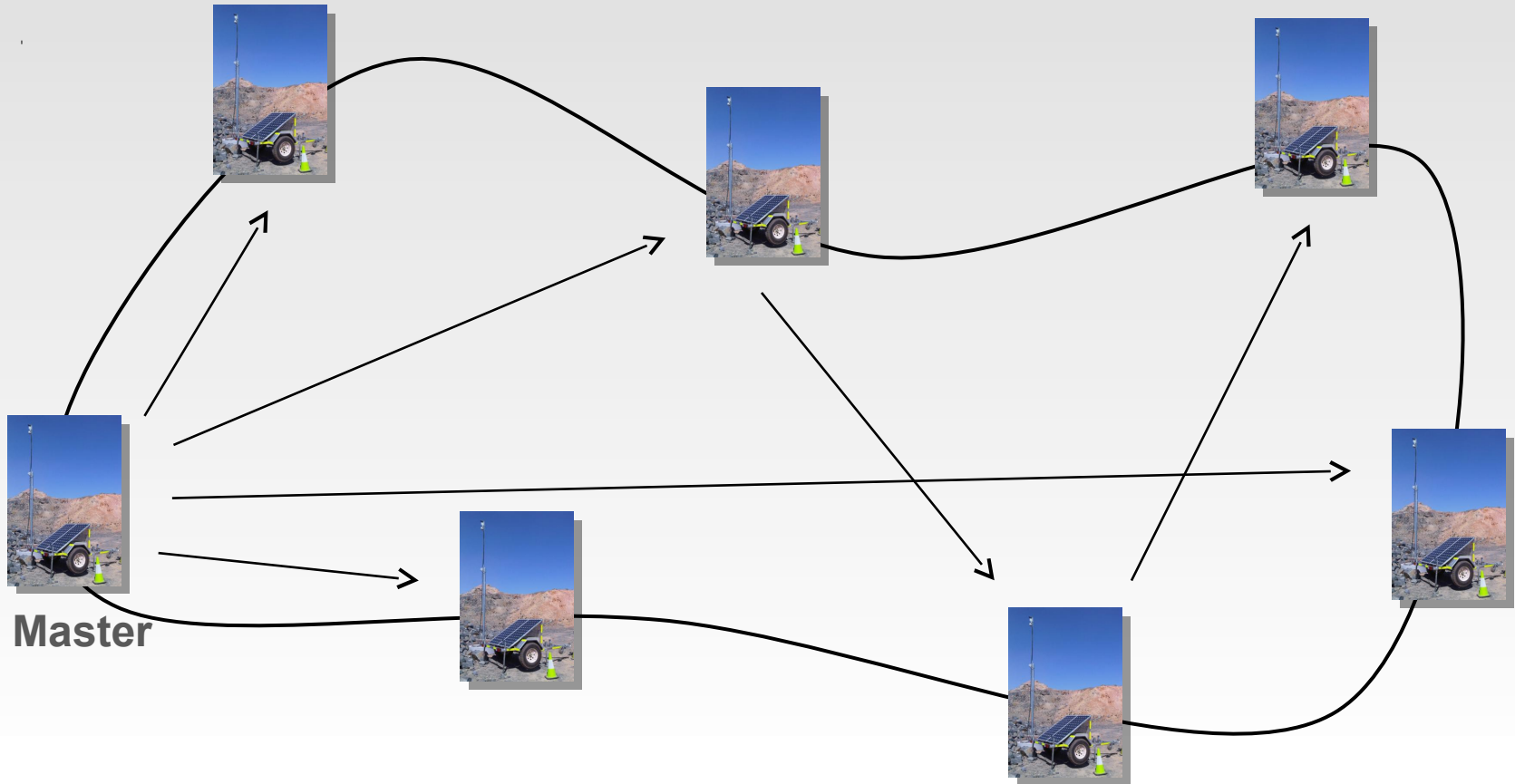
## Designing a Network – Simple round / oval pit



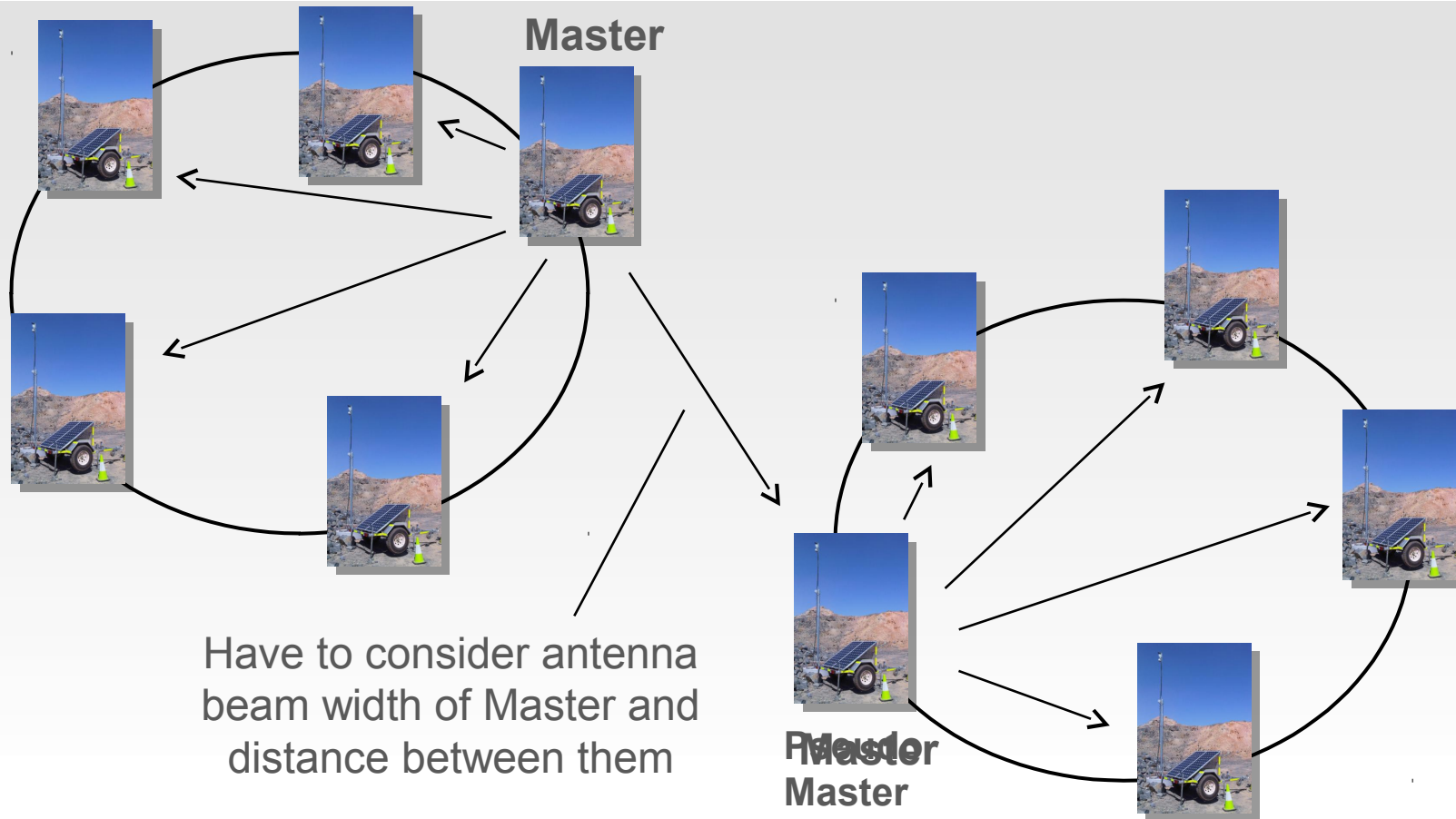


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## Designing a Network – More complicated shape pit



## Designing a Network – Multiple pits



# Leica Jps Product Features

- Redundant signals: transmits 4 signals per Jps LocataLite in the 2.4GHz ISM band (aka WiFi)
- Does not require additional base station
- Does not need additional corrections
- Support for multiple networks in multiple pits
- Jps LocataLites can be mobile and self-surveying
- Jps Receiver supports GPS (Navstar), Glonass, BeiDou, Galileo and Locata from single co-located antenna
- Jps Receiver designed as an add-on to Leica Jigsaw Mining Guidance Systems or even 3rd Party High-Precision guidance systems using Ethernet or serial connection



# Leica Jps

## Technical Specifications

- Temperature -20 to +65 degrees Celsius
- Vibration Tested
- FCC, C-tick and CE compliance
- Ethernet or RS232 connection to application system
- Configuration and Diagnostics via Web Interface
- External diagnostics support (Leica Jigsaw system only)





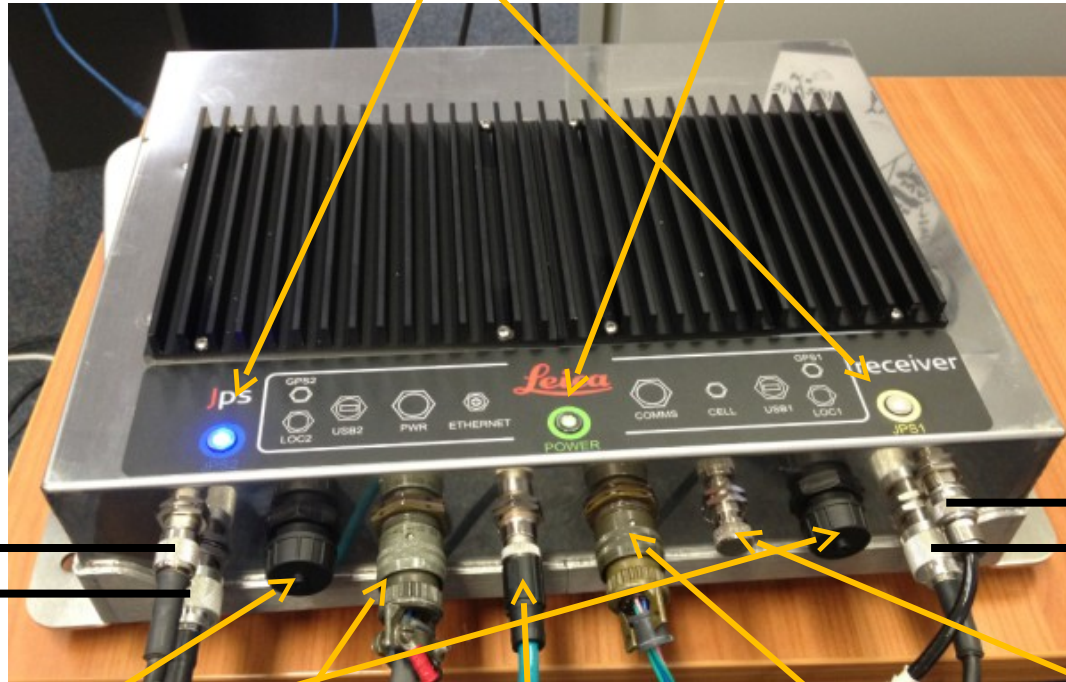
# Leica Jps

## Technical Specifications

- Co-Located Antenna (X and Y) with 50mm Z offset
- At the moment, Jps requires the following to initialise **with good DOP** (poker hand)
  - Full house: 3 GPS + 2 Glonass + 2 LL
  - Four of a Kind: 4 GPS + 2 LL
- To maintain RTK fix, Jps requires 'Four of a Kind: 4 GPS OR 4 LocataLites

# Leica Jps

## Jps Receiver – World's 1st GNSS & Locata Rover



Jps Tracking Status LEDs

Power Diagnostic LED

USB for upgrades

Power / Ignition, Reset

Ethernet Comms

RTK Corrections / Debug

Optional Cell



# Leica Jps Simple Configuration

Leica Geosystems AG - LEICA JPS - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites

Address <http://192.168.1.163/> Go Links >>

Status Overview

GPS 6/6/8 Gal -/-/ RTK AUTO Free 99% 192.168.200.100

GLO 6/6/9 Gal UOC 3/3/6

Leica Geosystems - when it has to be right

Home | Device | Current Status | Configuration | User

**Device**  
Primary  
Version Information  
Swap to partner device 192.168.200.101

**Current Status**  
Position  
Satellite status

**Configuration**  
Satellite Settings  
Start / Stop Logging  
RTK Corrections  
Network Configuration

**User Data**  
Transfer Files  
Load System Files  
Export Configuration  
Import Configuration

LEICA JPS | Version: 1.00 © Leica Geosystems 2012

# Leica Jps

## Published White Paper – September 2012

### MINE POSITIONING

The team from Leica Geosystems\*, Locata Corporation and Newmont\*\* review the latest results using Leica's Jigsaw Positioning System with Locata Technology at the Boddington gold mine in Western Australia



# Well positioned





# Leica Jps

## Current Deployment

- Two Pits both covered with a single Jps LocataNet
- All HP machines are to be equipped with Jps Receivers

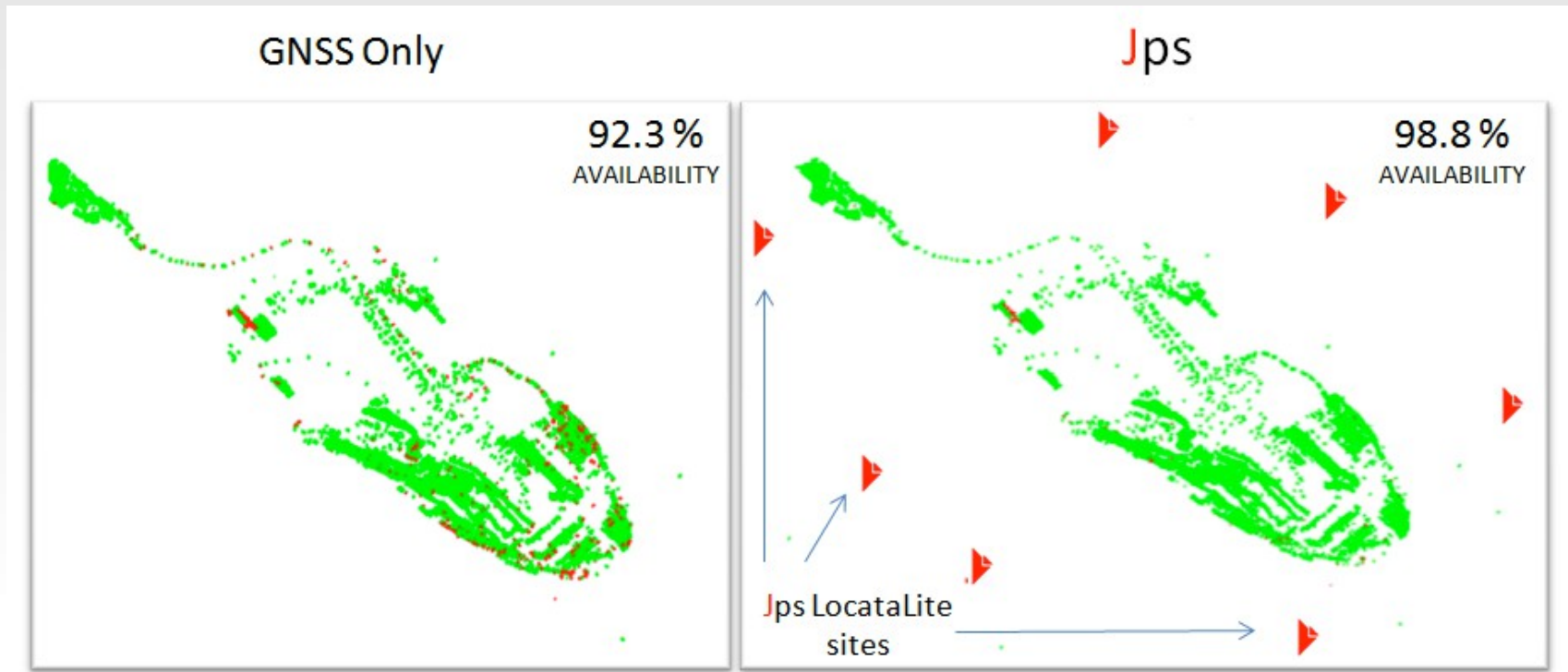


More coming, currently 36 in Total

# Leica Jps

## The Results – Availability of Drill Rig RTK Positioning

- 2 Months of 2Hz data on 2 drills, North Pit with partial obstructions, up to 90m depth
  - 6.5% improvement in Drill Positioning daily (almost an extra 2 hours)
  - Equates to 4.7 days or nearly 113 hours of additional guidance



# Leica Jps

## Potential Cost Savings – 2 Drills over 2 months

\$1000 / hr OPEX

92.3% → 98.8% UPTIME

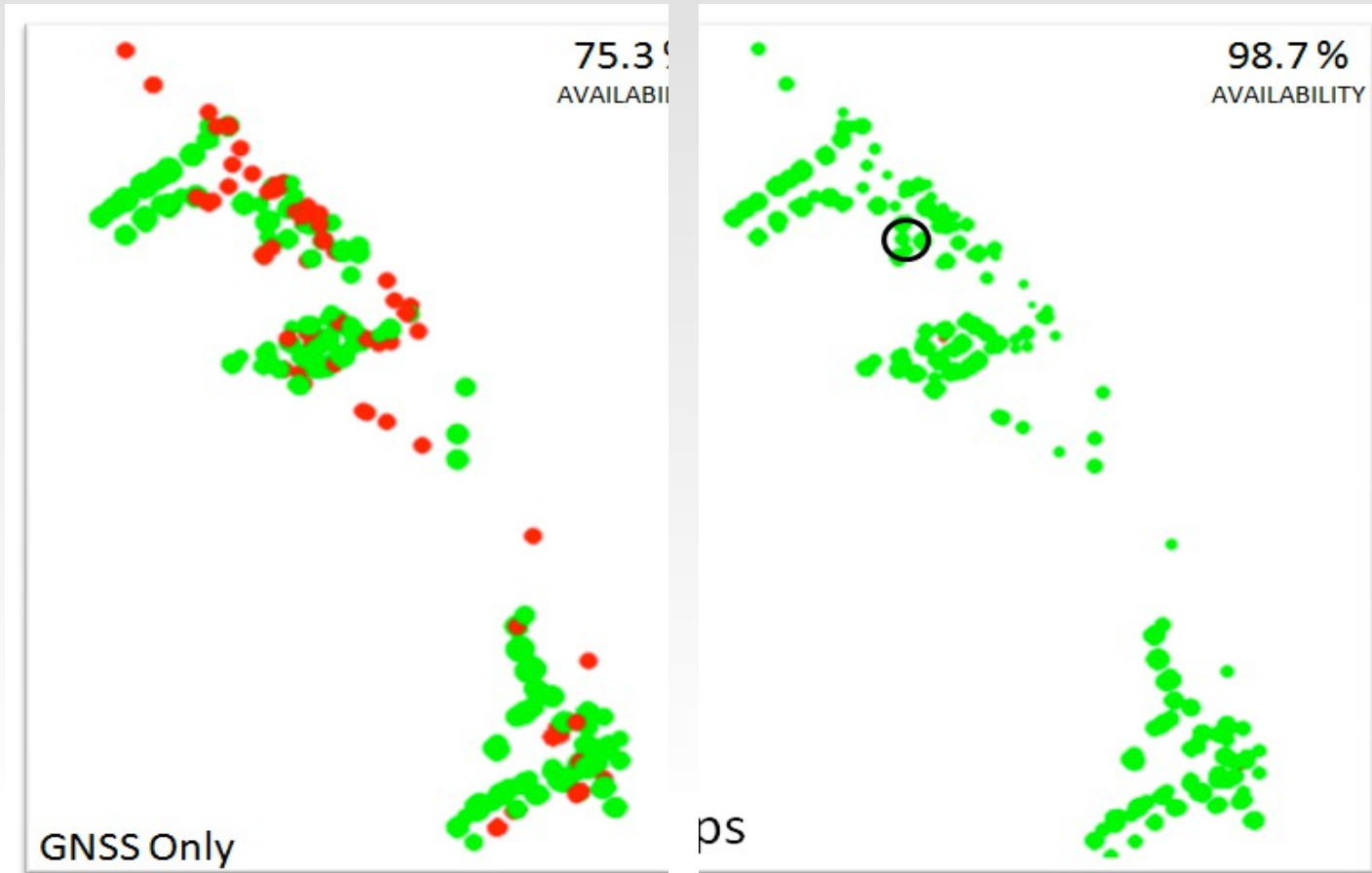
112.7 hrs EXTRA

\$112,700 SAVINGS

# Leica Jps

## The Results – Availability of Drill Rig RTK Positioning

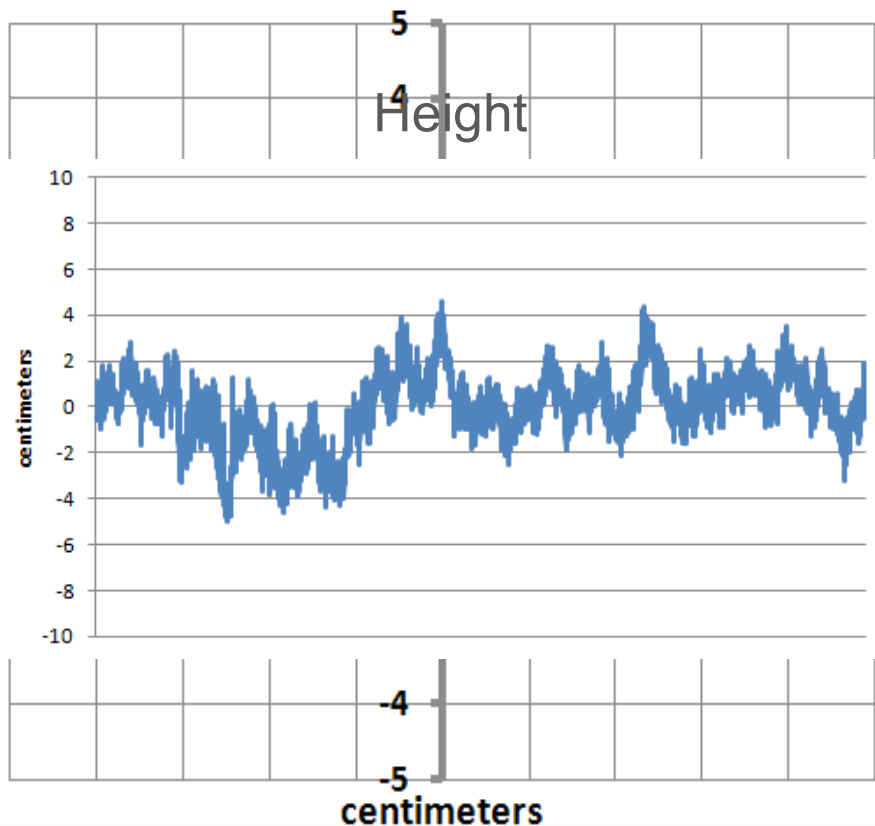
2 Days of 2Hz data on 2 drills, Pit with only limited obstructions, up to 90m depth





## Accuracy – 1 Hour Dataset GNSS-only vs Jps

Plan Position

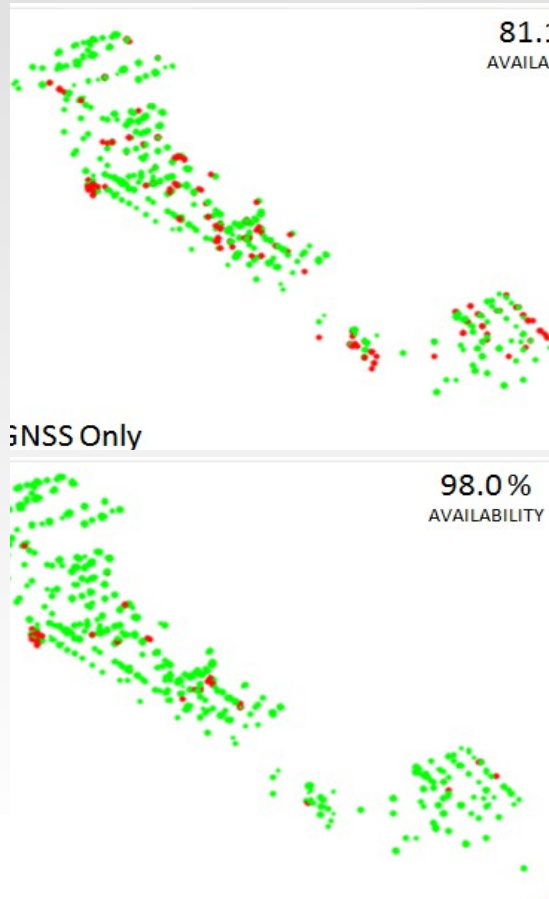


Height Difference to GNSS-Only	0.027 m
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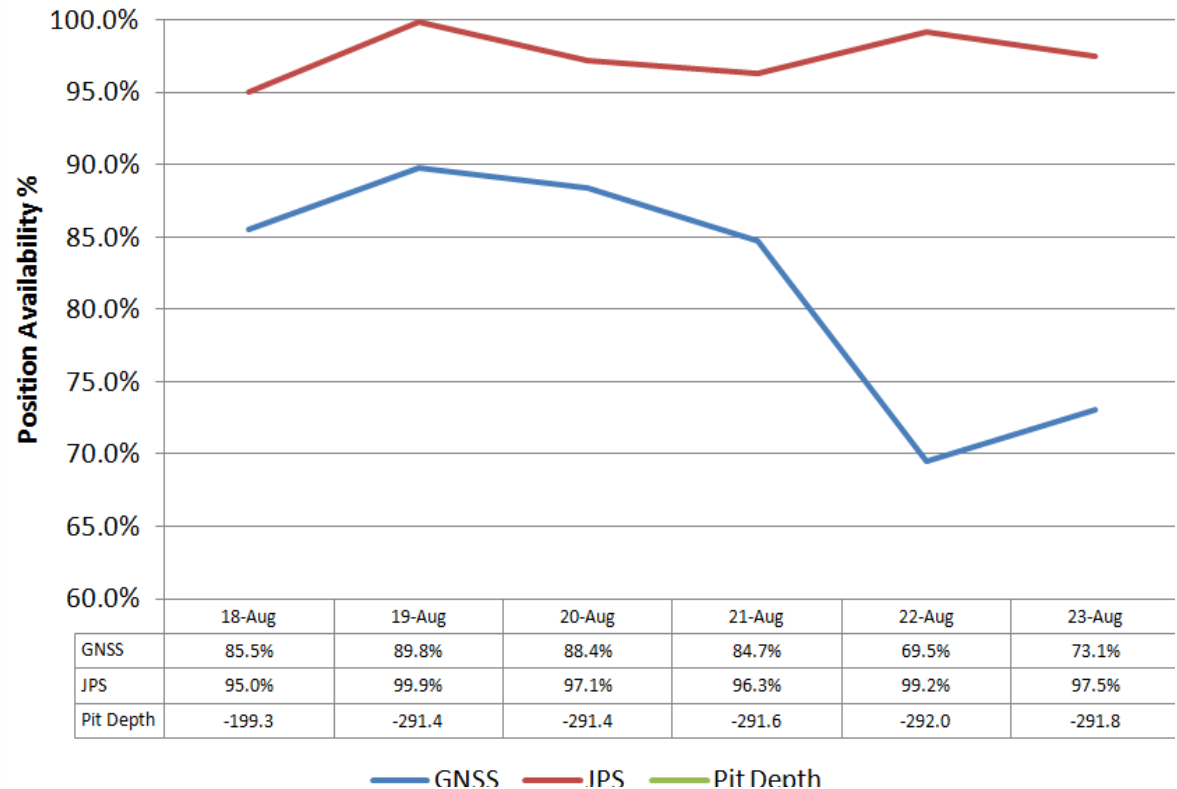
	GNSS-only	Jps
Vertical RMS	0.079 m	0.015 m

# Leica Jps South Pit Performance

6 Days of 2Hz data on 2 drills, Pit with serious obstructions, up to 180m depth



## Drill 02 Position Availability (August 2012)



# Leica Jps Summary

- Significant improvement in position availability is achieved when augmenting ground-based signals with existing GNSS.
- Leica Jps allows open pit mines to continue to use high-precision RTK guidance systems especially when GNSS signals are reduced (i.e. by obstructions or interference).
- Higher Position Availability corresponds to Higher Productivity
- Jps LocataLites can be easily and quickly deployed to provide optimal coverage for HP activities anywhere in an open pit.
- Leica Jps outputs open NMEA streams supporting easy integration into 3rd Party guidance systems sites.
- Leica Jps has tremendous potential to improve positioning availability and Safety for Autonomous vehicles, during solar storms, etc.

# Leica Jps Thank You

**2012 - White Paper Article. “Well Positioned – Leica Jps” –  
LILLY, B. et al ; International Mining Sept 2012 Edition: <http://www.im-mining.com>**

**2012 - Inside GNSS Magazine Cover Article. “Truth on the Range” –  
CRAIG, D. et al ; June 2012 Edition: <http://www.insidegnss.com/node/3071>**

## **An integrated Locata & Leica Geosystems positioning system for open-cut mining applications**

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