



INKONOVA

Pioneering 3D laser scanning in mines with drones



Pau Mallol
Founder&CEO

THE PROBLEM

- **Deaths** underground due to manual inspection of dangerous zones (ILO: about 12000 deaths/year)
 - **Inaccuracy or low speed** of terrestrial data collection solutions
 - **Inaccessibility** to certain zones, due to danger or vertical location (eg. blocked orepasses, cave-ins, stopes)
 - **Inability to 3D** model and map restrictive zones
-

Safety and costs issues

CHALLENGING SCENARIOS

- Ore pass blockages
- Ore pass/shaft condition assessment (ore flow optimization, schedule maintenance, predict arches/blockages...)

Knowledge is power!

- Cave-ins (inaccessible)
- Stopes (inaccessible)
- Drifts (inaccessible)
- Mine re-conditioning
- Mine re-opening
- General mine 3D data
- Search and rescue

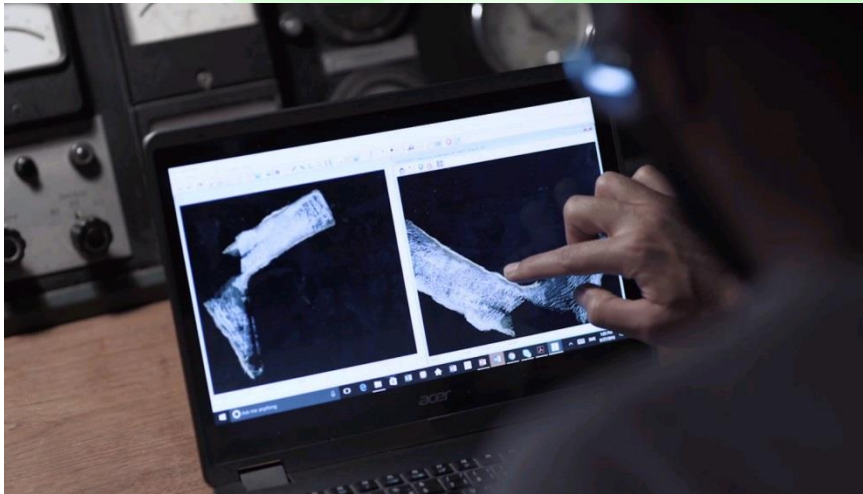


CONSEQUENCES

- Lack of awareness state/maintenance
- Out-of-date mine data (old drawings, incomplete models)
- Productivity reduction
- Increase cost per ton of ore
- Incidents and accidents

THE SOLUTION

3D laser scanning drones for inspection and mapping in mines, tunnels and other **underground** and **light-absent environments**



TILT RANGER

Ranger is a versatile drone combining all the features required to complete underground mines surveillance missions. Its gear enables it to combine vertical and horizontal movement on wheels and flight (up to 20 mins) in order to overcome the challenging environment of narrow shafts and rocky terrain. The high accuracy laser scanner can perform stationary as well as SLAM-based 3D scanning and mapping. The data are processed on an on-board computer and the point cloud can be downloaded over Wifi for viewing and further processing. Three first person view (FPV) cameras allow for full front, top and down visibility beyond line of sight



3 SWITCHABLE FPV CAMERAS



INTEGRATED HIGH ACCURACY
3D LASER SCANNER



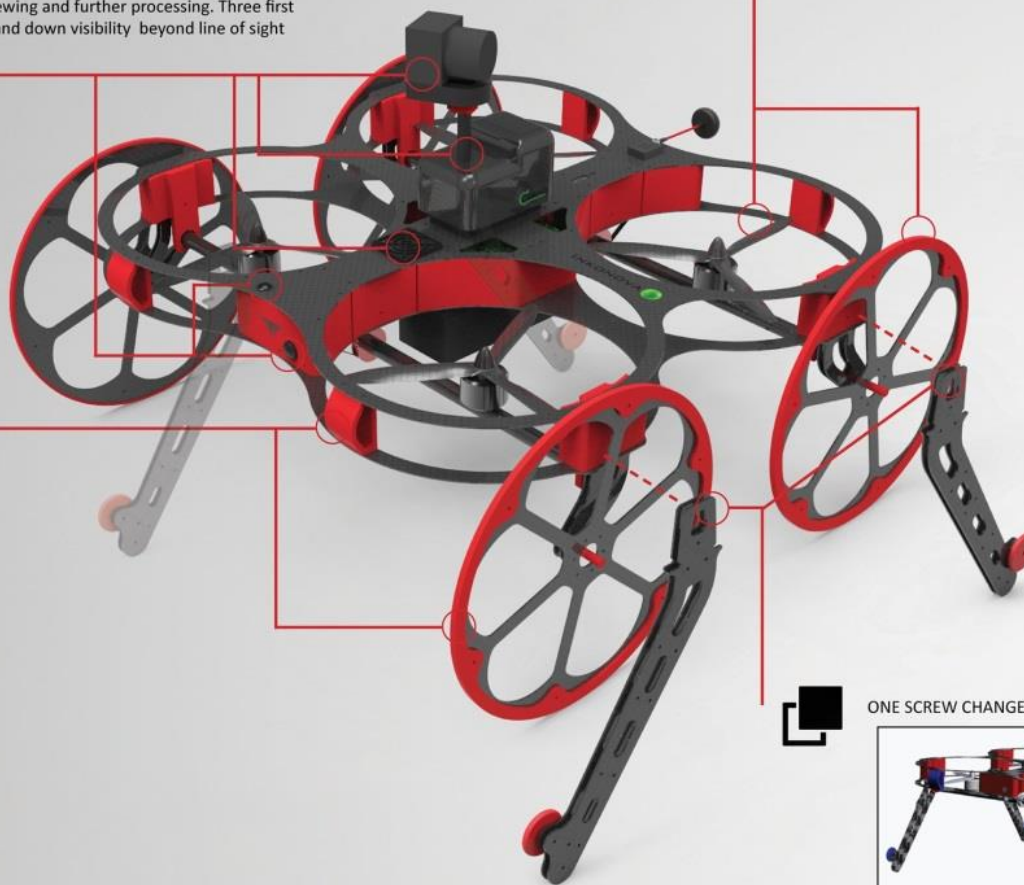
DEDICATED COOLING SYSTEM



SAFEGUARD BUMP



ROLLING ON INCLINED AND VERTICAL TERRAIN
(MULTI-MODAL STABILITY)



ONE SCREW CHANGE BETWEEN SKIDS AND WHEEL



INKONOVA 
www.inkonova.se

Clickmox
www.clickmox.com



TILTTM RANGER



- **Full protection** body and propellers protection
- **Up to 1kg payload capacity**
- **Up to 20 min flight time**
- **Body stability** (stays horizontal)
- **Multiple scanners** via a twin payload bay
- **Can climb and roll**



TILTTM RANGER



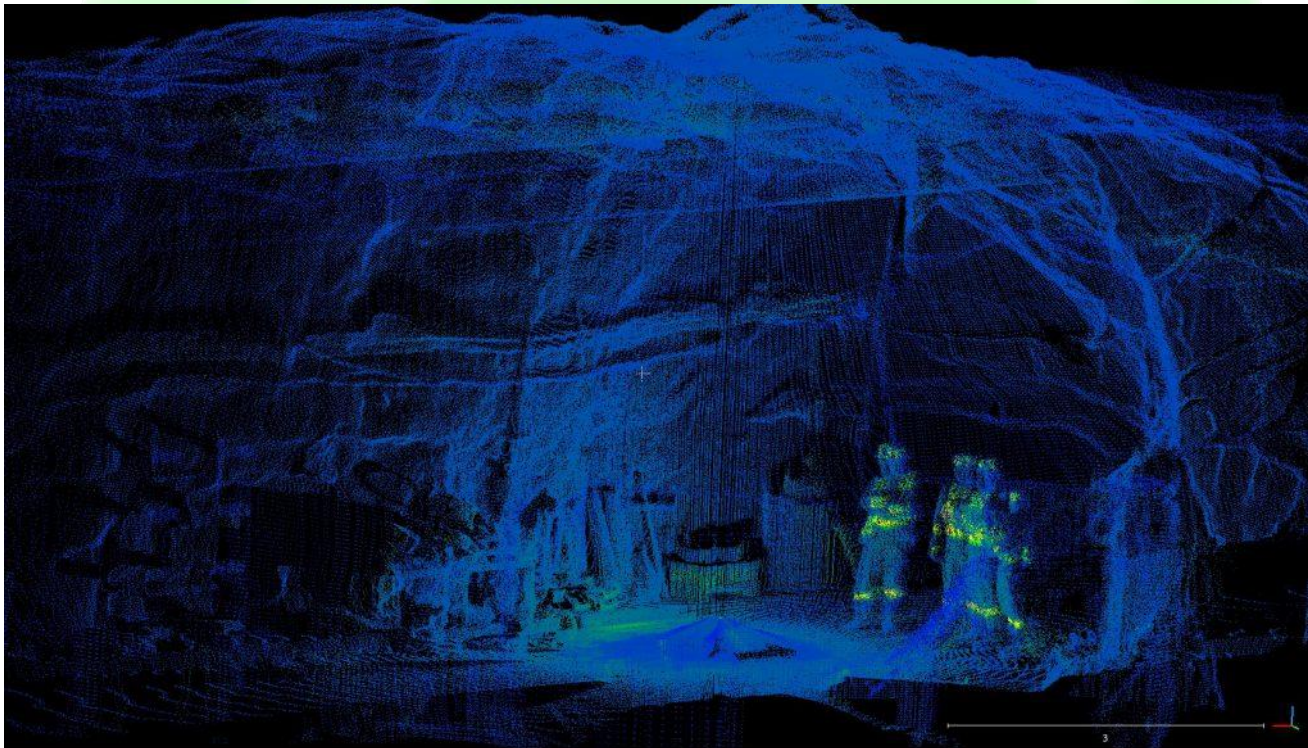
- **Quick deployment:** under 20 from opening the case to ready-to-fly, (including pre-flight checks)
- **Portability and protection** thanks to a wheeled, air-tight, Pelican case
- Enclosed body to **minimize dust- and water-related issues**
- **Four configurations in a single unit:** combinations of wheels/legs with top/bottom scanner

RESULTS

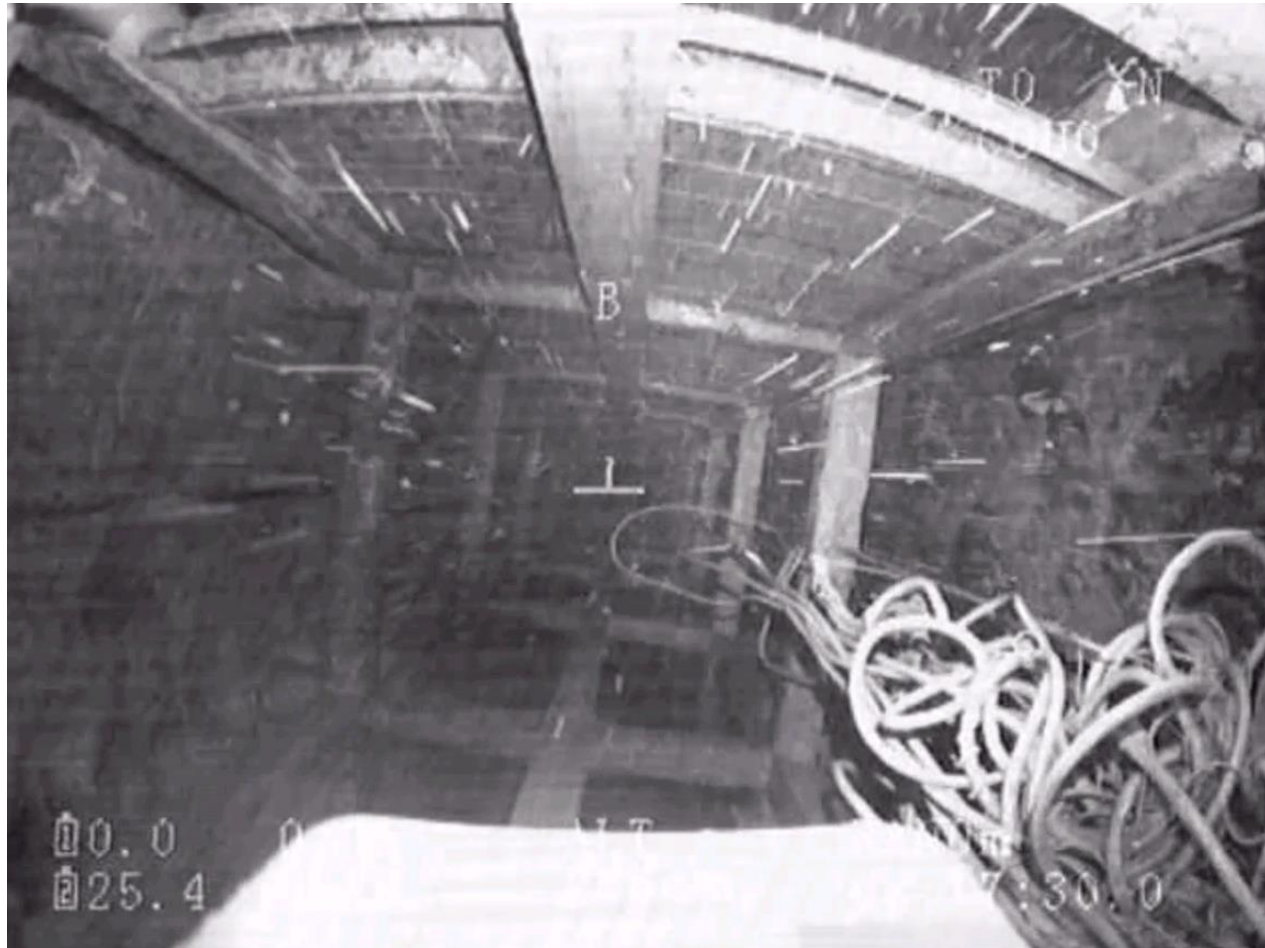
- **Partnered** with a leading scanner producer: **Clickmox**
- **Tested and validated** in 4 Canadian and 3 Swedish mines: Boliden, LKAB, Glencore, Rambler...
- **Aerial and automation advantage** over current solutions:
 - Accurate Data
 - Saves Time
 - Can save Lives
- **Specialization advantage:** custom tailored solution, first in the market.
- **Development and tests** in Q1-Q2 2016 and **paid missions** since Q3.

RESULTS

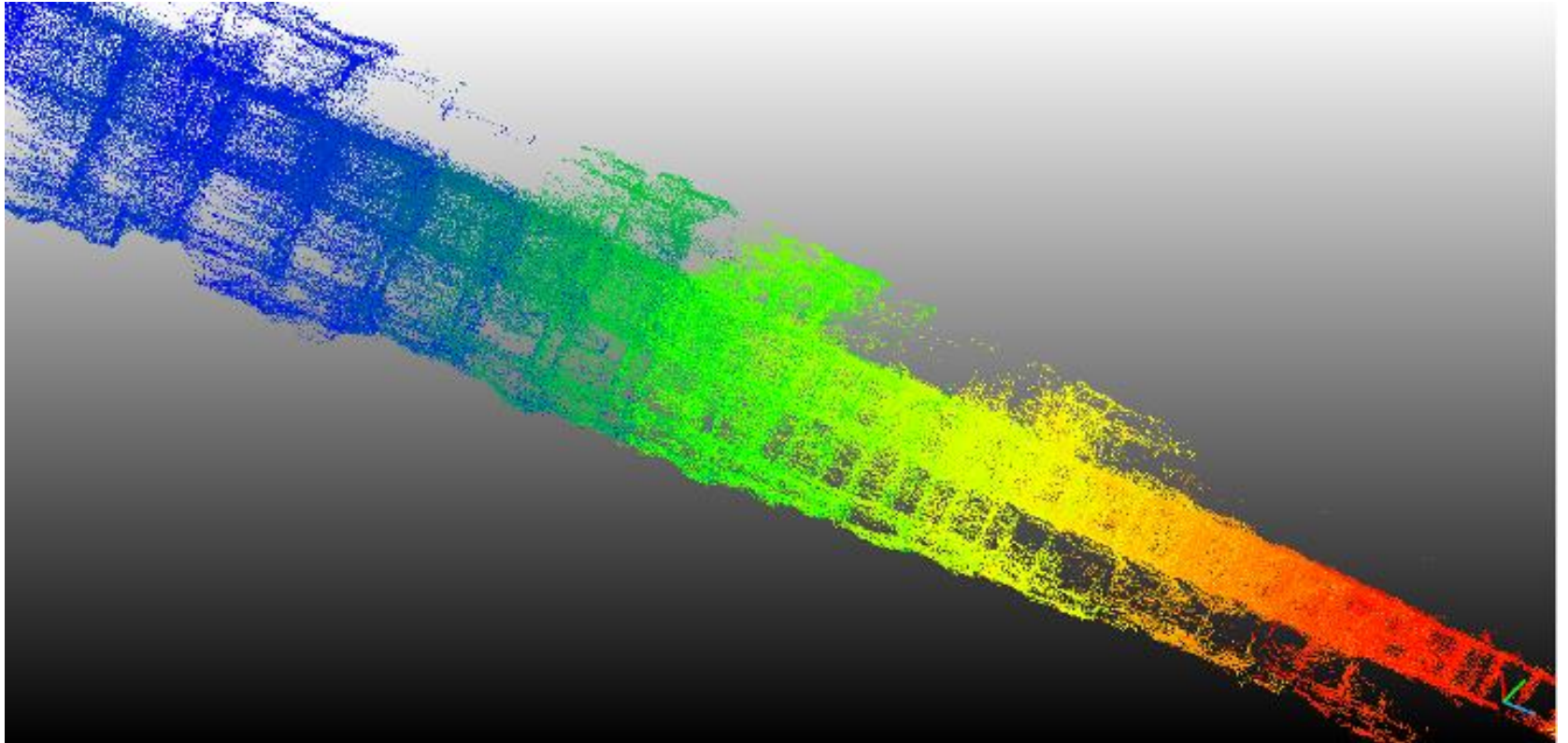
- High accuracy, real-time, 3D maps for GPS-denied, underground, indoor and dark environments using SLAM algorithm.



100M SHAFT SCANNING



100M SHAFT SCANNING



VENTILATION SHAFT

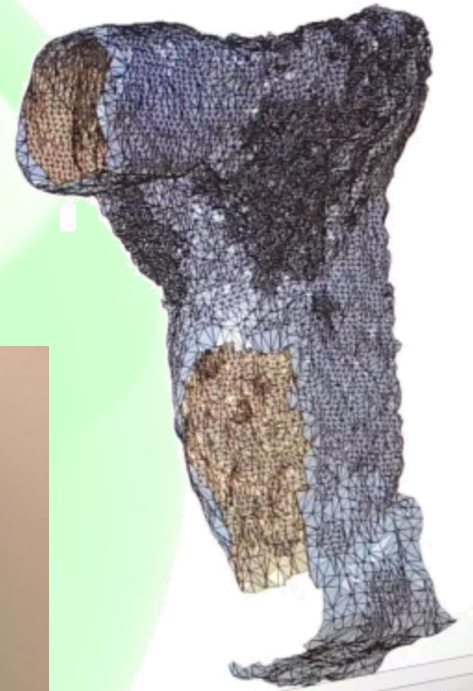


COMPETITION

- **Manual Inspection** (slow, unable to access dangerous areas)
- **Terrestrial Robots** (terrain-limited, no aerial or blindspots detection capability)
- **Scanners mounted on consumer/non-specialized drones** (not suitable for harsh/underground environments)
- **Other primitive improvisations** (cable an bucket, camera-on-a-stick type)

BUSINESS PROCESS TODAY

- Define Mission
- Fly Drone and Acquire Data
- Postprocess Data for the deliverable
- Deliver results (usually within 2 days from mission date)



WHAT WE DO

- **WE SPECIALIZE** in inspection of GPS-deprived, dark and constricted spaces with different sensors (case/client dependant)
- **WE PUSH** the limits of existing technology
- **WE CREATE** new technology



INKONOVA

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EXTRA SLIDES

INKONOVA GROWTH

- 2015 - START
- 5 months first to Commercialize the TILT Rotor Technology
- 5 months TILT Pro - One of the world's fastest drone racers
- 11 months Developing Multi-Modal Stability, first drone to change body-angle inflight
- 14 months Developing the TILT Car; Drone for land/air/ceilings/rugged slopes
- 15 months TILT Mine, One of the First, if not the first, of its kind
- 16 months TILT HL, a heavy-lift TILT drone with a payload of about 4kg.
- 19 months Several tests and demos in Swedish and Candian Mines
- 19 months Developing a collision avoiance system specific to underground mines

INKONOVA GROWTH

Budget

Q4 2016:

Tech. Dev.: 840 kSEK

Others: 190 kSEK

Q1 2017

Tech. Dev.: 640 kSEK

Others: 260 kSEK

Q2-Q4 2017

Current share holders

	Shares	%
Pau Mallol	1500	70
Ahmed AlNomany	500	23
Clickmox Solutions	70	3
Private investors (6)	82	4
TOTAL	2152	

FORECASTS

Forecasts

Revenue 2017 – from 3 up to up to 7 MSEK *

Revenue 2018 – up to 23 MSEK *

Two potential patents in Progress

*estimates are based on the pace and success rate of the technology development and funding rounds to grow/expand

Total Investment sought in current round: 12 MSEK