Mining Automation
Mining’s Production Robots

Mines
Cat
Sandvik
Automation Benefits:

- Improved Safety
- Fewer resources
- Less machine damage
- Higher utilization
Mining’s Production Robots

Komatsu

Freeport
Rio Tinto / CRC Mining

Cat D10T
Caterpillar’s Robots in Development

800,000 lbs rated load  (C5 Galaxy has a max 769,000 lbs at takeoff)
24x30x47 ft = 2800 Sq home
Tires cost $40K - $80K
Drivers for Automation

• Safety
• Lack of people / Location
  – Australian outback
  – 12,000 foot elevation
  – Canadian tar sands
• Utilization & Efficiency Gain
  – In a 24 hour operation, 15 – 16 hours of run time is the norm.
  – > 20% efficiency gain demonstrated in some cases

NIOSH: 1 Fatality per Year

Stockpile Summary

• 464 Dozers on 337 Stockpiles
Future Vision

- Robots will certainly be the workhorse that drives future mining and allows the developing world to enjoy our standard of living.

- “FCS” like connectivity will provide transparency into the construction/mining operation to allow site level optimization – largely based on the consistency provided by automated machines & systems.

- Autonomous systems will work more efficiently with less environmental impact.
  - Up to 40% fuel savings per unit work
  - Increased utilization & productivity
  - Improved safety
Challenges

Product:
• In general our customers are not risk takers on technology
• Conditions are harsh > Mil Spec in many cases
• Reliability targets are high > 10X military
• Cost targets are low

Technical:
• Reliable Communications
• Reliable / consistent object detection (small rocks)
• Robust positioning in GPS shaded areas