

A large yellow autonomous haul truck is shown in an open-pit mine. The truck is positioned on a dirt road, and its massive size is emphasized by the surrounding environment. The background shows a dense forest of tall trees under a clear sky. The truck's body is primarily yellow with black accents, and it has a large, flat roof structure.

***Recent Experiences with Autonomous
Haul Trucks in Open Pit Mines***

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Introduction

- *History of Autonomous Trucks*
- *Vehicle Control - Drive and Navigation*
- ***Supervisory Control - Optimization***
- ***Demonstrations***

History of Autonomous Truck Projects

- **Early 70s** *Cable-laid systems in haulroad*
- **Early 80s** *Radio Transmitters*
- **80s** *Ground beacons, Optical Fiber Gyros*
- **Early 90s** *GPS operational system (prototype)*
- **Mid 90s** *Refined GPS development*
- **1997** *Integration of a Supervisory System*
- **1998** *Full cycle demonstrations using AT Supervisory Systems*
- **1999, 2000** *Integrated Development and Operational Testing of a "Production Capable" System*
- **2001** **Real Autonomous Production**

Vehicle Control



Major Components of Unmanned Mining Trucks



Vehicle Navigation System



The Result !



Haul Road

Supervisory Control

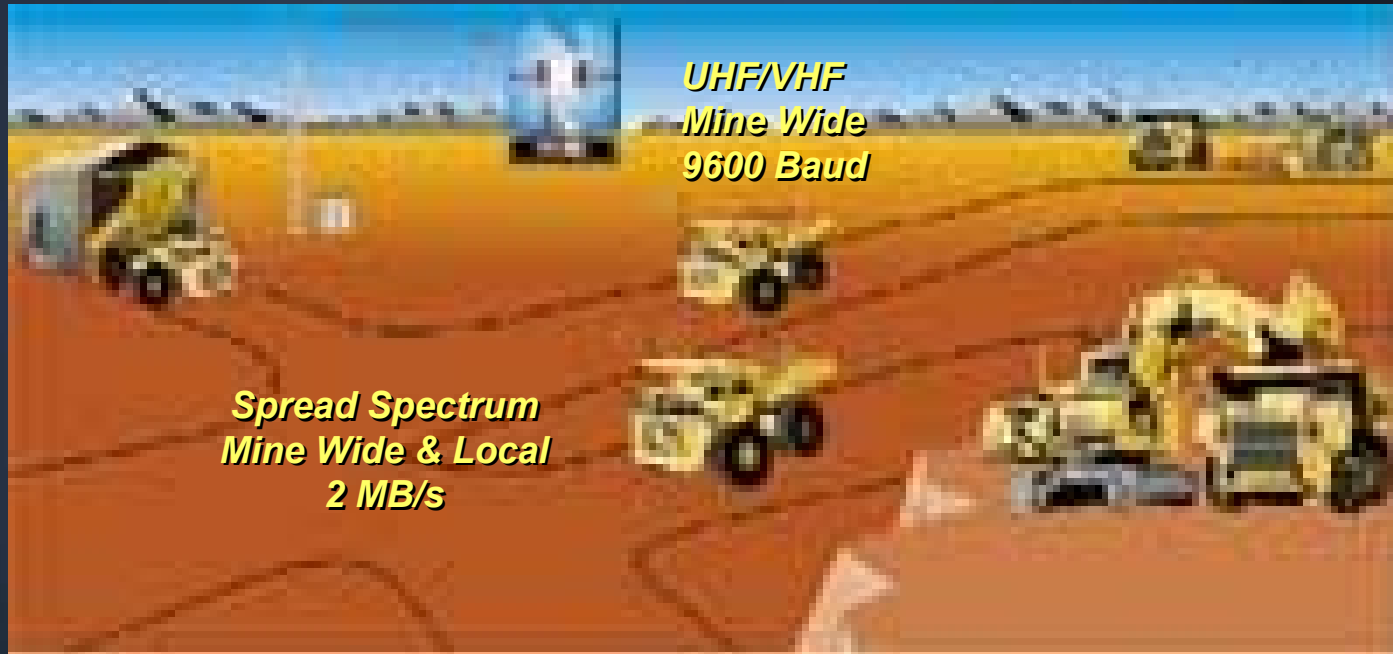


Control Room



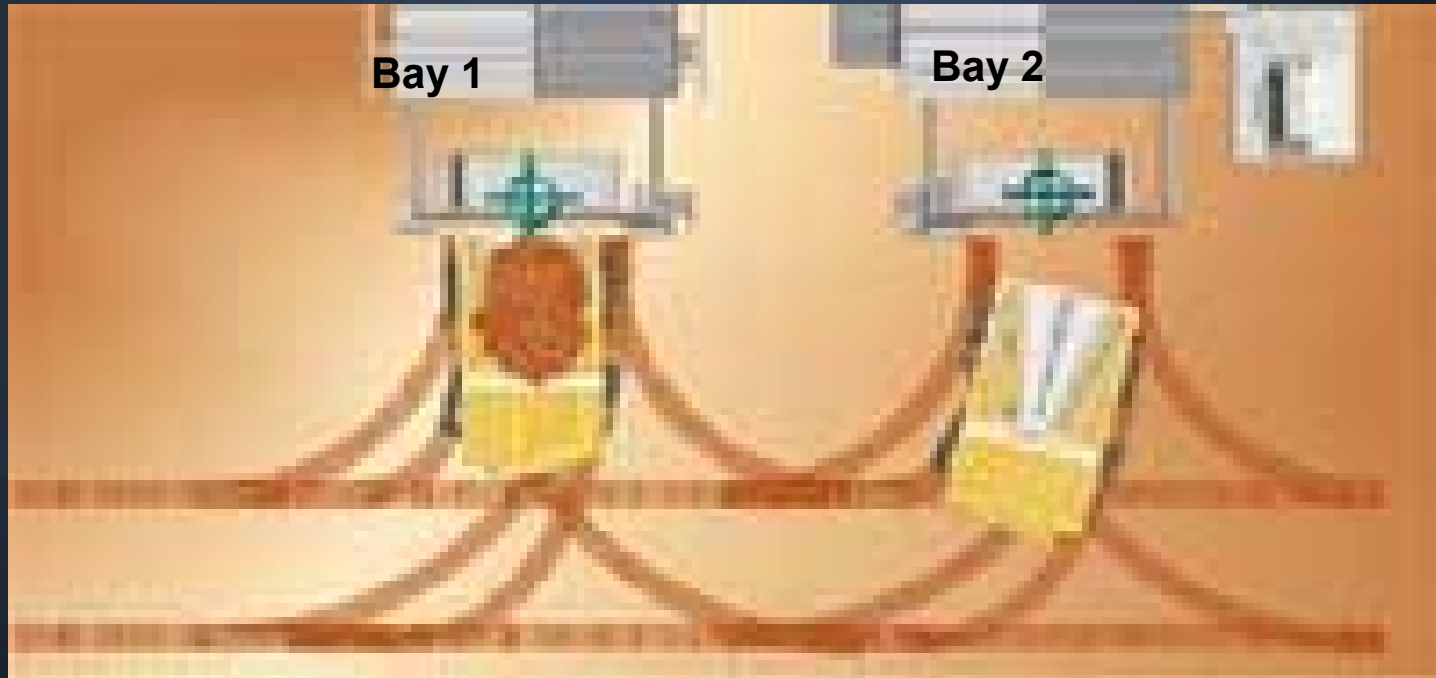
Pit Patroller





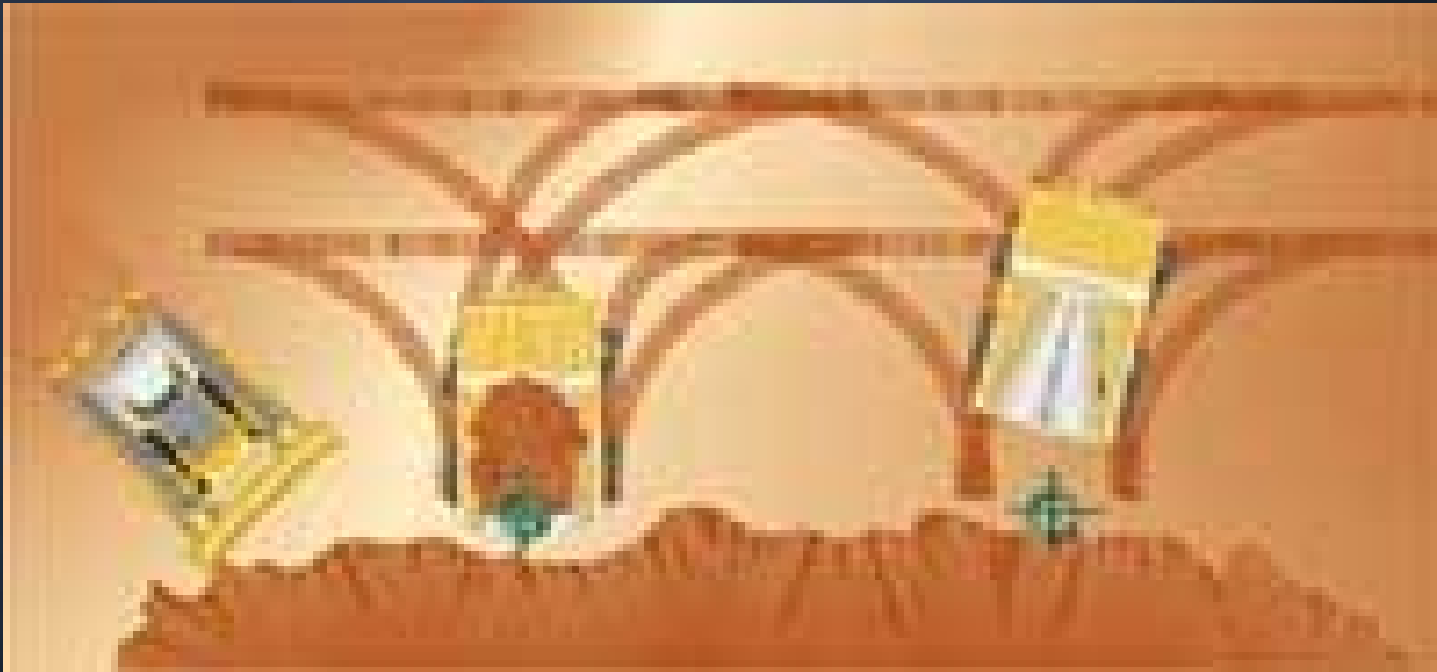
Communications Network
“Open Systems” Standards

Autonomous Haulage System



Dumping at Crushers

Autonomous Haulage System



Dumping at Stockpiles/Waste Dumps

The Results !



Autonomous Haulage System



Truck Back-up Strategies

Autonomous Haulage System



Top Loading

The Introduction of Autonomous Trucks

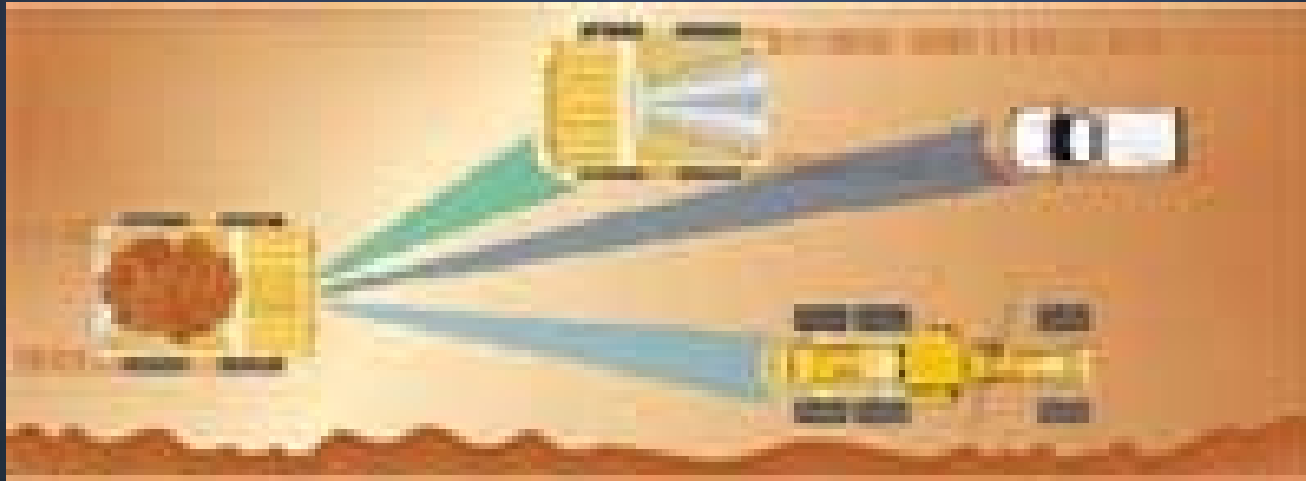


Safety & Adaptability



Obstacle Detection Systems

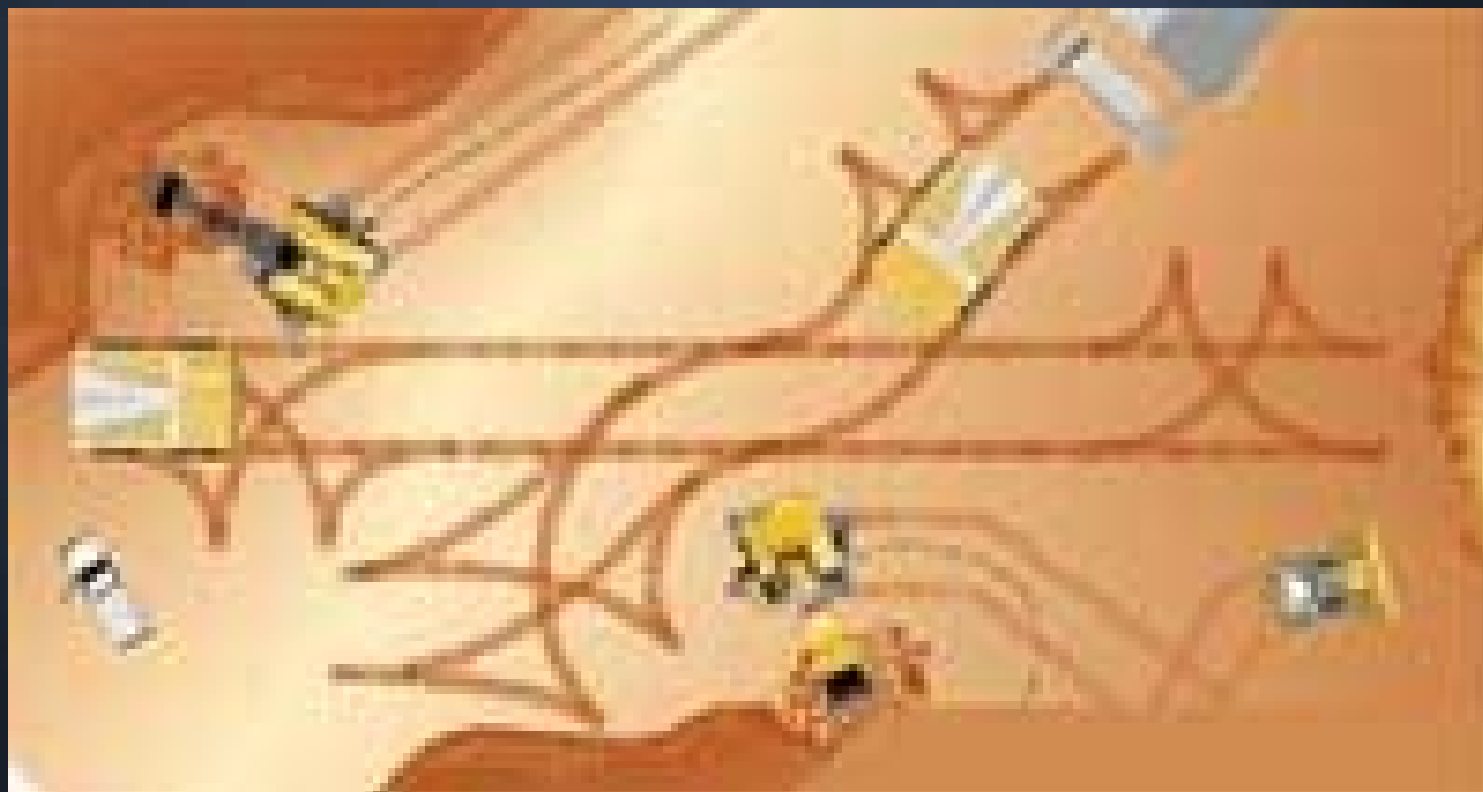
Safety & Adaptability



Vehicle Detection

- ***Proximity Communications***
- ***Obstacle Detection***

The Result !



Demonstrations



Obstacle Detection Systems









System Benefits

- *Improved Material Flow Control*
 - **Improved Blending**
 - **Positive Material Destination Control**
- *Improved Fleet Availability*
 - **Improved Fleet Monitoring**
 - **Reduced Wear and Tear**
 - » **Improved Fuel Efficiency**
 - » **Predictable Component Wear**
- *Improved Use of Availability*
 - **Significant Reduction in Break Times**
- *Improved Fleet Control (Dispatching)*
 - **Events Happen When Expected**
- *Improved Mine Safety*
 - **No Operator Stress**
 - **Minimal Manned Interaction**

Thank You!

