

# **Acumine Collision Avoidance Safety System for Heavy vehicles**

**“ACASS”**

**WILL KEEP HEAVY VEHICLES SAFE BECAUSE....**

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# ACASS Unique Features

- 360° view in all conditions
  - Notwithstanding inherent blind spots
  - Through stockpiles and berms
  - Through fog, smoke, dust
- Automatic assessment of risk
- Automatic warning to operator of the actual risk
- Warning to operator in time to avoid collision
- No false alarms
- Inbuilt redundancy
  - Two radio networks at different frequencies

# Other Features

- Complete Logging System
  - Replay incidents
  - Identify hazards, speeding
  - Assess training requirements
- Decentralised Operation
  - Guarantees detection and full functionality over whole mine
  - Eliminates inherent dropouts/delays
  - No reliance on Central Server to operate
  - Enhances reliability
    - Each truck does its own processing
    - Not rely on comms back to central location

# Other Features (continued)

- Patented Context Switching
  - Eliminates false alarms
  - Maps roads automatically
  - Provides aerial view of working vehicles
- Display Options
- Audible and graphic alerts
- Robust
- Fleet Management System

Acumine Collision Avoidance Safety System (ACASS) is the commercialisation of one of the technologies of ACFR.

- Who is ACFR?
- What ACFR does?
- Who is Acumine?
- Set up to commercialise ACFR technology

# Who is ACFR?

- Acumine is the Commercialisation vehicle for ACFR Technology.
- Established in 1995 – Internationally one of the largest research providers and developers in field robotics and Automated Systems.
- \$85+ million in outcomes in Automation to date.
- \$50 million in orders at present.
- Commitment to Real Industry Outcomes
- Over 85% of all our funding comes from Industry.
- Reputation for delivering to Industry expectations and standards.
- 198 Researchers, including the world's best.
- Dedicated buildings, laboratories,
- Dedicated flight facilities (2,000 acres) at Marulan
- Dedicated Island for our Underwater R&D.

# Who is ACFR (continued)

Group is led by:

- **Prof Hugh Durrant-Whyte**
  - Research Director of CAS
  - Federation Fellow
  - **Acumine Inventor/Shareholder**
- **Prof Eduardo Nebot**
  - Patrick Logistics Chair, The University of Sydney
  - Director of ACFR
  - **Director of Acumine**
  - **Major Acumine Inventor and Shareholder**
- **Associate Professor Salah Sukkarieh**
  - Program Leader – Systems Engineering and Unmanned Aircraft
  - Project Manager for Aerospace Systems
- **Olga Sawtell, BA.LLB.,**
  - Chief Executive of ACFR
  - **Chief Executive of Acumine**
  - **Acumine Shareholder**

# What does ACFR do?

ACFR Specialises in:

- Automation that does NOT FAIL.
- Automation of heavy vehicles in unstructured environments.
- Total integrity and fail safe redundancy in all our systems
- Commercial applications of unmanned and fully automated systems in the areas of:
  - Aerospace – unmanned, totally autonomous planes and helicopters
  - Materials handling - straddle carriers, container terminals
  - Indoor robots
  - Mining – Rio Tinto first fully automated mine, autonomous shovels,& diggers
  - Defence – under confidentiality
  - Subsea – underwater robots
  - Media art – Fishbird
  - Transport – trains
  - Agriculture – autonomous helicopters spray noxious weeds



# Case Study 1

## Patrick Stevedores – Unmanned Straddle Carrier

Research, design and development into robust localisation and control systems for 24/7 reliable operation

First completely automated port operation from manifest initiation to auto pick and place

Fisherman's island (Brisbane) is fully automated with originally 18 and now 26 autonomous straddle carriers

Totally operated out of Sydney

# Automation Pay Offs

- Automated scheduling and traffic management
- Improved efficiency and flexibility on the waterfront
- Productivity levels higher than manned vehicles
- Precise and on time control and scheduling
- Significantly reduced maintenance costs including tyres
- Flexible and incremental deployment and expansion
- Safe and efficient interface to port personnel and equipment

# Completed Straddle System(s)



# Patrick AutoStrad Terminal

- Officially opened by Queensland Premier Peter Beattie December 2005



# Fisherman's Island Berths 7,8 & 9

- Operational automated terminal
- Located in Brisbane, run from Sydney
- The worlds most technically advanced container terminal
- Sydney and Melbourne are following.



# Operations



# Video



# Case Study 2

## Acumine – Mining: Unmanned and Driver Assist

### **Autonomous vehicles to:**

- Manage Driver Fatigue
- Reduce driver injuries and fatalities
- Carry out repetitious and boring work
- Minimise maintenance and repair
- Maximise production
- Improve bottom line



# Accidents involving Manned Haul Trucks



# Acumine Collision Avoidance Safety System (ACASS)

**ACASS provides a 360 degree unlimited view around a heavy vehicle that:**

- Automatically identifies potential problems, risks AND
- Automatically assesses the level of risk of those potential problems and warns according to the level of risk AND
- Provides System Monitoring / Full replay operation for Mine Safety Analysis, Design and protocols.
- Ease of installation and maintenance,
- retrofits to all vehicles
- Robust

# ACASS Provides

- High Reliability and inbuilt redundancy: System operates over 2 networks, each with a different frequency and different sensors to ensure system integrity
- Real time risk assessment alarm in time to warn the Operator of imminent collision/danger
- Minimum false alarms because of Acumine Context Switching technology [patented]
- 360° awareness enhancement for operator
- Sees through dust, the fog, the smoke and around blind corners
- Data logging for monitoring and recording: system operation, mine safety design and for Mine Production Planning.
- Self checking: verify that system is operating under specifications and report malfunctions on-line
- Integrates with existing Mine Management Systems.
- Customised to the mine operation

# Intellectual Property

There are three patents:

- Patent 1: “**Haul Truck Safety Management System**” has been patented in the name of Acumine PCT/AU2004/001201.
- Patent 2: “**Virtual Network Systems**”, being a decentralised wireless protocol to efficiently move information in a mine type environment CRC: International PCT/AU 2004/905293.
- Patent 3: “**Context Switching System**” in the name of Acumine: International PCT/AU2008/001021

# Intellectual Property (cont)

## Virtual Network Patent

- Moves peer-to-peer information between resources

## HaulCheck Patent

- Monitors position of vehicles
- Improves situational awareness

## Context Switching Patent

- Incorporates all information available
- Infers the risk according to the area of operation/current situation
- Essential to reduce risks
- Essential to reduce false alarms

# ACASS Trials

- a. Bracalba Quarry, Australia – 2007-2009
- b. Freeport Mine, Indonesia – 2007-2008
- c. Brockman Mine, Pilbara, Australia – 2008
- d. Andina Mine, Chile – 2009

# Results of Brockman Trial established

- Mesh system – limitation of standard GPS augmented by RFID at 2.4GHz and 433 MHz
- Single individual ad hoc network, independent of central server
- No false alarms
- System sees through the fog, the dust, the berms, around blind corners
- Real time risk assessment alarm in time to avoid incident
- Retrofit to any vehicle, easy to install and maintain
- Simple operating system
- Totally redundant system (two networks, different frequencies)
- Monitoring and Fleet management capability
- Each vehicle has:
  - Dedicated on-board computer for processing and alarming
  - GPS sensor and omi direction antenna for wide area coverage

# Brockman Mine

- Rio in-house video



# Questions?

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