

Haulage & Loading 2007 Machines, Mining and Mankind: Finding a Balance

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Keynote Address

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On Behalf of the

Earth Moving Equipment Safety Round Table

Machines, Mining, and Mankind— Finding a Balance

Abstract

Most fatalities, accidents and incidents in the mining industry involve equipment operation or maintenance. Mining companies face a common problem ensuring that earth moving equipment is designed to be operated and maintained under all site conditions without causing harm to people. In 2006 the Earth Moving Equipment Safety Round Table (EMESRT) took initial steps towards establishing a process of engagement between Original Equipment Manufacturers (OEMs) and mining customers; a process designed to accelerate the development and adoption of leading practice designs of earth moving equipment to minimize Health and Safety risks.

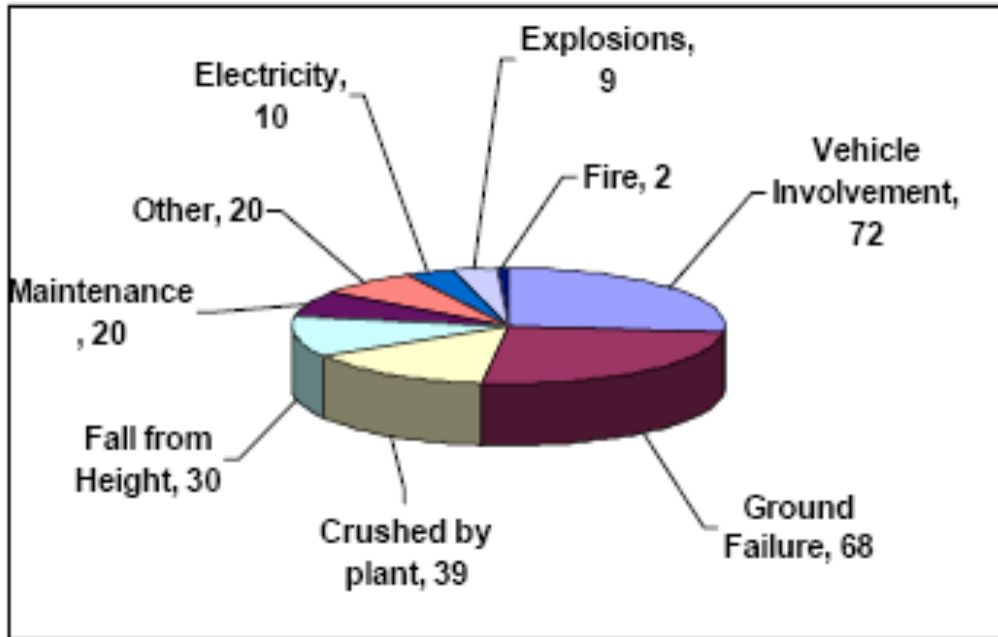
Introduction

To stand back and take a hard look at today's modern large mining equipment, it is relatively unchanged in the past 30+ years. Sure the size of mining equipment has increased with advances in tire technology, engines, control systems and drive systems but how else has the mining equipment changed? Haul trucks have 2 axles on today's 400 ton units as did the 170 ton trucks in the late 1970's. Graders are still tandem axle units. Dozers tend to have cabs with ROPS now. Many of the human factors design issues for mining equipment of 30+ years ago remains today.

Background

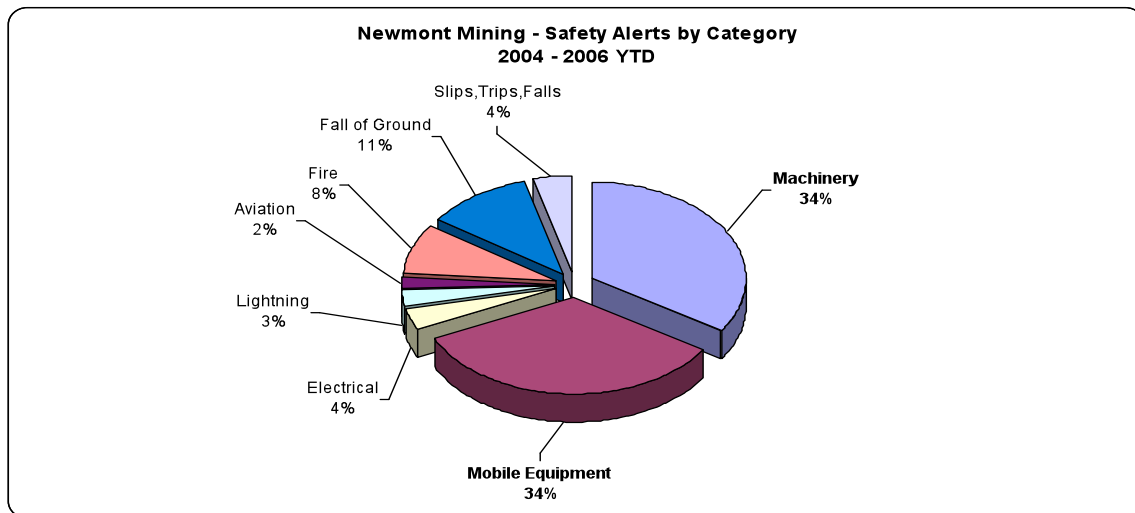
Fatalities in any industry are not acceptable with most fatalities in the mining industry involving equipment operation or maintenance. Figure 1 shows the profile of fatal incidents in the Australian minerals industry (source: *The MCA [Mining Council of Australia] Mobile Equipment Incident Causation Survey 2005-6*) with 27% of fatalities related to vehicle involvement.

Figure 1-Profile of Fatal incidents in the Australian minerals industry 1990 to 2004



Accident and incident data from Newmont Mining Corporation and other large mining companies shows similar trends to the findings in Australia noted above therefore changes need to be made on all fronts. Figure 2 shows Mobile Equipment accounts for 34% of Newmont's Significant Incidents for 2004 – 2006.

Figure 2-Newmont Mining Corporation Significant Incidents 2004—2006.



Most fatalities, accidents and incidents in the mining industry involve equipment operation or maintenance. Causal factors include behavior (human error), the work process and equipment design. The latter appears to contribute significantly to fatalities and lost time events.

Mining companies face a common problem ensuring that earth moving equipment is designed to be operated and maintained under all site conditions without causing harm to people. Mine accident data has clearly implicated poor human factors design issues in fatalities, injuries and illnesses associated with earth moving equipment incidents, such as collisions with light vehicles, isolation problems, falls from heights, loss of control and factors such as fatigue, noise and dust.

The trend in the mining industry demands that companies do more with less, for example using larger haul trucks resulting in fewer haul trucks to produce the same tons with fewer operators or to work 12-hour shifts to reduce time lost at shift change. As mining companies continue the push to produce more the impact on operator fatigue, illness and injuries increases. Over the years there have been a mix of industry and equipment manufacturer design improvements, trying to address operator health and injury complaints, but these changes come with decisions. These decisions may not be appropriately coordinated and may not achieve the intended results.

EMESRT.....the story so far

The suggestion of a joint customer approach to improve Human Factors design of Earth Moving Equipment (EME) was first mooted by some Australian mining companies in 2004. The idea gradually gathered momentum, and in March 2006, the first meeting to discuss a new multi-company initiative took place at Bulga in NSW, involving representatives from Xstrata Coal, BHP Billiton, Anglo Coal and MISHC. Rio Tinto officially joined the group in April 2006, with Phelps Dodge and Newmont joining in August 2006. Barrick, the newest member of the group, joined in late 2006 following meetings with the major manufacturers of earth moving equipment.

The Minerals Industry Safety and Health Centre (MISHC) was invited to facilitate and coordinate this innovative engagement process. Jim Joy, Professor of Risk Management at MISHC, and project leader of the Australian Coal Association Research Program (ACARP) funded research project "Improvement of Human Factors Engineering in Large Surface Mining Equipment Design" also brings considerable Human Factors (HF) expertise to the MISHC component of EMESRT.

The EMESRT initiative was consistent with the intent of this ACARP project, prompting agreement by ACARP to provide additional funding for MISHC to assist EMESRT with the critical development phase of the OEM engagement

process. ACARP also agreed to provide funding for the dissemination, via MIRMgate (mirmgate.com), of information about leading practice designs and issues that have prompted the development of EMESRT design philosophies.

The Earth Moving Equipment Safety Round Table (EMESRT) was formally established in the 3rd quarter of 2006.

Design gap

Despite the fact that earth moving equipment is generally designed to recognized international standards, human factors design aspects often fail to meet customer requirements for compliance with both company and regulatory standards, as well as controlling risks to 'As Low As Reasonably Practicable' (ALARP). This has created a gap or 'design vacuum' between OEM designs and customer needs, which allows inadequate opportunity for identifying and managing residual risks that may exist. Over time, dealers and entrepreneurial third parties have attempted to fill this vacuum by retrofitting customer driven solutions, which has created new issues. Redesign is not a core business area for most dealers, who generally lack appropriate design resources. The need for redesign also creates a long lead-time to users, resulting in higher costs to the customer.

Design Philosophies

EMESRT members agreed that their ability to align company requirements and expectations for human factors design would be critical for presenting a 'common voice' to OEMs. This need has led to the development of design philosophy sheets that present an aligned viewpoint on objectives, general design outcomes and risks to be mitigated. These sheets are supported pictorially by images that depict both the problem and leading practice example solutions developed by companies and third parties. The aim of a Design Philosophy is to provide information to help the OEM design equipment with risks reduced to an acceptable level. Design philosophy sheets for "Access & Egress" and "Working at Heights" were discussed with the OEMs in late 2006 and proved a useful tool for demonstrating the issues concerning EMESRT.

Fifteen topics have been identified as priority areas for 2007 and 2008. Development of the eight priority design philosophies for 2007 is being championed by focus leaders drawn from the EMESRT member group. Champions intend to utilize company and other resources to enhance the accuracy and validity of their selected topic. MISHC will assist with gathering input on design requirements, reviewing related ISO standards, and sourcing information about events or incidents related to the relevant design philosophy. EMESRT will also engage the OEMs in other areas such as the development of Operability and Maintainability Concept Risk Analysis methods. The following are the fifteen (15) design philosophies:

<u>Design Philosophy</u>	<u>Priority</u>
<i>Access & Egress</i>	<i>2006/2007</i>
<i>Working at Heights</i>	<i>2006/2007</i>
Noise	
<i>Vibration</i>	<i>2007</i>
<i>Fire</i>	<i>2007</i>
Dust	
<i>Isolation</i>	<i>2007</i>
<i>Visibility/ collision detection</i>	<i>2007</i>
Machine stability / slope indication	
Guarding	
Displays, controls, including labeling	
<i>Tires & Rims</i>	<i>2007</i>
<i>Manual materials handling</i>	<i>2007</i>
Work postures	
Confined space	

OEM meetings

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EMESRT has initiated an engagement process aimed at establishing an effective relationship between EMESRT and OEMs. The group has also agreed to work towards educating user mines about the design philosophy aims and to encourage use of the design philosophies in the purchasing process for new earth moving equipment.

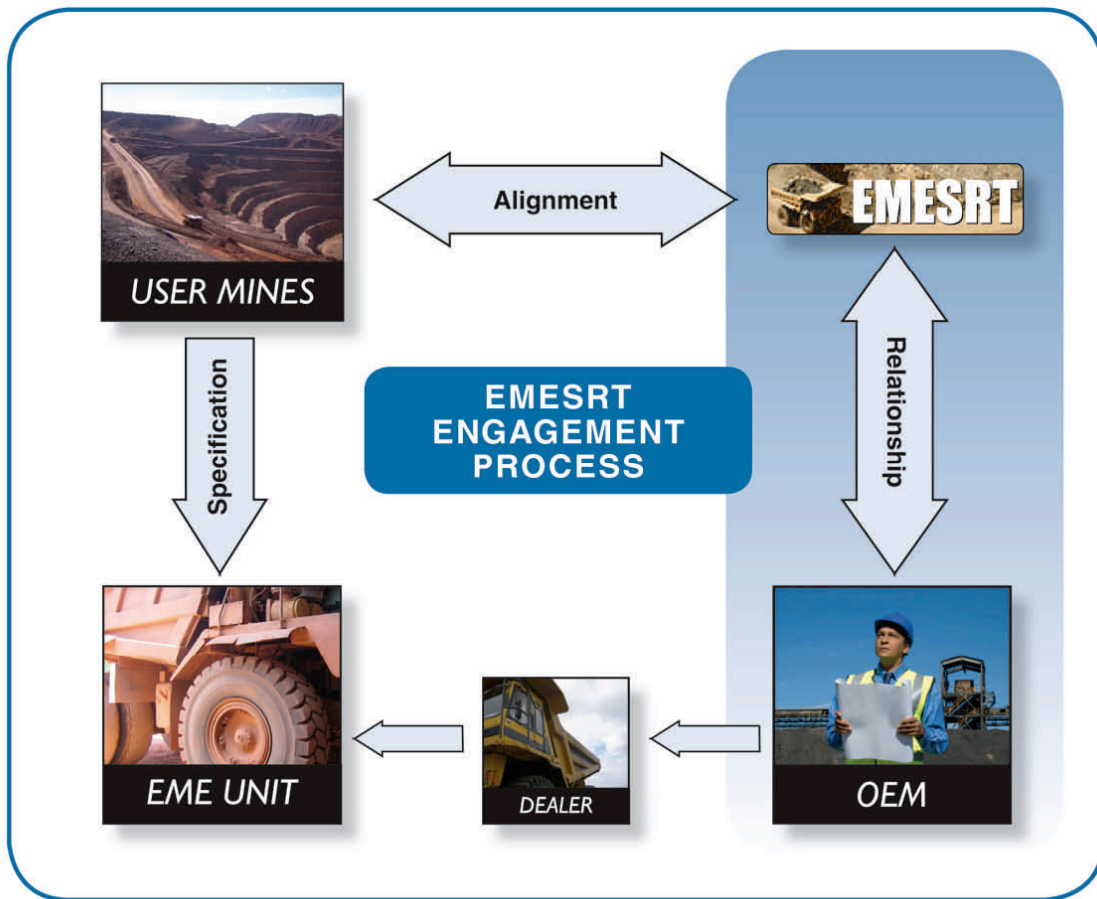
The project involves engaging with OEMs, initially haul truck OEMs, to speak with "one voice" about Health & Safety equipment design issues.

EMESRT member met with six OEMs at their North American offices (Terex, LeTourneau, Liebherr, Hitachi, Komatsu and Caterpillar) in late 2006 to initiate the engagement though establishing the issues, providing two major areas of need (access/egress and falls from height) and challenging the OEMs to define a

potential productive engagement process with EMESRT. The OEMs provided useful feedback and ideas for determining the future role of EMESRT and focused on improving the human factors design of earth moving equipment.

Engagement Process

EMESRT has initiated an engagement process (graphically depicted below) aimed at establishing an effective relationship between EMESRT and OEMs. The group has also agreed to work towards educating user mines about the design philosophy aims and to encourage use of the design philosophies in the purchasing process for new earth moving equipment.



Future of EMESRT

Membership of EMESRT currently extends to Anglo American, Barrick, BHP Billiton, Newmont, Phelps Dodge, Rio Tinto and Xstrata, with the potential for expansion in 2007.

Further engagement with the leading manufacturers of earth moving equipment is planned for 2007. The current focus of EMESRT is on improving the design of earth moving equipment operating on the surface at mines. It is likely that this could be extended to other areas once the engagement process has been fully developed and demonstrated success.

Resources

www.mishc.uq.edu.au

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