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## Australian Systems Safety Conference 2019

# Autonomy: Is It Really As Safe As We Think? *Practical Examples from the Real World*

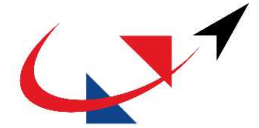
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## Survey says...



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*"There needs to be a focus on the available safety technology... Let's get the technology right before we're using human beings as guinea pigs."*

*- Jason Levine, Center for Auto Safety, 2018*

*The survey shows that the public will not accept [autonomous vehicle] technology unless it is shown to be... four to five times as safe as human-driven vehicles.*

*- Society for Risk Analysis, May 2018*

*"Self-driving cars are supposed to be our salvation, drastically reducing the 1.3 million road fatalities worldwide each year by replacing humans with robots who can do precision piloting and never get distracted, drowsy or drunk."*

*- Keith Naughton (Bloomberg), Mar 2018*

*"But experience from aviation shows that as new automated systems are introduced, there is often an increase in the rate of adverse events..."*

*"... comparisons between humans and automated vehicles have to be performed carefully. This is particularly true because human-controlled vehicles are likely to remain on the roads for many years and even decades to come. How will people and driverless cars mix together, and who will be at fault for any collisions between them?"*

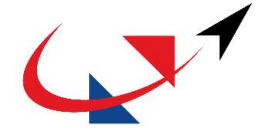
*- Peter Hancock, Uni. Central Florida, Feb 2018*

*"The driver in this case could have reacted and brought the vehicle to a stop 42.61 feet prior to the pedestrian... entirely avoidable."*

*- Tempe Police investigation after the Uber incident, 2018*

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## Questions, not answers...

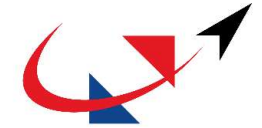


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- What is 'safe', for an autonomous system?
- How can we assure ourselves that it is safe?
- How do we deal with mixed autonomous and manned operations?
  
- Questions and Discussion

# What is 'safe', for an autonomous vehicle?



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84t @ 1.5kph



**'Safe' has to be relative**



40,000t @ 80kph



400t @ 320kph



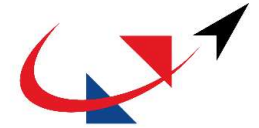
2t @ 110kph



450t @ 900kph (and 12,000m)

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# What is 'safe', for an autonomous vehicle?



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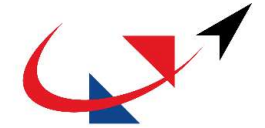
➤ Are we applying a different standard of safety for autonomous systems? Should we?

▼ 2018 Tempe Arizona Uber accident:

- ▲ About 100 people die every day on the roads in the US (~40,000 in 2018)
- ▲ This accident got more press than a limousine crash that killed 20
- ▲ This accident is being investigated by the NTSB
- ▲ Occurred during a trial approved by the Governor of Arizona

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# How can we assure ourselves that it is safe?

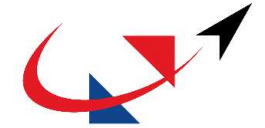


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- ✦ ISO 17757 / 61508 – obligations on both the operator and the supplier
- ✦ Aviation has mature standards developed over 40-50 years (autopilots have been around for a long time)
  - ▼ Apply to suppliers, operators, maintainers, controllers...
- ✦ Will the pace of technology mean that autonomous vehicle standards mature more quickly?
  - ▼ Standards almost always lag technology
- ✦ Challenge of machine learning
  - ▼ Can it actually be tested?
- ✦ Role of the licencing authority for public roads?
  - ▼ Learn from aviation – probably best example

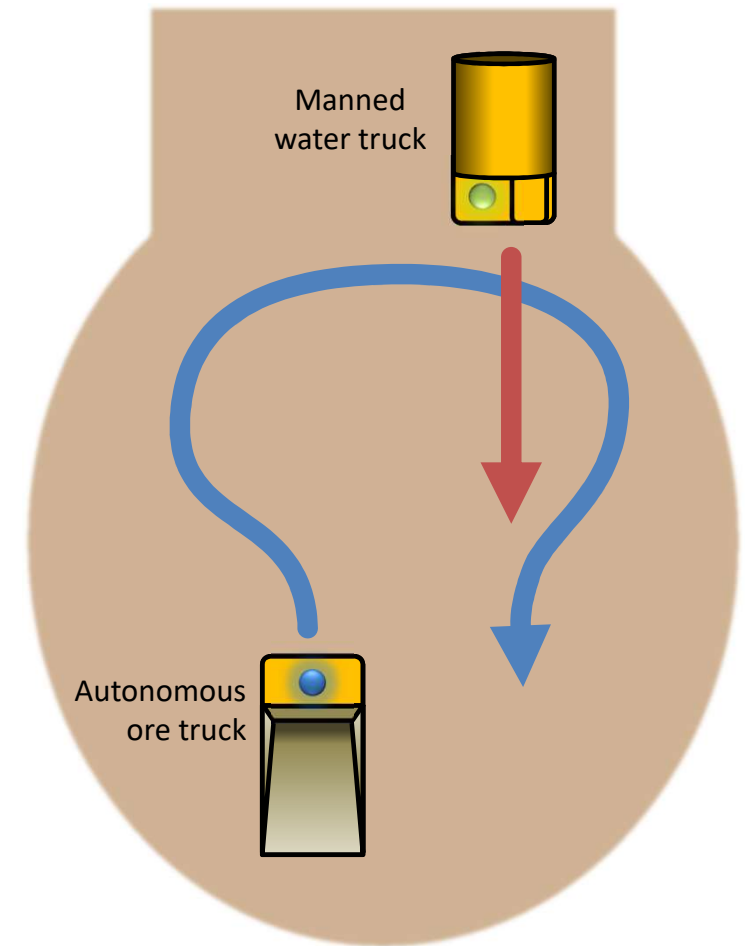
# How do we deal with mixed autonomous and manned operations?



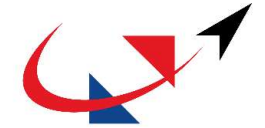
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## ✦ Autonomous Haulage accident

- ✦ Collision between an unmanned ore truck and a manned water truck on a mine site in the Pilbara (August 2014)
- ✦ Manned water truck was moving into an active loading area
- ✦ Autonomous ore truck was waiting to load
- ✦ Autonomous truck was programmed to make a 'U' turn to move into position for loading
- ✦ The intersection and loop existed in the control system, but there were no physical markings
- ✦ Manned truck had a screen to show autonomous truck movements and should have given way to the autonomous truck
- ✦ Manned truck moved into the path of the autonomous truck
- ✦ Accident occurred in a mine pit where everyone is specifically licenced and trained to operate in a autonomous operations zone
- ✦ Systems and road rules were in place to integrate manned and autonomous traffic, but the accident still occurred



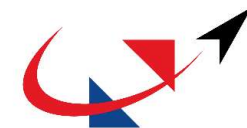
# How do we deal with mixed autonomous and manned operations?



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- Mixed autonomous and manual operation is inevitable – it's happening right now
  - ▼ A Tesla may have driven past while we've been speaking
  - ▼ There will always be some level of manually driven traffic on a mine site
  - ▼ Truck platooning is being developed
    - ▲ Trucks will travel in convoys by communicating with each other – but not with other road users
- Could full autonomy be restricted to computer controlled roads?
  - ▼ Flick the switch overnight and you are only allowed to use the freeway in autonomous mode
  - ▼ And only in autonomous mode – no manual until you exit
- Is it actually safer to have no steering wheel?
  - ▼ Force the designers to develop systems that have no requirement for human intervention
  - ▼ The only way to change from autonomous to manual might be at a full stop





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## Questions and Discussion

Thank you