



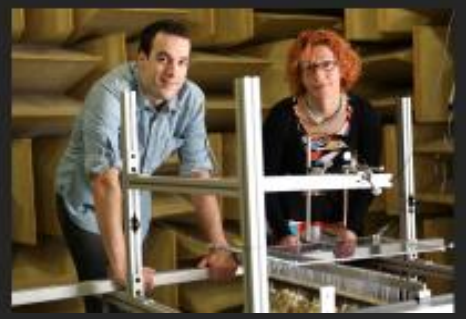

POLYTECHNIQUE MONTRÉAL

WORLD-CLASS ENGINEERING

Levels of Automation

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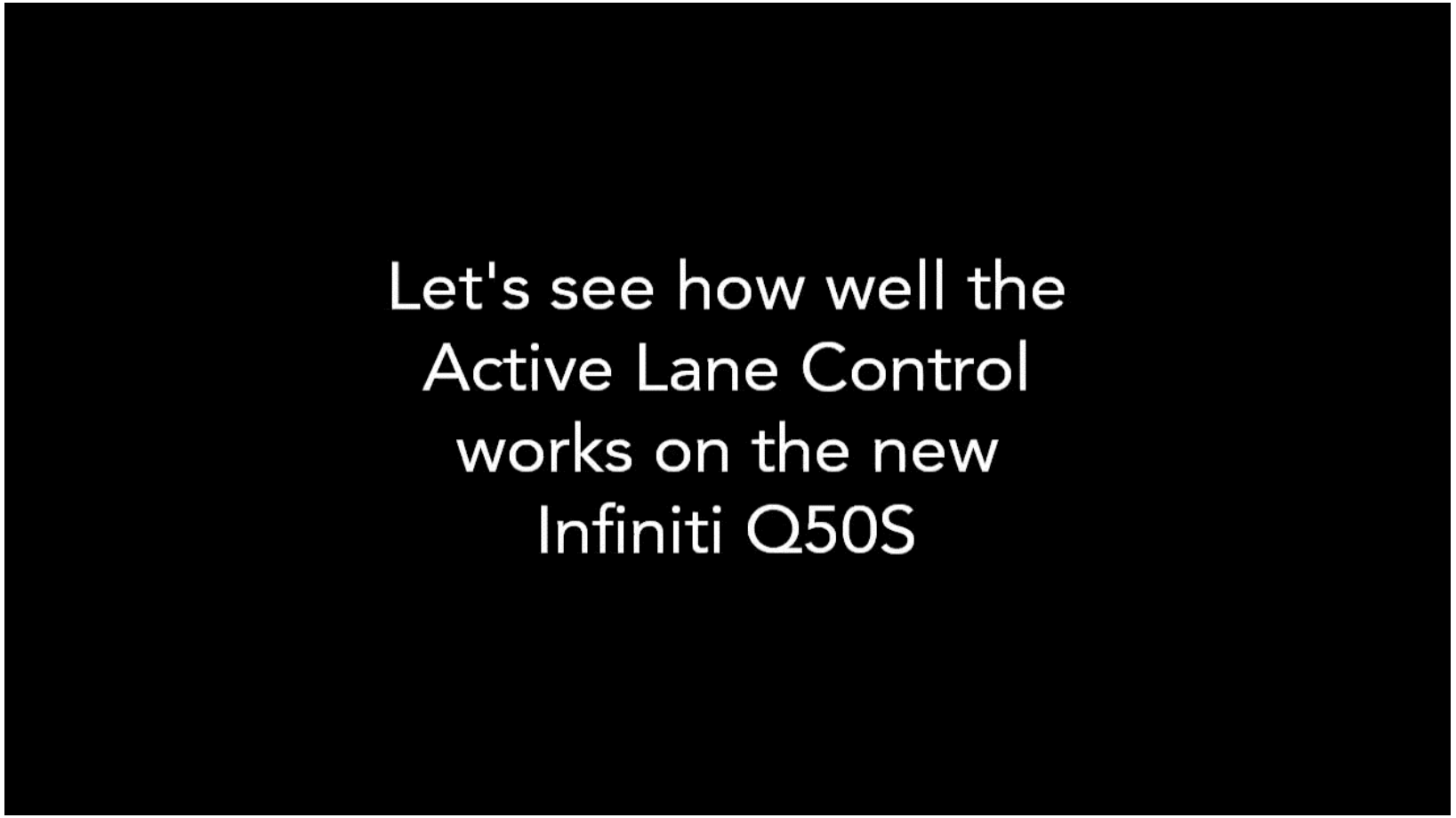
Science Fiction?



Science Fiction?

Volvo develops the 'no death' car: Vehicles which drive themselves and are totally crashproof could be on British roads in eight years

- **Vehicle will be fitted with sensors that can detect potential collisions and take action**
- **Firm claims 'nobody will be killed or injured in a new Volvo by 2020'**

By RAY MASSEY, TRANSPORT EDITOR

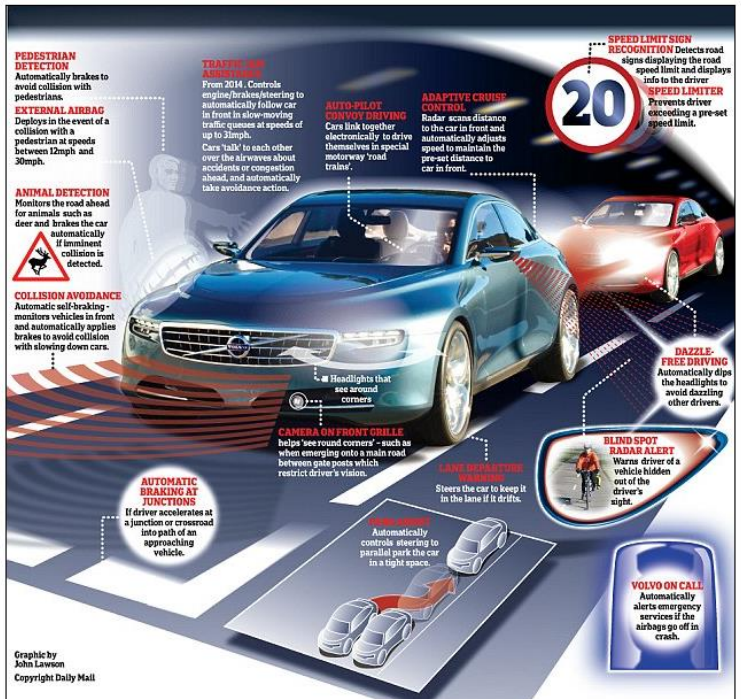
PUBLISHED: 17:59 GMT, 4 December 2012 | **UPDATED:** 07:45 GMT, 5 December 2012

Car giant Volvo is developing 'no death' cars that drive themselves and are impossible to crash – ready for launch in showrooms within eight years.

The computerised vehicles will be fitted with high-tech sensors and will 'refuse to be steered' into other objects.

Volvo says they will be on sale to customers by 2020, but that some of the life-saving technology will be incorporated into its vehicles even earlier – from 2014 – it says.

Scroll down for video



Science Fiction?

Connected Vehicles?

Levels of Automation

SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability *(Driving Modes)*
***Human driver* monitors the driving environment**						
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial Automation	Intelligent Cruise Control +Active Lane Control	**System**	Human driver	Human driver	Some driving modes
***Automated driving system* ("system") monitors the driving environment**						
3	Conditional Automation	Tesla	System	**System**	Human driver	Some driving modes
4	High Automation	the *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full Automation	Waymo?	System	System	System	**All driving modes**

Standard J3016

Some Challenges

- Weather / Winter
- Road construction
- Legal framework
- Insurance
- Interactions with other users

Some Impacts

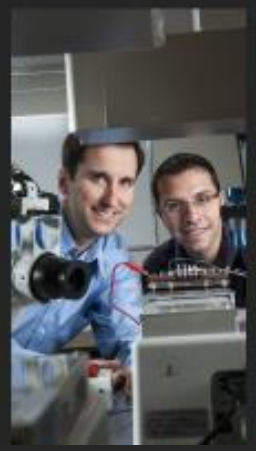
1. Safety
2. Road capacity
3. Increase of vehicle miles traveled
   - mobility for people who cannot drive
4. Urban planning: parking, urban sprawl
5. Car ownership: shared robo-taxis, aka Uber 2.0?
6. Jobs, jobs, jobs

Conclusion

- Remember the current alternative...
  - every year: 1.2 million dead, 50 million injured
  - history will judge us harshly if we slow down the adoption of life-saving technology for the wrong reasons

- The adoption and use of disruptive technologies are difficult (impossible?) to predict



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THANK YOU !