

Casualty Actuarial Society

Automated Vehicle Task Force (CAS AVTF)

March 11, 2014





Example of misuse

Let's see how well the
Active Lane Control
works on the new
Infiniti Q50S



CAS AVTF: Overview

Goal

The CAS AVTF is researching the technology's risks to provide policymakers with the information needed to ensure **the product is brought to market as safely and efficiently as possible.**

Focus		
Pre market	Post market	Post claim
identify & quantify risks	accurately price the technology	compensate claimants fairly & efficiently





Agenda

- **Automated Vehicles – Background**
- **Automated Vehicle Risk Profile**
- **Vehicle Symbol Analysis**
- **Regulatory Overview**



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Many technologies will need to work together for AVs

V2V/V2I

- Vehicle to Vehicle or Vehicle to Infrastructure
- Dedicated Short Range Communications (DSRC), similar to wifi
- Vehicle to communication to other vehicles or infrastructure (traffic signals, toll booths, etc)

LiDAR

- **Light Detection And Ranging**
- combination of light and radar, and uses laser light to create 3D images of the surrounding environment.
- Remote sensing technology to measure distances

Inertial Navigation Systems & GPS

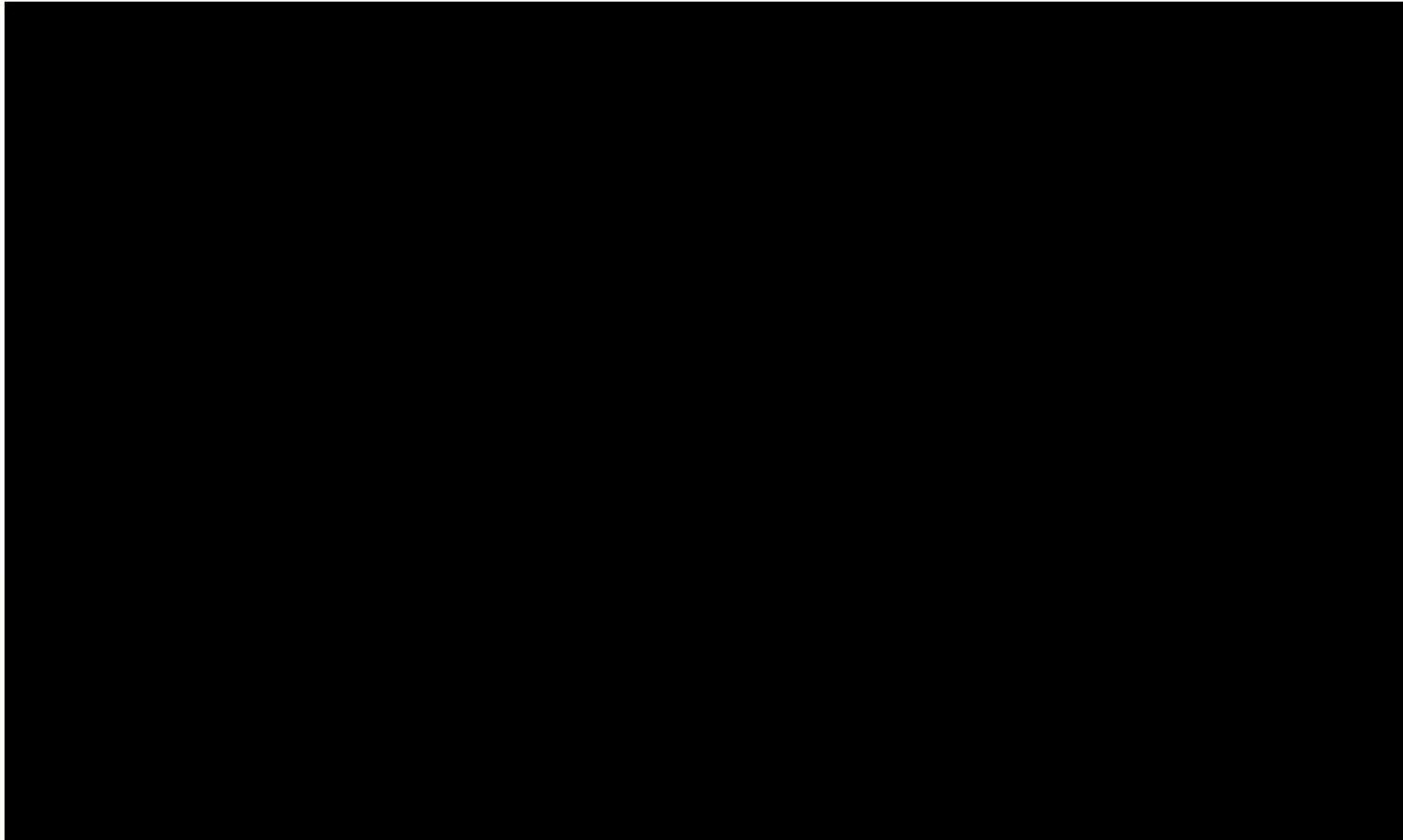
- INS uses computers, accelerometers (motion), and gyroscopes (rotation)
- Calculates position, orientation, and velocity





Cameras and Deep Learning may be another technology

NVIDIA @ CES 2015



Historic Developments

2005 –
2010

- 05: Stanford wins DARPA Grand Challenge
- 07: CMU wins DARPA Urban Challenge
- 09: Google begins testing on public roads
- 09: EU launches Project SARTRE
- 10: Volvo City Safe standard

2011

- Google surpasses 150K miles
- BMW begins testing self driving car on public roads
- NV passes autonomous car law

2012

- Google @ 300K accident free miles
- Nissan opens research facility in Silicon Valley
- Google & Continental receive autonomous car licenses
- FL & CA pass autonomous car laws

2013

- Google @ 500K miles
- Oxford creates a \$7,750 self-driving system
- Public road testing
 - Britain
 - Mercedes
 - CMU
- Audi receives AV car license
- NHTSA issues policy on AVs
- DC passes AV car law

2014

- MI passes AV law
- NHTSA passes V2V
- Google @ 700k miles
- Google developing driverless car without steering wheel or brakes

2015 has already had many new investments in AVs

Audi and Nvidia

January 2015

- Audi will partner with Nvidia to use Tegra X1 chips to compute and process the data from sensors and cameras

Uber and Carnegie Mellon

February 2015

- Strategic partnership including Uber Advanced Technologies Center
- center will focus on the development of key long-term technologies

Apple

February 2015

- Apple reportedly working on its own AV
- Apple reportedly poaching Tesla and A123 engineers

Sony and ZMP

February 2015

- ZMP, Japanese company makes 'robot cars'
- Sony's image sensors and ZMP's robotics to make AV



Every year brings new research opportunities

University of Michigan

Spring 2015

- 32 acre testing facility for V2V, V2I, and AV.
- Support 2,800 connected vehicles in Ann Arbor in pilot and 9,000 within 3 years

Volvo: Gothenburg

2017

- 100 self driving cars on the road by 2017
- Array of sensors for AV on highways
- No AV in inclement weather

A9 Autobahn: Bavaria

2016 or later

- V2V and V2I for AV, similar to Michigan facility
- A9 Connects Munich to Berlin

Singapore

March 2015

- 6km test route in real traffic
- Approved vehicles get one year license for testing
- Located in One North Business Park



London's AV testing regulations may increase investment

No special licenses or permits requires

No geographical limits

No additional insurance requirements

Goal

- Light-touch non-regulatory approach
- provides clarity for industry to invest in further in research



London had 3 trials underway

UK Autodrive Programme: 3 years to pave way for introduction of AVs

Dept. of Transportation put ~\$29M USD for trials

Explore both legal and technical changes required for Autonomous Vehicles

Milton Keynes and Coventry

- Lutz Pods that drive in pedestrian zones
- Max speed 15 mph
- Electronic AV



Greenwich

- GATEway shuttles
- Electronic AV
- Local tour with drop off points: input destination on CPU



Bristol

- Venturer consortium will investigate congestion and safety
- BAE Wildcat



Future development may create two models for AVs

All driving, limited location



- End to end service
- Only operates in specified area
- “Taxi” service
- Google, Uber

Some driving, all locations



- Takes over some of the driving
- E.g. Supercruise, parallel parking
- Only operates in specified area
- Driver owns and operates
- Mercedes, BMW, Volvo, Cadillac, Tesla

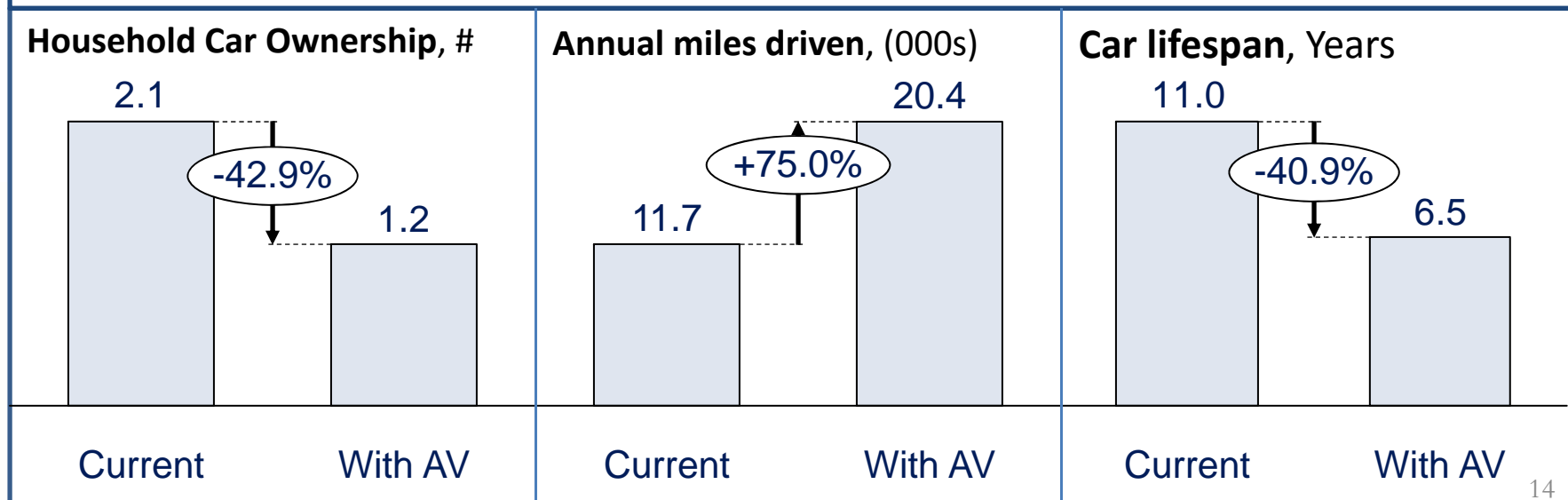
AV ownership may change household car ownership patterns

University of Michigan: 2009 National Household Travel Survey from U.S. DOT

- 84% of U.S. household trips today do not overlap with other trips
 - Only 16% of households require 2+ cars

Does not contemplate

- Additional miles from 'return to home' feature
- Additional miles if 'non-drivers' can operate vehicle for transportation
- Many commuters do not want to share vehicle



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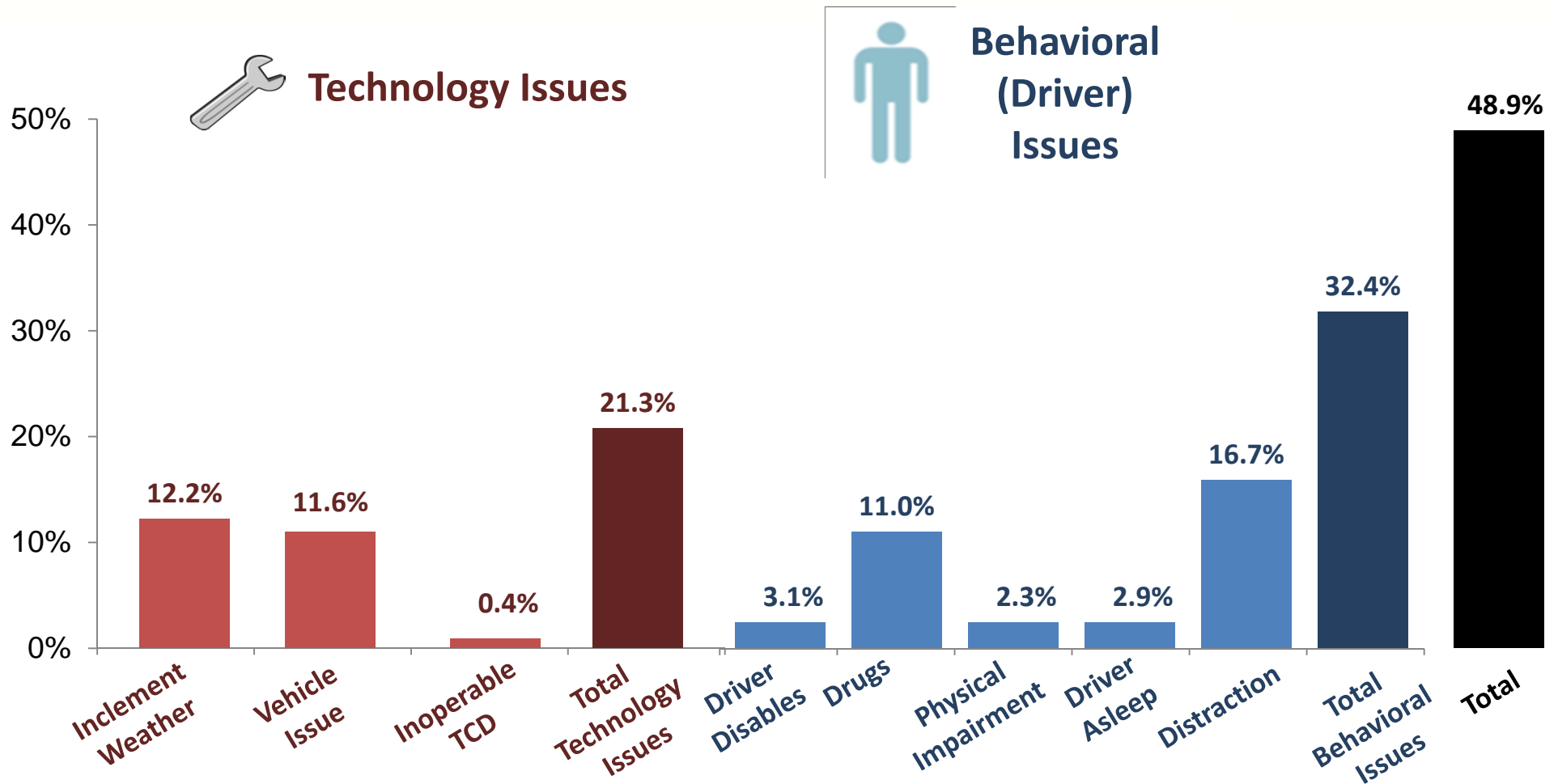




“93% of accidents are caused by human error.”



NMVCCS – Limiting Factors



NMVCCS – Implications of the CAS Study

New benchmark should be calculated

- Data is old and unrepresentative
- Human driving risks <> automated vehicle risks

Appropriate test for each risk

- Computer simulations for technology's error rate
- Simulations provide little insight into driver's actual use of technology.

Policy changes can increase AV's safety

- 1% reduction in accidents is ~55k fewer accidents and \$1.4 billion of economic value per year
- Policy cost benefit analysis
- E.g. driver training program, automated vehicle only lanes, allowing the Avs to speed



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Vehicle symbol analysis approach

Vehicle experience groups

- Each group's experience is weighted and combined with similar vehicles

Complements to credibility

- Vehicle's body style factor
- Prior year factor

Automated vehicle symbol: option 1

- Assume a brand new vehicle
 - e.g. Mercedes introduces a new fully automated vehicle
 - No initial prior year factor, growth trend impacts credibility

Automated vehicle symbol: option 2

- Assume update to a current vehicle
 - e.g. all new Honda Civics sold with AV equipment



Vehicle Symbol Calculation

**Automated
vehicle symbol:
option 1**

- Assume a brand new vehicle
 - e.g. Mercedes introduces a new fully automated vehicle
 - No initial prior year factor, growth trend impacts credibility

Vehicle Symbol Discount						
Number of Exposures	Year	Loss Attenuation				
		0%	25%	50%	75%	100%
2,500	1	0.0%	0.5%	0.9%	1.3%	1.8%
5,000	2	0.0%	1.4%	2.6%	3.9%	5.1%
7,500	3	0.0%	2.8%	5.1%	7.4%	9.7%
10,000	4	0.0%	4.4%	8.0%	11.6%	15.2%



Vehicle Symbol Calculation

**Automated
vehicle symbol:
option 2**

- Assume update to a current vehicle
 - e.g. all new Honda Civics sold with AV equipment

Vehicle Symbol Discount					
	Loss Attenuation				
Year	0%	25%	50%	75%	100%
1	0.0%	4.3%	7.4%	10.5%	13.6%
2	0.0%	7.1%	13.7%	20.0%	26.3%
3	0.0%	9.7%	18.2%	25.7%	35.4%
4	0.0%	11.1%	21.0%	31.0%	41.2%

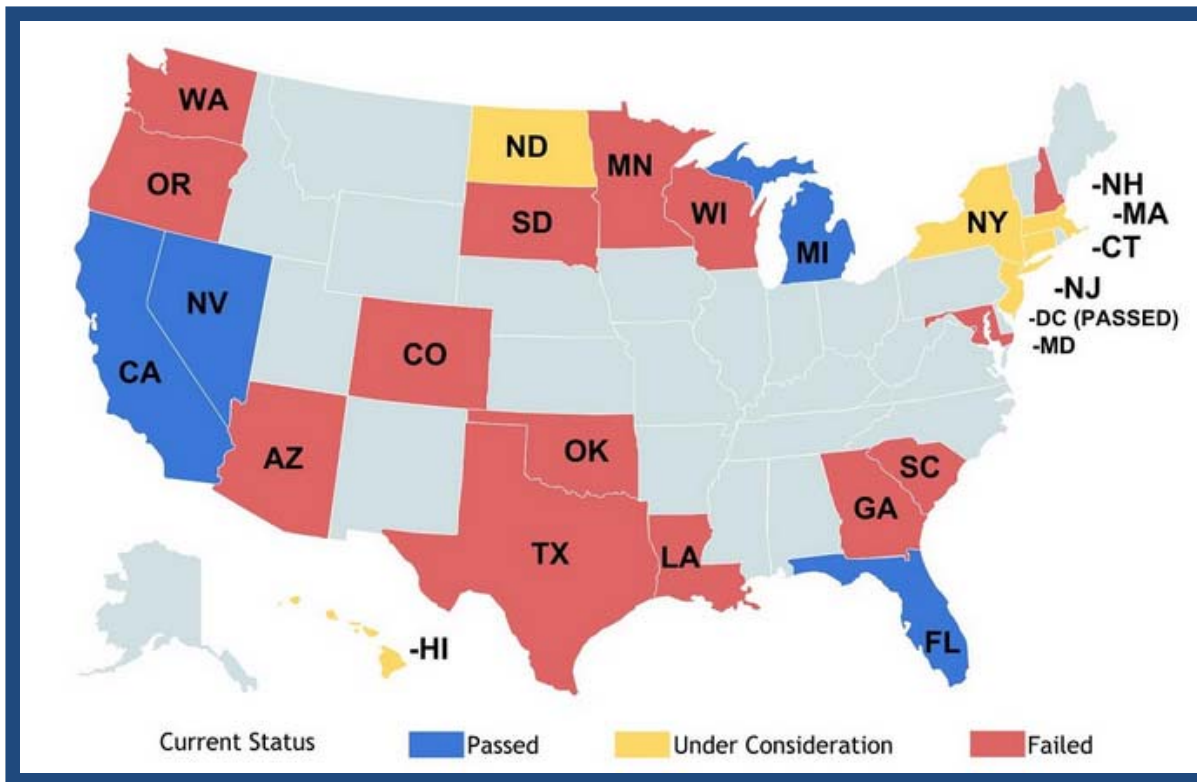


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Current U.S. regulatory approach varies by state



Comments

- CA, DC, FL, MI, NV have regulations that permit operation/testing of AVs
- May 2013 NHTSA publication
- Statement with guidance to states on AV regulations
- Statement outlined NHTSA plans for testing AV technology



Auto Manufacturer Regulations: Consumer Protection

NHTSA

- establishes regulations that manufacturers must self-certify with

States

- State regulators can impose additional requirements

Individuals

- Individuals can sue manufacturers if an error occurs

Question?

- What happens if automobile accident risk shifts entirely to manufacturers?



Regulatory approach needs to be updated

Insufficient protection for consumers and manufacturers

- Dawson vs. Chrysler
- Illusory Park

NHTSA does not have the scale: annual budget



Claims handling incentives

- Compensating claimants fairly and efficiently is a core competence of the insurance industry
- Auto industry's competence is not insurance



CAS AVTF: Next Steps

Studies		
Pre market	Post market	Post claim
Identify and quantify risks to improve the technology's safety and speed to market	Ensure the product is priced accurately	Ensure claimants are compensated fairly and efficiently



Questions and Discussion

