Title Slide
Thank you, Gary/Ron, for the kind introduction. And thank you to all of you for coming here tonight to hear some of my thoughts about engineering and the future.
[CLICK]

Slide 2
Since Disney already has coined the word “imagineering” and I don’t want to spend my time in court arguing over trademarks, I came up with a similar word. But instead of making theme parks where you can have fun, all of us are focused on
[CLICK]
“Making Possibilities Real.” Doing that can take a long time--sometimes years. For the people here, many of YOU are already at the leading and bleeding edges of technology. You hold the future in your hands and heads every day.
[CLICK]

Slide 3
YOU have the
[CLICK]
POWER to INFLUENCE
[CLICK]
LIFE, SOCIETY and the ENVIRONMENT in the
[CLICK]
TIME YET TO COME
[CLICK]
with SOMETHING NEW.

[CLICK]

Slide 4
Let me help celebrate some successes in envisioneering. For over 125 years now, Breitling has been making quality equipment. For thousands of years, man has envisioned being able to fly. Now, we can!!! Sit back and relax for 5 minutes while we vicariously experience personal flight.
(5:32)
[CLICK]

Slide 5
For over 50 years now, I have been enthralled with the space program. This year I met someone that was involved in creating the inertial navigation systems used in the space program while he was at Honeywell in the 50‘s and 60’s (Len Van Regenmorter). He went on to work at Control Data and then on supercomputers while head of engineering at Floating Point Systems in the 80’s and early 90’s. Over 8 years ago, NASA envisioned another trip to Mars for exploration.
[CLICK]
Envision a vehicle weighing 899 kg, almost 2,000 pounds and bigger than a small car (approximately 9 ft square and 7 feet tall [9.5x8.9x7.2]) It is more than 3 times the size, and 4 times the weight of the previous rover and carries 10 times the scientific gear. [CLICK]
It had to fit into a “transport vehicle” which looks very different than a typical tractor-trailer rig.

[CLICK]
On Sunday, August fifth, just 4 months ago, NASA successfully landed the rover Curiosity on the surface of Mars with another satellite taking a picture of its descent.
[CLICK]
It safely landed and took this early picture. Curiosity is able to roll over obstacles approaching 30 inches in height. It is able to sprint at 300 feet per hour using automatic navigation and algorithms based on variables including power levels, terrain difficulty, slippage, and visibility. It will go just 12 miles in its two-year mission. And how do you power such a vehicle? Not with diesel fuel or gasoline, but with nuclear power. Curiosity is powered by a radioisotope thermoelectric generator (RTG), like the successful Viking Mars landers in 1976. That means we have been using nuclear energy to power vehicles for over 35 years.
[CLICK]
It was actually the submarine USS Nautilus that was the first nuclear powered vehicle--it went to sea 20 years earlier than that, in 1955!
[CLICK]

Slide 6
On May 31, the first commercial venture successfully launched a rocket and docked in space with the International Space Station. That's 55 years after the first government launched a satellite into orbit, the USSR launching Sputnik. Let's watch.
(2:27)

[CLICK]

Slide 7
Now, let's come back down to earth. Sony is well known for its robotics work.
[CLICK]
Yet, the earliest reference I can find is only 13 years ago with the first generation, 4 legged friend called AIBO.
[CLICK]
More recently, we can all get a robot for as little as $350. It may not do much, but people are spending money on these things. I have a friend that purchased a beauty salon and uses a pet-hair capable version to clean the floor each night.

I am originally from Michigan, and accustomed to preparing the house for winter. Right now people in the midwest will have to clean out the leaves from their gutters before the heavy snows come. In fact, this week my gutters plugged up and I had to reach in with gloves to remove the wet leaves and slime.
[CLICK]
I noticed this hyperlink in the ad.
[CLICK]
Anyone want to automate this nasty task?

[CLICK]

Slide 8
The Defense Advanced Research Projects Agency, DARPA, is often at the leading edge of technology. Here's their latest attempt at humanoid robots.
(2:04)
[CLICK]

Slide 9
But, did you know that 18 years ago, John Deere was moving in the same direction with this vehicle? It had sensors in the legs that react automatically to soft, sloping or uneven terrain and a computer control system that distributed weight evenly to all six legs. Only two were made. One is on display at the John Deer Pavilion in Moline. I can easily envision that agricultural vehicles will be more autonomous soon--and before on-highway vehicles.
[CLICK]

Slide 10
In fact, they are already in advanced testing as shown in this video from a conference just last year.
(1:59)

[CLICK]

Slide 11
And trucks will be the next opportunity.
[CLICK]
Tractors today have typically just 1 trailer. More and more often
[CLICK]
they have 2 and 3 trailers with the trucking industry pressing for changes in laws to allow these longer combination vehicles in more places.
[CLICK]
There are multiple, legal configurations.
[CLICK]
Michigan is somewhat unique with its B-Double trains.
[CLICK]
In Australia, road trains exist with tens of trailers being pulled at a time.
[CLICK]
The record is 112 trailers with a single tractor. But all of these combinations have a physical, mechanical connection between the units. Can you envision an electronic, wireless connection?
[CLICK]

Slide 12
Let’s take a look at where we are with that approach to platooning. (4:02)

[CLICK]

Slide 13
I will bet, a few of you are thinking that platooning is nothing compared to the autonomous vehicles that Google and others are working on. But, the real world is a bit more conservative. Volvo will be taking a small step and giving us “hands free” capability below 30 miles per hour in a couple of years.
[CLICK]

Slide 14
One of the enabling technologies for autonomous vehicles is a map of its environment. GPS started 23 years ago. Thanks to military GPS being made available to us about 12 years ago, we have tremendous capabilities now. Google’s street view has been in the news in the last year as we deal with privacy issues. I ran across this visionary’s comments in 1983 about an MIT activity 4 years earlier.
[CLICK]
So, from an idea for street view to it being a “necessity” it was over 30 years.

[CLICK]

Slide 15
Everyone here should be familiar with the “S” curve. Several times now, I have talked about it taking 20-50 years or more to go from concept to growth.
[CLICK]
I’ve been talking about this long part here at the beginning of the curve. Does it really take that long?
[CLICK]

Slide 16
We think of cell phones as an overnight success in the last 5 years. Yet, the concept was originated at least as early as the 1940’s. AT&T offered a Mobile Telephone Service in St. Louis in 1946.
[CLICK]
The first cell phone call is credited to Motorola in 1973.
[CLICK]
By 2000, the growth phase was finally in process.
[CLICK]
And SmartPhones are the next “S” that so very many people are building apps for and looking to make millions of dollars.
[CLICK]

Slide 17
The internet growth phase was, perhaps, a bit faster. This chart suggests it was as little as 10 years. But, in reality, the TCP/IP protocol was standardized in 1982. So, it really was closer to 20 years for the internet to reach the growth phase.

[CLICK]

Slide 18
FaceBook is one of the fastest growth stories out there. From a concept in 2004 to a growth stage just 4-5 years later. The original investors made millions of dollars. I am not as confident of its future.
[CLICK]

Slide 19
One more example, Groupon. From concept in 2007 to growth phase in just 3-4 years. But, it has competition and financial problems.
[CLICK]

Slide 20
So, what drives this growth in companies offering products and services? I say it is people. It took millions of years to reach the first billion people. Only 100 years to add the second billion and just 40 years to add the third billion. In my lifetime, we have doubled the population from 3 billion to 7 billion today.
[CLICK]

Slide 21
This is a chart of Abraham Maslow's hypothesis of the Hierarchy of Needs. It starts from a base of basic, physiological needs of food, water, movement and reproduction--the basic definition of life. It moves up the pyramid to safety and security. Then it moves into loving and belonging where the social media of twitter, facebook and others are focused. I'll leave it to artists and politicians to comment on esteem and self-actualization

[CLICK]

Slide 22
Thanks to people and their needs, we have created tremendous technological wonders.
Expound extemporaneously.
[CLICK]

Slide 23

Now, let me spend a few minutes talking about 3 trends where development is going to be needed.

[CLICK]

The first is reliability. I may accept my iPhone slowing down when I have 30-40 applications running in the background. I might accept having an application "crash" and take me back to the home screen on an iPhone. I can accept a few dropouts of Pandora music. But, the computers for transportation are not just entertainment devices. People's lives are at stake for what is controlled. Software design and testing must be improved. Communications among computers must be assured in acceptably small time frames that are imperceptible to the human behind the wheel. How many of us spend minutes or hours each week keeping our computers and entertainment electronics at home working and updated? How many downloads of new software do we do each week? And is it all compatible? I solved one problem with WiFi coverage at home by adding a powerline wireless extender. But, I cannot get the TV in our bedroom with cable to be controlled by a single remote! The cable adapter is an older IR system and the TV is different. My wife, to her dismay, is stuck with one control to set the sleep timer on the TV and the other for everything else. If I would just get rid of that old cathode ray tube TV, I might solve the problem--Honey may I?

[CLICK]

The next trend is fuel economy. Passenger cars have a Corporate Average Fuel Economy goal of 37.8 miles per gallon by 2016 and 56 miles per gallon by 2025. Commercial vehicles now have a Corporate Average Fuel Economy goal for 2017 as well. (as little as 6.5 gallons per 1,000 ton miles while keeping grams CO2 per ton-mile below 66) Accomplishing this reduction in our dependence on oil is going to take development at the level of understanding the plasma in the fuel cylinders during combustion to the chemistry needed for the aftertreatment system, to the typical cycles of use in everything from city operations to long haul, to off-road. Even off-highway equipment needs to be clean and fuel efficient. Low power in running electronics and appliances is another example of reducing the use of energy.

[CLICK]

The third trend is safety. Governments around the world are focused on saving lives and reducing accidents. For both commercial vehicles and light duty vehicles, they continue to press for advanced safety systems. Currently it is braking for stability control and collision mitigation using radar. There will be more with lighting, wireless roadside inspection, hours of service, and sleep apnea.

That is three trends--making things reliable from the customer's point of view, saving fuel and reducing CO2 emissions, and preventing accidents that harm individuals, damage property and slow down traffic or harvesting.

[CLICK]

Slide 24
An important part of safety is making things easy to understand and use. We still have challenges in this area. The very newest and best in the automotive environment is the Cadillac User Experience. Let me CUE up this video and let you decide how easy and safe this vehicle will be.
[CLICK] (2:34)
[CLICK]

Slide 25
I like to say the future is driven both more and less. More of things like convenience, reliability and safety. And less of other things like weight, cost and emissions.
[CLICK]

Slide 26
I also recognize that governments around the world are driving technology for the future as we look to solve the problems of society that are driven by the increasing population around the world.
[CLICK]

Slide 27
I am a firm believer that the future commercial vehicles, both on-highway and off-highway are here and in the news. They are prototypes today or just concepts. Most have been thought of by someone at some time. The Army is working on magnetized highways. UPS has plastic bodied walk-in vans and solar powered road panels are in the concept stage.

[CLICK]

Slide 28
We can make driving so easy that we can sit in the back seat with our friend and either get work done or be entertained while the vehicle gets us to our destination by itself.
[CLICK]

Slide 29
But it may be hard to do it all over the world.
[CLICK]

Slide 30
The advance materials for the talk tonight promised 5 things. In summary, here are the take aways from tonight's talk.
Concept to production takes too long, and much longer than expected. Necessity is the mother of invention. It is people and their needs that drive innovation. Making things reliable, safe and easy to use will continue to be a challenge for product development--not to mention cost. Innovation is also driven by more of some things and less of other things as people and governments strive to make a better world. And finally, vehicles on wheels will continue to dominate the movement of goods from factories to consumers.

Thanks ever so much for listening.