



ME290

**Global Engineering Professional
Seminar**

Knowledge of Contemporary Issues



Contemporary Issues

ABET* requirement: General Criterion 3. Student Outcomes

The program must have documented student outcomes that prepare graduates to attain the program educational objectives:

- 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

*ABET (Accreditation Board for Engineering and Technology, Inc.) is an organization that accredits post-secondary education programs.

Technologies will shape the future



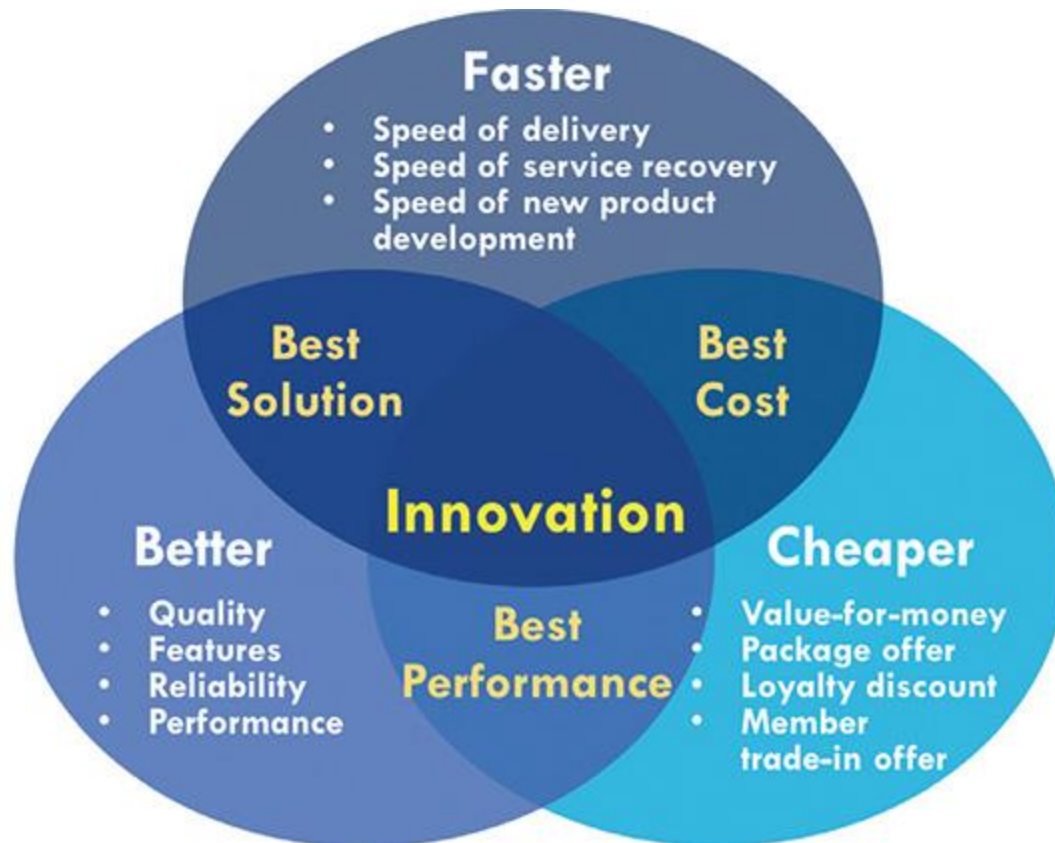
"The best way to predict the future is to invent it." Alan Kay



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Need for Change: Better – Faster – Cheaper Products and Services



6 Key Drivers for “Change”

Political

Economic

Social

Technological

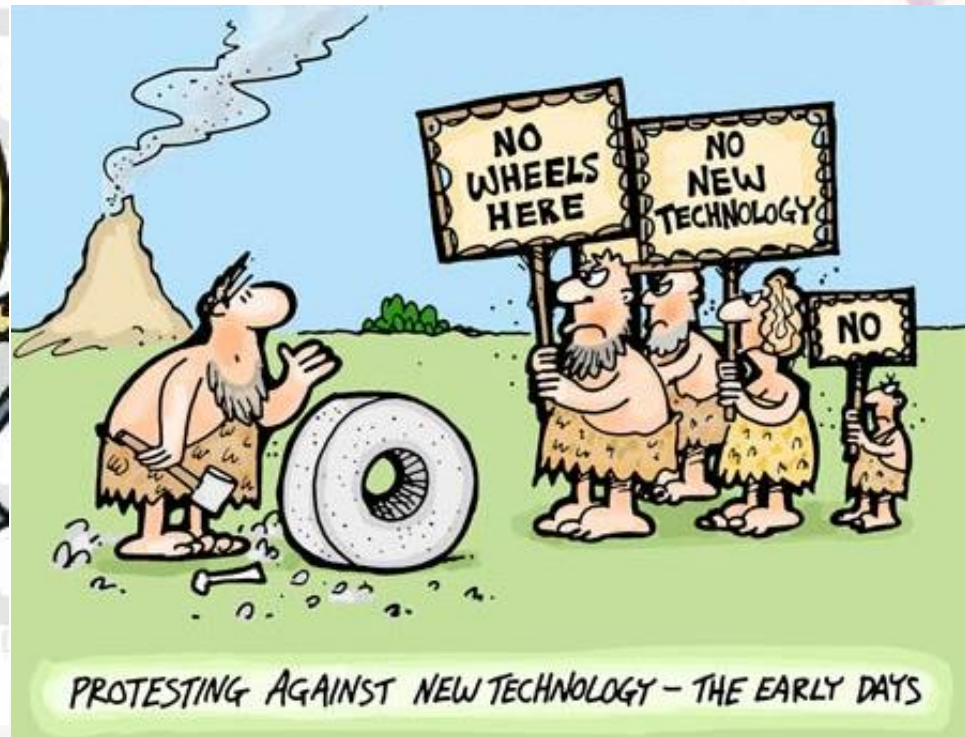
Environmental

Legal

Technological factor



Social factor



Key Drivers for “Change”

- ***Political Factors:*** For example, Government policies, taxation changes, foreign trade regulations, political risk in foreign markets, changes in trade blocks (EU).
- ***Economic Factors:*** For example, business cycles, interest rates, personal disposable income, exchange rates, unemployment rates, GDP trends.
- ***Socio-cultural Factors:*** For example, population changes, income distribution, lifestyle changes, consumerism, changes in culture and fashion

Key Drivers for “Change”

- *Technological Factors:* For example, new discoveries and technology developments, ICT innovations, rates of obsolescence, increased spending on R&D.
- *Environmental (‘Green’) Factors:* For example, environmental protection regulations, energy consumption, global warming, waste disposal and re-cycling.
- *Legal Factors:* For example, competition laws, health and safety laws, employment laws, licensing laws, IPR laws.

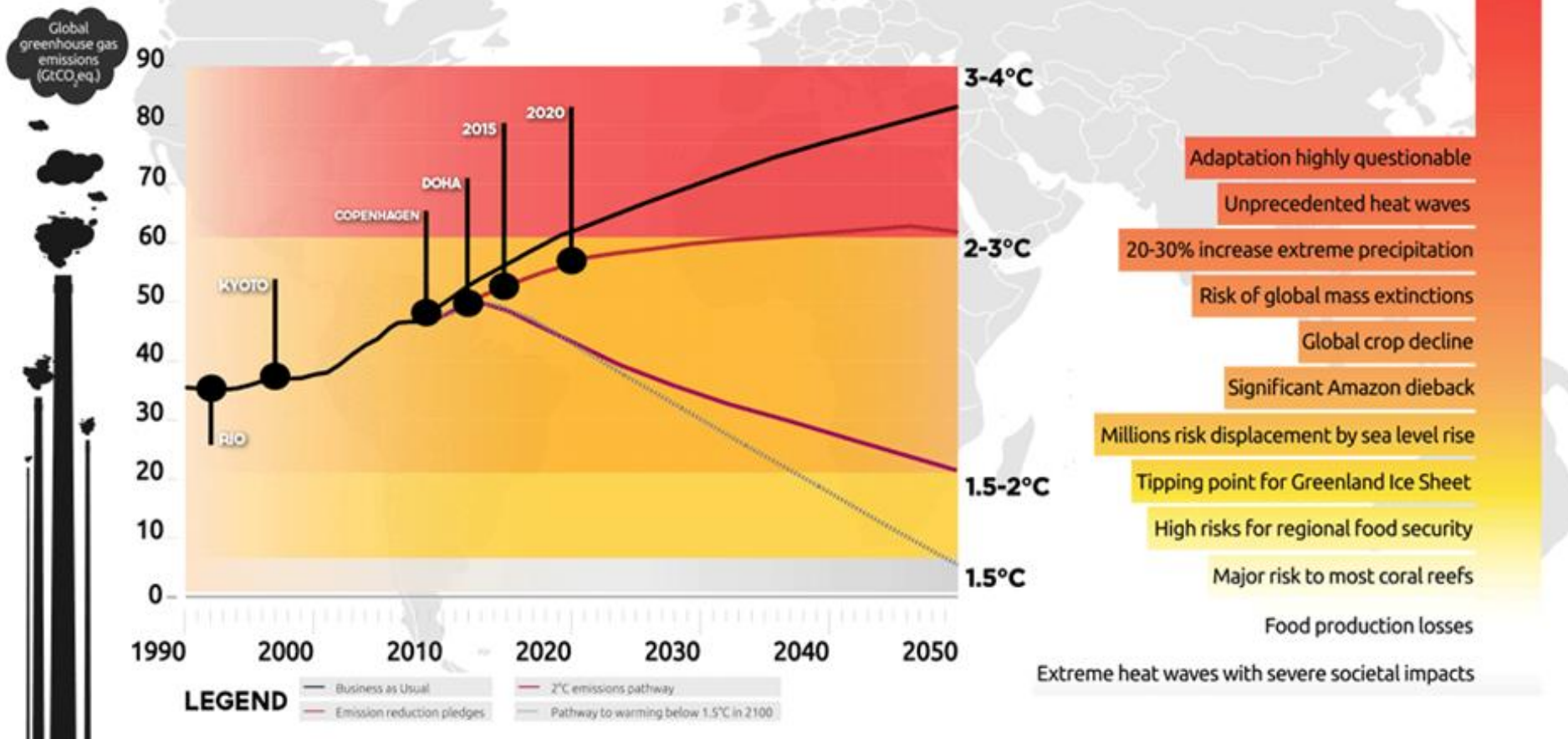


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Key Driver: Environment

With current pledges on the table to cut emissions, we are heading to a 3.3° C warming future. No further action before 2020 will limit society's choices. As temperatures rise, so do the impacts.



Key Driver: Environment

M Science ▶ Earth Day

Crusading social scientist says we've gone 'past the point of no return' when it comes to climate change

Mayer Hillman has delivered the harsh truth about humanity's efforts to fight climate change



By [Jeff Parsons](#) Tech/Science Reporter
14:08, 26 APR 2018 | **UPDATED** 14:10, 26 APR 2018

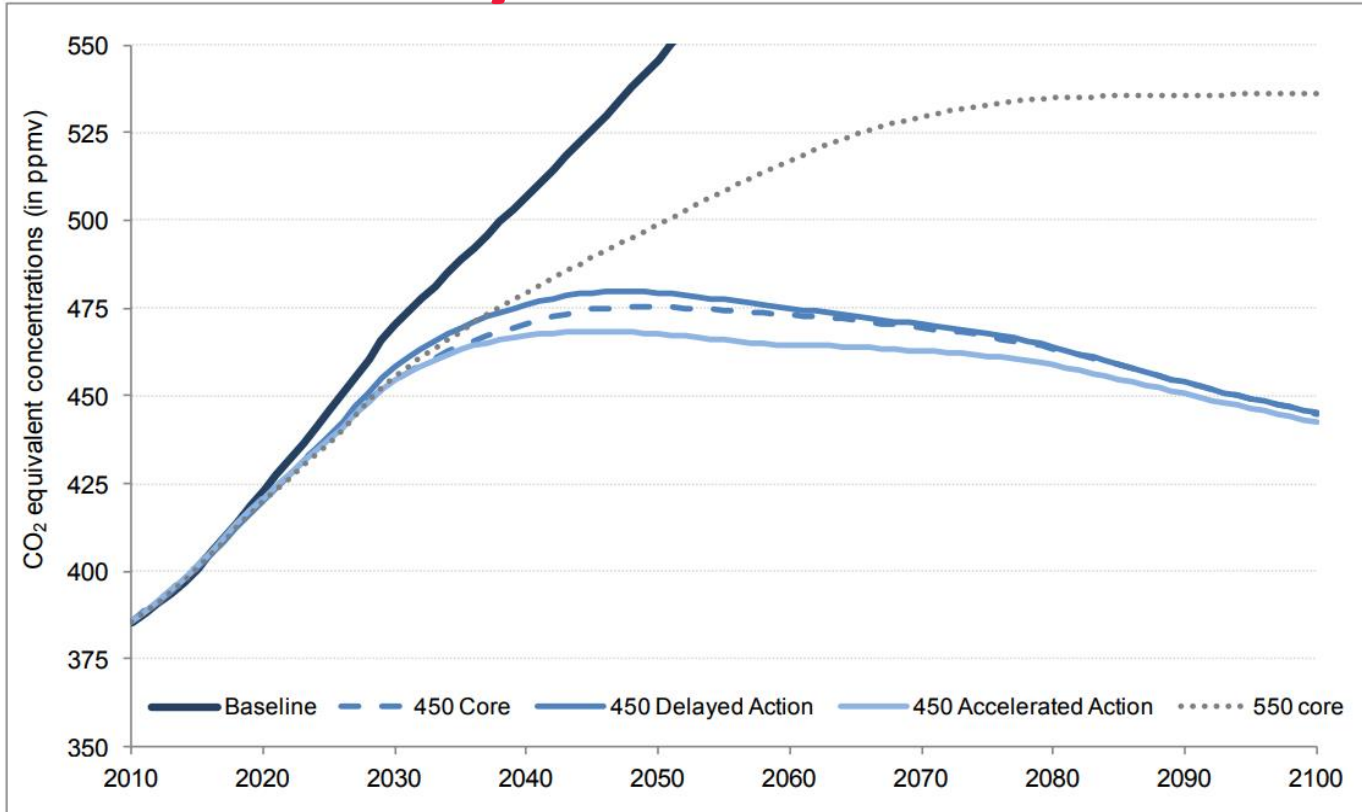
SCIENCE



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Key Driver: Environment



OECD: Organisation for Economic Co-operation and Development is an intergovernmental economic organisation with 35 member countries, founded in 1961 to stimulate economic progress and world trade

Source: OECD Environmental Outlook projections; output from IMAGE.

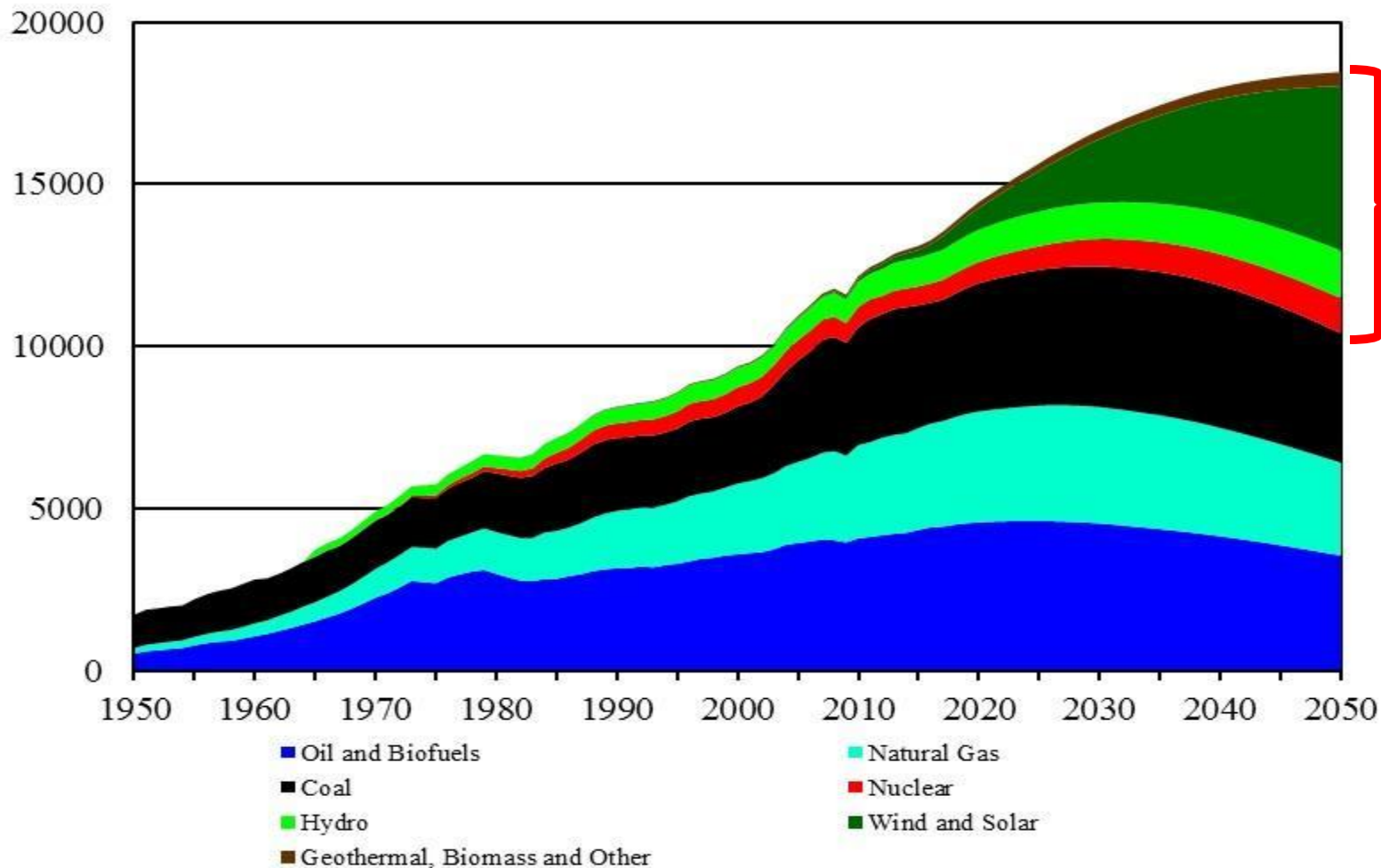
Compared with the “no new policies” *Baseline* projection, all three 450 ppm scenarios would have significantly lower climate impacts, and offer at least a medium chance of limiting global average temperature increase in 2100 to 2 °C.



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World Primary Energy Consumption (Million Tons of Oil Equivalent, 1950-2050)



Solution:
More
Renewable
Sources

Can
we do
it?

Group Exercise

- Provide contemporary issues/projects which help to reduce carbon emissions as you heard from media and your ideas.



Enabling technologies

- An **enabling technology** is an invention or innovation, that can be applied to drive radical change in the capabilities of a user or culture.
- **Enabling technologies** are characterized by rapid development of subsequent derivative **technologies**, often in diverse fields.





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Technology Roadmaps



Roadmap for Fully Autonomous Vehicles

Roadmap for Fully Autonomous Cars

Active Control Systems

- ACC
- LKA
- AEB
- Auto Park Assist

2010-15

Autonomous Driving Systems

- Platooning
- Active V2X
- Active Driver Monitor
- Night Vision AEB

2015-20

Autonomous Cars

- Limitation on:
- Specific Road
 - Speed
 - Traffic Condition

2020-25

Fully Autonomous Cars

2030-35



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The route to the autonomous car

Frank J. Gagliardi, CFA®; senior research analyst and John D. Connolly, writer at The Boston Company Asset Management LLC* explore the future economic and social potential of driverless cars.

THE BOSTON COMPANY
ASSET MANAGEMENT, LLC

Advantages

Safety
90%

of road traffic accidents are currently caused by human error.¹

Driverless cars could translate into approximately

36,000 lives saved each year and approximately **US\$ 488 billion**.

Social
Greater mobility provided to elderly and disabled people.

People over the age of 65 expected to double in US by **2050**.²



Economic
Morgan Stanley estimates Autonomous cars will result in **US\$ 1.3 trillion** savings every year for the US economy, globally this translates into **US\$ 5.6 trillion**.³

Economic benefits for drivers

- Fuel costs
- Productivity gains
- Accident costs

Potential obstacles

Liability
Who accepts responsibility in the case of an accident?

Legislation
US infrastructure deficiencies mean that **US\$ 10.8 billion** had to be found to keep the Highway Trust Fund solvent until May 2015.⁴

Consumer adoption

Once people accept and trust the systems, adoption rates are expected to climb.

Welcome to the autonomous car



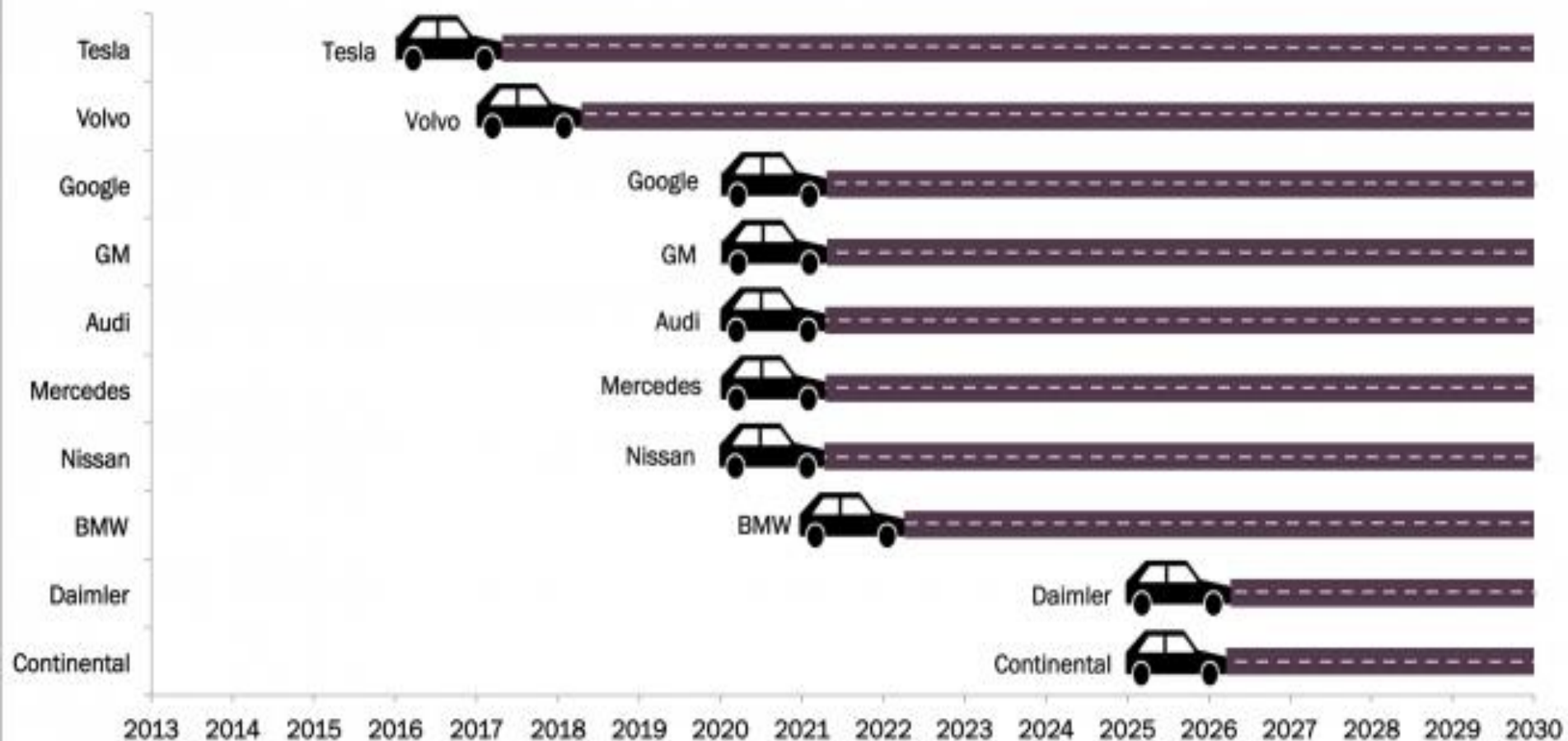
2030



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When will Automakers Release an Autonomous Car?

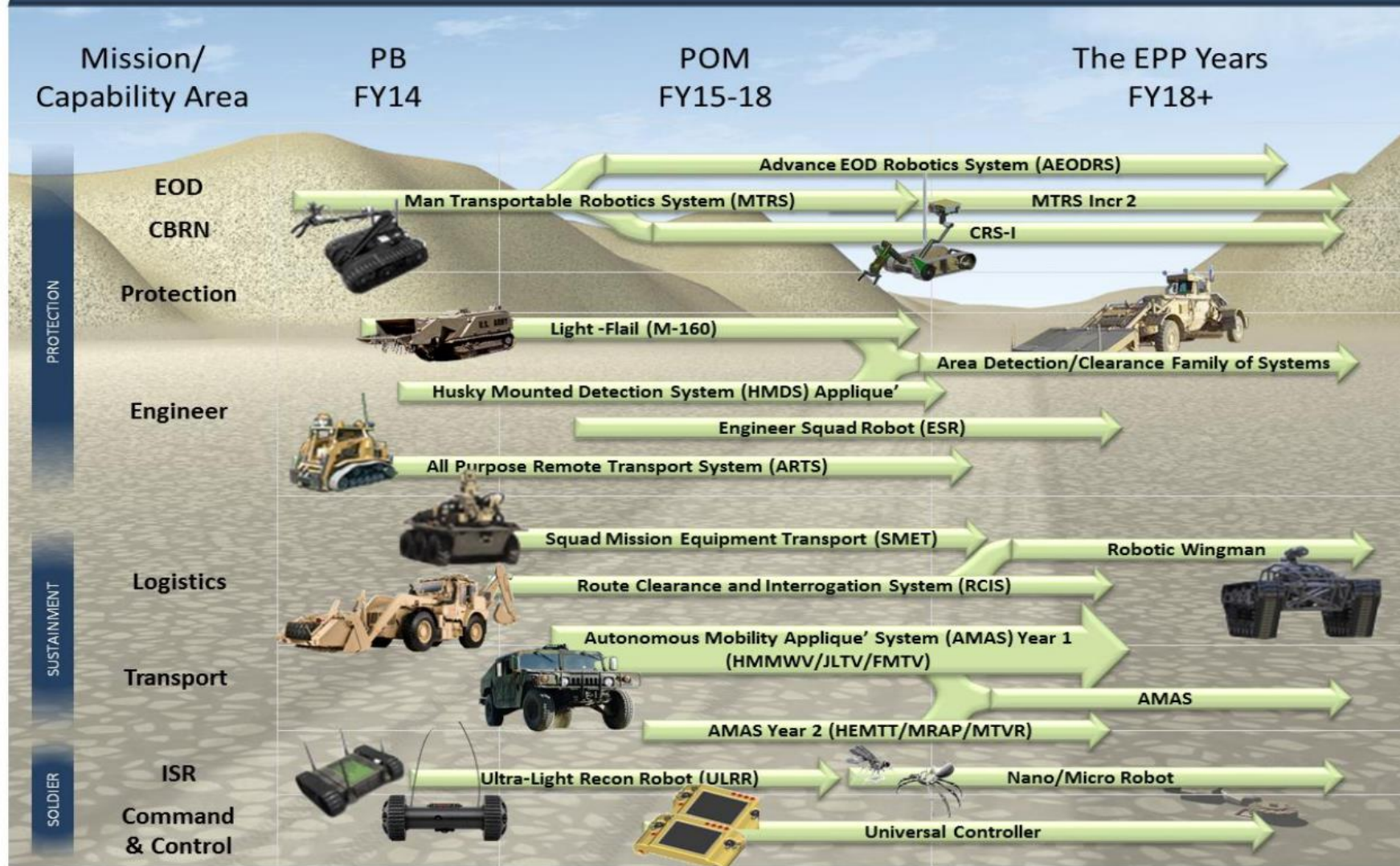




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Unmanned Ground Systems





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Unmanned Maritime Systems (PB13 and beyond)

Mine Counter-Measures (MCM)

Mine Countermeasure (MCM) USV



Remote Mine-hunting
System (RMS)
AN/WLD-1



Surface Mine Countermeasure
(SMCM) User Operational
Evaluation Sys Increment 1



Battlespace
Preparation
Autonomous
Undersea
Vehicle (BPAUV)



MK18 Mod 1 Swordfish UUV Sys



MK 18 Mod 2 Kingfish UUV Sys



Surface Mine Countermeasure
(SMCM) UUV



Maritime Security

- ISR
- Port Surveillance
- Special Operations Forces (SOF) Support
- Electronic Warfare

SeaFox



Mk I

Mk II



Modular Unmanned Surface Craft
Littoral (MUSCL) Use Operational Evaluation Sys

Sea Stalker



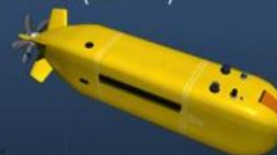
Sea Maverick



Semi-Autonomous
Hydrographic Recon Vehicle



Large Displacement
Unmanned Underwater
Vehicle (LDUUV)



Hull Underwater Vehicle /
Hull Underwater
Localization Sys (HULS)



Littoral Battlespace Sensing AUV
Littoral Battlespace Sensing Glider

ECHO Ranger





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Unmanned Aircraft Systems (PB13 and beyond)

Mission Areas

2013 Expanding Strategic Focus from Irregular Warfare to Include Anti-Access Area Denial/Near Peer 2035+

Increasing Performance, Payload, & Vehicle Size

Strike Capable

ISR / Data Relay Platforms

Penetrating

- Group 5
- > 1320 lbs
 - > FL180

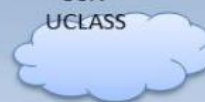
USAF
MQ-9 Reaper



USAF
RQ-4B Global Hawk
USN
MQ-4C Triton



USN
UCLASS



Unfunded



USAF MQ-L



USN UCAS
FAA-XX

Persistent

- Group 4
- > 1320 lbs
 - < FL180



USAF
MQ-1B Predator



USA
MQ-1C Gray Eagle



USA
RQ-5 Hunter



USN MQ-8B/C
Fire Scout



USMC
MCTUAS



USN
USA VTOL

Tactical

- Group 3
- < 1320 lbs
 - < FL180
 - < 250 knots



USN / USMC
STUAS



USA / USMC / SOCOM
RQ-7 Shadow



USSOCOM EUAS

Small Tactical

- Group 2
- 21-55 lbs
 - < 3500 AGL
 - < 250 knots



USN
ScanEagle

Micro/Mini Tactical

- Group 1
- 0-20 lbs
 - < 1200 AGL
 - < 100 knots



USN/USAF
T-Hawk



USSOCOM / USA / USMC
Puma



USMC / USSOCOM Wasp



USA / USN / USMC / USSOCOM
RQ-11 Raven

Small Family of Systems



USA Nano UAS

USAF = US Air Force; USN = US Navy; USMC = US Marine Corps; USA = US Army; USSOCOM = US Special Ops Command



European
Commission



Research by area

Research areas in which the European Commission works.

Bioeconomy

Energy

Environment

Frontier research

Health

Information and communication technologies

Industrial technologies

Science with and for society

Security

Small and medium-sized businesses (SMEs)

Social sciences and humanities

Space

Synergies with structural funds

Transport



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AUM Research Themes and Directions

← → ↻ ⓘ aumportal/AcademicResearch/SitePages/Research%20Themes%20and%20Directions.aspx

Apps AUM Outlook Web

SharePoint

BROWSE PAGE

Research Themes & Directions

Research Policies

Research Resources at AUM

AUM Research Groups

AUM Research Projects

Current Projects

Completed Projects

Latest News

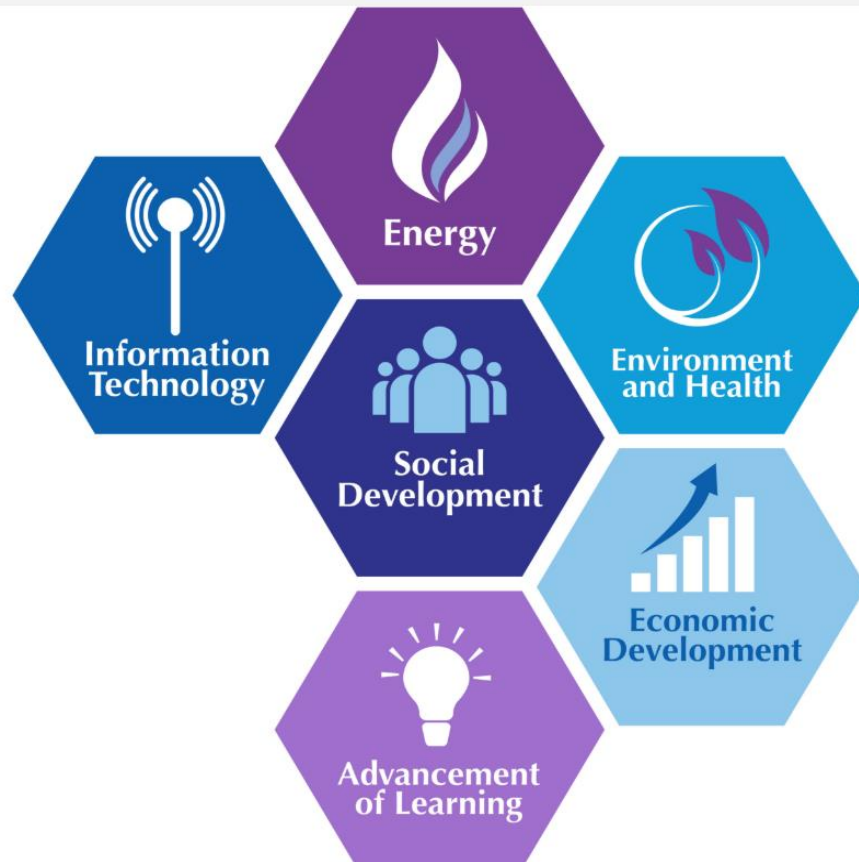
6th International
Conference on Energy
Research &
Development (ICERD-6)

Kuwait International
Nanotechnology
Conference & Exhibition

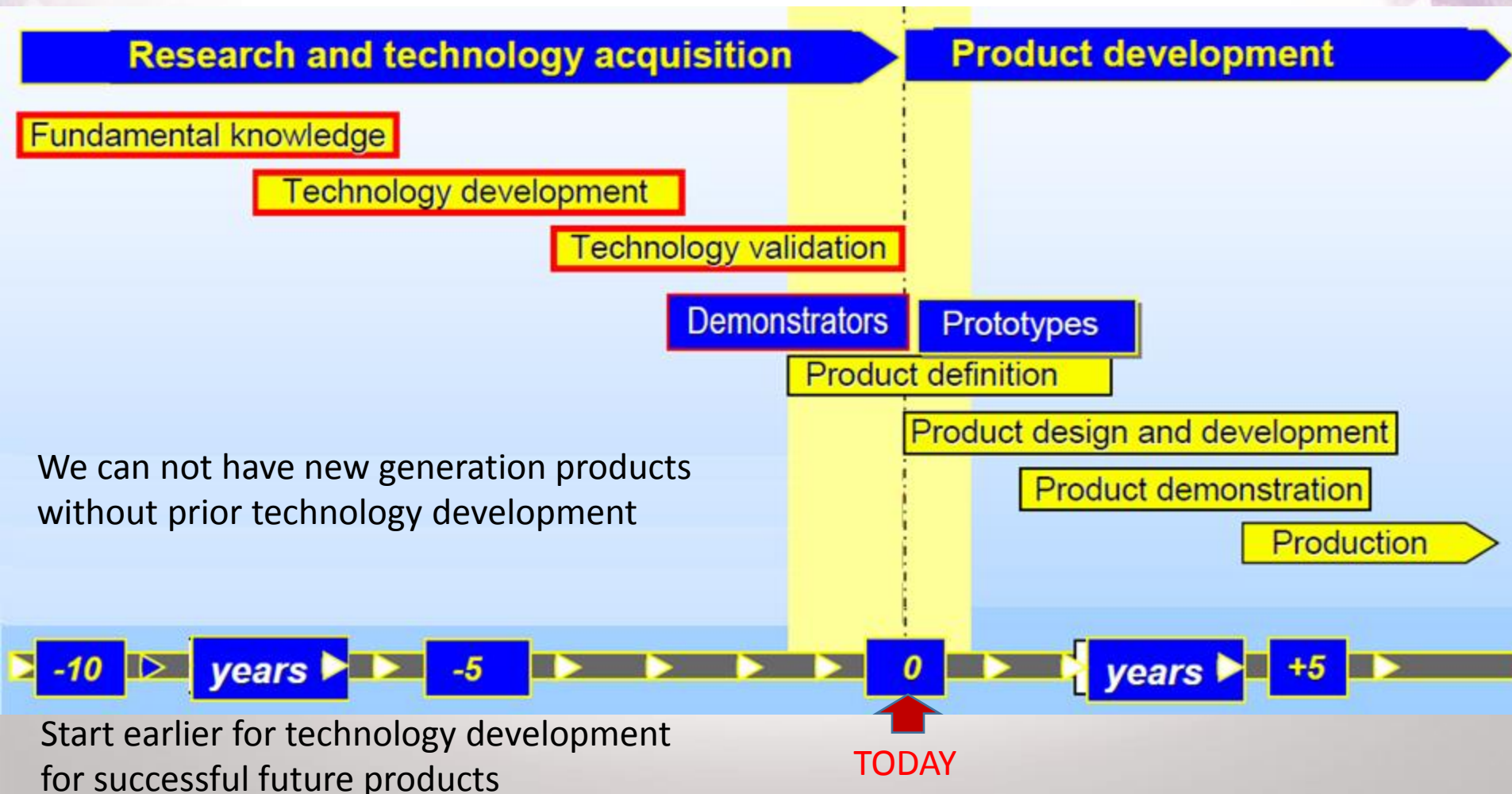
Featured Conference
Attendances &
Research Achievements

Previous Research

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Technology → Product

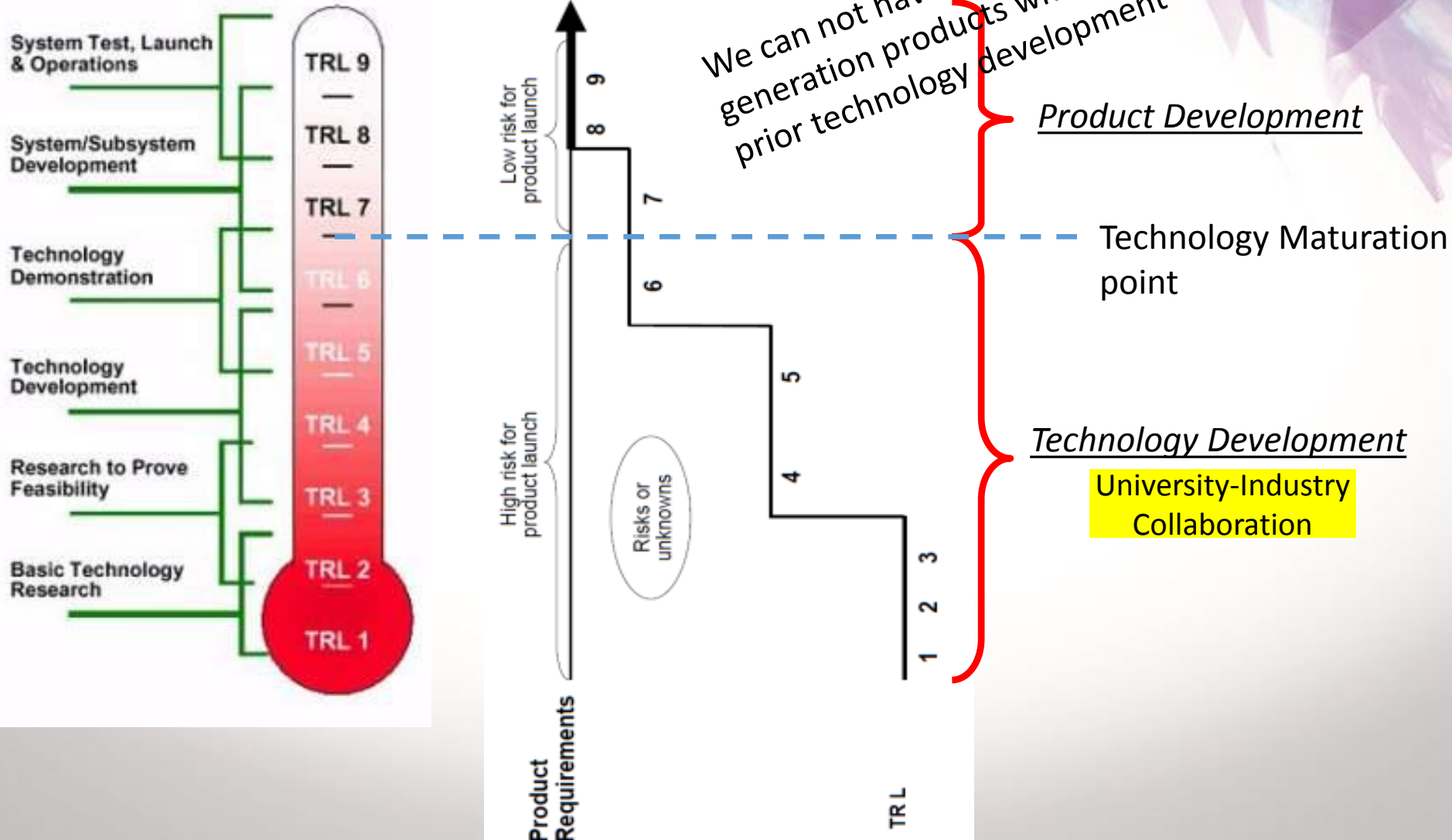




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NASA Technology Readiness Level (TRL) Scale



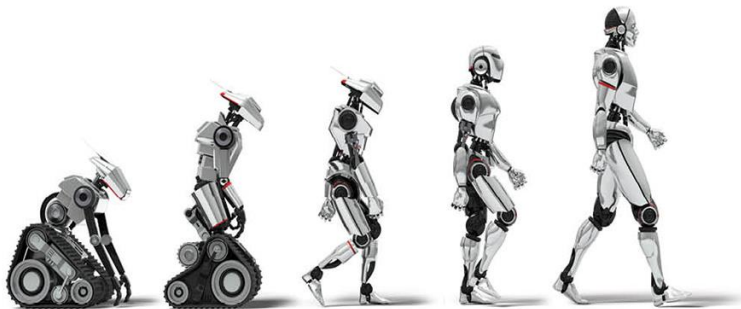


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Contemporary Issues/Technologies

The Next Steps in Robotics



ARTIFICIAL INTELLIGENCE Today's AI allows robots to answer simple questions; unscripted conversations are a ways off.

VISUAL RECOGNITION
This capability must improve if robots are to become more useful at retrieving objects and tidying up messy rooms.

VOICE RECOGNITION
If robots are to do your bidding, this will be a critical skill. Today's prototypes respond to few voice commands.

FASTER PROCESSORS
The sensors in a robot's body generate vast amounts of data, making faster chips necessary.

SMALLER POWER SOURCES
Miniature fuel cells could reduce pollution as well as the number of pit stops needed.



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Contemporary Issues/Technologies

Artificial Intelligence: Sub-Industry Heatmap 2011-2016 (as of 6/15/2016)

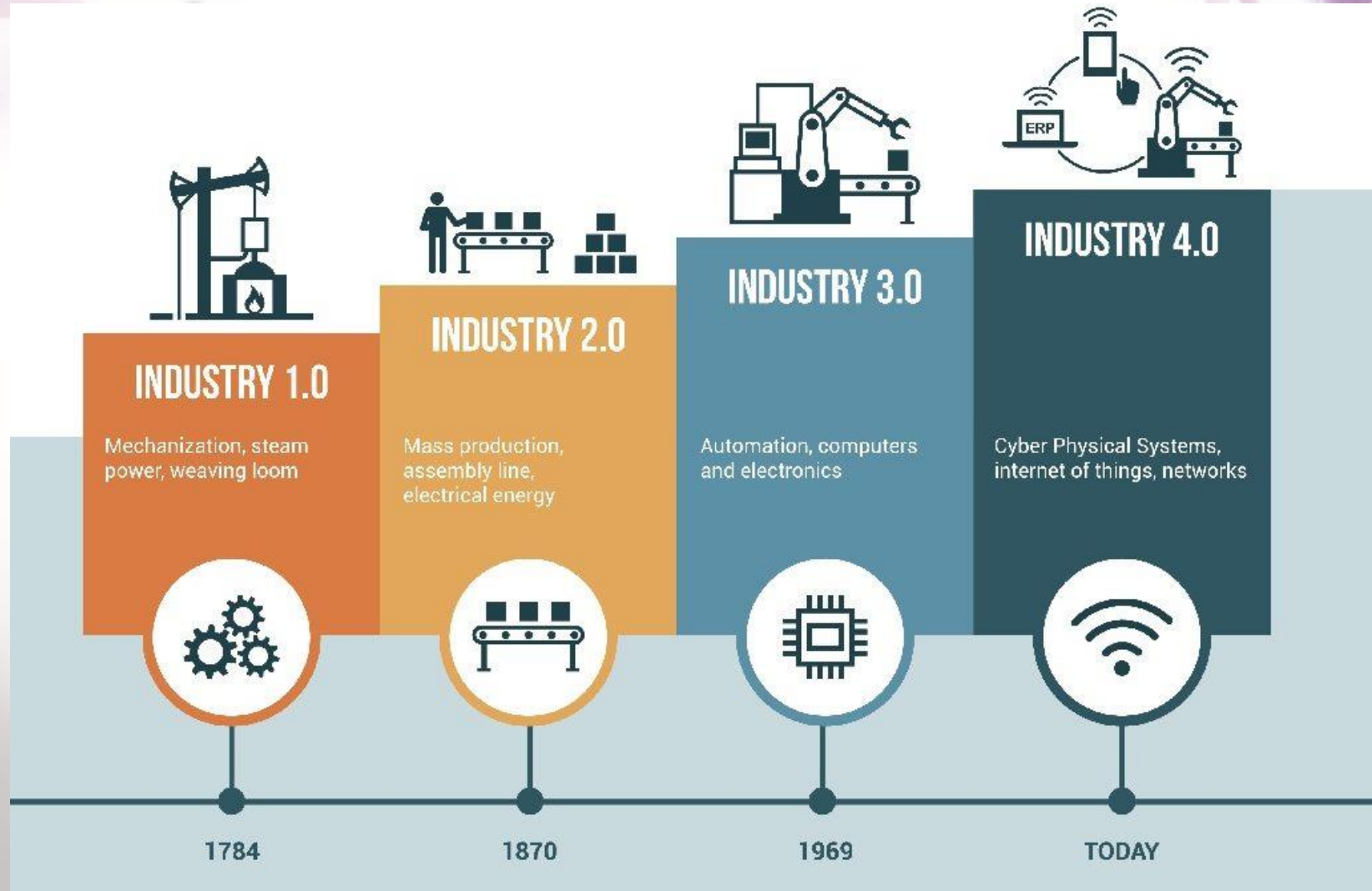
Sub-Industry	2011	2012	2013	2014	2015	2016(YTD)
Healthcare	Yellow	Orange	Orange	Red	Red	Red
Advertising, Sales & Marketing	Orange	Orange	Orange	Orange	Red	Orange
Business Intelligence	Yellow	Yellow	Orange	Orange	Red	Orange
Security	Yellow	Green	Yellow	Orange	Orange	Yellow
Finance	Green	Green	Yellow	Orange	Yellow	Orange
IoT/Wearables	Green	Green	Yellow	Orange	Orange	Orange
Education	Green	Green	Yellow	Green	Yellow	Green
Customer Relationship Management	Green	Green	Green	Yellow	Yellow	Yellow
Personal Assistants/Productivity	Green	Green	Green	Green	Yellow	Yellow
E-Commerce	Green	Green	Green	Green	Yellow	Green
Robotics	Green	Green	Green	Green	Yellow	Green



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Contemporary Issues/Technologies

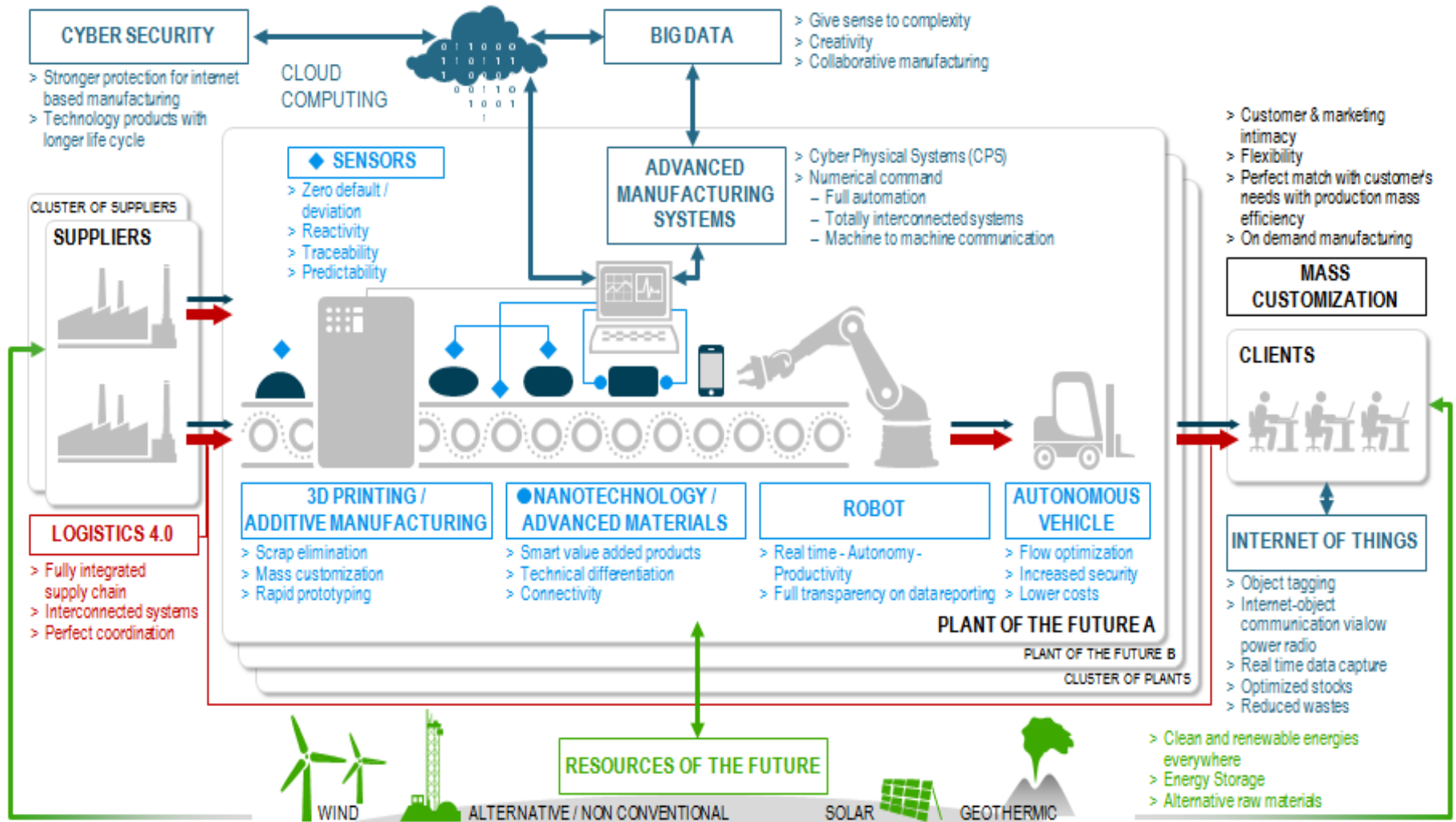




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Industry 4.0 Ecosystem



3D Printing

Materials covered:

- Thermoplastics (FDM, SLS)
- Thermosets (SLA)
- Powder based composites (3D printing)
- Metals (EBM, SLS)
- Sealant tapes (LOM)



3D Printing

ADVANTAGES

- Complex and Unlimited Geometries
- Less Tooling
- Speed
- Less Waste Production
- Assorted Materials in one part
- Creative Designs
- Touchable Designs
- Early prototyping and Risk Reduction

DISADVANTAGES

- Limited Materials to be used
- Limited strength and endurance
- Expensive
- Surface finish
- Dimensional accuracy
- Small build volume
- Manufacturing Job Losses



Components made of Ti
and Co-Cr alloys



Biomedical components
made of Ti alloys



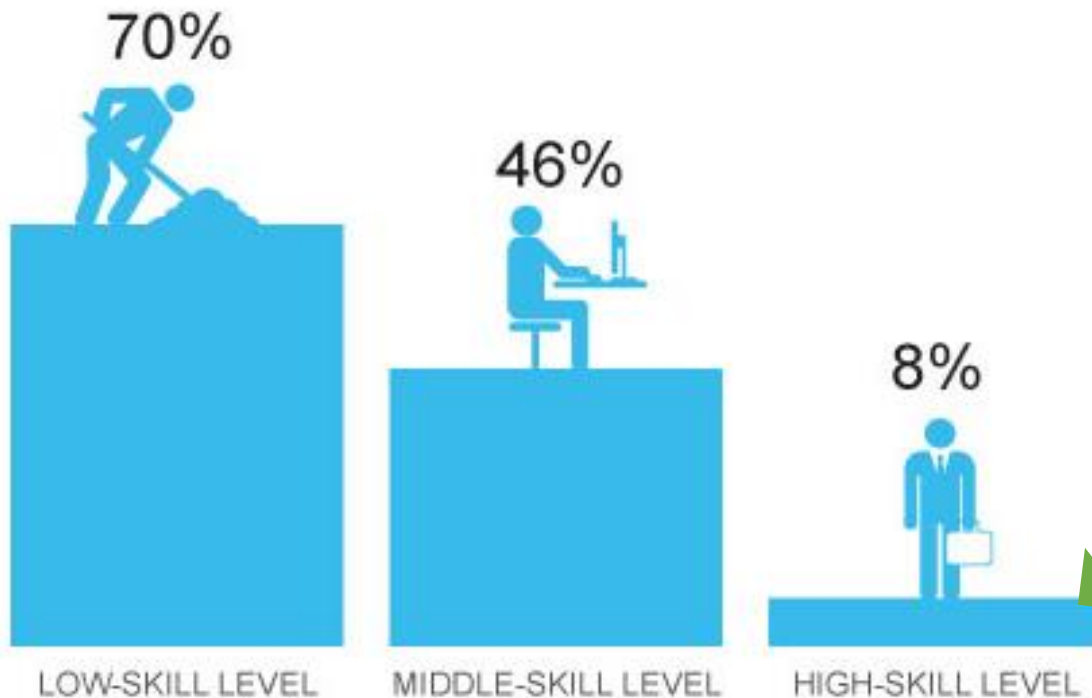
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Social Impact of Automation

Low-skill jobs at greatest risk

Percentage of jobs, by skill level, at a high risk of being automated in 20 years.



Engineers also have to be more skillful

Note: Low skill requires no post-secondary education; middle skill requires some college or training; high skill requires a bachelor's degree or higher.

Source USA TODAY analysis of data from Carl Benedikt Frey and Michael A. Osborne, authors of "Future of Employment" and EMSI/CareerBuilder.



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Everything gets `Smart`

Smart phones



Smart Homes



Smart Cars



Smart Factories



Market
Pull

Technology
Push



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Wearable Technologies

FROM HEAD TO TOE WEARABLE TECHNOLOGY

SHIRT

Conductive thread means a computer is literally built into the fabric of the shirt, providing the processing power for all the other wearable gadgets.

WRISTBAND

A sensor that tracks movement to determine the number of steps taken through the day – 10,000 is ideal – and how much sleep the wearer gets at night.

GLASSES

Overlays navigation directions and information about points of interest directly on to the wearer's field of vision.

WRISTWATCH

Vibrates when a message arrives and displays it on the watch face. Tells the time too.

HAND





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Wearable Technologies



Benefits of Interactions with Professionals Outside the University and Field Trips

- See the applications of what you learned in university courses.
- Get fresh ideas, new perspectives and insight into industry in your professional area
- Get best practices and knowledge from their real-world experience
- Get career advice and guidance
- Get information about application areas of your engineering
- Get advices for your job applications
- Build social skills and confidence
- Advance your career with their support

Summary

- **“A Knowledge of Contemporary Issues”** is an ABET requirement and helps improve Engineering education
- Change Direction is always for “Better – Faster – Cheaper”
- Key Drivers for “Change” are Economical, Environmental, Social, Political, Technological and Legal
- Impact of all solutions must be evaluated carefully