U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

International Workshop on the Use of Robotic Technologies at Nuclear Facilities February 2nd – 4th 2016

Plenary Discussion: Session 1

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Technology Evolution is Accelerating

Wright Brothers - 1903

~ 100 years

Airbus A380 – 2010s

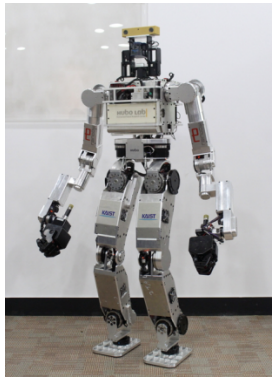
Model T - 1908

~ 100 years

Lamborghini Aventador - 2015

C-3PO (Fiction) - 1977

~ 40 years



Hubo : DARPA Winner - 2015

One Building Block: Multiple Evolutions for Multiple Applications

WWI fighter plane – 1918

Spitfire – 1940s

P86 Fighter – 1950s

F22 RAPTOR – 2010s

Wright Brothers - 1903

B52 Bomber – 1950s

B2 Stealth Bomber – 1990s

Douglas DC3 - 1936

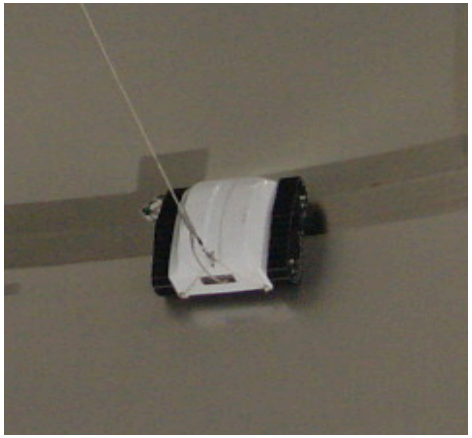
De Havilland Comet – 1950s

Boeing 737 – 1970s

Airbus A380 – 2010s

Robotic Systems in use in non-nuclear industries…..

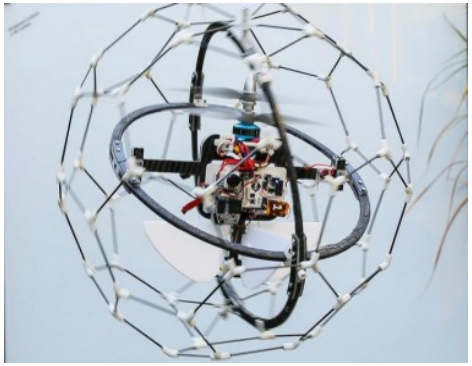
Aerospace - Sealant Applicator



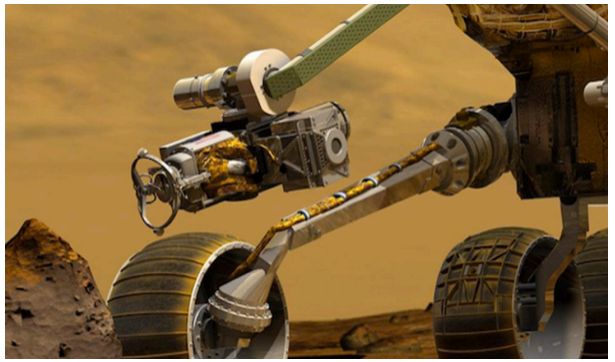
Agriculture – Silo Inspection

Construction – Panel Handler

Consumer – Grill cleaner



Oil & Gas – Surveillance drone



Space – Rock grinder

…. that have application in the nuclear D&D field

Robots used at Fukushima

Robo crawl and dump – fixing contamination

Sakura 2 – characterization platform

MEISTER – dual armed system for light duty tasks such as carrying, drilling, opening/closing valves

Decontamination system

Executive Summary

- The development and use of robotics and remote systems has become widespread and relatively common in many industries
- Although there are many opportunities for the use of such systems in the nuclear industry (operations, outages, D&D), there is an inherent conservatism to their implementation
- The move towards the use of robotics and remote systems is driven by the need to reduce cost, improve operations and safety and to facilitate work in challenging environments
- One of the most prevalent successes has been driven by the critical needs at the Fukushima Daiichi which has caused a paradigm shift in thinking about the use of remote systems

Executive Summary

- While robotic technologies have emerged and continue to be improved for application in the nuclear industry, the overall context within which their use will be maximized must also evolve (e.g. training, certification, regulation)
- One objective of this workshop is to initiate dialogue, exchange ideas and extend this paradigm shift to non-emergency applications and implementation to parallel the use of such systems in non-nuclear industries

Executive Summary

- This workshop will address the essential issues of:
  - Ensuring a common foundation of knowledge of
    - the state-of-the-art of robotic & remote systems available today
    - where and how systems have been applied
    - what lessons can be learned from past activities
  - Future technical challenges and applications of robotic & remote systems
  - Establishing a workable regime that includes certification, training and regulatory aspects to enable a smooth transition to implementation of remote systems
  - Developing a motivating and incentivization culture for system developers and vendors to focus more effort on the nuclear market