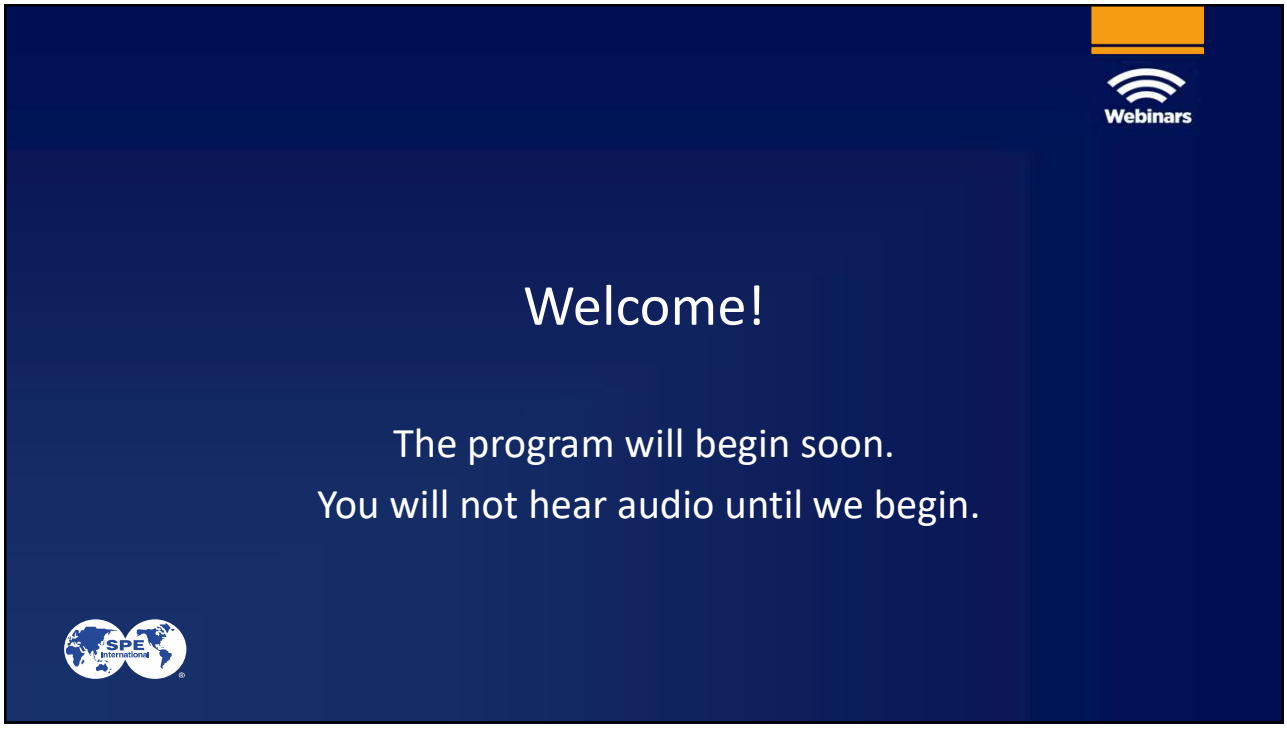
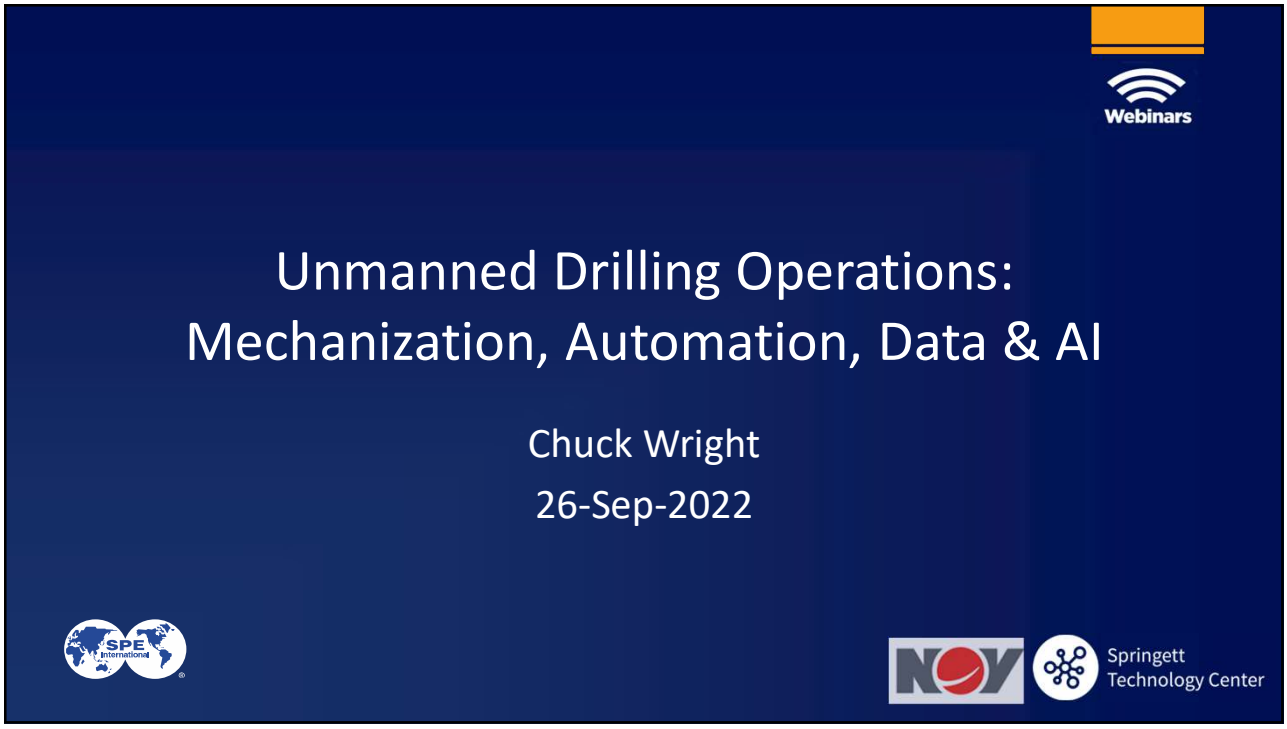
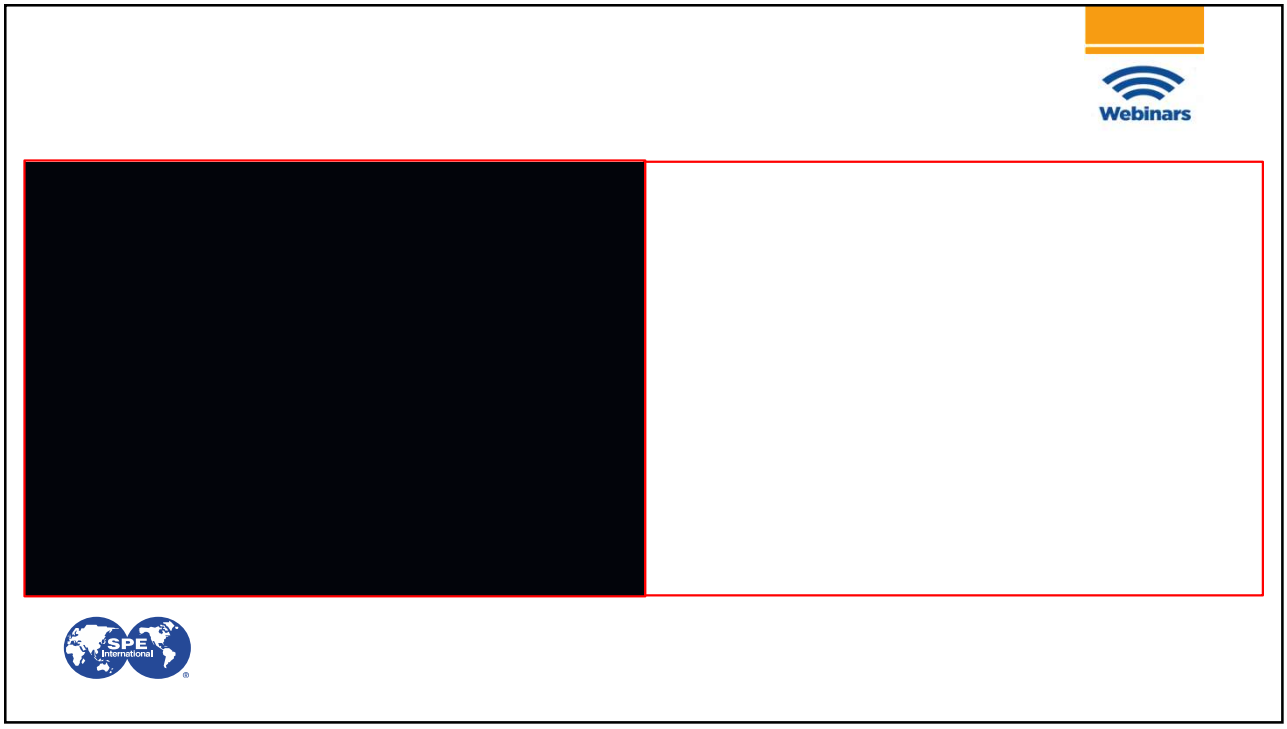

Webinars
Welcome!
The program will begin soon.
You will not hear audio until we begin.
SPE International

1


Webinars
Unmanned Drilling Operations:
Mechanization, Automation, Data & AI
Chuck Wright
26-Sep-2022
SPE International
NOV
Springett
Technology Center

2

3



4

Definition

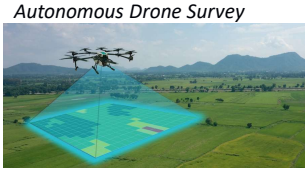
- Mechanization: the process of putting an apparatus, operation, or system under the control or regulation of mechanical or electronic devices
- Automation: the technique of making an apparatus, a process, or a system operate automatically
- **Manless** Autonomy– Depends HEAVILY on above first two:
  - Are we talking - work - w/out man
  - Are we talking - think - w/out man
  - Are we talking about both

5

Human-'less' System Examples

Reaper Drone

Autonomous Drone Survey



Roomba Self-Cleaning

Autonomous Warehouse Robot

Tesla Self Driving

Source: *Internet Open Domain Pics*

1960 – MIT Paper Man-Computer Symbiosis

"Man-computer symbiosis is an expected development in cooperative interaction between men and electronic computers."

"The main aims are 1) to let computers facilitate formulative thinking as they now facilitate the solution of formulated problems, and 2) to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs. In the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routinizable work that must be done to prepare the way for insights and decisions in technical and scientific thinking. Preliminary analyses indicate that the symbiotic partnership will perform intellectual operations much more effectively than man alone can perform them."

Source: Licklider, J. (1960). Man-Computer Symbiosis. IRE Transactions on Human Factors in Electronics, Vol HFE-1, pg: 4-11, March 1960.

7

1960 – Computer Advancement Status

Managed Japan's first on-line, real time reservation system for Kinki Nippon Railways in 1960.

Capable of executing one operation I/O and an arithmetic operation simultaneously and used for business, scientific, and engineering applications

Source: NEAC 2203 Computer – Nippon Electronic Automatic Computer

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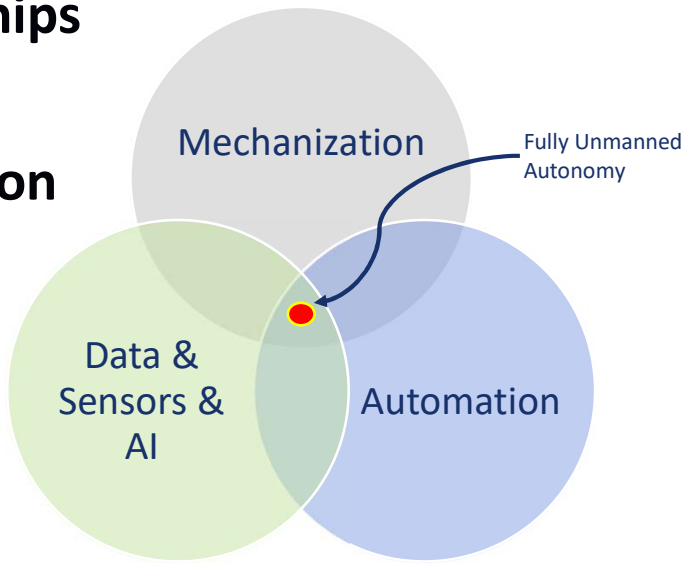
Relationships

Interrelation



Source: *Chuck Wright*

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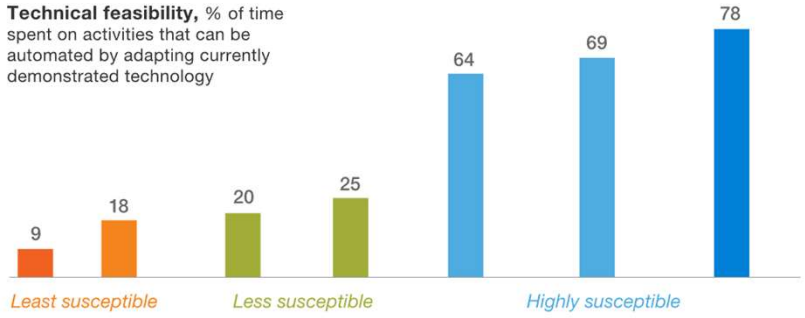
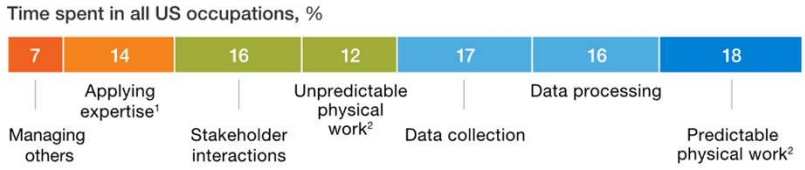
McKinsey Digital | 08-Jul-2016 Article

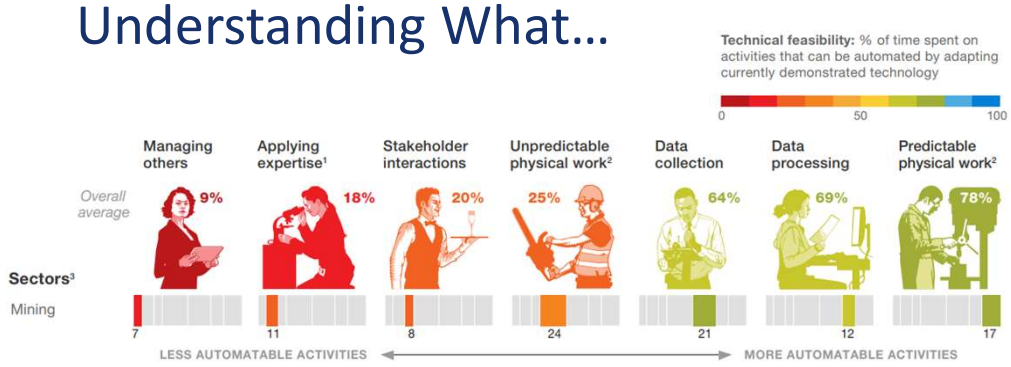




Factors:
-Technically Feasible
-Costs to Implement
-Relative Scarcity
-Skills
-Cost of Workers
-Benefits
-Regulatory-Social Accept

Source: *https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet*

Understanding What…



Source: *McKinsey&Company - (Poster Excerpt from website link)*
Website:
https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/where%20machines%20could%20replace%20humans%20and%20where%20they%20cant/sector-automation.pdf

11

Mining - Autonomous Drilling Capability

In 2013…
-Autonomous one hole to next
-Autonomous bit/BHA watch and change
-Autonomous drilling
-Autonomous sense of rock and change of plan
-Autonomous notification machine was changing blast hole plan.

Source: *Atlas Copco*

Levels of Automation

Level-1 The human operator does the task and turns it over to the computer to implement
Level-2 The computer helps by determining the options
Level-3 The computer helps determine and suggests options. The human operator can choose to follow the recommendation
Level-4 The computer selects the action and the human operator decides it if should or should not be done
Level-5 The computer selects the action and implements it if the human operator approves the action
Level-6 The computer selects the action and informs the human operator in case the operator wants to cancel the action
Level-7 The computer does the action and tells the human operator what it did
Level-8 The computer does the action and tells the human only if the human operator asks
Level-9 The computer does the action when told and tells the human operator only if the computer decides the operator should be told
Level-10 The computer does the action if it decides it should be done. The computer tells the human operator only if it decides the operator should be told

Four Stage Model	**Equivalent System Functions**
Sensory Processing	Information Acquisition
Perception and/or Working Memory	Information Analysis
Decision Making	Decision & Action Selection
Response Selection	Action Implementation

Source: https://petrowiki.spe.org/Levels_of_automation → *Adaptation from Sheridan and Verplank original levels automation*

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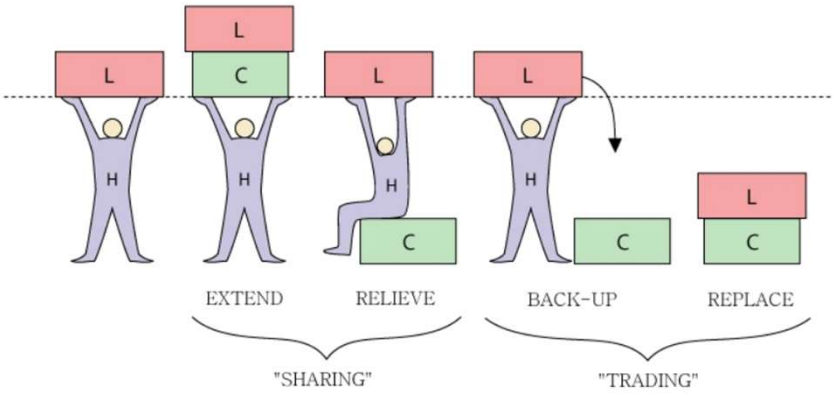
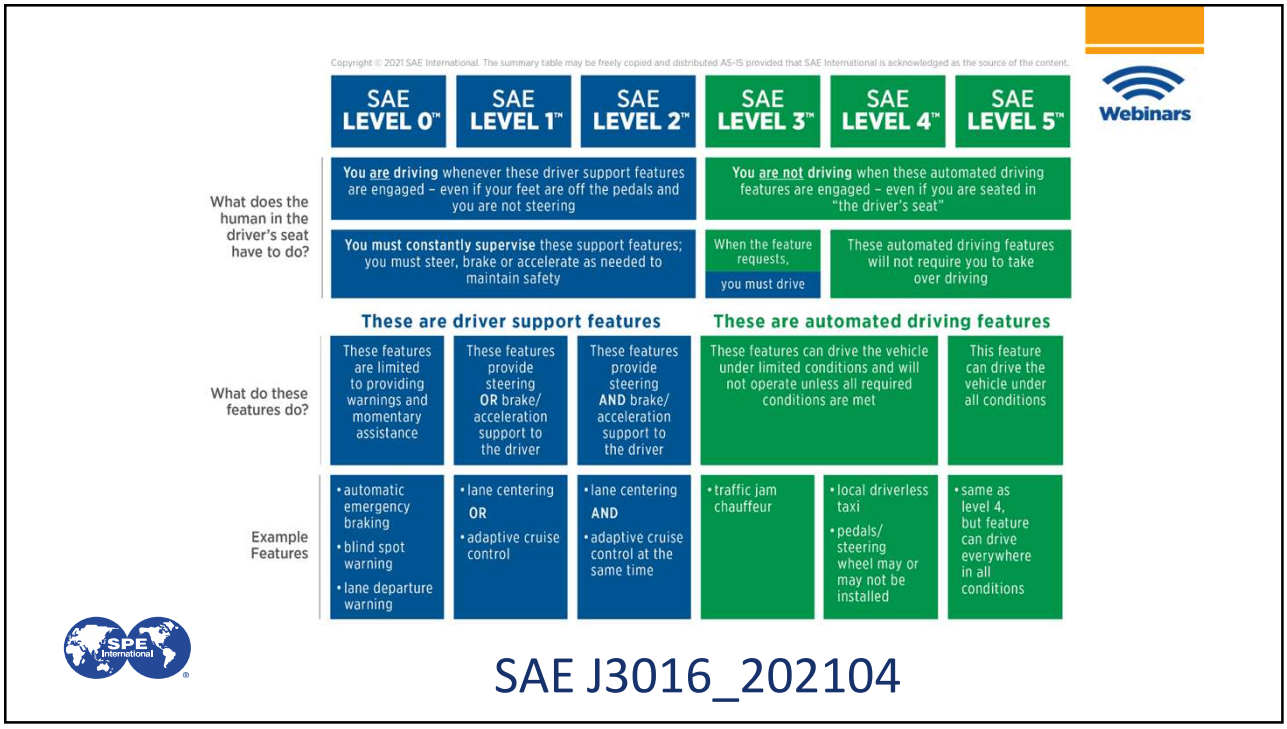
Sheridan & Verplank 'Basic' Notions



MIT Course Slide - 16.422 Human Supervisory Control of Automated Systems

The notions of trading and sharing control between human and computer. L is the load or task, H the human, C the computer. [Adapted from W.Verplank.]

Sheridan T B and Verplank W L (1978) Human and computer control of undersea teleoperators (Department of Mechanical Engineering, MIT, Cambridge, MA, USA)



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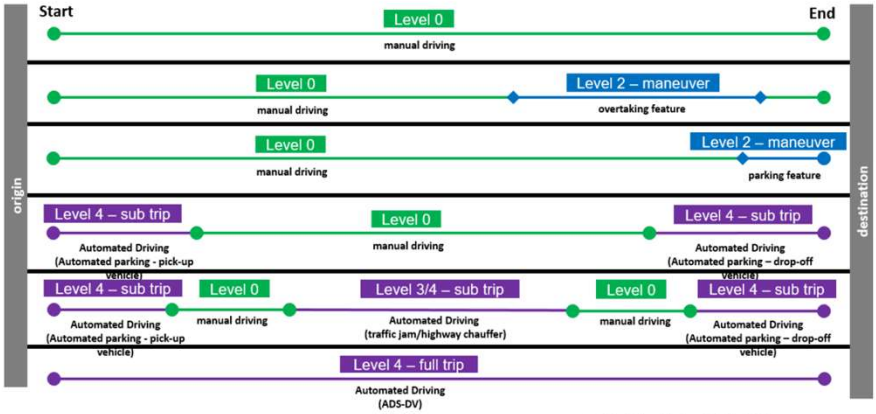
SAE J3016_202104

Taxonomy & Definitions for Terms Related to Driving Automation Systems



Source: *J3016_202104 Figure-1*

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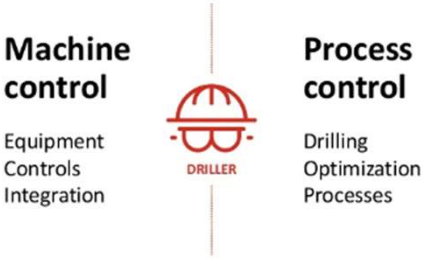
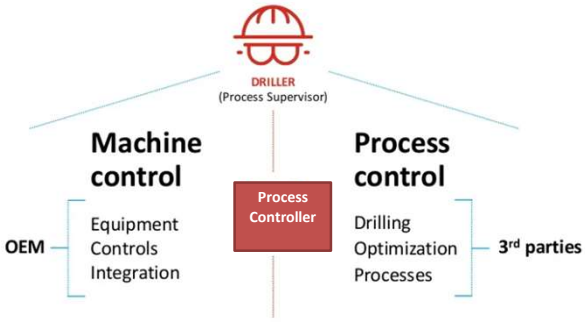
Process Automation Schemas

Generally, Where *Most* Industry is



Generally, Where Industry is *Headed*



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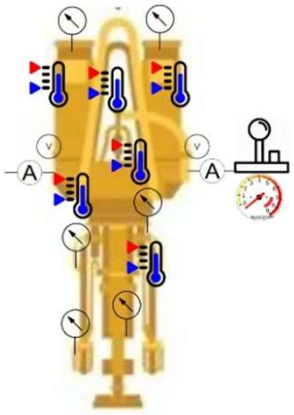
Machine Control- Process Automation



Source: *Internet Open Domain Pic*

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Process Rig Automation

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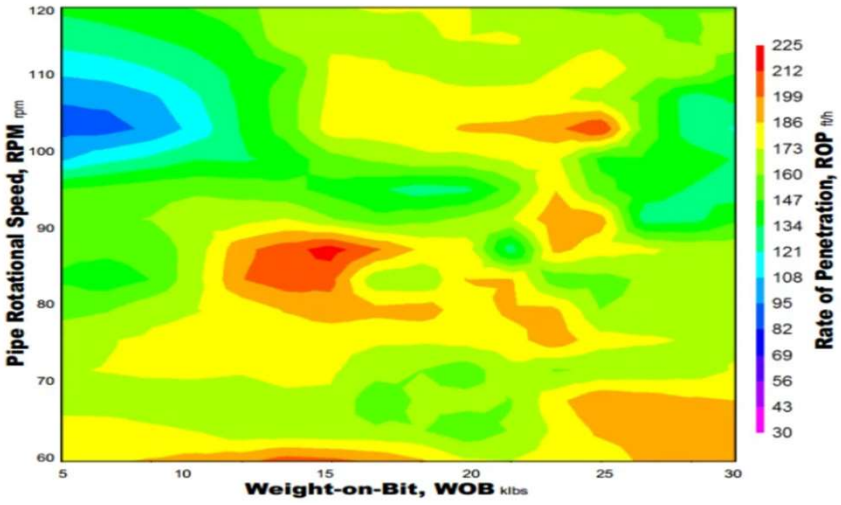
AI Optimized Drilling - Task



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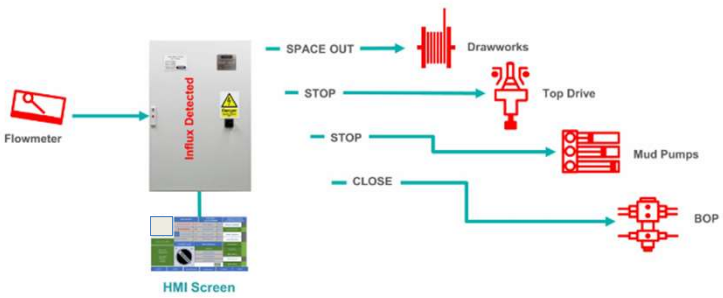
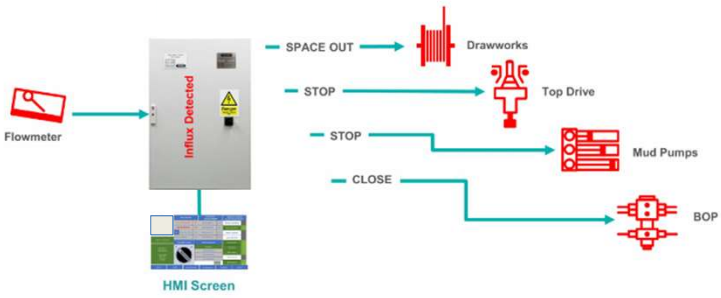
Automated Well Control - Task

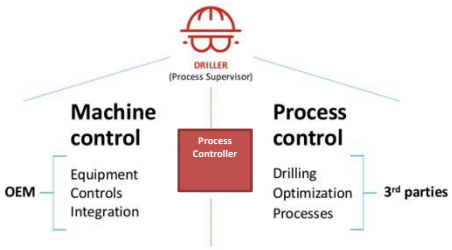


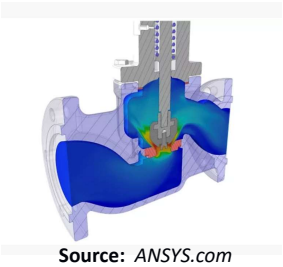
Source: *www.safeinflux.com*

Autonomous Problem –
What is the process



Source: *www.safeinflux.com*





Source: *ANSYS.com*

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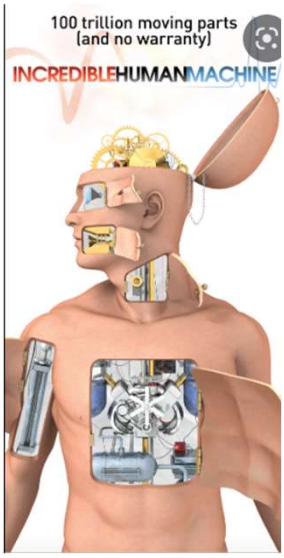
Human Machine Complex Example - **TASKS**

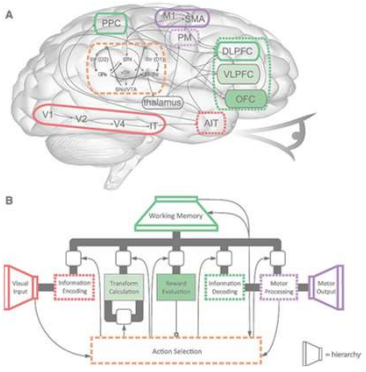


Source: *National Geographic*

The "Human Machine" is not one distinct "thing" but rather an interwoven complex of systems of incredible complexity working together in fantastic fashion to accomplish a series of "tasks" in overall plans (intent).

The very action of "doing something" uses independent systems that require no conscious effort (heart regulation, breathing, sight & touch processing…

There is a connection of multiple processes to greater tasks…



Source: *By http://nengo.ca/build-a-brain - Chris Eliasmith, Public Domain, https://commons.wikimedia.org/w/index.php?curid=26088844*

Logic Architecture vs. Cognitive Architecture

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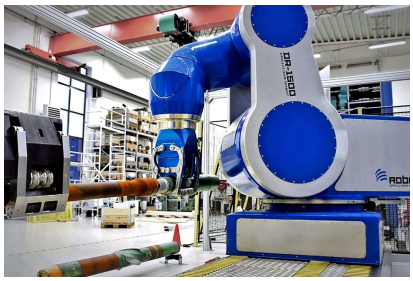
Examples of Integrated Mechanized - Process

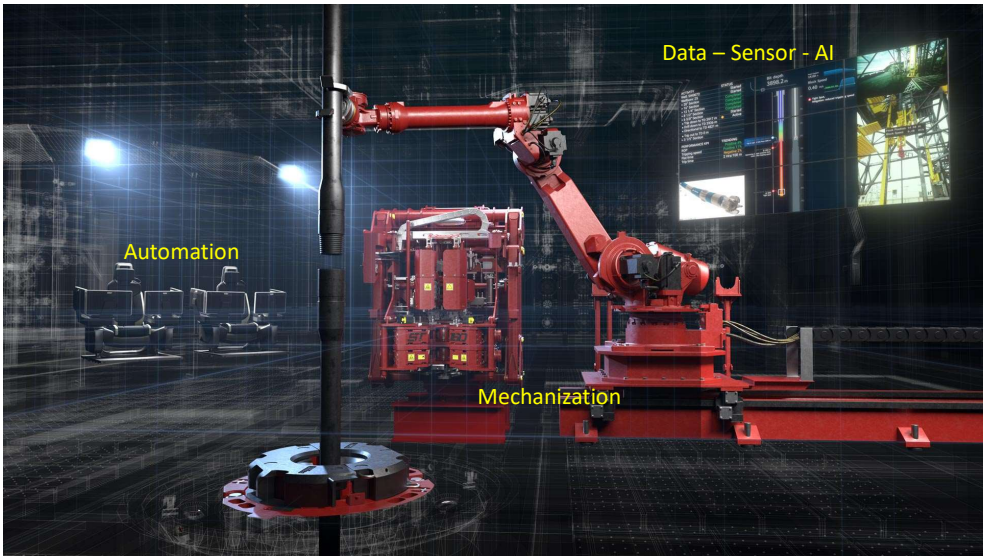
Source: *Nabors PaceR801 – JPT Article*
https://jpt.spe.org/a-robot-takes-over-the-drilling-floor



Source: *Photo - Nabors*

Source: *NOV Prime1 Rig – STC Facility*
NOV Presentation

Mechanized – Automated – Autonomous Systems



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Autonomous Drilling - **Looks Like**

What does a machine look like that can do full autonomous?

What does a full autonomous car look like?

The vacuum doesn't look like a vacuum and the warehouse "bot" does not look like a forklift → maybe a true autonomous rig does **not** look like a rig anymore at the end of the day.

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Questions

Source: *Internet Open Domain Pics*

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