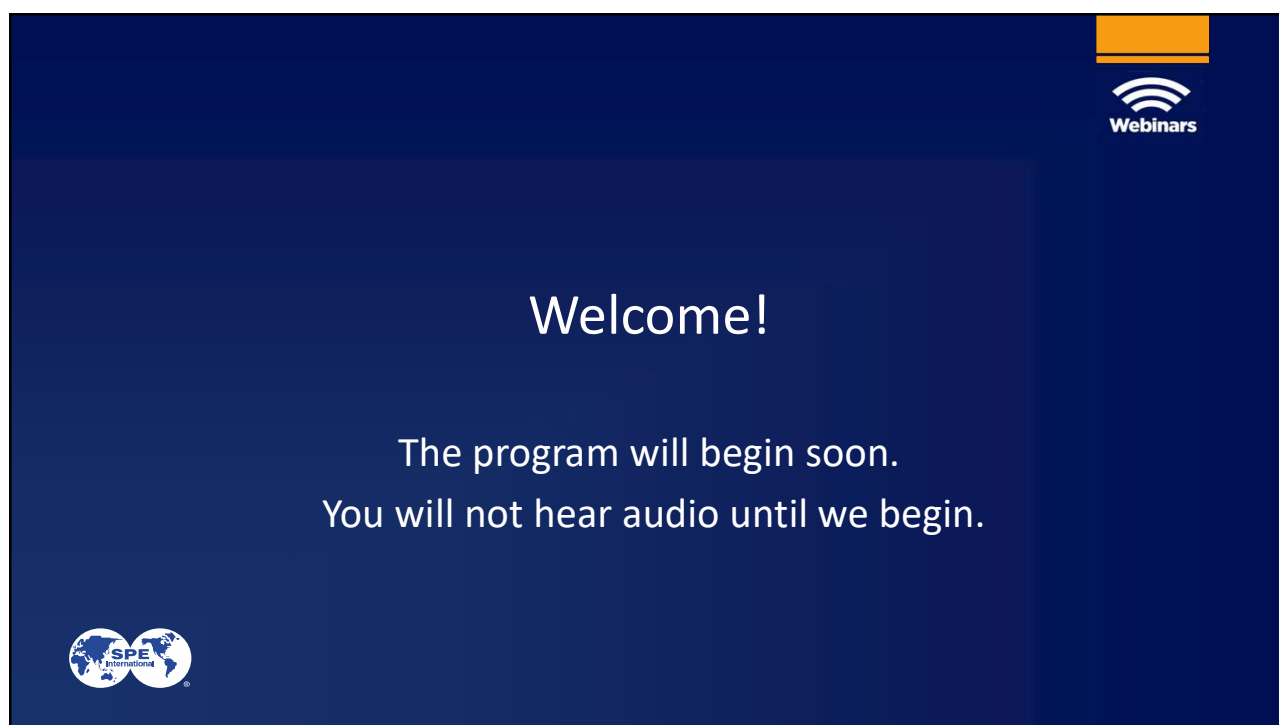




A dark blue rectangular slide with a white border. In the top right corner, there is an orange square above a white Wi-Fi symbol and the word "Webinars". In the center, the word "Welcome!" is written in large white font. Below it, two lines of white text read: "The program will begin soon." and "You will not hear audio until we begin." In the bottom left corner, there is a white logo for "SPE International" featuring a globe.

Webinars

Welcome!

The program will begin soon.
You will not hear audio until we begin.

SPE International



Unmanned Drilling Operations: Mechanization, Automation, Data & AI

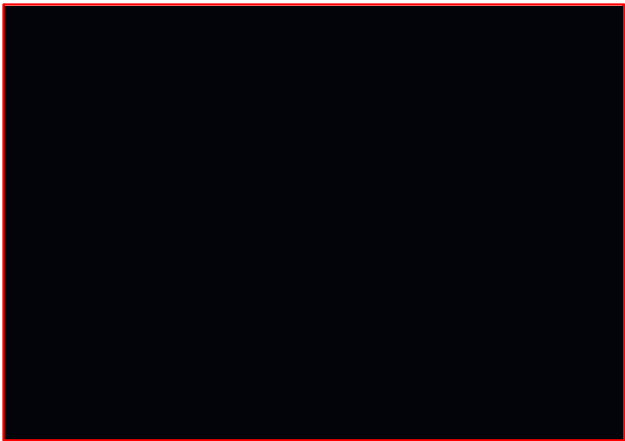
Chuck Wright
26-Sep-2022







Webinars





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

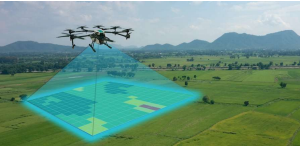


Human-'less' System Examples

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.

1960 – Computer Advancement Status

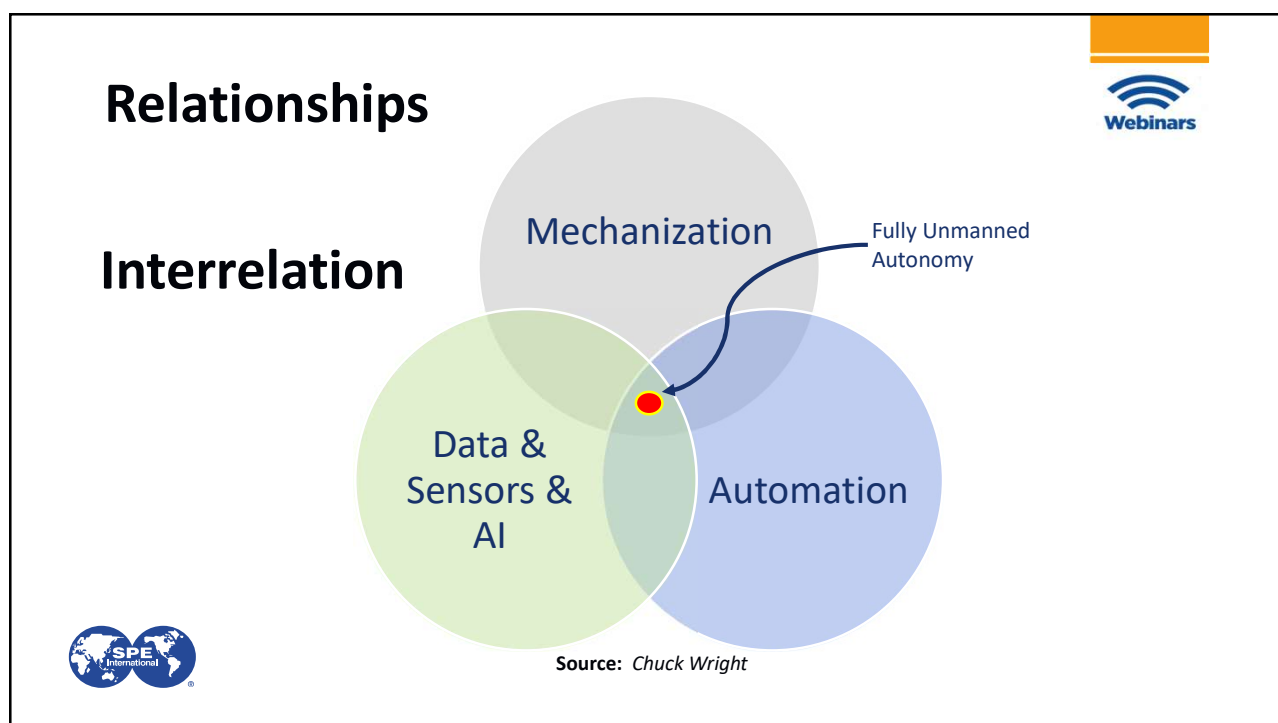


Managed Japan's first on-line, real time reservation system for Kinki Nippon Railways in 1960.

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

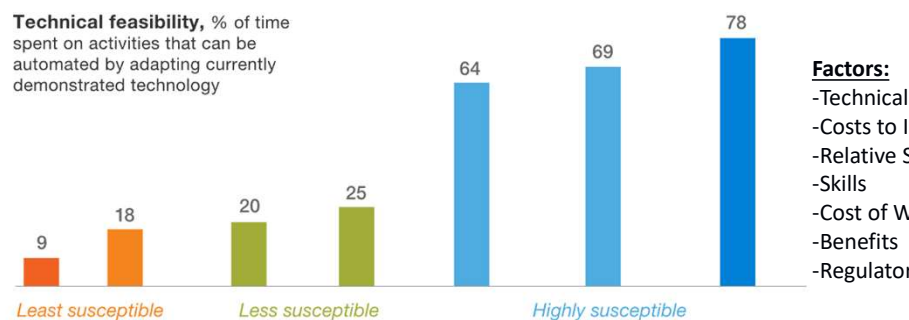




McKinsey Digital | 08-Jul-2016 Article



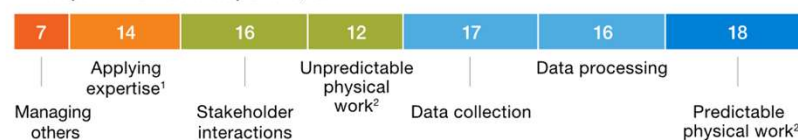
Technical feasibility, % of time spent on activities that can be automated by adapting currently demonstrated technology



Factors:

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

Time spent in all US occupations, %



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%20human%20and%20where%20they%20cant/sector-automation.pdf>



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 if it 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

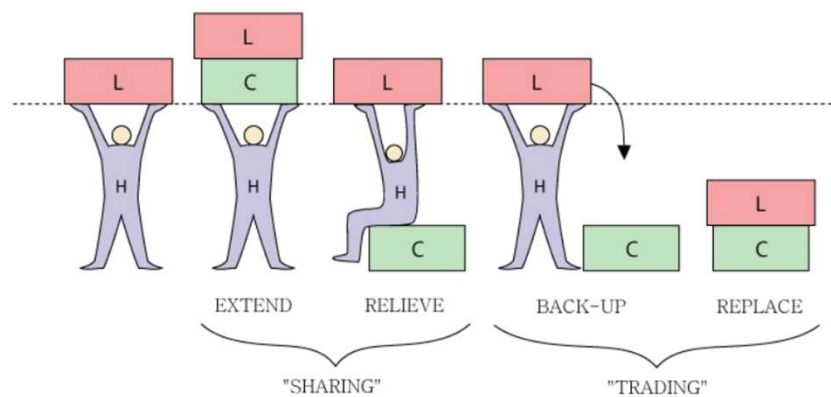
Sensory Processing
 Perception and/or Working Memory
 Decision Making
 Response Selection

Equivalent System Functions

Information Acquisition
 Information Analysis
 Decision & Action Selection
 Action Implementation

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

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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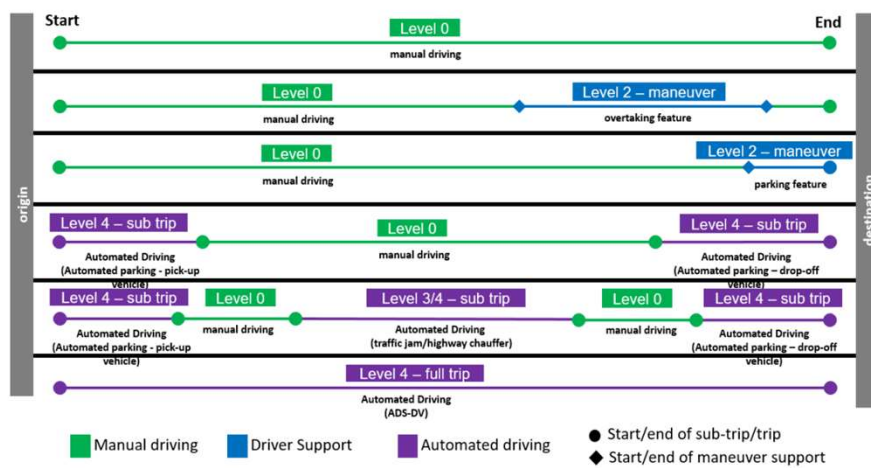
	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering OR • adaptive cruise control	• lane centering AND • adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions



SAE J3016_202104

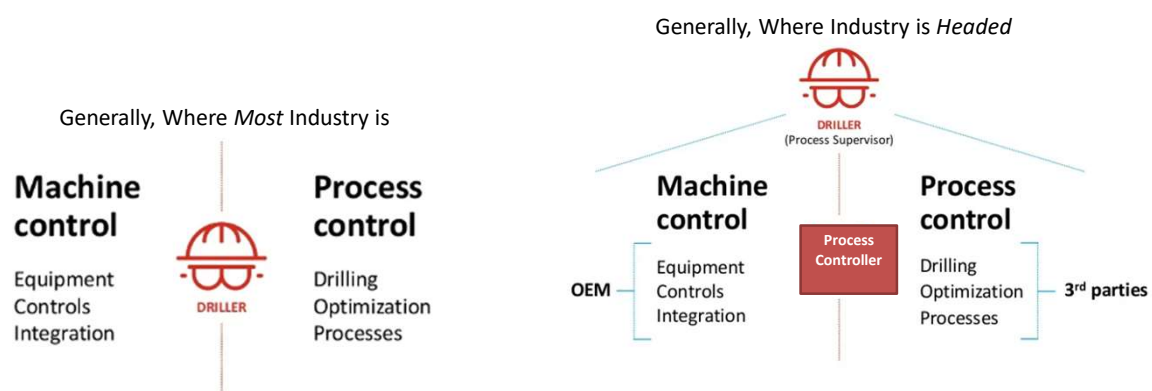
SAE J3016_202104

Taxonomy & Definitions for Terms Related to Driving Automation Systems

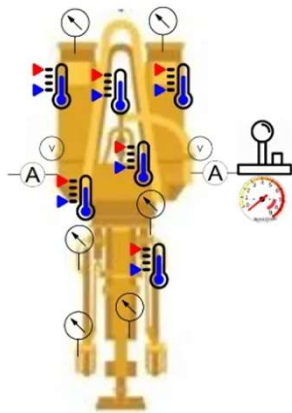


Source: J3016_202104 Figure-1

Process Automation Schemas



Machine Control- Process Automation

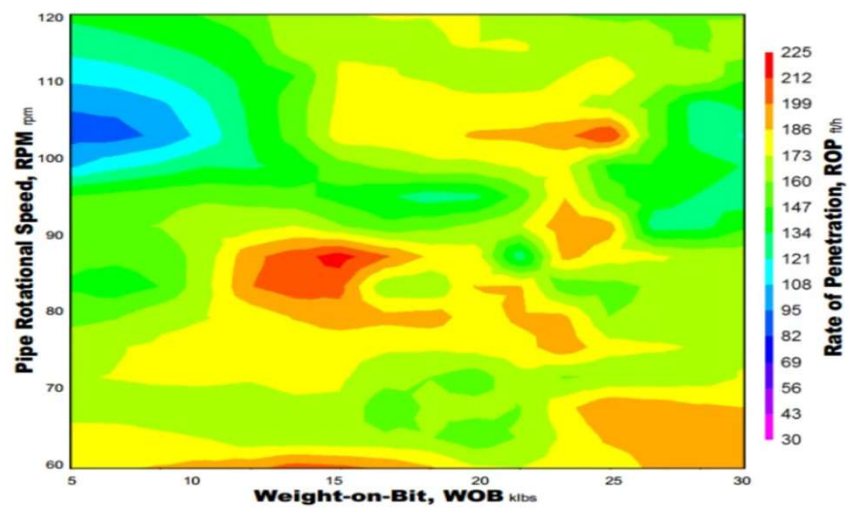


Source: Internet Open Domain Pic

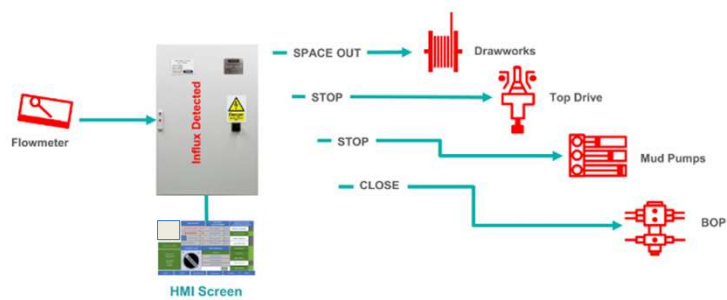
Process Rig Automation



AI Optimized Drilling - Task

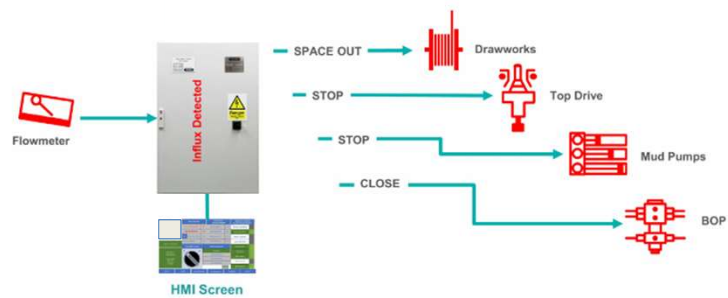


Automated Well Control - Task

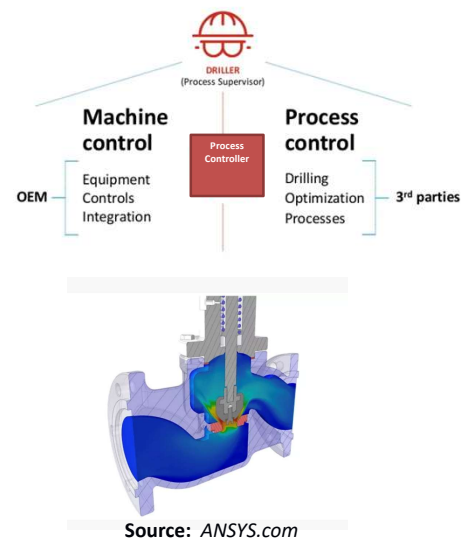


Source: www.safeinflux.com

Autonomous Problem – What is the process

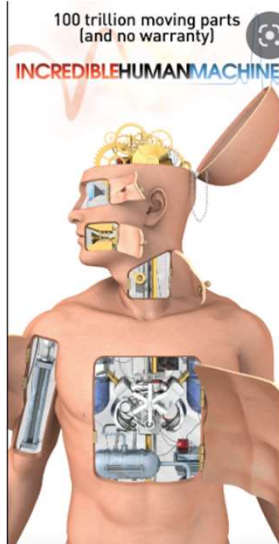


Source: www.safeinflux.com



Source: ANSYS.com

Human Machine Complex Example - TASKS

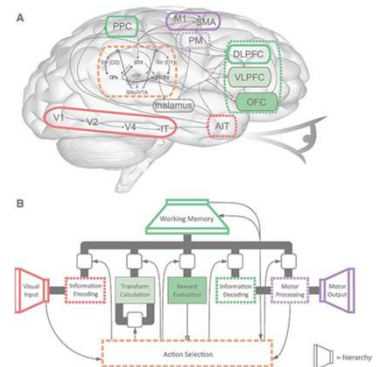


Source: National Geographic

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...



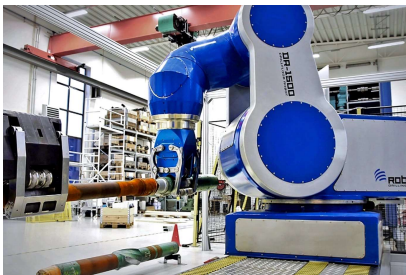
Source: By <http://nengo.ca/build-a-brain> - Chris Eliasmith, Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=26088844>

Logic Architecture vs. Cognitive Architecture

Examples of Integrated Mechanized - Process



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

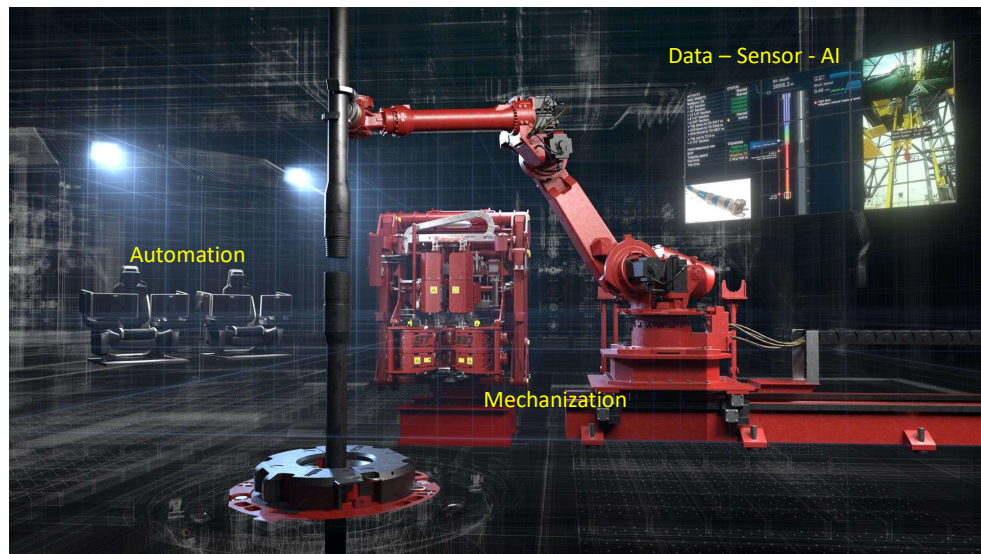


Source: Photo - Nabors



Source: NOV Prime1 Rig – STC Facility
NOV Presentation

Mechanized – Automated – Autonomous Systems



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.

Questions



Source: *Internet Open Domain Pics*