MultiKon - Concept for monitoring and control of multiple unmanned offshore facilities

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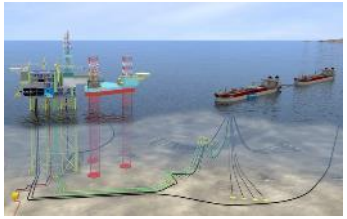
Background

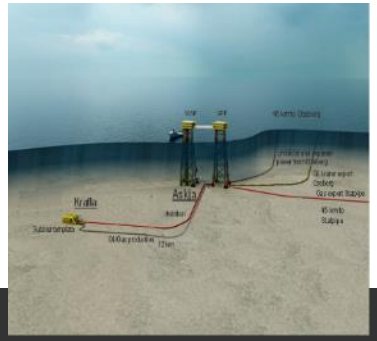
- Statoils first land based control center for remote operations is operational at Sandsli for Valemon
- Martin Linge (bought from Total) will be starting up onshore operations in 2019
- Future mix of normally-not-manned, limited-manned and un-manned concepts on the NCS
- The business case for remote operations will be associated with the number of facilities that can be controlled safely from one location with a proper production efficiency
- Various types of UWHP installations are built that are designed for unmanned operations
- Need to investigate and demonstrate how the new concept can be scaled towards multi-field operation from a single environment

Valemon VROP (2017)

Oseberg Vestflanken (2018)



Martin Linge (2019)



New unmanned concepts (2020->)

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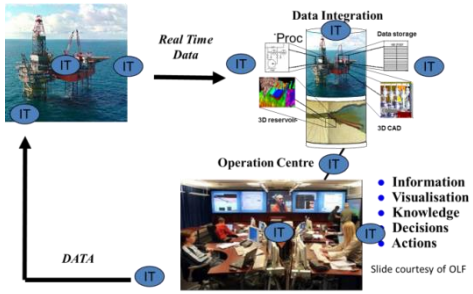
Statoil's digital roadmap

1. Digital safety, security & sustainability
2. Subsurface analytics
3. Next generation well delivery
4. Field of the future
5. Data driven operations
6. Process digitalisation & insight

Digital Center of Excellence

Digitalisation of the oil and gas industry



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Integrated operations

- Development of high capacity band-with and transfer networks
- Standardization hard/software platforms
- Convergence of computer technology and tele communication solutions into integrated collaboration tools
- Globalisation of the labour market and requirements to 24/7 operations that lead to new requirements to management and the work force

Big Data

- Data sets that are so large or complex that traditional data processing applications are inadequate.
- Challenges include analysis, capture, data curation, search, sharing, storage, transfer, visualization, querying, updating and information privacy
- Predictive analytics to extract value from data
- Accuracy in big data may lead to more confident decision making, and better decisions can result in greater operational efficiency, cost reduction

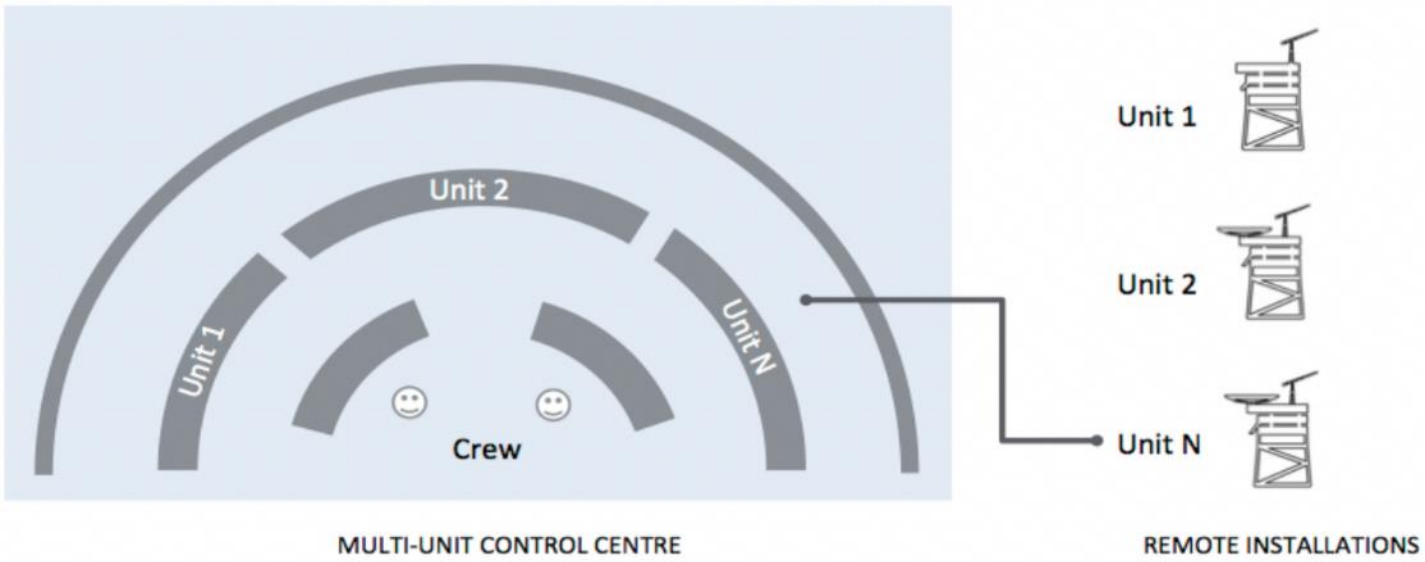
Internet of things

- Network of physical objects that enables these objects to collect and exchange data
- Physical objects can be sensed and controlled/ integrated remotely across existing computer/ network infrastructure.
- Each thing is uniquely identifiable through its embedded computing system but can also interoperate within the existing Internet infrastructure

Social media

- Development of online social networks by connecting a user's profile with those of other individuals and/or groups
- Interactive platforms through which individuals, communities and organizations can share, co-create, discuss, and modify user-generated content or pre-made content on the WWW
- Operate in a dialogic setting, many sources to many receivers

R&D Scope of work: Remote operation of several installations from one onshore control centre



- The project shall identify the necessary conditions to maintain a safe and efficient operation of unmanned facilities from one control center.

Deliverables:

- Guideline and concepts for setting up multiple control onshore control centers with new HMI's

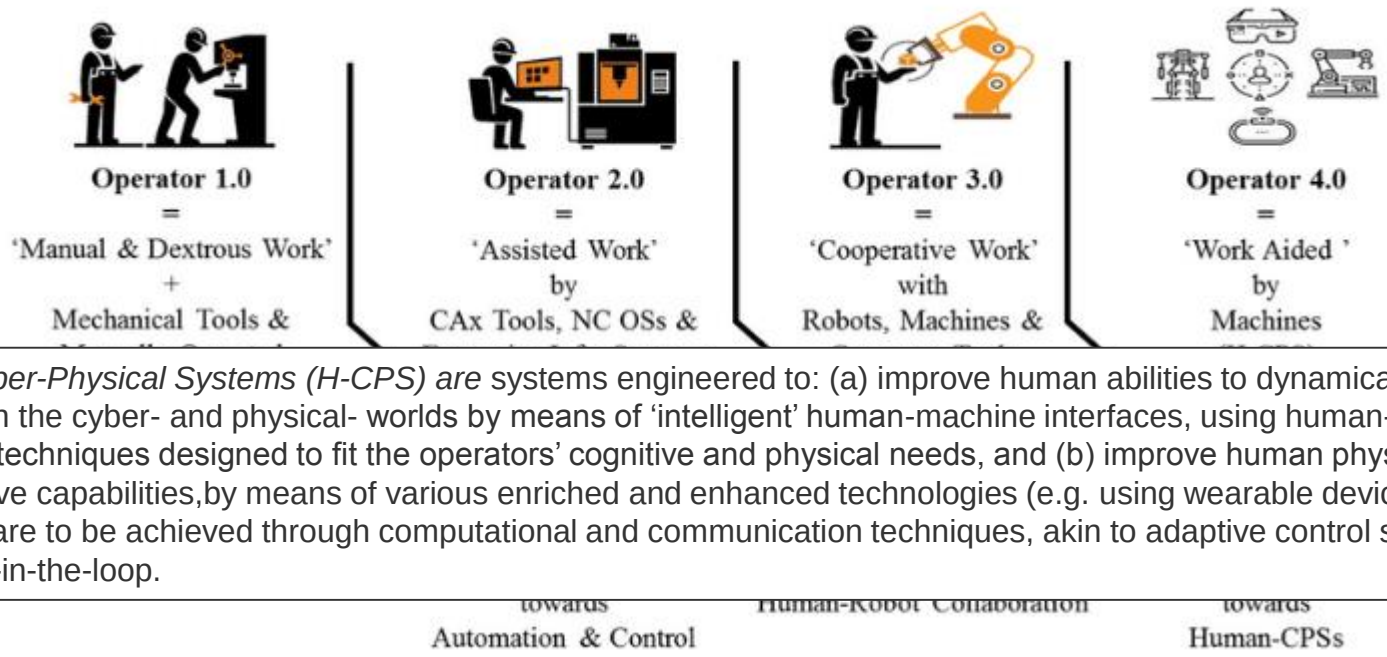
- Through more efficient work spaces, procedures, training and process simulators one aims to improve the capability to operate, monitor and respond from several processes/platforms at the same time

MultiKon research questions

- How can operators maintain an overview of multiple units that are in different process states?
- How can operators transition smoothly between roles and tasks when they work on several units simultaneously?
- Could operators confuse units under high task demand and/or time pressure? If so, how can we avoid this?
- How can the operators handle multi-unit disturbances? What should be the design basis centre capacity related to such events?
- How many units should be operated from a single operation centre, and in which circumstances?
- Under which circumstances should control be handed over to offshore crews (partially or fully)? How can we avoid confusion about who is in control?
- How much ”local” unit knowledge and experience should be required for operators in remote control? E.g. could an operator who has never physically been on the unit be expected to solve complex problems? When does such operators need expert assistance? How is this provided?
- What kinds of HMI tools are critical to multi-unit operation? Is it for example sufficient simply to move existing HMIs on-shore, or are there additional needs/requirements related to remote and/or multi-unit operation, such as aggregated alarm-views?

Operator 4.0

A smart, skilled operator who performs not only cooperative work with robots but also aided work by machines as and if needed by means of human cyber-physical systems, advanced human-machine interaction technologies and adaptive automation towards achieving human-automation symbiosis work systems”



Human Cyber-Physical Systems (H-CPS) are systems engineered to: (a) improve human abilities to dynamically interact with machines in the cyber- and physical- worlds by means of ‘intelligent’ human-machine interfaces, using human-computer interaction techniques designed to fit the operators’ cognitive and physical needs, and (b) improve human physical-, sensing- and cognitive capabilities,by means of various enriched and enhanced technologies (e.g. using wearable devices). Both H-CPS aims are to be achieved through computational and communication techniques, akin to adaptive control systems with the human-in-the-loop.

Research gate

Romero, et al (2016) The Operator 4.0: Human Cyber-Physical Systems & Adaptive Automation Towards Human-Automation Symbiosis Work Systems

Unmanned production platform (UPP)?

- A smaller production platform with a simple process facility
- Built without control room and living quarter
- Fewer systems and simplified equipment compared to traditional facilities
- Is unmanned most of the time (i.e. 8 months)
- Few maint. Hours (2-3000) and built for campaign based maintenance
- Operated from onhore or existing offshore control room depending on process integration and existing infrastructure
- Visit by special purpose vessel (SOV)with walk-over bridge
- For small marginal fields and a substitute to subsea field developments
- Statoil is developing UPP-jackets (100 m sea depth) but also doing work with floating UPP's (400 m) that can open up the Barents and the Norwegian Sea for such developments

Example UPP og SOV

- Oseberg Vestflanken
- Topside 1100 tons, (Valemon 10000 tons)

- SOV Esvagt Njord UK vind operations

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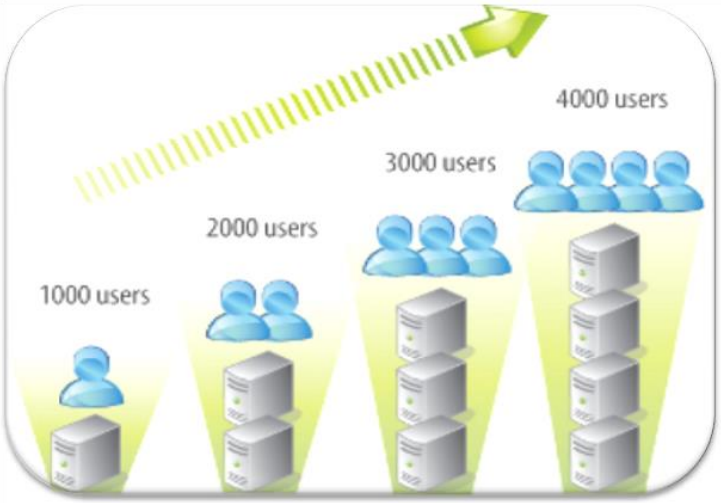
Scalability and replicability



SCALABILITY

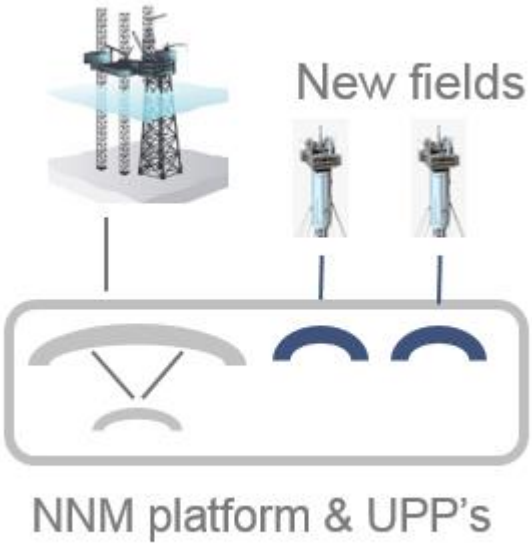
The ability of a system to change its scale in order to meet growing volumes of demand.

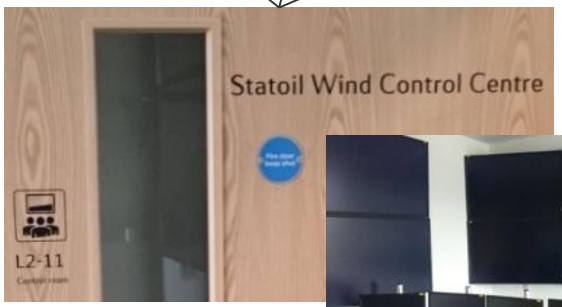
REPLICABILITY

The property of a system that allows it to be duplicated at another location or time.

http://www.grid4eu.eu/project-demonstrators/general-work-packages/gwp3-scalability-and-replication.aspx

Scalability and replicability



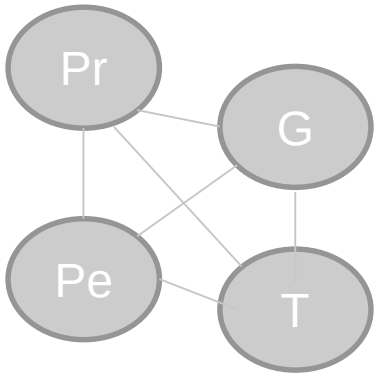


UK wind operations (2018)

- Operate and control UK wind operations from Great Yarmouth

Scalability of remote operation is an aligned configuration of four resources/capabilities

- **T**echnology: Buildings working environments, facilities, plants, pipelines, sensors, equipment and systems, automation, IT and communication, HMI software/algorithms and data
- **Pr**ocess: Business processes - workflow, roles and responsibilities, and collaboration
- **Pe**ople: Skills, competence, experience, leadership, training and all other soft people issues
- **G**overnance: Organization, positions (decision rights), location of resources, business structure, internal/external sourcing, business model, contracts, agreements, rules, and regulations

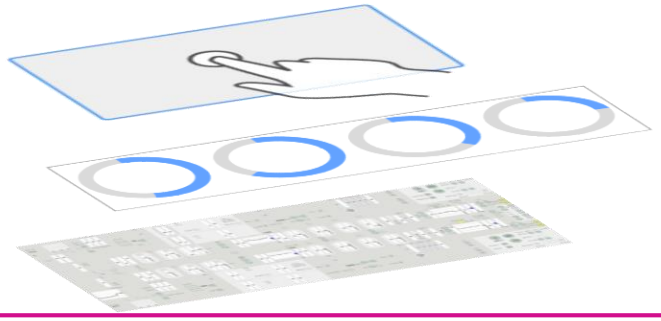


Configuration

Degree of homogeneity / heterogeneity important for scalability

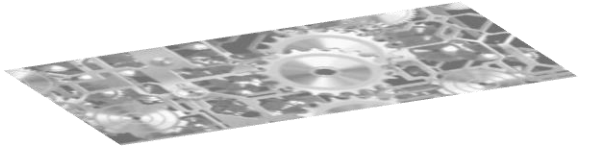
HMI

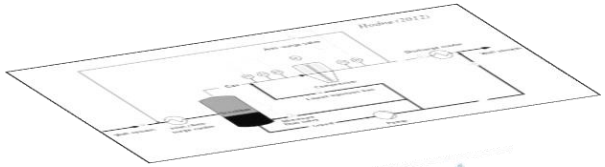
- Process information and control system
  - Alarm philosophy
  - Hierarchy, symbols, navigation
  - Interaction
  - Communication

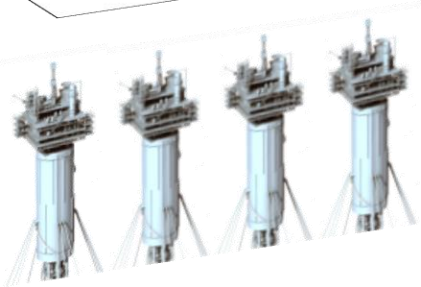


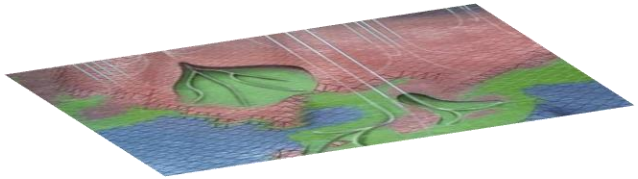
Unit (UPP)

- Automation
  - Autonomy
  - Monitoring (sensors) and logic
- Process
  - Separation, compression, gas dehydration
  - Flow assurance
  - Possible dependencies
- Installation
  - Power supply
  - Rotating equipment
  - Maintenance demands
  - Topside
- Reservoir and wells
  - Depth, area
  - Composition, volume, pressure



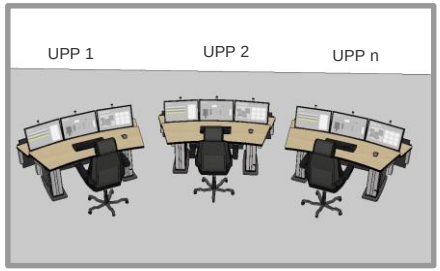




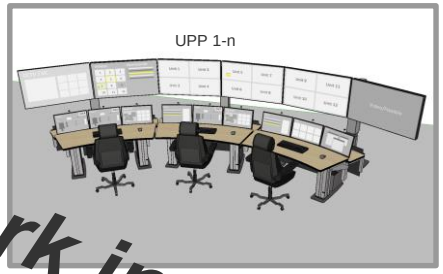


Exploring control room and HMI concepts

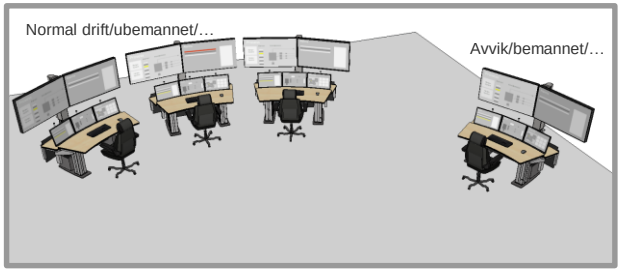
1. Separate HMI pr UPP



2. Integrated HMI for all UPPs



3. Functionally organized HMI: Different sones

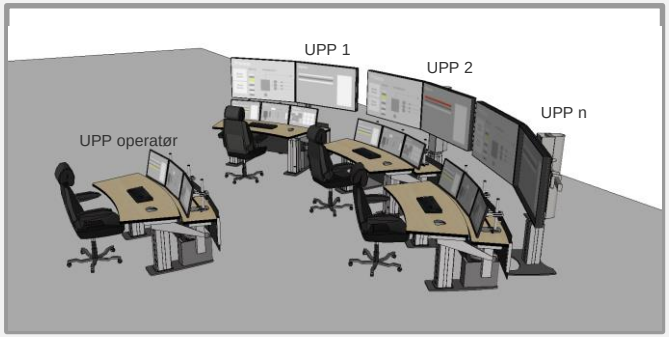


Mulig å skille ut enhet(er) ved behov. Dele arbeidet, der noen sørger for overvåking av enheter i "normaldrift", mens andre fokuserer mer eksklusivt.

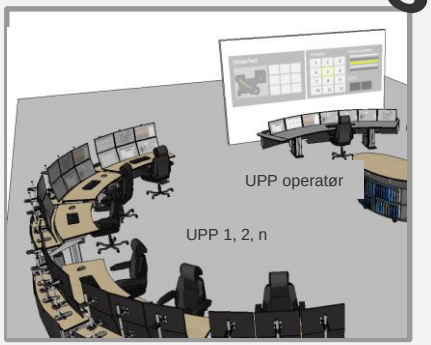
Work in progress

Variants and combinations

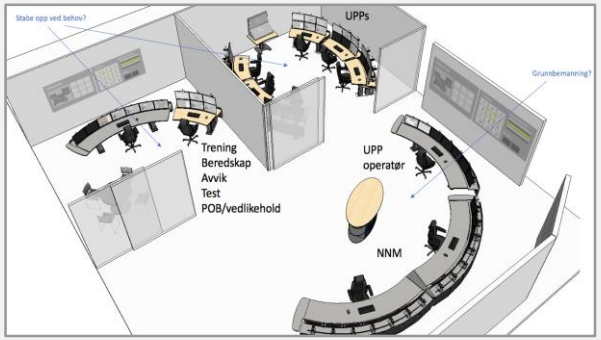
A. Operatør holder oversikt fra avstand. Går til hver enkelt for å styre?

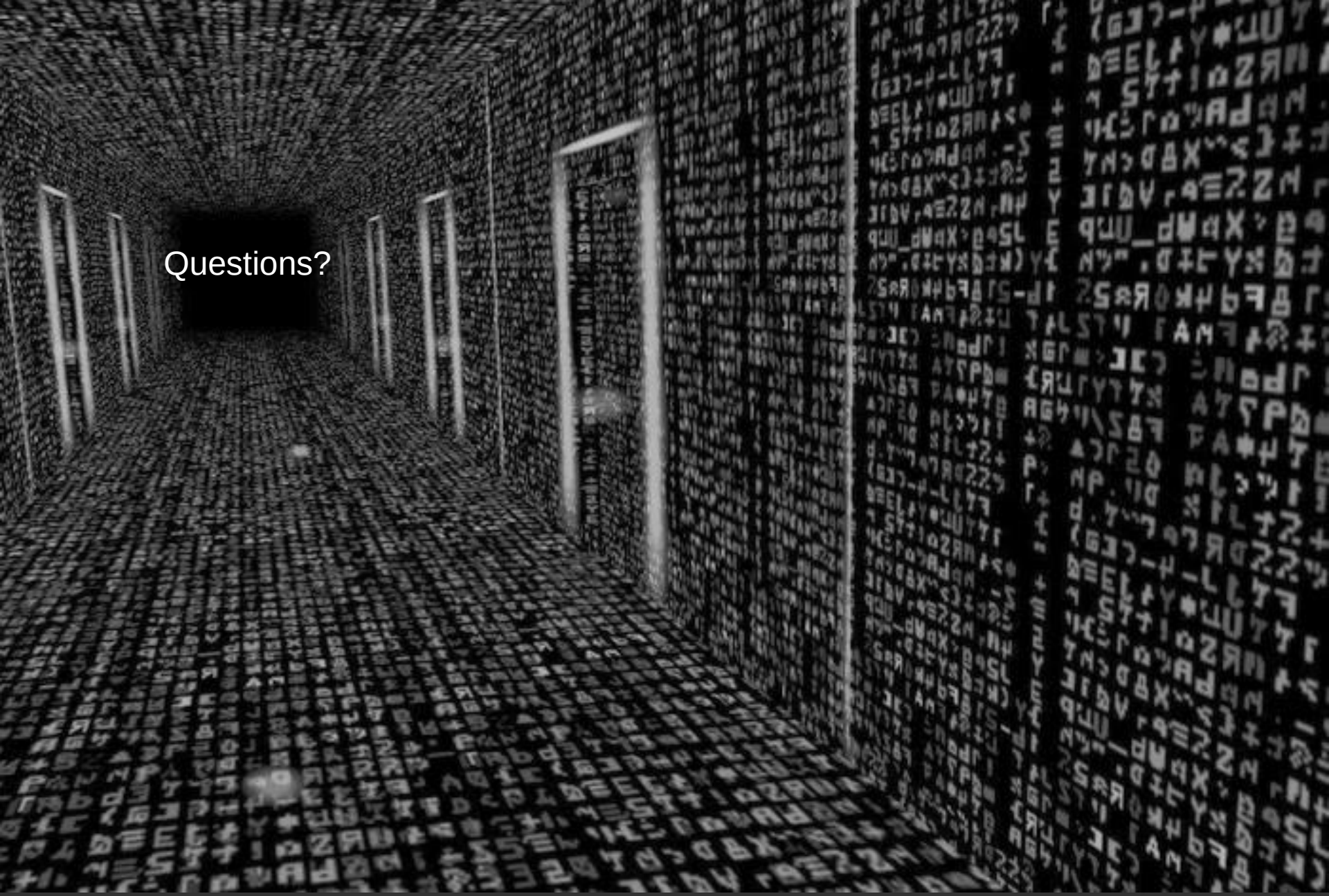


B. Operatør normalt fysisk separert fra UPP-nes HMI (egnet for å samkjøre med andre roller/oppg…



C. UPP operasjon som del av større kontrollmiljø.





Statoil. The Power of Possible

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