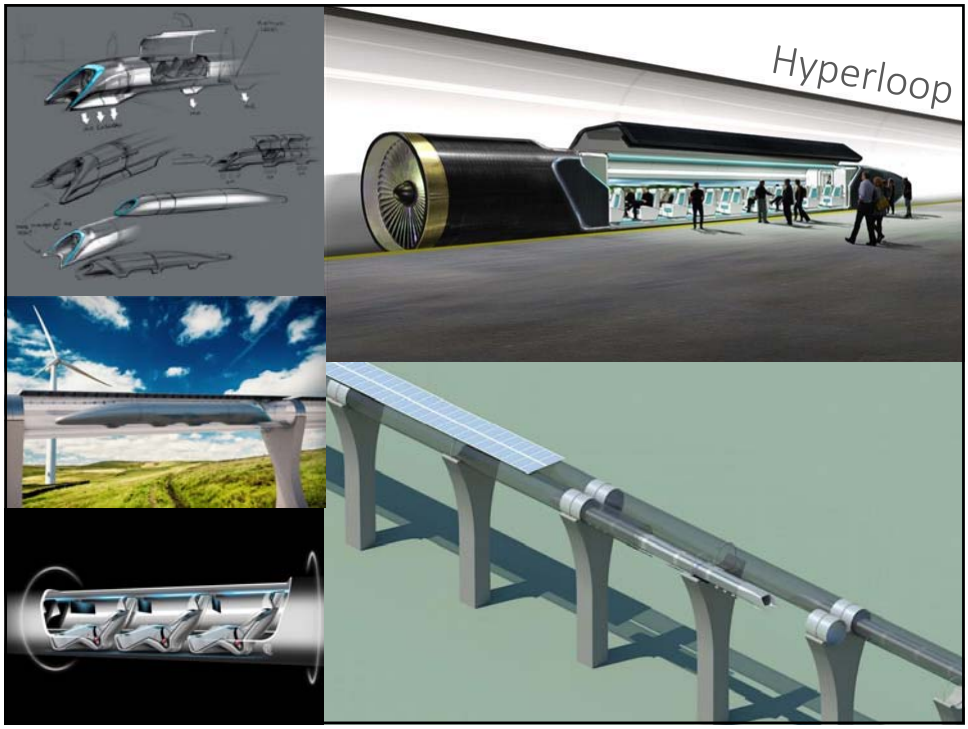
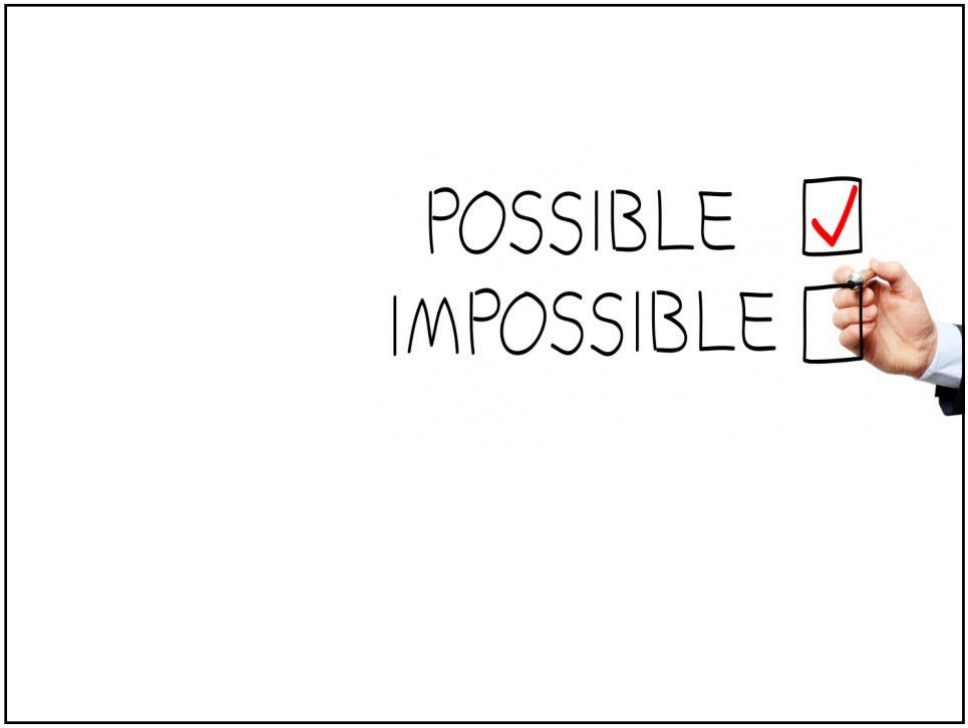
The use of feasibility studies in early design

Gyrd Skraaning jr.


Hyperloop


POSSIBLE
IMPOSSIBLE

Technically feasible?

Economically feasible?

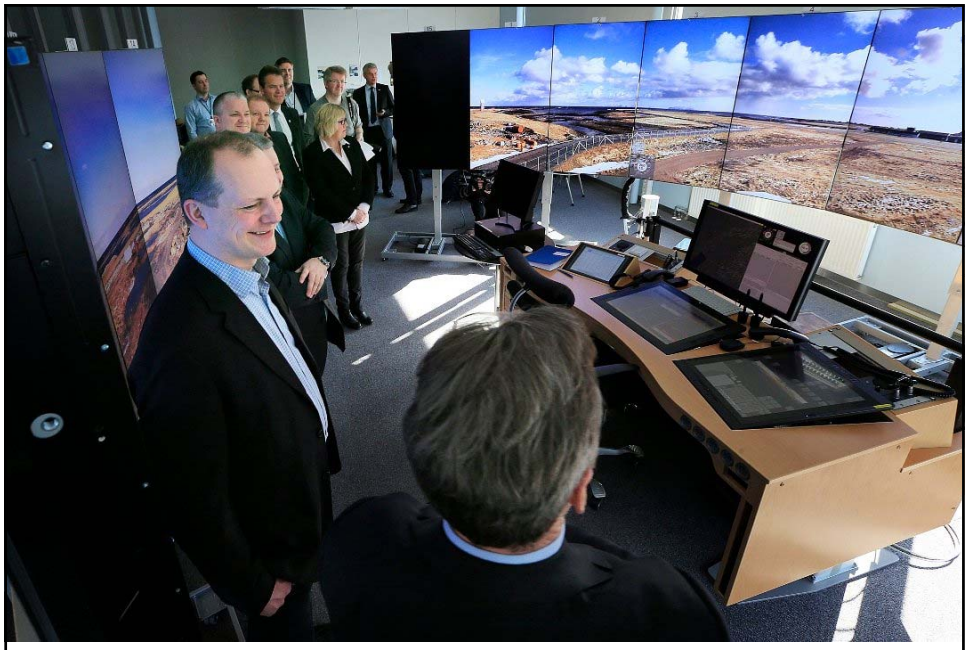
Legally feasible?

Operational Feasibility

- ✓ new levels of automation
- ✓ new ways of working
- ✓ new operator roles
- ✓ new HMI tools
- ✓ new skill-sets
- ✓ new teams
- ✓ new rules
- ✓ new risks

ATM Remote Tower Concept

Conventional Tower



Remote Tower

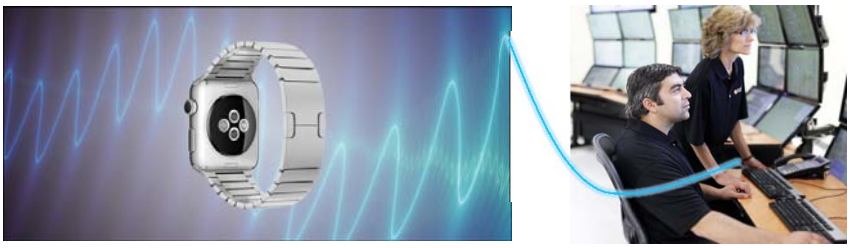
What is a Feasibility Study?

Evaluation of new design concepts

- should we, or should we not develop a new concept further?
- assess the usefulness of early design ideas

Example

Can we use haptic feedback to protect against confusion of plant units in Small Modular Nuclear Reactors?



Product development process

Conceptual design → Technical development → Implementation

Concept of operations | Rapid prototyping | Working prototype | Design iterations | Specification | Final design

Feasibility vs. Usability

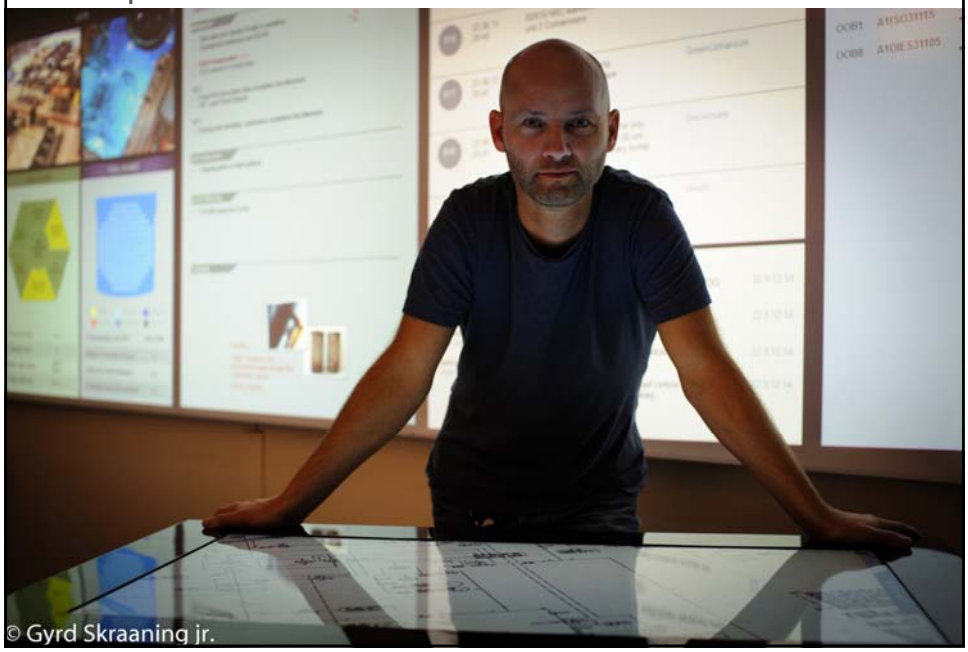
- computer
- ultra portable
- touchscreen
- long battery life
- instant on/off

- A prototype is just one possible manifestation of the design idea
- Usability of prototypes cannot express the feasibility of an idea
- Usability of early prototypes are not representative of the final product

Tablet prototype – 1980s

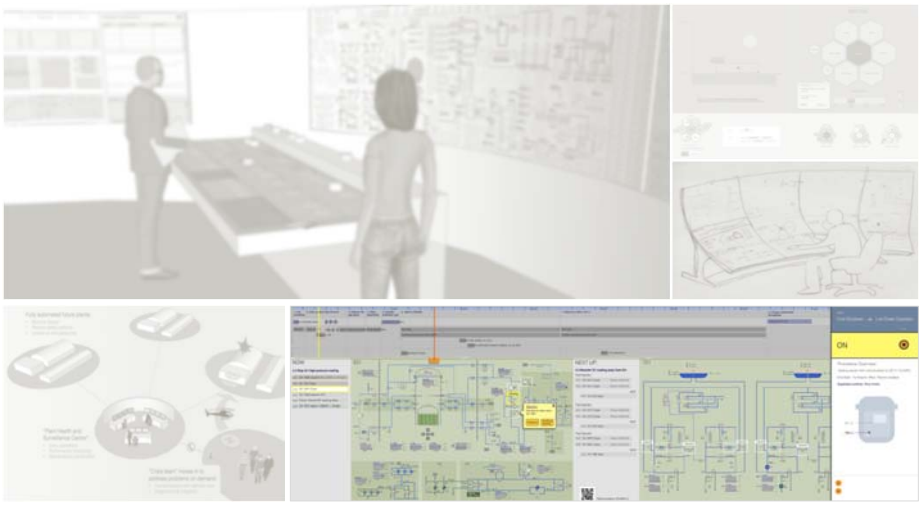
Mature product

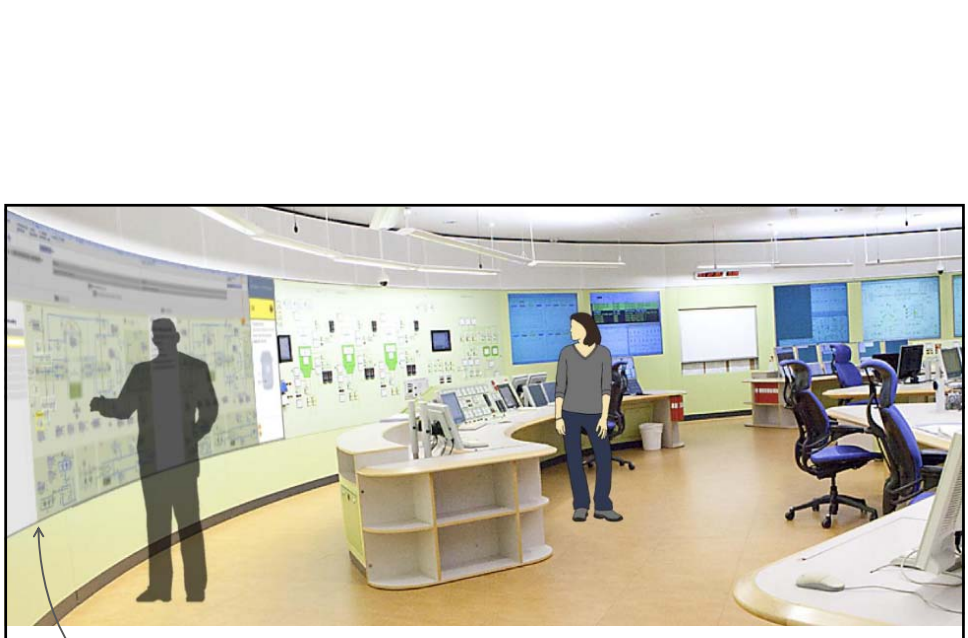
Examples from IFE FutureLab



Prototypes

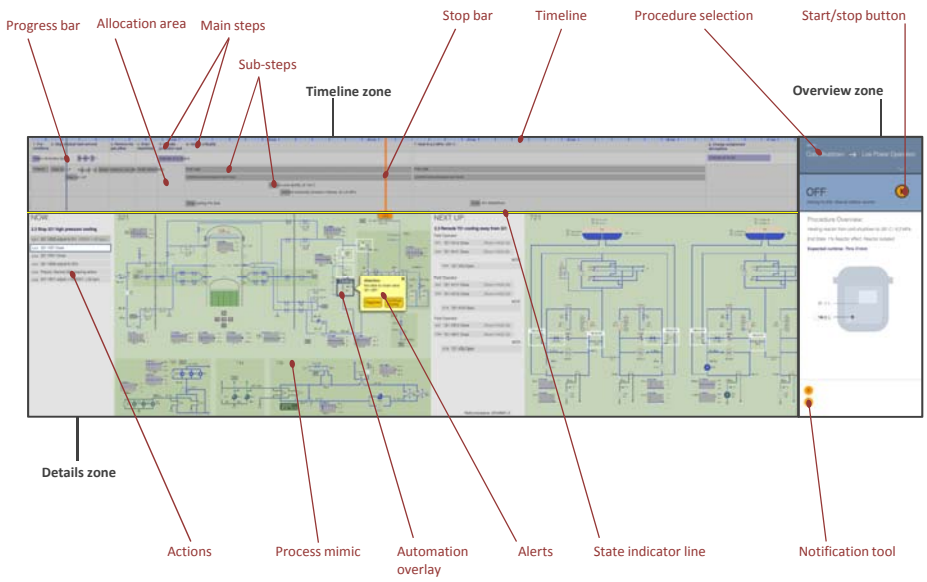
Prototypes





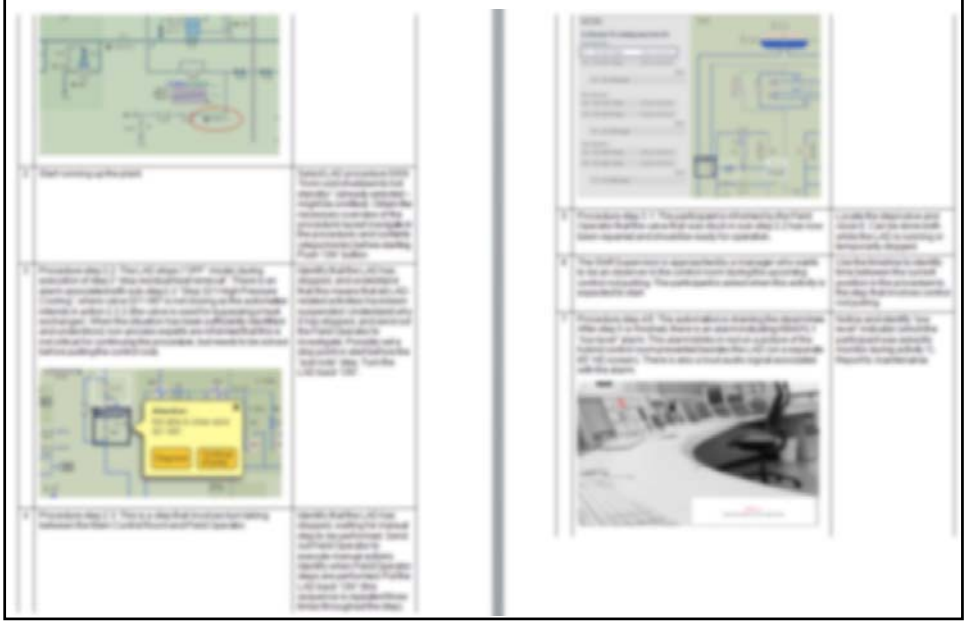
Large Automation Display (LAD)

- enhance human-automation collaboration in highly automated plants
- could be retrofitted to existing control rooms


Progress bar
Allocation area
Main steps
Sub-steps
Stop bar
Timeline
Procedure selection
Start/stop button
Timeline zone
Overview zone
Details zone
Actions
Process mimic
Automation overlay
Alerts
State indicator line
Notification tool

(LAD video)

8 participants in realistic use-case

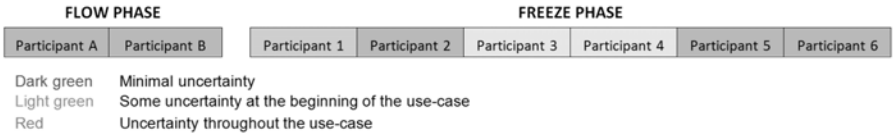


Adaptation to new operator role

FLOW PHASE		FREEZE PHASE					
Participant A	Participant B	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6

Dark green	Minimal uncertainty
Light green	Some uncertainty at the beginning of the use-case
Red	Uncertainty throughout the use-case

Adaptation to new operator role



Dark green — Minimal uncertainty
Light green — Some uncertainty at the beginning of the use-case
Red — Uncertainty throughout the use-case

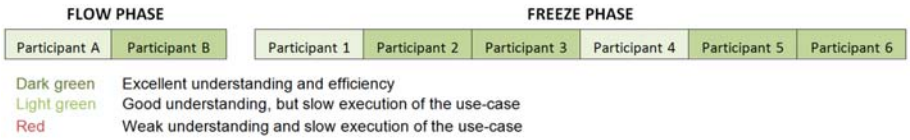
prototype design, use-case and laboratory set-up evolve progressively through trial runs with 2-3 participants

Adaptation to new operator role

Dark green — Minimal uncertainty
Light green — Some uncertainty at the beginning of the use-case
Red — Uncertainty throughout the use-case

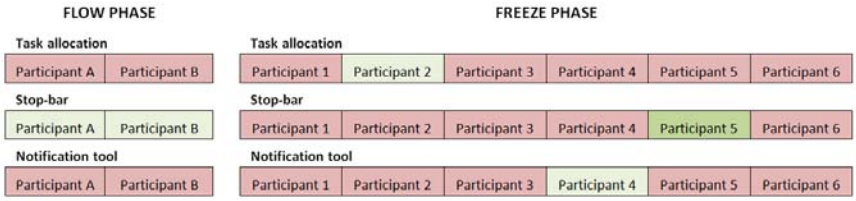
4-6 feasibility trials are executed with new participants under standardized conditions

Operation of the LAD



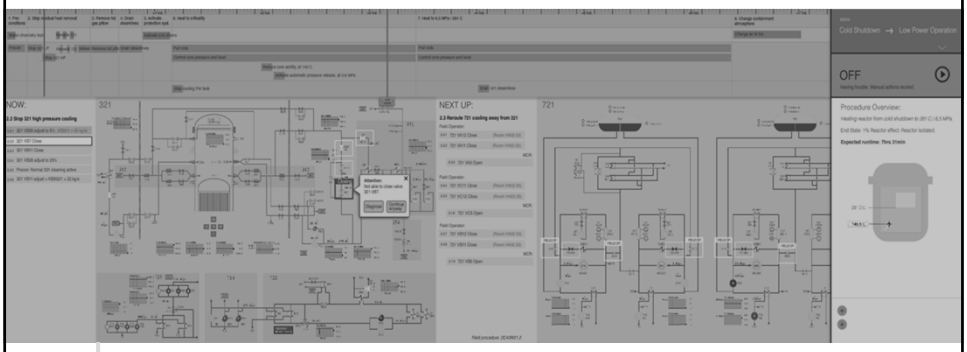
Dark green	Excellent understanding and efficiency
Light green	Good understanding, but slow execution of the use-case
Red	Weak understanding and slow execution of the use-case

Use of special features



Dark green	Used more than once
Light green	Used once
Red	Never used

Conclusion

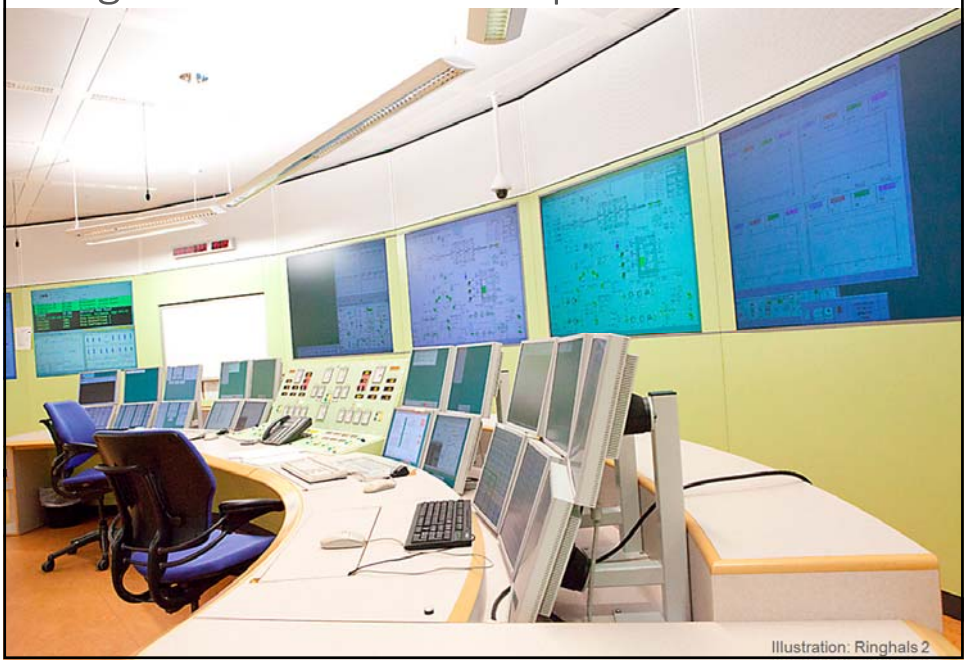


«The LAD is a feasible concept that can be taken further towards technical development»

Prototypes

The PlantPanel

Fragmented view of the process



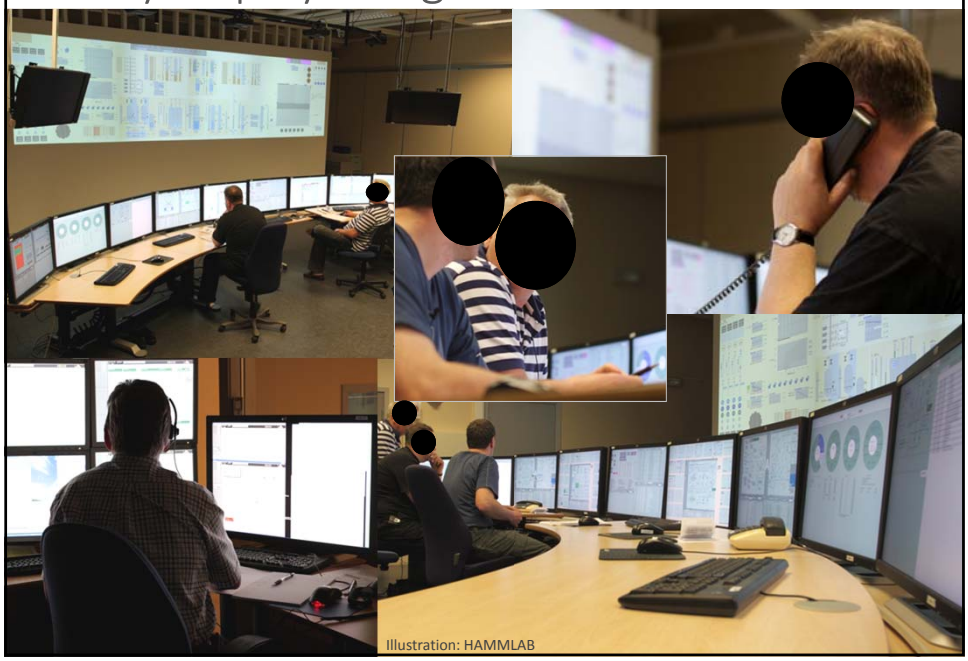
Inconsistent design philosophy

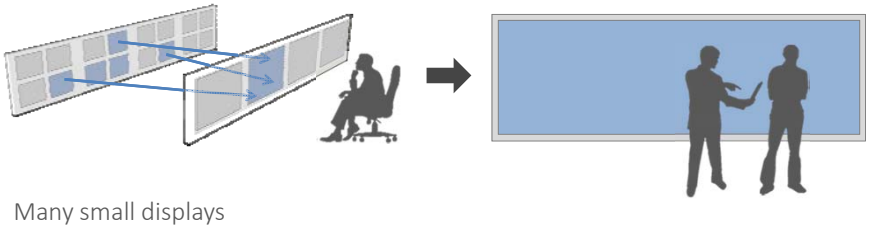
Illustration: TVO/Markku Korpi-Hallila

Poor team transparency

Illustration: AP1000 simulator

Heavy display navigation





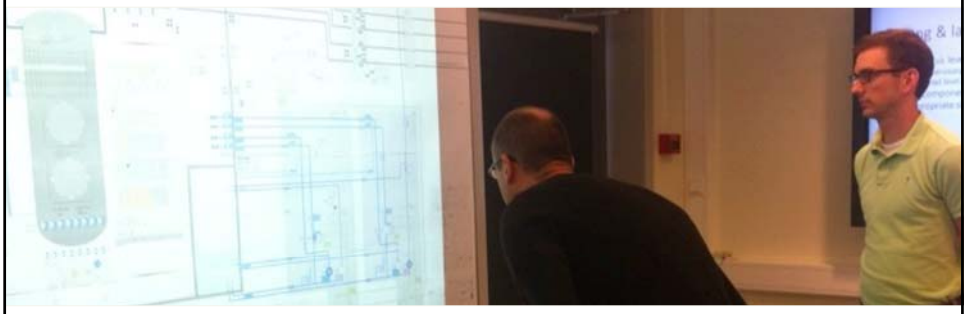
- Many small displays
- Fragmented view
- Heavy navigation

- Fewer larger displays
- Integrated views
- Less navigation

- Next logical step?

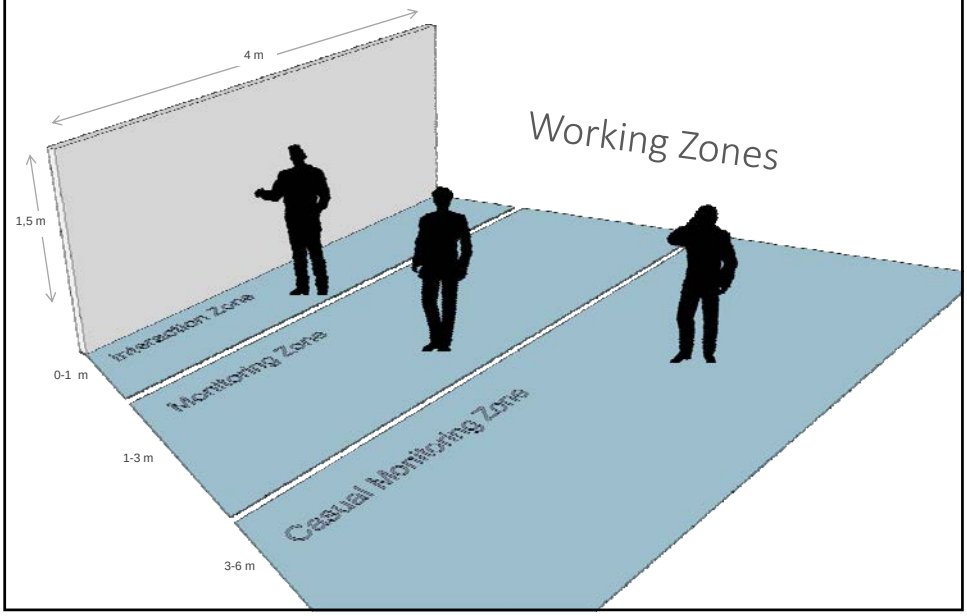
(Video PlantPanel)

Feasibility study



- 7 participants (mostly NPP process experts)
- Short use-cases

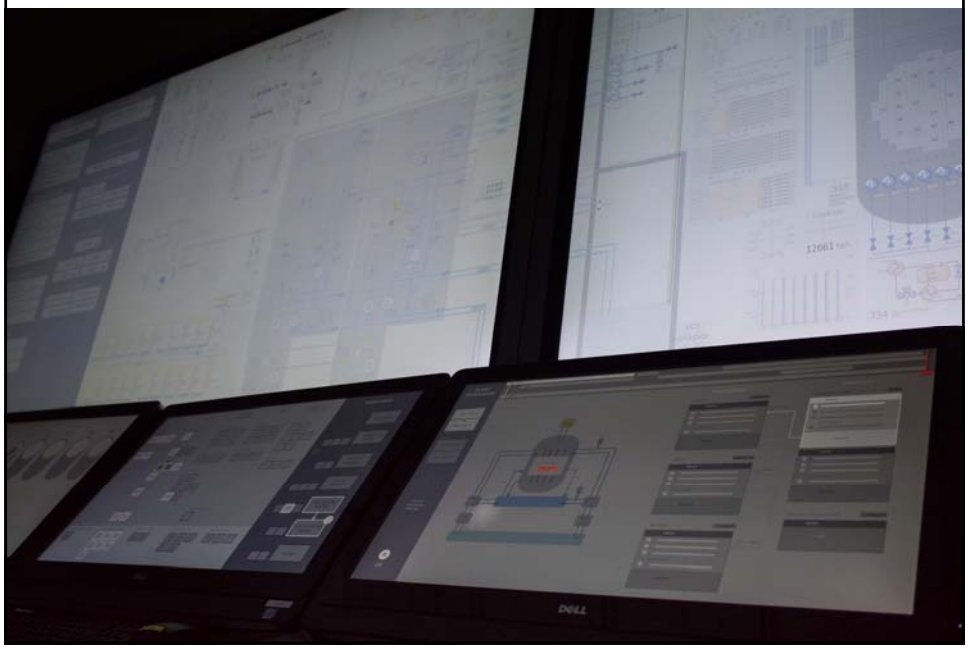
Moved back and forth shifting between overview and details/interaction



Findings cont.

- Participants positive to PlantPanel
- Process overview and collaborative aspects highlighted as particularly promising
- Some operators lost the overview when they worked close up
- Feasible design idea

Integrated concept



Conclusion

Feasibility studies

- provide better justification of novel ideas than arbitrary preferences, technological trends and group think
- evaluate the potential of promising design concepts
  - before large investments are made
  - while the threshold for making substantial changes is still low

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