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FOR A SAFER WORLD

aware® Toolbox - safety related humane design in an automated environment

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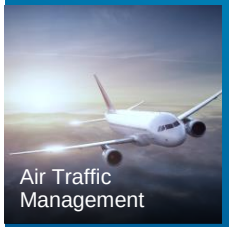
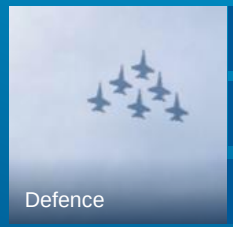
Safety Management & Control Room Consulting

Safety-Critical Organisations & Automation

What is common among these industries?





- Technological changes are often introduced
- High expectations toward improvement of workplace efficiency
- Every organisation has different business processes

- Most of them meet us in safety - critical projects ☺

24/7 high reliable service

Safety-Critical Organisations & Automation

What should the human do?

What should the machine do?

How should they work together and share the tasks?

Ironies of Automation

- ✓ Humans should not be included in systems because they are unreliable and inefficient
- ✓ Automated systems are implemented because they can perform better than the operator

How is function allocation done?

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70 years of experience in safety critical Control Rooms

Usability needs Understanding

All safety critical control rooms have the same demand

- Surveillance
  - Make yourself a picture of the situation beyond line of sight
- Workflow Support
  - Understand what the desired target situation is
  - Understand where you are on your way to get there
  - Understand what are the next step(s) to achieve the target situation
- Communication
  - Keep contact to the outside world
  - Communicate your decisions to trigger actions

A control room without communication is meaningless!

Our Cornerstones & Differentiators

Advanced Situation Awareness

- Where are my resources, what is the status quo?
- What is the desired end-result, the “global optimum”?
- How big is the delta?

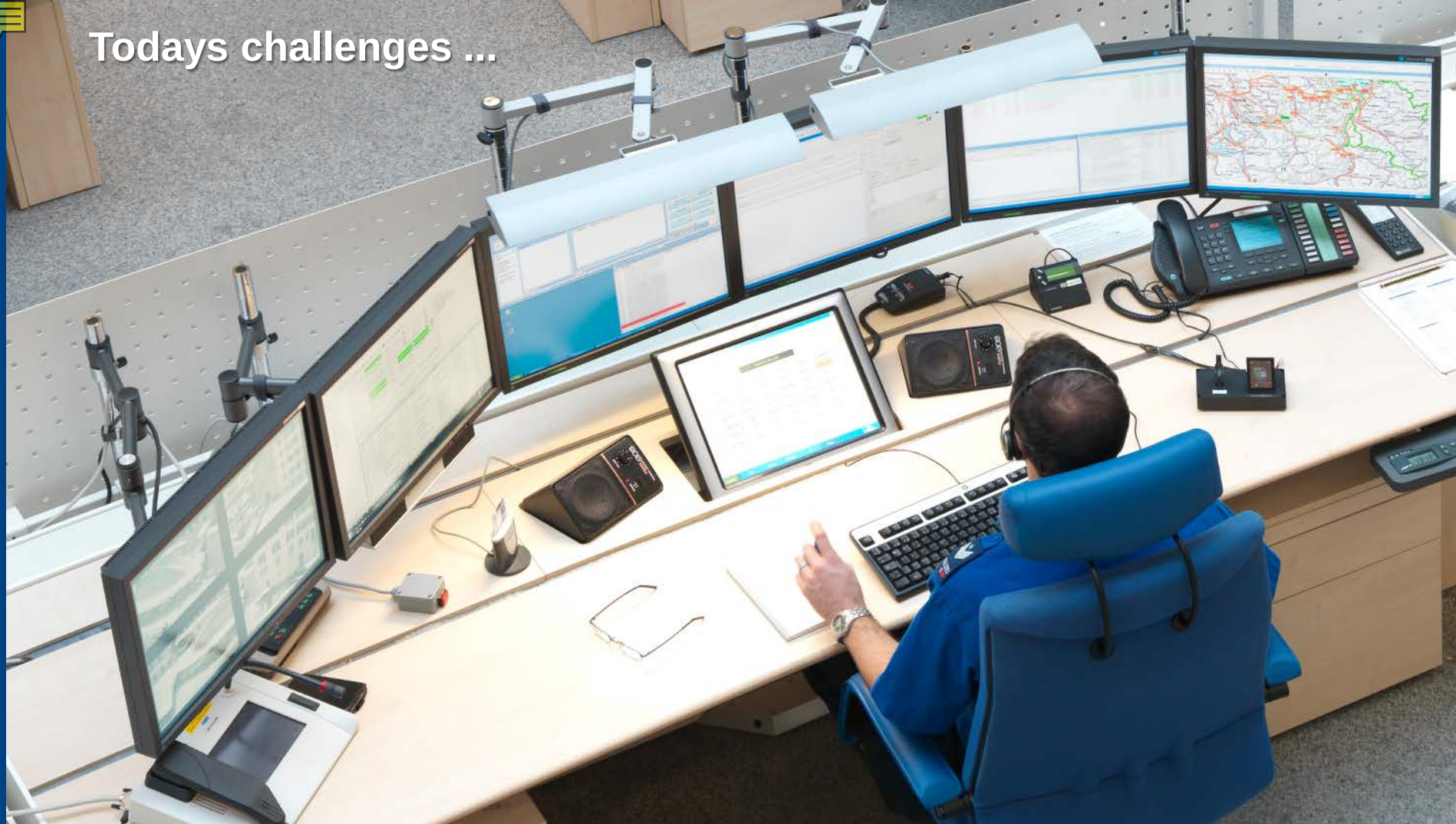
Decision Support

- How do I reach the desired end-result, the “global optimum“?
- What is the ideal next step to get me there?

Workflow Driven Communication

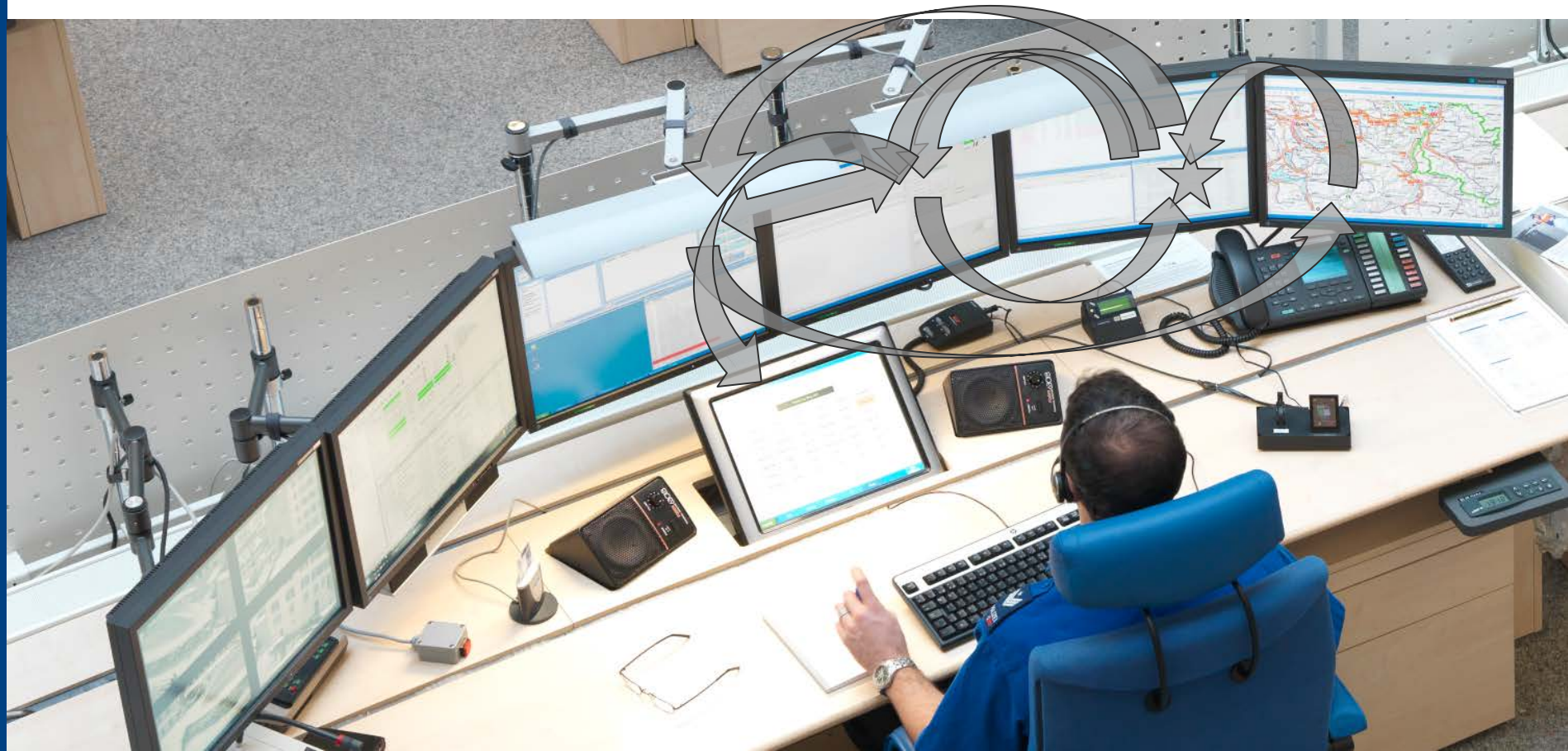
- How do I receive data?
- How do I communicate decisions?
- Embedded in the workflow with minimum cognitive need!

Todays challenges ...



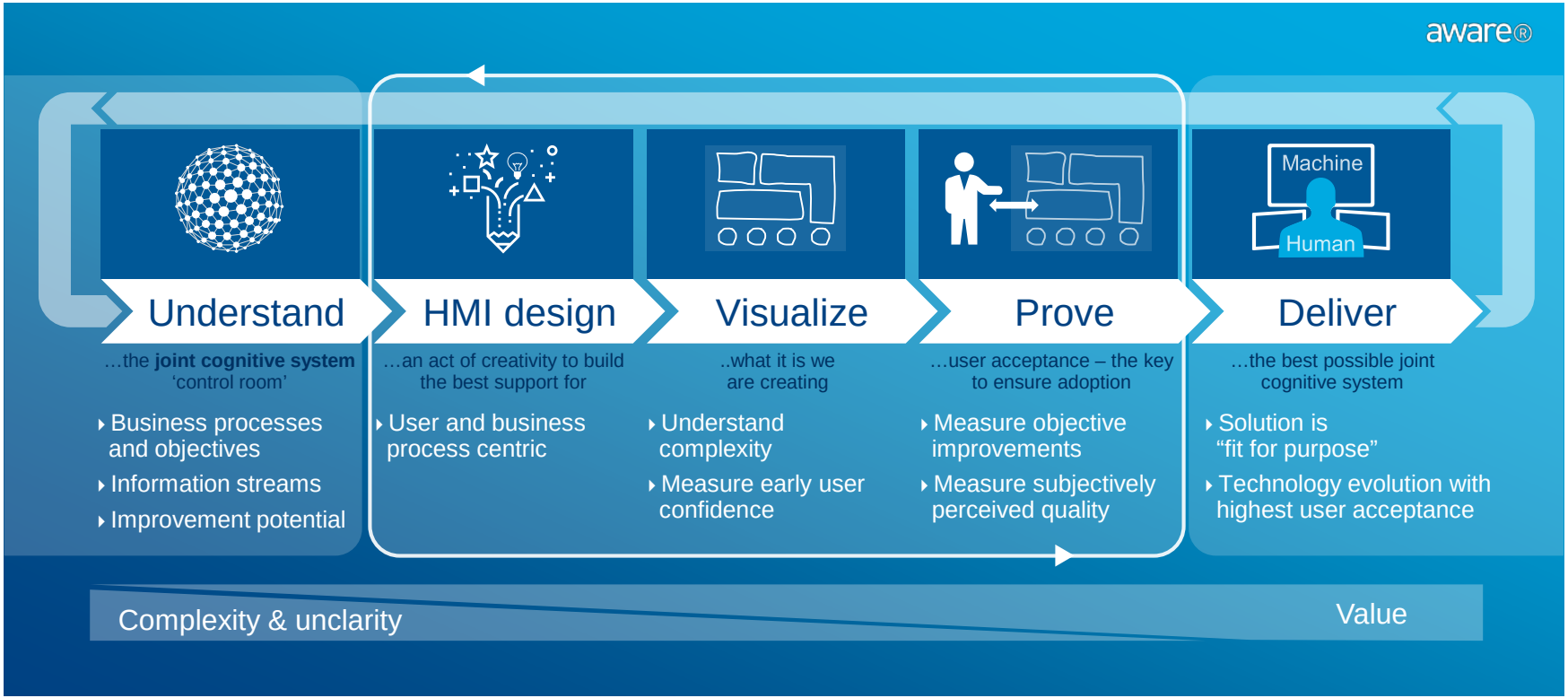
Information Flooding

What does it mean to support the workflow?



Easing digital transformation of the joint cognitive system ‘control room’

Control Room Consulting – *what do Users need to do the right thing*

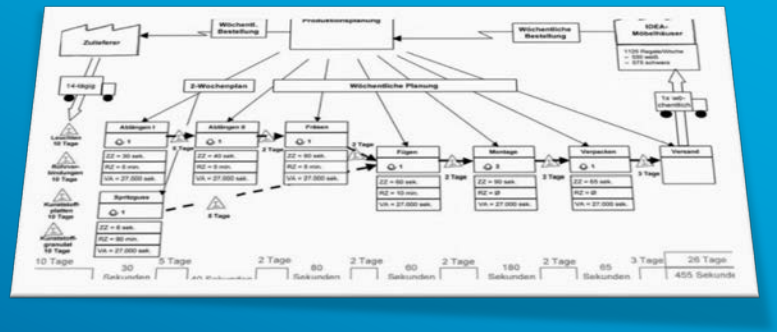


Understand

…the **joint cognitive system** ‘control room’

Information Stream | Value Stream – what's in it?

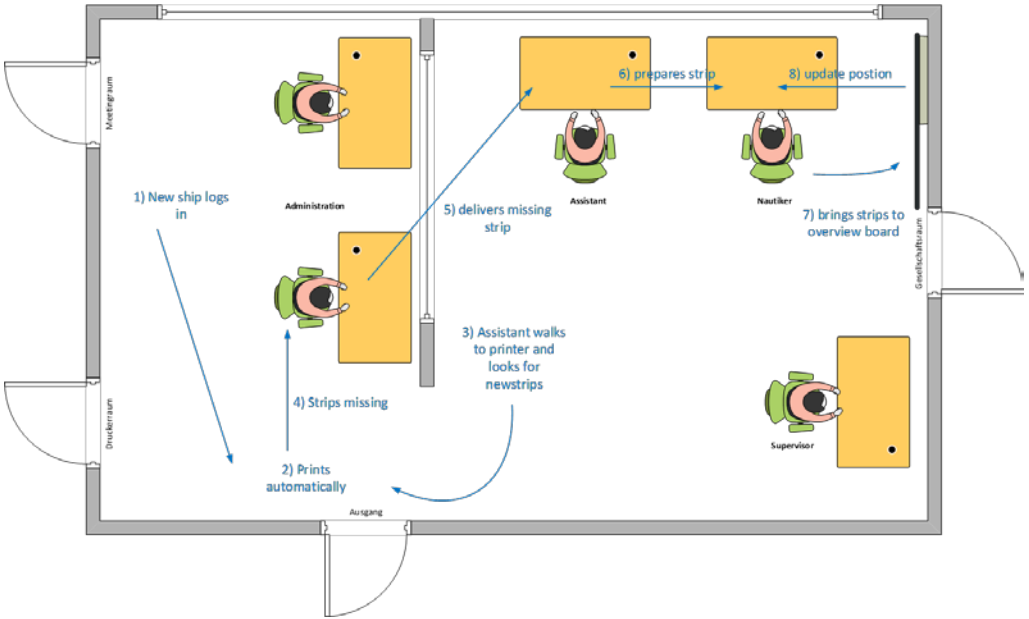
- Information stream analysis is a flow chart method for illustrating, analyzing and optimizing the process to produce and deliver a product or a service.
- To identify delays, any restraints, excessive inventory, in-efficiencies, etc. in the process.
- Reduce costs and improve quality of production and products / services.



It works for production processes as well as in control rooms

Information Stream Design – *mapping everything which counts*

Preparation – Context Analyses



Aim:

Get an overview of:

- working environment
- context of work
- systems in use
- Tasks (working routine)

How:

- Onsite survey
- User observation
- Contextual interviews
- Subsequent discussion / questionnaires
- Focusgroup
- Analysis and interpretation of the results

Recipe – how to

Identification & Scope

Understanding the Problem

- Definition of the Objectives and the (80/20) user scenarios to be examined
- Definition of KPIs

Capture actual process

Information Stream Mapping

- Capturing and mapping of the actual business process
- Visualization and description of the needed information streams

Analyze actual process

Information Stream Analyses

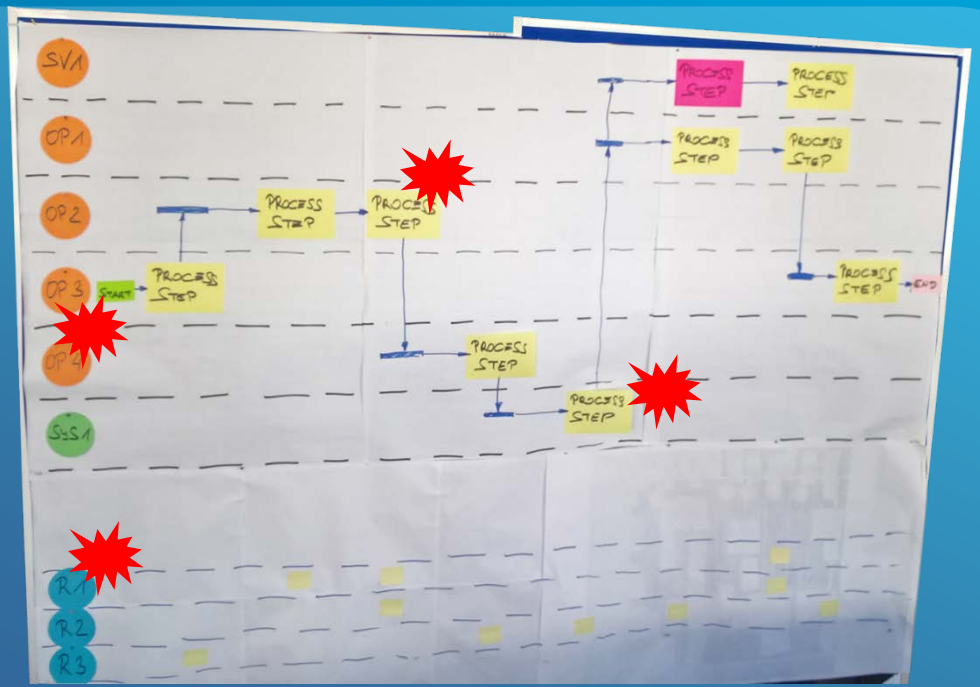
- Identification of strengths and weaknesses of the actual Information Streams
- Identification of gaps (Kaizen Flashes)

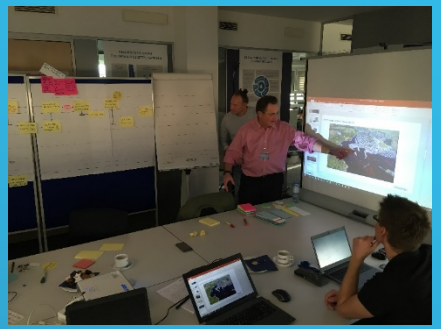
Optimize actual process

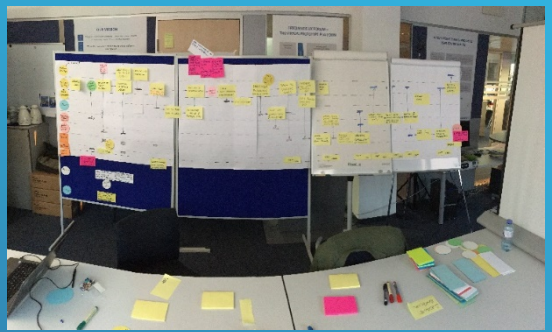
Information Stream Optimization

- Elimination of the gaps
- Design optimised business- and user-centric information stream

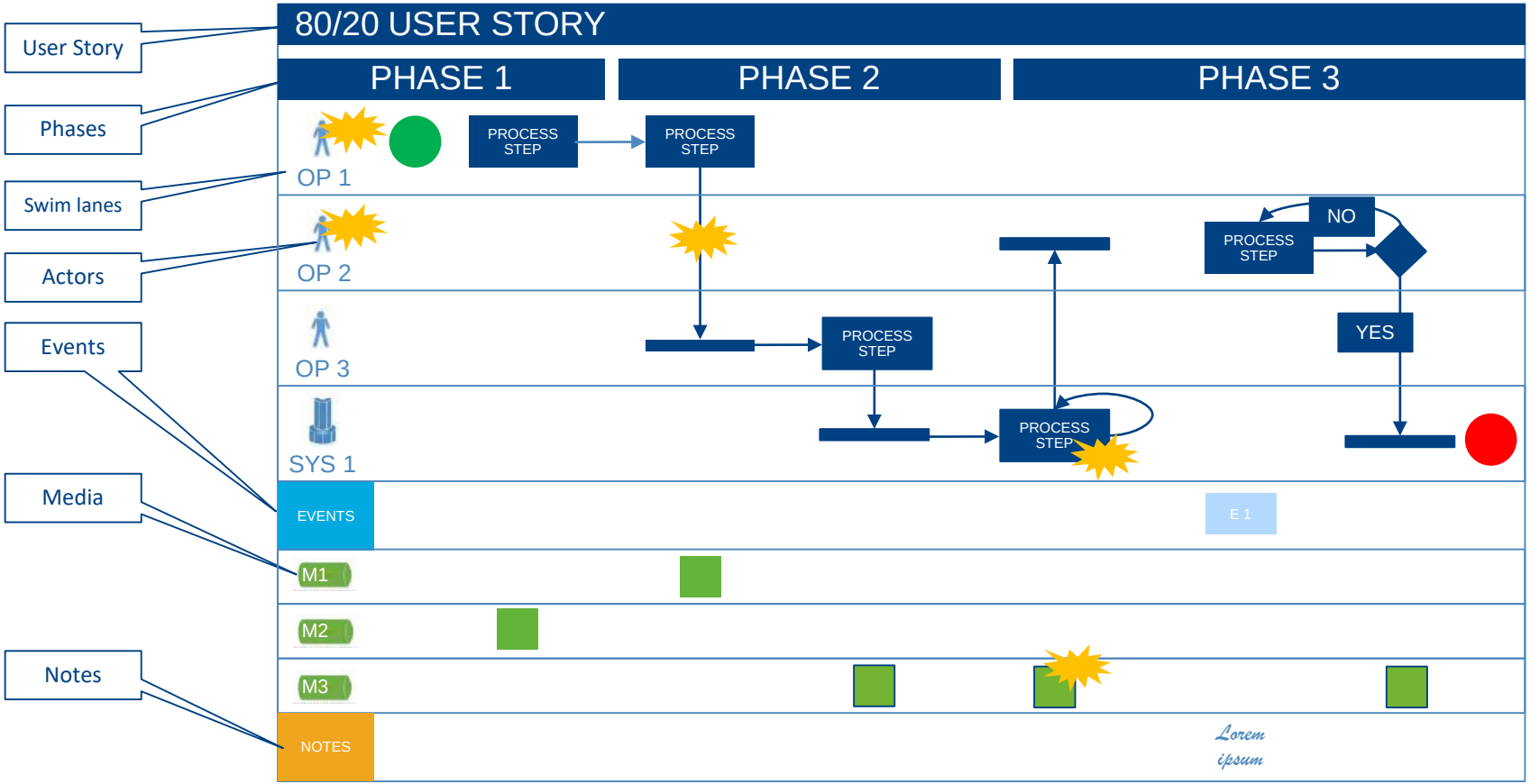
FRQ Information Stream Design Workshops







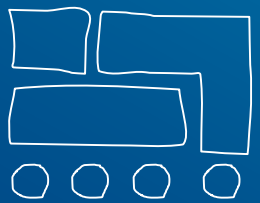
FRQ Information Stream Design



Design

…an act of creativity to build the best support

&



Visualize

...what it is we are creating

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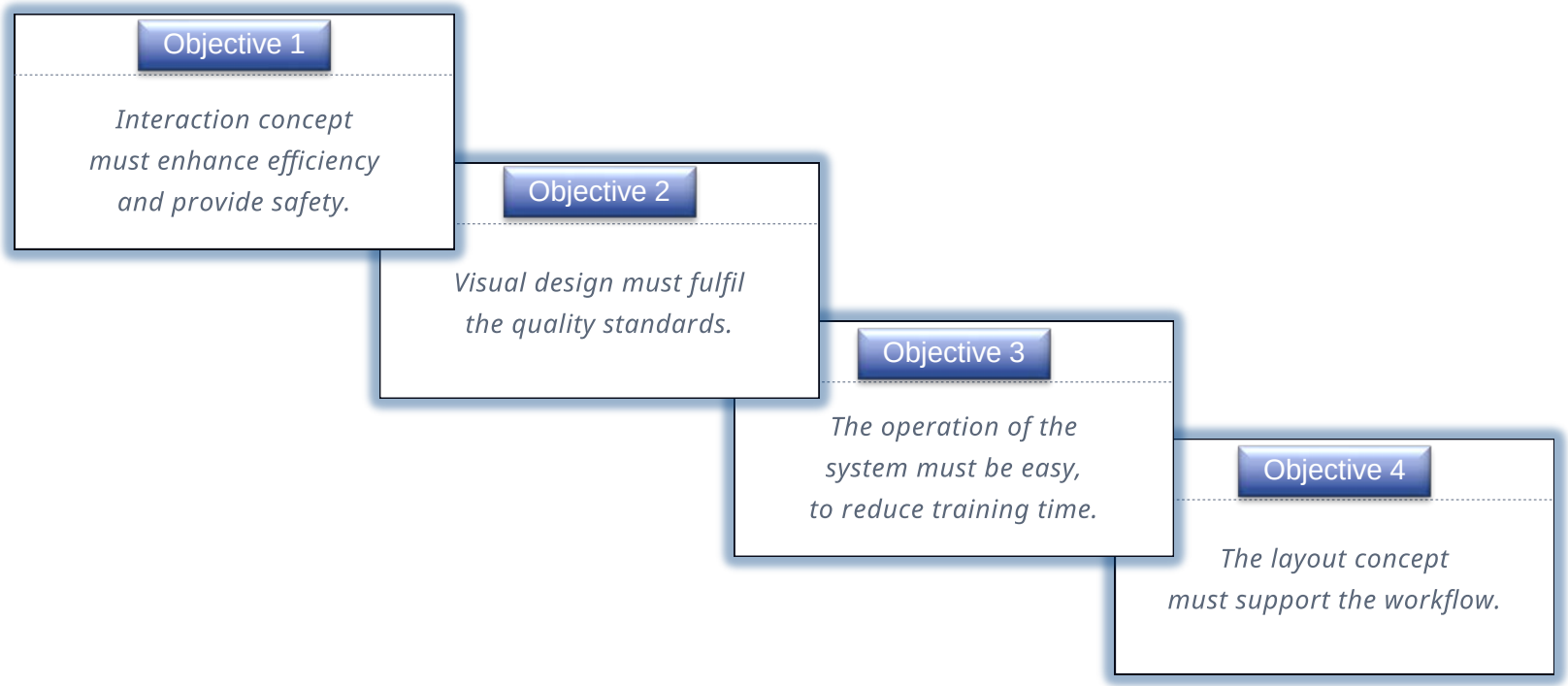
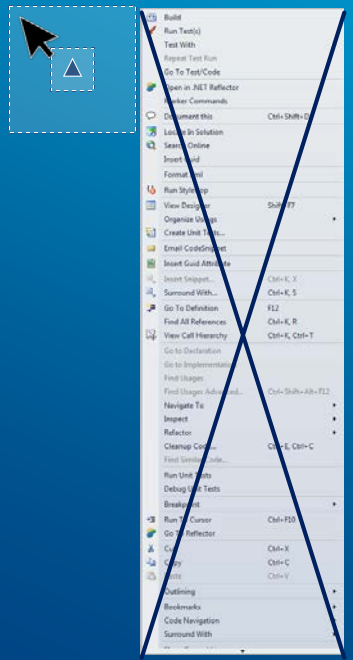
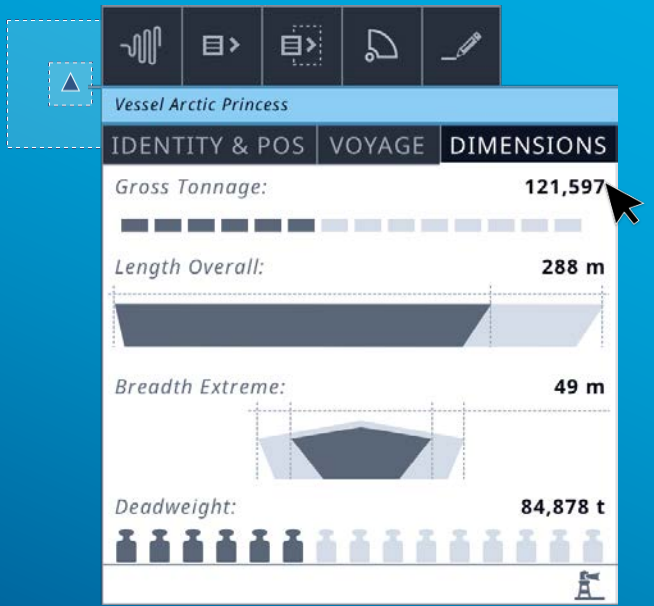
Design vs. User Experience

Safety related UX design



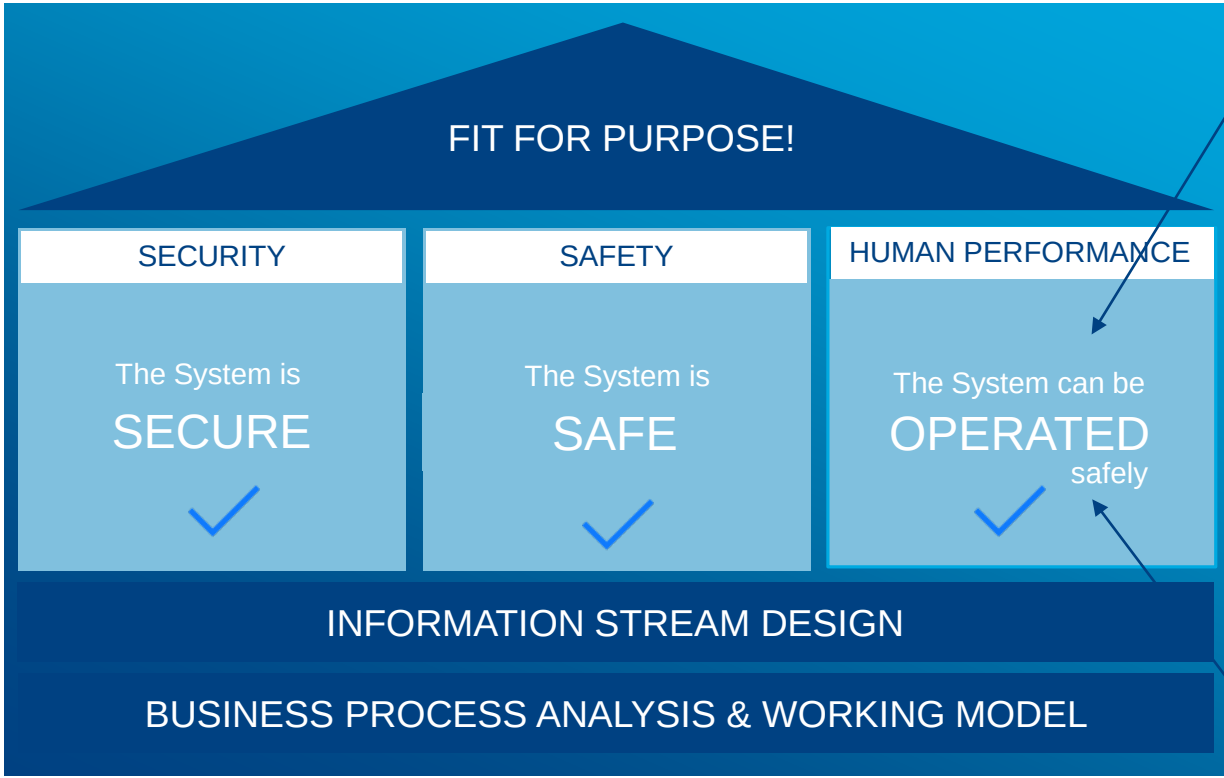
1. Interaction concept must enhance efficiency and provide safety





BASED ON INFORMATION STREAM DESIGN

2. Visual design must fulfil the quality standards



Applicable HP Standards (Examples)

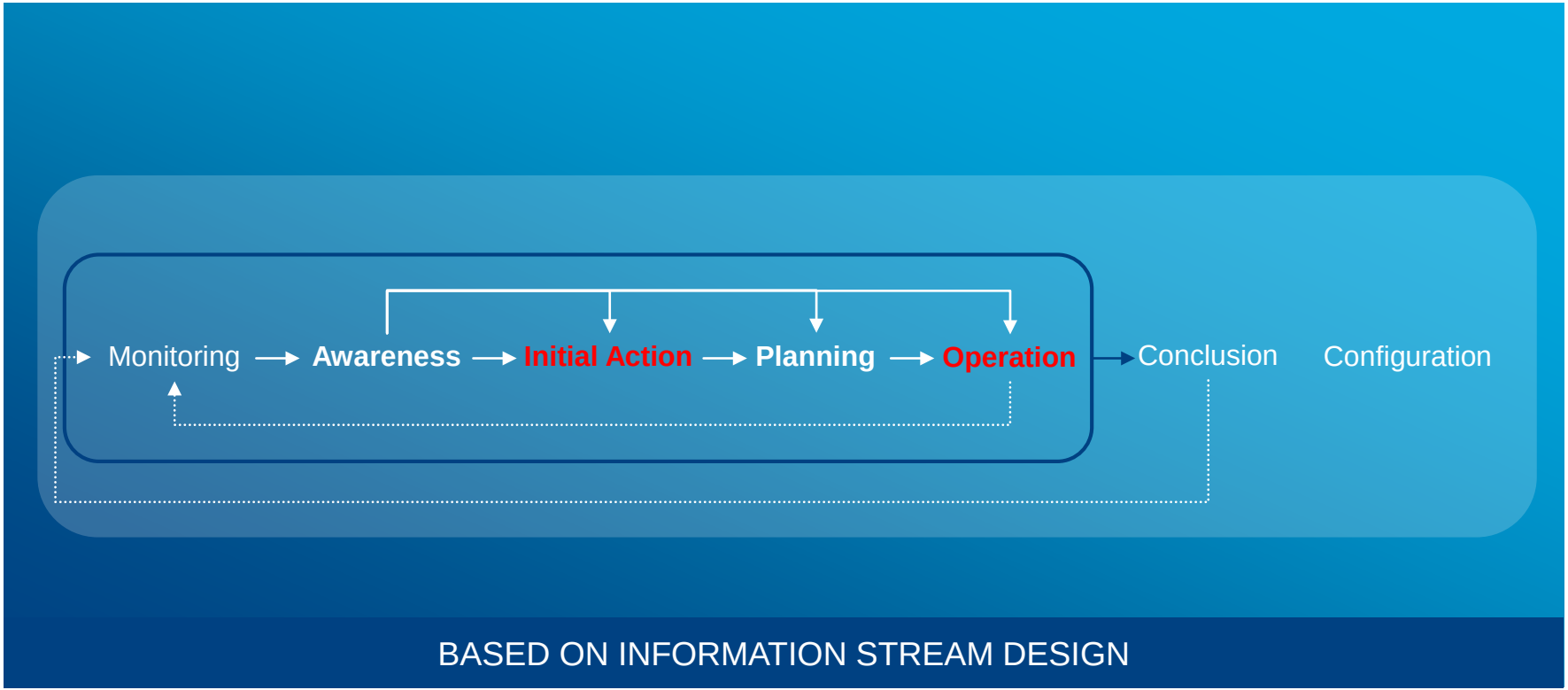
- MIL-STD-1472G: Human Engineering (as of Sep.24, 2014)
- MIL_HDBK_46855A: Human Engineering Program Process and procedures
- Defstan 00-250 : Human Factors for Designers of Equipment, especially Part 7: Visual Displays, Part 13: HCI
- ISO 11064: Ergonomic Design Of Control Centres
- ISO 6385:2004:Ergonomic Principles In The Design Of Work Systems
- ISO 7000:2004:Graphical Symbols For Use On Equipment
- ISO 9241:Ergonomics of Human System Interaction (Parts 10-17 Software Ergonomics)
- ISO 13407: Human Centred Design Process for Interactive Systems
- HF-STD-002: Baseline Requirements for Color Use in Air Traffic Control Displays
- FAA-HFDS: Human Factors Design Standard
- EUROCONTROL HF Case:HF Case Guidance V3
- Various ICAO Standards and Guidelines, e.g. ICAO Human Factor Guidelines (2000), ICAO HF Guidelines for ATM Systems (Doc 9758/AN-966)

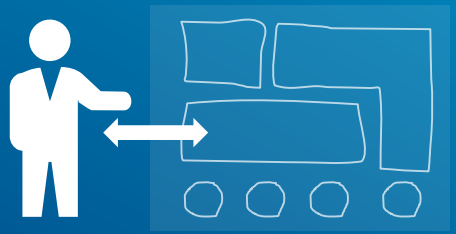
3. The operation of the system must be easy to understand, to reduce learn and training time

The system behaves always “as expected”

BASED ON INFORMATION STREAM DESIGN

4. Layout concept must support the workflow





Prove

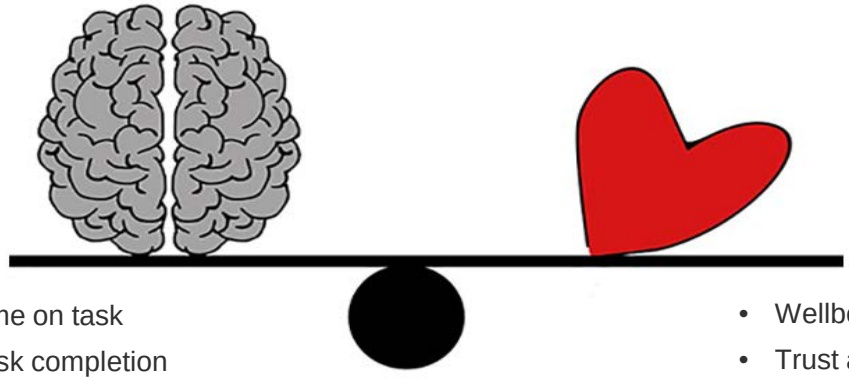
…user acceptance – the key to ensure adoption

Standard Compliance vs. User Experience

Minimum for safe operations

User feels confident and safe in operating the system

Balance of objective and subjective quality criteria



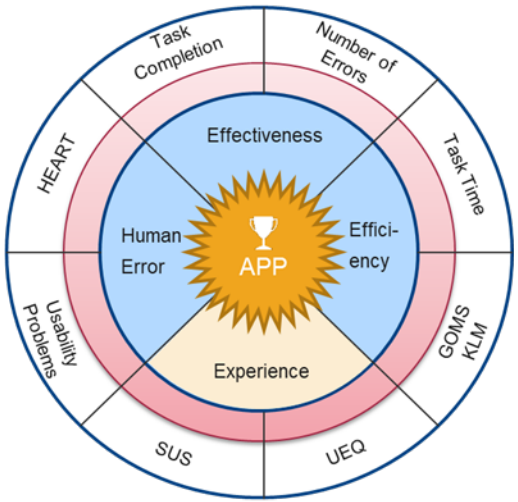
- Time on task
- Task completion
- Failure Rate

- Wellbeing
- Trust and Satisfaction
- Haptic User Needs

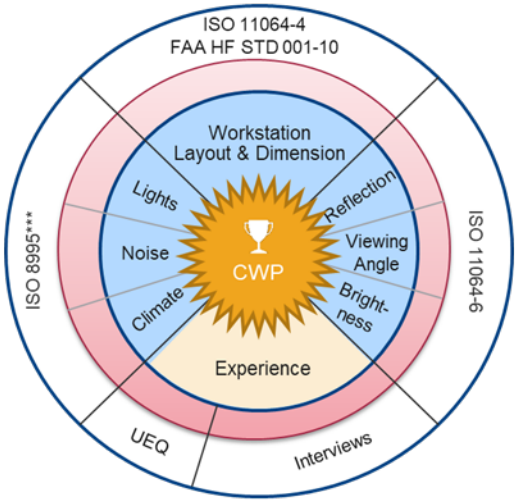
Prove - Human Performance quality criteria

Ensure Fit for Purpose based on objective and subjective quality criteria

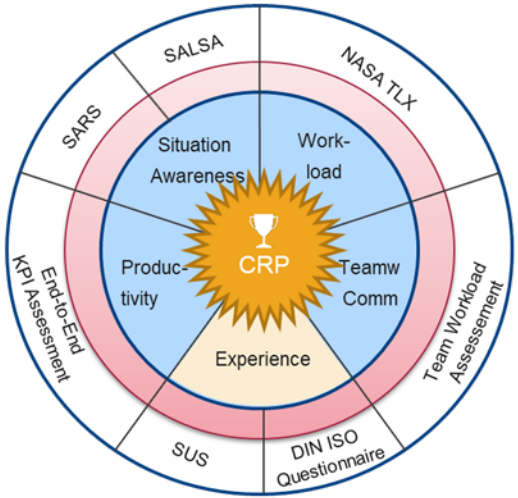
HP @ Application



HP @ Working Position

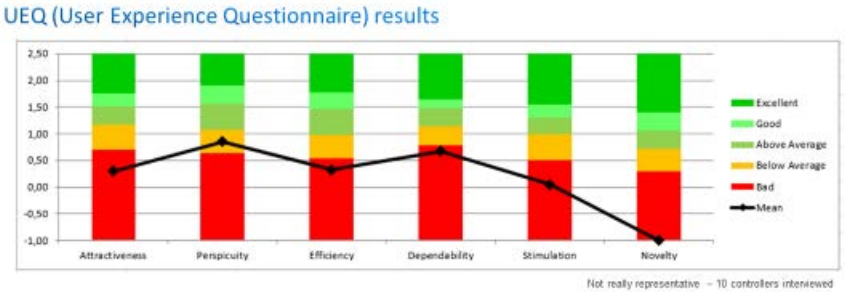


HP @ Control Room



User Experience Questionnaire - UEQ

Purpose of use: UX Benchmark



Attractiveness: Overall impression of the product. Do users like or dislike the product?

Perspicuity: Is it easy to get familiar with the product? Is it easy to learn how to use the product?

Efficiency: Can users solve their tasks without unnecessary effort?

Dependability: Does the user feel in control of the interaction?

Stimulation: Is it exciting and motivating to use the product?

Novelty: Is the product innovative and creative? Does the product catch the interest of users?

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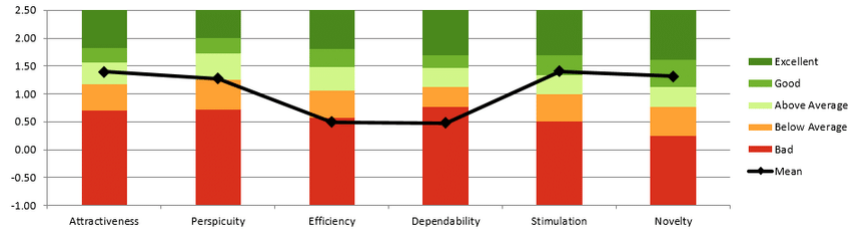

	1	2	3	4	5	6	7	
annoying	○	○	○	○	○	○	○	enjoyable
not understandable	○	○	○	○	○	○	○	understandable
creative	○	○	○	○	○	○	○	dull
easy to learn	○	○	○	○	○	○	○	difficult to learn
valuable	○	○	○	○	○	○	○	inferior
boring	○	○	○	○	○	○	○	exciting
not interesting	○	○	○	○	○	○	○	interesting
unpredictable	○	○	○	○	○	○	○	predictable
fast	○	○	○	○	○	○	○	slow
inventive	○	○	○	○	○	○	○	conventional
obstructive	○	○	○	○	○	○	○	supportive
good	○	○	○	○	○	○	○	bad
complicated	○	○	○	○	○	○	○	easy
unlikable	○	○	○	○	○	○	○	pleasing
usual	○	○	○	○	○	○	○	leading edge
unpleasant	○	○	○	○	○	○	○	pleasant
secure	○	○	○	○	○	○	○	not secure
motivating	○	○	○	○	○	○	○	demotivating
meets expectations	○	○	○	○	○	○	○	does not meet expectations
inefficient	○	○	○	○	○	○	○	efficient
clear	○	○	○	○	○	○	○	confusing
impractical	○	○	○	○	○	○	○	practical
organized	○	○	○	○	○	○	○	cluttered
attractive	○	○	○	○	○	○	○	unattractive
friendly	○	○	○	○	○	○	○	unfriendly
conservative	○	○	○	○	○	○	○	innovative

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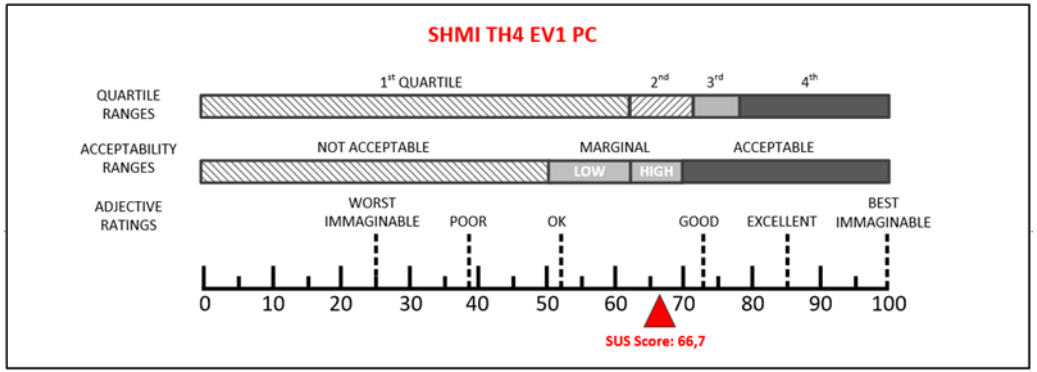
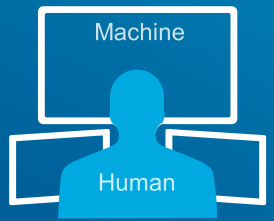
System Usability Scale (SUS)

Usability Benchmark



	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5



Deliver

..the best joint cognitive system

People create safety.

Tell me, and I will forget.
Show me, and I may remember.
Involve me, and I will understand.

Confucius

Change Resistance within technological change

Change always leads to resistance

“Transition” normally just smoothens technological change

Change affects the overall “Joint Cognitive System“ Humans and Machines

Managed Change – Social Transition Management

SOCIAL TRANSITION

Planning phase		Realisation phase	Review phase
Identify: • User needs • Risks	Plan transition	Manage the change on a functional and emotional level Implement the change Communicate with the stakeholders	Review /test user satisfaction
5-step approach: • Description of change • Identify affected stakeholders • Identify impacts of change • Define mitigations • Plan user acceptance reviews		• Integration of mitigations into the overall project plan to support the execution of the project in an optimised way. • Addressing risks at the right time with affected stakeholders • Supported by social transition specialists based on an individual mitigation plan	• Check the effectiveness of the mitigations • Check job satisfaction based on structured user satisfaction analysis

Example

Information Stream Design and benefits

Understand – Setting the scene

1st you have to understand the problem

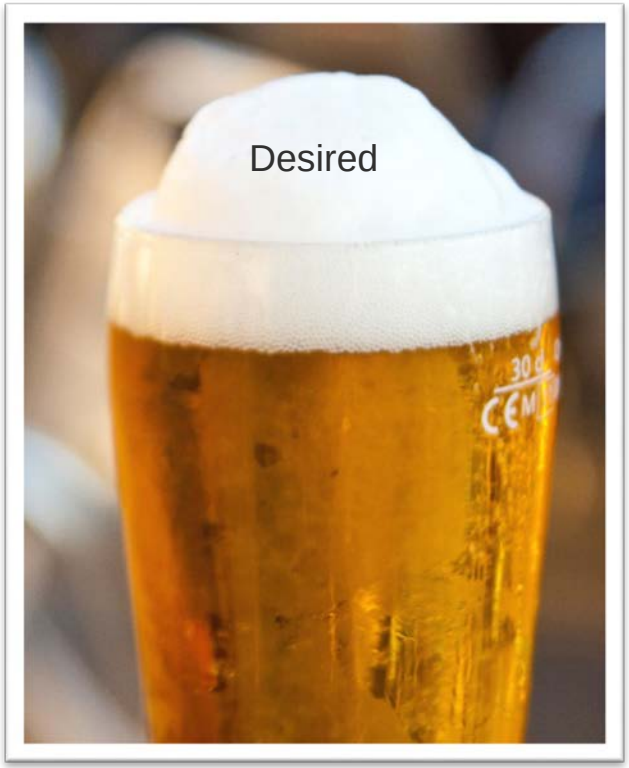
Scenario:

It's a **warm summer day** and sales man John wants to **go for a beer** after his work.
Therefore he stops his work at 5pm and walks to the so-called "Schutzhaus". All at all he can **drink only one beer**, because at 6pm he has to be at home.

Problem statement:

How to order a beer orderly so you get a fresh and cold beer with enough time to drink it in a relaxed way.

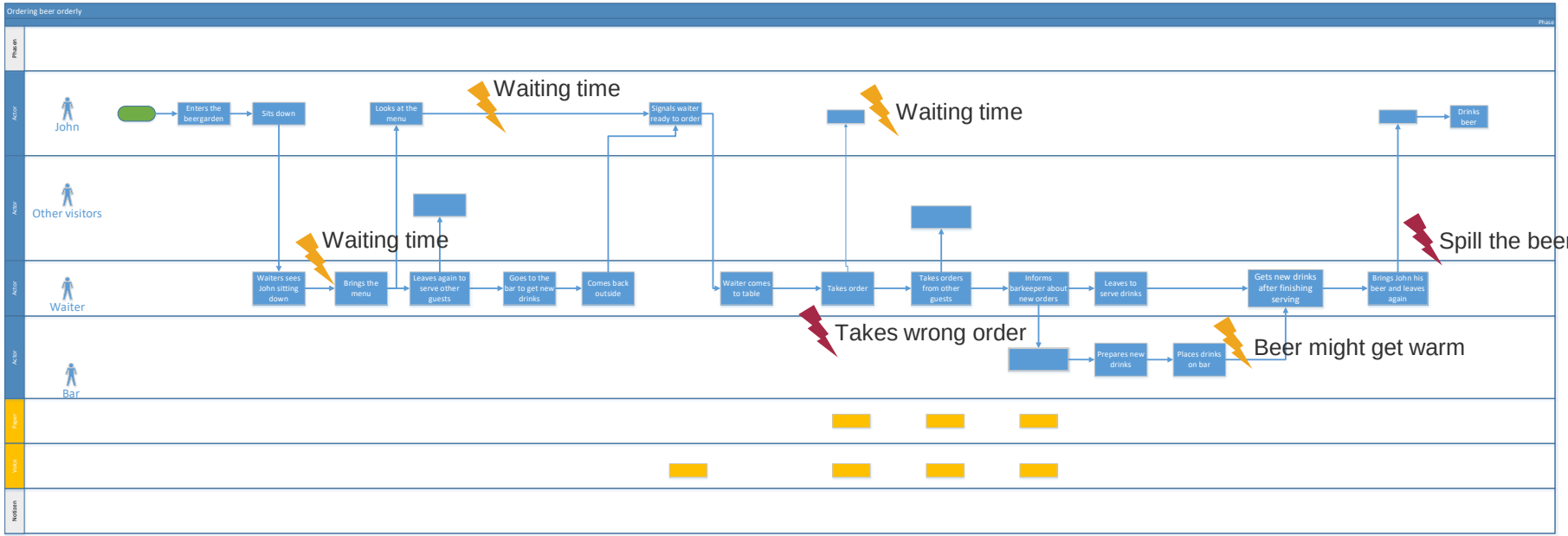
Understand – What needs to be improved?
Define KPIs



- KPIs are important to measure if the improvements met with the expected benefits
- They are required for UX tests

Understand – Take a look at the process

Information stream analysis



Design & Visualize

Look at the identified kaizen and start creating concept

In our example:

- How can we reduce waiting times?
- Is the beer cold enough?
- How to ensure the correct drink is received.
- Avoid spilling the beer

Design & Visualize

Prototype concepts to address the kaizen flashes

Prove

Test if the new concepts work

- Check if the concepts met the previously defined criteria.
- Check the improvements of KPIs
- Check the User acceptance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