ERGOS

Human Factors Engineering

Workspace design I Interface design I Job design I Validation and Verification

Control Centre Ergonomics

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About ErgoS

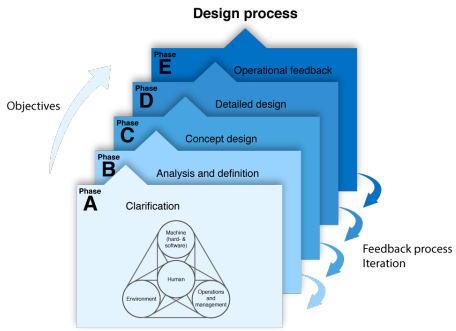
ErgoS specializes in Human Factors Engineering (HFE) of Control Centres. There are 8 Human Factors Professionals with a variety of educational backgrounds working at ErgoS, of which 5 are certified European Ergonomists. HFE aims for optimizing the work system, including operator workload, jobs, work organization, control centre layout, workplace layout, instrumentation, graphics, and the work environment.

Control centres are everywhere.

ErgoS designs control centres for many areas: food processing, oil & gas production, process industries, logistic systems, power generation, waste treatment, traffic control (roads and waterways), etc.. We have worked in close cooperation with manufacturers of automation systems, engineering contractors, interior designers and manufacturers, and last but not least project owners (i.e. operations, engineering, and human resources).

Our thirty years of experience and up-to-date know-how enables us to find adequate, innovative, and cost reducing answers to challenges related to operator behaviour and performance.

We are consultants as well as engineers. Our project scope covers the design process from feasibility up to the implementation. We deliver photo realistic visualizations, detailed specifications for materials and complete construction drawings, ready to be forwarded to suppliers. Project management, prototyping, user test, mock-up, and hierarchical task analysis are examples of ErgoS' activities in projects.



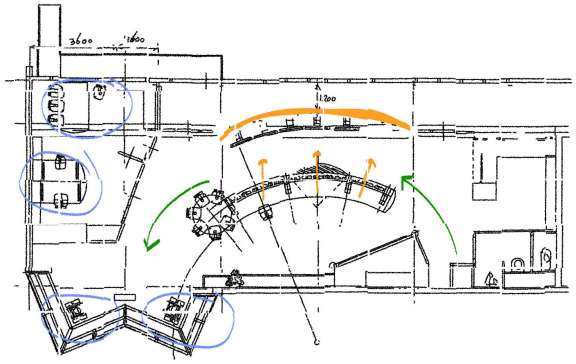
Approach

ErgoS uses a systematic approach to human centred design in engineering. The approach will be adapted to company standards and procedures. The main components of this approach are:

1. Situation analysis: gathering data on the operator tasks.
2. Functional design: based on a set of requirements we present several alternative solutions and make them subject of discussion.
3. Detailed design: together with client and end users, we select the most promising solution and elaborate this into a detailed design.
4. Realization: guiding contractors, guarding the human-centred design.
5. Commissioning and evaluation. Guiding principles can be found in ISO 11064 on control centre design.

Our Services

Control room design



Thirty years of control room design experience, shows that user participation is one of the keys to success in control room design projects. 3D-modelling techniques are a helpful aid to visualize and evaluate design solutions. Even better results can be achieved by a full-size mock-up. A mock-up evaluation often reveals important details that did not show up at the task analysis. Both mock-up and 3D-models are perfect visualization aids, giving the end user 'hands-on' experience in the design process. This is essential for user acceptance and management approval of the end result, and it helps to quickly find practical solutions to many detailed design questions.

Although there are many different control centres, the common denominators are a multi-screen environment, human information processing, communication (equipment), and usually large screen displays for process overviews or CCTV-images.

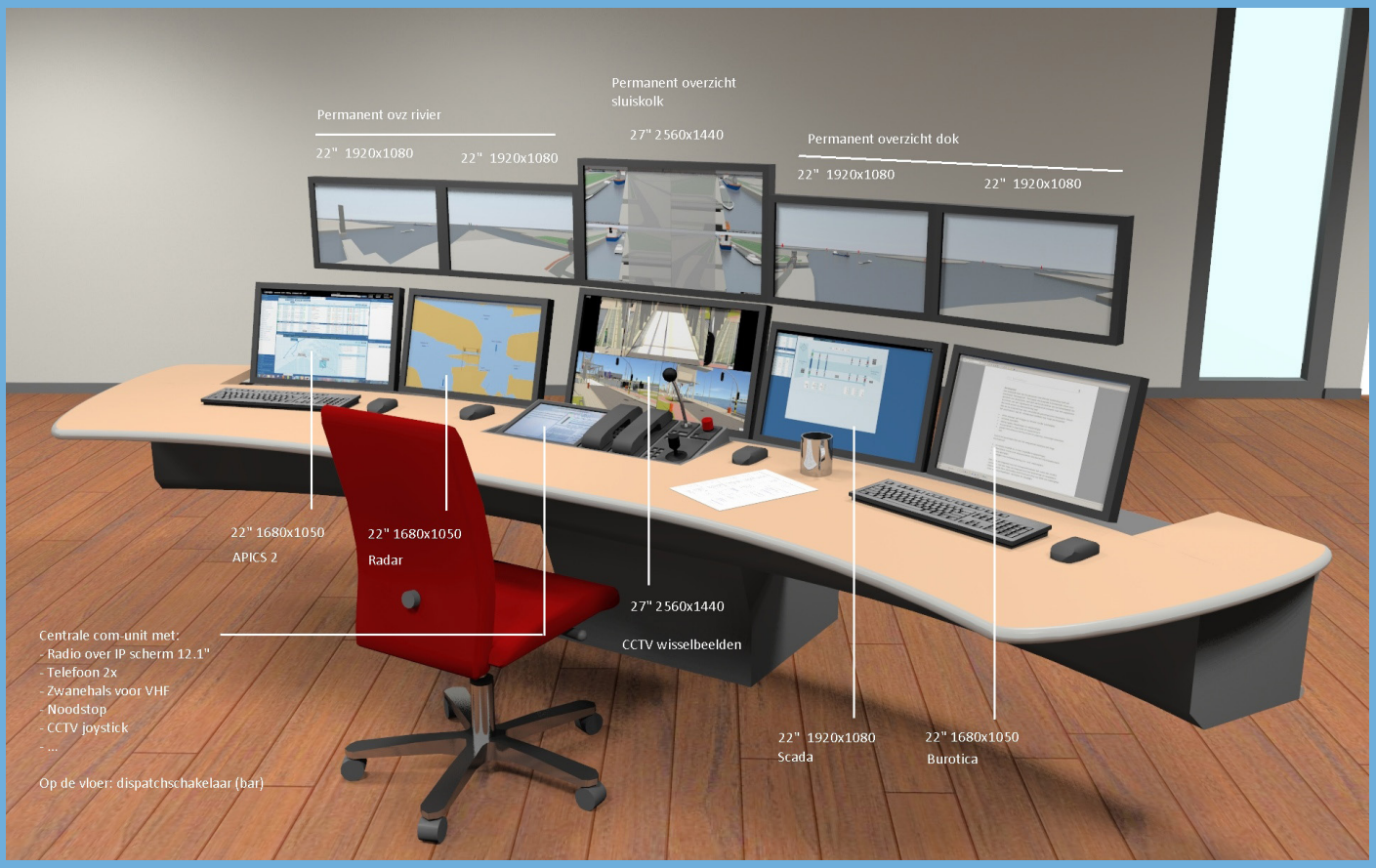
Automation may reduce operator workload. The challenge is to find a balance between too much and too little work for the human operator. Unlike discrete manufacturing processes, we cannot easily measure the amount of work, while human information processing is difficult to observe. As Human Factors Professionals, we have the tools to estimate the impact of automation, sufficiently reliable for control room engineering purposes.

Work organization design

Operators work in teams. There are tasks to be done in the control room and tasks to be done in the plant. In addition there will be management and maintenance activities. Any Human Factors contribution starts with a task analysis in order to get insight in human operator tasks. This information is the key for a good estimate of operator workload, communication requirements, and on how to organize all tasks efficiently.

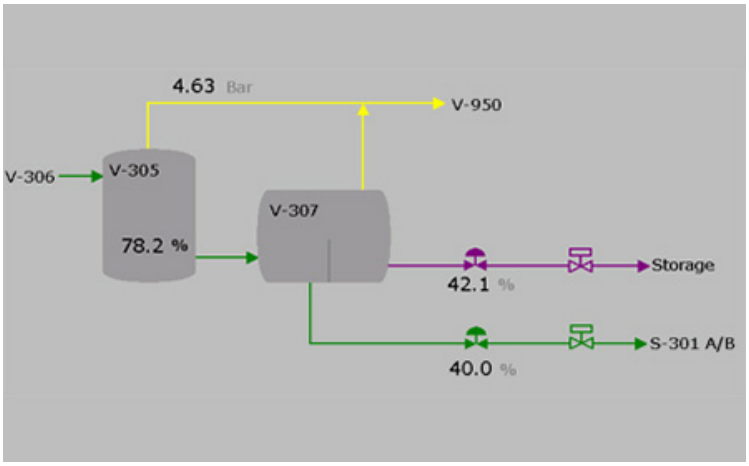
Projects may concern combining local control rooms in one control centre and/or reducing staff. Return on investment is calculated on the basis of staff reduction versus project costs. Staff reduction is possible, if there has been spare operator capacity at local control rooms, tasks can be automated, or "non-value adding activities" such as frequent walking from control room to process equipment are found. Effects of automation need to investigated. It is not uncommon, that project estimates are a rather optimistic.

Once the number of control room operators is established, we are able to determine the number of operator consoles, space requirements, the number of systems/screens on the desks, and console size. It will also result in a draft layout of the control centre, reflecting relationships – communication – between users: the work organization.



Office Automation

Consider office automation systems (LAN) at the operator desks, such as e-mail access, text editing (process log) and enterprise resource planning software (ERP). ERP may interact different from process control systems, leading to confusion and mistakes. ERP software/office networks also tend to be slow. Firewalls between process control and LAN, may lead to boring and sometimes tedious tasks of copying data from one system into the other.



Graphics

Existing control rooms usually show cluttered and ill structured graphics, preventing users to acquire a good process awareness. Unplanned unit shutdowns or production losses have been reported, because operators missed vital process information. Graphics can be improved by applying a set of straightforward, ergonomic guidelines on information display. A proven reduction of at least 50% on the number of graphics can easily be achieved, leading to a better operator task and workplaces.

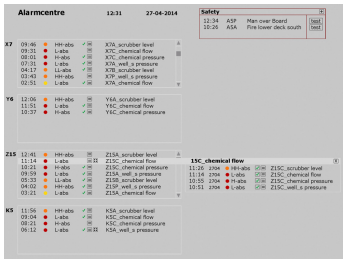
Graphics and interaction design have an impact on console design and vice versa. New high resolution display technology and wide screens, enable better representations of symbols, process equipment, indicators, etc. Automation projects should always consider a HF inspired graphics redesign approach, consisting of an operator task analysis, a review of existing graphics, and an analysis of the capabilities and limitations of the instrumentation system. Next, an Operating Philosophy and HMI Conventions have to be developed, agreed upon, and implemented.

CCTV-systems

A CCTV-system is a human machine system, consisting of an observed reality, cameras, transmission, displays, image presentation, workplace(s), and information processing. CCTV may be used for production control, site access control, or remote control and supervision. Guidelines for CCTV information display are equal to those for simplifying process graphics or reducing alarm messages: keep it simple, present no more images then needed for the job, and show sufficient image resolution to see what you actually need to see.

3D Models

During initial design phases, it is always difficult to get a good impression of a work environment. In particular for complex systems, 2D drawings do not suffice. To answer this type of questions an analysis using 3D computer modeling is useful. We use the industry standard AutoCAD for this purpose. It is possible to generate pictures and movies from every conceivable position. These can be used for example to simulate the field-of-vision of the control centre operator towards colleagues or to find out what a possibly cramped workspace between baggage conveyors looks like.

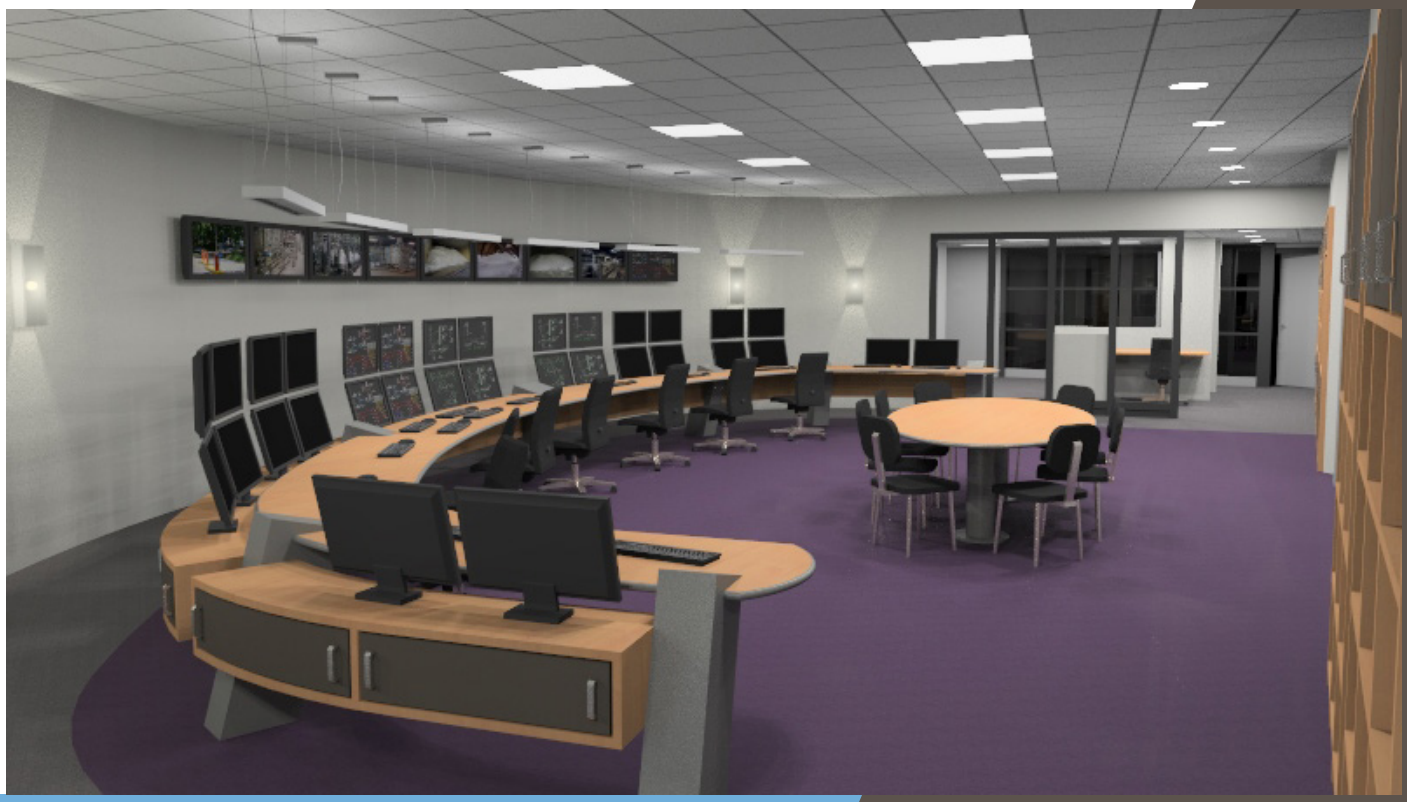


Alarm management

A common problem is alarmflooding, i.e. that far too many alarm messages are presented to the operator. The effect is, that too many irrelevant messages lead to not paying attention anymore. Applied research led to general guidelines for the acceptable number of alarms per operator position:

- < 2 alarms/10 minute interval, for normal process conditions;
- < 10 alarms/10 minute interval, for up-set process conditions;
- < 10 standing alarms.

For existing installations, some cleaning up should be considered. Simply collect alarm data over a one month period and list the Top 10 of most frequent alarms. Probably, several Top 10 alarms are not really ‘alarming’. Solving these issues will reduce the alarm frequency considerably. Next, look for double messages: two or more alarms related to one event.



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