Track Record Control Organisations

Researchgroep Human Behaviour & Organisational Innovation

TNO

MISSION

TNO connects people and knowledge to create innovations that boost the sustainable competitive strength of industry and well-being of society.

FIGURES (2012)

Turnover: 587 million euro

Employees: 3892

THEMES

TNO concentrates on seven themes:

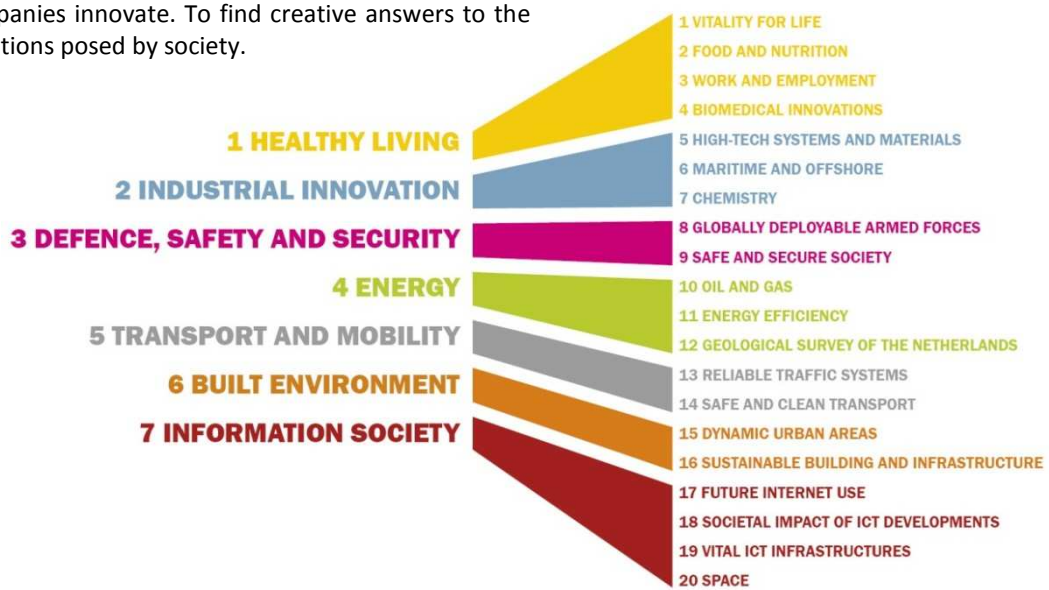
1. Healty living
2. Industrial Innovation
3. Defence, Safety and Security
4. Energy
5. Transport and Mobility
6. Built Environment
7. Information Society

ABOUT TNO

TNO is an independent research organisation whose expertise and research make an important contribution to the competitiveness of companies and organisations, to the economy and to the quality of society as a whole. TNO's unique position is attributable to its versatility and capacity to integrate this knowledge.

Innovation with purpose is what TNO stands for. We develop knowledge not for its own sake but for practical application. To create new products that make life more pleasant and valuable and help companies innovate. To find creative answers to the questions posed by society.

We work for a variety of customers: governments, the SME sector, large companies, service providers and non-governmental organisations. Working together on new knowledge, better products and clear recommendations for policy and processes. As 'knowledge brokers' we advise our customers, moreover, on finding the optimum solutions that are geared precisely to the questions they have.



Control Organisations

ORGANISATION

Control Organisations is part of research group Behavioural & Organisational Innovation.

GOAL

Expertise group Control Organisations develops innovative operational concepts and helps costumers to organize or optimize operational teams and to design effective control rooms.

THEMES

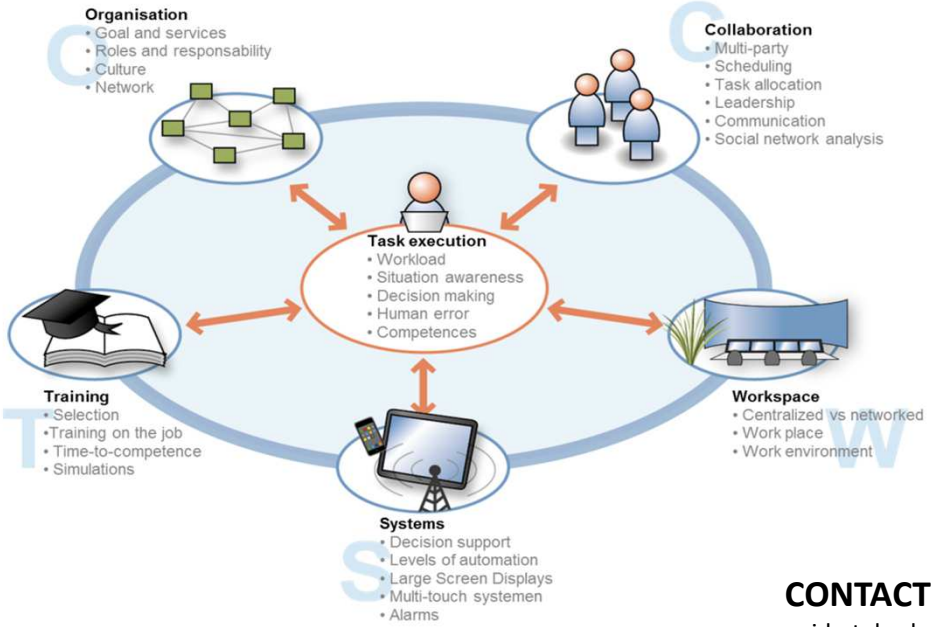
Projects are mainly conducted in the themes Defence, Security and Safety, Mobility, and Energy.

Recent customers are Rijkswaterstaat, ProRail, Munipality of the Den Haag, Royal Netherlands Navy and the UK MoD.

APPROACH

An integral approach is used to solve organisational and operational issues in critical monitoring and control environments. Both organisational, procedural and ergonomic aspects are taken into account, as they are closely related. This approach delivers efficient and optimal solutions ready for future developments.

We deliver creative, innovative designs of collaboration with networked partners, work organisation, or room lay out. By working closely with users and stakeholders, we create practical and accepted solutions that meet the needs of the organisation and employees.



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Walrus Engineering Support Project (WESP)

Royal Netherlands Navy /Defence Materiel Organisation, 2009-2012

SITUATION

As part of improving the Walrus class submarines at the Naval Forces Command (CZSK), the Life Extention program of the Walrus class (IP-W) was launched in 2008. The consequences of the planned adjustments are substantial.

QUESTION

The Defence Materiel Organisation (DMO) has therefore asked TNO to determine the future way of working on board, and redesign to the command center.

RESULT

- New business concept, amongst others: optimal working relationships and better information management.
- Design of the command center, and operational, ergonomic, technical and economically tested
- Functional Program of Requirements of the spatial design of the center and the consoles

APPROACH

This project is carried out within an industrial consortium, on the basis of a methodology, called Manning Oriented Design, developed by us specifically for this type of project

In the project, various design phases through co-creation with domain experts from the Submarine, material experts, DMO and designers of our consortium partners. Each phase was concluded with a review of the technical and economic feasibility to the expected operational benefits. Evaluation of the final device design took place by means of a 3D stereoscopic evaluation, by independent, future users.

For lay-out and workplace design, different levels of innovation are explored, which created new insights and new design concepts, including a Command Desk and top screens to support Shared Situational Awareness.

Also, the future way of working in the command center is determined, optimal adapted to the new systems and sensors, including an optronic mast

.

The design is embodied in a Functional Program of Requirements for the spatial lay-out and the consoles of the command center.

Finally, we supervise the construction of the consoles through reviews of the plans and evaluation of the prototype of the supplier.

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Workload and manning in bridge- and lock control rooms

Rijkswaterstaat, 2004-2012

SITUATION

The operation of bridges and locks is increasingly centralized. With centralization comes remote operating and working in teams. The necessary staffing must be determined and will be more efficient relative to local control.

QUESTION

TNO was asked by different districts of Rijkswaterstaat to identify the work-load of the operator and to give advice concerning the necessary staffing when centralized in a control room based on this workload.

RESULT

An advice for efficient staffing based on the experienced workload and the objective work load is tailored to each district. The staffing advise takes into account a dedicated operating procedure “ritsend bedienen”, working at a duo-workplace and in a team.

APPROACH

In order to determine the necessary future staffing for the control rooms provide various methods are used: Workload meters (PDA’s), to measure the subjective workload of operators. Observations at the workplace and interviews with operators and team leaders to gain insight into the working methods and the factors that are perceived to add to high workloads. Questionnaires to get an impression the work experience. And finally, objective data of the work to get an impression of the work supply.

The objective data consists for example of, the number of ships passing, number of telephone calls, number of incidents, number of camera images, etc. In the staffing advice differences in the amount of work during the day, between week and weekend days and between different seasons takes are taken into account. A staffing advice for bridge- and lock control rooms has been performed at various districts:

- RWS Zeeland (MOBZ)
- RWS Beatrix
- RWS IJsselmeergebied
- RWS Utrecht
- RWS Limburg (south and north)
- RWS Zuid Holland
- RWS Noord-Brabant

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Shore Support

Shipping Company Koninklijke Wagenborg, 2008-2011

SITUATION

The international regulations impose stringent requirements on the staffing of seagoing vessels. This legislation dates from the seventies. Since then, ships, and especially engine, have become easier to maintain, while the availability of technical staff is a growing problem. This calls for a revision of the required composition of the crew.

QUESTION

Three Dutch ship owners commissioned TNO to investigate whether modern ships could be sailed with modern crews at least as safe as conventional sailing crew. The study focused on short sea ships.

RESULT

Based on this investigation, the IMO (International Maritime Organization) has recently adjusted the requirements for modern Dutch coasters.

APPROACH

In the study, 25 coasters were involved with a propulsion power between 749 kW and 3000 kW. Measurements were made on 311 trips, during more than 16,000 shifts lasting over 60,000 hours. The measurements were made by masters, chief mates, chief engineer, and maritime officers.

This investigation shows that the workload on board ships with a maritime officer is distributed more equitably. A maritime officer is trained in both technical and nautical skills. He or she is able to monitor the engine room and may also take on navigational tasks.

This helps to prevent fatigue of the entire crew, and to increase work satisfaction. Especially the participating masters felt comfortable with this.

Based on this study, the IMO has given permission to potentially all 200 Dutch coastal vessels to sail with the modern crew composition, provided that the conditions specified by us are fulfilled.

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Uniform Man-Machine Interface for controlling locks and bridges

Rijkswaterstaat, 2007 – 2011

SITUATION

In The Netherlands, Rijkswaterstaat (the executive body of the Dutch Ministry of Infrastructure and the Environment) is centralizing the control of locks and bridges in control centers.

The current local control panels do not have a consistent design. Consistency between control panels is a requisite for central control, in which multiple objects have to be controlled simultaneously without making errors.

QUESTION

Rijkswaterstaat asked TNO to develop a uniform Man-Machine Interface (MMI) for the central control of locks and bridges.

RESULT

- A usable MMI design for controlling RWS locks and bridges
- Basic design variants for different control standards
- Design flexibility for local differences
- Usability review of the operating simulator

APPROACH

The MMI design is based on the TNO concept of alternate control. This means that an operator can control two objects from one work station.

During the design process ergonomic design principles were used. A consistent look and feel of the graphical user interface (GUI) was developed.

Also, the camera pictures are presented in a consistent and logical form, in which the images are synchronized with the control process and the operator tasks.

The layout of the monitors and corresponding applications are ergonomically determined and applied in the design.

The design is developed in cooperation with end users, Rijkswaterstaat experts and other stakeholders. Through a joint, co-creative process suitable applications, information support and camera images were established, resulting in the optimal conditions for safe and efficient distant control of locks and bridges.

Rijkswaterstaat developed a simulator of the MMI design, which was reviewed by TNO.

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Modernisation Object Control Zeeland (MOBZ)

Rijkswaterstaat, 2005 – 2011

SITUATION

Rijkswaterstaat (RWS) is currently centralizing the lock and bridge operation Zeeland in two nautical control rooms. This requires a new organization, work process-concept and workplace layout.

QUESTION

TNO was asked to advice about staffing, way of working and control room layout. In 2011 the new way of working and layout in the first nautical control center has been evaluated.

RESULT

- Efficient staffing advice based on subjective and objective work workload.
- A work process concept which facilitates work ing without too low or high workloads of operators.
- Workplace layout for the control room, tailored to the new business.
- Optimization of organization, teams, tasks and work in the control center.

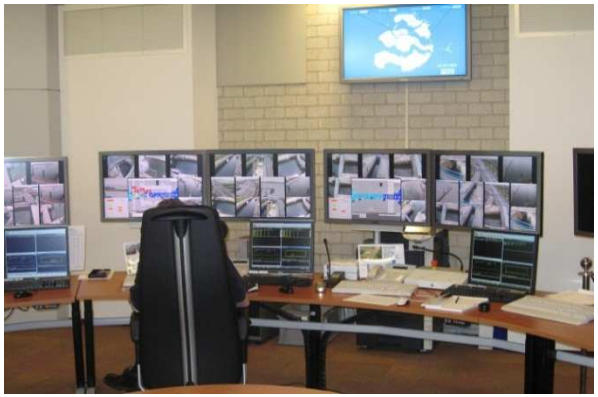
APPROACH

Within the RWS MOBZ project, TNO has performed the following steps:

Measure the workload in the old situation “operators not centralized”.

Develop a work process-concept, in which the activities are carried out in an efficient way.

Develop a staffing plan in which the number of operators is determined, based on a good balance between work supply and workload.



Describing the Functional Requirements room layout, the workplace design, the graphical user interface and the camera plans. This has been used by RWS for the procurement of the nautical control rooms.

Evaluation of the nautical control room once it has been in use. It is assessed whether the proposed organization, method and functional requirements are actually realized and proposals for further optimization have been provided.

Thanks to the integrated approach are two nautical control centers are experienced as safe, efficient and pleasant to work.

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Workload and Manning in Traffic Management Control Centers

Rijkswaterstaat, 2004 – 2011

SITUATION

To increase road capacity, new tunnels, shoulder driving lanes and steering measurers are developed. This means additional work for the six traffic management control centres (TMCs) in the Netherlands.

QUESTION

TNO was asked by Rijkswaterstaat to measure the workload for different function groups in the TMCs. Rijkswaterstaat also wanted to how many operators are required in the next four years to conduct al the work, and in which way the control centres could be made more efficient.

RESULT

- Situations with high workload were identified
- Manning requirements were established until 2014.
- Advise has been given how to reduce the manning and make the traffic control centres more efficient.

APPROACH

To measure the workload in the six traffic management control centres (TMCs), a number of different methods are combined: workload meters, task duration measures, observations, interviews and an anonymous online questionnaire. Based on the data collected, the workload is estimated for the different function groups in TMCs Together with Rijkswaterstaat a computational model to calculate manning numbers was updated and improved, enabling forecasts until 2014 to be made.

The manning and workload have been compare d to similar control centres in the Netherlands and abroad.

In close cooperation with domain experts from Rijkswaterstaat, innovative solutions were developed to increase control room efficiency. Innovations were technological, but also organisational and procedural innovations were considered. The most promising concepts were elaborated, and quantified. Based on these results Rijkswaterstaat can improve their business case.

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Redesign Joint Emergency Room Utrecht

GMU, april-august 2010

SITUATION

The Joint Emergency Room Utrecht (GMU) wants a redesign of the emergency room based on a multidisciplinary assumption for police, fire brigade and ambulance.

QUESTION

TNO was asked to give an expert opinion regarding opportunities and risks of the plans for the new working method in the emergency room. She was also asked to design the new floor layout, with optimal support of the new working method. Resulting in a Functional Program of Requirements, for use in procurement.

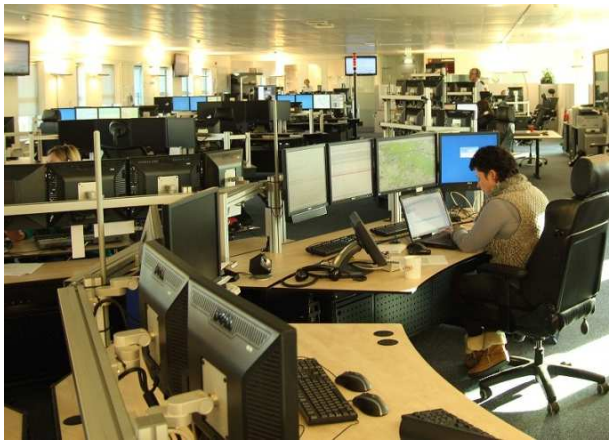
RESULT

- Clear floor layout, with good sightlines and based on the communication and collaboration between employees.
- Uniform desk for all disciplines, for flexible use (growth and shrinkage) of the room.
- Support for the new floor layout and the uniform desks among all disciplines.

APPROACH

GMU had developed a vision of the future working method, organization, staffing, and the applications and number of monitors on the desks. Based on this information and on interviews with employees we gave an expert opinion regarding the opportunities and risks of the new plans.

In this project we used a user-centered design approach and worked closely with the project group. The project group was represented by members of the three disciplines (police, fire brigade and ambulance), an emergency coordinator, the operational manager and members of the engineering department.



In close collaboration with the project group, we defined the principles and requirements for the new emergency room for optimum support of the new working method with multidisciplinary assumption. Based on these requirements we designed the layout and the uniform workstations for the new emergency room. While disturbance of people passing the emergency room was one of the current problems, we separated the pedestrian route from the operating floor in order to minimize the disturbance.

In several workshops we presented the concepts of the floor layout to the project group. Together we created the final layout.

The design is described in a Functional Program of Requirements, completed with requirements for lighting, acoustics and climate.

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Design Operational Control Center Rail (OCCR)

ProRail – the railway infrastructure manager of the Netherland, 2007-2010

SITUATION

Initiators ProRail, NS and Railion (the main railway companies in the Netherlands) decided to a closer cooperation of their national services in a common workplace.

QUESTION

TNO was first asked to assess the organizational consequences of such a cooperation. Subsequently, TNO was asked to describe the collaborative model and - after that - the control room layout and workplace design. In addition, TNO advised on cooling, lighting and acoustics.

RESULT

- Organizational impact analysis;
- Cooperation Concept for both the normal situation and the fallback situation;
- Functional requirements package including control room layout and workplace design;
- The OCCR was successfully put into operation in October 2010.

APPROACH

Mid-2007 TNO began to investigate the possible effects of a cooperation of the participating organizations and their constituent parts in one workplace. The results of this study where used for decision making on the future control center for the entire Dutch rail sector.

At the end of 2007 the decision was made to develop the control center. TNO was asked to shape the desired cooperation model and contribute to the design of the new control room.

In 2008 TNO started with the design of the collaborative model. In consultation with parties inside and outside the new OCCR new consultation structures were determined and new functions and roles were identified. The non-discriminatory actions of ProRail and the equal treatment of all railway companies where crucial to the development of the new center. Because the OCCR has no fallback facility that can house all partacipating companies TNO also made an alternative collaborative model.

On the basis of the cooperation model and after performing a link analysis a control room layout design was made and a functional set of requirements was described. Also the new control room desk was designed by TNO.

In the realization phase TNO stayed involved; deviations from the set of functional requirements where checked against the original objectives.

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Command Bridge Offshore Patrol Vessel

Royal Netherlands Navy /Defence Materiel Organisation, 2007-2008

SITUATION

The Royal Navy has developed four patrol ships which should operate with minimizing staffing size. This requires extensive integration at all levels. This placed high demands on the design of the organization and the activities on board, but also to the layout of the operational areas, such as navigation bridge and command center.

QUESTION

The Defence Materiel Organization (DMO) has asked TNO for a design of the organizational and operational areas on board these four new patrol ships.

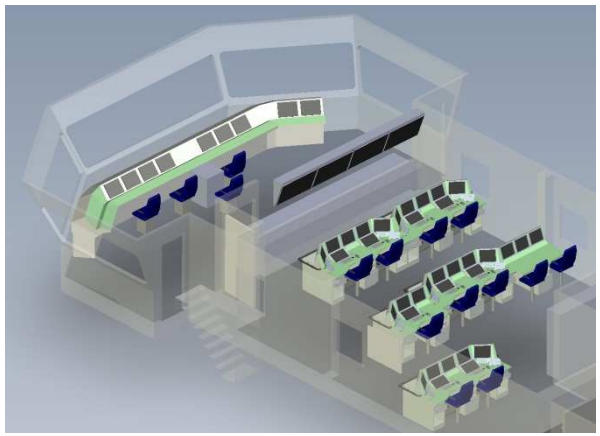
RESULT

- Reduction of Command Center staff by 33% (saving 15-20 million on life cycle costs of per ship).
- Interior of bridge and workstations, tailored to the new way of working.

APPROACH

We have conducted this project according to a proven approach and in close cooperation with representatives of the Royal Navy. Topics that are covered include:

- What functions should be identified and how should these functions be divided over the various operations rooms ?
- What job positions are distinguished and which information services are needed? What demands are thus placed on the design and layout of the workstations?
- How to position the workstations in the rooms, to support working together as a team, while taking into account the effects of ship movements



Based on this, we designed the new way of working, the interior of the central command and navigation bridge, and the workstations.

Using virtual environment, the design was judged on aspects such as collaboration and visibility, both inside and outside the room.

Our approach led to the introduction by the Royal Navy of a totally new concept: the Command Bridge, linking directly the navigation bridge with the command center, including an optimal outside view.

The vessels are currently built and tested to our specifications.

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Riskanalysis Location Emergency Room

Ministerie van Veiligheid en Justitie, 2013

SITUATION

One of the ten national emergency rooms is intended for in the vicinity of a high risk location. When the standing Committee "Veiligheid en Justitie" handled the location plans, the question arose whether, with the proposed location of the emergency room, continuity in such a crucial phase could be guaranteed in case of calamities. TNO was therefore asked by the Ministry to carry out a risk analysis.

QUESTION

Map the location-specific risks of the proposed emergency room location. Consider the effects of the measures taken and planned on the identified risks. Indicate what additional measures may be taken.

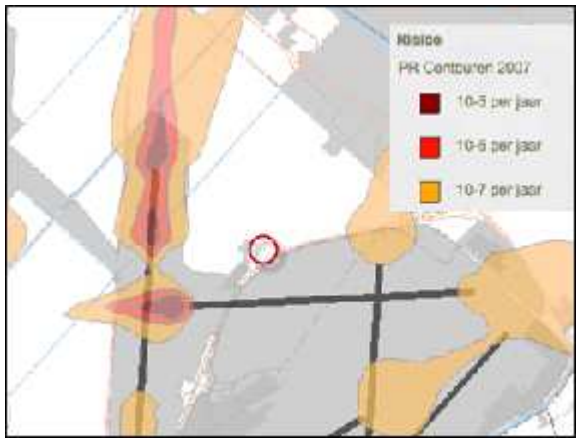
RESULT

Risks, measures taken and measures to be taken are mapped in such a way that the client can decide on positioning the emergency room at the intended location and possible additional measures themselves.

APPROACH

The project was carried out in a three week period. A team of subject matter experts in the areas of expertise Earth, Environmental and Life Sciences en Behavioral and Societal Sciences was composed. This way, risks at the site could be considered in the context of operation and on the performance of people in the environment.

First a risk inventory was performed. Where possible, existing materials, such as risk maps of the province and safety regions, were used. The incident types as defined in the National Guidance Regional Risk profile (landelijke Handreiking Regionaal Risicoprofiel) were used as starting point and supplemented where necessary.



Incident types that specifically apply to the intended location were considered further. (called location-specific risks). Incident types that apply equally to other locations in the country – for example power failure – are not taken into account. For these risks, whatever the location, measures should be taken to ensure continuity of the emergency room. These are not distinctive for a new to build emergency room.

This analysis has lead to an overview of the location-specific risks, an image of past and planned measurements and advice on additional measures to be taken to reduce possible risks. Explicitly no judgment on whether or not it is acceptable to locate a emergency room at the intended location.

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Teamwork at the Operating Room

Wilhelmina Kinderziekenhuis Utrecht, 2008-2013

SITUATION

In addition to technical skills of medical professionals, non-technical skills are considered more important. According to recent research, good teamwork is associated with shorter operative time, reduced postoperative morbidity and les 'adverse events'. However, it is unclear exactly how teamwork processes relate to these outcome variables.

QUESTION

TNO has performed a study, in cooperation with Wilhelmina Children's Hospital, on communication processes in a medical team at the pediatric cardiac surgery department.

RESULT

The used methods helped to accurately map teamwork and identify areas for improvement. In addition, we a gained better understanding of the importance of good teamwork for patient safety.

APPROACH

In order to map the teamwork of the operating-team a multitude of methods was applied. First, using a questionnaire both before and immediately after surgery, the degree of preparation and the the actual course according to the teams perception was inventoried. In addition, all communication processes between team members were mapped through live observations by trained human factors observers. The observers attended 40 surgeries in total to score and assess the teamwork. Similarly, any non-routine events were mapped, for example, the temporary interruption of a surgery due to lack of material, a telephone call, or by an unexpected patient-related event.

Finally, the complexity of the operation, the duration and patient outcomes were mapped.

Video recordings were made of a limited number of operations. Teamwork-relevant aspects from the video were given back to the team. This happened halfway through the study. The results showed that, after the intervention, the number of non-routine events was reduced by half in comparison with the situation before the intervention. Through social network analysis, the communication processes were described accurately . It appears that this team adapts to the complexity of the procedure: as the procedure was more complex, the team used a flatter communication structure, with many closed-loop communication. Also, unexpected events resulted in a flatter structure. Only during critical transitions between major phases in the operation a hierarchical form of communication was used.

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Control Rooms PostNL

PostNL, 2011

SITUATION

PostNL performs a centralization through which the operational planning of the postal service will be accommodated in five control rooms. Due to the centralization the way of operating of the operational planners will change radically.

QUESTION

TNO was asked to develop a task-execution-concept for the operational planners, in line with the deployed centralization and its technical innovations. A second question concerned the design of a uniform room-lay-out and workplace design for the new control rooms.

RESULT

New task-execution-concept and related room-lay-out for the future control rooms.

Pro-active and efficient control of the delivery process.

Flexible scaling possibilities for regulating workload and reduces disturbances.

APPROACH

The centralization of operational planning will require a drastic adjustment in task performance of the operational planners. In addition to embedding new technical systems and a different way of control of the drivers, new opportunities arise as the operational planners work in cooperation from a control room, such as absorbing peak workload and increasing flexibility in the task-execution.

Through site visits and interviews with the various stakeholders, a quick scan and impact analysis have been performed. The task-execution method, the desired developments and the opportunities and risks of centralization have been mapped.

Based on source data and a workshop with operational planners from different regions, an inventory has been made of the discrepancies between the regions which must be accounted for in the new task-execution-concept. This formed the base for several task-execution-concepts have been studied, of which the best concept has been chosen and developed further in close collaboration with the PostNL projectteam.

Based on the task-execution-concept a uniform room-lay-out and a workplace design was developed, suitable for all five control rooms. This has been translated into a, practicable, functional requirements document.

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Operating unmanned systems

Ministry of Defense – United Kingdom, 2013

SITUATION

The number of unmanned systems being deployed by the UK MoD is increasing. Besides technological innovations, organisational, psychological and human-system interaction aspects determine the operational effectiveness.

QUESTION

TNO was asked to research three questions:

1. Does detachment of operators lead to negative consequences?
2. Which organisation and staffing issues can be expected in the future?
3. Which developments in the field of HMI are relevant for future missions?

RESULT

A list of recommendations has been composed that limit or prevent negative effects of detachment. Manning issues have been identified, as well as important new innovations in het field of HMI that can improve human UXV interaction.

APPROACH

The increase of unmanned systems within the three services of the English Defense raises a number of HF related questions. There is a need for evidence of the impact of distance on the decision-making process and risk-taking. A concept map of relevant entities and aspects was constructed, that provides the insight required to address these issues effectively. In addition, the increase in the deployment of unmanned systems will affect future organizational structures and staffing. Organizational risks, issues and challenges that affect the deployment of unmanned systems were identified in interviews and analysis. Finally, a coherent image of the state of the art of human interaction with (semi-) autonomous systems was created by reviewing future mission needs and studying recent HMI literature.

A way to avoid risks of detachment is to reduce the effects of the physical distance by reducing the experienced psychological distance, for example by better sensor feedback. Other recommendations are giving training on moral competences and encouraging systematic empirical research on the task performance of operators of unmanned systems. Increasing autonomy of unmanned systems also calls for additional research, because this may have far-reaching consequences for the feeling of moral disengagement and responsibility.

Multimodal interfaces for operators can improve situational awareness and lower the experienced workload. In particular, tactile and auditory interfaces, in addition to visual displays, can support UXV interaction. Adaptive automation is a promising development to guide the transfer of tasks from operators to automated systems. Development of the appropriate level of trust is the main issue.

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Control of energy flows and networks in 2020

Liander, 2012

SITUATION

Liander, a system operator of energy networks faces a major transition. The world of energy generation and distribution will change substantially in the coming years. Because of the complexity of a number of aspects (such as regulations, future energy mix, technological capabilities, customer needs) it is uncertain what the outcome and impact of those changes will be. This change is expressed as a transition from a control center to a Decision Center.

QUESTION

TNO has been asked to construct the roadmap for the development of the Decision Center.

RESULT

TNO has drawn up a roadmap that enables Liander to realize all technological and organizational innovations that are required to be ready for large scale distributed energy generation, net optimization and balancing.

APPROACH

Liander has a number of control centers where the management of electricity and gas are located. From these centers energy flows and networks are monitored and controlled. All control actions required for planned work on the energy grid are prepared and carried out or coordinated. At looming energy interruptions operators proactively intervene to prevent disruptions. When disturbances occur, a incident management and recovery are conducted. The current task set will be extended in the near future which tasks related to be large-scale distributed energy generation and new regulations.

To enable sustainable energy transport in the coming years Liander invests in the digitization of the networks. A large number of sensors will give more insight into the status of networks and energy flow. The ambition is to become an intelligent decision center and use predictive models to manage the networks in a more effective and efficient way. Data collection and information processing are key assets in the Decision Center. All activities for maintenance and incident recovery are controlled from a single location, exploiting the improved information position. Customers and mechanics can be informed and supported much more proactive and effective than currently possible, and disturbances will be solved quicker. Due to better availability of operational data the network can be operated more effectively and energy losses can be limited.

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Integration of road and water traffic management centers?

Municipality of the Hague, 2010

SITUATION

To be able to reach the objectives for traffic flow, accessibility, security and quality of life, the city of the Hague wants to establish a traffic management center. They considered two scenarios: build a new traffic management center or integrate a new traffic management center with the existing nautical management center.

QUESTION

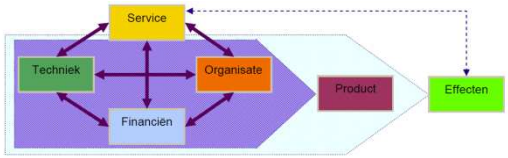
TNO was asked to study the pros and cons of an integrated center versus two separate centers. The costs for both scenarios were calculated as well.

RESULT

- Deliver evidence for the feasibility, opportunities and risks, and the associated costs for the two scenario's.
- The study provided the municipality of the Hague with the information required to make a reasoned choice between developing two separate or an integrated traffic management control center.

APPROACH

To answer the question we used the STOF methodology. The STOF methodology is developed to study the aspects Service, Technology, Organization and Finance, necessary for a business model, in an integrated manner. Central in the STOF methodology is the idea that a new service, such as providing dynamic traffic management in the municipality of the Hague, should not be considered from the perspective of one aspect (e.g. technology), but that choices affect outcomes in other aspects.



For example, the ability to deliver a component of a service (e.g. prioritizing traffic flows on the basis of environmental criteria) depends on the chosen technology (poke poles for CO2 emissions) but also of organization choices (staffing levels, agreements with suppliers) and finance (costs-benefits). Both scenarios were analyzed and compared on all four aspects of the STOF methodology to enable the municipality of the Hague to make a profound choice.

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Validation method performance 911 calls control rooms

Ministry of Safety and Defense, 2013

SITUATION

112 (European 911-emergency number) control rooms are judged on their performance, for example speed with which operators pick up the phone and the amount of lost calls. The performance criteria are determined by calculations on the telephone-data, using a specific method. In the past year the infrastructure of the regional control rooms has been renewed, thus the need has arisen to investigate whether the current calculation method is still usable.

QUESTION

Assess the method of performance measurement for 112 telephony;

1. Completeness, validity, imperfections and interpretation of technical data collection.
2. Use of the correct performance criteria; what additional criteria are desirable and what are realistic values for these criteria?

RESULT

Recommendations for use of methodology, the reporting systems and the performance criteria were given.

APPROACH

To investigate whether the used method is still valid in the new infrastructure and the correct criteria are measured, desk studies were performed, multiple interviews with experts of TPM, KPN, directors of 112 control rooms and technical experts have been held and a test protocol has been executed.

Due to the amount of systems used which makes the 112 circuit complex and laborious, it is recommended to display the performance by using one system.

112 control rooms are willing to make clear performance agreements and pursue these. To do this effectively the control rooms need to be able to see their own data easily in order to compare these to the performance assessment.

For example, during peaks, when all operators are busy, it is possible that a call can not be answered immediately. To solve this, the 112 control rooms have to know when and how often this occurs. With this understanding it is possible to tune the manning in the control rooms. In addition, solutions are to be found in assigning responsibilities to different centralists. Finally, operators can be trained in handling calls more efficiently.

Peaks in workload can still occur, but when the National Unity in Driebergen, who forward all mobile 112 calls, can see that all operators of the control room are busy, they will be able to forward a call to another control room where operators are available. In the future, it is desirable that the system finds a free centralist itself and “forwards” a call immediately.

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Operating Systems and Fixed Observation systems

Haaglanden Police, 2013

SITUATION

The Camera Observation and Surveillance System of Haaglanden Police is a complex of hundreds of cameras and multiple functional separated operating and viewing facilities. The system grows rapidly while high demands are placed on the continuity, the quality and the reliability of the system. For this reason Haaglanden Police decided to reorganize the system.

QUESTION

Providing support to Haaglanden Police in the realization of the new system.

RESULT

In close cooperation with Haaglanden Police, we established the functional and technical requirements for the supply of equipment and software for the two building blocks Operating systems and Fixed Observation systems.

APPROACH

With the transition of analog to digital camera surveillance systems, the functionality and performance of the system will increasingly be determined by software. The main part of the camera surveillance system is therefore the Video Management System (VMS). The following steps are performed to achieve a Program of Requirements (PoR) for VMS:

- Inventory of the changes to be taken into account in the VMS.
- Determination of the overall system design.
- Support with a Request for Information to a number of selected suppliers.
- Support during the tender.

During the establishment of the PoR regularly consultations have been committed with staff of Haaglanden Police.

The PoR contains the following topics:

- Definition of the concept.
- View of live and recorded video in the control room.
- Export of live/recorded video to other locations.
- Interfacing/integration with other systems; communication, police-databases and internet for example.
- User authorization, -roles and -rights.
- Security based on internal CRAMM analysis.
- (functional) User Interface of VMS; screen layout and interaction structure in outline.
- Camera- and network management.
- Software interfacing / protocols serving internally analysis software to be added (Video Content Analysis software e.g.)
- Incident registration, analysis and export (e.g. serving agreements between police and municipalities).
- Maintenance and documentation.
- Migration plan.

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New Generation Surveillance Center

Centre for Innovation and Safety, 2012-2013

SITUATION

With the increasing number of cameras, the number of operators has to grow proportionately, in order to provide the same quality of camera surveillance. For this reason, to prevent costs becoming unacceptably high, it is necessary to develop a more efficient and effective way of work.

QUESTION

Develop a new compact workstation, for camera operators to perform his different tasks more efficient and effective, using available technology.

RESULT

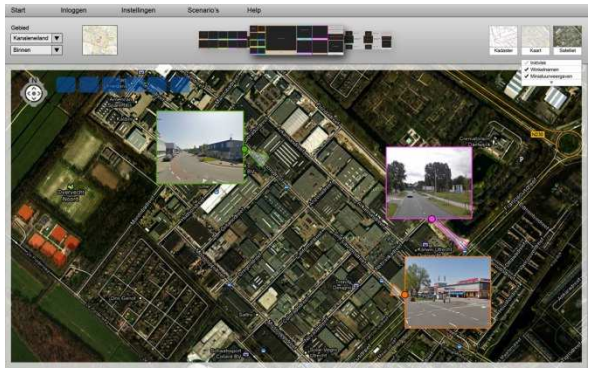
The project resulted in a task inventory and a task-oriented design of interfaces in which the used equipment, interaction and information presentation are described.

The lay-out of the workstation with the new interfaces. The workstation has access to the network of the center for innovation and safety, so the effectiveness with respect to the current situation can be measured.

Evaluation of the prototype by users, by testing the added value in practice.

APPROACH

The project “New generation surveillance center” is an innovation on the design of the previous project “Smart Surveillance”. In Smart Surveillance, miniature-camera views have been added onto the map, which resulted in more situational awareness, unknown areas could be watched better and less exposure time. Using the miniatures it is easier to see which other camera might get a view on a suspect. With the new design it’s expected that camera surveillance can be performed more effectively. In order to ensure an operator performance with less support of colleagues, so possibly less people would be needed, we looked at how the interface could support better at task-level.



Interfaces are designed for the different tasks; monitoring, following and surveillance, task-oriented.
An example of further improvement of the system is the function “Auto follow”.

To make it even less likely that a suspect is lost, all cameras that can focus on the side streets of the road that is currently viewed on the spot monitor, will do so automatically. With this, chances of loosing a suspect will be less and the help of a second operator is less often needed. In addition a 360° navigation panel is applied. The panel shows a historic panorama view of the surroundings of the current cameraview in shades of grey and the camera image in color within it. This way an operator has a better impression of the environment around the camera and thus enhance his situational awareness further.

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How much cameras can an operator handle?

The municipality of Rotterdam, 2009

SITUATION

In recent years, the number of cameras in Rotterdam has increased significantly. There are also plans to expand the cameras further. Rotterdam-Rijnmond Police, Rotterdam City Supervision and the Management of Safety of Rotterdam think it's important that operators are able to view camera-images sufficiently and do not just want to redistribute new camera-images on the workstations.

QUESTION

The municipality of Rotterdam asked TNO to determine the justified number of cameras per operator, where operators are able to carry out their duties properly. This number can be used to determine the required amount of operators.

RESULT

- Advice on the number of cameras per workstation.
- Assessment and recommendations for reduction of workload.
- Summary of factors of influence.

APPROACH

Essential in a camera surveillance center is that operators detect as much incidents as possible (preferably all). To determine how many cameras an operator can manage for optimal performance, we have elaborated the current work method in the camera surveillance center using interviews and observations, and have estimated the workload of the operators. Documentation and log data have been used to analyze the number of detected incidents per operator in relation to the number of cameras per workstation.

The results showed a detection limit of the number of camera images per workstation. Above this point the number of detected incidents rose less rapidly and even stagnated while the number of camera images per workstation continued to increase.

This number of cameras is determined as the maximum number of cameras per operator.

However, the number of cameras an operator can handle is not straightforward and depends on many factors. A list of factors of influence on the workload and quality of camera surveillance is composed. A distinction is made between human factors (operator), factors related to the tasks to be performed and factors related to the available resources, and coordination between these. These factors, and the intended service to be provided, determine the number of cameras that can be viewed.

On the occasion of the findings, recommendations have been given on how to reduce the work load of the operator. This has been done based on the factors of influence.

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