top engineer

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Covid-19 Issue

CFD studies have been carried out to address the transmission of the Covid-19 virus. – Bingzhi Li

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Covid-19 – preparing for the new normal

The corona virus pandemic has brought widespread human suffering and thrown the world economy into an unprecedented contraction. To mitigate the effects of the economic downturn, the European central bank is pumping just over 1,3 trillion euros into its Pandemic Emergency Purchase Programme. The bank has also indicated that it remains open to additional funding, if necessary. In early June, it announced that it expects the eurozone economy to shrink by as much as 8.7 percent this year. Similar scenarios are playing out across the globe.

Closer to home, the epidemic meant that large numbers of Elomatic employees had to start working from home at very short notice. Fortunately, communication tools like Microsoft Teams had already been taken into use before the pandemic, and remote working was not a new phenomenon for us. What was new, however, was the scale of the operation and the number of employees that had to be transferred to home working over such a short period with virtually no warning. Despite the challenges, the transfer to remote working has been successfully achieved.

It remains to be seen what the new normal will look like after the pandemic, there are bound to be long-term effects on the way we live our lives and operate as businesses. We are actively considering the ramifications on our business and our customers. Successful businesses always look ahead: during an upturn, one should prepare for a downturn, and during a downturn, for an upturn.

Our current focus is on safeguarding our business and ensuring the required liquidity. This should not be done at the expense of development, however. Now is also the time to develop and ensure that we are competitive and can serve our customers to the best of our abilities in the post-Covid-19 world.

Despite the negative effects of the pandemic, opportunities are presenting themselves. Large investments will be required to prepare us better for future pandemics and technical solutions will likely be needed, e.g. in air conditioning, automation, storage facilities, flexible production and multi-function use. Studies and analyses of spaces are required to minimize the risk of transmission in public spaces and transport. The list goes on… Many governments around the world have already pledged to invest vast sums in this regard.

Most articles in this issue of the Top Engineer magazine are Covid-19-themed. They, among others, provide human resources and ICT perspectives on how remote work is progressing at Elomatic, consider how we can better prepare for the post-Covid-19 world, discuss best practices and solutions, and analyse how ventilation simulations may prevent infectious disease transmission on board ships.

I hope that you will enjoy this edition of our magazine and welcome your feedback.

Patrik Rautaheimo
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Contents

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Ventilation simulation

Preventing infectious disease transmission on board

Text: Bingzhi Li

The Washington Post reported on April 25, 2020 that the Covid-19 coronavirus had infected passengers and crew on at least 55 ships, about a fifth of the total global fleet of cruise ships (Washington Post, 2020).

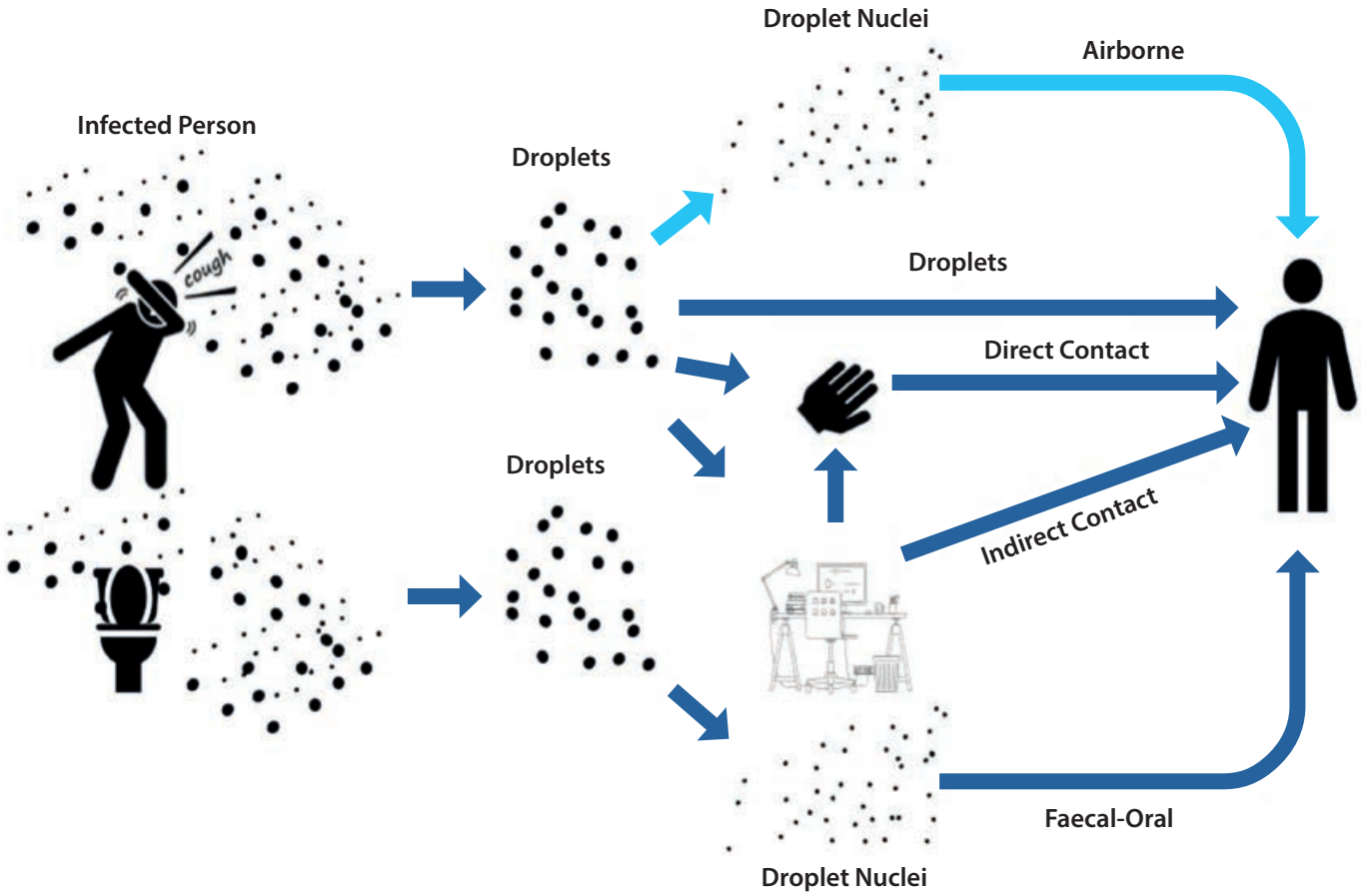
On February 1, 2020, one guest that had travelled for five days on the Diamond Princess tested positive for the coronavirus after disembarkation. On February 4 in Yokohama, ten people onboard tested positive, and the ship was put under quarantine. Over the next month, more than 700 people were infected among 3,711 passengers and crew members on board and for weeks the ship was the site of the largest outbreak outside China (Princess Cruises, 2020) (Mallapaty, 2020).

A study (Mizumoto & Chowell, 2020) on the outbreak on board the Diamond Princess indicates a high transmission potential of the Covid-19 virus inside the confined settings of a cruise ship. The reproduction number, which represents the number of new infections that originate from a single case, is higher in the confined setting than those estimated from community-level transmission cases. After the Japanese government implemented an enhanced quarantine control – the passengers were requested to stay inside their cabins – the reproduction number decreased substantially.

Covid-19 transmission

Transmission of infectious diseases can occur through direct contact with infected individuals, indirect contact via fomites, droplet transmission, and aerosolized fine particles (airborne transmission). It is considered that the

◄ *March 16, 2020. The US Coast Guard escorts the Grand Princess cruise ship out of the Port of Oakland for 2-week quarantine.*



▲ *Figure 1. Dark blue colour: WHO reported exposure mechanisms of Covid-19 SARS-CoV-2 droplets; Light blue colour: airborne mechanism that is known from SARS-CoV-1 and other flu strains. Currently there is no reported evidence specifically for SARS-CoV-2 (figure by Francesco Franchimon) (REHVA, 2020).*

Covid-19 virus mainly spreads through close contact from person-to-person (CDC, 2020).

Respiratory droplets are produced when an infected person coughs, sneezes, or talks. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs. Large droplets (> 10 µm) formed from coughing and sneezing mostly fall onto surfaces no further than 1–2 m from the infected person. Small particles (< 5 µm) involved in airborne transmission form from respiratory droplets which evaporate and desiccate. The small particles (droplet nuclei) may stay airborne for hours and travel long distances. For the Covid-19 virus, airborne transmission is likely but not yet documented. There is also no reported data or studies to rule out the possibility of the airborne route (REHVA, 2020). Currently, WHO recommends airborne precautions of the Covid-19 virus only for circumstances and settings in which aerosol generating procedures or support treatments are performed (WHO, 2020a).

The faecal-oral transmission routes cannot be excluded as the Covid-19 virus have been detected in stool samples. It was observed during the 2002–2003 SARS outbreak that open connections with sewage systems appeared to be a transmission route in an apartment building in Hong Kong (Yu, et al., 2004). It is also known that flushing toilets create plumes containing droplets and droplet residue when toilets are flushed with open lids (REHVA, 2020).

In addition to the person-to-person transmission, aerosol transmission via central air supply or drainage systems are considered to contribute to the high reproduction number observed during the outbreak on board the Diamond Princess (Zhang, et al., 2020).

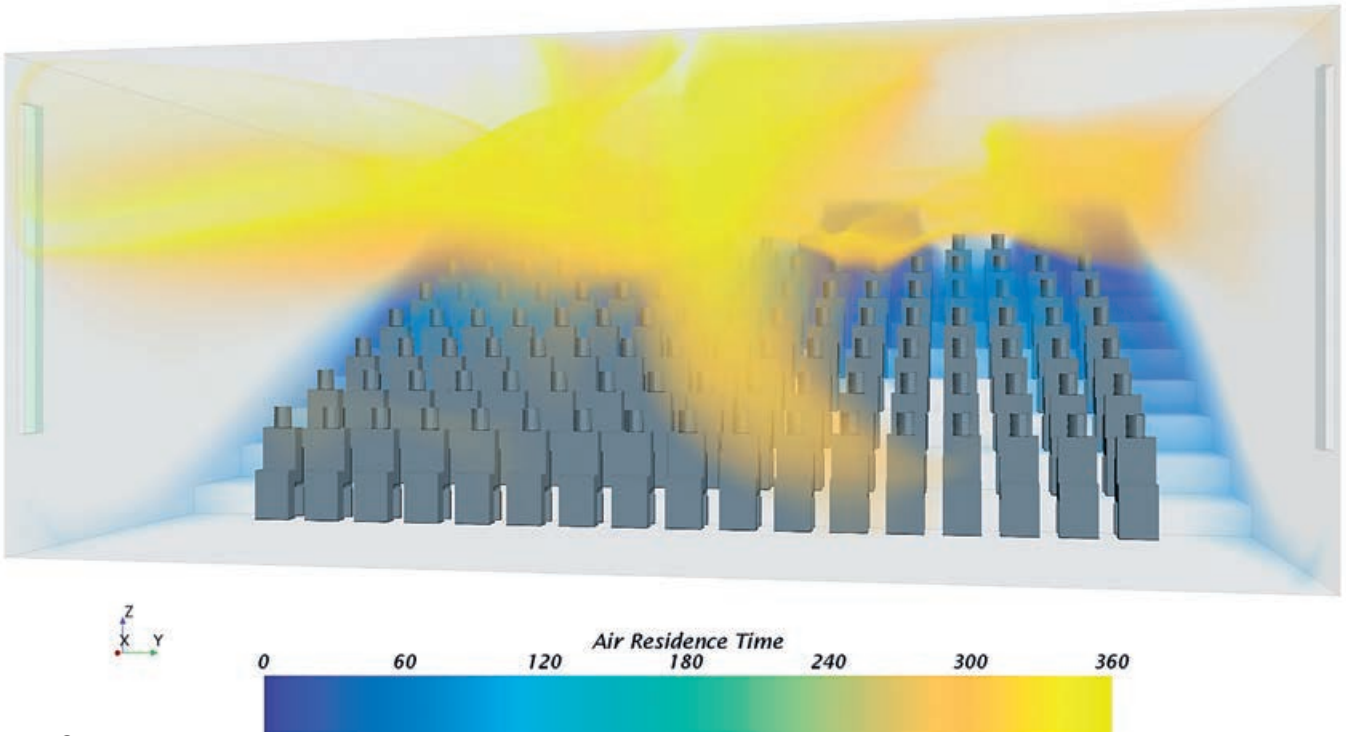


Figure 2a

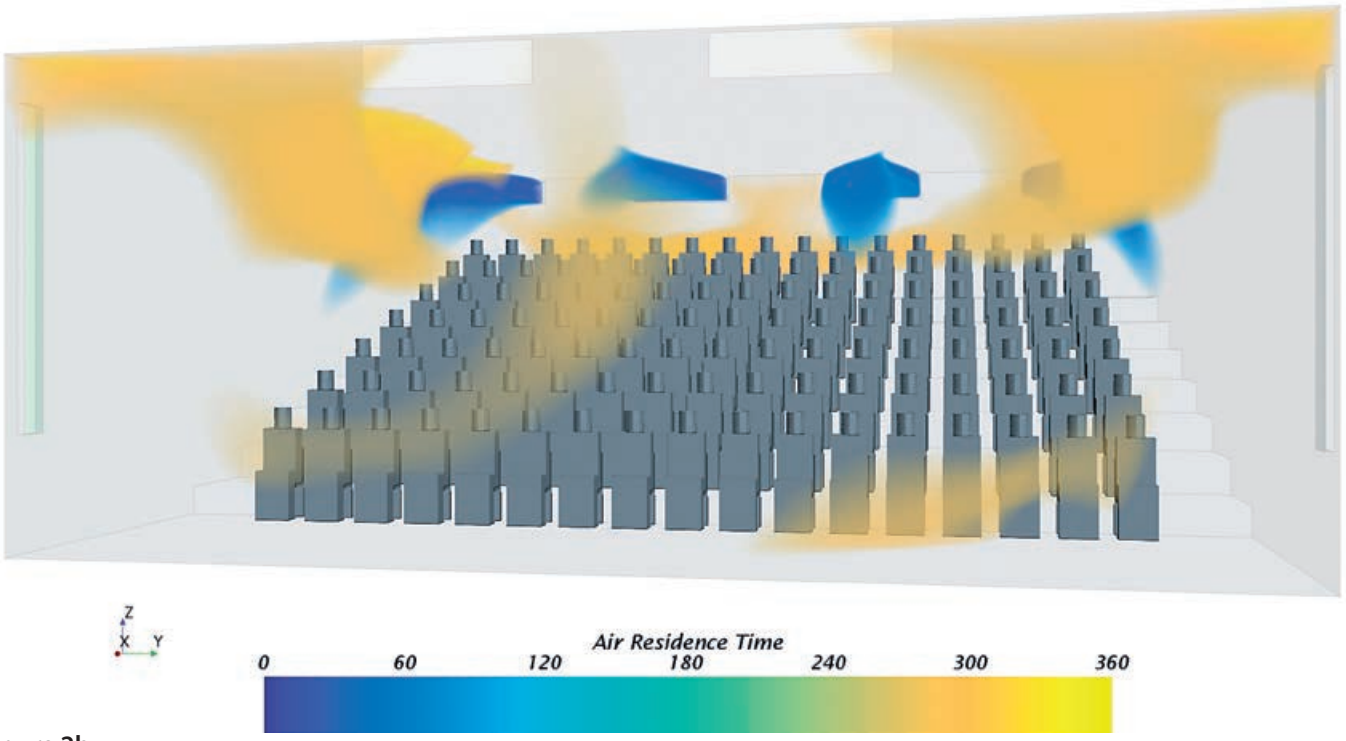


Figure 2b

▲ *Figure 2. Areas with the shortest and the longest air residence time in a theatre with two ventilation arrangements a) and b) – a longer residence time indicates less fresh air and probable air circulation (pictures and simulations by Atte Rättyä, Niko Siilin / Elomatic)*

Ventilation is used as a primary infectious disease control strategy in hospitals and other facilities.

Ventilation in infectious disease transmission

By promoting the dilution of room air around a source and the removal of infectious agents, ventilation is used as a primary infectious disease control strategy in hospitals and other facilities. The Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA) has published a guidance document on how to operate and use building services in areas with a coronavirus outbreak to prevent the spread of Covid-19 depending on HVAC or plumbing system related factors (REHVA, 2020).

In relation to the airborne transmission route, REHVA proposes, especially in "hot spot" areas, the use of the ALARA (As Low As Reasonably Achievable) principle and to take measures that help to also control the airborne route in buildings apart from standard hygiene measures (WHO, 2020b). It is recommended, e.g., to increase air supply and exhaust ventilation, to use more window airing, to flush toilets with closed lids, but not to use recirculation. The recommendations should also be applicable in the settings of a cruise ship.

Correia et al. (2020) proposed three hypothetic ways in which, if not correctly used, HVAC systems can contribute to virus transmission through:

1. air circulation in confined compartments with infected patients;
2. recirculating air in building ventilation systems to different floors/compartments;
3. exchanging air with the surroundings if exhaust filtering systems are not adequate.

There are gaps in the knowledge regarding the role of mechanical ventilation in airborne pathogen transmission. As summarized in a review by Luongon et al. (2016), studies showed an association between increased illness and decreased ventilation rate, however, there was insufficient data to quantify how mechanical ventilation might affect the airborne transmission of infectious agents. The authors called for studies to establish causal relationships between airborne exposures and outcomes and between HVAC system factors and exposures. The outbreak on board the Diamond Princess should be within the scope of such studies.

CFD simulation of ventilation and pathogen transmission

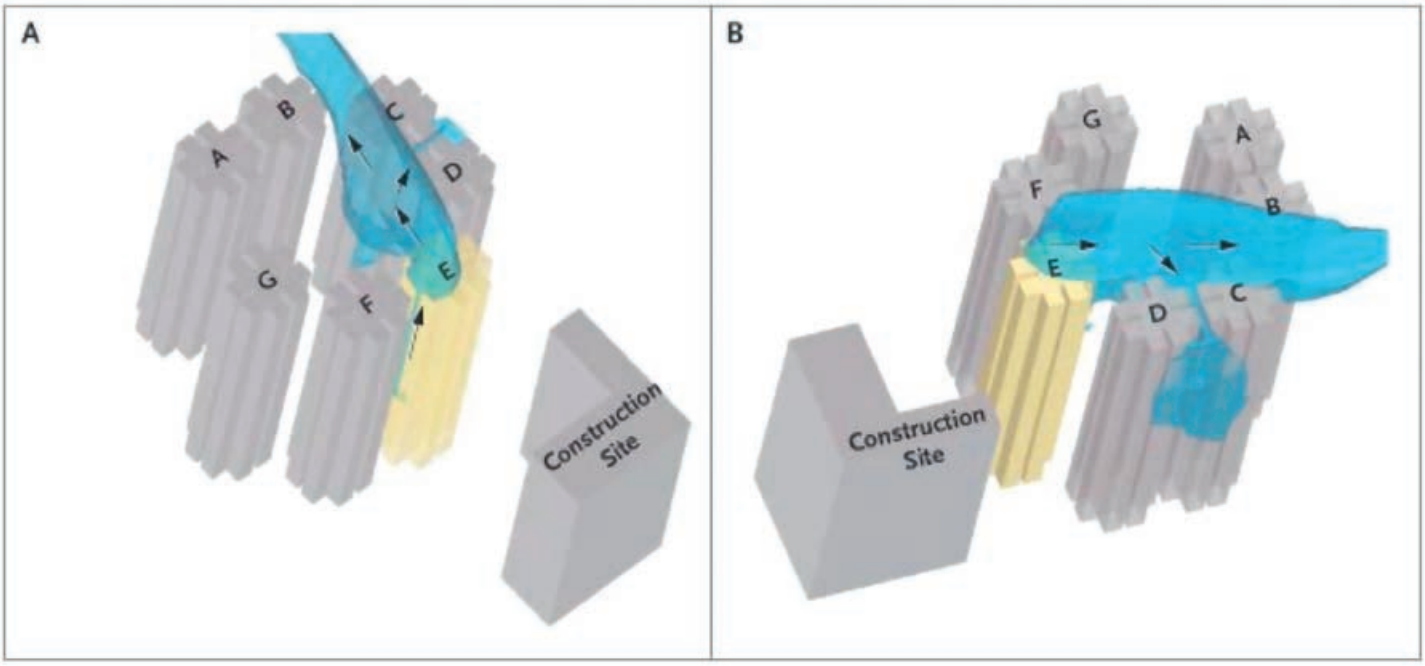
CFD has been widely used in HVAC design to ensure optimum health and comfort for occupants in buildings and to meet regulatory requirements. In a HVAC CFD analysis, thermal comfort and air quality indicators such as temperature, relative humidity, pollutant concentration, velocity, and mean age of air, can be investigated.

CFD should also be able to play an important role in the above-mentioned causal relationship studies, and further, in HVAC design to fulfil requirements in preventing airborne pathogen transmission (Aliabadi, et al., 2011). The dispersion of airborne pathogens in ventilation spaces is affected by many variables such as particle size, mean and fluctuating velocities of air, temperature, and the rate at which the particle transfers mass and heat with the environment (i.e., cooling/heating, evaporation). These processes cannot be modelled analytically except in the most idealized cases. The airflow distribution structure in a room can have a major impact on infectious aerosol concentration beyond the simple effect of increased ventilation rate. Detailed CFD simulations would be necessary to study the effect of room envelope conditions, the location of diffusers and exhaust ports, the air exchange rate, and the ventilation strategy used.

The age of air/air residence time can be used to assess the air change effectiveness of the ventilation system in a building (ASHRAE Standard 129-1997). Different ventilation arrangements of a theatre fitted for cruise ships were evaluated at Elomatic with CFD simulations. As shown in Figure 2, the incoming air is from openings at a) the lower part and b) the upper part of the back wall while in arrangement b) there are additional outlets on the front wall. An area with a local air change effectiveness equal or above 0.95, as required by the ASHRAE standard, can be obtained from the simulations. The area that meets this requirement is 20 % larger in arrangement b) than in arrangement a).

Figure 2 also shows areas with the shortest and the longest air residence time, indicating the airflow distribution structure. The blue color indicates shorter air residence time and fresh air while the yellow color indicates the opposite. With arrangement a), there are significant areas with air residence time in the shortest and the longest spectrums. Near the ceiling, there are larger areas with long air residence time, suggesting pockets of circulating air which is less fresh.

With b) arrangement, there are fewer areas with extremely short or long air



▲ *Figure 3. Model of the movement of a virus-laden plume. The plume originated from the bathroom of an apartment in building E and moved upwards in the air shaft. At the top of the air shaft, the plume was blown by wind towards other buildings (Yu, et al., 2004).*

▼ *Figure 4. Researchers from four Finnish research organizations modelled a situation in which a person coughs down a shelf-restricted corridor typical of grocery stores (picture by Petteri Peltonen / Aalto University) (Aalto University, 2020).*

residence time, indicating a more even distribution of the ventilation air. While a direct link between the air residence time and the risk of airborne pathogen transmission is not established, a comparative analysis is possible. This is so especially for the transmission related to smaller aerosol particles, which tend to closely follow the air flow. Virus-carrying aerosols could be carried away in sufficiently short time from among the audiences, though some could be trapped to the ceiling because of the circulating air. In that respect, arrangement b) with smaller circulating zones would be better.

During the SARS epidemic in Hong Kong in 2003, there was a large community outbreak in the Amoy Gardens housing complex. In a study on evidence of airborne transmission of the SARS virus, the researchers used CFD to predict the detailed airflow pattern in the air shafts and around the buildings in the housing complex (Yu, et al., 2004). The results of CFD simulations conformed to the epidemiologic analysis and supported the probability of an airborne spread.

CFD studies have also been carried out during the current pandemic to address the transmission of the Covid-19 virus (Vuorinen, et al., 2020). Researchers from four Finnish research organizations modelled a scenario where a person coughs in an aisle between shelves like those found in grocery stores while taking into consideration the ventilation. In the situation under investigation, the aerosol cloud spreads outside the immediate vicinity of the coughing person and dilutes in the process. The dilution process can take up to several minutes, emphasizing the importance of avoiding busy indoor spaces (Aalto University, 2020).

Upon the WHO's declaration of a pandemic in mid-March, CLIA (Cruise Lines International Association) ocean-going cruise lines voluntarily suspended worldwide operations (Viking Cruises and Princess Cruises suspended their operations prior to that). The suspension will inevitably have a pronounced detrimental effect on the global economy. However, like in many other sectors, the priority is to stop Covid-19. There is a compelling need to have a better understanding of the transmission routes of the Covid-19 virus on board and the way to prevent it.

Elomatic stands fast with our partners in different sectors to face the challenges brought by Covid-19. For the cruise community, we are ready to provide our support to prepare for the recovery, including CFD simulations for the evaluation of ventilation arrangements and the risk of airborne transmission, and assistance in finding solutions to stem the transmission.

Disclaimer

Knowledge of Covid-19 is still forming, hence information in this article, e.g., on the airborne transmission route, could become outdated. Elomatic and the authors are not liable for any direct, indirect, incidental, or any other damages that may result from, or be connected to the use of the information presented in this document.

Sources

Mallapaty, S. (2020). What the cruise-ship outbreaks reveal about COVID-19. Nature, 580(18). doi:10.1038/d41586-020-00885-w

Mizumoto, G., & Chowell, G. (2020). Transmission potential of the novel coronavirus (COVID-19) onboard the diamond Princess Cruises Ship, 2020. Infectious Disease Modelling, 5, 264-270.

Princess Cruises. (2020, February). Diamond Princess Updates - Notices & Advisories. Retrieved May 2020, from https://www.princess.com/news/notices_and_advisories/notices/diamond-princess-update.html

REHVA. (2020). How to operate and use building services in order to prevent the spread of the coronavirus disease (COVID-19) virus (SARS-CoV-2) in workplaces. Federation of European Heating, Ventilation and Air Conditioning Assosiations. Retrieved May 19, 2020, from https://www.rehva.eu/fileadmin/user_upload/REHVA_COVID-19_guidance_document_ver2_20200403_1.pdf

Vuorinen, V., Aarnio, M. A., Alava, M., Alopaeus, V., Atanasova, N., Auvinen, M., . . . Kuusela, J. (2020). Modelling aerosol transport and virus exposure with numerical simulations in relation to SARS-CoV-2 transmission by inhalation indoors. Safety Science.

Washington Post. (2020, April 25). The pandemic at sea. Retrieved May 2020, from https://www.washingtonpost.com/graphics/2020/politics/cruise-ships-coronavirus/

WHO. (2020a). Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations. Scientific brief. Retrieved May 19, 2020, from https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

WHO. (2020b, March 3). getting-workplace-ready-for-covid-19.pdf. Retrieved from World Health Organization: https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf

Yu, I. T., Li, Y., Wong, T. W., Tam, W., Chan, A. T., Lee, J. H., . . . Ho, T. (2004). Evidence of airborne transmission of the Severe Acute Respiratory Syndrome virus. The New England Journal of Medicine, 350, 1731-1739. doi:10.1056/NEJMoa032867

Zhang, S., Diao, M., Yu, W., Pei, L., Lin, Z., & Chen, D. (2020). Estimation of the reproductive number of novel coronavirus (COVID-19) and the probable outbreak size on the Diamond Princess cruise ship: A data-driven analysis. International Journal of Infectious Diseases, 93, 201-204. doi:https://doi.org/10.1016/j.ijid.2020.02.033

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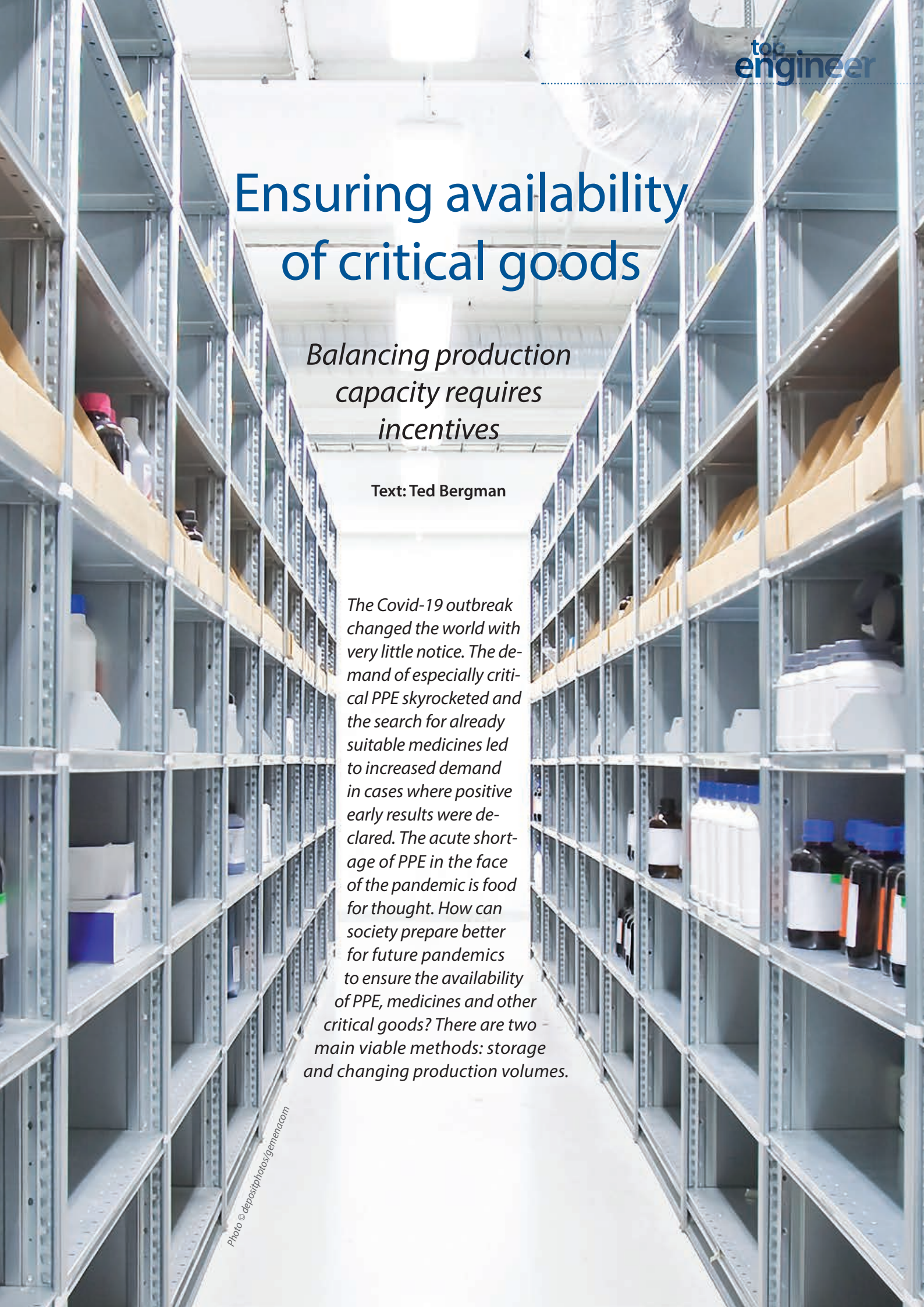
Ensuring availability of critical goods

Balancing production capacity requires incentives

Text: Ted Bergman

The Covid-19 outbreak changed the world with very little notice. The demand of especially critical PPE skyrocketed and the search for already suitable medicines led to increased demand in cases where positive early results were declared. The acute shortage of PPE in the face of the pandemic is food for thought. How can society prepare better for future pandemics to ensure the availability of PPE, medicines and other critical goods? There are two main viable methods: storage and changing production volumes.



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During the pandemic, the change in demand for PPE masks of higher FFP3 quality with relatively low production capacity left many hospitals and the general public without masks. Few companies where able to change production to FFP3 masks at short notice. By comparison, the demand for hand sanitizer also increased rapidly. It was, however, much easier for many companies that typically handle bottling of other types of fluids to change to producing hand sanitizer.

Overall, the change was of a magnitude that most industries and the public where not prepared for. As it is inevitable for new viruses to emerge, it is critical to know what measures can be put in place to be better prepared next time. The current high demand will subside, either due to natural immunity, a vaccine, or lockdowns that stop the spread of the disease.

Learning from electrical grid balancing

The time between outbreaks so far has been much longer than common pay-back times of industrial investments. Additionally, there is uncertainty about when the next outbreak will be and how the world will react to it. This means that industrial investments will go back to the old normal and the readiness for more demanding supplies during outbreaks will be insufficient, unless economic incentives are put in place.

The electrical grid is a similar system for comparison: there are peak shaving plants and discussions and investigations for the future a centred on increasing energy storage. The fluctuation in the electrical grid is much faster, which has necessitated systems where cost sharing for plants on standby is in place. Similar systems will be required for virus outbreaks and demand fluctuations of critical materials (e.g. PPE, APIs, Medicines, IVs, food), even though the cycles are unpredictable.

Ramping up storage and changing production volumes

There are two main methods to secure the availability of critical materials: a)

A stock reserve is necessary to buy time at the start of a pandemic.

storage and b) changing production volumes.

Storage is a viable option in many cases. For the energy sector, storage will be one of the next big leaps in order to enable full utilisation of volatile green energy such as wind and solar. The scale of fluctuations ranges from hourly to seasonal, but not beyond that. At the same time, there are elements of consumption that can be regulated.

The demand for materials storage between pandemics is quite different from the demand fluctuations of the electrical grid. The electrical grid is more controllable than a pandemic, which is characterised by extreme demand peaks and fluctuations that are far beyond seasonal. Storage dimensioning for PPE during pandemics is, therefore, more challenging.

A stock reserve is necessary to buy time at the start of a pandemic. The difference between low and peak demand is so vast, however, that a stock supply will be difficult to maintain. It will also be challenging to maintain enough material rotation to keep the PPE in usable condition. This will result in outdated materials in stock or the disposal of aged materials.

By comparison, electrical grid dimensioning is aided by the knowledge of when production will start again, i.e. when the sun rises, or the wind starts blowing again. The same principle needs to be applied to pandemic demand; the stock should be dimensioned to last for the extreme peak until production can be ramped up. This means that plans for ramping up production need to be in place.

As noted earlier, the initial shortage of hand sanitizers was handled quite rapidly. Companies were able to rearrange and change production rather quickly. One could say that the market-driven development in this case was fast.

The same cannot be said about some other supplies that were in short supply such as medicines and especially PPEs. Problems were also encountered in increasing the number of hospital beds. Some facilities were very light; tents were used where there was good warm weather, while sports facilities and school buildings were taken into use as hospitals. The planning for these facilities was based more on military demands and it would be beneficial to be better prepared in future. Multi-function use can, for example, already be incorporated in design criteria when schools are designed so they may be used as hospitals should the need arise.

During the pandemic, the supply chain vulnerability of industrial products has been notable. The reason for this is normal global market competition. Here the electrical grid may yet again prove a good guide. Funds need to be directed towards influencing preparedness. The same applies to the readiness to ramp up or change production for peak demand. Such incentives would pave the way for the development of technical solutions to meet the required levels of preparedness most cost efficiently. This will not take place, however, without incentives due to the unpredictable pandemic cycles and the political reactions to them.

The incentives thus need to be managed at the state level, regardless whether it is IV production, PPE, APIs, or medicines. With good models, industry will surely find technical solutions to ramp up production when needed in the same way innovations are being developed for the electrical grid.

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Ted Bergman joined Elomatic in 2019 as Vice-President with a focus on developing international business. His professional experience dates back to 1995 and covers sales, design and commissioning tasks in e.g. the power industry, pulp & paper industry, and process industry.

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Remote work

Best practice and practical experience: an HR perspective

Text: Marja Salenius-Ranki

Covid-19 has seen exponential growth in the number of employees working from home. From a human resources management perspective, this brings fresh challenges. What is best practice and how does one keep employees motivated in the completely new working environment?

The increase in home working has seen a surge of media articles and advisories as to how remote work can be conducted efficiently and managed effectively. In this article, I review guidelines gathered from elsewhere and draw on practical experience and surveys conducted among Elomatic employees to discuss the efficacy of remote work, best practices, and what the future holds.

Staying focussed and productive

According to Tsedal Neeley, a professor at Harvard Business School, there are several simple ways leaders can help their employees to remain productive, focused, and psychologically healthy as they work from home during the current global pandemic.

The right tools and technology to operate remotely are naturally needed,

Remote work is functioning surprisingly well.

but Neeley stresses that frequent communication and interaction is more critical than ever. Frequent virtual meetings should be arranged, and managers should really pay attention to their employees' behaviour. She also points out that it is important that to keep to daily routines, but at the same time to take advantage of the flexibility provided by working from home.

Communication is paramount

When working remotely, constant communication has become paramount. There are some pointers that are good to remember, as virtual communication is very different from face-to-face discussions.

First: Get your video on. There is a massive difference between being connected by video and only having audio available. Having both a visual and an auditory connection boosts understanding. The more channels you have, the better the communication is. Also, video connections lead to more concentrated participants who do not multitask while in meetings – they do not, for example, read or send emails while in meetings.

It is also good to remember to slow down. There is a tendency to make every virtual interaction as fast and efficient as possible. In these times of isolation, communication is important to remain socially, psychologically, and emotionally connected, and not only get work done. Time should also be allocated for small talk and having virtual coffee breaks. Also, do not forget to laugh and have fun from time to time.

Internal surveys shed light on remote work experiences

At Elomatic, surveys have been conducted among employees to gauge how they have experienced remote work and to collect ideas for tips and best practices. The overall theme of the feedback was that remote work is working surprisingly well.

After the first weeks of remote work, the feedback was mainly positive: no need to commute, flexibility of working time, and no interruptions. Employees tips for managing remote work included going for a walk before starting work, remembering to have breaks, writing down goals, having online coffee breaks, taking care of ergonomics, and generally concentrating on positive things.

Most employees feel that their work has been even more efficient while working remotely. Naturally, not all the feedback has been positive. Negative feedback has included the inability to chat with colleagues in the corridors or during coffee breaks, the challenges of working at home with children in the household, and occasional network issues.

After 10 weeks of remote work, 72 % of all managers felt that their teams could work as efficiently or slightly more efficiently remotely than in the office. Challenges included personal time management with increased Microsoft Teams meetings and increased communication needs.

With regards best practices in leading remote teams, managers highlighted frequent communication, one-to-one meetings, the use of chats and shared documents. Positive attitudes and trust were also mentioned. Importantly, all managers feel that it would be possible for their teams or part of their teams to work remotely in future.

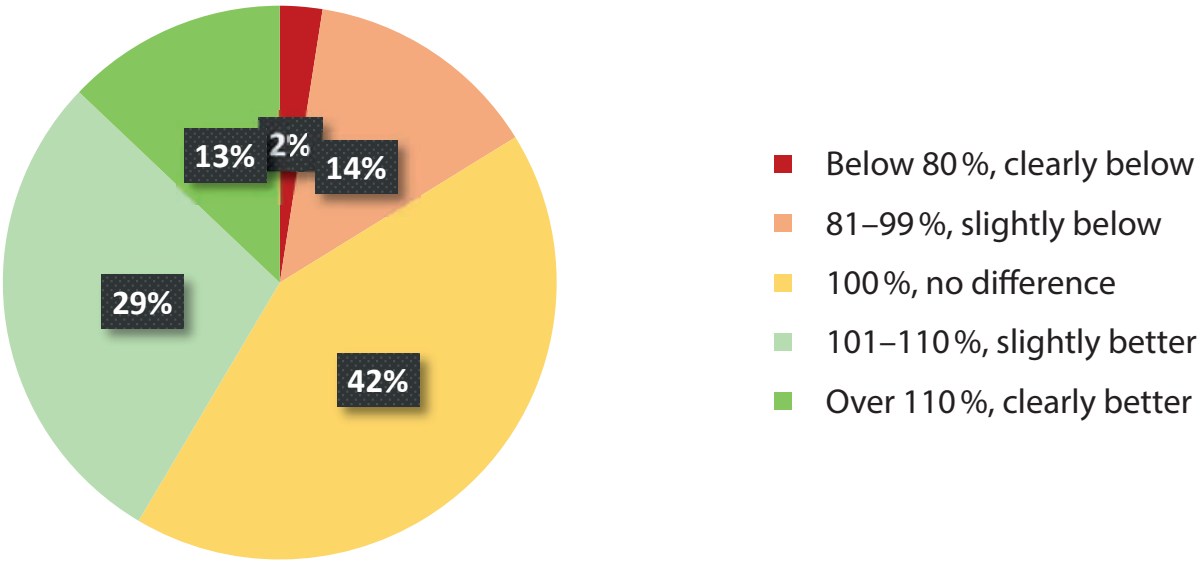
Work efficiency at office levels or better

Unsurprisingly, 84 % of all respondents felt that there is either no difference (42 %) or they can work even slightly better (29 %) or clearly better (13 %) at home. As the purpose of the surveys was also to collect views on how to continue in the future, employees were asked whether they would be willing to continue with more-or-less permanent remote work with no permanent workstations at the office. Almost 38 % of all employees indicated that they would not need a permanent desk and would like to continue working remotely almost permanently.

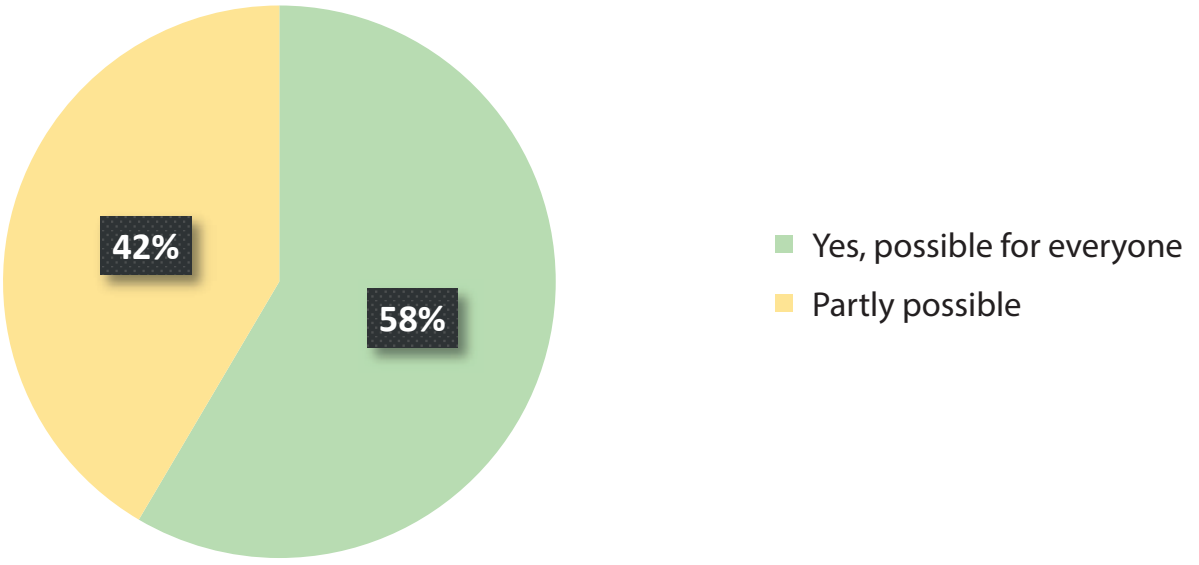
They valued time saved not commuting to work and felt that working at home provides more flexibility and freedom. Some employees indicated that they would like to continue remote work but would still like to have their own dedicated workstation for office days. Developing ergonomics and internet connections at home would improve remote work

▼ *Selected results from internal remote work surveys*

How efficiently were you able to work remotely compared to working at the office?



If you could work remotely more permanently (for example 1–2 days at the office, 3–4 days remotely), would it be possible for your team?



even further. Negative experiences were related to longer working days and the lack of social contacts and canteen services.

Based on the feedback, it seems that most employees and managers feel that working remotely has been a rather positive experience. It requires new skills and ways of working, active communication and teamwork skills, but no major obstacles were encountered.

Not all sunshine and roses

As always, there are two sides to a coin. According to a study conducted by Lindsay McGregor and Neel Goshi, employees who work remotely are less motivated. It was found that employees that have no choice in the matter, were the least motivated.

It was also found that employees may miss the joy of problem solving together and that decision-making may be more difficult when people are not in the same room. They indicate a higher probability for misunderstanding and that the ability to learn from colleagues and help them develop is impaired without physical proximity. They furthermore point to mental health problems and insecurities about the future that may influence some employees' wellbeing. These factors are naturally something that HR managers need to keep an eye on.

What next?

The Covid-19 pandemic forced many companies into the unprecedented and unplanned experiment of remote work for most of their employees.

From our internal surveys, it seems that both managers and employees are positively inclined to the idea of continued remote work, at least partly. This will require planning on how and to what extent the remote work option will be an alternative once the pandemic is over.

It is still important to work physically together, and one should not forget the value of people truly working side-by-side, brainstorming, developing and innovating new solutions – it is easier when we are in the same room.

Life will most likely not be the same after the pandemic, but fortunately we will continue having brilliant, clever, innovative and kind employees, regardless whether they work from the office or remotely.

Seven top tips for remote work

1. Remember to have regular breaks to maintain your productivity and motivation.
2. Keep in touch with your colleagues and manager. You can always call and just ask how they are.
3. At the end of the day, check your accomplishments and celebrate your wins.
4. Check if you are not sure. Don't be afraid to call to ask for help.
5. Set clear boundaries at home – what is work time and what is free time.
6. Maintain a regular schedule and stick to it.
7. Get dressed – it puts you in the right mood to work.

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Marja Salenius-Ranki is a HR expert with over 20 years' experience in global HR roles. She has a passion for development and people. She joined Elomatic in 2014 to lead Elomatic HR function. During her time at Elomatic, the company has almost doubled its headcount to over 1,100 employees. She strongly believes that employees come first – engaged, happy and motivated employees result in successful and happy customers.

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Protecting the vulnerable against infectious diseases

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Residential care homes and units for supported living are facing a very difficult situation in the face of the Covid-19 pandemic. Generally, care home inhabitants are the most vulnerable to the virus, and care homes have very limited resources to provide their customers with enough protection against the spread of infectious diseases. This article discusses possible mitigation actions, drawing on knowledge from the pharma and biotech industry.

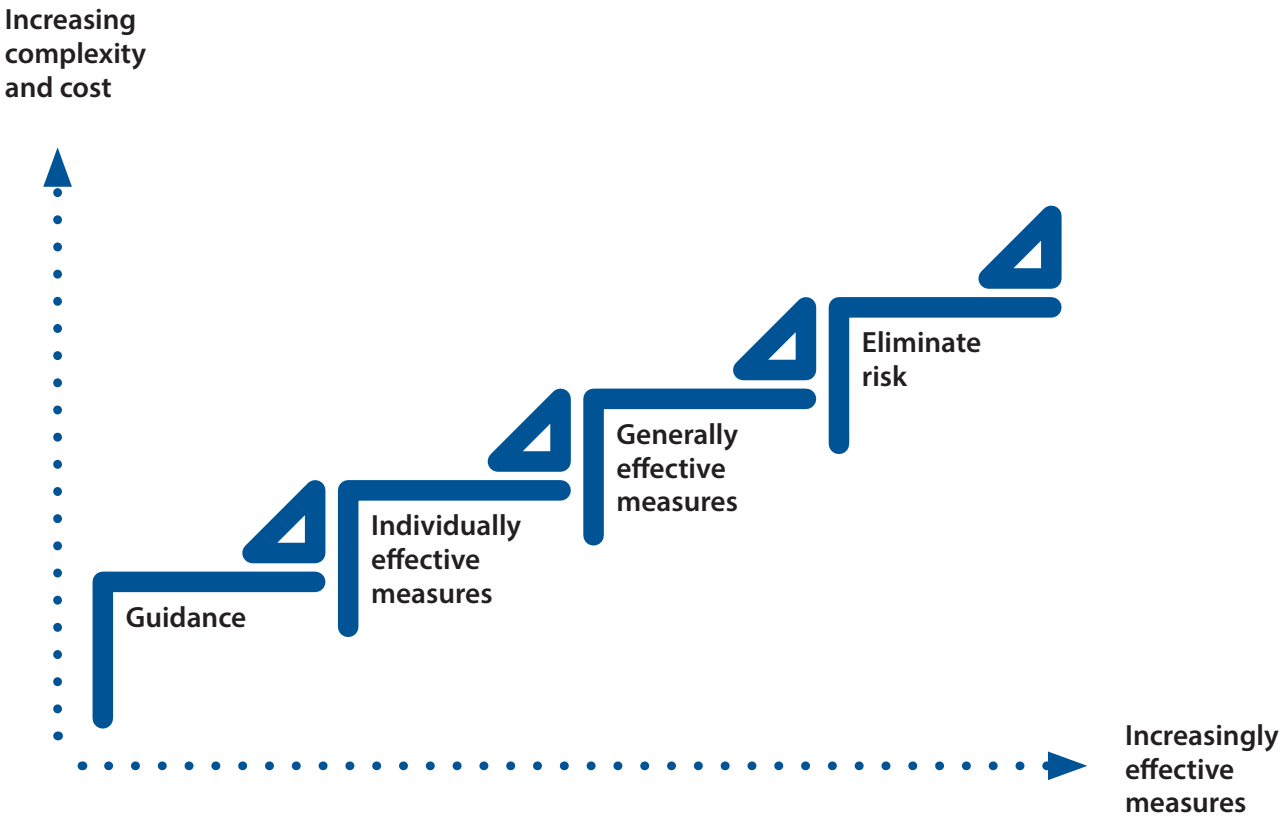
We can only observe risks that we are aware of. To put it slightly harshly, crises tend to help identify risks at a general level. In several countries, residential care homes have reported unfortunate events of how the corona virus has caused devastation among their inhabitants, killing many defenceless, sick and elderly people. Thus, in the aftermath of this ongoing crisis, the authorities will most probably impose new controls to prevent the spread of infectious diseases in care homes.

Spreading paths

Many infectious diseases are airborne, which means that they spread via human respiratory organs. Viruses are insidious; they cannot be felt or seen in any way. To make matters worse, symptom-free persons can spread them.

To most people, the current disease has mostly been a (frightening) nuisance, but especially for elderly people it is a matter of life and death. The virus is generally brought into care homes by personnel who got infected outside of the care home, or by new inhabitants that come into contact with the other inhabitants. The main enabler is that the person in question has not yet developed symptoms of the disease. In these cases, the risks have not been properly identified.

Text: Tony Lönnbäck



▲ *Balancing the complexity and effectiveness of measures.*

Prevention or protection?

Having identified a risk, it should, if possible, be prevented. If this is not possible, the risk should be reduced to an acceptable level. In theory, preventing an infectious disease from spreading is very simple; the virus or all interactions between people must just be eliminated. In practice, this is, however, not feasible, so another strategy needs to be applied.

Risk reduction measures should be prioritized so that generally effective measures are preferred over personally effective measures, which in turn have priority over guidance only, which is the last step – and the least effective measure.

The availability of options boils down to cost and preparedness. Cost and timing are crucially important. In the face of a crisis, the mitigation measures at the lower end of the priority scale are in general the cheapest and quickest to implement. When mitigating the spread of an infectious disease, the actions that are the simplest to implement are washing hands and wearing respiratory/face protection. They are also part of the least effective protective measures.

The more prepared one is, the larger the selection of available actions is. For example, if a facility was originally designed to enable quarantining or isolation of persons, and the personnel have been trained properly in dealing with infectious diseases, the best preparedness possible has been achieved. This is rarely the case, however.

Effective mitigation measures

As previously indicated, implementing a quarantine or isolation area is the most effective way of preventing the spread of disease. Currently, only few residential care homes and hospital bed departments have fully-fledged areas for the purpose. There

Organisational measures are generally as important as technical ones.

are, nevertheless, some technical and organisational measures that can be implemented to reduce the probability of an outbreak. These measures can be selected by means of a risk-based approach.

'Contamination' and 'cross-contamination' are terms that are used in the pharma and biotech industry to describe the transfer of a contaminant into a product or carry-over of one product into another. These unwanted phenomena happen via various flows, which could be called spreading paths in this context. The idea is to cut as many spreading paths and flows as reasonably possible – or at least to ensure a unidirectional flow towards the quarantine/isolation area.

The risk-based approach mentioned above would include identifying all possible spreading paths, assess their importance with regard to possible transmission, and develop effective mitigation measures to cut as many paths as possible from a technical and economical perspective.

This systematic, in-depth study then presents the possibilities available and modifications required at the facility. Typical paths may be related to persons (inhabitants and personnel), materials (e.g. foodstuffs, mobility aids) and air (both building ventilation and exhalation). The target is to keep "wildcards" separated as much as possible from the rest of the inhabitants and personnel. Some level of added safety can sometimes be achieved relatively simply by e.g. closing a door or two inside the facility and using a back door as a spare entrance. If ventilation can be separated for a certain area, that could also increase safety.

Organisational measures are generally as important as technical ones. Especially when there are people who have fallen ill, preventing personnel exchange between departments is crucial. One way to do this would be to provide a "take-away" meal service to the quarantine or isolation ward. There are many aspects that can and need to be observed, and in some cases professional advice may be beneficial. The most important perspective, however, is to ensure that everyone is provided human interaction and care.

Return on investment

How does one calculate the return on investment (ROI) for an investment that is not directly related to increasing the accommodation capacity of the facility? How does one quantify the value of possibly being able to save human lives? To be able to answer this question, one needs to consider business dynamics. Competition always favours the prepared and good business reputation is founded on preparedness.

The recent events caused by the corona virus pandemic will certainly have at least two consequences: firstly, the authorities will most probably introduce legislation that obliges care home operators to identify and address risks related to infectious diseases, and secondly – and more importantly – customers and their families will question whether their elderly family members are safeguarded against diseases in a facility.

Therefore, if a facility is safe, customers will come knocking at its door also in the future. This is a clear return on investment that will also allow carers to safely focus on their core business.

About the author

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Tony Lönnbäck holds a Master's degree from Åbo Akademi University. He has been involved in projects in the bio and pharma industries since 2002 and is an expert in GMP and validation matters. During the past few years, he has been focusing on safety tasks within plant projects. Based at the Elomatic Turku office, he is currently assigned to leading and developing Elomatic's HSE service portfolio.

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Covid-19 sparks medical

– sheds light on device requirements

Text: Kalle Virta

The Covid-19 pandemic has brought the whole world to a practical standstill, while healthcare is operating just beyond its limits. Currently, there are not enough health care staff to treat all Covid-19 patients as well as a shortage of much needed medical devices. This presents vast opportunities for established players and new entrants. Proper protocols need to be followed in product development, however, to ensure that devices are safe and reliable.

Covid-19 is caused by a coronavirus (SARS-CoV-2) and results in problems virtually in the whole body, the most serious of which occur in the lungs. A wide variety of devices can be used to ensure the functioning of the respiratory system of a Covid-19 patient. Unfortunately, there are too many Covid-19 patients, which has greatly fuelled demand for medical devices and created an unprecedented need for new innovations.

Medical device development a demanding process

Getting a medical device to market may seem cumbersome, time consuming and a little daunting. The process is indeed demanding, but it is intended to ensure that products launched on the market have been properly designed, are safe and reliable. There is a natural temptation to look for shortcuts or alternatives, but this should be avoided. In most cases, such approaches are doomed to cause delays and increase costs further down the road.

High demands are a requirement even now during the pandemic, although the need for fast equipment availability has grown tremendously. The path to the market may be faster at the moment, but the associated quality standards remain high.

Consider the following scenario: Company A has an excellent product idea, a product design or even a product prototype. The market is also ready for the product and a clear need exists.

When considering how to develop and get the product launched, Company A begins to consider whether a medical device classification for the product will result in an unnecessarily expensive and lengthy project. What if competitors use this time to fill the

Photo © depositphotos/sudok1

device boom

space? Would it not be better to avoid the medical device classification and fast-track development, thereby ensuring success? In short, the answer is a resounding NO.

If a device is erroneously classified as serving a purpose other than that of a medical device, and the classification needs to be changed later, the entire process needs to be started from scratch. It makes much more sense to reduce uncertainty by adhering to proper processes.

There are seven phases involved in developing and launching a medical device successfully, starting from defining the device use and product classification, as well as its essential requirements, and ending with registering the device and product to market. A detailed overview of the phases follows overleaf.

Phase 1
Defining device use and product classification

Phase 2
Fulfilling essential requirements of device

Phase 3
Clinical evaluation

Phase 4
User and safety instructions

Phase 5
Evaluation of compliance with requirements

Phase 6
CE marking

Phase 7
Registering device and product to market

Phase 1: Defining device use and product classification

In the first phase of getting a medical product to market, the device designer or manufacturer must define the device use. In practice, this is where the manufacturer decides whether the device is a medical device or not.

The definition of use also defines the entire process of getting the product to market and, therefore, this phase requires special attention. In Europe, guidelines for defining use are provided in the European Medical Devices Directive 93/42/EEC.

Once a device has been defined as a medical device, the manufacturer is obliged to classify the device appropriately according to the directive (see Figure 1). The EU's Medical Devices Info internet pages (http://meddev.info/) are an invaluable resource in this regard, and manufacturers and developers are well advised to make full use of it.

▼ *Figure 1. Classification of medical devices. Manufacturers are obliged to classify medical devices appropriately according to the directive.*

Phase 2: Fulfilling essential requirements of device

The manufacturer is responsible for ensuring that the medical device fulfils the essential requirements as set out in the Medical Devices Directive for its intended use. The directive defines which standards are to be adhered to when designing, manufacturing and storing the device. The European commission also maintains and updates these harmonised standards on its web pages.

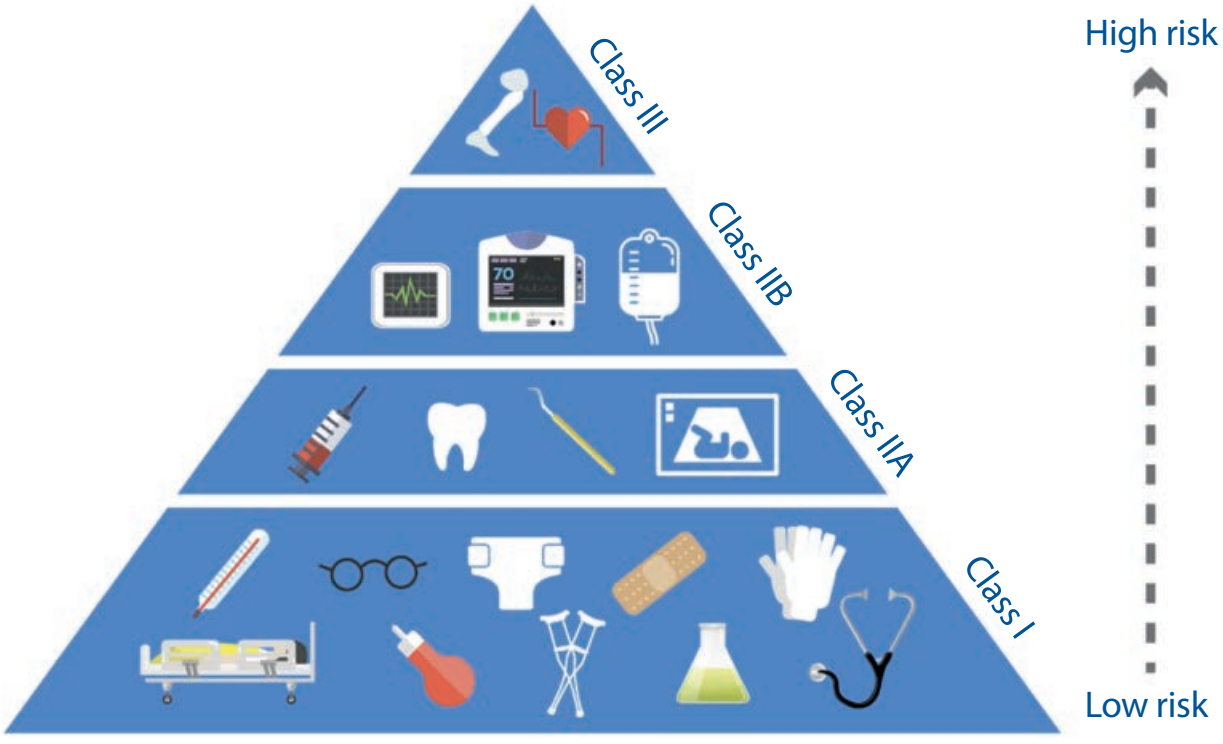
By fulfilling the essential requirements, the manufacturer ensures that the device can meet its defined performance levels and does not endanger the lives of patients and users. For this reason, the manufacturer also must perform a risk analysis of patient and user safety for the device.

Phase 3: Clinical evaluation

The manufacturer must specify the intended use of the product. The product description must also provide information about the characteristics and performance of the product in its normal environment of use. The demonstration of product compliance must include a clinical evaluation, which includes both an evaluation of the efficacy and functionality of the device. Any adverse effects should be identified and evaluated based on a risk analysis. A clinical evaluation is mandatory for all products.

A clinical evaluation determines, if necessary, the functionality and suitability for use of the device and its accessories. It determines and evaluates the properties, performance, and side effects of the device and its accessories. It is part of the procedure of attesting conformity before it is placed on the market or put into service.

The requirements for clinical evaluation are included in national legislation.



Proper protocols need to be followed to ensure that devices are safe and reliable.

The SFS-EN ISO 14155 standard can be used to assist in the design and implementation of research.

Phase 4: User and safety instructions

The device or its packaging needs to be labelled with information regarding the manufacturer and safe use. High quality user instructions should also accompany the product. The level of required detail in labelling usually becomes clear when fulfilling the essential requirements of the directive in phase 2.

In Finland, instructions for safe use intended for end users and/or patients are required in both Finnish and Swedish. General user instructions or similar information is required in Finnish, which is to be supplemented with either Swedish or English.

Legislation requires that high quality user instructions are drawn up and provided with medical devices. The proper use and operation of medical devices is essential from the perspective of the patient's and user's safety. It is, therefore, imperative that enough time and effort is put into drawing up such instructions.

If necessary, the help of experts with experience in producing high quality instructions should be considered. The quality of instructions is one of the areas the authorities consider when evaluating whether a device complies with the set requirements.

Phase 5: Evaluation of compliance with requirements

The manufacturer is obliged to draw up technical documentation regarding the fulfilment of essential requirements, as well as about the measures that enable the evaluation of the device's compliance with requirements.

A clinical trial should always be conducted in order to verify compliance with requirements. The clinical approximate values define the device features and performance. The results of the risk analysis in phase 2 are also evaluated during the clinical device trial.

Specific procedures have been set out for different device classifications to prove compliance with the requirements. The provisions for acceptable clinical device trials are set out in national legislation. It is mandatory for all medical devices to undergo clinical trials.

For devices with IIA, IIB and III classifications the evaluation of compliance with requirements can be conducted only by facilities that have been declared by EU country governments. In Finland, there are currently two such facilities.

Phase 6: CE marking

When the compliance with requirements has been evaluated and proven, the manufacturer can attach a CE marking to the device. By attaching the marking the manufacturer confirms that the device fulfils its defined essential requirements. The marking also confirms that the manufacturer accepts responsibility for the design and manufacture of the product.

Phase 7: Registering device and product to market

When the first five phases have been completed, the manufacturer must register the device with the appropriate national authorities. In Finland, Fimea (http//www.fimea.fi) is responsible for maintaining the device register.

At this stage, one can say that the manufacturer has diligently followed the process and taken responsibility for ensuring that the device meets its defined requirements. It also at this stage the product could be considered ready for the market.

The marketing and launching of the medical device is in itself a challenging project, but if the process described in this article has been followed, the manufacturer can at least feel that all bases have been covered before the actual marketing and launch of the product.

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Kalle Virta graduated as a physiotherapist from the Jyväskylä Institute of Health Care in 1995. After some years in the health care sector, he graduated as an engineer, majoring in health technology from the Jyväskylä University of Applied Sciences in 2004. Kalle has extensive healthcare experience in health and assistive technology. He works as a product engineer at the Elomatic Jyväskylä office.

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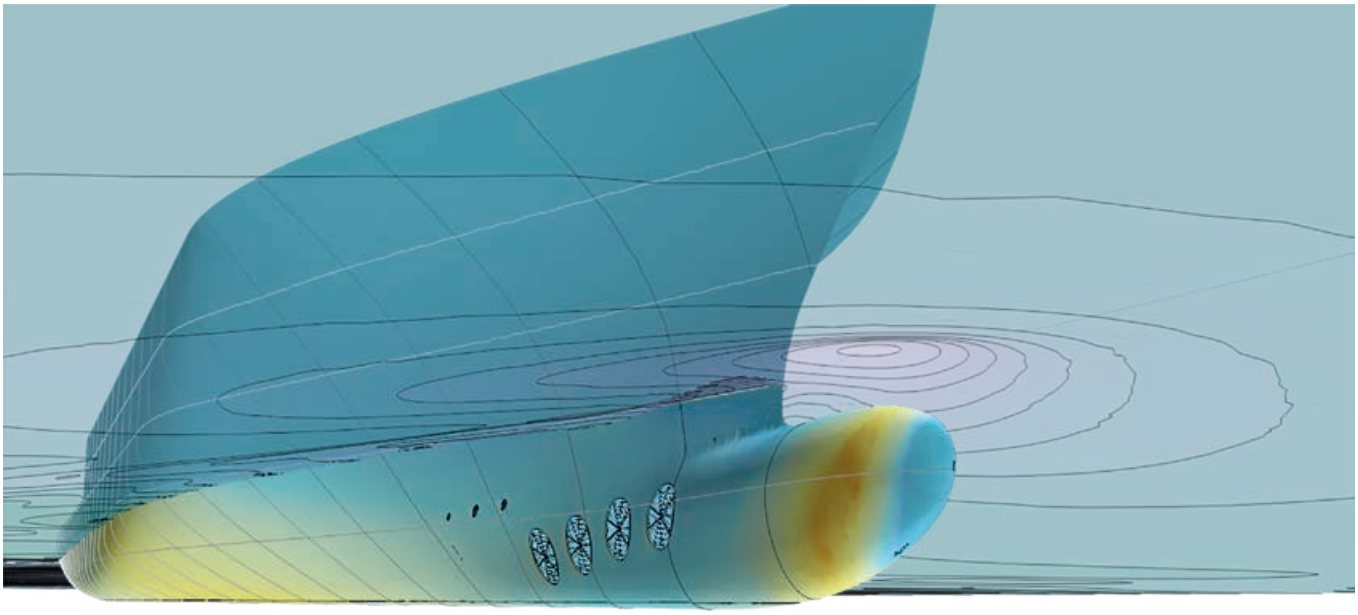


Improving ship hull hydrodynamics

ELOGRID utilised in bow thruster tunnel openings

Text: Juha Tanttari

Ship hulls are equipped with thrusters that allow lateral ship motion, for example, in harbour manoeuvring. The propellers that induce the force are mounted inside tunnels in the bow section or, in some cases, in the stern section. These tunnels increase ship resistance, which can be reduced with the use of grids set in the openings.

Thruster tunnels are necessary to improve ship manoeuvring but adding these tunnels to a nicely shaped ship hull can contribute to additional resistance, which is reflected in ship fuel consumption.

The additional fuel consumption depends on the hull shape and varies from 1 % per tunnel to 3 % per tunnel. In some cases, the additional resistance contributed by the tunnels can be as high as 10 % of the ship hull's total resistance. This means that a relatively large amount of money will be spent on fuel while also producing additional CO_2 emissions.

The additional resistance can be reduced with the use of vertical grids set orthogonally to the streamlines close to the hull surface.

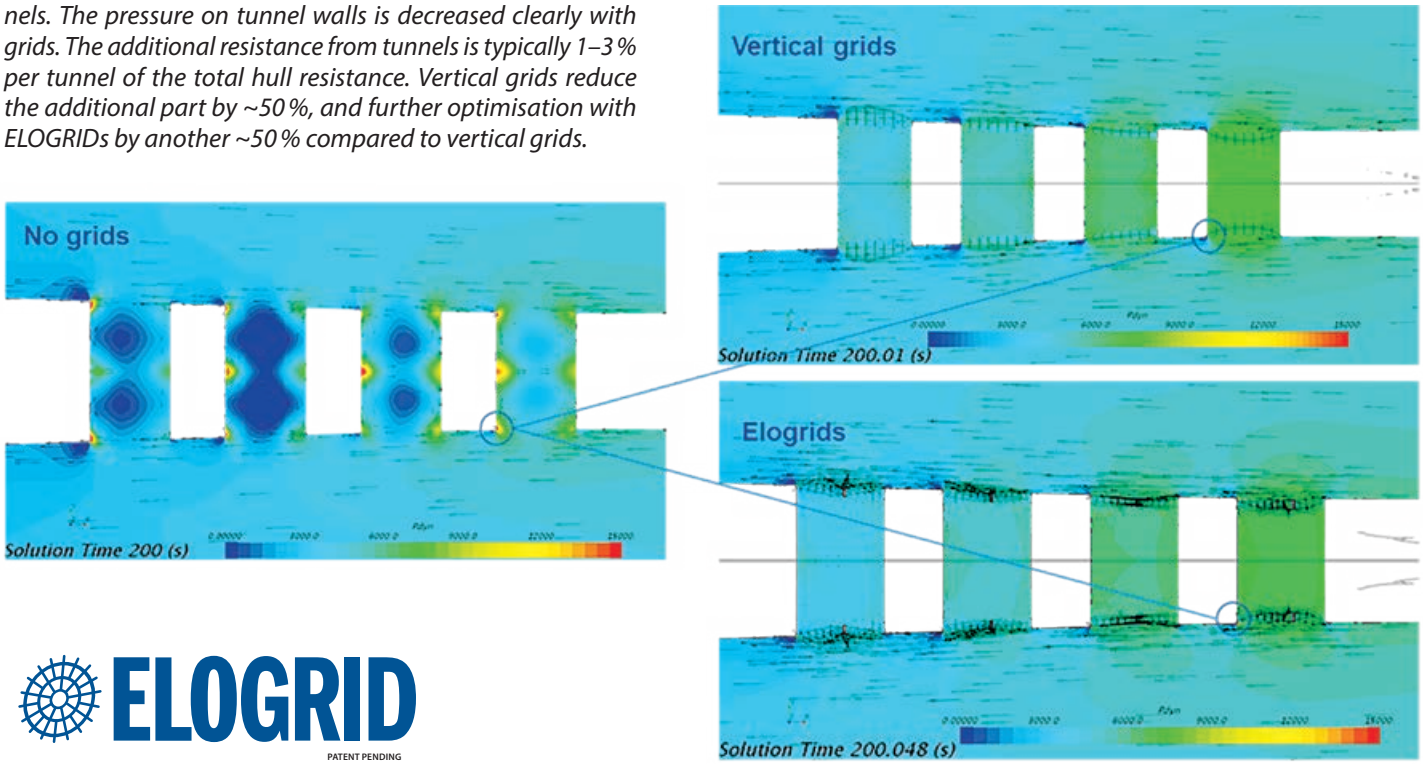
With good dimensioning, these vertical bars can decrease the additional resistance from tunnels easily by 50 %, which results in noticeable improvements in fuel economy. A drawback of such vertical grids is that they reduce thrust forces up to 10 %. The vertical bars work as stators in two narrow sectors of the circular flow path, and mixers in most of the opening. The blade profiles are not designed to increase the thrust forces and static pressure is elevated on the wrong side of the blades.

ELOGRID

A new grid design for thruster openings has been developed in order to reduce the additional resistance from tunnels while at sea and to improve the

Annual savings potential of $500 000 with ELOGRID

Hydrodynamic pressure on a plane set in the middle of tunnels. The pressure on tunnel walls is decreased clearly with grids. The additional resistance from tunnels is typically 1–3 % per tunnel of the total hull resistance. Vertical grids reduce the additional part by ~50 %, and further optimisation with ELOGRIDs by another ~50 % compared to vertical grids.



ELOGRID
PATENT PENDING

thrust forces induced by the propeller when manoeuvring.

The additional resistance is decreased, in principal, in a similar way as with vertical grids. The turbulence length scale at ship service speed with the boundary layer development speed determines the distance of the plates needed to prevent main bulk flow entry into the tunnel surfaces. Most of the tunnel resistance is created by pressure forces contributed by the flow into the tunnel.

The thrust forces are increased using the grid stator effect. The propulsion induces swirling with higher circumferential velocity, which is decreased and aligned more axially with the use of stator blades. At the same time, the static pressure is elevated resulting in improved thrust forces on the ship hull.

Instead of causing forces that work in the opposite direction than propulsion, ELOGRIDs are designed to produce thrust forces that work in the same direction as propulsion. That is made possible with radial blade profiles designed keep the boundary layer attached to the blade suction side.

When stator blades are designed to provide thrust forces, instead of reducing them – the thruster capacity can be elevated. Compared to open tunnels, the additional forces can be 5 %, and compared to conventional grids with a 10 % handicap, the addition can be as much as 15 %.

Considering ship performance, this update to tunnel openings provides lower fuel consumption at sea and improved manoeuvrability in harbours. The better manoeuvrability is available at higher wind speeds, and results in faster turning times. Dynamic positioning can be improved, and the elevated propulsion efficiency produces less noise. In newbuilds, the grids allow smaller thruster sizes as well in some cases.

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Juha Tanttari has 20 years' experience of working in fluid dynamics consulting. His experience covers a vast range of industrial segments including marine hydrodynamics and aerodynamics, project management and sales. Juha joined Process Flow in 1999, which was acquired by Elomatic in 2017. He currently holds the position of Lead Consulting Engineer, Technical Analysis.

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Remote control

ICT considerations in setting up and managing remote work

Text: Jaakko Lahti-Mononen

For a long time, organisations have used the option of remote work to lure new employees. Are they, however, able to take full advantage of remote work or does it simply offer the chance of a comfortable, easy-going working environment? The Covid -19 pandemic has brought these questions strongly to the fore and has required the adoption of new working methods and tools to support remote working.

For the end user, remote work seems easy. All that is required is a laptop and a mobile phone and then work can start. The necessary instructions and co-workers are available on the Intranet, and if any problems arise, the IT support team can be contacted. All the software and data has been set up into shortcuts on desktops and co-workers, supervisors and customers are available via online meetings. This begs the question why anybody would need need to go to the office in future? What is behind all the shortcuts?

Remote work not for everyone

Remote work is not for everyone. Does it boost efficiency or simply offer an excuse to laze about? Some people find motivation in an office environment and find it easier to mentally let go of the day's work when they can physically leave the workplace. At home, this may not be so straightforward.

Remote work is better suited to employees who primarily work outside the office, such as salespersons, consultants and specialists.

Photo © depositphotos/Rawpixel

If employees are used to a culture of being around the office, having conversations, comparing tasks and working on something side-by-side with a supervisor, how can this be achieved when the team is scattered for weeks at a time?

In principle, any work that does not require one to physically face another person can be carried out remotely. This was completely turned upside down by Covid-19; when even some doctor's appointments were handled remotely. Organisations have faced challenges in measuring remote work results, managing the work, and ensuring the flexibility of tools and systems used.

ICT solutions behind remote work

Technical solutions already enable efficient remote work with various devices and even with slow connections. However, the preparedness and operating methods of organisations may not have yet reached the same level. That is why some employees still need a traditional VPN solution. Cloud storage and internal systems still support VPNs, but this is by no means mandatory. All it takes is an organisation-level decision to primarily favour remote work, grant the required resources and, thus, achieve a technologically functional environment.

A VDI platform and cloud service go a long way and may even fulfil all the needs. Both require a personal username and password and authentication with a one-time password (Multifactor authentication MFA is an absolute requirement). VDI offers a Virtual Desktop Image for even the heaviest software (even 3D design) or the virtual software is simply shared as a shortcut on a desktop. All the data runs in the organisation's data centre or in the cloud and no one needs to worry about accidentally disclosing data to third parties. The services may also be divided according to roles; no extra data is made available or visible.

Setting up these kinds of solutions is naturally not free. VDI solutions are available as hardware, if considered necessary, but the cloud offers raw computing power or virtual desktops paid by the minute. In 8/5 -type work (normal working time), a calculator can be used to select the most cost-effective service. What is the payback period and the benefit? Data centre infrastructure and telecommunication links may require further investments. Remote work also enables 24/7 service (every hour of the day and the availability of the services must comply with this requirement).

It is worth taking into considering the following: reduced commuting, enhanced use of working hours, more affordable workstations, more extensive recruitment opportunities, increased information security, use of a temporary workforce for projects, scalability (also down), and potential cutbacks to office spaces as part of the payback/benefit.

Remote work prior to Covid-19 at Elomatic

Before the Covid-19 pandemic, the only employees who occasionally worked remotely at Elomatic were administrative workers, supervisors and project managers. Their days mostly consisted of working on Office documents, inspecting and approving invoices and hours, reading and sending e-mails, and attending Teams meetings.

To work remotely, a company laptop with a VPN client installed, a mobile phone for the one-time password and, of course, an Internet connection either at home or through their phone was required. Before the pandemic, there were about 400 employees with VPN licences and about 40–50 simultaneous users each day. Office 365 services such as e-mail, Teams, OneDrive, and SharePoint/Intranet can be used without a VPN connection, whereas it is required for travel expense reports, approvals of hours and invoices, cloud storage, and software licences. The operating culture of the organisation also dictates the attitude towards remote work.

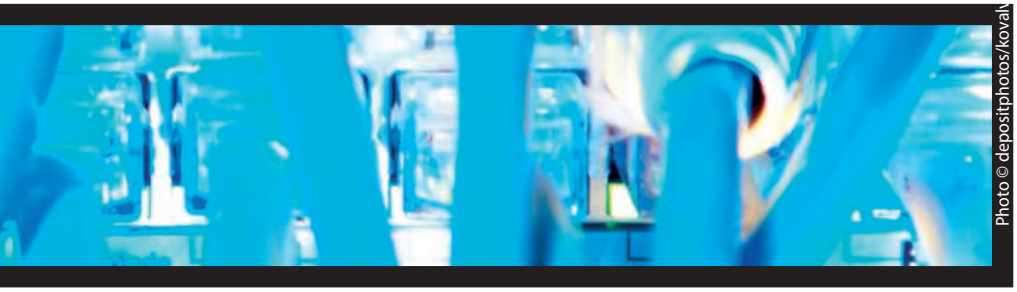
At the time, Elomatic's remote workers did not experience many ICT issues, probably in part due to low user numbers. All the systems used by the organisation had not been properly tested for remote work; testing was limited to sporadically collecting user experiences. There was no need for extensive testing before the pandemic.

Covid-19 leads to scramble for ICT resources

In March 2020, the Covid-19 pandemic changed everything. People were asked to stay home, some were even quarantined. Travel bans and even curfews were put in place. The recommendations, instructions and orders issued by the government had a major impact on business operations. Some companies were forced to shut down

as their operating models gave them no choice.

At Elomatic, this resulted in a strong recommendation to work remotely. Preparation was not in place to transition to remote work so quickly or in such large numbers. This resulted in a short-term shortage of licences, computers, laptops, information on system functionality and the sufficiency of VPN capacity for so many users.



The company's Service Desk received numerous VPN licence subscriptions and questions about available laptops. The company laptops ran out in a few weeks and licences had to be ordered without knowing whether they would be of use to all employees. For this reason, the decision was taken not to order licences for all employees immediately. System administrators were asked to quickly test the functionality of the systems through home connections. Some users had no laptops, only desktop computers. The computers are extremely powerful and could not, therefore, be replaced with laptops. Buying new computers was not an option either, due to the hectic schedule.

However, the administrators' feedback on the functionality of the systems indicated that the situation might not be so dire after all. As some systems could not be used from home at all, their users remained at the office or were given an RDP connection to a desktop at the office. However, this connection requires a company laptop and a VPN connection and does not run 3D images, for example. Fortunately, today's home connections are relatively fast and enable even heavy remote work, as long as a slower work pace is taken into consideration.

Thereafter, more licences were ordered in batches of 20 or 50. Occasionally, the licence deliveries were slower than expected. The offices emptied quickly, which resulted in new types of support requests for the ICT department: The Service Desk received tonnes of tickets concerning basic support and connections.

Supporting use of tools on home computers through VPN

As use became more widespread, a new question arose: how could support personnel use their tools on the users' home computers through a VPN connection? Fortunately, a solution was already available, it only needed to be scaled up: Systems such as Teams and Dameware (alternative to e.g. remote support) are used for this purpose. Users could take laptops and monitors home, thus bringing the related problems home with them. Telephone support is used as necessary.

The VPN system sometimes jammed as the number of simultaneous users grew tenfold. Fortunately, this only required a small licence upgrade to bring the previous 50 MB band to 200 MB. This did not quadruple the data transfer rate but helped the system support simultaneous users more efficiently.

What lies ahead?

Currently, remote work is running smoothly. There are employees in quieter offices whose tools could not be set up for remote access. There are also many who still want to do their work in an office setting.

Microsoft Teams has seen an enormous increase in users. Supervisors have regular meetings as well as more casual coffee breaks with their teams, while one-on-one video calls take place each day. The Teams chat is very active and the channels are full of messages.

Remote work will most likely be favoured and developed further going ahead. Running teams and projects remotely may require some training. It remains to be seen what the best practice is for monitoring projects and ensuring consistent efficiency and quality while progress cannot be reviewed face to face with the designer? Technology is not the answer to everything. Teams has, however, proved invaluable in this regard.

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Jaakko Lahti-Mononen started his IT career as a support person 1998. He has 11 years' experience as an IT Specialist and 10 years' experience as an IT Manager. He joined Elomatic in January 2018.

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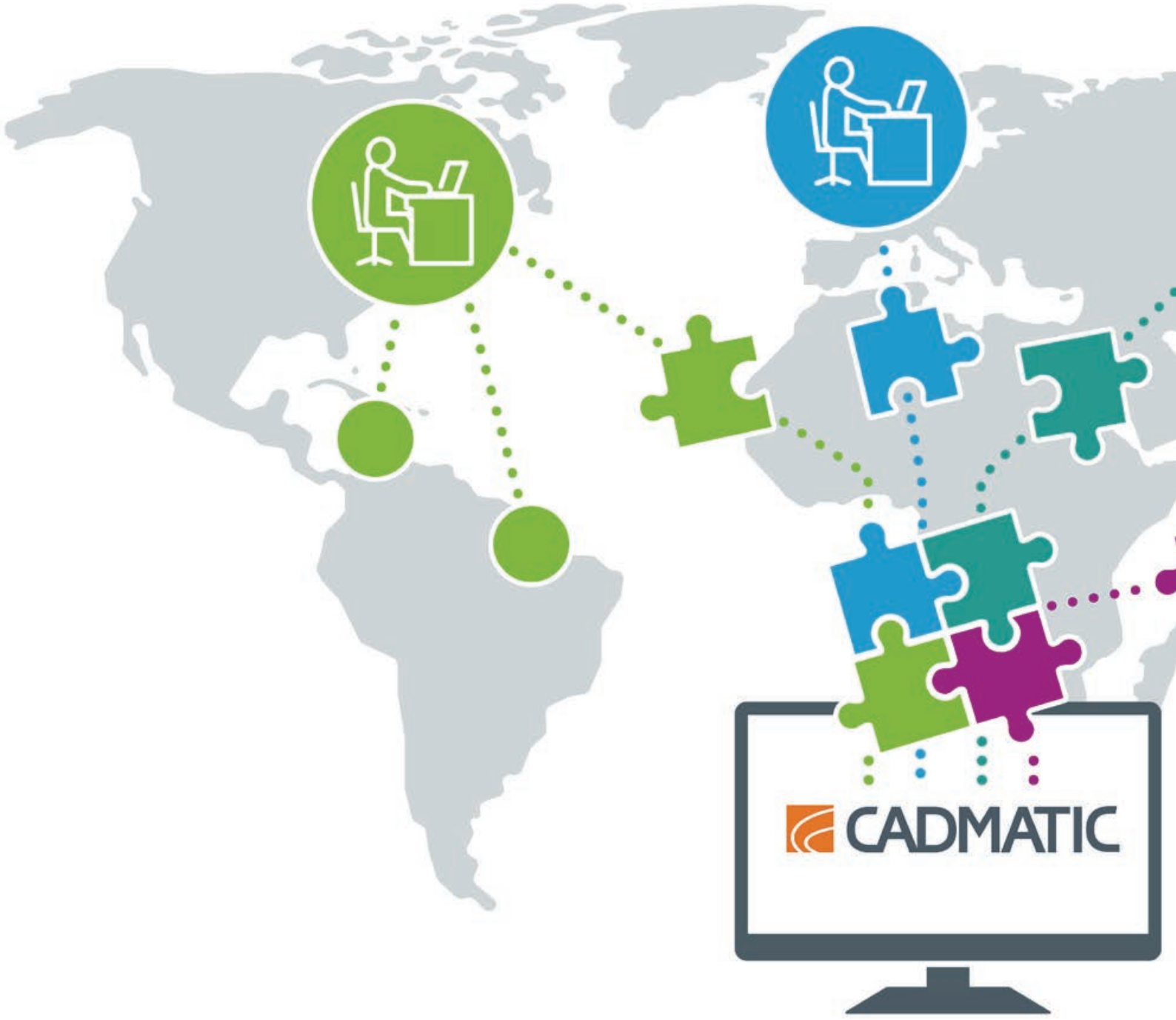


CADMATIC global work sharing

Overcoming remote work challenges on design and engineering projects

Text: Martin Brink

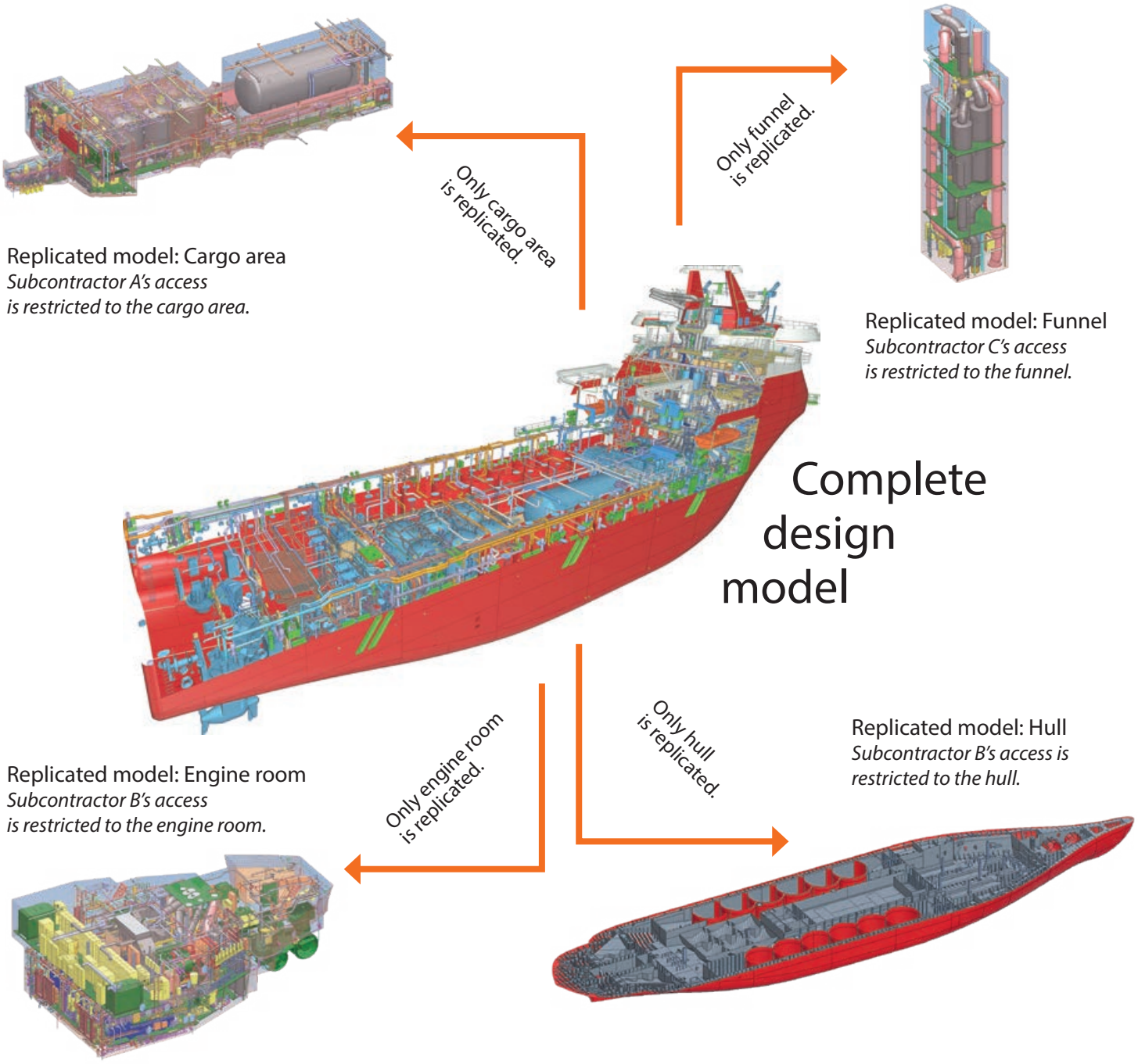
The Covid-19 pandemic has seen unprecedented restrictions on human movement, with many governments around the world urging citizens to work from home where possible. For design and engineering companies, this poses challenges in managing remote design and setting up networks that support the new normal. At the same time, companies must always ensure the integrity and security of project data.

Engineering companies faced with the urgent need to set up remote work processes, have encountered numerous challenges: the need for simultaneous work, geographically separated participants and subcontractors, weak and unstable internet connections from home offices, and limited possibilities for ICT support on site. Software providers for CAD design systems have had to react fast to ensure their licensing policies, which are usually tied to clients' geographical locations, were relaxed and that the software can support the new work processes.

Challenges in remote work in 3D design and engineering

CAD design in big projects, such as process industry plants or ocean-going vessels is an iterative and complex process. It includes many stages and involves many specialists. Design teams often specialise in only one discipline, such as HVAC design, electrical design, or ballast water treatment, and have several team members who need to see the work of other teams in the 3D environment.

Setting up this kind of work with everybody in the same office is already



▲ *Figure 1. Trade secrets can be secured by masking sensitive information or parts of projects to protect IPR. Model courtesy of Wärtsilä Ship Design Norway AS.*

a challenge. In a lockdown situation, all team members are separated, but still need access to a complete 3D model and means to communicate with other project participants.

This type of arrangement is impossible for systems that use file-based structures, where every person works with his or her own files. Conflicts in design decisions are unavoidable and the work process is slow. Database-centric client server systems are better equipped for such work, providing all project participants access to the same 3D model and project documentation. Additional pressure is born from the need to protect IPR and unique know-how and preserving design integrity.

Adapting to the new normal

From the beginning of March 2020, almost all design and engineering companies found themselves in a situation that, at first, was hoped would last for a few weeks only. However, by the time of writing, it has lasted for over two months, while the long-term outcome and predicted dramatic shifts in the ways of working and the whole society are not yet known.

Database-centric client server systems are better that file-based structures in handling remote 3D design work.

Compared with many other industries, the engineering field has significantly better chances to adapt. Elomatic's daughter company CADMATIC, which provides complex CAD solutions for multiple industries globally, was better prepared than most to deal with the pandemic and its effects. By the time Covid-19 started disrupting work and normal life, CADMATIC already had a well-established system for work sharing that had been fine-tuned for more than a decade.

Distributed design was initially needed to facilitate the work of remote teams and to add design teams with special expertise that are often located in different offices, companies, or countries. For software vendors that have not invested greatly in remote work sharing, however, it has been a steep learning curve to establish short-term working solutions.

Managing everyday remote design work

The key to the CADMATIC work sharing system is its database system that efficiently stores 3D models, documents and component libraries in a database hosted by a server. This ensures that design work can be easily shared globally via an intelligent replication based on inbuild technology, and that new users or design teams can be added in minutes.

In globally distributed projects, data is updated at set intervals between remote design sites via an online network such as the internet, or in offline mode by exchanging the files in an email attachment. There is no need to send the complete database; for optimized performance, only changes are synchronized between sites. The automatic replication system takes care of data synchronization, thereby ensuring that no design hours are wasted due to incorrect information.

Change management is facilitated with work requests in 3D; a manager can assign certain objects, add a specific task for a designer and monitor progress.

For project reviews and management, designers can access all project documentation via a single web portal called eShare, without installation or distribution of licenses. It provides powerful 3D visualization with linked documents and integrated data about a whole project, while allowing designers to exchange comments and review the project.

For advanced cases, designers can use VR/AR sets to get a virtual experience of a 3D model on a one-to-one scale. This often solves ergonomic issues and enables a better understanding of layouts. The ability to conduct virtual tours enhances the design phase, which is often separated from construction. A world where physical distancing has become the norm has given a further boost to such technologies.

Managing IPR in work sharing

Another concern in remote work sharing, especially when subcontractors are involved, is securing trade secrets. Some parts of a 3D model, for example, may be for certain eyes only. It is important, therefore, that work sharing systems allow users to efficiently control access to their designs and thus protect their most important assets.

One way to meet these challenges is masking sensitive information or parts of projects to protect IPR. The project replication setup can include a filter for 3D objects to limit access for design teams to only parts of the 3D model and related information needed for their tasks. See Figure 1.

The so-called filtered replication allows a user to restrict access to desired parts of a project. The project replication setup can include a filter for 3D objects via a 3D box-based selection. This way, the remote design team only has access to the part of the 3D model needed for their tasks.

Conclusion

Effective solutions for design work sharing with inbuilt IPR protection were important before the Covid-19 outbreak, but the pandemic has exponentially increased the number of employees and subcontractors working from home, which has led to unprecedented needs for and demands on work sharing. It is no longer only a tool to access the most efficient design resources around the globe, but an essential part of operations.

It is entirely plausible that a post Covid-19 world will see more distance working, which will increasingly highlight the efficacy of work sharing systems as drivers of efficiency and profitability.

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Elomatic is committed to environmentally friendly operations. For this reason, we have decided that the printing of the Top Engineer magazine also needs to be carbon neutral. Our printing partner, PunaMusta, provides the service.

The printing of the magazine is now ClimateCalc-certified, which means that the CO_2 emissions from paper production up to delivery of the finished printed matter are calculated and fully compensated. Also, the electricity used in the printing of the magazine is produced by renewable energy.

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