MANAGEMENT

CONT-ROL ROOM COOL

HWL companies manage huge projects with billions of moving parts. At the centre of it all: The Control Room. Who – or what – are the brains that ensure that the grand dance of power, ships, and waste flow to the places they are needed?

Man's advance to civilisation came through his command of fire, farming and the wheel. But to urbanise and develop the real hallmarks of civilisation – learning, commerce, laws, courts and systems – he needed infrastructure. Road networks, not trails. Aqueducts, not rivers. Energy delivery and waste disposal, not hot sun and latrines. With modern infrastructure in all its glorious complexity, man needed better systems, interlocking systems, systems with safeguards. For civilisation to grow and for man to advance, he needed The Control Room.

The Control Room has its own special place in fiction – and dramatic fact. From Tom Cruise's Minority Report to the bridge of the USS Enterprise in Star Trek, the control rooms of science fiction have been scenes of high suspense. Very real control room dramas have been brought to life in films like Apollo 13, where NASA scientists tried to save astronauts suffering equipment failure in the cold and dark of space.

HWL engineers manage hugely complex real life systems. They are no drama queens. They manage the infrastructure of the modern world moving goods, water, energy, and even our garbage, around cities, nations, and continents without a hitch day after day.

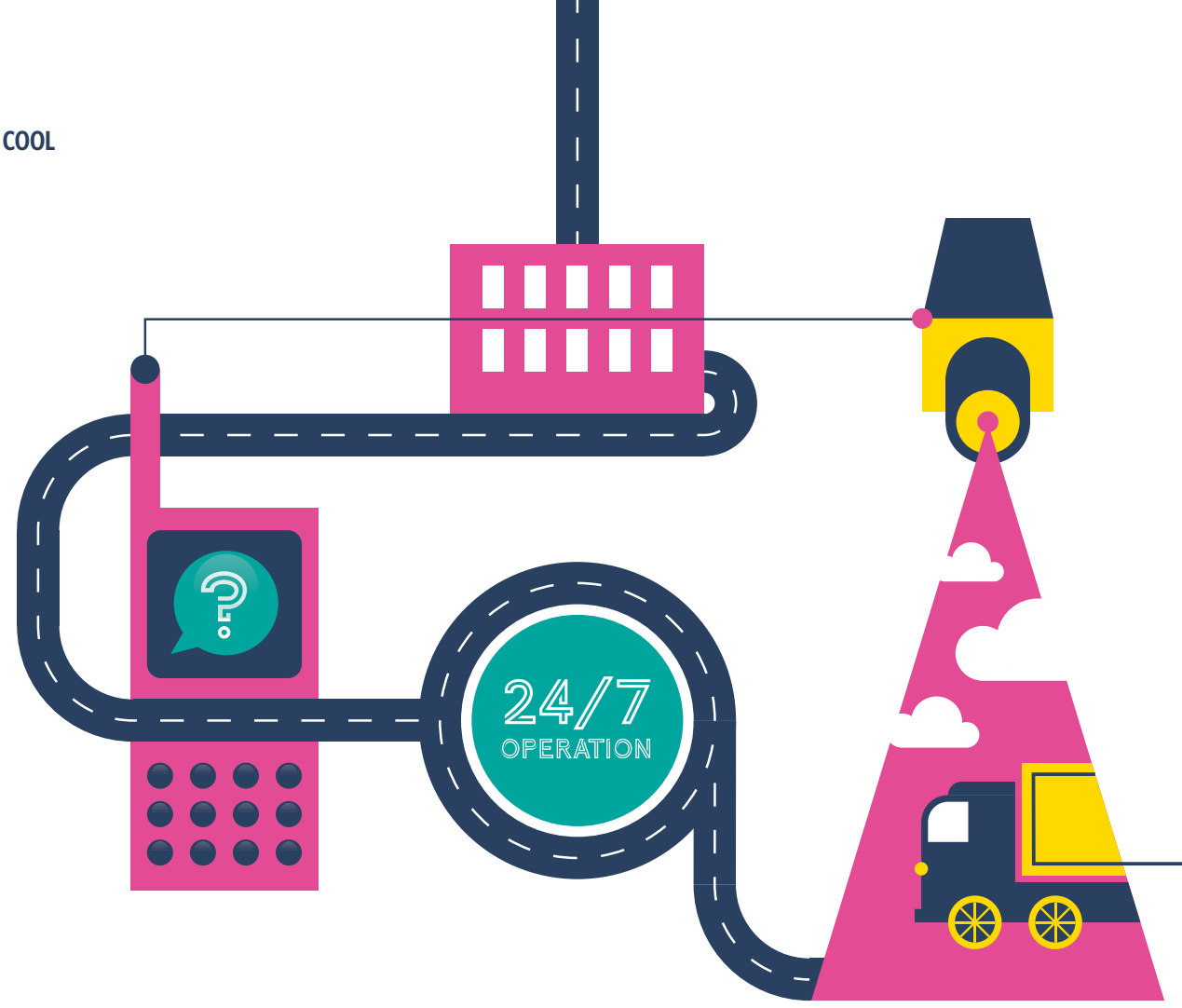
Here we examine HWL Control Rooms around the world. This small sampling showcases some of the range of operations and what is commanded from the centre. Hutchison Ports Holdings (HPH), as one of the world's largest port operators, no doubt has an eye-catching number of port related control centres.

Energy is one of the pillars of modernity. Hongkong Electric's (HK Electric) performance standards are the most demanding in the "world's most vertical city". A small group of elite individuals ensure the lights stay on and the lifts always rise in the city that never sleeps.

Without water, we could not survive. Northumbrian Water makes sure 700 million litres of water a day arrives in the right places in the UK, and leaves them again safely. They closely monitor water flow and quality 24/7 to ensure against flooding, water loss and even contamination that can lead to fatal loss of life.

Control rooms can even watch over alchemy as lead is turned into gold. Or in the case of AVR, from waste into valuable energy.

All these control rooms deploy state-of-the-art technology in the hands of well trained, dedicated staff who guard against disaster every day around the world. Turn the page and step into… The Control Room.



Hongkong International Terminals

THE HIT CONTROL TOWER – TRADITION AND TECHNOLOGY

This Control Room is not like other ones. Most control rooms evoke the science fiction of today or the more antiquated perception of a 1960's vision of the future. But not this Control Room. Its next generation award-winning proprietary terminal management software is artfully concealed in a veneer of the past.

Walking into the Hongkong International Terminals' (HIT) control room that oversees 11 million plus TEU movements a year is like walking into a posh seaside restaurant. Polished oak with hints of brass evoke a maritime history. All that's missing is a ship's wheel and ropes on the wall for decoration. The atmosphere is intent, but not tense; quiet, but not sombre. Franco Ning, Assistant General Manager – Operations, was *Sphere's* guide into one of the world's busiest container terminal control rooms.

CHANGING OF THE GUARD

The maritime industry is often characterised as being populated by hoary old men of the sea. This Control Room did not reveal that. There were some lifers, including Mr Yip Wing-tat (Duty Officer, Control and Planning) who has been with HIT for 30 years, and he shared his wisdom with us. Franco himself has been with HIT for over 20 years. They did not look it – must be something in the seaside air that keeps them youthful. But the rest of the staff looked young. Intense, purposeful – and young.

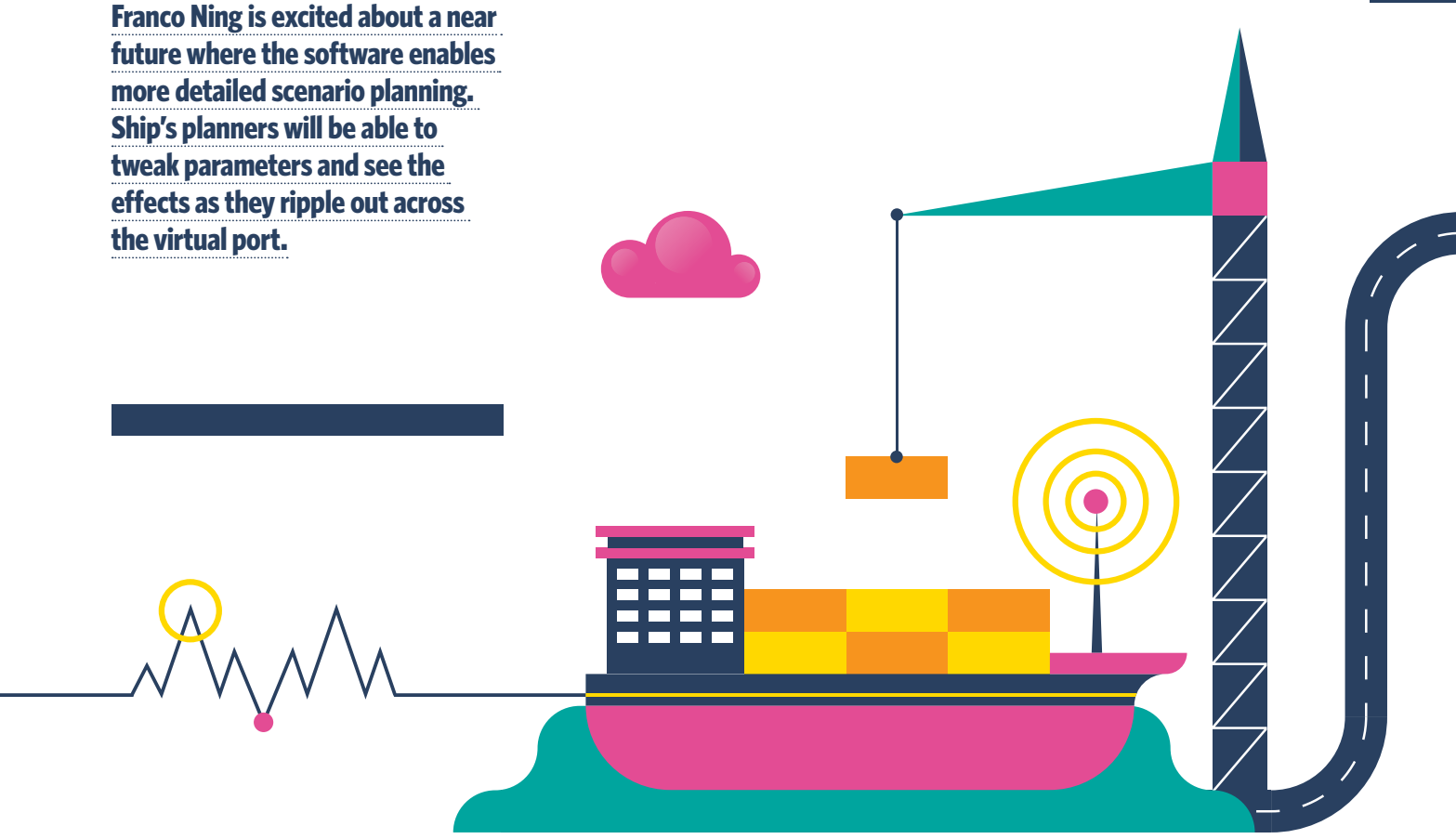
Franco explained that there was a time when most of the people who came in had worked on ships or perhaps with the agents who render port services. On-the-job training or vocational, more practical education, was the norm. Back in the old days, they were experts in planning the 'movements' – deciding which ship came in where, what cranes and trucks needed to be deployed and how containers were stacked on board ships. They mastered the quickly changing technology needed to stay competitive in a fast moving business.

Now, things are different. Many new trainees in the Control Room are from Hong Kong Polytechnic University, encouraged by their professors to be there. One young lady that *Sphere* met, Janet Wong, had studied Industrial Engineering and Logistics Management. Her professor had encouraged her to take a post with HIT – "My teacher loves HIT!" – and had promoted the firm heavily as an employer of choice. She has mastered the skills of a ship planner and is in a trainee phase to go back out to the front lines where the action is, radio in hand.

TECHNOLOGY DRIVEN

She will need to work with the seamless technology platform run by the proprietary terminal operating system nGen (next Generation). This modular, scalable system has been adopted in whole or in part by various new and acquired ports in the HPH network around the world. It has won awards from institutions as venerable as the Smithsonian Institute – and is never released to outside firms. "It is our competitive edge!" exclaimed Jeannie Chiu, Manager, Group Corporate Affairs, during a tour of the operations, aghast at the idea that anyone else could possibly have their hands on it.

Franco Ning is excited about a near future where the software enables more detailed scenario planning. Ship's planners will be able to tweak parameters and see the effects as they ripple out across the virtual port.



Cranes, trucks, tractors (external trucks coming into the yard with deliveries), even CCTV cameras are all online to monitor operations in the yard and are controlled from the control room.

THE FLOW OF INFO

The nGen system does have some knowledge of what happens in the world outside the terminal. Ships, as soon as they leave port, will send an EDI (Electronic Data Interchange) that goes into the nGen system with details about its cargo, and what cargo needs to go where. Agents may amend those instructions while the ship is in motion, but the Control Room has some idea of what is coming and can start planning. That notice can be weeks ahead of a ship's arrival if coming from Europe or as little as six to eight hours if coming from Yantian Port, just up the river.

Once the EDI arrives, it files automatically into nGen which sends it to 'Guider', the ship planning part of the software. Algorithms do their thing and prepare a Smart Plan – an initial guide as to where to send the boat and how to unload it based on the EDI instructions. The plan will land in the hands of a real person – a ship planner, who will adjust it based on their experience. That person will then be responsible for ensuring that the final plan works.

The OMS – Operational Monitoring System – is the software that tracks every element in the yard. It knows where the trucks, cranes, containers, river barges, and sea-going vessels are. The ship planners work on one ship at a time, ensuring a smooth execution of the plan and happy customers.

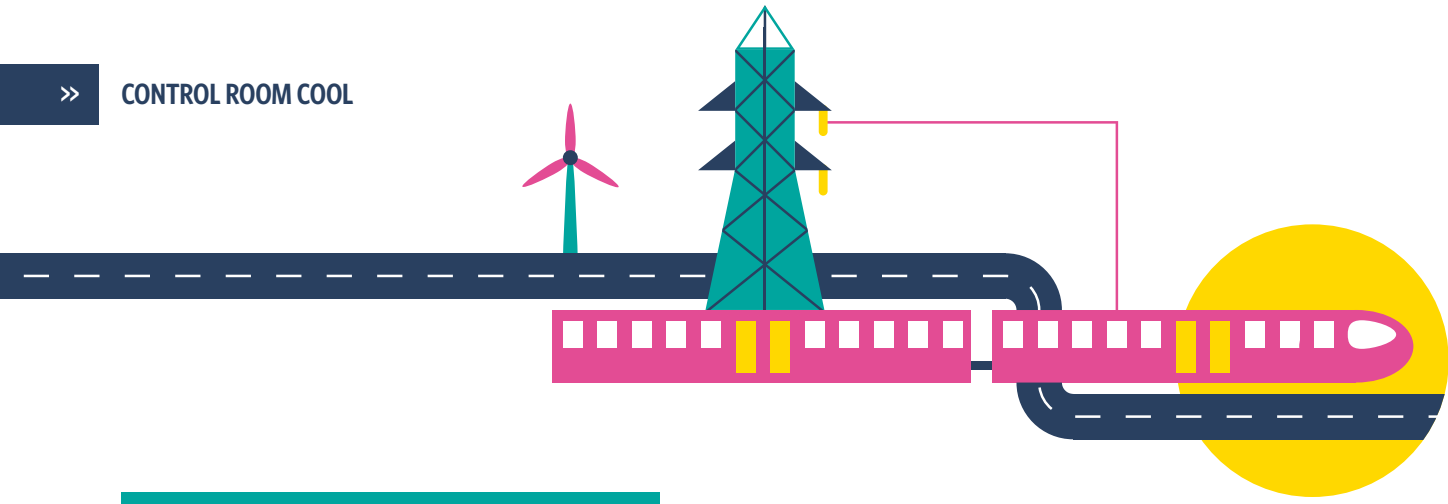
The planners then check final loading with a ship's captain – sometimes at the behest of Guider, which will flag any loading issues related to container weights and stacking patterns.

THE FUTURE

Franco Ning is excited about a near future where the software enables more detailed scenario planning. Ship's planners will be able to tweak parameters and see the effects as they ripple out across the virtual port. This will allow them to make better use of resources and improve their already world class KPI results in stay-at-port times, tractor turnaround times and more. Technology will increasingly be used in operations to enhance efficiency and maximise resources.

New technologies have also been deployed to make the port increasingly environmentally friendly. Many of the previously purely diesel cranes have been replaced by hybrid and purely electric cranes. Franco said that this has had a visible improvement on the air quality in the ports, reducing diesel emissions at ground level. Still, he can see near and far future technologies transforming the work of the control room and terminal.

The HIT control room respects its maritime history both in its appearance and in its traditional values of commitment and hard work. With a nod to the past and an eye on the future, the Mr Nings, Mr Yips and the young Ms Wongs of the HIT control room will keep the containers flowing well into the 21st century.



Hongkong Electric

IN THE BEGINNING...
HK Electric started operation on 1 December 1890 at 6 pm and lit up Hong Kong's first electric street lights in the Central Business District.

BACK IN THE DAY...
Before 1969, there was no system control centre in HK Electric. In the old days, the telephone operators working in the Transmission and Distribution Division were responsible for taking down reports from customers regarding supply interruptions and then passed them to the duty area engineers for action.

In 1969, a System Control Desk was attached to the North Point Power Station Control Room. Two years later, system control engineers officially took over the responsibility to monitor and control of the transmission and generation system. But it was only in 1974 that the first System Control Centre was established on Kennedy Road. After over 11 years' of service, this centre was replaced by a more advanced and well-equipped one in the Apleichau Operational Headquarters in 1985. The existing System Control Centre, the third generation in the series, was officially opened in July 1999 to take over the control and monitoring work of the entire HK Electric electricity supply system, including the generation, transmission and distribution of power.

AND IN THE MODERN DAY...
Since 1990, electricity generation has been entirely carried out at Lamma Power Station. The Lamma Power Station and Lamma Power Station Extension have a total installed capacity of 3,737MW with eight coal-fired units, five gas turbine units, one wind turbine, one solar power system and two combined cycle units.

The System Control Centre reached a new milestone in July 1999 when it was moved to the Electric Tower and at the same time had its new Energy Management System (EMS) and Distribution Management System (DMS) commissioned to replace the old System Control Centre in Apleichau Operational Headquarters. The design of the new centre takes into account operational needs and places special attention on human factors.

The new EMS and DMS employ a Siemens EMPOWER Spectrum system with a distributed open system architecture. The EMPOWER Spectrum uses state-of-the-art technology and is characterised by easy upgradability and extensibility. Both the EMS and DMS are built with full redundancy for all hardware including LAN to ensure that no function is lost due to a single point of failure. In addition to the normal supervisory control and data acquisition (SCADA) functions, the systems also come with special SCADA functions, advanced applications and links to other systems such that automatic control functions, timely, relevant and accurate information plus analytical tools are available to System Control Engineers for effective control and operation of the HK Electric power system as well as prediction and management of contingencies.

The principal functions of the system control room are to monitor and control the company's power system, to handle power system emergencies, as well as to provide information to the Customer Emergency Services Centre for answering customer enquiries. In the control room, it contains EMS consoles, DMS consoles and an operator training simulator. One assumes that it would take an army to coordinate this operation.

One would assume wrong.

SO MANY RELY ON SO FEW
In order to get the full picture, *Sphere* reached out to the head of the control room – Mr CS Leung. To join the nerve centre of HK Electric, Mr Leung explained that the personnel have to be good at making decisions and handling stress, as there are always timely decisions to be made. Mr Leung let us in on a surprise: this nerve centre runs round-the-clock in three shifts with only three or four System Control Engineers in each shift. While this may seem normal for smaller operations, this is the electricity supply for over 1.2 million people in the world's most vertical city. Millions of escalators, lifts, major train systems, traffic, water pumps, air conditioning and much, much more – all being watched over by three to four engineers.

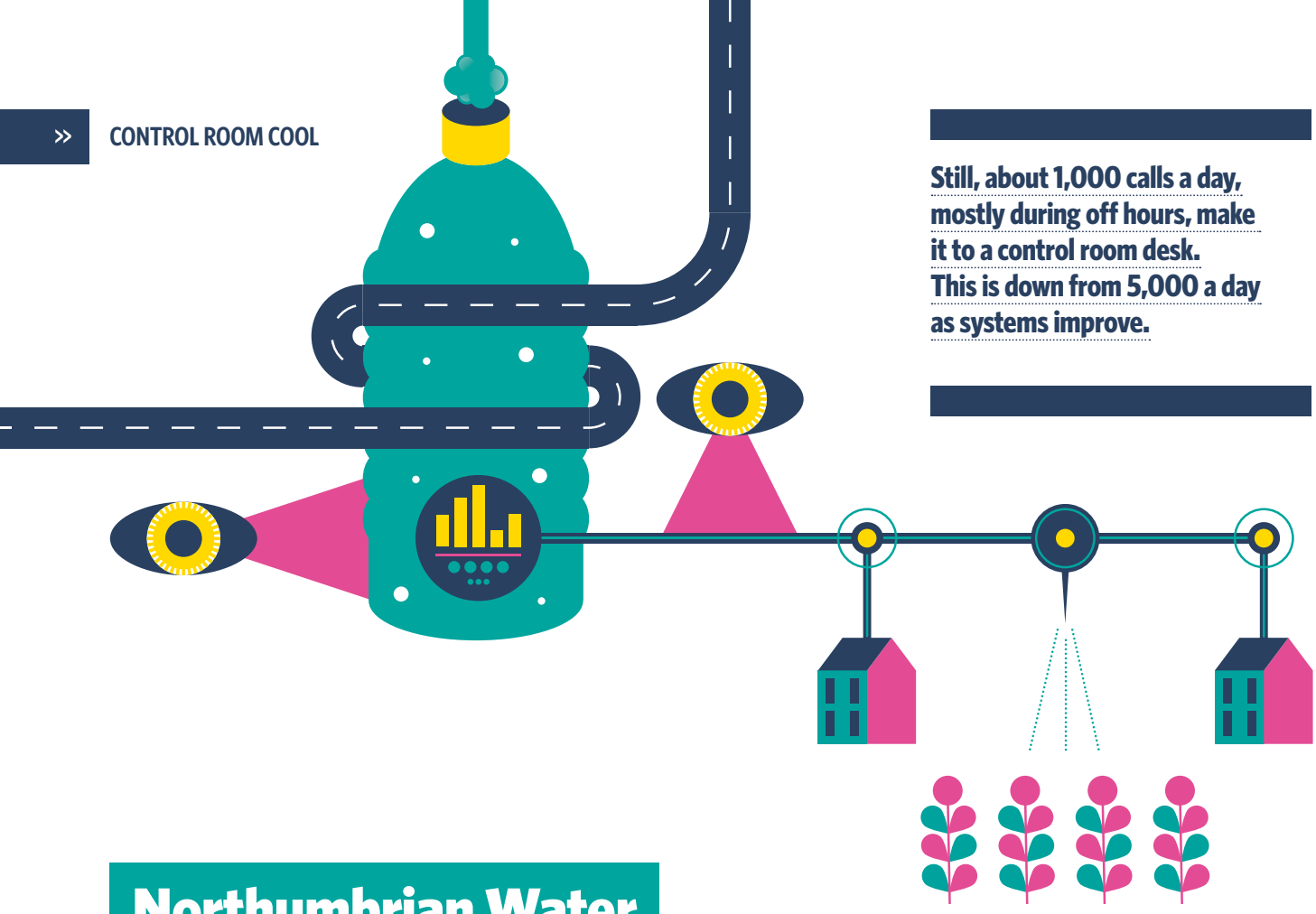
The whole room controls and monitors all generation units in the power station, tens of switching/zone substations and more than 3,000 distribution substations. The engineers also coordinate responses to all equipment outages in the generation, transmission and distribution systems. In order to improve the supply reliability, the Distribution Fault Isolation Expert System (DFIES) has been developed which can identify and analyse the faults in the 11kV system within 15 seconds. The DFIES not only identifies problems such as sections of faulty cable, but also makes recommendations for actions to be taken by expertly trained System Control Engineers. Contingency plans are prepared and laid out and studied by the engineers. As a result, supply restoration for unplanned outages in 11kV system are normally completed within one to five minutes.

About 1.2 million people residing on Hong Kong Island, plus millions more who go to work, dine and shop there every day, rely on this skeleton crew to see, move and survive. It is unlikely that, throughout history, so many have unknowingly depended so much on so few and is a testament to the organisational power that has, as its focal point, the Control Room.

A combination of systems and world class technology means that problems are identified and analysed within 15 seconds of an incident...

1.2M people residing on Hong Kong Island... rely on this skeleton crew to see, move and survive.

HK Electric's power plant on Lamma Island.



Still, about 1,000 calls a day, mostly during off hours, make it to a control room desk. This is down from 5,000 a day as systems improve.

Northumbrian Water

THE STUFF OF LIFE

There are the daily conveniences of life, and those things that make modern life possible. But when it comes to a true must-have, water is the stuff of life. At Northumbrian Water, they move 700 million litres of it a day to residential and industrial clients. And it has to be perfect.

Rob Elrington, Operations Manager in Water Production, spoke to *Sphere* and explained, "Quality is key. It's an extra dimension of the work we have. If gas or electricity comes through a bit iffy, it's one thing. But water has to be clean enough to drink." This 28-year veteran of the firm shed some light on the mysteries of the Control Room.

CONTROL CONTROL CONTROL

"You're better to be in control, than out of control."

This sums up the philosophy behind the Northumbrian Water control room operators. Two people watch over a system that controls over 3,000 sites – major water and waste water control facilities – and more than 53,000 points (pieces of information) are measured. Their job is to see problems before they happen, making adjustments before it becomes a problem to customers. With a system this big, you can't watch for problems and solve them at the same time – so the team is split into parts.

Northumbrian Water had its origins in many smaller companies that were consolidated over time. As a consequence, the firm had multiple control rooms controlling smaller areas. But now, one control room controls the whole vast system. While the 24/7 controllers deal with the worst problems, coded as P1 or P2 alarms, most problems are automatically routed to field operators who can move to a trouble spot and fix problems independently; these are coded P3 or P4 alarms.

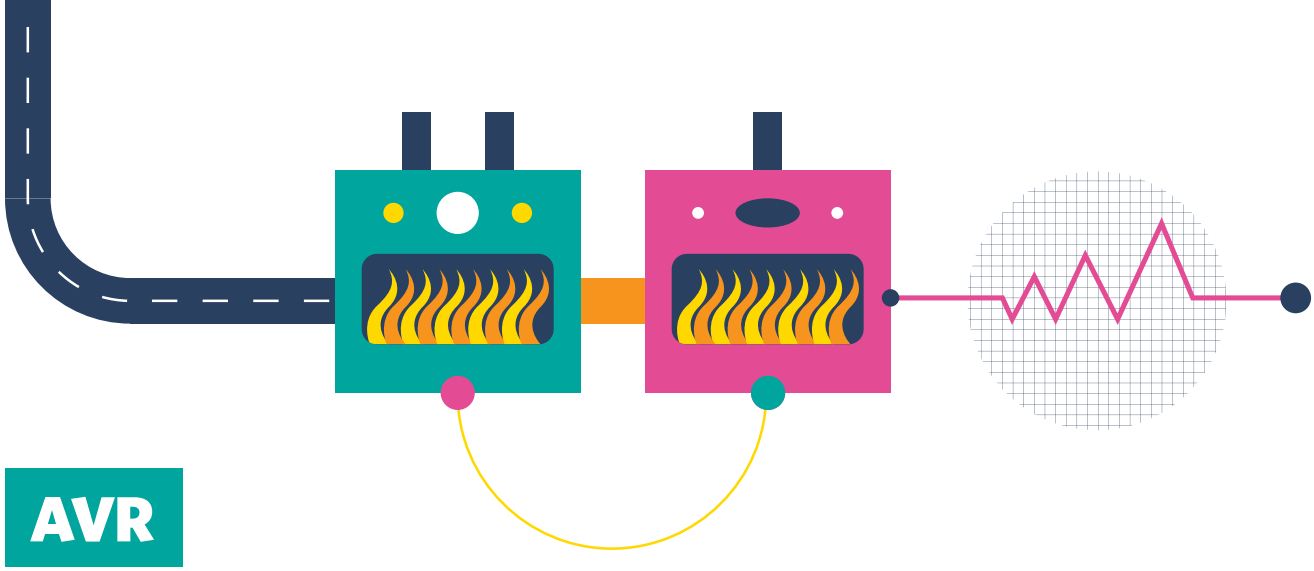
P1 and P2 alarms cover potential disruptions in service, such as flooding or a major pipe break – although these happen very rarely. P3 and P4 alarms are the ones which do not require such immediate attention.

The control room is supported by standby teams who can be called on out of normal hours to assist in dealing with major problems. Just because there is a problem in one area does not mean the other 53,000 points of information can be neglected. This division of labour between network controllers, field specialists and problem solvers makes sure that the incidents are manageable. In the words of Mr Elrington, "operators don't want to become lost in a sea of alarms". Given such a vast system, even a small percentage of minor issues would overflow a control room without robust systems in place.

Still, about 1,000 alarms a day, mostly out of office hours, make it to a control room desk. This is down from 5,000 a day as systems improve. The controllers must be well trained and ready for anything. They use one of the old control rooms from previous water companies as back-up. Rob Elrington remembers on one occasion there was a problem with their power supply and they had to instantly decamp to their back-up site over 35 miles away – and did so without a hitch.

Controllers do not have to be university trained, but are trained by Northumbrian Water. Controllers can come from operations teams within the company or from other control room environments.

The old saw about how it all flows downhill makes water distribution seem an easy game. But the complex systems, detailed alarm protocols and the lifetime commitment of the people at Northumbrian Water belay the truth: huge effort and intelligence goes into making sure they can stay in control. That is why they call it, after all, The Control Room.



AVR

GARBAGE IN, ENERGY OUT

AVR is the Group's largest EfW – Energy from Waste – operation. A three-in-one operation, they must monitor the inflow of garbage, control and burn waste and then connect to the energy grid. The product is combustible and safety concerns are paramount.

Mr Joost van Rooijen, a 15-year AVR veteran who has risen from operator to head of the production department, gave *Sphere* some insights into what happens in AVR's control room.

ONE ROOM TO RULE THEM ALL...

According to Mr Rooijen, the complete waste energy and biomass plant is controlled from one single control room. There are no fewer than five different systems controlled from the one Control Room:

- **7 Energy from Waste (EfW) boilers including flue gas treatment and cogeneration power plant (electric and heat production),**
- **4 vortex ovens for waste water incineration,**
- **1 Biomass plant including flue gas treatment and steam turbine, the BEC (Biomass Energy Plant) produces carbon dioxide neutral electrical energy,**
- **Utility systems as cooling water and instrument air for all sites, and**
- **Fire fighting systems.**

The boilers produce the steam by the incineration of the combustible waste, while the vortex ovens burn waste water. The resulting heat is fed into AVR's heating grid.

Vortex ovens aren't named for the shape of the oven, but rather the shape of the rotating flame. This gives the best flammable mix of waste water and auxiliary fuels, removing contaminants.

The BEC (Biomassa Energie Centrale, "Biomass Energy Plant" in English), produces 100 per cent green energy, by burning waste wood. The steam produced drives a turbine, generating electricity.

The utility systems and fire fighting systems must be maintained in top condition in the unlikely event of a fire or other disasters. Control Room operators have to know where a problem is long before it becomes a problem.

SEEING PROBLEMS BEFORE THEY HAPPEN

AVR not only draws power from the grid for their operations – it feeds power into the grid. Accordingly, it must have backups of backups to ensure integrity across the system. AVR has back-up panels of electrical rooms in the plant from which the staff can control most important parts of the operations. Other backup systems, like emergency generators, are on standby in case of power drops. The control system itself is completely equipped with its own electrical back-up system.

Moreover, AVR has an "island mode" system in which they can generate and provide their own electrical supply in case there is an issue in the external power grid.

The human element is crucial and AVR's efforts in emergency response aren't purely restricted to Control Room personnel. Crisis teams manage fires, technical failures (such as with a valve or pump), injuries or other incidents. Mr Rooijen said, "We do emergency drills in collaboration with local emergency services such as fire department and police."

THE CONTROL ROOM PROFESSIONALS

Who is qualified to work in this important control room? Mr Rooijen described the people who work in the control room as skilled operators with a minimum of four years' experience on site. Most of them are trained in thermodynamic physics. Many have backgrounds in power and transportation. The operators in the control room need to be stress resistant and have good communication skills.

"When I was an operator I was tested by a Belbin (personality) test. For other jobs I had assessments on personal skills. In some cases people get personal coaching to improve necessary skills," said Mr Rooijen. In AVR, the internal training of an operator takes up to two years, including making a set of reports on various plant parts, culminating in an examination. Every five years all operators are tested on their knowledge and skill levels. Every year the operators get an appraisal which is used by employer and employee to improve personal performance. Cases that need more than average attention receive a mid-term appraisal once every quarter.

MOVING TARGETS

When being asked about the most challenging part of his job, Mr Rooijen explained that keeping the carbon monoxide level under the national limits is the most difficult part. Since the AVR fuel is from waste and waste changes day to day, as well as having seasonal trends, it is an unstable factor. Practices must be monitored, managed and adapted to continue to meet national standards.

The variable nature of inputs also impacts the mechanical workings of the operations. The Control Room has to spot when bottlenecks or impending problems are about to impact the processes. "The plant consists of many mechanical parts which require a lot of attention. Obstructions on conveyors and funnels are also common in this business," said Mr Rooijen.

A nimble and well trained staff is needed to deal with unseen contingencies. Rigorous selection combined with constant coaching, training and testing ensure that AVR's control room operators will be able to manage the difficult challenges involved with the complex elements of their business.

Mr Rooijen himself is setting an example showing how crucial continual personal improvement is to excel on the job – today and for the unknown future. "I have a bachelor degree in thermodynamics, and at this moment I am doing an MBA at TiasNimbas, at Tilburg University to develop skills for my current job and for possible future jobs." □