

Solution overview

How to build your own mast



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Introduction

There has been massive growth in the temporary and remote site security market in recent years, which has been driven by the technological advances led by manufacturers producing rapid deployment towers and utilising the latest advances in camera technology.

Rapid deployment security towers have become increasingly popular in the protection of construction sites, vacant property, transport, infrastructure, and remote sites.

In this paper, we look at the growth in the use of these towers across the UK and Europe and aim to demystify the subject for end-users, consultants and installers, and explain how to choose, build and use them for maximum benefits.

Rapid deployment towers can be set up in minutes and provide flexible and efficient security solutions that are ideal for providing cost-effective and visible deterrents to intruders, thus securing temporary sites and reducing the need for manned guarding.

Towers provide many benefits to site security in addition to being a highly visible deterrent, helping to prevent trespass on sites before it occurs, and as truly rapid-deployment solutions they can be installed and operational in a matter of minutes.

What is driving the growth in the use of rapid deployment CCTV security towers?

In many applications where the site and buildings being protected are static and the protected areas do not change from one month to the next then a traditional fixed CCTV system, combined with physical security measures and access control is sufficient to protect the site. If the site only requires temporary or short-term

security or if it is changing regularly, such as a building site, then system designers are often considering deploying mobile CCTV towers as they are more effective in protecting the site throughout its phases and changes during its operational life.

Other benefits of mobile CCTV towers include:

- * Provide video surveillance in all weather conditions
- * Greater viewing capability – many masts go up to 6m high
- * Connections to central stations enable 24-hour cover and the ability to challenge intruders
- * Early detection systems – capture intruders early to minimise damage
- * Thermal options detect heat much further away and secure perimeters at night-time
- * Ability to view sites in all weather conditions and at night
- * AI software on cameras – reduces false alarms
- * Provide a highly-visible deterrent
- * Provide 360-degree coverage
- * Able to detect multiple intrusions simultaneously
- * Powered by long lasting batteries, solar or fuel cells that are eco-friendly solutions
- * More cost-effective and less expensive than traditional guards

Solution overview

How to build your own mast



Where are mobile CCTV towers more effective than fixed systems

The growth in the number of mobile security towers being deployed in the UK and across Europe is led by the wide range of applications that they can be used within and the speed at which they can be deployed.

Here are some of the main applications where mobile CCTV towers can be deployed more effectively than a fixed system:

Rapid Deployment

If a site needs immediate protection, then a rapidly deployable CCTV tower which is connected to a remotely monitored central station, will provide the most effective site protection with the added benefit of being a highly visible deterrent.

Typical Applications include:

- * Building plant & machinery
- * Construction sites
- * Property management
- * Crowd control
- * Housing estates
- * Industrial units
- * City Centre surveillance

Perimeter Protection

Extended perimeters can be difficult to protect with fixed CCTV systems. With mobile solutions, activity tracking and thermal cameras, perimeters can be secured more easily during working hours and at night-time.

Typical Applications include:

- * Construction sites
- * Industrial units
- * Solar farms
- * Utilities
- * Railway lines
- * Border security

Temporary CCTV

Temporary CCTV is often used on sites that change and evolve over a period of time, such as a construction site, which will have plant and machinery that moves around as the buildings are constructed. Using a temporary mobile CCTV system that can also be moved during the life cycle of the site enables continuous coverage to be achieved throughout the building project. In other temporary applications that have moving security or safety risks such as roadside monitoring, temporary CCTV towers that can be moved are the ideal solution.

Typical Applications include:

- * Construction sites
- * Property management
- * Housing estates
- * Industrial units
- * City Centre surveillance
- * Solar farms
- * Car parks
- * Roadside

Remote Sites

Any site that is remote from the main buildings can be better protected using a mobile CCTV tower. These towers can be self-sufficient in terms of power for long periods off-grid and can use 4G/5G communication to a video central station to ensure round-the-clock coverage and surveillance.

Typical Applications include:

- * Property management
- * Wind turbines
- * Solar farms
- * Utilities
- * Waste management

Solution overview

How to build your own mast



Vacant Property

Monitored CCTV provides round-the-clock visual verification of vacant properties which keeps them safe and secure and provides a visible deterrent to intruders without the high cost associated with employing multiple security guards.

Typical Applications include:

- * Commercial property
- * Industrial
- * Social housing
- * Managing agents
- * Insurance
- * Retail
- * Insolvency

Unmanned Sites

Any sites that do not have people working on them 24/7 such as a solar/wind farm or roadworks, will be better protected with a mobile CCTV solution that works in all weather and light conditions and is capable of communicating back to a monitoring station with two-way audio challenge.

Typical Applications include:

- * Wind turbines
- * Solar farms
- * Utilities
- * Roadside
- * Railway lines

Choosing your mobile CCTV Tower

There are two choices when considering mobile CCTV towers for your business, your sites or those of your customers. Firstly, you can purchase or rent a complete tower from an established and reputable manufacturer who has proven expertise in building mobile CCTV towers. The second option is to buy a tower frame or shell and build your electronics into it. Clearly, for this option, you will need sufficiently skilled engineering resources in-house, but the cost of building will be lower than buying a pre-built tower from a third-party manufacturer. Whichever purchasing choice you make the next most important step is to choose the technology used on your towers. In the following section, we examine the considerations to help you make an informed decision when buying and deploying mobile CCTV towers. The three main technical considerations on mobile CCTV towers are:

- * Camera technology
- * Tower construction
- * Power requirements

Camera technology

When choosing a mobile CCTV tower the first consideration should always be the camera type that you have installed on your tower.

This is the single most important element of a CCTV tower because it is the cameras that provide the video for the remote monitoring centre that enables the operators to interact with intruders, gather evidence and ultimately protect your site more effectively.

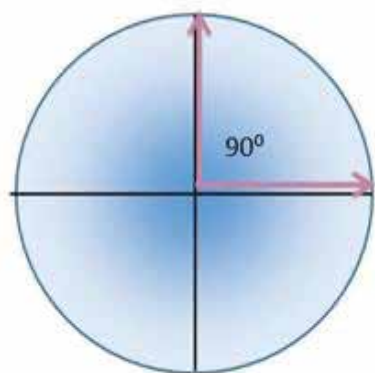
Types of camera technologies used on mobile CCTV towers

Where possible stick to low voltage or IP cameras which can be powered using POE and have built-in motion detection, onboard storage and analytics.

Fixed cameras – These have a fixed field of view/detection area. On CCTV towers these are normally deployed in a 4-camera configuration with each giving 90 degrees of coverage. This gives total coverage of 360 degrees on each tower as shown below.

Solution overview

How to build your own mast



A camera with four 90-degree cameras provides 360-degree view

Advantages of using fixed cameras on mobile towers:

1. The ability to cover 360 degrees (with limited depth of field)
2. Low cost
3. Easier to deploy and set up
4. Wide area coverage with fewer towers

Disadvantages of using fixed cameras on mobile towers:

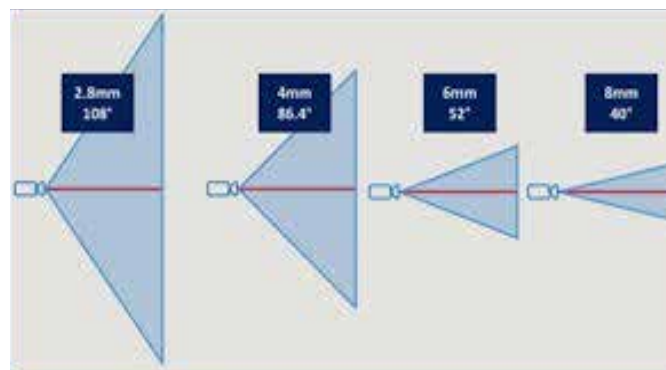
1. Limited range
2. Cannot track intruders
3. Limited protection in applications which require long-distance intruder detection such as perimeter protection

Pan, Tilt and Zoom cameras

- are normally deployed in the form of a speed dome on mobile CCTV towers due to their high speed, low weight and small form factors.

Domes are perfect in applications where they can be monitored live out of hours in a video alarm receiving central station.

It is important to remember that speed domes are only able to view the areas they are focused on so whilst they can cover potentially huge areas when zoomed in, they are missing areas outside of the target zone. In the case of multiple simultaneous attacks, this could compromise intruder detection.



Advantages of using speed dome cameras on mobile towers:

1. The ability to cover huge areas
2. Can be configured to do tours of pre-sets on the site
3. Control room operators can control the cameras to respond to an incident or track an intruder
4. Wide area coverage reduces the cost of ownership (which means fewer cameras are needed)

Disadvantages of using speed dome cameras on mobile towers:

1. PTZs can only see and record where they are pointing
2. They have moving parts and mechanisms which can impact reliability over time
3. Storage of video takes 2-4 times more data than that of a fixed-angled camera (they need more recording space)
4. PTZ's are typically 2-3 x more to buy than a fixed camera

Solution overview

How to build your own mast

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Fixed/Speed dome hybrid cameras

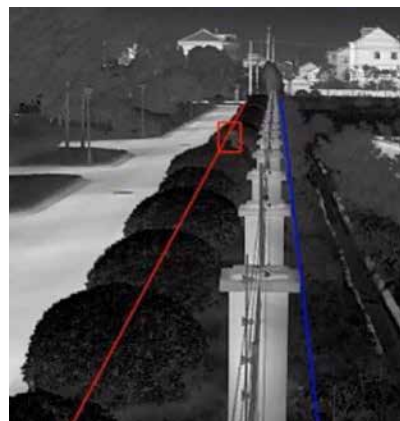
When used on a mobile tower these provide all the benefits of fixed camera coverage with the ability to track intruders through the speed dome. However, it should be noted that these towers tend to cost more as you are deploying both technologies, and they are more complex to set up. System design needs to be carefully considered to ensure analytics and pre-sets are set up to optimise intruder detection.

Thermal Cameras

are especially useful when protecting perimeters and fence lines and have several advantages over conventional fixed or PTZ cameras. Whilst they are more expensive and take longer to set up, the benefits can often outweigh the costs. Here are some of the applications where thermal cameras can optimise your mobile CCTV towers:

Long-distance fence line detection

Long-distance intruder detection can be achieved at distances beyond the range that the human eye can track and in all weathers.



Adverse lighting conditions

Thermal cameras will not be affected by elements of light that can seriously compromise an optical camera.



Optical camera under headlights



Thermal camera under headlight

Adverse weather conditions

Thermal images will be less affected by severe weather conditions.



Optical camera in a snowstorm



Thermal camera in a snowstorm

For conventional CCTV cameras heavy rain, fog and snow can seriously compromise images as optical based cameras are blinded. However, with thermal cameras, the heat signature of a potential intruder is detected against the background temperature and accurate analysis of potential alarms can be achieved.

Where there is an atmospheric or physical obstruction in the scene

Thermal images are less likely to be affected by atmospheric obstructions.



All thermal pictures Courtesy of STL Technologies

Solution overview

How to build your own mast



Tower Construction and Deployment

After the selection of the cameras, the next most important consideration is the tower itself.

This is important because the cameras can only view and protect a site when they are deployed at a height that enables the camera to view a scene or along a fence line. Towers available in the UK and Europe that are designed for CCTV applications broadly fall into two types:

- * Static Towers
- * Mobile Towers

Static towers

are often designed in a lattice style to withstand high winds and are suitable for applications where permanent monitoring is required. They are typically fixed to a 1m² concrete base that is permanently fixed into the ground which can be susceptible to attack through climbing risks.



Altron Lattice Tower



Mobile towers

are designed to be rapidly deployed to a site and then once installed can be moved as many times as the site requires, depending on the threats and evolution of the site. They should have anticlimbing features built in.

There are several different manufacturers of mobile security towers which can be purchased as completely prebuilt towers or as empty shells. The latter option gives the buyer the flexibility to use the technologies that they prefer and to use the ARC that they are most comfortable with to monitor their towers. They can then build the towers themselves or appoint a tower builder who will build a tower to the buyer's specification. This will typically save 15-20% of the total purchasing costs.

TelescopicMast Tower

Solution overview

How to build your own mast



When choosing the physical shell for your mobile towers there are several questions that you will need to ask your supplier:

How will I get the mobile tower to the site?

Towers typically comprise two parts; a cabinet that houses the equipment and a mast to which the cameras are attached. These masts are either telescoping employing a winch or comprise of separate parts which are assembled on site. The former is quicker to deploy. In both cases, the tower will be typically shipped on the back of a flatbed lorry either as a pre-built mast or flat packed ready to be assembled on site. If only one or two towers are being deployed then choose a manufacturer that provides trailer options to tow the towers to the site such as the Mobile Security Box Trailer, single and double axle version (telescopicmast.com) which has the trailer and forklift built-in.

How will I unload the tower once it has arrived on-site?

When the lorry arrives on site the tower will need to be moved from the back of the lorry via a crane in which case the tower will need lifting eyes to pick it up or built-in forklift slots.

How quickly can I deploy the tower after unloading?

The tower will need to be moved to the position on the site that offers maximum protection based on the risks associated with the site. This position should have been identified before taking the tower to the site and will take into consideration the areas to be viewed, the detection zones being used and the configuration of cameras on the tower.

If the tower is pre-built and has forklift slots or eyelets for lifting then it can be placed in position easily using a hand pump forklift or a crane, both of which will enable the user to deploy a tower very quickly.

In cases where the tower cabinet and mast need to be assembled then the user will need to factor in the additional time for the engineers to take the cabinet and mast off the lorry, usually done via a tail lift and then time to assemble and move to the desired location.

What are the final steps before leaving the site?

After connecting the mains power to the tower, the onsite technician will need to check the tower is functioning correctly and connecting to the monitoring station. At this point, a walk test and audio challenge tests will normally be completed.

If there are any issues at this stage, the technician will need to get inside the tower cabinet to diagnose and resolve the problem. This is why the cabinet selected for the tower must have enough space for equipment inside but also for the technician to work safely and preferably protected from any adverse weather conditions.

Solution overview

How to build your own mast

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Typical features to look for in a tower shell.

Steel Construction

The best towers are constructed from 100% galvanised steel.

- This means they are:
- Heavier, making them more difficult to push over
- More stable in winds so pictures from cameras are clearer
- More reliable as the steel parts last longer

Easy Access

When deploying masts on remote sites in adverse weather conditions, it helps to have easy access to the electronics inside the tower. Manufacturers like TelescopicMast provide two doors on their masts which makes it extremely easy for the engineer to work on the mast.

Robust Internal frame and mounting structure

Mounting frames should be robust and capable of ensuring the stability of the mast whilst allowing internal IP rated boxes to be mounted at a serviceable height. There should also be ample space for fuel cells and batteries inside the masts.

Stability cables from the base to the mast head

These reduce movement at the mast head which in turn reduces false alarms and ensures clear pictures in adverse weather conditions

High quality winch – ideally CE certified

The winch should be reliable and smooth in operation and if CE marked will be guaranteed to be more reliable and last longer. In addition, the winch should feature a double break on the winch and mast so that the mast cannot fall and injure an engineer during deployment.

Vandal resistant shell

This often comes in the form of anti-vandal spikes like this model MSB-6 Premium that deters and prevents attacks to the tower and its valuable electronics.

Lockable doors to side and top of mast

This makes the tower more secure in situ and in transit whilst protecting the equipment when in use on a site.

The following checklist identifies and prioritises the key considerations when selecting the physical cabinet and mast for a mobile security tower:

MUST HAVE	
Easy To Move the Tower	✓
Extendable Mast minimum 4.5 metres	✓
Strong Steel Construction	✓
Anti Climb Barriers	✓
Secure Space for Electronic Equipment	✓
Stable Base with Extendable feet	✓
Can be moved by Crane	✓
Stable Top to Reduce Movement	✓
Lockable Top Covers	✓
SHOULD HAVE	
CE Certified	✓
CCTV Brackets at Head End	✓
Lockable Door(s)	✓
Spirit Level	✓
Compatible Trailer to redeploy	✓
Manual Winch	✓
Tilt/Movement Sensors	✓
Cable Management	✓
Internal Bracketry Patch Box Prepared	✓
Dual Locking Mechanism	✓
DESIRABLE	
High Sides for messages/advertising	✓
Tilt/Movement Sensors	✓
Asset Tracking with Geolocation	✓

Solution overview

How to build your own mast



Final questions before choosing a housing for a security tower.

Q1 How high are the cameras?

– Anything less than 4.5 metres may make them vulnerable to attack from the ground.

Q2 Is the base cabinet vandal resistant?

– Can it be opened at ground level or climbed on? If an intruder can get on top of the cabinet, then they can damage the cameras and bypass the intruder detection.

Q3 Is the top of the tower protected?

– If the tower cabinet is open then it is vulnerable to attack and damage from the weather.

Q4 How much of a visible deterrent is the tower?

– The bigger the cabinet and mast the more visible it will be to potential intruders.

Q5 Does the site require products that are CE compliant?

– CE certification is an important requirement on many UK and European sites as it is a guarantee of quality and proves the masts have been designed and built to the highest standards.

Q6 – Where are the Solar panels going to be mounted?

– Some manufacturers place these at the foot of the tower which means there needs to be additional security measures around the tower to protect the panels from theft or damage. Ideally, the tower used should allow for panels to be mounted securely on the tower itself without the need for additional security measures.

Power requirements

The final consideration when choosing a mobile tower for your site or business is how the tower will be powered. This is the function that dictates more than any other feature, where the tower can be deployed and for how long. Whilst most security professionals are well versed in designing CCTV systems to reduce risks, the area of providing power to remote towers raises more questions than any other to the author when talking with clients about rapid deployment mobile towers.

Power options for mobile security towers

In the table below, the four main types of power used for mobile security towers are identified and in the following section, we examine each in turn as we seek to demystify the subject of power for mobile security towers.

	POWER SOURCE	FEATURES
ZERO HOURS BACK UP	MAINS	Works when power connected. Disruption to power source - Tower stops working
48 HOURS BACK UP	MAINS + BATTERY	Works when power connected. - Powered by Batteries when mains lost
3-5 DAYS BACK UP	MAINS + BATTERY + SOLAR	Works when power connected. - Powered by Batteries when mains lost - Solar Panels top up Batteries off grid
2 - 25 WEEKS BACK UP	MAINS + BATTERY + SOLAR + HYDROGEN/METHANOL FUEL CELLS	Works when power connected. - Powered by Batteries when mains lost - Solar Panels top up Batteries off grid - Fuel cell supports when off Grid

Solution overview

How to build your own mast

Mains

Mains fed towers are perfect for applications where you can guarantee that power will be supplied to the tower 24/7 whilst it is on-site.

Towers should be able to operate from 110V and 240V inputs and will then step down the voltage to a low voltage level at 12VDC or 24VAC using transformers to allow for maximum versatility. When using IP cameras, it is normal to use a POE injector switch to power the camera devices.

Mains + Battery

As above but with the addition of battery backup which enables the tower to continue working in the event of a mains failure. Batteries should be industrial grade and the tower cabinet should be of sufficient size to accommodate the batteries and protect them from the elements.

In normal operation, the mains power will be converted to a low voltage which then powers the devices inside the tower.

The important thing to consider when building your towers is the power consumption and the time you want your tower to continue operating after the loss of power.

This is achieved in the first instance by adding up the power consumption from your equipment list which will typically consist of:

- * Cameras
- * Detectors
- * Lighting
- * Loudspeaker
- * Antenna
- * DVR/NVR
- * Switcher/Router

Once you have the full load consumption in milliamps you can then plug the numbers into the following equations:

$$\text{Battery Life in Hours} = \frac{\text{Battery Capacity (in mAh)}}{\text{Load current (in mAh)}}$$

$$\text{Battery Capacity} = \text{Battery Life in Hours} \times \text{Load current (in mAh)}$$

Mains + Battery + Solar

A mains/battery tower that is fully loaded should typically be expected to operate offline for 48 hours.

On most remote sites, it is recommended that a third power source is added to the tower to extend its life when offline. This is achieved by adding one or two Solar panels onto the tower which ideally should be mounted on the

TELESCOPICMAST

tower as shown in the picture below. This allows the panel to be directed more easily towards the sun. To set up a Solar power system you will need solar panels, a charge controller and batteries and a power inverter.



Dual Solar Panels on Tower



Single Solar Panel on Tower

Solution overview

How to build your own mast

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Panels can be mounted adjacent to the tower although this is not typically recommended as it takes up a larger footprint and makes it more difficult to rapidly deploy a mast to a site or move it when onsite. It also increases the space required when shipping.

In terms of positioning the tower with solar panels on, the general rule is that the solar panels should face true south as this is the best direction for the panels to receive direct light throughout the day.

Mains + Battery + Solar + Fuel Cell

Using a hybrid tower that is self-powered from integrated solar and battery power will typically provide up to 72 hours of off-grid operation.

If the tower is going to be off grid for several days or even months, then a fuel cell needs to be added to the tower to supplement the solar and battery options. At the time of writing there are two main fuel cell options available for security towers*:

- * Hydrogen fuel cell
- * Methanol fuel cell

***Disclaimer:**

As this paper is designed to be educational, I have detailed the main manufacturers available in the two fuel cell technologies and have stated the features as they present them. The author does not have any commercial link with these manufacturers.



*Courtesy of HYMERA®
Hydrogen Fuel Cell Generator |
BOC online UK*



HYMERA® Hydrogen Fuel Cell Generator | BOC online UK

The HYMERA Hydrogen fuel cell is made by BOC and is a low-carbon, hydrogen fuel cell generator designed to replace small petrol and diesel generators or large battery banks.

Providing up to 175 watts of peak power whenever and wherever needed, the HYMERA incorporates hydrogen fuel cell technology, which produces electricity from the reaction between hydrogen and oxygen from the air. Powered by compressed hydrogen cylinders as shown below the HYMERA supports several off-grid applications in security and lighting systems.

Key benefits of Hydrogen include:

Cost savings

For CCTV tower applications, Hydrogen offers significant cost savings when compared to conventional diesel generators, typically delivering savings of up to 75% for loads up to 150 watts.

Quiet operation

Hydrogen fuel cells are almost silent in operation providing an ideal power solution for covert operations or in environments where noise pollution must be avoided.

Solution overview

How to build your own mast



Operates in all weather conditions

The units typically operate in a wide range from -10 degrees and in temperatures up to 40 degrees.

Emission-free

The only exhaust is water vapour, so Hydrogen fuel cells are good for the environment and can be used in sensitive areas safely.

Methanol Fuel Cells (EFOY fuel cells)



Courtesy of: EFOY fuel cells by SFC Energy
Product overview (my-efoy.com)

EFOY fuel cells by SFC Energy – Product overview

EFOY methanol fuel cells convert chemical energy into electrical energy in a highly efficient way. They generate power to charge 12V and 24V batteries whilst being exceptionally environmentally friendly as their by-products are water heat and water vapour.

The fuel cell comprises an integrated controller which switches on the fuel cell when the battery needs recharging and switch it off again when the battery is full. It only requires maintenance when the fuel cartridge is empty.



Methanol Fuel Cartridge

Key benefits of Methanol include:

Cost savings

For CCTV tower applications, Methanol offers significant cost savings over long periods when compared to conventional diesel generators.

Quiet operation

Methanol fuel cells make as much noise as a laptop fan which makes them an ideal power solution for covert operations or in environments where noise pollution must be avoided.

Operates in all weather conditions

Methanol fuel cells operate in all weather conditions and range from -20 degrees and temperatures up to 40 degrees. Unlike solar panels, they work even in bad weather, or during long periods of winter.

Emission-free

1. EFOY methanol fuel cells use fuel cartridges to generate electricity. They contain high-purity methanol and are a safety-tested system which is specially developed for EFOY fuel cells. The fuel cartridge can be changed in seconds.

Solution overview

How to build your own mast

TELESCOPICMAST

2. They generate environmentally friendly electricity through a chemical process; only waste heat and water vapour with a small amount of CO₂ are produced in addition to electricity. Therefore, the fuel cell can be installed in the base of the tower safely.



Courtesy of: Technology - How the EFOY fuel cell works (my-efoy.com)

Fuel Cells – Which to use?

The decision between using a Hydrogen or a Methanol fuel cell comes down to the individual's priorities. Hydrogen fuel cells are approximately 60% lower in initial purchase cost than a methanol fuel cell however the Hydrogen cylinders last for shorter periods between changes, typically 7-14 days. This means more service visits will be required for a tower powered by Hydrogen.

By comparison, a methanol fuel cartridge could keep a tower live for 3 months.

Conclusion

In this paper we have studied what is fuelling the growth in rapid deployment security towers which is an escalating niche within the security sector. These towers have become increasingly popular in recent years as a way to temporarily protect construction sites, vacant properties, infrastructure and remote sites.

We began by exploring the various applications where securing towers are being successfully deployed across the UK and then the three main elements of a tower which are the cameras, power and fuel cells and the physical tower enclosure and built-in mast. In this section we examined the various technology choices that a builder of security towers should consider when building in-house or when choosing an external building partner.

The section on selecting technologies for security towers reviewed the latest camera technologies, fuel cell and power options that are currently available on the market and finished with guidance on selecting the best enclosure and mast for your security tower. This section will arm the reader with sufficient knowledge to be

confident in choosing suitable vendors, products and partners when deploying a tower.

When building a security tower in-house, one of the key considerations is the choice of mast and the secure enclosure as it likely with the developments in camera technology and advances in analytics that you will swap out your electronics every 3-5 years during the lifetime of your mast enclosure. For this reason, it is important choose a high-quality tower shell and mast as a good quality enclosure should outlast the camera technology by a factor of 2-3 times and is normally the single largest cost when building a mast.

