

Newcastle University

The Client

Newcastle University is one of the oldest universities in England. It originated with the establishment of The Newcastle Upon Tyne School of Medicine and Surgery in 1834. The College of Physical Science was added in 1871 and then Armstrong College in 1888. It was not until 1963 that the University of Newcastle upon Tyne was finally created and its elements officially gained its independence from the University of Durham.



Newcastle University, as it is called today, has grown substantially in recent years so that today it has more than 20,000 students including over 2,000 overseas students from around the world. The University's City Campus, located very close to Haymarket in the heart of the city, is made up of more than 20 large buildings. The University won the *Sunday Times* University of the Year award in 2000 and was recently short-listed for The *Times Higher Education* 'University of the Year 2010'.

The Challenge

Crime figures on campus had been rising consistently during the 1990s before George Westwater was appointed as the University's first Estates Security Manager in 1998, managing a security team of 25 staff at that time. Simultaneously the University was going through unprecedented expansion in student numbers. The campus itself was growing fast and the parents of students were beginning to demand tighter security and improved safety on campus.

In addition to these wider societal trends, one specific crime was on the rise throughout the city: bicycle theft. In response to this problem, the University had built a number of new covered bicycle racks where students' bicycles could be locked. However, these racks became targets for professional thieves. The modus operandi of these gangs is as follows: the youngest gang member comes onto campus and takes pictures on his mobile phone of some of the higher quality bikes in the designated racks located all round the campus. These images are texted to other gang members who may give orders to steal specific, high value bikes.

George Westwater explains:

"We heard stories of up to six high quality bikes being stolen from around the campus in a single day. Some of these bikes are worth £1,000 each so there is clearly big money there for the 'king pins' in these gangs who sell the bikes on to second hand dealers."

The Specification

Under George Westwater's direction, Newcastle University began looking at the potential for securing central government funding for an investment in CCTV to combat rising crime on campus. In 2000, the University partnered with Northumbria Police to secure £165,000 of funding from central government. This grant was sufficient to issue a request for tender to install a 16 channel mono camera CCTV system with VHS recording, which 2020 Vision won and installed during 2000.

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2020 Vision was the natural choice for Newcastle University having completed a number of high profile installs in major education establishments, hospitals and other campus situations in the Northeast region with over 20 years of experience designing and installing CCTV systems.

Following the success of this initial install the University applied for a second grant in 2001 and secured further funding to extend the system to make it more comprehensive.

Internal and external PTZ, dome and static cameras were deployed, in higher risk locations. Key areas covered include building entry and exit points as well as crime hot spots such as the bicycle racks and computer rooms.

The original analogue-based colour/mono, half-inch lens PTZs are gradually being replaced with dome cameras primarily because would-be villains have become knowledgeable about movements of the PTZs - learning to avoid detection by moving undetected behind or in front of the regular panning cycles of these cameras.

All these cameras are controlled, processed, monitored and recorded from a 24-hour manned CCTV Security Control Room, located within the Armstrong Building, in order to provide proactive centralised surveillance of the site.

During 2005, 2020 Vision led a project to re-design the CCTV system to make it a much more scalable and future-proof 'hybrid' analogue and digital system, operated over a distributed CCTV network, using a total of six collector points or 'nodes'.

Peter Houlis, managing director, 2020 Vision Technology, explained:

"Our task at this stage was to redesign Newcastle University's surveillance system to provide a cost effective migration path from analogue to the current hybrid solution and then on to a full IP-surveillance solution as existing equipment reaches life expectancy and obsolescence rather than advocating an expensive 'rip out and replace' approach which was considered unnecessarily wasteful."

This distributed architecture reduced coaxial and fibre optic cabling costs substantially as the system grew. Each node controls up to 64 cameras, each within close proximity of the node. Each node contains a Honeywell Max1000 camera control matrix for switching between cameras and remotely controlling their movement. This CCTV matrix is networked with between two and four Instek DVR-16F-3U Digital Video Recorders (DVRs) per node, as well as video processors and a video distribution amplifier, all wired into a fibre optic patch panel and fibre optic transmission equipment. All node equipment is housed in a 19 inch 42U 600x800 lockable equipment rack.

A total of 38 PTZ CCTV cameras are operating today across the campus. A further 182 are static and dome cameras. The majority of these are positioned externally to cover high traffic areas and high-risk zones like the covered bicycle racks. Others are positioned to scan perimeter locations to monitor pedestrians, cyclists and vehicles on and off the open campus.

Some PTZs cover the high-value equipment inside the computer rooms, which have been the target for thieves in the past. All other internal cameras are of the conventional static type. These tend to be sited at buildings' entrances and exits to provide a high quality visual record of people entering and exiting the University's academic buildings.



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The Instek DVRs offer 16 channels of analogue and a further 16 channels of IP recording per unit. Today the Instek DVRs provide images at 12 frames per second (fps) and 4CIF resolution, back to the control room. Each DVR has six Terabytes (TB) of storage, which can be progressively doubled to 12 TB as one TB disks reach end of life and are swapped for newer two TB versions. The system is currently set up to archive 14 days of images but has a maximum recording capacity of 25 days.

Veracity TIMENET GPS-based NTP Time Servers ensure that all recordings are accurately time-stamped for evidential purposes. TIMENET integrates a GPS receiver and master NTP (Network Time Protocol) clock server into a single device, which is directly connected to the network.

All nodes are linked back to the control room via an eight core fibre optic backbone. Two fibres provide a 10-base 10/100 LAN network for retrieval of recorded images from the node. These are required for access control and intruder alarm signals, voice over IP for help points and public address. Each of the other pairs of fibres is used to create up to five real-time peer-to-peer video channels and an RS232 data channel for control of the collector point slave control system for the master matrix.

Coaxial cabling is used to all internal and external cameras and then fibre optics from each node which is set up to deliver real-time and recorded images at 25 fps and 4CIF resolution back to the central control room. A dedicated fibre channel carries data and analogue CCTV images from all six nodes into a high security room to the rear of the central CCTV Control Room or 'viewing suite'. All data channels are then processed by a single Honeywell MaxPro 1000 video matrix switch connected to four MaxPro workstations and eight Instek MatriVideo DVRs (HR-DR 3600-3U Series).

Instek's nCCTV video processors deliver images from the DVRs, in playback or real-time mode, to a total of eight 42-inch LCD screens in the University's CCTV Control Room. Instek Command Center video management software ensures that the CCTV operators in the control room can select and control cameras from there in case of suspected incidents or in order to track suspicious individuals through the campus and its buildings.

A secondary control room is being established at the opposite side of the campus, to ensure business continuity in the scenario that the main control room systems fail or the Armstrong Building, in which the primary control room is based, has to be evacuated because of fire or another emergency such as a terrorist attack.

In this way, 2020 Vision has created a 220-camera CCTV infrastructure covering more than 80 per cent of the University's main campus. This infrastructure has proved flexible enough to benefit from technological advances such as digital recording and also provides a good platform for migration to Internet Protocol (IP) to take advantage of some of the latest developments in IP-Surveillance, when University security budgets allow. It is also able to help the University to adapt to new security threats and procedure stipulations as they emerge.

The Solution

2020 Vision carried out all initial installation work and developed the node-based distributed CCTV system architecture which enabled the University to continue to expand the system cost effectively out of its own security budgets during the next 10 years as new buildings are constructed and brought on stream to cope with a near doubling of student numbers at the University during this period.



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The CCTV system, which was initially analogue-only, has been gradually migrated by 2020 Vision to a hybrid model through the introduction of Instek DVRs in each of the nodes as well as eight Instek MatriVideo units in the central control room, ensuring tight and effective management and control of all CCTV cameras today and IP cameras in the near future.

The University's CCTV Control Room looks like 'mission control' today. Eight 42-inch LCD screens display key sections of the University in quad or 16-split screen views. The use of Instek Command Center software enables the University CCTV operators to set up groups of cameras.

Newcastle University CCTV operator, Larry Dewhurst, explained:

"Through proactive surveillance we've managed to catch several crimes in progress. We even work alongside Northumbria Police to monitor suspect individuals' movements through the campus. The introduction of dome cameras in place of some of the older PTZs covering the bike racks will help us reduce bike thefts over time...because the would-be thieves don't know whether they are in the field of view now like they can with the PTZs."

Larry Dewhurst is able to set up all cameras covering all bicycle racks in one preset camera grouping on-screen using Instek's control software. So in the event that suspected thieves are moving around on campus he simply goes to that preset on his PC screen and displays live images from all cameras covering all 27 bicycle racks around the campus.

Watching the racks together is a good way of assessing whether a would-be thief is merely checking out what is available across the campus or is looking intent on theft imminently. This sort of proactive surveillance, working in concert with Northumbria Police, will enable the University's security team to reduce bicycle theft over time.

As the operators of the system have learnt how to use more and more of the functionality of the system, they have found themselves able to track suspect individuals through Newcastle University's campus and in some cases work with Northumbria Police and the adjacent Northumbria University's security teams to ensure that known villains are managed out of an area where they look to be intent on committing crime. This proactive intelligence-led approach is particularly important for teenagers that do not fear surveillance because they are still too young to be prosecuted.

Larry Dewhurst explains:

"We work in partnership with our neighbours and provide each other with real-time intelligence on threats. The CCTV system enables us to offer proactive security, acting fast to prevent crime and warn our neighbours of potential threats so they too are able to do the same. In this way we have practically eliminated threats on campus and contributed significantly to reducing crime elsewhere in the city."

"Such is the rapport that we have with 2020 Vision's engineers that the University's CCTV operators are able to get ongoing training from them on various aspects of the system so that we can perform maintenance activity and get early site of any functionality improvements."

George Westwater, Estates Security Manager in charge of the University's security arrangements, added:

"The response from 2020 Vision's team is always very fast if we have a problem. Because they are based in the city they are often able to attend within an hour. We keep a sound maintenance schedule and this is important given the size of the system and the age of some of the cameras. If a PTZ goes down we can call 2020 Vision and trigger an 'operational call out' to ensure the system is not compromised for more than 24-hours."

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Control room staff are able to store known security incidents and authorise copies of key surveillance images to be burnt to disk for the police to take away when an investigation is underway, all strictly in line with Data Protection guidelines. In October 2010 for example a total of 11 incidents have been saved for possible use as evidence at a later date. These incidents cover the movements of suspect or known-criminal individuals across campus. A small percentage of them will show evidence of an actual crime in progress. All other data will be recorded over after 14 days at 18 fps and 4CIF resolution 24-hours, 7 days per week. The system can be sped up to 25 fps if known incidents are in progress or risk of security incidents is high. With the existing system it is in theory possible to keep up to 25 days of recording before image integrity is affected.

Larry Dewhurst added:

"We can also store still images of suspects and print these off for use in formal identification purposes if necessary. Instek offers 'Argus View' which enables the security team to set up a section within an image that you want to monitor."

Each of the four security teams include a team leader, deputy team leader, and a designated Northumbria Police officer who patrols the campus, creating a total team of 41 and a permanent on-shift team of nine. The team leaders run the control room, operate the cameras in case of incidents and alert the designated police officer to go to the scene where appropriate or call for back up if not.

The Results

When George Westwater, Newcastle University's Estates Security Manager was appointed in 1998 the University experienced over 500 reported crimes per year on its campus. Just 12 years later his 41-strong team, supported by a comprehensive CCTV system installed by 2020 Vision, he has been able to reduce that number to 92 crimes against a backdrop of a near doubling of student numbers and campus size. Crime has decreased by over 80 per cent over that period.

George Westwater explains:

"Every time we invest in additional cameras to protect a larger section of the expanding campus there is a corresponding reduction in crime. The investment has paid off almost immediately and consistently over the 10-year period in which we have been investing."



"The CCTV system is definitely a major deterrent. But it also enables us to work with Northumbria Police to secure prosecutions or cautions in the vast majority of cases where crimes are committed on campus. Our findings run completely contrary to what you read in the national press yet these are the real numbers we can verify."

The Future

Several new buildings are being absorbed into the University's estate in the next two years. For example, the new Science Park, the Institute of Ageing Health in the old Newcastle General Hospital site, the Bradley Clarke Building and the Downing Building are all relatively new additions to the expanding campus and these will need to be secured with the fitting of new cameras.

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In addition, there are immediate plans to bring surveillance into the Student's Union building. A total of 25 fixed IP cameras; two HD PTZ dome cameras and two AXIS P1344 IP cameras will be fitted externally to cover the front of the building.

All 29 additional cameras will be linked to two additional Instek Network Video Recorders, each with eight TB of storage capacity. This new system will operate over a highly secure private Ethernet network and will be linked back to the University's central control room. This will increase camera numbers campus-wide to over 250 by May 2011. The existing hybrid distributed infrastructure is purpose-built for additions like this.

The Instek Digital DVRs located in each node, supplied by 2020 Vision's valued partner Veracity, are designed to take 16-analogue channels and 16 IP-channels in parallel so the existing infrastructure will serve well as the University surveillance moves in the direction of IP as analogue infrastructure and equipment becomes obsolete, more expensive parts within units fail, or new types of cameras come to market and are specified.



Peter Houlis, managing director, 2020 Vision Technology, added:

"Deployment of Instek's hybrid DVRs, as well as NVRs in the future, across the Newcastle University campus has created a system which is right for the University today, but is also future-proofed – ready to exploit the benefits offered by the latest IP-based technologies as and when they become appropriate campus-wide."

"We rely on relationships with key technology partners, none more so than Veracity. Veracity is not only the supplier of Instek DVRs and its own complementary transmission and storage products, but has immense know-how which enables us to design and implement highly reliable yet flexible analogue-IP hybrid and pure IP-Surveillance systems to meet the needs of a wide range of customers."

For example, Veracity and 2020 Vision together created a fully integrated surveillance and access control system at the new Bede Academy School at Blyth, Northumberland in 2009. This installation won the highest accolade in the UK professional security installation world: the 2009 Security Excellence Awards' 'Best Integrated Security Solution of the Year'.