Home Office

Home Office Security, Science and Innovation

Centre for Applied Science and Technology

An Introduction

“The team at CAST have provided excellent support throughout the data improvement exercise for CAID [the child abuse image database], whilst also responding efficiently to ad hoc queries, providing a granular level of detail when required and advising on best practice for processes. This work has been instrumental in improving the quality of data for CAID and uploading the information onto the database itself.”

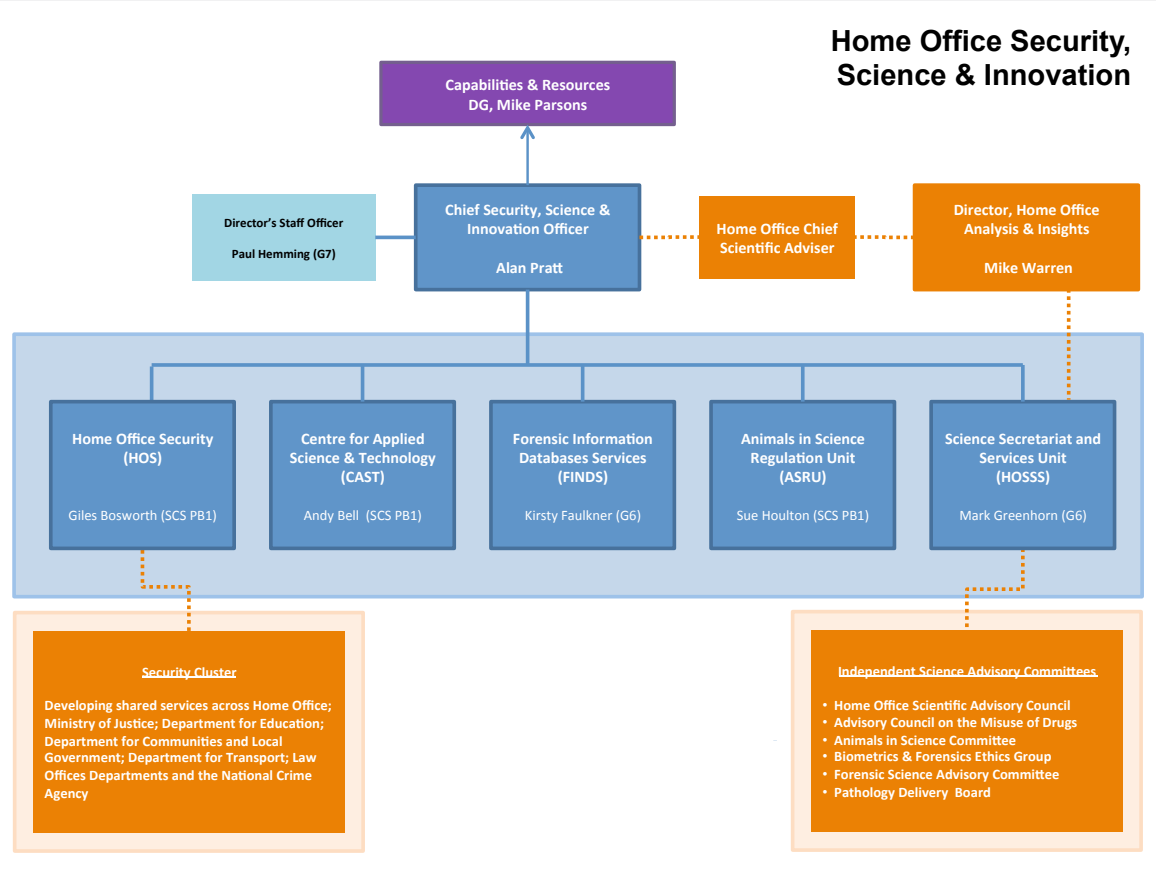
“Thank you for the information about the Fingermark Visualisation Manual. Here in the Danish Laboratory we purchased the electronic version right after it was released and it fulfilled our expectations. Well done to you and your colleagues.”

“The innovative idea that you implemented using ground penetrating radar allowed us to gauge the wall depth … this was essential for the next phase of the operation. Without your assistance, and that of the National Crime Agency we could not have progressed with the technical side of the operation. Over and above your technical expertise, the fact that you were willing to deploy as part of a covert team in cold, damp conditions demonstrated an extremely high level of professionalism and commitment.”

Home Office Security, Science and Innovation

Science is essential to the Home Office and its partners to inform policy and enable effective operations

Home Office Science brings together the department's scientists, researchers and analysts and has a vital role in underpinning the Home Office's work, both policy and operations, with the best science and technology available.



Home Office Security, Science and Innovation has a unique workforce of physical scientists and engineers, economists, social and operational researchers, statisticians, and veterinary, medical and biological scientists. It aims to:

- shape and support the policy stance taken by the Home Office through the provision of a credible evidence base;
- support operations and frontline delivery through the application of science and technology;
- provide effective regulatory functions in our defined areas of responsibility; and
- stimulate innovation and drive economic growth through science, engineering and technology.

It works to achieve these aims by:

- delivering an effective and efficient service to our customers;
- engaging with relevant stakeholders across government, in other agencies, in industry and academia, and internationally; and
- developing, supporting and making best use of our high quality workforce.

THE CENTRE FOR APPLIED SCIENCE AND TECHNOLOGY

A unique team of scientists and engineers at the heart of the Home Office providing expert advice, innovation and frontline support

The Centre for Applied Science and Technology (CAST) is the primary science and technology interface between Home Office ministers and policy makers, frontline delivery partners, and the suppliers of science and technology. Understanding the policy and operational context of Home Office business allows it to operate where others cannot for reasons of impartiality, national security or market failure.

It supports the full range of Home Office interests in policing and tackling crime, counter-terrorism, border security and controlling immigration. Its extensive in-house skills and expertise, coupled with access to industrial, academic and international networks, ensures that it is able to provide the right advice and support, irrespective of the problem.

CAST's expertise and activities are focused into capability areas that serve the range of Home Office interests in:

- contraband detection;
- crime prevention and community safety;
- digital investigations;
- forensics;
- identity assurance;
- protective security;
- public order and fire; and
- surveillance.

CAST operates from several locations in England, two of which (Sandridge and Langhurst) have specialist facilities.

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The Fingermark Visualisation Manual

Providing expert advice on fingermark recovery and enhancement

CAST and its predecessors have been involved in research into fingermark visualisation for over 45 years. Despite the more recent introduction of forensic identification methods, such as DNA, fingerprints remain the most widely-used forensic identification method in the UK, providing over 40,000 identifications per year. Ongoing changes in factors including materials and legislation mean that it is necessary to update the processes used for fingermark recovery and the advice given to practitioners. This ensures that this important forensic area continues to deliver robust evidence to the criminal justice system. CAST plays an important role in ensuring that law enforcement uses safe, effective and validated methods, and the principal tool in providing this support is the Fingermark Visualisation Manual.

The first edition of the 'Manual of Fingerprint Development Techniques' was printed in 1986. This ground-breaking publication was the first of its type anywhere in the world. It provided practitioners with a combined collection of processing instructions, health and safety advice, and optimised sequences for recovering fingermarks from the wide range of surfaces encountered in operational work. It facilitated a step change in laboratory practices, enabling standardisation of methods and selection of the most effective processes, and contributed greatly to significant improvements in forensic recovery. A significantly updated second edition was published in 1998.

CAST recently undertook a fundamental revision of the publication, expanding its content to over 900 pages and converting to a digital, interactive format to enable rapid location of relevant content. The renamed Fingermark Visualisation Manual was launched in January 2014, supported by a series of CAST-led workshops, and was distributed free of charge to all UK law enforcement agencies. The new publication has received international praise and been sold to every continent, with nearly 300 copies and licences sold to date and income approaching £100k. More than 30 years later, the CAST Manual continues to underpin the work of fingermark enhancement laboratories, both in the UK and further afield. It also supports the aims of the Forensic Science Regulator by providing practitioners with a range of processing techniques that are validated, fit for purpose, and adaptable to the diverse and unpredictable scenarios encountered in casework.

Home Office

Fingermark Visualisation Manual

Preventing Terrorism

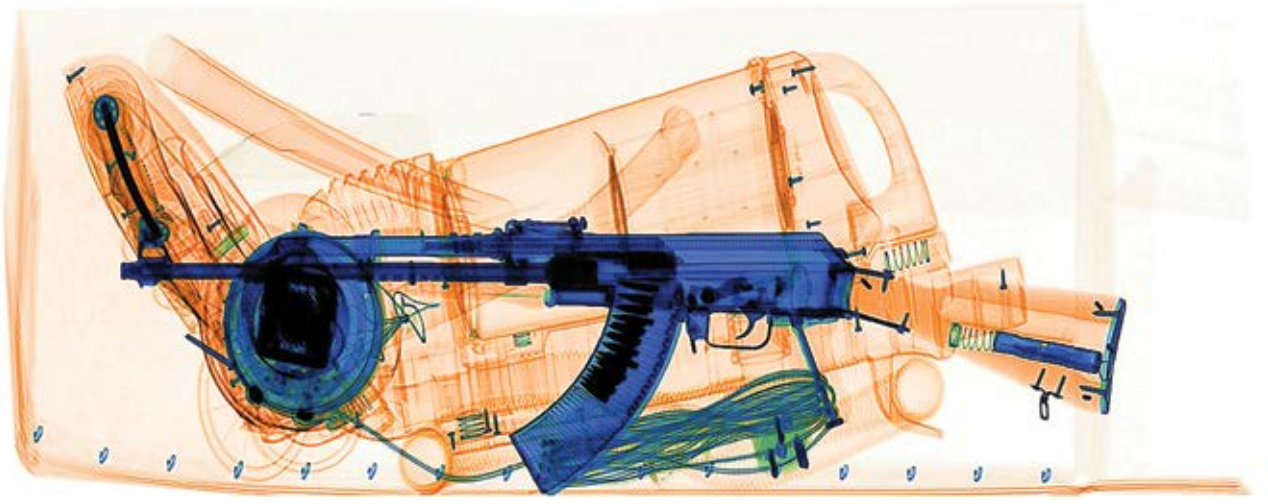
We work to increase our capabilities to detect, investigate and disrupt terrorist threats

Case Study – The Centre for Applied Science and Technology is at the forefront of protecting the United Kingdom's border from terrorist threats

The terrorist threat is constantly evolving. Technology must not only keep up, but provide the capability to tackle diverse new threats as yet unseen. CAST solves this problem in a number of ways. Using our specialist scientists and engineers in conjunction with our expert networks we help generate, evaluate and down select the most innovative approaches to detect and mitigate these threats. Using this approach recently we have identified ways in which the UK border can be made even more secure in the future using new technology and new concepts.

Of course, the very fact we need to have a secure border is only part of the solution. What if we could identify threats well ahead of the border? That is why CAST is working internationally to ensure the safety of UK citizens by investigating the feasibility of exploiting all data available to identify threats. In this way we can constantly update our response to be even more impactful. It could also provide law enforcement a richer picture to act upon - denying and disrupting terrorist networks and understanding their methods of operation.

The examples above represent a small fraction of CAST's overall efforts. All act together to ensure the security and prosperity of the UK and its citizens.



Case Study – The Centre for Applied Science and Technology Front Line Services Surveillance Team

The CAST Front Line Services Surveillance Team assists the police at major events by providing technical solutions to security issues. Short-term video and thermal CCTV cameras are installed by the team at events including party political conferences, international diplomatic conferences and some international high-profile sporting events. The presence of CCTV cameras identifies security breaches, records crimes and acts as a visible deterrent.

Following a request from a police force the team starts with an initial meeting at the event venue to discuss the force's requirements and assess any potential problems. This includes identifying which CCTV images are to be transmitted from the venue and where these images should be received. Often this involves picking up existing CCTV feeds from the venue and surrounding area and supplementing these with additional cameras supplied by CAST. Issues to address can typically include interfacing securely with commercial and police networks and overcoming the challenges in getting high definition images to off-site multi-agency control rooms. CAST provides all the required IT equipment including the monitors to display and record the captured images. Using Internet Protocol (IP) encoders the existing venue camera images are converted to IP and then egressed from the venue to the control room using a combination of the police IT network infrastructure and CAST's own wireless radio transceivers. There is also the option of using optical fibre for network connectivity where long distances in rural environments are required and the terrain makes wireless options impossible.

Further visits and pre-build at CAST's laboratories allow potential solutions to be tested before deployment. It is at this stage that any network configuration issues are addressed. CAST also provides training to those operating the CCTV systems. The team remains on site for the duration of the event to solve any technical issues that may arise.

The work of CAST contributes to UK security at major events. It also has a real impact on police resourcing during these events. The provision of one camera feed into a control room saves many hours of police time and the associated costs.

Controlling Immigration

We identify and assess technologies that aim to enhance our border security

Case Study – Biometrics at the border

Assuring the identity of travellers and citizens is essential to the efficient delivery of Home Office services, especially for law enforcement and border security.

CAST is at the forefront of developments in identity technologies and their use to secure the UK's border and manage immigration. Whilst fingerprints and DNA are well established in law enforcement, at the border it is facial images that are the key to assuring the identity of travellers. There are challenges not only in deploying automated systems but also for the human examiners and border officials involved in the end to end process of managing travellers.

CAST is working with international partners across government, industry and academia to steer the development of Face Recognition technology and establish effective training methods for human facial comparison. The procurement and deployment of biometric e-gates at the UK border is one such example of where CAST provided advice to ensure that security was not compromised by the introduction of automated processes.

Working with bodies such as the International Organization for Standardization (ISO), CAST leads on biometric standards development to ensure interoperability, promote best practice and influence industry's development of technologies where there are niche requirements. Specifically, CAST's work on Face Recognition from video is enabling the development of systems that impose fewer constraints on the individual than is currently the case with e-gates.

Recognising individuals on the move or at a distance are examples of emerging technologies that will help to manage increasing volumes of people transiting the UK border, maintaining high levels of security with minimal inconvenience for the legitimate traveller.

Case Study – Maritime surveillance and protection of the United Kingdom's border

The UK considers maritime security to be the advancement and protection of the UK's national interests, at home and abroad, through the active management of risks and opportunities in and from the maritime domain. Its purpose is to strengthen and extend the UK's prosperity, security and resilience and to help to shape a stable world.[1]

Within the National Strategy for Maritime Security, a key objective is to protect the resources and population of the UK and its Overseas Territories from illegal and dangerous activity, including serious organised crime and terrorism.

Currently, coastal security and defence for the UK is delivered by a host of different government departments, agencies and providers, giving rise to a complex operational environment. Strategically, the UK has an aspirational aim to secure and defend the UK's coastline through one central command, rather than the disparate structure that it currently functions under.

Working in partnership with Border Force, CAST is seeking to support this ambitious endeavour through identifying and tackling the variety of technological challenges that may be encountered. These challenges come about not only in the practical formation of such a command, but also at a technical level, in terms of how the functions are executed.

CAST has facilitated cross-government workshops resulting in horizon scanning outputs that include a number of innovative technological concepts and potential solutions to support these objectives. This work is shaping future perspectives of coastal surveillance.

1 National Strategy for Maritime Security – May 2014.

Promoting Growth

UK security exports have doubled over the last five years; CAST is working to ensure that the UK security industry stays at the forefront of the global export market and at the same time contributes to the safety and security of the UK

The Centre for Applied Science and Technology hosts the annual 'Security and Policing' event jointly with the Department for International Trade.

The UK is recognised as a world leader in the field of security, the development of cutting edge technology and for its extensive experience and expertise in training. Since its inception over 30 years ago the Security and Policing event has provided a platform for professionals from the UK and across the world to engage with the very highest level of security expertise. The event continuously develops in size and scope and supports the Security and Resilience Growth Partnership (SRGP), which was established to create a strong relationship between the UK government and the security sector, to deliver the UK government's security requirements and grow UK prosperity through supporting exports. In 2015, UK security sector exports rose to £4 billion from £3.4 billion in 2014, allowing it to retain its position as the sixth largest exporter globally.

Security and Policing is aimed at the police, law enforcement and security professionals who are tasked with security, civil protection and national resilience. The event showcases world-leading products and services, taking advantage of the unique opportunity to bring together people with operational needs and companies with the relevant solutions, within a secure environment. It currently attracts around 400 exhibitors and international delegations from over 50 countries.

- The UK security sector employs an estimated 322,000 people in the UK.
- The global security market is valued at around £400 billion.

CAST works together with end users, academia and industry to ensure that the UK continues to benefit from the European-funded research programme, Horizon 2020.

The Horizon 2020 (H2020) programme is a European-funded research programme that covers a wide range of topics determined by the EU Commission to be of societal importance to the citizens of Europe. The programme will run from 2014 through to 2020 and has an overall budget of €80 billion. Within the programme, the 'Secure Societies' theme is aimed at improving the security of Europe through innovative research. The broad topics within the scope of this theme are: disaster resilient societies; fighting crime and terrorism; border and external security; and digital security.

H2020 operates as a collaborative programme that requires a minimum of three partners from EU Member States. These partners are typically from academia and industry, but increasingly there is a demand for end-user engagement as bids are assessed on impact. This is a competitive process and there are no guarantees that all proposals will lead to a funded project. The timescales involved in H2020 follow an annual cycle and projects typically last for three years.

CAST has made significant progress in engaging with the H2020 programme with active participation as partners in nine funded projects covering the Home Office priorities:

- detection of terrorist activity on the internet;
- advanced tools for data analysis;
- stand-off detection for items concealed on and in the body;
- novel biometrics for the border;
- technologies for the mitigation of drones;
- advanced video analytics;
- human factors in crowd management;
- interventions into a terrorist plot along a timeline; and
- law enforcement networks across Europe.

European Commission | Horizon 2020 European Union funding for Research & Innovation

Cutting Crime

CAST's scientists are working hard to reduce the harm caused by drugs

Case Study – The Forensic Early Warning System project

CAST's work on the Forensic Early Warning System (FEWS) project has increased the UK's knowledge of new psychoactive substances (NPS) and has enabled the implementation of ground-breaking legislation to tackle the problem of NPS in the UK.

In recent years, the UK, along with many other countries across the world, has seen the emergence of new drugs that have similar effects to traditional drugs but are designed specifically to fall outside national and international control. These drugs are collectively called new psychoactive substances but are more colloquially known as 'legal highs'. Small changes made to the structure of these drugs meant they were not controlled by the Misuse of Drugs Act 1971, leaving the police with little legislative power to take action against them. NPS-related deaths have increased sharply over the last five years. They have the potential to pose serious risks to public health and safety, and have unanticipated side effects for the user. In 2015, new psychoactive substances were involved in 204 deaths in the UK, an increase of 25% from 163 deaths in 2014. The initial aim of the FEWS project, established in 2010, was to identify NPS in the UK through collection plans in a variety of areas including prisons, festivals, online and high street 'head shops'. FEWS worked with forensic providers to increase the capability of identifying NPS and created a platform for information sharing of new or unknown substances.

In 2015, FEWS took on the role of defining and implementing the testing regime to support the Psychoactive Substances Act 2016, which aims to control the supply, import and export of psychoactive substances. The FEWS team worked with industry, academia and the government to produce a technical specification for in-vitro testing, ensuring the results would stand up to evidential scrutiny in court. The team also sourced expert witnesses who could interpret and present the data in court, thus providing a complete package for law enforcement agencies when utilising the legislation. The FEWS team has worked closely with the Home Office's Drugs and Alcohol Unit to ensure that the drugs being selected for testing will have the most benefit and impact on law enforcement. The core work of FEWS in identifying substances in different sectors of the UK continues to provide crucial information to both ministers and the Advisory Council on the Misuse of Drugs.

Case Study – Mobile drug testing technology

CAST has taken the technical lead to increase the efficiency of the police in testing drivers for suspected drug driving.

Drug driving causes tremendous harm; it can destroy lives of individuals and families and devastate communities. In 2014 there were 55 fatal road traffic collisions and 264 serious injuries in which the driver's impairment due to an illicit drug was judged to be a contributory factor. Tackling this important road safety issue is a priority for the Government.

CAST was the technical lead on a joint Home Office and Department for Transport project that allows the police to use saliva drug testing technology to help to combat drug driving. This technology allows the police to screen for THC (cannabis) and cocaine in a driver's saliva at the roadside.

The law allows the police to carry out a 'preliminary drug test' on a sample of saliva from a suspected drug driver to see if they have a drug in their body. The police can only use a drug testing device that is 'of a type approved' by the Secretary of State. The type approval process is underpinned by rigorous laboratory tests to make sure that the device is accurate, reliable, and detects the drugs it should, but does not react to common chemicals that may also be found in saliva. Working in an ISO 17025 accredited laboratory facility at CAST, our team carried out thousands of individual laboratory tests to ensure that devices meet the stringent performance requirements of the type approval process.

CAST's work in this area has, for the first time, allowed the police to have saliva-testing technology to test suspected drug drivers at the roadside. As well as saving the police time and money, using this mobile technology will help to promote road safety by supporting drug driving enforcement.

Case Study - Digital investigations

The digital evidence element of crime scenes is having a greater impact on criminal investigation than in the past. As such, a growing number of devices and online sources are now available to investigators. CAST seeks to improve the capabilities of investigators to exploit digital crime scenes.

CAST's work in digital investigations is designed to be relevant both to policing in the investigation of crime, and to a much broader group of investigators including those working within Immigration and Borders. They face similar challenges in being able to identify individuals online from their digital footprint and to obtain robust digital evidence of their activity that can be used in prosecutions.

CAST is focusing on two key areas:

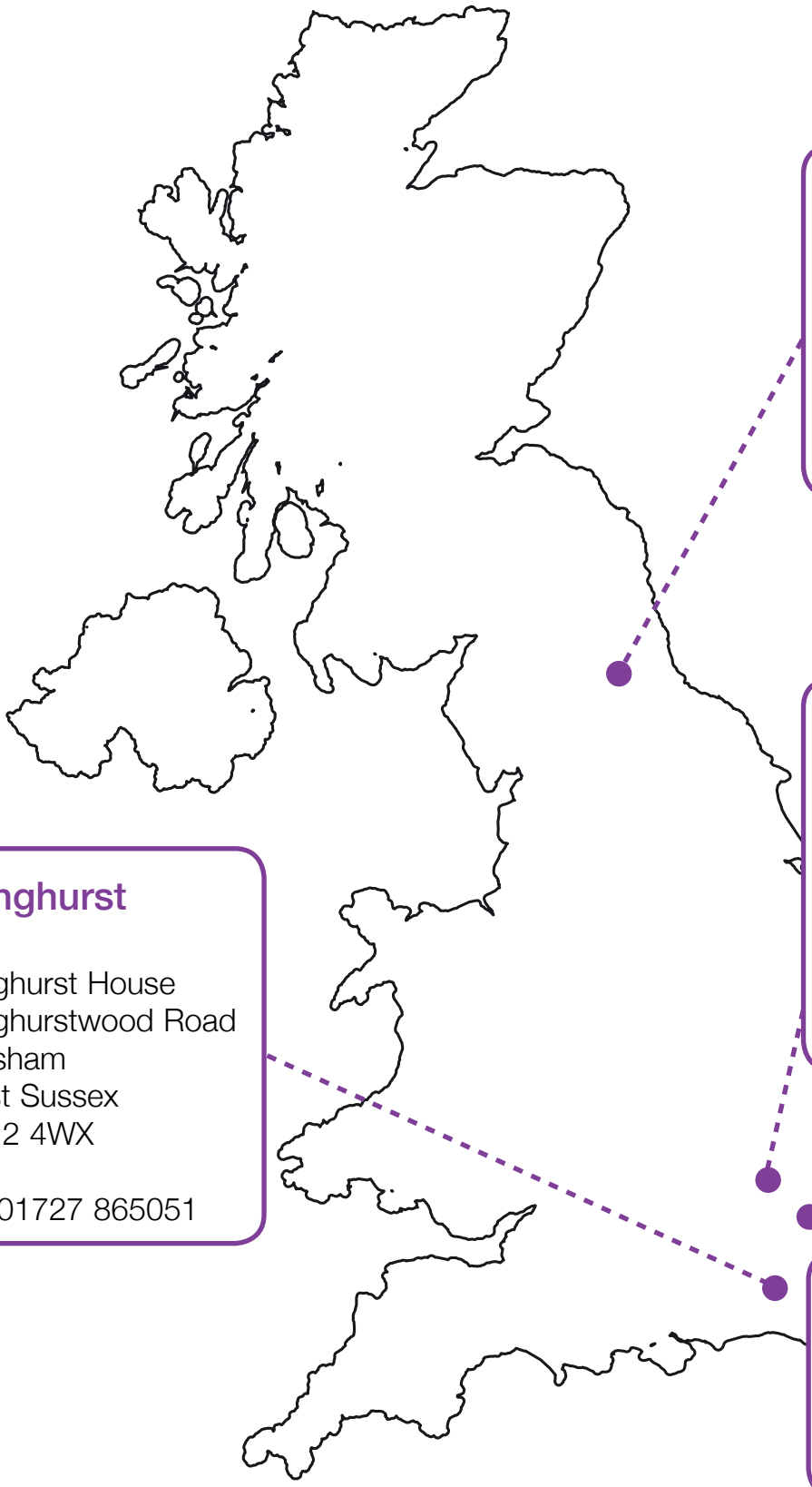
- Digital forensics
- Open source intelligence (OSINT)

As part of our digital forensics work, we are looking at novel tools and techniques that can be deployed to recover digital evidence from the increasing variety of devices that may be found at a crime scene. Devices may include the latest smartphone or tablet on which multiple apps are installed, games consoles, smart TVs, or even drones. We are looking at commercially developed tools that can be deployed by frontline officers, and specialist techniques that could be used by digital forensics practitioners in more challenging and complex cases. We are also working to ensure that the methods used to recover digital data are forensically sound and result in evidence that can be relied on in court.

The use of open source online information is at the forefront of changes to investigations in policing and wider law enforcement. There is a vast array of relevant technology under development in the commercial sector, some of which could be applied in a law enforcement context. This ranges from complex analytics software down to 'free' applications that are available to anyone with a web browser. CAST is advising on the use of technology, but is also supporting the change to the policies and methods during an investigation to ensure that the information is gathered safely, legally, effectively and efficiently. We are also helping investigators understand what online footprint they may leave when carrying out internet investigations.

To deliver against these broad challenges, we will be using both our in-house technical skills and working in partnership with industry and academia, developing and collating the most up-to-date knowledge and then disseminating it to those who can deploy it operationally.

CAST's Locations



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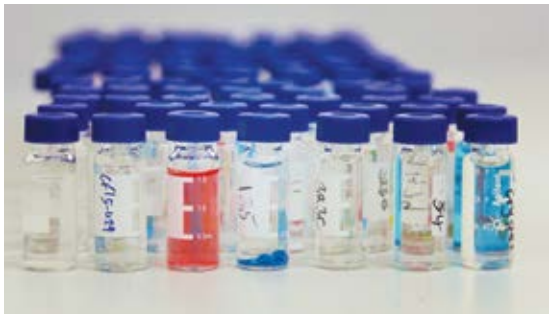





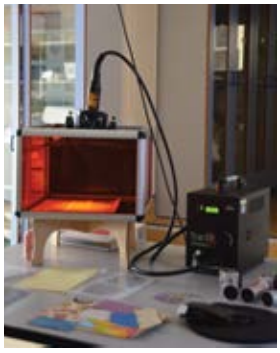





UKAS TESTING

4665

CAST's ISO17025 accreditation covers testing of preliminary drug testing devices, testing of breath alcohol screening devices and evidential breath alcohol analysis instruments.

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