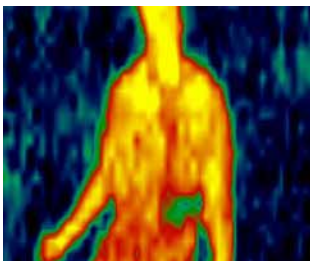




Home Office

Home Office Science Centre for Applied Science and Technology

An Introduction

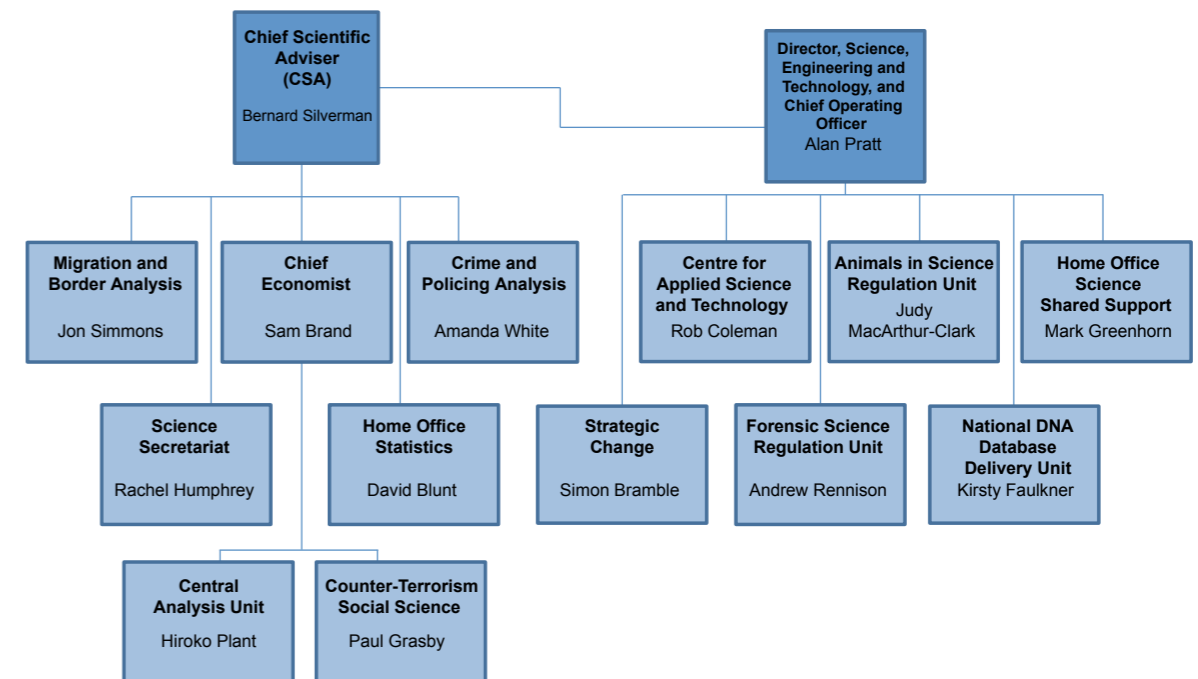




Home Office Science

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.



Led by the Chief Scientific Adviser and supported by the Director of Science, Engineering and Technology (SET), Home Office Science includes 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;
- stimulate innovation and drive economic growth through science, engineering and technology;

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;
- developing, supporting and making best use of our high quality workforce.

CAST is...

The CENTRE FOR APPLIED SCIENCE AND TECHNOLOGY

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

We are 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 us to operate where others cannot for reasons of impartiality, national security or market failure.

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

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

- contraband detection¹
- crime prevention and community safety
- cyber
- forensics
- identity assurance
- protective security
- public order
- surveillance

For general enquiries, or if you are not certain who to contact, please use our information service:

Telephone: 01727 816400

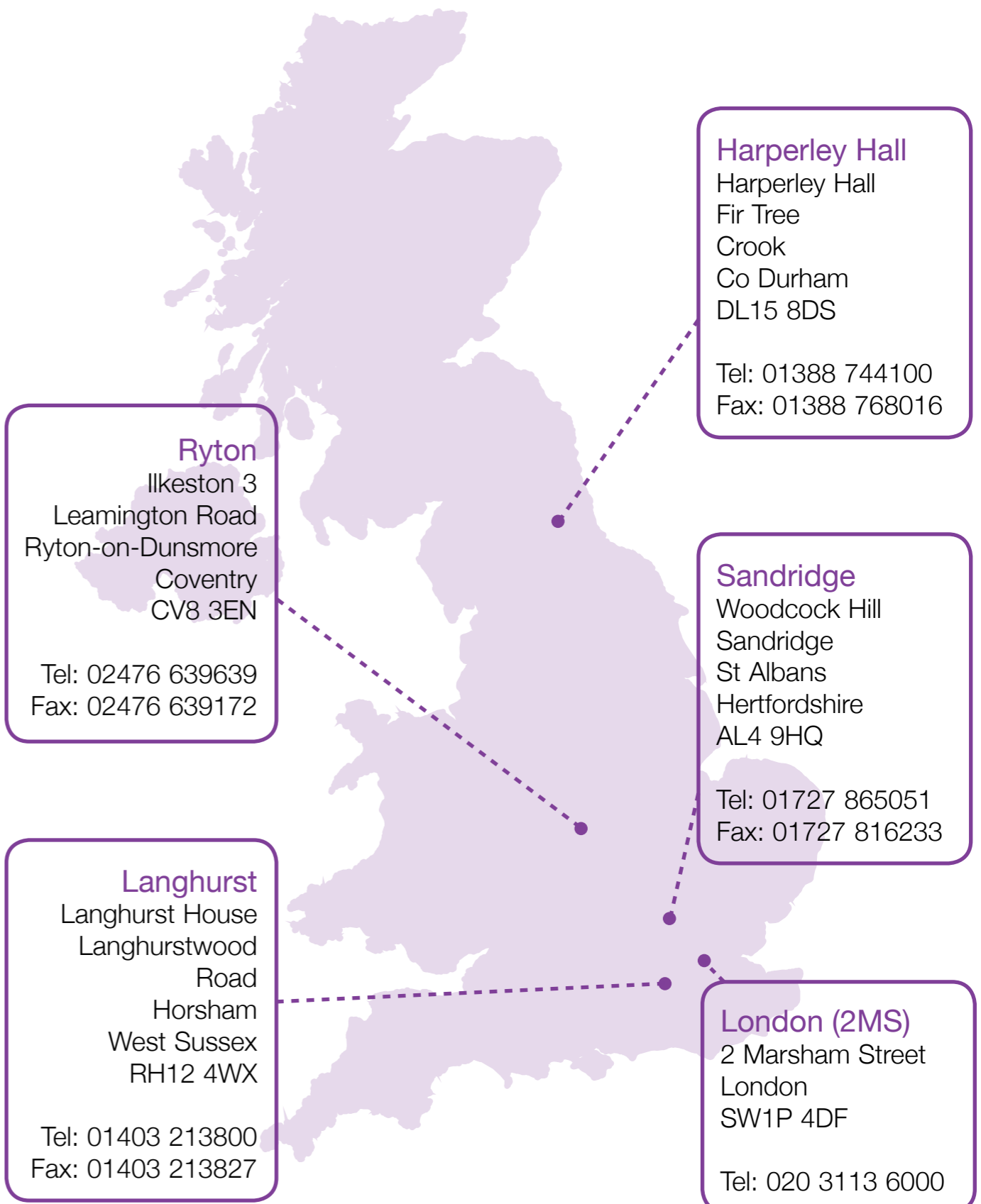
Email: cast@homeoffice.gsi.gov.uk

Website: www.homeoffice.gov.uk

¹ Illicit material including people/stowaways, money, drugs, explosives, weapons and chemical, biological, radiological and nuclear material.

Where is CAST?

We operate from five locations in England, two of which (Sandridge, Hertfordshire and Langhurst, West Sussex) have specialist facilities



Advice

We provide expert and impartial scientific and technical advice

CAST's scientists and engineers are experts in their field and at the heart of government, so we are able to give impartial and accurate technical advice across a wide range of issues. Our customers tell us this is one of our more valued roles.

Case Study - CCTV code of practice

The UK has led the world in the deployment of CCTV. Its use in crime and counter-terrorism investigations is now routine. However, until now there have not been clear regulations and standards around the effective use of CCTV. To address this, the Protection of Freedoms Act 2012 requires the Home Secretary to issue a code of practice relating to surveillance camera systems, principally CCTV and Automatic Number Plate Recognition (ANPR), and to appoint a Surveillance Camera Commissioner.

The code aims to ensure that the use of CCTV is legitimate and proportionate in meeting its intended purpose. CAST is leading national and international efforts to develop technical standards to assist manufacturers and installers to develop cameras and recording systems that are fit for purpose. We are also producing guidance for non-technical end-users so that they can have confidence that these systems will meet their needs and those of the criminal justice system. In particular, we are developing standards to improve the picture quality and the ease with which the imagery can be retrieved and replayed in court. This will improve the effectiveness of CCTV in crime detection and prevention, and the evidential value of the imagery in any subsequent investigation.



Case Study - Less lethal options

Over the last decade CAST has continuously assessed 'less lethal' options for the UK law enforcement community in response to a growing number of situations where the public are at risk and police officers are faced with violence. We have been at the forefront of driving innovative solutions with industry to find alternatives to using lethal force such as firearms. Providing evidence of the operational effectiveness and medical implications of less lethal technologies is a key facet of the advice provided to ministers.

The changing nature of public disturbances necessitates new ways of safely controlling crowds at a distance and of identifying offenders post-incident. Working with the police, we are exploring novel approaches to marking offenders that can be used to tie them to their offence with supplementary evidence such as photos and CCTV, and increase the likelihood of prosecution. Additionally, we are assessing a range of technologies that may assist in controlling and managing rioters, including acoustic devices and long-range irritant delivery systems.



Innovation

We innovate by applying scientific methods and credible technologies to real world problems

CAST has extensive networks at home and abroad with government, industry and academia and so we are able to influence and develop the most cost-effective technologies to solve our partners' problems. We translate needs and outcomes into scientific and technological requirements to drive innovative and cost-effective solutions across the science and technology supply base. We also have the ability to develop novel capabilities in-house.

Case Study - Exploiting mobile technologies

Over recent years mobile communications technologies and the range of applications they can support have advanced significantly and have had a major impact on policing.

Not only do most frontline officers now make use of BlackBerry® or similar mobile devices as an integral part of their normal day-to-day business, but almost 1,500 mobile ID fingerprint capture devices are now in use by police forces. These enable officers on the street to identify individuals that they come into contact with whom they suspect may be providing false information, without having to take them to a custody suite for fingerprinting. This is helping to keep officers out on the frontline.

Mobile technologies will continue to improve and will impact further on all areas of policing, including identification of suspects out on the street, as well as forensic identification from samples found at the crime scene. We are working to drive further innovation in this area. This includes liaising with suppliers of such technologies, collaborating with international partners to develop standards and best practice guidance, understanding legal and ethical concerns, and advising potential users on the benefits/limitations of such technologies.



Case Study - Novel explosives and weapons detection technologies

The evolving nature of crime and terrorist threats requires new approaches and technologies to be developed to protect the public from harm. In conjunction with our partners across government and in the USA we have established an Innovative Research Call (IRC) on explosives and weapons detection to partner with industry (mainly small to medium enterprises) and academia to deliver novel detection capabilities.

Since its inception in 2007, 27 projects have been funded, with early successes in:

- an off-set Raman detection system for screening liquids;
- some novel x-ray detection systems with significantly improved energy resolution;
- systems employing millimetre wave and terahertz technology to detect objects concealed on the body.

We continue to work with our partners in industry to ensure these ideas are commercialised ready for frontline use.



Support

We provide hands-on technical support to all our frontline partners

With a wide range of expertise and equipment we provide hands-on technical support and advice to our frontline partners. Our support ranges from preparing for major events like the 2012 Olympics to the use of technology in day-to-day operations.

Case Study - Ground-penetrating radar

Looking for evidence buried underground is not easy and the police needed a fast and effective way to examine large areas of ground.

One of the most recent additions to the range of equipment CAST offers to police forces is ground-penetrating radar (GPR). GPR uses radio waves to make an image of the structure of the ground beneath the surface. It sends out a pulse of electromagnetic radiation, which reflects from changes in the subsurface structure or from buried objects. These reflections are received at the surface and can be used to identify the location and depth of buried bodies or other items.

Identifying potential targets on the scan requires analysis by an experienced operator, which is why we provide both the equipment and trained staff. The advantages of GPR are that it is relatively quick and it is non-destructive, so any evidence is preserved for excavation by forensic archaeologists.

This technology speeds up searching for bodies and weapons and other contraband, having wide utility in counter-terrorism, crime investigation, missing persons and cold cases.



Case Study - Support for major security events

CAST has a number of staff trained to deliver capabilities over a range of areas including: searching for drugs, explosives and weapons, surveillance tools and techniques, CCTV and security audits, and explosion vulnerability surveys.

Our expertise was used during the design, build and assurance stages of the high risk Olympic and Paralympic venues. We used our extensive knowledge of airport security technologies to help create one of the world's biggest screening areas at the Olympic Park. This enabled approximately 450 people per hour to move through each lane of the security checkpoint area. We also worked with the security suppliers to ensure their solutions, once installed, were fit for purpose.

During the development of designs for each of the Olympic venues the London Organising Committee for the Olympic Games (LOCOG) acknowledged that they lacked the technical knowledge within their own team to undertake an assurance programme in order to verify that venues would be 'safe and secure'. In collaboration with the Metropolitan Police Service (MPS) and the Centre for the Protection of National Infrastructure (CPNI), we provided this service and reviewed all of the highest risk venues including Greenwich Park, ExCel, Eaton Dorney, Earls Court and the Olympic Park.

Due to the large area to be secured, one of the first venues to start installation of its perimeter security system was Greenwich Park. This venue has a complex terrain and many trees, which made the task for the supplier particularly difficult. We were able to identify several installation errors, which would have affected the number of false alarms being generated in the control room.

Another issue was LOCOG's use of SCRIM – the Olympics branding product attached to the fence – which made it impossible for CCTV cameras or security staff to obtain a clear view of the area immediately outside the perimeter. In negotiation with LOGOC, we were able to influence where SCRIM was used and ensure that the security effect was not reduced in vulnerable locations.

We continued to provide support up to and throughout the Games and made repeat visits to ensure that any faults were rectified. This support work was highly effective and CAST was acknowledged for the support provided to delivering a 'safe and secure Olympic Games'.



Engage

We engage with all our partners in the public and private sectors, listening and learning, and using this feedback to influence the use of science and technology in support of Home Office priorities

CAST engages with industry and academia to develop their capacity and capabilities to support the range of Home Office interests where science and technology has a role to play. We use our in-depth understanding of the policy and operational landscape to influence the science and technology supply base to meet priority requirements and produce more cost-effective products and services.

Case Study - Automatic Number Plate Recognition

Automatic Number Plate Recognition (ANPR) is used by law enforcement agencies across the UK and has successfully contributed to the police's ability to gather intelligence and identify and locate criminals. As the name suggests, cameras located across the UK are able to automatically read a vehicle's number plate, tie it to a particular time and location, and compare it with police, insurance and vehicle registration databases. The ability to provide this service depends on the certainty with which a plate is captured and the accuracy with which it is read.

CAST provides scientific guidance on standards that drive the improvement of ANPR systems so that they provide the maximum information to the best possible quality. We also work with the British Standards Institute, the Department for Transport and number plate manufacturers to ensure that the plates are easily readable by ANPR systems and to comply with legal requirements.

This work is intended to maximise the police's ability to accurately pinpoint those involved in criminal behaviour.



Case Study - Drug driving

Drug driving causes tremendous harm to individuals, destroying lives and families and devastating communities. In 2011 there were 49 fatal road traffic collisions in which impairment due to a drug was judged to be a contributory factor; tackling this important road safety issue is a priority for the Government.

If a driver is suspected of being impaired by a drug, the law allows the police to carry out a 'preliminary drug screen'. This tests a sample of oral fluid (saliva) to see whether or not the driver may have a drug in their system. A positive result enables the police to request an evidential sample of blood or urine for analysis without the need for assessment by a medical practitioner. The preliminary drug screen can only be carried out using a device that is of a type approved by the Secretary of State. The use of preliminary drug screeners would save police forces both time and money but, until recently, no devices were approved.

Type approval is supported by a rigorous process of technical testing to ensure that devices are accurate and consistent. Testing regimes are already well established for breath alcohol and speed cameras, so CAST was asked to design and undertake the requisite testing for preliminary drug screeners.

We published a guide, setting out what the equipment would have to do and how it would be tested. This gave manufacturers a clear view of the requirements and an equal opportunity to submit their device for laboratory testing at CAST.

The testing process itself involved assessing the performance of the devices when exposed to the target drugs at several different concentrations. This allowed us to be certain that the devices met the stringent requirements laid out in the guide. The process also involved checking that the devices were not affected by multiple drugs in the same sample, or by the presence of common interferents.

Following CAST's tests, devices have now been approved, allowing the police to more easily enforce the laws against drug driving and potentially saving lives.



Case Study - Enhancing cyber crime investigation capabilities

CAST's cyber work involves looking at tools for different digital forensic areas, assessing their relative strengths and identifying gaps in the market.

Digital media – including computer and phone devices – is increasingly associated with a wide variety of crime. Automated analytical tools are routinely used in the analysis of digital media, allowing for large volumes of exhibits and data to be analysed and reported. We are carrying out an extensive comparison trial of multiple e-discovery tools to see if they can be used by frontline staff instead of High Tech Crime Units (HTCUs).

Retrieving digital evidence is currently carried out by HTCUs and it is estimated that a backlog of 37,000 cases may result in the next five years if alternative approaches are not found.

All our findings will be shared with industry to help them develop the next generation of their products.

Future work will focus on vehicle electronics exploitation – the forensics of computer-based systems in cars including, but not limited to, the Engine Control Unit (ECU) and built-in satellite navigation systems (SatNavs).

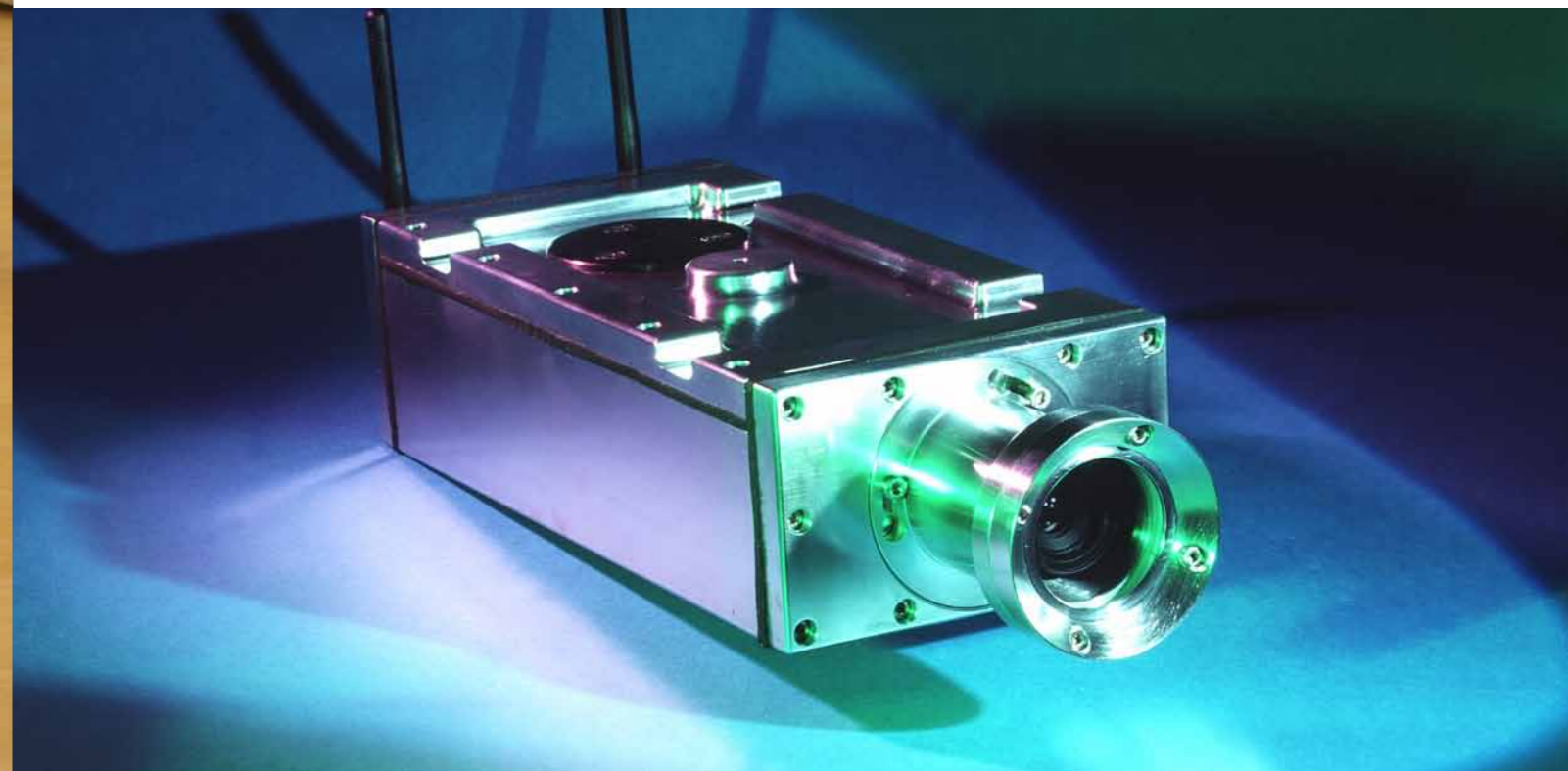
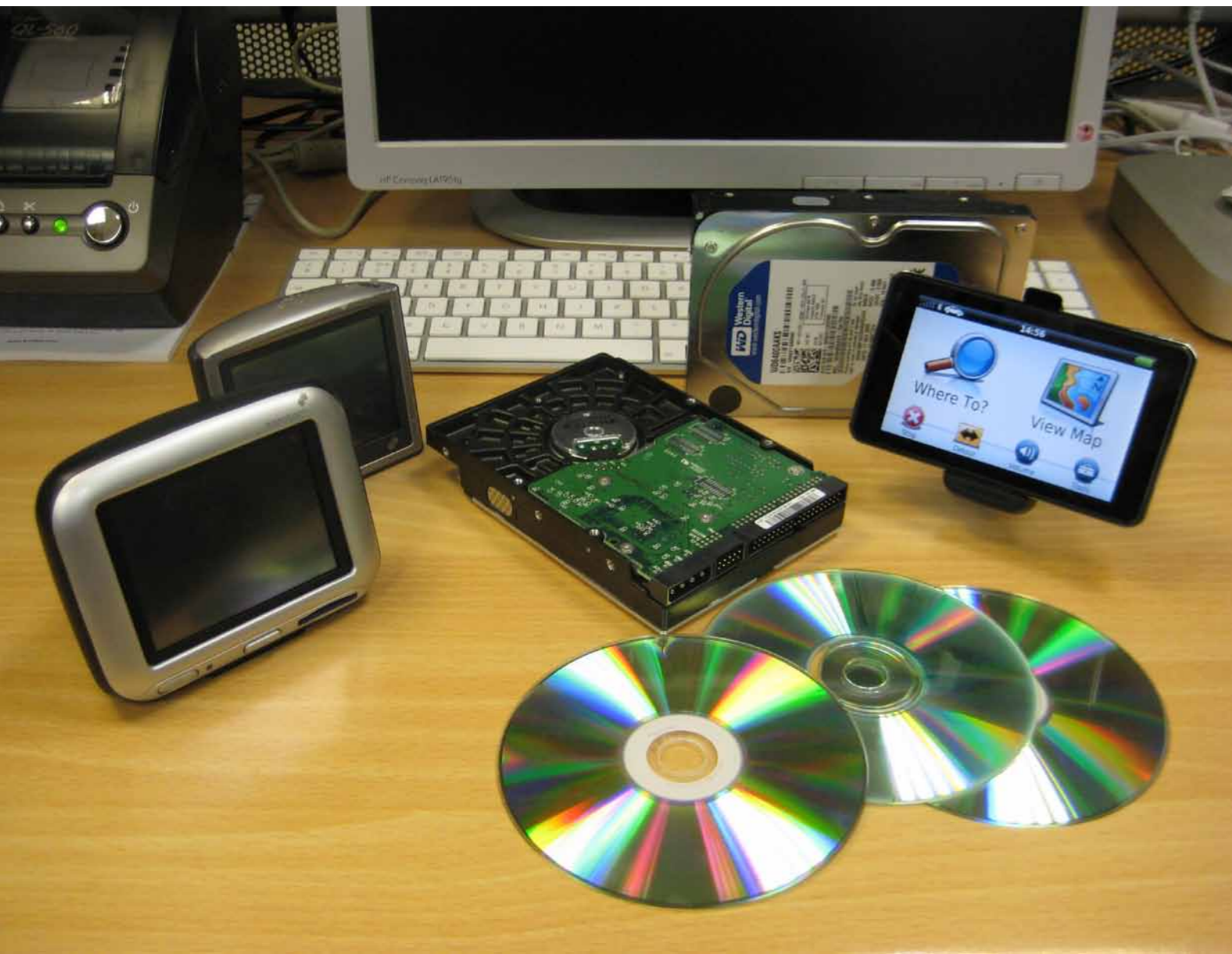
Horizon Scanning

We conduct horizon scanning activities to identify the technologies that may create threats and opportunities to the way that the Home Office delivers its business

CAST supports horizon scanning activities throughout the Home Office and its agencies and across government by providing specialist science and technology input. Our work helps the Home Office and its frontline partners to stay ahead of the game in the development and delivery of policy and strategy that is resilient to technology shocks.

We use horizon scanning to:

- **Identify threats and opportunities** to Home Office and government business. This is primarily from a science and technology perspective with a focus on Home Office priorities. We also provide specialist science and technology support to other government departments as part of our cross-government collaboration role. Our work allows the Home Office to assess potential opportunities and threats from new technology with the possibility of significant savings being achieved through early action. We also use our horizon scanning work to help to identify early opportunities for designing out crime from products, places and services.
- **Develop robust policies and strategies** across the Home Office. Future scenarios and horizon scans can be used to test the robustness of strategies and policies. We work with colleagues across social science and policy units to develop scenarios and horizon scanning products for use in a variety of business areas. Our input helps policy makers and planners to generate more resilient policies, plans and strategies by making them aware of these potential futures.





CAST's ISO17025 accreditation covers the testing of preliminary drug testing devices for type approval and the use of a range of fingermark visualisation processes.

ISBN: 978-1-78246-105-0
CAST Publication no 04/13
Published by Home Office
© Crown Copyright 2013

