ALL CHANGE

INTO THE AGE OF INFORMATION

It is almost inconceivable to think of a world without the Internet and Smart Phones, yet neither existed in 1990. Today all the information you could want is seconds away at the touch of a screen, then it was hard won by wading through the Telephone Directory, consulting an Encyclopedia or trawling through books or documents. Today it is necessary to turn your back on information to retain sanity, then it was illusive and never sufficient.

The revolution started in 1989 / 90 when Tim Berners Lee, an English Scientist working for CERN in Switzerland, began to see the possibility of broadening internet connections beyond closed computer communities. He came forward with three ways to marry hypertext to the internet:

- He devised a system of globally unique identifiers – the **UNIFORM RESOURCE LOCATOR (URL)** and the **UNIFORM RESOURCE IDENTIFIER (URI)** - THE Web address system.
- Also a standard mark-up language for documents to be displayed on the Internet – the **HYPERTEXT MARK-UP LANGUAGE (HTML)** designed to make Internet data (text, images and other material) into visual or audible web pages.
- And the **HYPERTEXT TRANSFER PROTOCOL (HTTP)** the foundation of data communication for the World Wide Web where hypertext documents include hyperlinks to other resources that the user can easily access through a software application called a **WEB BROWSER** and a **WEB SERVER.** The Browser initiates communication by a request for a Web Page and the Server responds with the content of the resource.

The Browser allowed access to the Web from a wide variety of operating systems and devices. It allowed untrained users to click and browse from web-site to web-site. Initially called the **WORLD WIDE WEB** its name later changed to **NEXUS.** The first Web Page appeared in 1991 but it was not until 1993 with the development of the **MOSAIC WEB BROWSER** by Marc Andreesen and Eric Beena that the Internet became accessible for everyone. It was the first Browser that could display images and it quickly became popular as web sites for everyday use started to become available. Very quickly browsers were refined with two front runners battling for supremacy the **Netscape Navigator** and the **Internet Explorer (for Windows)**. As Web usage expanded **Search Engines** designed to carry out web searches by Keywords to generate lines of results also emerged. The first popular Search Engine was **Yahoo** in 1994 but

others vied for attention including Magellan, Excite, Infoseek, and AltaVista, but all were eclipsed by Microsoft's Windows Internet Explorer and, in 1998, by **Google**.

The early Internet experience was slow and cumbersome. Connection was achieved by plugging into a telephone port. A dial-up sequence of low bleeps followed by a couple of rude noises preceded the slow filling of the screen from top to bottom. Changing web sites took a while. Nevertheless, the number of sites and usage grew rapidly and it was not long before the commercial world woke up to the potential for free advertising. Thus followed the **Dot Com** bubble pioneered by Jeff Bezos who launched **Amazon** selling books out of his garage in 1995. By the turn of the Century **Surfing** the web had become a widespread practice and most companies worth their salt had registered a Web Site.

Running parallel to the work of Sir Tim Berners-Lee, Linus Torvalds, a Finnish computer scientist, developed the **Linux Operating System.** Rooted in the UNIX multi-user computer operating system he created the **LINUX KERNEL** the core of an operating system which was open-sourced and could be modified for different uses. As a free and robust system it became the basis for systems as diverse as cellular phones and supercomputers. Today Linux runs everything from light bulbs to cars and to almost all TV's and phones on the market.

The Linux Kernel was one of several elements which came together in the early 90's to make possible the modern mobile phone. In 1991 standards were agreed by the European Telecommunications Standards Institute to describe the protocols for second generation (2G) digital networks. First deployed in Finland in December 1991 it became the global standard for mobile communications arriving in the UK in 1993 when the Government offered licenses to two Service Providers – Orange and One2One. The first digital phones then made their appearance – the Mercury M200 made by Siemens and the M300 made by Motorolla. At first take up was not fast. Geographical coverage was patchy and the regulatory system of contracts and call charges made by the Service Providers were new and off putting to consumers. It was not until 1997 with the introduction of Pay-as-you-Go services that the consumer landslide started. By then much had changed.

1992 saw the beginning of **TEXT MESSAGING** but again it was slow to gain traction. Mobile phones adapted quickly, but until 1999, messaging continued to be constrained by Service Providers who permitted it only within their own network.

Meanwhile developments were rapid. The phone soon mutated into something very different as the potential of micro-electronics was realised in a range on new hand-held gizmos. More applications were added to the humble telephone, It became increasingly 'Smart'!

The scent of difference was noticeable in the Nokia 2110 introduced in 1994. With the famous Nokia Ring-tone it could send and receive SMS messages and list 10 dialled calls, 10 received calls, and 10 missed calls on screen. It cost £700. It was, however, totally eclipsed in the USA with the introduction of the IBM Simon Personal Communicator released by Microsoft in 1994. It was the first PDA (Personal Digital Assistant) to include a phone application which is often regarded as the first 'smart' Phone. Simon was able to send and receive faxes, e-mails and cellular pages. It included an address book, calendar, appointment scheduler, calculator, world time clock, electronic notepad, handwritten annotations and stylus input via a screen keyboard. It cost $899 with a contract and over $1000 without, but was only available within a 15 State service area and was only on the market for 6 months.

Simon was followed in 1996 by the Palm Pilot, a hand-held computer which itemised contacts, notes, to-does and events – all synchronized to a desk-top computer with the press of a button. It too was a US product costing $299 but it opened up an entirely new dimension to the Personal Digital Assistant. However, it's capacity was overtaken by the Nokia 9000 'Communicator' which also hit the market in 1996. Opening like a mini Lap-top with a keyboard and a black and white display it was large and heavy by today's standards and expensive at £1000. For the first time though, it had all the features of a computer on a phone putting e-mail, web browsing, fax, word processing and spreadsheets into a single pocketable device. It was an ideal companion to the business man.

By 1999 internet access on a mobile phone became more readily available to the man in the street with the introduction of the Nokia 7110. It was the first mobile that could access information on the internet through WAP – the 'Wireless Application Protocol technology.' It was the first mobile phone with true global communication, though through WAP it was text only. Nonetheless, it provided ITN News, Traffic and travel information, Business Directories and last minute deals through lastminute.com.

Throughout the 90's the extent of the digital revolution was demonstrably astounding. It was as if there was a 'eureka' moment and the world went crazy. Life speeded up. Personal reach became global. Information sharing revolutionised every aspect of human life. Change accelerated.

The advance of computers was similarly amazing. Power and function grew beyond measure. Mystique faded, they were made much more user friendly and they emerged from the shadows and into the main stream. The decade was dominated by **Microsoft**, who, with their Windows software, revolutionised how people used their personal computer. In 1990 the Company released **'Windows 3'**. With a new Graphical User Interface it was a game changer with Applications represented as clickable icons as opposed to a list of file names seen in its predecessors. It also introduced Microsoft Word, Excel and Powerpoint whilst retaining many of the simple applications such as Notepad, Calculator and Paintbrush. It also added a media control interface designed for media related devices such as graphics, audio cards, scanners and video-tape players as well as supporting the recording and playing of digital audio and Midi. Updates and modifications were constantly made until the advent of **'Windows 95'**. This was no longer based on DOS (Disc Operating System). The software made it possible to connect with the Internet by a few clicks of the Mouse and it was faster and more stylish than previous versions and much more attuned to regular people rather than professionals or hobbyists. Within 2 years it became the most successful operating system ever produced. It too was superseded by **'Windows 98'** with further refinements and additions.

As the demands of ever expanding software increased so too did the need for more powerful computers. In 1990 the Commodore Amiga represented the most up-to-date home computer on the market:

Commodore Amiga : 16 or 32 Bit, 256 Kb RAM, Clock Rate= 7.14 Mhz

The Pentium 111 released in 1999 illustrates the increase in power and capacity

Pentium 111: 32 Bit 4Gb RAM Clock Rate= 400Mhz – 1.4Ghz

Within 10 years, therefore, the computer had been transformed into an entirely user-friendly conduit to an ever expanding array of indispensable functions housed within ever smaller portable machines. Improvements in battery technology from heavy lead-acid batteries to Lithium Polymer batteries accompanied by power-saving processors and improved liquid crystal displays led to the birth of the modern day Lap-Top and gave new life to mobile phones and all other portable gadgets.

Apply the same ingenuity and inventiveness to the development of digital technologies within the commercial world and the extent of the Third Industrial Revolution becomes ever more apparent. Offices and work-places were everywhere transformed. Word Processing, Spreadsheets, E-Mail, the beginnings of Internet Commerce – all usurped traditional methods. Elsewhere advances in reprographics substantially lessened the burden of documentation. Ever more slick and compact machines combining a variety of functions like the Canon J10 (1992) raised efficiency and saved space. Offering Print, Scan, Copy and Fax it was available to both home and office. Laser printing in colour became widespread, scanners and E-Mail replaced Fax machines. Photocopying was made easy and accessible. Filing and recording in digital format was, however, in its infancy. Storage on computer disc was beginning to emerge but it was not until the early 2000's that 'Cloud' storage threatened the filing cabinet. Paper remained the main currency of the day.

On the shop floor the change was equally stark though in the competitive world of industry it was not so openly advertised. Computer control, automation and robotics were quietly revolutionising production everywhere. The removal of human fallibility raised quality, efficiency and speed to levels never dreamt of. The era of large scale mass production had arrived.

In the home, entertainment systems were the main beneficiaries of the most innovative change. The decade saw the introduction of DVD's (Digital Video Discs) and DVD Players which, in a few short years, saw off the Video Tape technology so popular in the 80's. MP3 Music Players allowing the storage of compressed music files also arrived to give further versatility to the way music could be accessed. Television too was on the cusp of a radical make-over. Digital Satellite television made an appearance in 1998 and the first Flat Screen TV, produced by Sharp and Sony, arrived in 1997. Both technologies were, however, still embryonic and wildly expensive. It was not until well into the 2000's that they made a real impact. In the 90's it was Gaming which benefitted from the most significant change with astonishing developments in animation and graphics. Moving from 2D to 3D, Compact Discs replaced Cartridges in consoles which, in turn, moved up a gear to 32 /64 Bits. Game controllers matched the rising sophistication of the software with buttons, even becoming pressure sensitive in 'Dreamcast' 1999. Competition between Games Producers was fierce. The most popular games included:

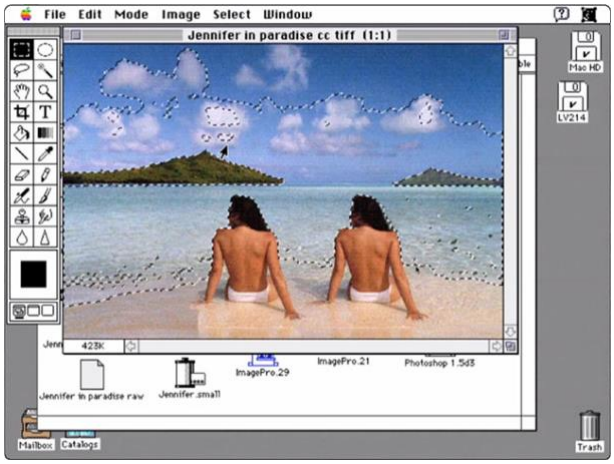
Golden Eye 007 , Mortal Kombat, Super Mario, Tomb Raider, Sonic the Hedgehog, Pokemon Red / Blue, Quake, 'Street Fighter, Sensible World of Soccer. Tony Hawks Pro-Skater.

Photography changed beyond recognition in the 90's as the digital revolution overwhelmed traditional film based practices with slick, immediate and processing free technology. The first consumer digital camera, the QuickTake 100, was launched by Apple in 1993. Equipped with image sensors measuring the intensity of light hitting a 'Pixel' – a small area of the image, the camera converted it to a digital value which was then stored to be resurrected on a computer screen. Time magazine ranked it among the top 100 greatest and most influential gadgets of the 20th Century!

The QuickTake was very basic. With 250 Kilo-pixels it had no focus or zoom controls. It had a fixed focal length lens capable of capturing images from 4ft to infinity with an auto-exposure function and a flash. Powered by three AA batteries, it was capable of storing 8 photographs at a resolution of 640X480 or 32 photos at 320X240 in colour. It had no preview screen and no way to delete individual photographs.

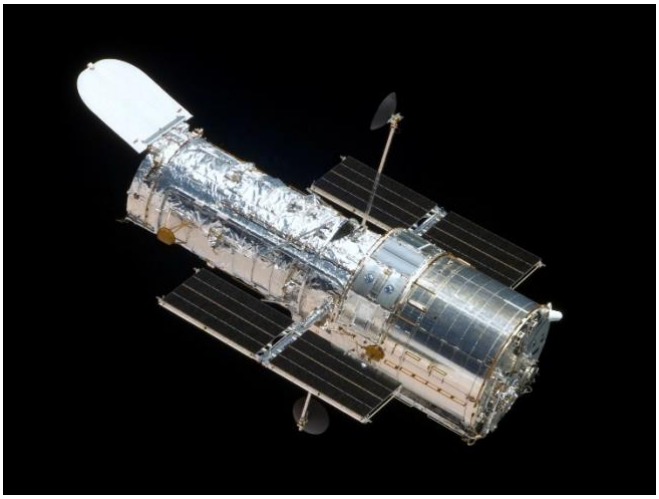
As with all other electronic devices in the 90's development was extremely rapid. There was a mad chase for Pixels, the more the merrier, and huge strides in capability and capacity. The Olympus C-2500L, launched in 1999 provides some insight into the extent of improvement. Advertised as having "Ultra-high Image Quality" with 2.5 mega-pixels (1712 X 1368) the camera offered a large aperture 3X Optical Lens with either manual or auto focus. With a storage capacity of 128 MB on Smart-Media Cards it also had the ability to store in JPEG compressed format. The camera was also equipped with 'TruePic Processing – an image processing algorithm to create "smooth, true-life images" and boasted an up-dated view-finder and a rear LCD Screen with multiple functions. Such development consigned the use of film to history.

The reduction of images to pixels opened the opportunity to engineer and manage them. From this premise emerged software designed to manipulate and edit images in myriad different ways. By 1990 prototype programmes had reached such a degree of sophistication as to be marketable. Chief amongst these was **Adobe Photoshop** which became the most powerful and widely used editing software in the world. Like digital cameras it too was refined



and developed very quickly during the 90's with 7 Versions each extending its capacity. Its impact cannot be under-estimated.

Perhaps the most adventurous demonstration of digital photographic technology was its role in the **Hubble Telescope** which was launched into low earth orbit on 24th April 1990. Featuring a 2.4 metre mirror its 5 main instruments observe in ultra-violet, visible and near infrared regions of the electromagnetic spectrum. It captures extremely high resolution images with substantially lower background light than ground level telescopes. As a result it has recorded some of the most detailed visible light images allowing a deep view into space. At 43.5 feet length and a diameter of around 14 feet Hubble orbits about 340 miles above the Earth at an average speed of 17,000 mph taking 95 minutes to complete one orbit. It transmits about 120 gigabytes of science data every week. Capturing light from remote objects it functions like a time machine. For example its view of the Andromeda Galaxy which lies about 2.5 million Light Years distant is as it was 2.5 million years ago. It's view of Ursa Major in 1995 revealed the existence of over 3000 galaxies hitherto unseen. For 30 years the revelations have kept coming. In the late 90's Hubble's observations of Supernovas revealed the ongoing expansion of the Universe and the mysterious forces of 'Dark Energy' as well as the discovery of 'Black Holes' in the core of major galaxies.

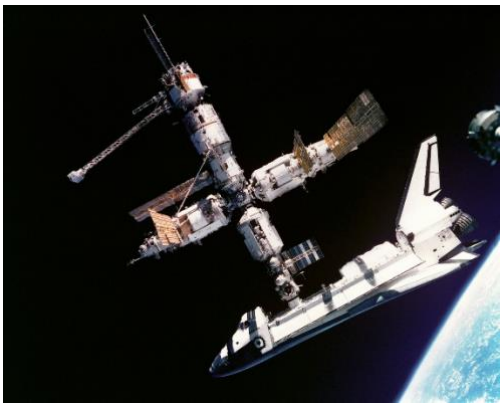


The launch and servicing of the Hubble Space Telescope was one element in a continuing programme of space exploration. Hubble was not without its difficulties. The first images conveyed to Earth were blurry and revealed a major defect in the main mirror. It took a 5-day Space Shuttle Mission in 1993 with multiple tethered space walks to fix the problems and Install new instruments. Further missions followed in 1997 and 1999, each improving the performance of the Telescope. The missions proved the viability of the Space Shuttle and the possibility of constructing Space Stations.

Shuttle missions were in full-swing during the 90's. Of the 135 missions between 1981 and 2011, 64 occurred during the 90's. Designed primarily to carry large pay-loads to enable the assembly of Space, it also played a key role in the delivery and positioning of, not only the Hubble Space Telescope but also in 1991 The Compton Gamma Ray Observatory, a 17 Ton

satellite dedicated to observing the high-energy Universe, and, in 1999 the Chandra X-Ray Observatory to study Black Holes, Supernovas and Dark Matter.

In 1992 an agreement was reached with Russia to use the Russian **Space Station Mir** to enhance knowledge of long-duration missions. During a 3-Year programme the Shuttle docked with Mir 9 times bringing astronauts to live, work and study across increasing time spans. It was the precursor to cooperation to build the **International Space Station (ISS)** which began in 1998 with the launch and positioning of Zarya – the control module designed to provide the Station battery, power, and fuel. It was followed by the 'Unity Node', the two being united in space to create the beginnings of the new Station. A further mission was launched in 1999 to fit out the Station with the logistics and supplies necessary to support life. The first occupants arrived in 2000.



Although the Shuttle programme and Space Station development was the main focus of human spaceflight, two important planetary missions were also launched.

1. The **Mars Pathfinder** Mission with the 'Sojourner' Micro-rover was launched in December 1996. Arriving on the Martian surface in July 1997 it was the first to explore the surface of the Red Planet returning 550 images.

2. **Cassini,** a Saturn Probe launched in October 1997 on a 7 – year journey to the ringed planet

Other notable space achievements included:

1991 – Nasa's **Galileo** probe – the first spacecraft encounter with an Asteroid

1992 - The discovery of planets beyond our Solar System.

1994 - The first Comet impact observed on the surface of Jupiter which left black spots as large as the Earth.

1995 - Galileo arrives at Jupiter dropping a probe into the planet's atmosphere

1997 - Mars Pathfinder lands and returns 6500 pictures and makes 8.5 million measurements of atmospheric pressure, temperature and wind speed.

Rapid improvements in medical science and technology in the 1990's brought about such breakthroughs as

- Stem Cell Therapy using bone marrow transplantation or cells from the umbilical cord blood to treat or prevent disease or conditions

- Gene Therapy also became a reality whereby genes are isolated and introduced into individual stem cells thereby creating a genetic modification to treat or cure genetic disorders.
- Cloning where scientists create exact genetic copies of living things as demonstrated in Scotland in 1996 where Dolly the Sheep became the first animal to be cloned.

Much of these discoveries evolved as a result of, and alongside, the 'Human Genome Project' which was launched in 1990. It became the world's largest collaborative biological project with the aim of identifying, mapping and sequencing all the genes of the human genome. It opened up a whole new world of science, not only in understanding of disease and the mutations of viruses, but also in the advancement of forensic applied science, in biofuels, agriculture, animal husbandry, bioprocessing, bioarchaeology, anthropology and evolution, not to mention Genomics, GM Foods and the development of DNA Databases.

New digital technologies were also changing medical practice and procedures. The major achievements can be listed as:

- 1992 – The Smart Pill - a tiny camera on a pill.
- " Smart Infusion Systems – with a dose rate calculator.
- " Venticular Assist Device – a mechanical pump that helps a weak heart pump blood
- 1994 - Radio Surgery for Epilepsy and malignant tumours
- " Headler's Cannulated Bio-absorbable Interference Screw used in reconstructive surgery to replace the Titanium screw. It degrades and is replaced by bone growth, thus negating the need for second surgery to remove the screw.
- 1994 - Palmaz –Schatz balloon expandable stent – a game changer for coronary artery obstructions.
- 1995 – Medical Lasers to treat or remove tissue
- 1996 – Angio Seals for closures in arteries.
- 1999 – CyberKnife Robotic Radiosurgery delivering a controlled beam to a targeted tumour.
- Da Vinci Surgical System – Micro-chip technology enabling complex surgical procedures through tiny incisions. The beginnings of Key-Hole Surgery.

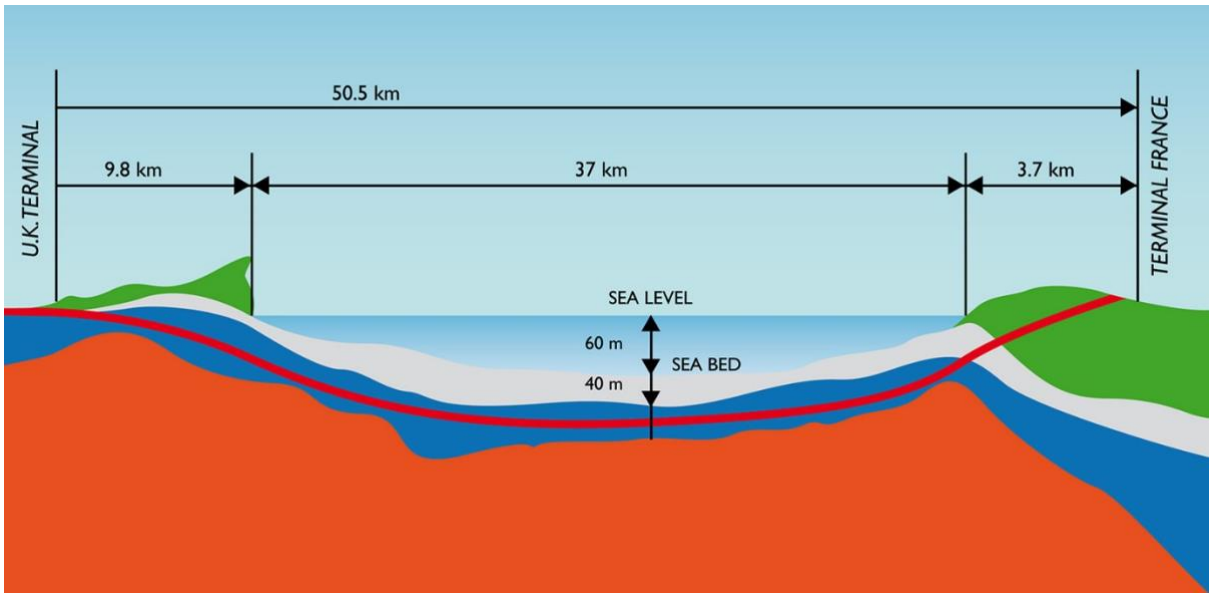
During the 90's concern grew over the relationship between Science and Nature. The potential of genetic engineering, of 'playing God' became a serious issue. Such was public feeling that when, in 1994, the first genetically modified crop was marketed (a delayed ripening tomato, 'Flavr Savr', used for puree) it was labelled as 'Frankenstein' food by the media. The growing wariness was not helped by the outbreak of Mad Cow Disease in Britain in the early 90's with hideous images of faltering animals in great distress. When in 1994 it showed signs of spreading to humans a worldwide ban on British Beef was instituted along with a cull of over 1 million animals. By this time the evidence of long-term damage by Industrial chemicals was growing. Air pollution was globally recognised as a major problem, DDT and Asbestos among others were proven to be dangerous to long-term health, toxic waste threatened life, substances like Teflon proved hazardous and Insecticides and weed

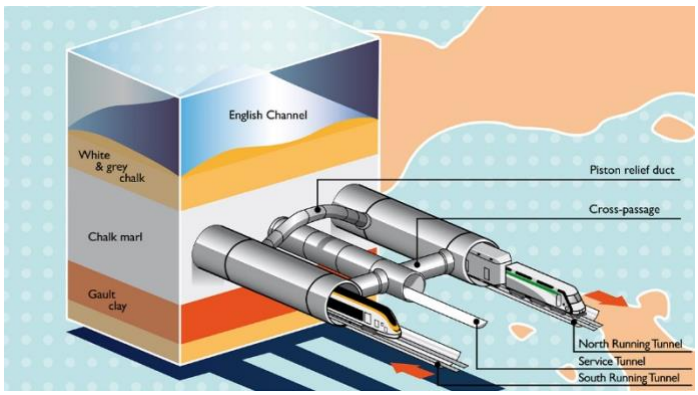
suppressants copiously sprayed on to land by farmers were known to be damaging to the environment. The profit over consequence model of free-market economics was patently damaging the natural world. Populations of wild animals, birds and insects in agricultural regions were everywhere in sharp decline. The delicate balance of the natural world was beginning to teeter.

Rising world population was constantly applying pressure on farmers to supply more and more food. Science, of course, responded. Much was done by selective breeding, as always, to improve the quality and yield of both crops and animals. With the addition of improved fertilisers and pest controls and far more sophisticated machinery, yields increased substantially. The prospect of genetically breeding to improve yield and disease resistance was, however, hard to resist and experiments were widespread. It seemed the obvious solution to food supply shortages for the foreseeable future. Once again fears for the future unknown consequences of such meddling erupted. In farming, once the cat had been let out of the bag there could be no return. Cross-pollination between GM plants and their natural relatives would be inevitable. By the end of the decade pleas for control in some countries grew to fever pitch.

The most notable changes in British Farming during the latter part of the Century were due to economic rather than scientific factors. Membership of the European Union and acceptance of the Common Agricultural Policy re-orientated British farming practice. During the period 1970 to 2000 the number of orchards more than halved, Barley production halved, Wheat doubled as did the number of sheep whilst there was a 10% decline in the Dairy herd. At the same time the total farming workforce dropped from 400,000 to 204.4 thousand.

Links with the European Union led to one of the biggest civil engineering projects of modern times – the construction of the **Channel Tunnel**. The 3rd longest railway tunnel in the world at 31.35 miles it stretches from Folkestone to Coquelles, just outside Calais, across the Strait of Dover.





The tunnel carries high speed Eurostar Passenger Trains at speeds of up to 100mph as well as 'Shuttle' Trains carrying road vehicles and international Freight Trains. It consists of three bores – East and West bores for traffic and a central Service tunnel providing safety for engineers and an escape route for passengers in the event of problems. Estimated to cost £5.5 billion in 1985 it was the most expensive project ever proposed. The cost finally amounted to £9 billion!

Tunnelling began in 1988 using giant boring machines. Tunnelling through soft chalk marl from both sides of the Channel was swift and the bores joined mid-channel in October 1990 – marked by a ceremony on 1st December when an Englishman and a Frenchman broke through the Service Tunnel and shook hands. The official opening followed on the 6th May 1994.

The growing optimism of the mid-80's triggered a number of other major construction projects designed to alleviate pressures on the transport system. Chief amongst them were:

The Queen Elizabeth Bridge at Dartford, Kent, the biggest estuary crossing in the country and a major pinch-point to road traffic, especially after the completion of the M25 in 1986. Built at a cost of £120 million it was, for a short time, the largest single span bridge in Europe. Two 84 metre steel pylons mounted upon 53 metre concrete piers support the cables which carry the road deck, 61 metres above river level. Supplementing the twin bore Dartford Tunnel the bridge carries four lanes of traffic over its 2872 metre length.

The Second Severn Crossing – The Prince of Wales Bridge opened in June 1996 was built to supplement the existing motorway bridge built across the estuary n 1966, which, by the mid-80's was running at capacity. The new bridge consisted of three principal sections – a 25 span viaduct on the English side 6,900 feet in length; a 24 span viaduct on the Welsh side of 6814 feet; and a connecting bridge called 'The Shoots' of 1496 feet. The deck carries 3 lanes of traffic in each direction at a height of 121 feet above river-level.

The millennium also inspired the construction of two other bridges conceived and built during the 90's.

The London Millennium Footbridge, nicknamed the 'Wobbly Bridge after pedestrians experienced an alarming swaying motion on its opening day on the 10th June 2000. Situated between the Southwark Bridge and Blackfriars Railway Bridge it was subsequently and embarrassingly closed for 2 years whilst engineers implemented a solution to stabilise it.

The Gateshead Millennium Bridge – a pedestrian and cyclist's bridge which spans the River Tyne connecting Gateshead to Newcastle. Constructed as part of regeneration schemes on both sides of the river, it was the world's first 'tilting' bridge. With a futuristic and clever design it rotates through 40 degrees to provide a navigational clearance of 25 metres.

Perhaps the most iconic construction of the late 90's was **The Millennium Dome** built on the Greenwich Peninsula in South east London to house a major exhibition to mark the beginning of the third millennium. Hastily designed and constructed amid much political dissent it attracted barely a half of the 12 million visitors its sponsors forecast. Occupying 48 acres of high-value land the Dome was the 8th largest building in the world by useable volume. At 1200 feet in diameter, it is supported by 12, 330- foot high towers, one for each hour of the clock face to represent the part played by Greenwich Mean Time. The canopy, made from durable, weather

resistant PTFE coated glass-fibre fabric, reaches a height of 170 feet. Costing £18.7 million it was repurposed as the O2 Arena and had since been used for a variety of purposes from P{op Concerts to shelter for the homeless and others in need.

As predicted the whirlwind of change hit Britain in the 1990's. The pace of life began to quicken substantially. Change invaded every corner of life. The young took to it with ease, recognised and relished the potential and forged ahead. The more elderly groaned under its weight, were dazed by the prospects and either muddled through or sank into the seas of nostalgia and did their best to avoid it. After all there were other, more important things to worry about as, once again, the national economy teetered on the brink.