

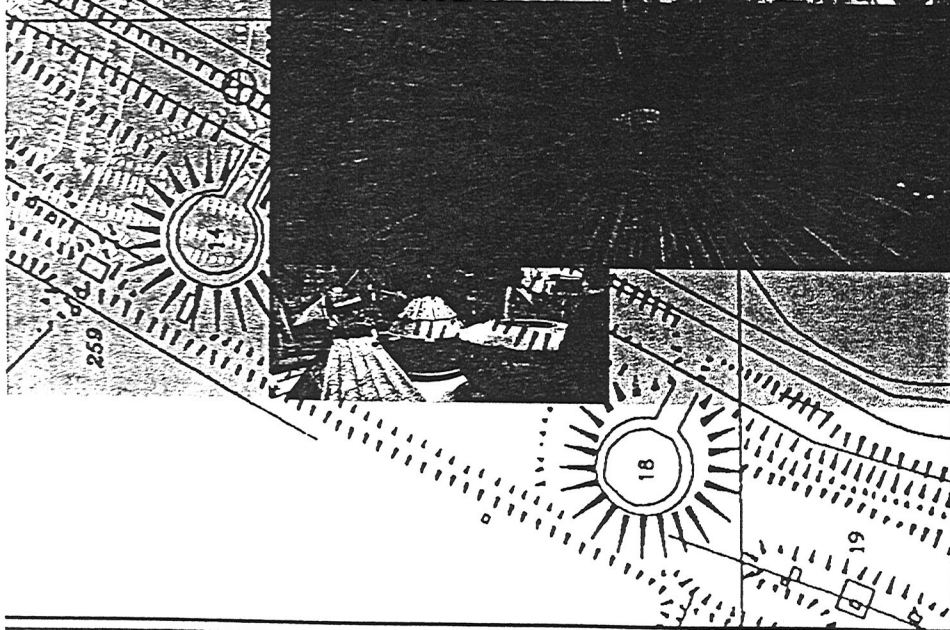
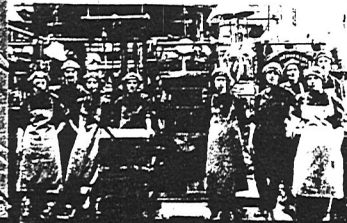
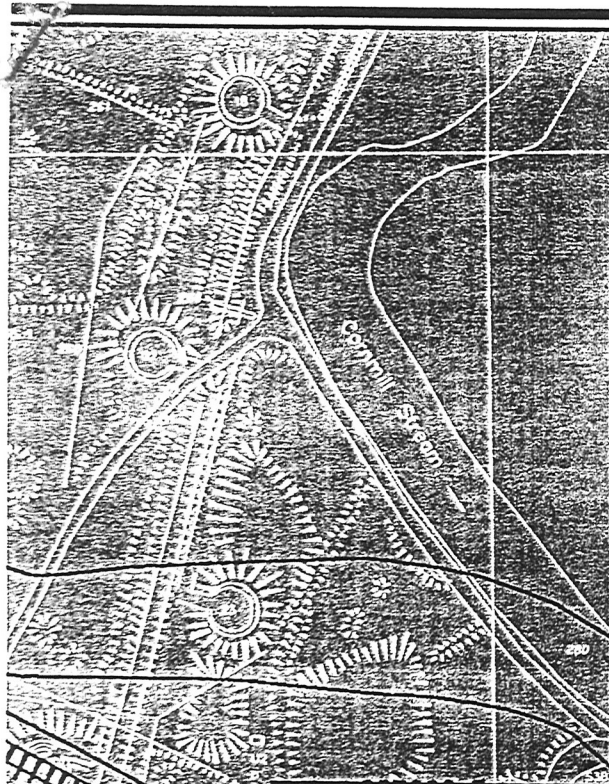
WASC 1911

WARGM Concept
Design Report

WALTHAM ABBEY

ROYAL GUNPOWDER MILLS

CONCEPT DESIGN REPORT



WALTHAM ABBEY

ROYAL GUNPOWDER MILLS

C O N C E P T D E S I G N R E P O R T

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INTRODUCTION

In June 1997, Event Communications, a creative group specialising in the interpretation and design of museum exhibitions and visitor attractions, was selected from a short list of design companies to undertake the design of the educational and interpretative elements at the Royal Gunpowder Mills at Waltham Abbey. This report is a response to the brief for the first stage requirement to produce an interpretative strategy and design concept for the development of the visitor experience on the site.

Subject to the validation of the concept design, Event Communications will carry out the further development and implementation of the scheme. The concept design builds upon the work already carried out by the Trust Steering Committee, advised by Prince Research Consultants, to develop a strategy for opening the site to the public on a phased, incremental basis. The scheme has been funded by the Heritage Lottery Fund and the Ministry of Defence.

The overall aim of the project is to interpret the site's technological, social and natural history in an informative and innovative way to appeal to a public of all ages and abilities. We have created a distinctive experience for visitors which will enable them to understand the importance of the site in a local, national and international context.

We have been greatly assisted in understanding the history of the site by a number of Trust advisers, notably, Wayne Cocroft of The Royal Commission on the Historical Monuments of England, Gordon Wyatt of English Nature, Steve Chaddock of Prince Research Consultants, Dr Brenda Buchanan and the other members of the Academic Committee of the Trust. On the design aspects of the project we are grateful for the assistance of Prince Research Consultants in identifying and controlling the practical management issues of the project, Ashted Dastor of Typearea for guidance on design matters and Pearson Landscape Design in establishing the landscape opportunities that are a key part of the visitor interpretation routes on the site.

The interpretation of a site of the size and complexity of the Waltham Abbey Royal Gunpowder Mills represents a substantial design challenge. The unique status of the site, both as a scheduled monument and as a site of special scientific interest, imposes constraints and limitations on the possible use of the buildings and structures. Our design plan gives visitors safe access to the site and enables them to understand the history of explosives and propellants.

At the same time as meeting these practical objectives, we have developed a concept that introduces the element of fantasy which is at the core of many successful visitor attractions. We wish to retain the idea that the Royal Gunpowder Mills is still a 'secret place' and the buildings and their layout on the site do much to help support this idea. Visitors will continually discover new buildings and experiences as they move about the site.

Event Communications has very much enjoyed the opportunity to interpret the site and the significant events of international importance that have taken place there. We look forward to the further development of our plan, working closely with the Academic Committee to create a visitor attraction that will be both memorable and an important educational resource.

DESIGN AIMS

The main aims of the design concept are:

To preserve, develop and interpret the site for the benefit of present and future generations.

To create a strong interpretative vision for the site and its services based on its uniqueness and importance.

To pursue an holistic approach to interpretation. Although various individual themes may be presented, the inter-relationships between industrial archaeology, social history, and the natural and created landscape and its supported wildlife should be elucidated. At the same time, the impact of the activities at the site on the course of modern history need to be evaluated and illustrated.

To create a distinctive visitor experience which will be seen as a significant visitor attraction of national and international interest, as well as providing a recreational amenity for people of the immediate catchment area.

To ensure that the site is presented as a major educational resource, contributing to life-long learning objectives and relevant and interesting for people of all ages, attainments, and physical or sensory abilities.

To ensure that the site and its associated information and services are accessible to all potential visitors without discrimination.

To ensure that the interpretative installations are durable and capable of at least seven years continuous usage.

To support the business plan's aspiration of attracting between 75,000 and 100,000 paying visitors a year.

INTERPRETATIVE APPROACH

The interpretative approach is based on the objectives identified in the Development Report prepared by Prince Research Consultants in August 1994 and the subsequent Outline Design Brief of June 1997.

The key requirements can be summarised as follows, with the site interpretation exploring three interpretative themes: -

Technology, in particular, explosives and propellants.

Ecology and the development of the landscape.

History - social, political, economic and military.

The design brief required us to create a strong interpretative vision through the pursuit of an holistic approach elucidating the inter-relationships between industrial archaeology, social history, the natural and created landscape and its supported wildlife. The interpretation of the site must promote understanding of science, technology and history by implementing the very best practices in museums, historic sites and science centres, appropriate for a significant visitor attraction in the 21st century. This exploratory, participatory approach will utilise a wide range of media to meet the expectations and needs of visitors. The Heritage Lottery Fund is keen for the site to develop interpretative methods that allow visitors to experience the site first hand without too much visual interference from interpretation in the field.

Targeting Interpretation

Fundamental to the interpretative approach is the need to cater for different market sectors within and between interpretative locations. Surveys suggest that the visiting public is seeking entertainment but in locations like museums and the Royal Gunpowder Mills they come with the intention of learning something as well. They accept that this kind of attraction has an educational function.

Interpretation will be targeted at adults and family groups with children aged eight and above, with little or no scientific expertise. School groups are a guaranteed audience; they will receive interpretative support and special hands-on spaces in Building A203. The interpretation must be understandable and usable by an unprepared audience. To supplement the main interpretation it will be necessary to provide for families with very young children or those with special needs; this should be done within the mainstream visitor experience.

In the longer term, additional exhibits, for example those stored in the Power House for the potential re-creation of process areas, along with database displays will satisfy those seeking a more in-depth knowledge.

The Interpretative Environment

Most visitors will move through the site with no particular agenda of their own. However, they will be actively 'sampling' the environment, open to interesting stimuli that impinge on their senses and recalling experiences they have had in the orientation spaces and elsewhere. Our approach to the exhibition planning has been to create a series of landmark exhibits where visitors can pick up messages, even at a sub-conscious level, which enable them to understand each area.

It is important to remember that visitors will be more open to learning experiences when their comfort needs are catered for - the careful planning of these facilities is essential.

Artefacts

One of the great strengths of the Royal Gunpowder Mills is its collection of buildings and associated artefacts. These must always remain at the centre of the interpretation.

Some buildings will be recreated, for example Drying Stove 98a, and others will incorporate artefacts where practical. However, understanding the nature of the buildings is sometimes difficult, particularly where all that remains are traverses or blast walls around the spaces where the buildings would have been. We are suggesting a partial reconstruction of some significant structures and buildings on the proposed visitor routes, with open wood or metal frames.

Interactive Exhibits

Interactive exhibits will assist visitors to understand processes and the functions of buildings and artefacts and these are developed:

- *with direct and obvious actions and reactions.*
- *with clearly stated operational and outcome goals.*
- *to allow for experimentation and provide feedback.*
- *to be intuitive to use and require minimal text reading.*
- *to work on more than one intellectual level.*
- *to encourage social interaction between friends and family members.*
- *to be well-designed, safe, robust and easily maintained.*

The use of interactives must be carefully considered. Hands-on activities, while enjoyable, do not guarantee communication or learning. Interactives need to engage the mind as well as the hand, even for young visitors. There is the need, which can be met, to communicate with visitors without interaction.

Evaluation

To assess the potential success of the Royal Gunpowder Mills presentation, it is advisable to set-up focus groups to ensure that the needs and interests of visitors are likely to be met. Exhibits, particularly those with a high commitment in financial terms, should be tested before completion and the appropriate adjustments made.

Other activities

The interpretative approach defines the permanent features of the presentation. However, there are opportunities to increase visitors' understanding in other ways. First- and third-person interpretation would clearly be effective as would demonstrations, for example, of charcoal making, or sulphur and saltpetre refining.

Entertainments involving products related to the Royal Gunpowder Mills, such as firework displays, would provide opportunities to bring visitors on to the site but could be framed within an educational approach to increase their value.

Interpretation strategy

Our strategy is based on the belief that it is not possible to achieve all the interpretation in one place at Waltham Abbey. The themes and stories have to be expressed in a number of places and by a variety of means. Our proposals must also take account of safety and conservation issues which will inhibit access to certain parts of the site. We recognise that our interpretative strategy must allow for change over time, given that conditions may alter, for example, if the herons decide to move elsewhere on the site. We also need to recognise that some visitors will spend less time at Waltham Abbey than others, while expecting to experience the interpretative themes to the full.

Our interpretative approach is structured thus:

Reception Building H7:

Conceptual and physical orientation.

From H7 to the A200 complex:

Early site history.

A200 complex:

The history of gunpowder and the site, the manufacture of gunpowder, cordite and propellants, social history and nature.

Ecology and the management of the natural world.

The wider political view.

Temporary exhibitions.

Incorporating Mill L157:

Gunpowder manufacture.

Cordite Press House L137:

Cordite manufacture.

Post-War Laboratory:

Post-war research.

Various locations:

The identification of representative buildings and their functions.

The structuring of the visitor experience is based on the practical issues of utilising available buildings, none of which can provide for all the requirements of the interpretation. It recognises that the main stories have to be told within an area surrounding Queens Mead and that this represents the 'critical mass' of the visitor experience. Concentrating the major parts of the interpretation reduces the potential pressures on more sensitive areas of the site while allowing visitors access to many areas. It acknowledges that a form of "natural selection" may apply - fewer visitors will want to visit the furthest reaches of the site, but no one is actually excluded from doing so.

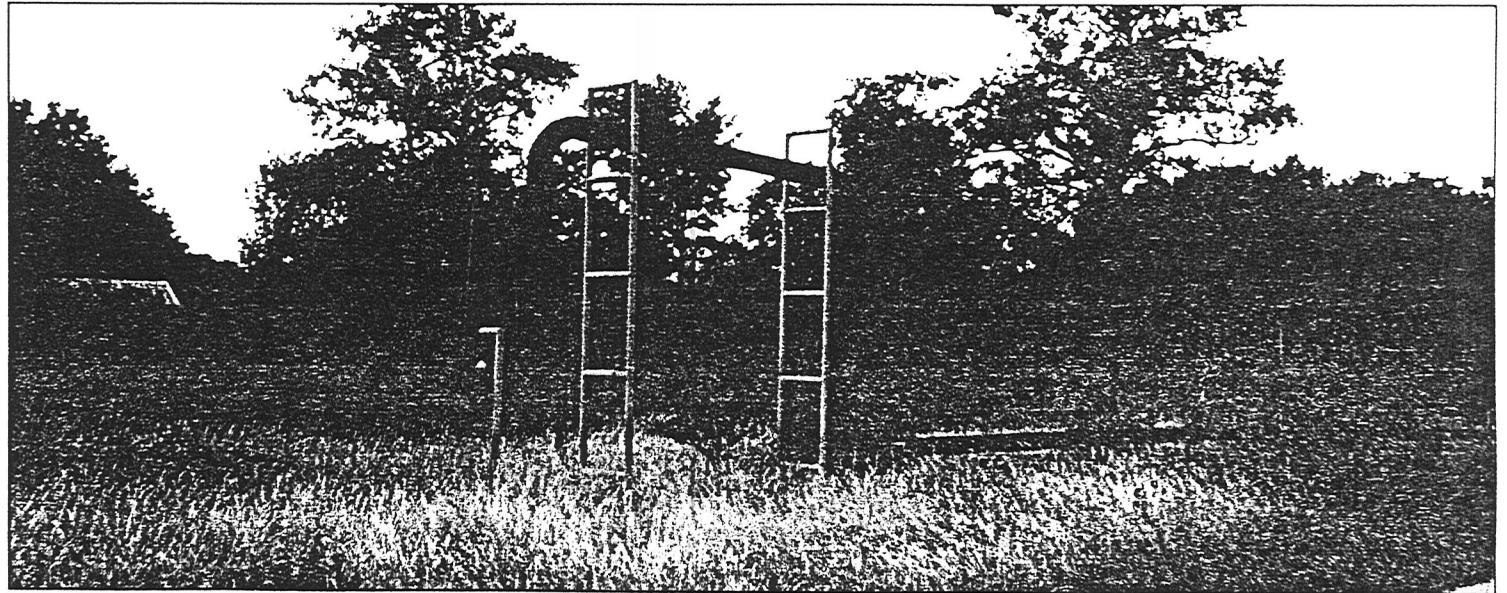
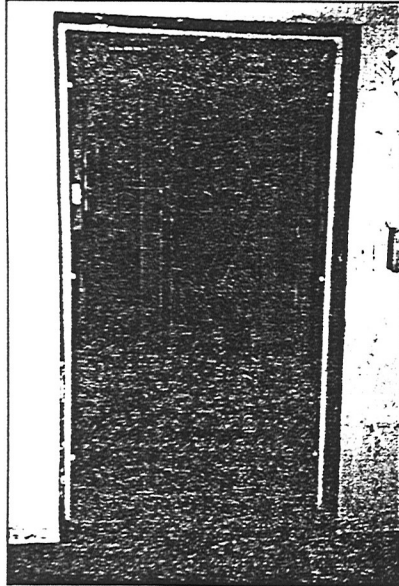
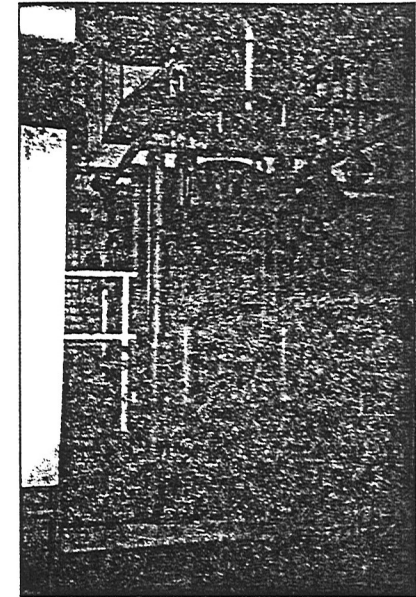
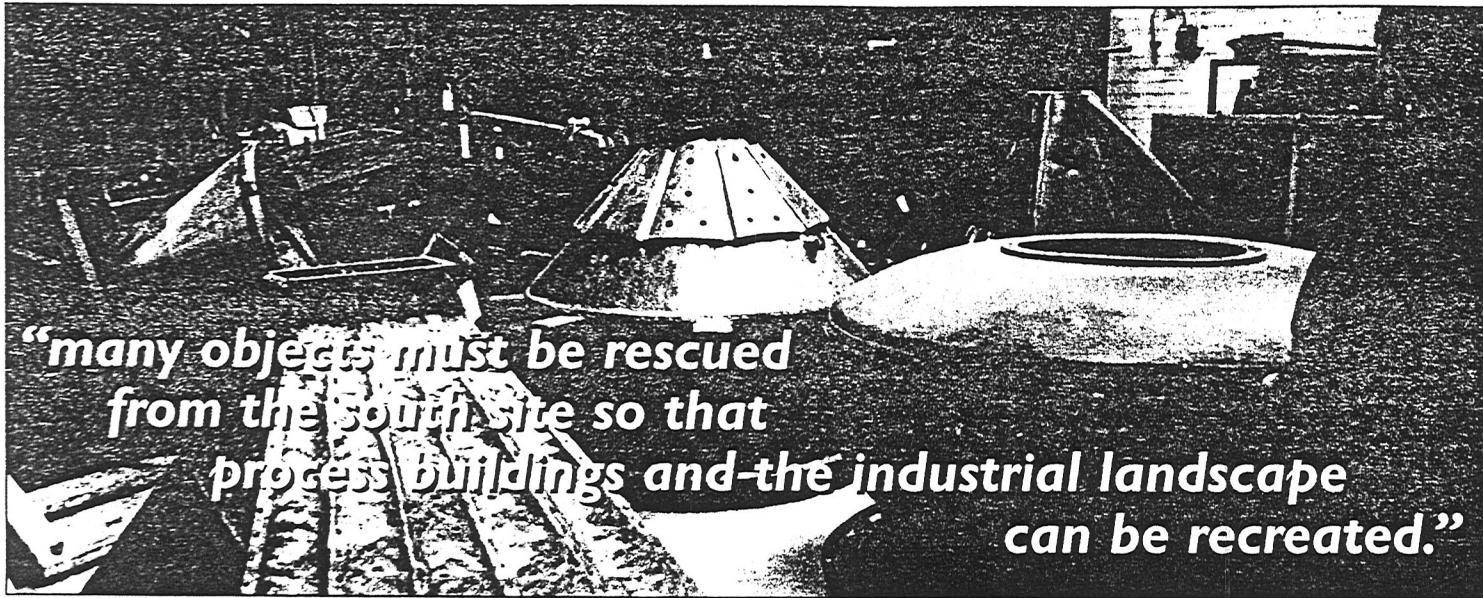
The availability of equipment on the South Site and elsewhere makes it possible to recreate some of the production areas in the appropriate buildings and elsewhere on the site. This will assist immeasurably in the educational role of the site and we recommend extending this principle wherever possible, for example by re-using the steam pipes which cross the roads on the South Site. In the first phase of redevelopment we propose that three areas be recreated to represent the three main phases of activity on the site.

Subject to the approval of English Heritage, we would recommend the removal of the modern accretions to the Incorporating Mill (L157) to show the original form of the building. We further recommend that part of the boarded walk and railway be recreated to place the building in an appropriate functional context.

To assist visitors to understand the canal systems, we recommend that, where present day roadways cross over canals, the infill should be removed and bridges created to cross the voids. We examined the opportunities for movement around the site, in particular the possibility of recreating the canals. The danger of spreading the water-borne alder disease and the difficulties of re-puddling the bottom of the canals precluded this option.

The need to protect the natural world precluded a transport system that allowed visitors to "hail and ride" anywhere on the site. Should funding become available there is the possibility of recreating a non-stopping battery-powered rail system. Confining access to the more sensitive SSSI areas to walking visitors was thought to be the most practical and safe solution. However, a transport system will be provided around the Queens Mead area for less physically able visitors.

The size of the site will be too great for many visitors and it will need to be broken down into more manageable, optional tour areas. It became clear that it would not be easy to follow specific trails, for example, a gunpowder trail. Most buildings have been used for different purposes, adapted over time to answer new functions, and as a consequence do not fall into conveniently separate routes. Our strategy is to create an overview of the site and its themes within H7 and A203 that provides a structure into which visitors can incorporate information about individual buildings which they come across on their journey round the site. Visitors will be helped around the site by the use of signs which will clearly identify points where decisions need to be made.



An unobtrusive form of outdoor display was felt to be the most appropriate form of identification for important buildings, explaining its place in the production processes of different phases of use. This interpretation can be supported by books and leaflets, which are thought to be more practical and economical, for the predicted visitor numbers, than sound guides. Many buildings are duplicates of others, for example, gun-cotton drying stoves and some will not be accessible without leaving the designated paths. On the interpretational routes these are obviously less critical. However, some visitors will find their way to these buildings, so we must provide a certain level of interpretation. Additionally, it is important that, in the event of an accident or someone becoming lost, all the buildings can be identified easily. As part of the corporate signing exercise, each building should be supplied with a discrete cast-iron identification plaque.

The cost of renovating and recreating a large number of buildings is clearly not possible in the first phase. However, many buildings are in relatively good condition and it is our recommendation that wherever possible the methods of securing buildings should give the impression that they are still in use. For example, instead of panelling over the windows of unused buildings from the outside, they should be panelled on the inside leaving a gap between panel and frame to create a shadow and the impression of occupation. More modern process buildings could have drawn blinds and internal security lights, running from solar powered batteries, that illuminate the buildings when dusk falls earlier in the winter months.

In conclusion, our interpretative approach is designed to be flexible and allow management to update or change the interpretative media to meet visitor needs. There are several different methods for the communication of messages which will provide a solid base for learning about Waltham Abbey and its internationally important role. For the future, priorities for the renovation of buildings, and the method of renovation, should be considered in relation to the potential for adding to or reinforcing the interpretation.

THE STORY OF WALTHAM ABBEY

The Gunpowder Story

There is much academic debate as to the origins of gunpowder and the date of its appearance remains obscure. It seems most likely that it was developed simultaneously and independently in at least three different regions, China, central Asia and the eastern Mediterranean; however only in China is there documentation for the existence of gunpowder. In the ninth century Taoist alchemists, searching for the elixir of life, discovered a proto-gunpowder. This was more an incendiary than a real explosive and was used for filling bombs and grenades. By the end of the 1200's it was also in use as a propellant.

Knowledge of gunpowder was transferred to Europe through Arab traders and scholars and later by direct contact between Europe and China. As early as 1249 the English Franciscan monk and scientist Roger Bacon recognised the potential of gunpowder, as well as its destructive nature - he wrote of its preparation in code because as he said, "The crowd is unable to digest scientific facts, which it scorns and misuses to its own detriment and that of the wise. Let not pearls then, be thrown before swine". Known as "Dr Mirabilis", Bacon also foresaw the magnifying properties of convex lenses and the possibility of mechanical cars, boats and flying machines.

The earliest European illustration of a weapon using gunpowder, a cannon firing an arrow-shaped object, dates from 1326; from the mid-thirteenth century there would be an increasing demand for gunpowder, initially mostly for use in siege warfare.

Gunpowder could be manufactured relatively easily, by grinding together charcoal, sulphur and saltpetre, with the proportions varying through time, for different purposes and in different countries.

Charcoal: in the medieval and early modern period the production of charcoal was relatively commonplace wherever wood was available; different species of wood were used for different types of gunpowder.

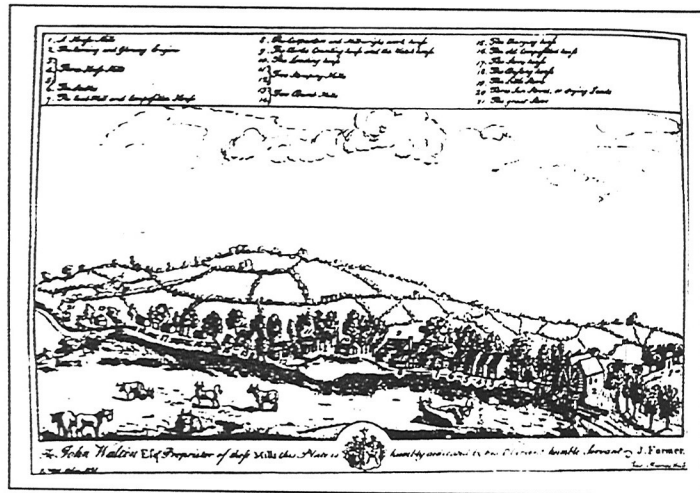
Sulphur: the principle sources of sulphur in medieval Europe were the Italian mainland and Sicily; supplies seem to have been relatively easy to obtain.

Saltpetre: mostly originated in the Baltic States; there were no naturally occurring deposits in Britain. The most common alternative source involved the collection of nitre-earth around places of human and animal habitation, including cesspits, byres, dovecotes and old burial grounds; this material then required extensive purification. Saltpetremen were given royal patents which allowed them extensive rights, including the right to dig wherever they saw fit and to requisition carts to move their goods. Understandably this caused considerable resentment in the areas where they were collecting.

Throughout the medieval period, English armies relied on foreign supplies of gunpowder or manufactured their own, usually relying on imported sulphur and saltpetre, sometimes grinding the components on the battlefield as the powder was needed. However, in the later Tudor period there was a growing determination to gain an independence of supply, no doubt prompted by the strained diplomatic relations which existed between England and much of Europe throughout the reign of Elizabeth I. By 1554 the first gunpowder mill in England is recorded at Rotherhithe.

Gunpowder at Waltham Abbey

Tradition relates that the monks at Waltham Abbey manufactured gunpowder, something of which Roger Bacon would have approved! However, documentary evidence of the manufacture of gunpowder at Waltham Abbey, and its dangers, begins in 1665 with an entry in the Waltham Holy Cross parish register of two deaths at the gunpowder mills: "Tho. Gutridg, killed with a powder mill, ye 4 day: Edward Simons, carpenter, so killed ye 5 day". Early gunpowder production was centred on the River Lea and took place in a converted oil mill. The engraving of 1735 by John Farmer shows the pastoral nature of gunpowder production in this era.



By the early 1700's the mills had passed into the possession of the Walton family. William Walton died in 1733 leaving his wife Philippa Walton with nine young children; she took over the business, helped by her son when he reached adulthood, and managed the mills until her death at the age of 74.

Gunpowder production was an uncertain business, both for the government and for factory owners. In peaceful times, producers had difficulty finding non-military markets for their powder and in times of war the government could not rely on the quality and quantity of the gunpowder produced by private suppliers. This became particularly apparent during the Seven Years War and the American War of Independence, when both French and British governments became acutely conscious of the deficiencies of their gunpowder supply. In 1759 the British government purchased the Home Works at Faversham in Kent as a means of addressing the problems. In 1783, Prime Minister Pitt came close to recommending the sale of the factory as unprofitable but through the efforts of Major Congreve, the Board of Ordnance was able to show that government gunpowder manufacture could be a profitable enterprise. The Faversham Mills were saved and in 1787 the government began negotiations to buy the Waltham Abbey works from the Walton family transforming it into a **Royal** Gunpowder Factory.



The Waltham Abbey Mills were put under the direct command of Major William Congreve, Deputy Comptroller of the Royal Laboratory at Woolwich. William Congreve and his son of the same name were to have a significant impact on Waltham Abbey, the elder as an organiser and the younger as an inventor. Major Congreve set about a major refurbishment and modernisation of the mills. Thus the mills were ready for the demand for gunpowder during the Napoleonic wars. Waltham Abbey was one of the most important suppliers to both army and navy, providing powder for the Battle of Waterloo and the Battle of Trafalgar.

In 1814 William Congreve the Younger succeeded his father as 2nd baronet and Comptroller of the Royal Laboratory at Woolwich. He is best remembered as the inventor of Congreve's Rocket, made famous by the reference in the American National Anthem to its use by the British against the Americans at the bombardment of Fort McHenry in 1814, "... the rocket's red glare ...".

Congreve the Younger was also involved in the development of new machinery for gunpowder manufacture which was introduced at Waltham Abbey; this a role, as a pilot plant, which Waltham Abbey was to undertake in the years to come. The granulating machine Congreve patented could be left without supervision and could produce a more uniform powder more efficiently than previous methods, thus increasing safety and reducing the number of workers involved.

With the total collapse of demand for gunpowder after the defeat of Napoleon, the work force at Waltham Abbey was reduced, from a wartime peak of 250 in 1813 to 34 by 1822. Three decades of peace ensured a minimal need for gunpowder; the Faversham and Ballincollig works were sold off. The future of Waltham Abbey was uncertain during this time; in 1845 an order was received for its closure, but it was never carried out.

In contrast, during the Crimean War and for the rest of the century there was constant growth and innovation at Waltham Abbey. The first steam driven incorporating mill was introduced in 1856, allowing the factory to operate independently of seasonal fluctuations in the River Lea. Along with steam power came a tram network which supplemented the canal system. In 1858 the American explosives manufacturer, Lammot DuPont made a tour of gunpowder mills in Europe. Waltham Abbey was high on the list of places he wished to inspect - British powder was regarded as the best in the world.

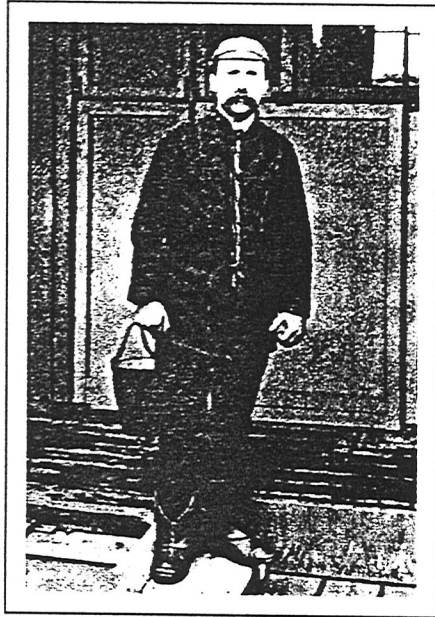
The inherent danger of gunpowder manufacture meant all the buildings at Waltham Abbey were designed to cause the least possible damage if they exploded. Many of the processes took place in light wooden structures within stone and earth traverses which would limit flying debris. Canvas rooves allowed explosions to exert their force upwards, away from expensive machinery. Trees were planted around process buildings as natural blast screens and additionally to provide a source of wood for charcoal. All equipment was sparkproof, made of copper, leather or wood and employees were forbidden to bring any flammable material, including cigarettes, pipes and matches, on to the site. Workers in danger buildings wore overshoes to prevent any grit they may have picked up on their own shoes sparking on the floor or getting into the machinery. Much of the factory was divided into "clean" and "dirty" areas, often demarcated by a red line on the floor. In the clean area explosions were possible and workers had to take the maximum possible care; in the dirty areas, outside clothing and footwear could be worn without danger of sparking.

Developments after the Crimean War were intimately connected with rapid advances elsewhere in British armaments technology, particularly in heavy engineering. Larger and larger guns with huge appetites for gunpowder were produced in the late nineteenth century arms race. They also demanded specialised forms of powder, moulded into different sizes and shapes. To meet these demands, a major refurbishment of the factory took place through the 1870's.

Ultimately, these developments marked the end of the road for gunpowder. The charges needed to fire the largest cannons became unmanageable and the development of chemically-based propellants provided a more powerful and less bulky alternative.

Cordite at Waltham Abbey

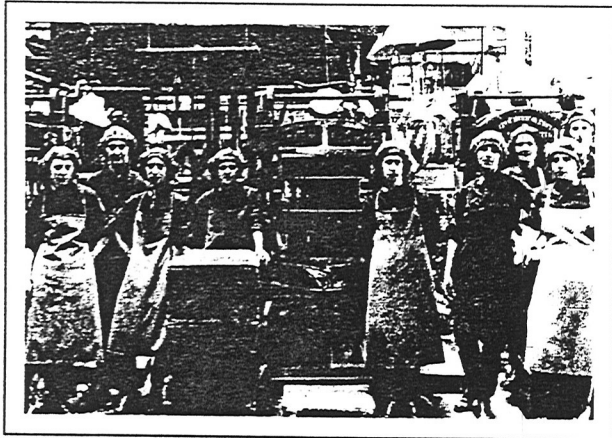
For thirty years the development of chemically-based explosives ran in tandem with ever more complex gunpowder products. With the beginning of cordite production in 1891, the manufacture of gunpowder ceased almost completely. Most of the gunpowder production buildings were converted to cordite use, a site to the south of the gunpowder factory was developed to expand cordite production and new acid and nitroglycerine factories were added. Only a proportion of the services' demand for cordite was met by the output of Waltham Abbey, the remainder being supplied by private firms under contract. Many of these were modelled on Waltham Abbey - the recurring theme of Waltham Abbey as pilot plant.



Safety procedures followed the same lines as during gunpowder manufacture, supplemented by official legislation. As a government establishment, Waltham Abbey was not legally bound to safety regulations but it followed legislation nevertheless. For example, the 1875 Explosives Act stipulated suitable clothing should be worn by workers in danger buildings. At Waltham Abbey workers in incorporating mills wore heavy cloth suits, gloves and cloth helmets.

Gun-cotton was discovered in 1846 in Switzerland but initial attempts to manufacture it resulted in a series of accidents both in France and Britain. Interest was not rekindled in Britain until the early 1860's when Frederick Abel, a War Office chemist, was directed to investigate the safe production of gun-cotton on an industrial scale. He conducted experiments at Waltham Abbey and at the Royal Laboratory, Woolwich and after ten years of work the process had been developed to the extent that manufacture could begin.

At the same time other powerful chemical explosives were being developed and through the work of Alfred Nobel the full potential of nitroglycerine was realised. Its inherent instability as a liquid prevented its transportation but by infusing a type of clay called kieselguhr with nitroglycerine, thus creating dynamite, it could be moved relatively safely. A further discovery was that by adding nitroglycerine to gun-cotton, its explosive effects could be further moderated, producing a substance Nobel called ballistite.



In 1888, the Explosives Committee of the British government, under Frederick Abel, took evidence from a wide range of people, including Nobel, to advise the War Office on smokeless powders. Within a year they had patented a substance called cordite which had a higher ratio of nitroglycerine to gun-cotton than ballistite. This was essentially arrived at through the work of others and produced the "Cordite Scandal" in which Nobel brought an action against the British government for infringement of patent. He was unsuccessful because of the slight differences in the make up of ballistite and cordite.

Nobel continued to dominate the market in the private manufacture of explosives and the British government recognised his particular expertise in the production of chemical explosives that was lacking at Waltham Abbey - they recruited at least two experts from his factory at Ardeer.

The significance of Waltham Abbey as the government explosives factory in popular consciousness is illustrated by H.G. Wells in *The War of the Worlds* (1898),

*".... there were rumours of Martians ...
and news of the destruction of Waltham Abbey Powder Mills
in a vain attempt to blow up one of the invaders."*

In this period, Waltham Abbey concentrated on the manufacture of propellants, but also played a crucial role in the development of a number of high explosives, including gun-cotton, picric powder and tetryl.

During World War One production was increased through the construction of additional buildings and, for two and a half years of the war, with round the clock production, as workers rushed to produce sufficient cordite for British and Allied troops on the Western Front. Output rose from 26 tons a week in the summer of 1914 to 140 tons a week within a year. The workforce expanded from 1200 to 5000, half of whom were women. 95% of all the cordite used by British troops on the Western Front was manufactured at Waltham Abbey.

As elsewhere in the industrial sector, the experience of women working at Waltham Abbey was significantly different from pre-war experience. A few women had been employed at Waltham Abbey in the years immediately preceding 1914, removing impurities from cotton to be used in the manufacture of gun-cotton. In the war years, women were engaged in nearly all aspects of the manufacturing process as well as in operating the light railway system.

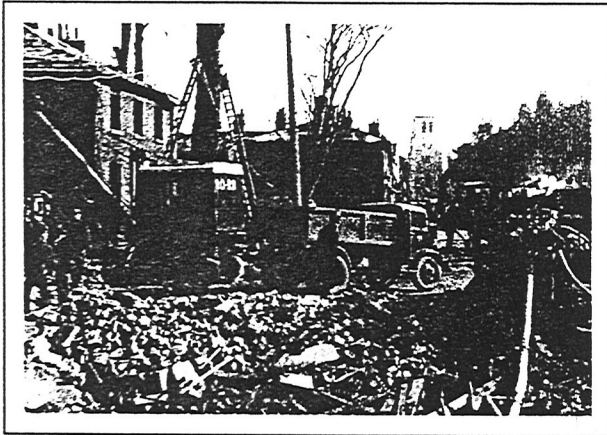
During the inter-war years a number of experimental production plants were established at Waltham Abbey, in conjunction with the Royal Laboratory at Woolwich; these acted as models for new factories established in the west of the country as rearmament was stepped up in the late 1930's and in the early years of World War Two. These in turn acted as models for factories further afield in countries of the former British empire while manuals and textbooks produced at Waltham Abbey were consulted all over the world.

In 1938 work started on an experimental production plant at Waltham Abbey for an explosive known as RDX. All its ingredients were synthetic and it did not require any imported materials. RDX became *the* explosive of World War Two, with a force half as powerful again as TNT. Waltham Abbey was the sole producer of RDX for the first two years of the war and produced the RDX used in Barnes Wallis' famous bouncing bomb.

The production of RDX was only an element of the crucial role Waltham Abbey played in the early years of World War Two. As well as manufacturing up to date explosives, often using plant which dated back to the previous war and before, Waltham Abbey provided trained staff who could take their expertise to new factories all over Britain.

Despite some new construction, production of explosives ceased at Waltham Abbey in 1943 - it was considered too exposed to aerial or land attack from the Continent. Production shifted to newer factories further west which were less vulnerable and, unlike Waltham Abbey, were linked to a network of armaments production, including the filling factories. Waltham Abbey's previous advantage in lying close to London and the Thames estuary now became its Achilles' heel.

Waltham Abbey was not in fact directly targeted by German bombers, although the existence of a marked Luftwaffe aerial map of the area indicates that the Germans were aware of the explosives factory on the site. In October 1940 a cordite stove on South Site was destroyed by enemy bombing and other parts of the site were damaged. A month later a parachute bomb caused further damage. In the last year of the war, two V2 rockets fell in the area. One caused extensive damage in the town, killing four people and completely destroying "The Ordnance Arms" in Highbridge Street, while the other fell close to the RDX plant on South Site. More damage was caused by two apparently accidental explosions in 1940: two cordite mixing houses blew up in January and April, killing ten men in total, causing devastation in the surrounding area and bringing production to a halt.



The Research Phase

Waltham Abbey Royal Gunpowder Factory formally closed on 28th July 1945 and reopened two days later as an experimental station of the Armament Research Department. One of the first priorities was research into liquid fuels for rockets and other purposes which involved at least two captured German scientists. Other early research projects included non-erosive propellants for guns, the reaction of explosives and propellants to tropical conditions and the cartridgeing and packaging of these substances. The establishment changed title three times in the 1940's, retaining the name Explosives Research and Development Establishment (ERDE) until 1977.

Work at Waltham Abbey concentrated on research into explosives and propellants; rocket propellant research transferred to Westcott in Buckinghamshire in the 1950's.

By the 1960's Waltham Abbey was the sole government laboratory responsible for the research and development of non-nuclear explosives. Much of the laboratory work happened in former factory buildings while test explosions were carried out in purpose-built firing points. The main research areas were centred on the degradation of explosives, their sensitivity to various stimuli and the risks in the handling of explosives. There was also work on non-explosive components in weapon systems, for example paint, varnishes and adhesives, to see how they reacted with explosive substances. Weapons systems introduced through research and development at Waltham Abbey included the anti-tank missiles Swingfire and Vigilant, and the Giant Viper, used in minefield clearance.

In the early 1980's Waltham Abbey again changed its name, to the Royal Armament Research and Development Establishment (RARDE). It was a time of uncertainty and many parts of the site fell out of use. In 1984 South Site and the Lower Island Works were transferred to Royal Ordnance plc in the run up to privatisation and three years later, the bicentennial of the Royal Gunpowder Mills at Waltham Abbey, final closure proposals were announced. The establishment was closed on 30th June 1991.

A DESCRIPTION OF THE VISITOR EXPERIENCE

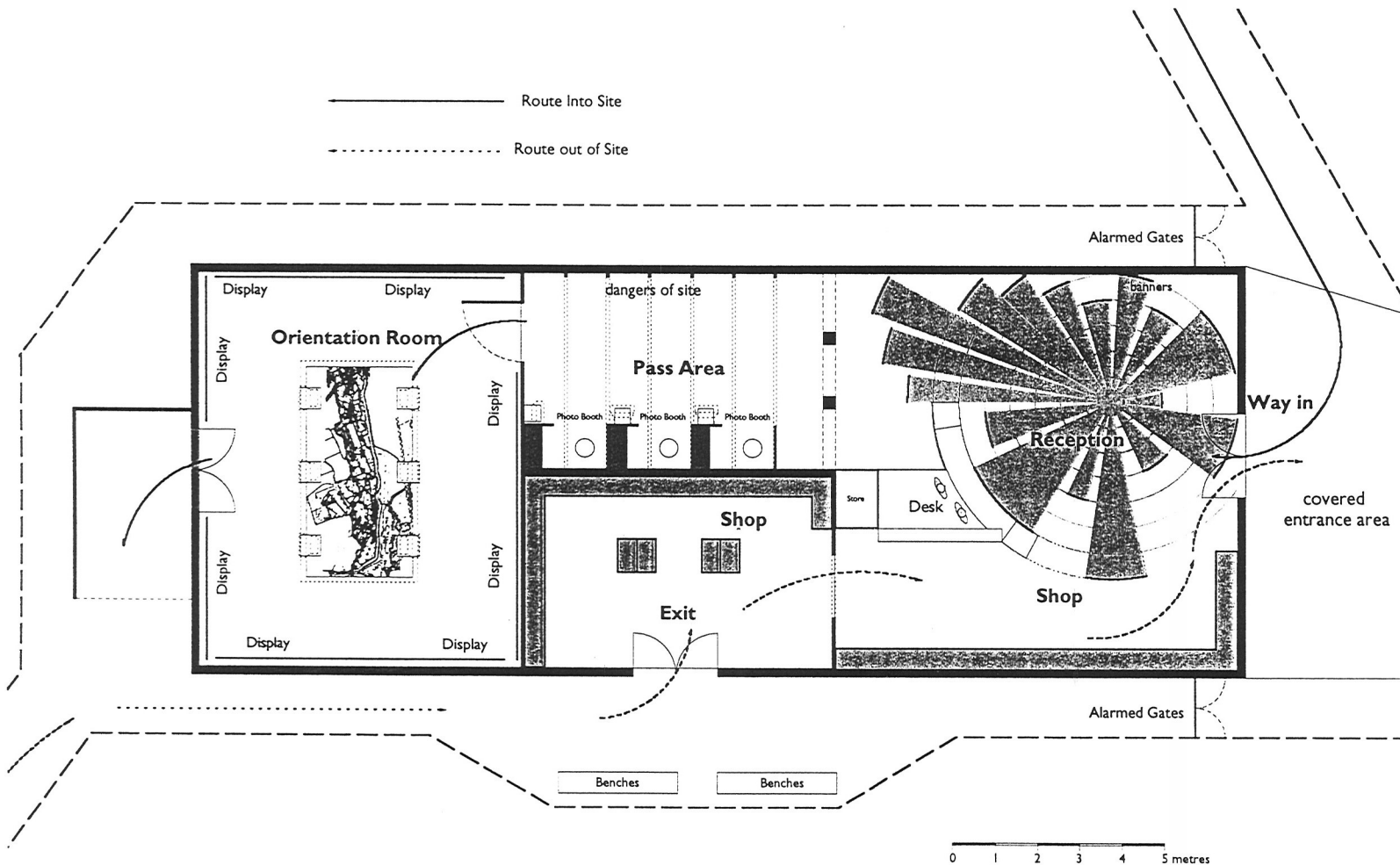
Visitors to Waltham Abbey Royal Gunpowder Mills will arrive along a new road linking the site with Highbridge Street. It is envisaged that most visitors will arrive by car or coach but other public transport links may be created in the future to provide for pedestrian visitors. All will arrive at a landscaped car park to the north of the redeveloped building H7 which is the visitor reception. At no time will visitors making this journey be aware of the site. Nearby housing and landscaping will retain the idea that the Royal Gunpowder Mills is essentially a 'secret' place.

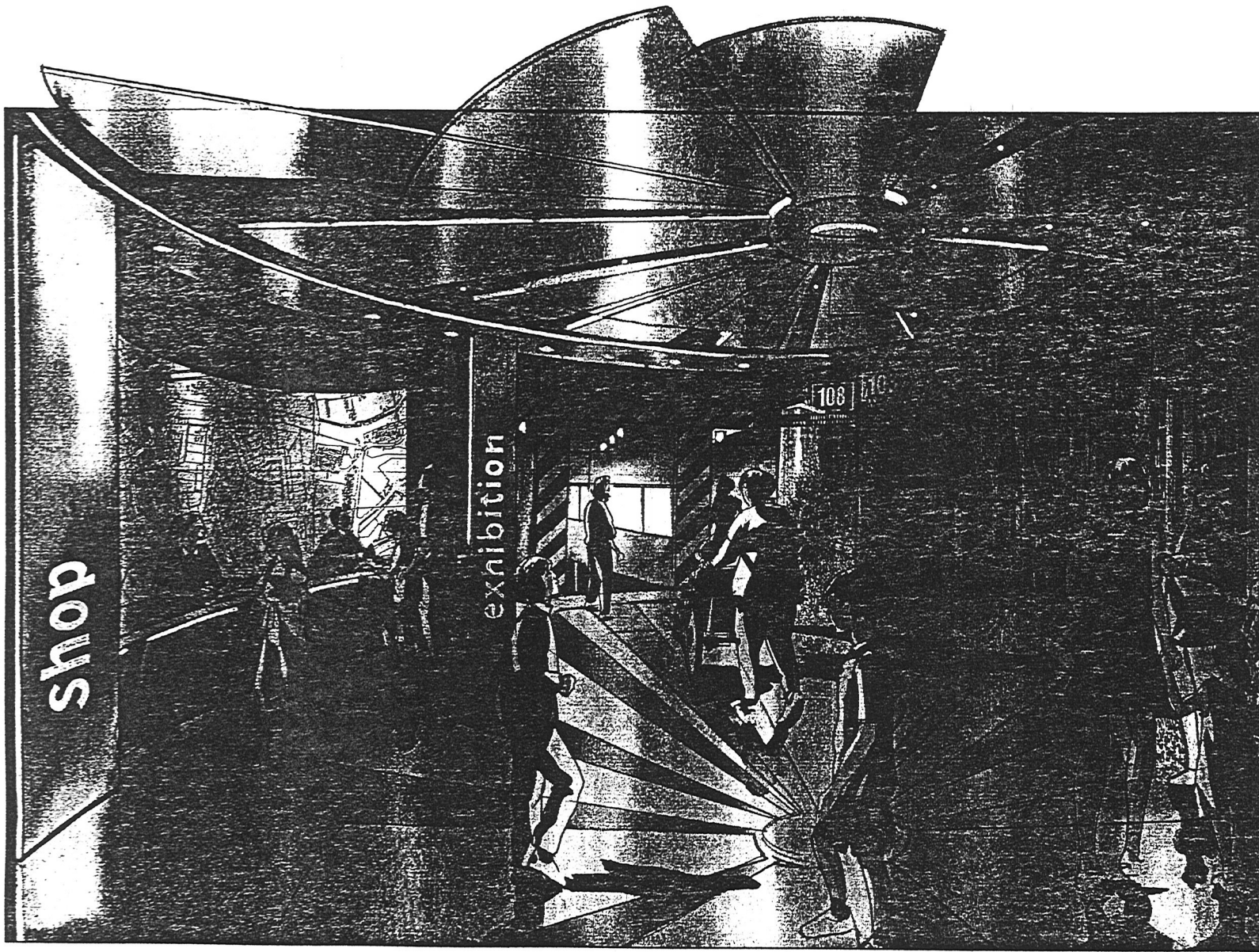
A key part of the early interpretation strategy is to generate an awareness that visitors are about to enter something special; this is a very different kind of place from the neighbouring Lea Valley Country Park. The concept behind the development of the reception building is based on the idea that visitors will be 'processed', as if going through a security check to gain access to a secret establishment. This concept achieves both effective objectives, in raising visitors levels of excitement and expectation, and practical objectives, in confirming the numbers of visitors entering and leaving the site and making them aware that they need to take care during their visit.

Building H7

Visitors enter Building H7 through the huge concrete traverses into the first reception area where they purchase tickets and guides to help them during their visit. The tickets will take the form of a security pass which is then validated in the second reception space. We are presently reviewing the practicalities of validating the passes and it may be some time before the latest technologies will become available at an economic cost. We are currently proposing that visitors enter photoboosts where their faces can be recorded and incorporated on the passes. Each pass will be given a bar code which can be used to record information about the individual. At the end of the visit, the pass is used to activate the turnstile exit. This will record how long each visitor has been on site and identify how many visitors have yet to leave. On a large site like the Royal Gunpowder Mills, it will be essential to keep track of visitor movements in order to ensure their safety and the security on the site. The pass can be taken home as a souvenir.

H7 SITE RECEPTION AND ORIENTATION BUILDING

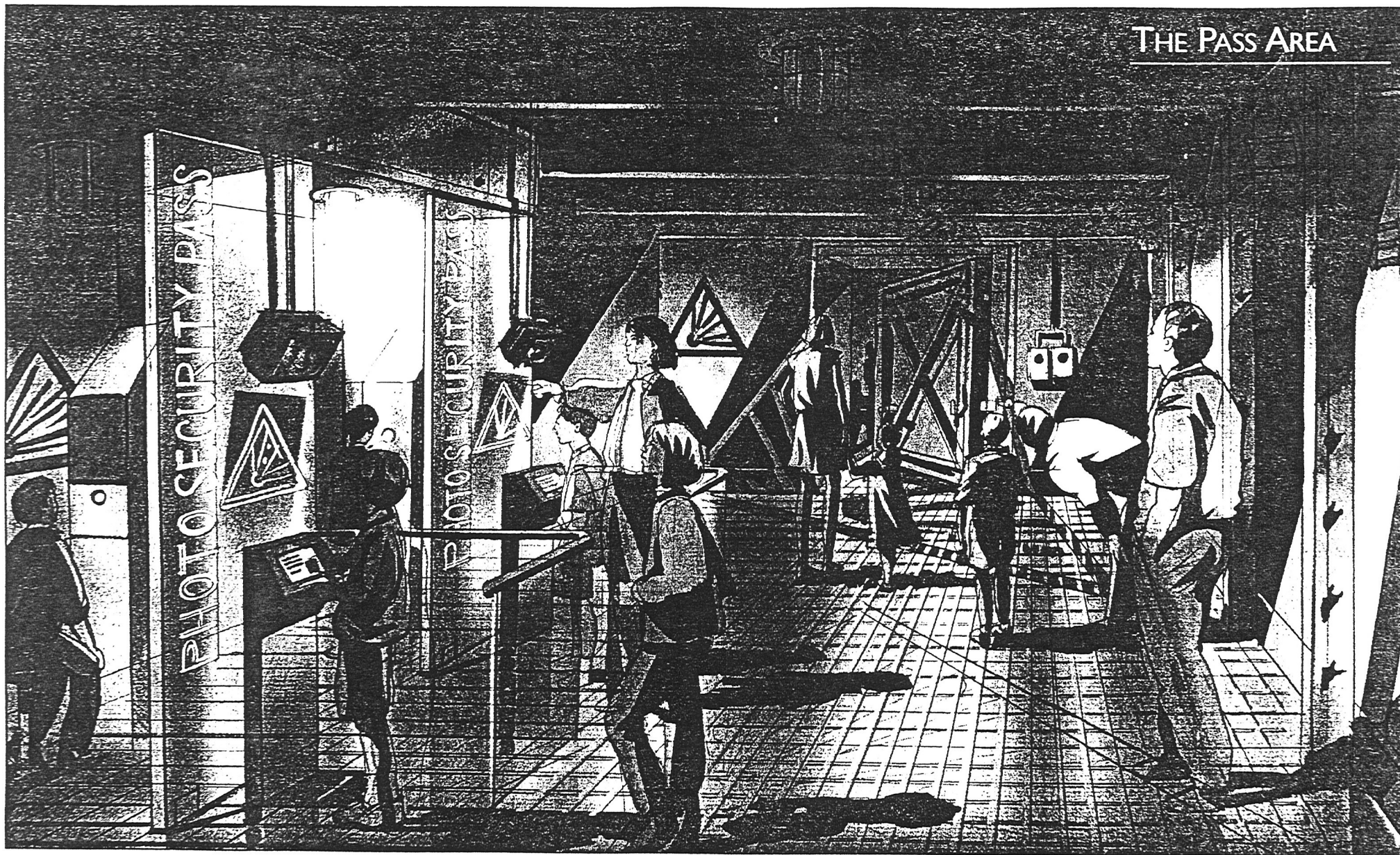




RECEPTION

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

THE PASS AREA



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

We propose that Building H7 should be the only point of access and egress from the site and to this end, the spaces are divided appropriately. (see Fig. 1).

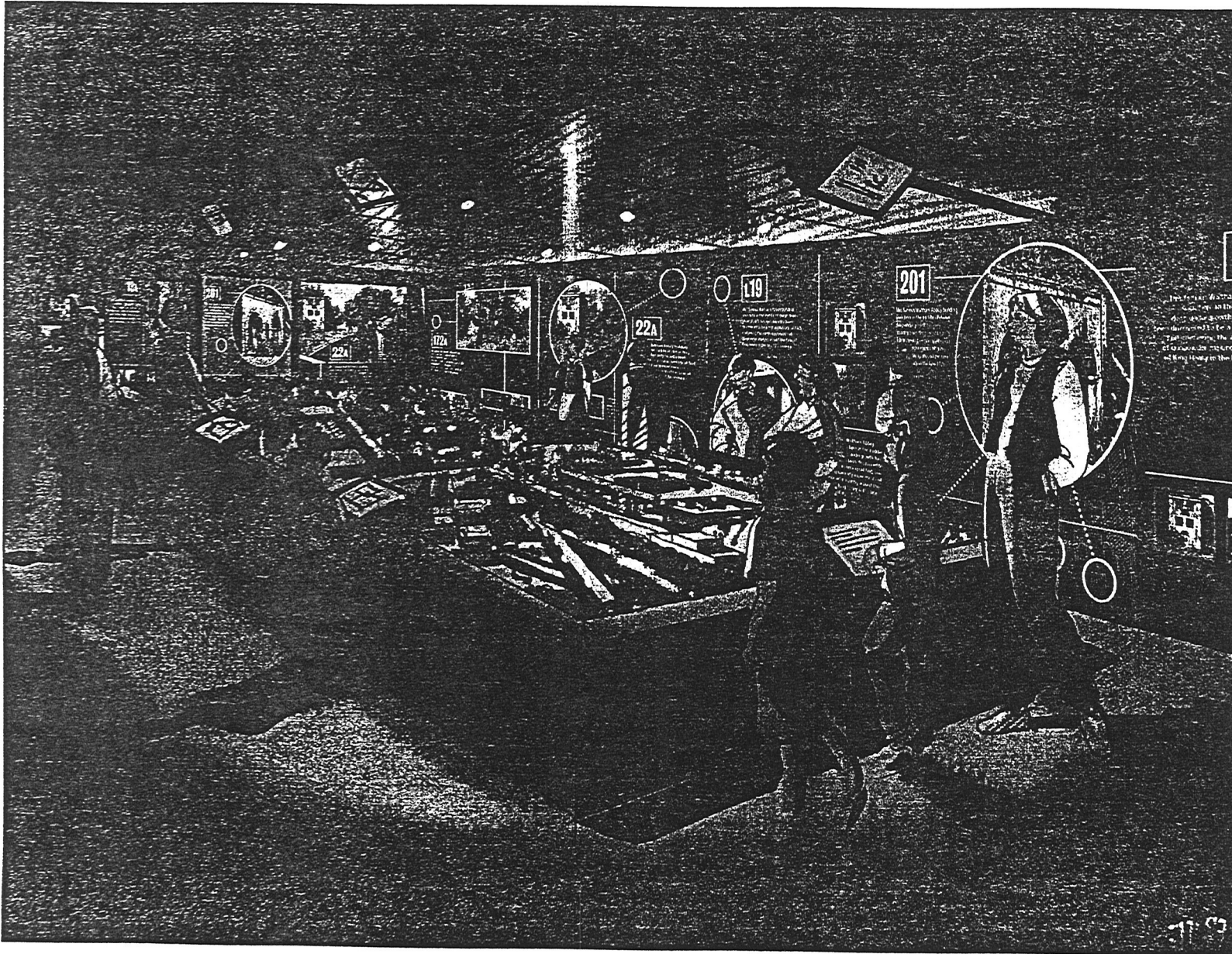
As visitors pass through the first two reception areas, the interpretation will begin. At first, graphic displays will feature some of the more unusual 'lost city' structures that can be seen. Our message here will emphasise the importance of the site and echo that of Dan Cruickshank introducing a 1997 piece in 'One Foot in the Past'.

'Although history would have you believe that many of the great battles were won on the battlefield, they were in fact won on a piece of boggy land near Waltham Abbey in Essex'. (see 'Taster' note)

In the second area (Fig. 2), it is proposed to adopt a different message. Here we will hint that the site is still 'dangerous' and that it is unwise for visitors to stray off the marked paths. This is intended to discourage visitors from disturbing wildlife, in particular the heronry, and to preserve the most sensitive parts of the site until they can be made more accessible in later phases of the project.

Visitors leave the pass area through a massive, steel blast door rescued from the south site to enter the third orientation space (Fig. 3). This final area will provide a space where visitors will understand something about the characteristics of the site and how it has come to look as it does today. The centre-piece of the space is a large scale model. This is sequentially lit from a lighting gantry above the model in a continuous programme illuminating individual buildings. As each building is identified, images appear on video monitors around the model showing the building as it is today. The purpose of the model is give visitors an impression of the enormous size of the Royal Gunpowder Mills site and to raise their awareness of the form and position of the buildings they will see. A commentary will identify the buildings and the options available to visitors, for example, to stay around Queens Mead or to visit the other areas of the site.

SITE ORIENTATION ROOM



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

Around the walls of this space we propose to feature each of the areas forming the visitors' walking options. Each option will be located on a site plan and a broad visit time will be identified, for example, the Nitro-Glycerine Plant on New Hill would add 35 minutes to a visit. Distances also need to be identified - it is very easy on a site of this size for visitors to overreach themselves, particularly if they are accompanied by children or elderly relatives. Some degree of overstatement also plays a part in encouraging visitors not to take on too much in one visit, and to visit again.

These displays also provide an opportunity to record the history of the site and specific buildings, including the Island and South sites. We propose to feature original photographs of the buildings in use, accompanied by the RCHME photographs taken when the site was 're-discovered'. We will also explain the work of decontamination and its effect on the site. It will be stressed that this is work that continues alongside the management of the natural environment.

Visitors leave from the south east corner of Building H7 to make their way to the main interpretative buildings centred on Building A203.

From H7 to A203

It is hoped that all visitors will make their own way directly to A203, particularly if this is their first visit. However, this is only one of the options available. It is proposed to create a vehicle based transport system for the site centred on a tour of the Queens Mead area. This will be more fully explained elsewhere. Visitors will be able to walk to A203 or take the transport vehicle to a point near the building, in front of L176, where they can make their way over the footbridge RCHM 133 to join pedestrian visitors.

Most visitors will be encouraged to make their way on foot from H7 to A203 along a new path beside the original waterways. At the crossing point, we propose to make use of the first of the external displays to tell visitors that this part of the site is where it all began. The display will feature a localised plan of the visible area showing the sites of the original mill buildings. Reconstruction drawings will show visitors how the site looked like from the point where they are standing. To reinforce a sense of what has been lost, we propose to create simple frame constructions to reveal the scale and outline form of one or more of buildings.

Visitors will walk alongside the waterways to the newly landscaped areas around A201-203. Cast iron plaques will identify the original functions of A200-202.

Building A203

A203 was designed for a different point of access from the one we propose and so it is necessary to create a new entrance to the building to acknowledge and encourage arrivals from H7. We have proposed a lightweight glazed construction creating a new lobby and link to A201. The lobby will provide access to new, extended toilet facilities, to the exhibitions, cafeteria and schools areas.

Schools teaching spaces, doubling-up as seminar rooms, will be located at the back of the building where the present stores are located. An additional access point will be created here that will allow coaches with disabled children to drive directly to the building. It will also permit classes to use the open space around the building in fine weather.

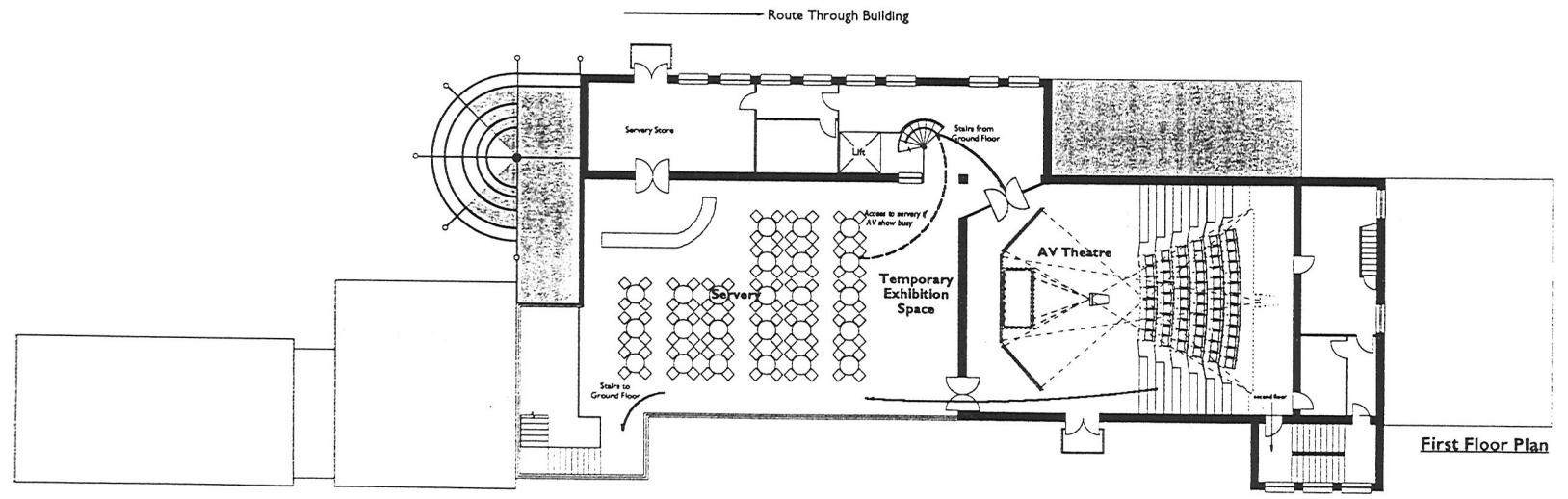
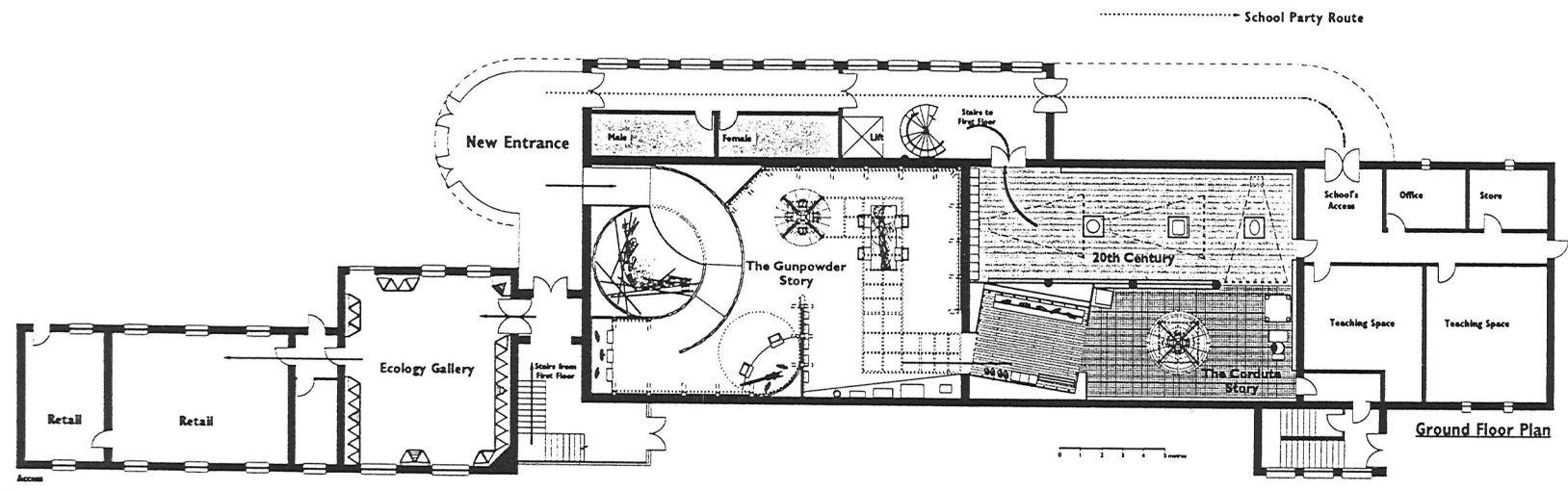
The Interpretative Exhibitions

We propose to create three main interpretative features in buildings A201 and A203. The principal exhibition on the history of the Royal Gunpowder Mills will be located in the old library space. Although the relationship of the natural world to the manufactory will be featured in this exhibition, the recent post-war period has seen an increased awareness in ecological habitats that did not exist in the earlier periods of the site's history. We are therefore proposing to create a specific ecology exhibition in Building A201 which will focus on the rich diversity of the natural world that has developed on the site and on the management of this heritage alongside that of the man-made structures.

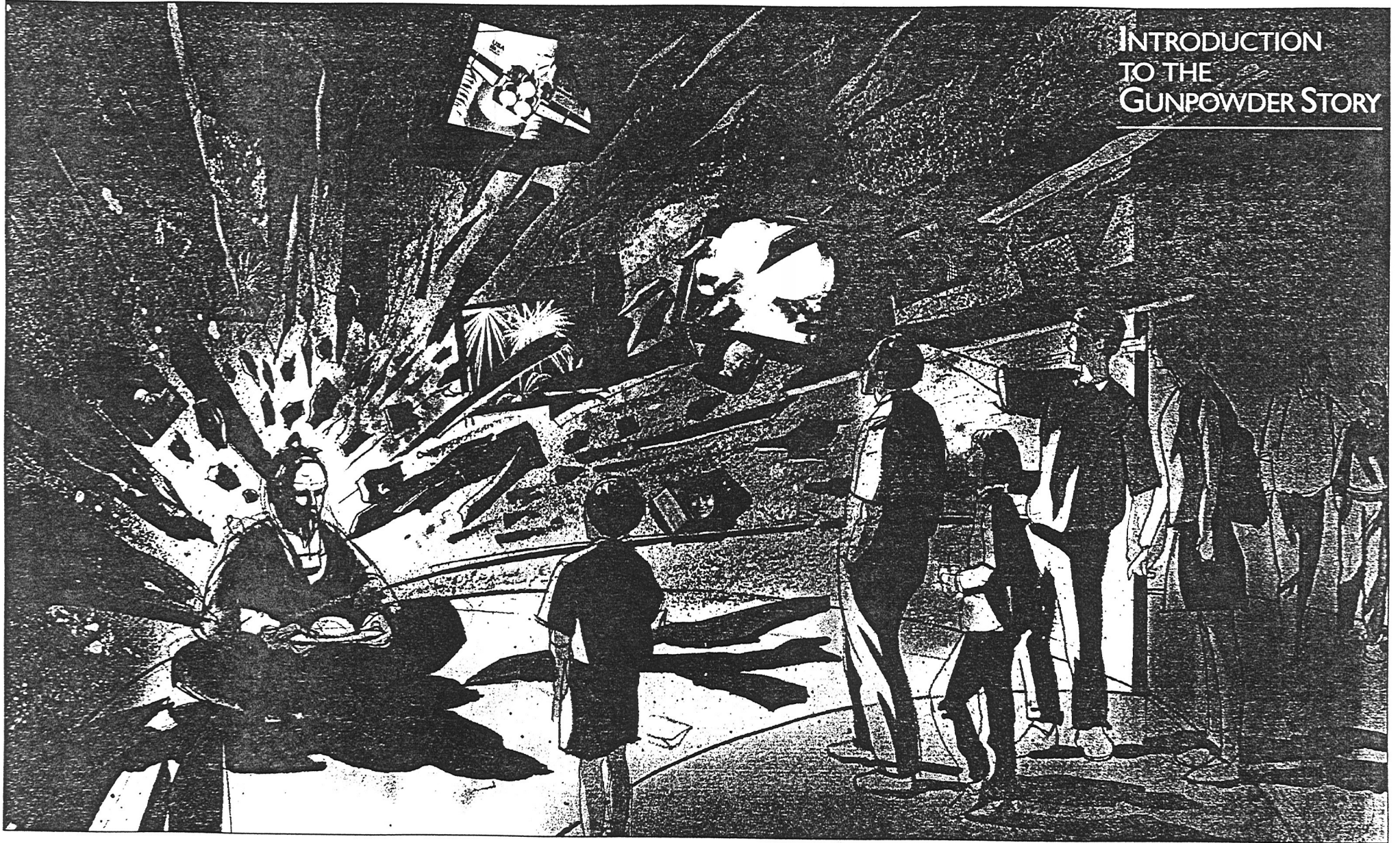
It is our view that the site is the principal attraction - the 'WOW' factor. However, it may lose some of its appeal in inclement weather, particularly in the winter months. We are therefore proposing to create a second 'WOW' factor in the form of a theatrical audio-visual presentation in the old lecture theatre. This presentation will focus on the wider history and impact of explosives and propellants to which Waltham Abbey has contributed. This presentation is intended to add to the critical mass of attractions and to place Waltham Abbey in an international context, thereby extending the educational value of the site.

Early in our study, we reviewed alternatives to Building A203 as the interpretative hub of the site. The Power House A210 has by far the greater appeal and space for a wide variety of interpretative opportunities. However, the practical impossibility of using the building for interpretation became evident. The costs of renovation and providing visitor facilities in this first phase were prohibitive. Therefore this building has to be seen as a long-term option for future expansion once the site has established its presence as a visitor attraction. Subject to other practical constraints, we would propose to use the Power House for open storage of large equipment. This can be used in later phases of interpretative development, for example, a modern cordite press from the South Site.

A203 MAIN EXHIBITION BUILDING



INTRODUCTION
TO THE
GUNPOWDER STORY



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

“From Archery to Rocket Fuel”

This area will form the central interpretation of the site; however the space available is not large for such a varied history and it is part of our interpretative strategy to spread elements of the detailed story around the site and to make use of additional publications to ensure that the information is available at a variety of levels of interest and prior knowledge.

Our story begins with a presentation to introduce gunpowder plus other explosives and propellants, linked to a need to identify for visitors the uncertainty surrounding the origins of gunpowder.

Visitors enter a small pavilion-like structure (Fig. ?). Before them is the seated figure of a Taoist monk holding before him a pestle of black powder. The monk is surrounded by an explosion which includes a series of video monitors. These have different screen sizes and feature a mixture of narrators and film footage to explain the different theories of gunpowder invention and its importance in laying the foundations of modern day science and warfare. The presentation will be supported by dramatic lighting effects and a continuous loop of information, lasting for around a minute.

Having identified the possible origins and importance of gunpowder, the next exhibit will explain what it is. Three sculpted figures of dirty, dishevelled labourers symbolise the three main components of gunpowder. Each figure stands by a heap of the product he has been digging, making or collecting: sulphur, charcoal and saltpetre. We will use Thomas Fuller's quote of 1662:-

“Gunpowder ... consisteth of three essential ingredients ...

*Brimstone, whose office is to catch fire and flame of a sudden
and convey it to the other two.*

*Charcoal, pulverised which continueth the fire and quencheth the flame,
which otherwise would consume the strength thereof.*

Saltpetre, which causeth a windy exhalation and driveth forth the bullet”.

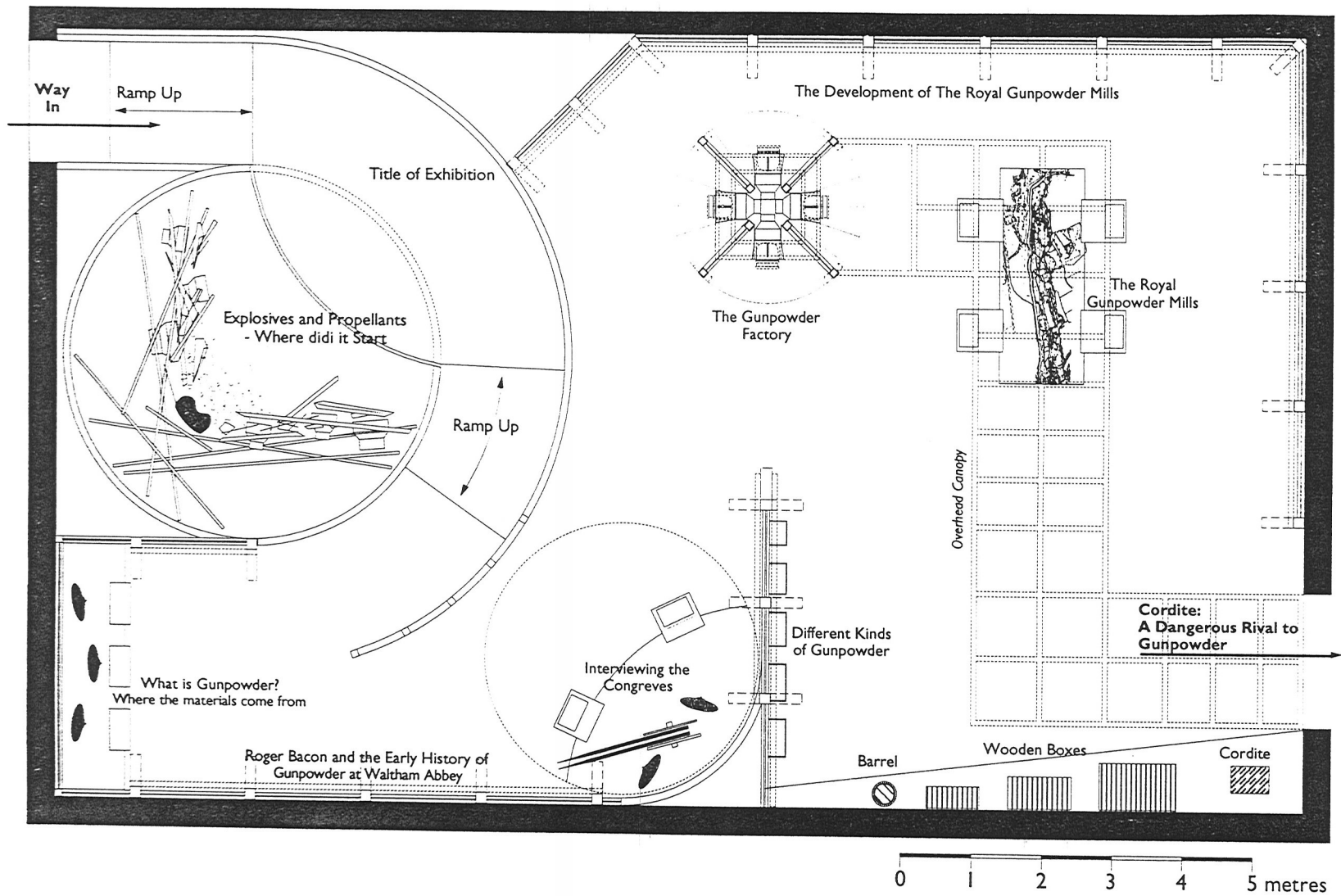
The proportions of gunpowder vary according to use and the graphics accompanying the figures will make this clear. Behind the figures a colourful collage of images will show the early uses of gunpowder.

WHAT IS GUNPOWDER?



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

GUNPOWDER STORY PLAN



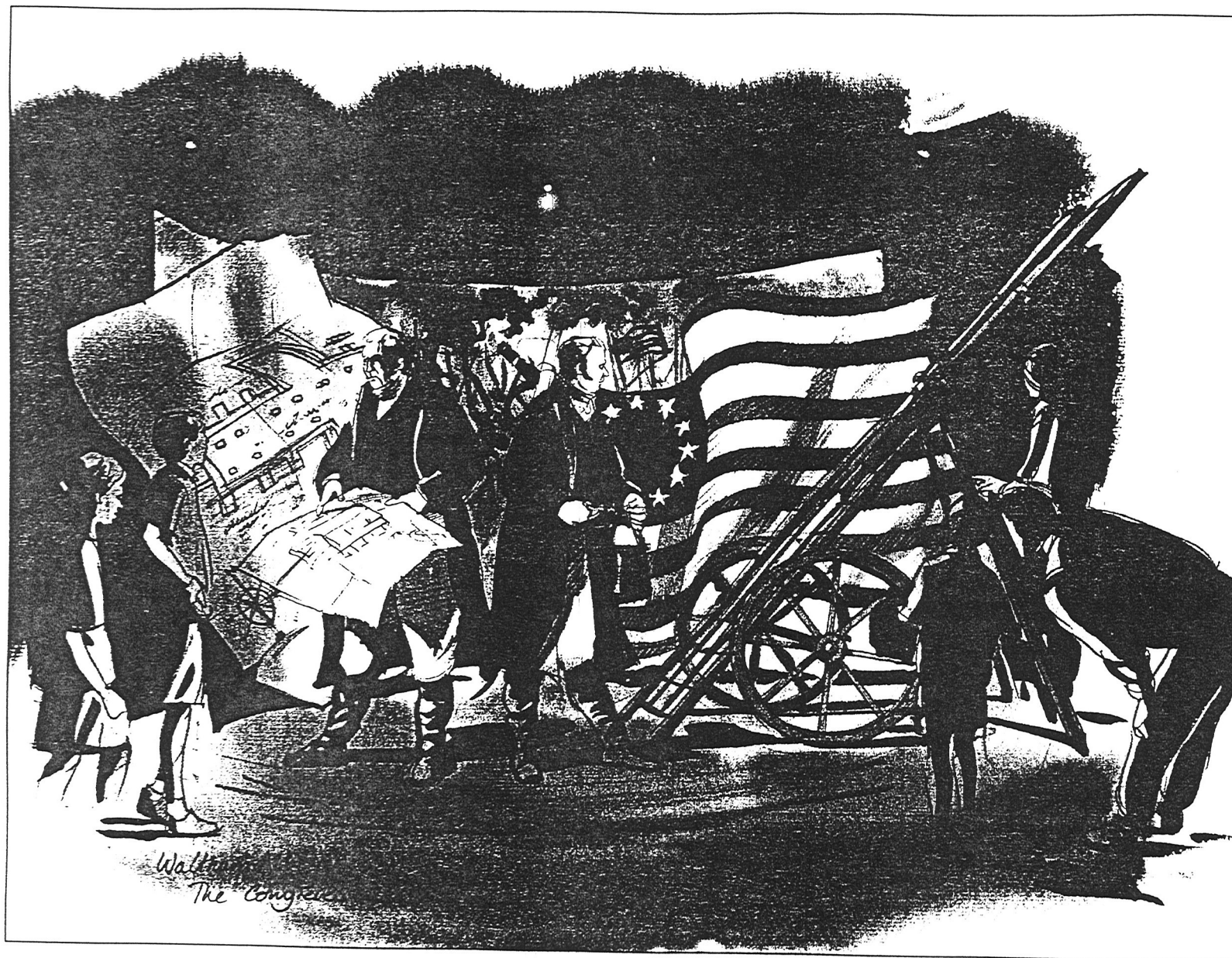
Gunpowder at Waltham Abbey

Graphic displays will remind visitors of key dates in the development of gunpowder and the establishment of the Royal Gunpowder Mills at Waltham Abbey including:-

- 1200s*** ***Roger Bacon, a Franciscan monk, known as 'Dr. Mirabilis', foresaw the magnifying properties of convex lenses, the possibility of mechanical cars, boats and flying machines and most importantly for our story, the extensive use of gunpowder, about which he wrote in code. Bacon will re-appear as part of the audio-visual presentation on the first floor.***
- 1555*** ***The first recorded gunpowder mill in England built at Rotherhithe.***
- 1665*** ***The first record of gunpowder production at Waltham Abbey.***
- 1735*** ***An engraving by John Farmer showing the pastoral nature of gunpowder production.***
- 1700s*** ***The mills at Waltham Abbey pass to the Walton Family.***
- 1733*** ***Philippa Walton takes over the mills.***
- 1787*** ***The Crown buys the mills and Waltham Abbey becomes The Royal Gunpowder Mills.***

The Crown takeover will be symbolised by a display featuring William Congreve and his son. Both are represented by figure sculptures standing back to back. Behind each figure, setwork illustrates the influences that the Congreves brought to bear on gunpowder production. The elder Congreve contributed ideas of quality control and scientific methods to gunpowder manufacture, while the younger represents invention, strands that were to characterise the Royal Gunpowder Mills for the rest of its working life. To understand the Congreves' contribution, visitors can interview actors playing the part of father and son on touchscreens. They explain their views on gunpowder production and other developments. The younger Congreve stands in front of a reconstruction of his rocket. (Fig.?)

THE CONGREVES



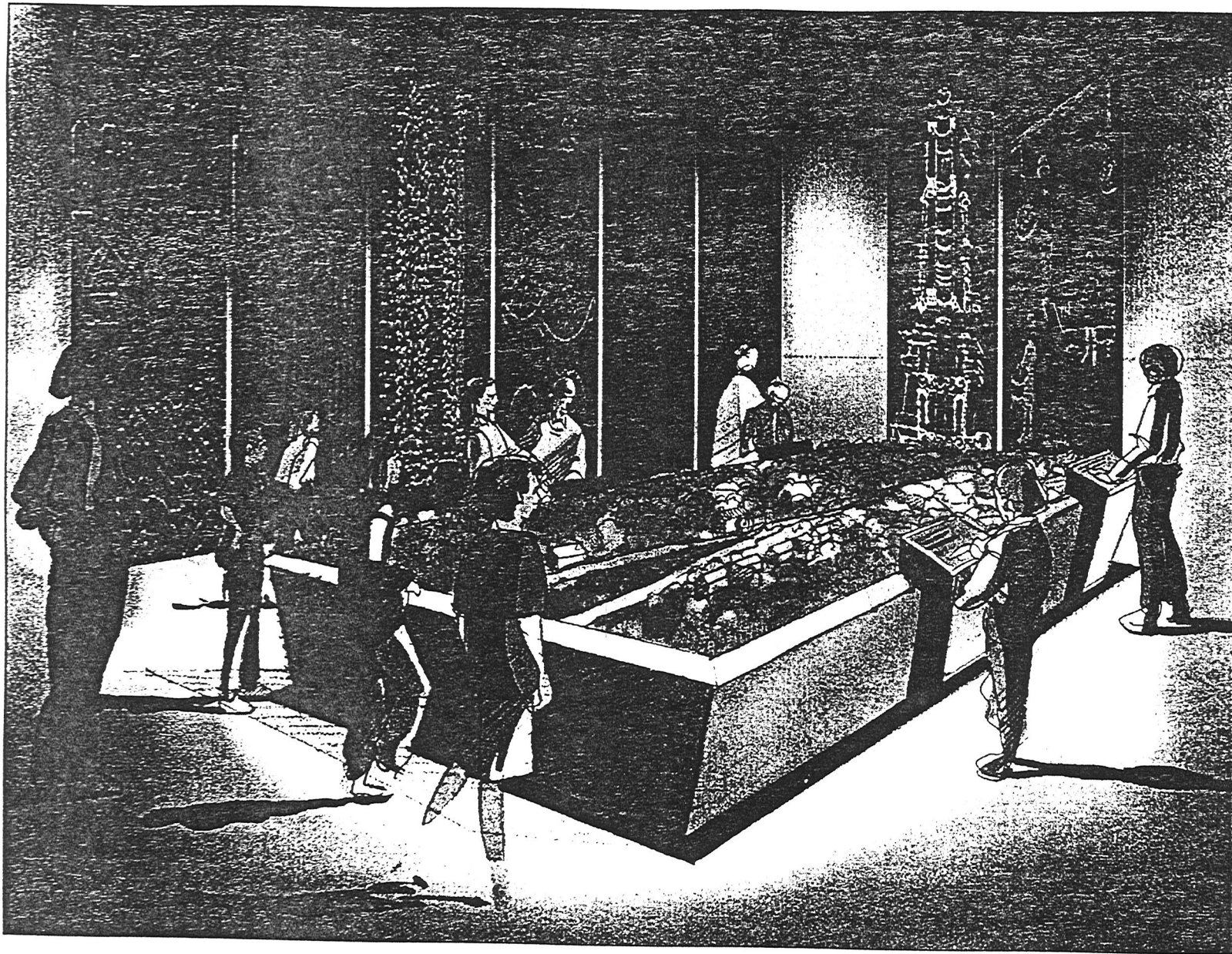
WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

To understand how the Royal Gunpowder Mills functioned, it is necessary to understand the basic process of making gunpowder. Given the limited space, we are proposing to create a simulation of a gunpowder factory in the form of a computer-based exhibit with mechanical control systems. Computers are well-suited to operating as educational exhibits because they allow visitors to explore a number of variables and can provide feedback throughout. Given that gunpowder making was something of a craft activity, we wish to reflect this character in the way visitors operate the display.

There will be four 'console' areas where visitors can explore the gunpowder making process. A good educational interactive needs to include an element of fantasy and the 'gunpowder factory' is no exception. The objective for visitors is to create enough quality powder to 'fire' a cannon. Visitors are given the characteristics of the components of gunpowder and some guidance. They will be taken through the process with one or two hurdles to overcome. Rules have to be obeyed during the operations and visitors will be required to acknowledge that they are taken into account - they might, for example, fail to see the nail that has found its way into the incorporating pan of the edge grinder. Visitors can choose their combination of ingredients and explore variations in the mixture.

Having created a mixture, visitors can then test it in an experimental mortar located on top of the console. The success of the mix is measured by the resultant bang, combining sound and light. As part of the simulated process, visual links can be made to the original buildings on the site.

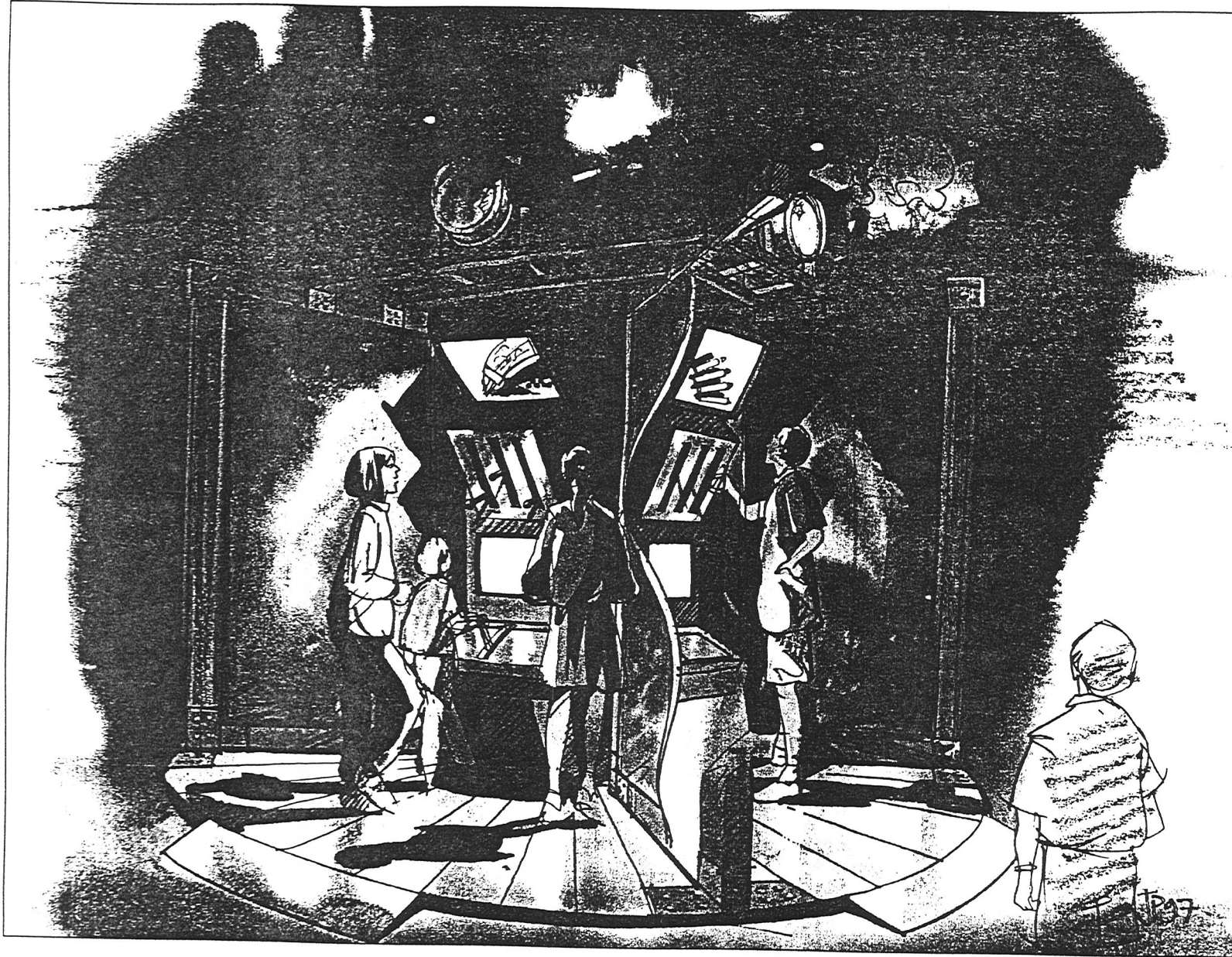
The number of interactives is limited by budget and by space. We also recognise that such displays do not appeal to all visitors. The exhibition will therefore illustrate the process by means including, for example, a small working model of an incorporating mill. Other equipment, samples and original design drawings will be included in displays to provide an alternative method of discovering how gunpowder was made at Waltham Abbey.



THE ROYAL
GUNPOWDER MILLS
INTERACTIVE MODEL

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

THE GUNPOWDER
FACTORY



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

Specific displays will show how the architecture of the site reflects the unusual functions it fulfilled. Transport on the site, specifically the canal systems, will also be featured. A clear message here is that movement around the site, relying on manpower, was as fast, or slow, as that of the visitor. A second interactive features another model of the site showing only those buildings used in gunpowder production. Around the model are touch-screen computer displays. Visitors can choose a building to examine. The building appears on the screen, looking as it does today; the image then transforms into a reconstruction of the building in its active life which visitors can explore by moving a cursor on the screen. They can look at the interior and the exterior; inside they will see one of the operations taking place and, in some buildings, they can call up one of the workpeople present during the operation. An actor, taking the part of a mill worker, tells visitors about his work.

Having understood something of the basic processes involved, the remainder of the displays focus on technical developments which improved gunpowder performance to match developments in armaments and how this was reflected in the refurbishment of the mills in the 1870s.

The huge appetite for gunpowder demanded by the late nineteenth century arms race was increasingly difficult to satisfy. The display will show how much powder was needed to fire guns at certain moments in time. In turn, this will be linked to the amount produced at Waltham Abbey. The need for a manageable alternative was apparent in the latter part of the nineteenth century and the final display '*Cordite - a dangerous rival to gunpowder*' will compare the equivalent amount of cordite to do the same job as 900lbs of gunpowder.

The suddenness of the change from gunpowder to cordite is reflected in visitors passing through an arch from one environment to another.

The Cordite Story

Visitors enter the different world of a recreated changing shed with 'clean' and 'dirty' areas. In the dirty area, visitors will discover that, unlike gunpowder, cordite is relatively stable but its constituents are highly dangerous. They are asked to consider what they are wearing or carrying that could be dangerous. By opening locker doors visitors can discover the answers, which include their socks! Visitors can try on felt boots and examine some of the non-sparking furniture and equipment that was used in danger areas.

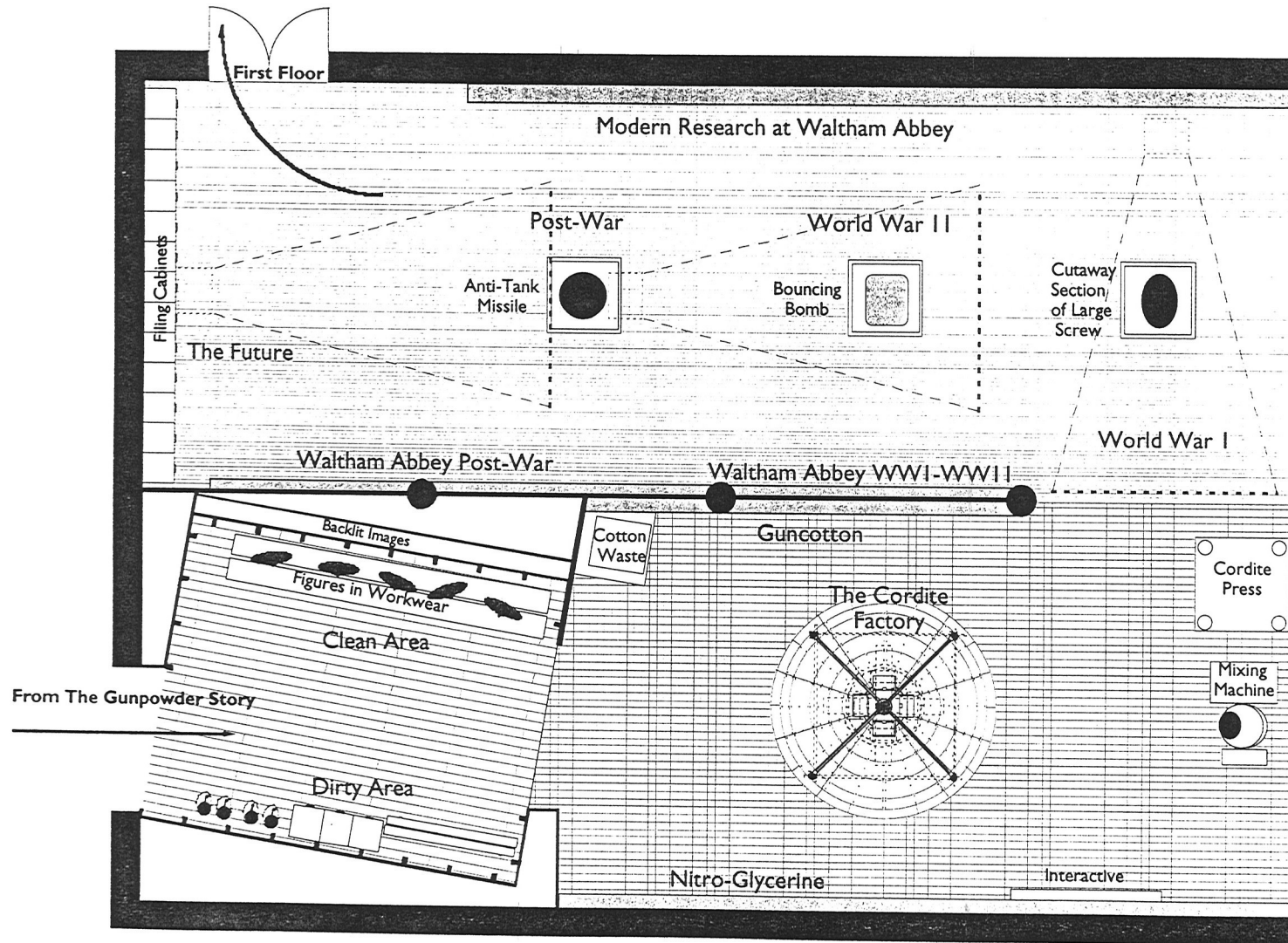
To the other side, the 'clean' area has four female figures in working clothes, each representing a part of the cordite process: gun cotton production, nitro-glycerine production, mixing and pressing. Each figure is lit in sequence and the rules relating to each process are read out. The rules themselves explain the nature of the processes in a simple way. Behind each figure is a painted theatrical gauze which appears to be solid until the figure is highlighted and backlit images of the processing buildings appear.

In the following exhibition space, one side features gun-cotton, the other nitro-glycerine. Visitors are invited to handle the cotton waste from which gun-cotton was made. Linked to reconstructions of the buildings, the process of bringing the gun-cotton to the mixing house is illustrated. Opposite nitro-glycerine production is illustrated with a series of gravity-fed tubes of liquid adjacent to images of the actual process buildings.

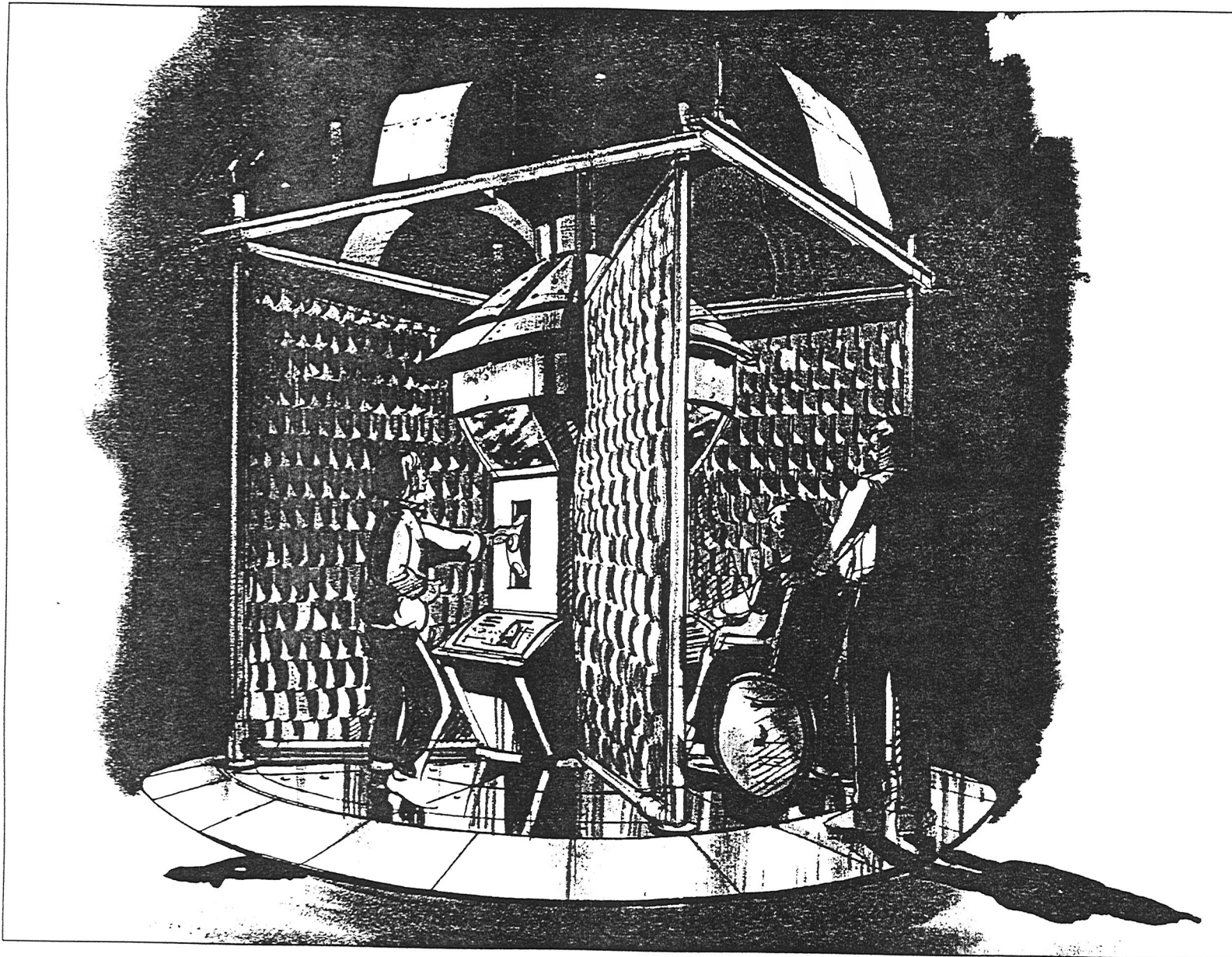
The end of both processes is the mixing or incorporating machine. One of these will be displayed, if available, revealing the relatively small scale of the mixing quantities, comparable to the food industry from where the technology originated. A cordite press, complete with extruding nozzles and associated equipment, marks the end of the cordite story.

In the centre of the space, we propose to create a second 'interactive factory'. Visitors play the part of workers in the cordite factory during World War I. The objective is to produce a particular type and quantity of cordite and visitors have to do so against the clock, adjusting speed and pressure to create the right charge for a particular kind of gun.

CHANGING ROOM, CORDITE FACTORY & WALTHAM ABBEY IN THE 20TH CENTURY



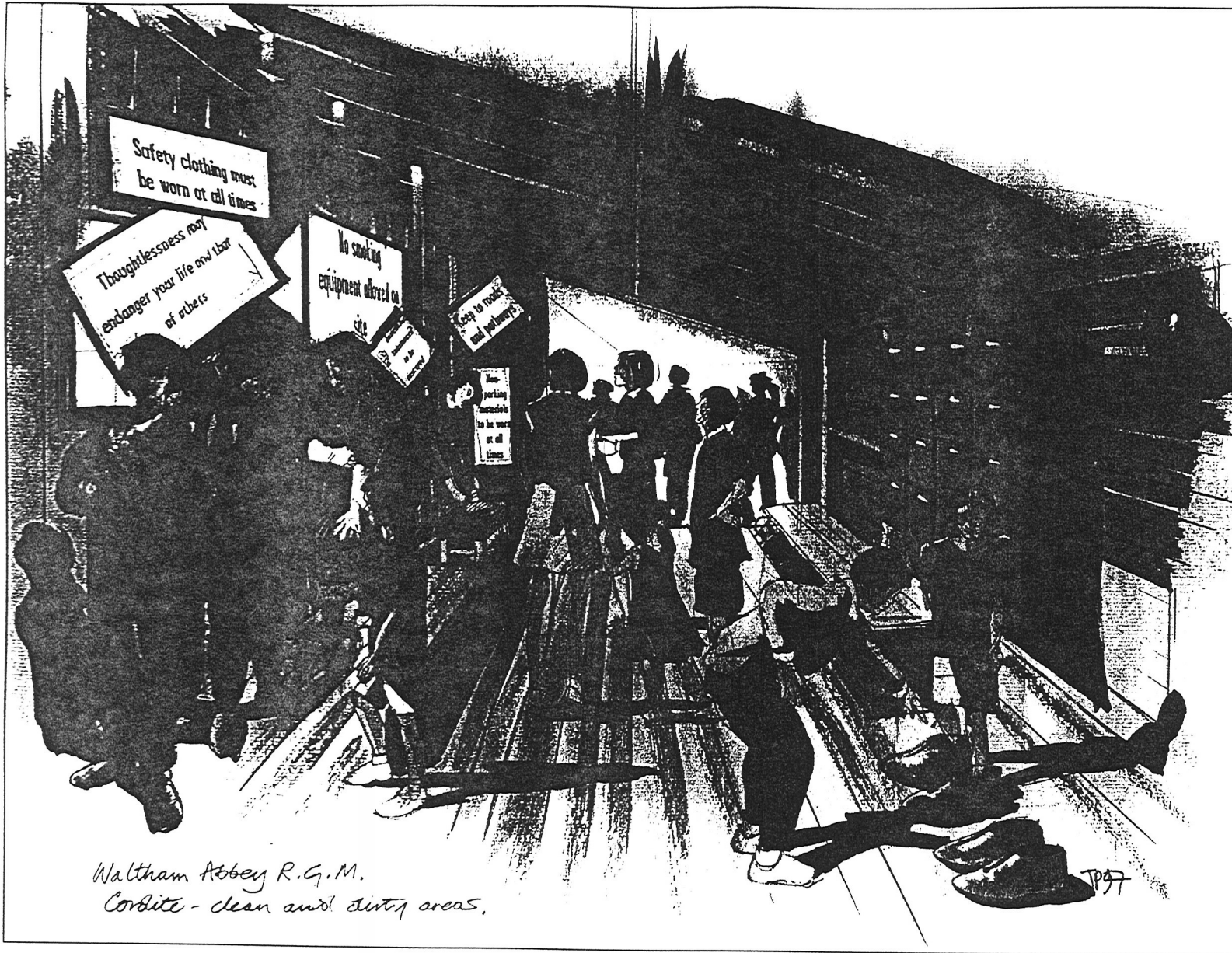
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THE CORDITE
FACTORY

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

CHANGING SHED IN
THE CORDITE STORY



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

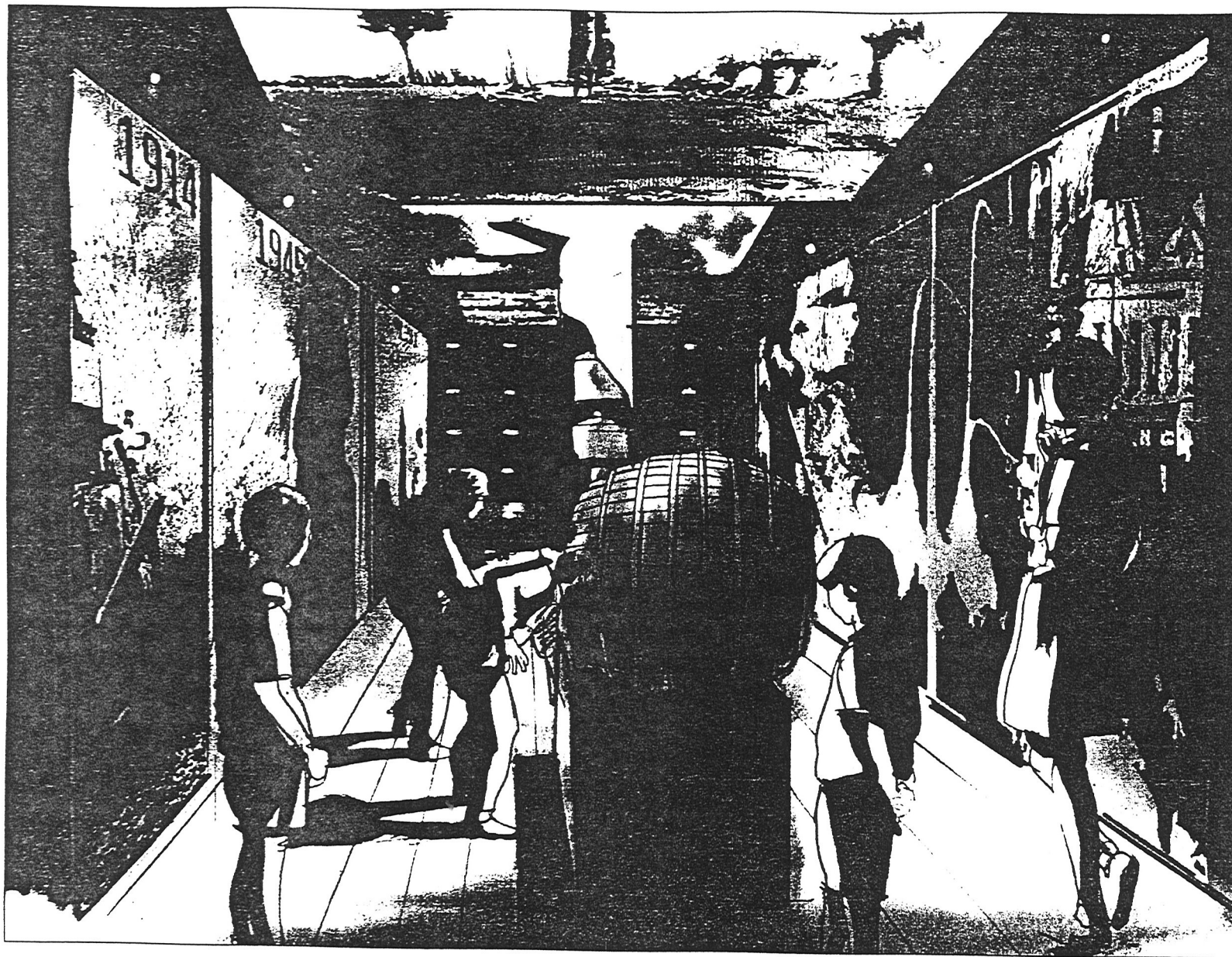
Waltham Abbey in the 20th Century

The final section of the exhibition focus on Waltham Abbey's role in the twentieth century. Above visitors, three back projected video screens show archive film from both world wars and the Gulf war. Beneath each is displayed an object that had been made successful through work at Waltham Abbey. These include the cordite charge used to propel millions of shells during the Great War, the 'bouncing bomb' made successful by RDX explosive developed and produced at Waltham Abbey and a Giant Viper minefield clearance system.

These displays are supported by the appropriate archive photographs detailing the post-war developments at Waltham Abbey. The final display of the exhibition takes the form of a series of filing cabinet drawers, each labelled "Not to be opened until 2018" illustrating that much of the research which took place is still classified as 'Top Secret'.

Visitors leave the exhibition and enter a lobby area with a new staircase and lift to the first floor cafeteria and audio-visual presentations. On the ground floor, it is proposed to illustrate the world-wide location of explosives manufactories. In a later phase, this may be combined with an Internet connection to some of the publicly accessible sites, for example the DuPont factory in Delaware, USA.

The first floor lobby forms a pre-show area to the audio-visual show; visitors can wait for the start of the show in the cafeteria. The lobby will provide an opportunity to display curiosities from Waltham Abbey which do not have a place in the exhibition, for example, the Physician's case or the samples of objects taken from the scene of explosions.



WALTHAM ABBEY
IN THE
20TH CENTURY

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

The Audio-Visual Show

Located in the old lecture theatre, the show will look at explosives and propellants in the wider historical context. The final show will be created by a specialist audio-visual team but a preliminary scenario might be as follows:-

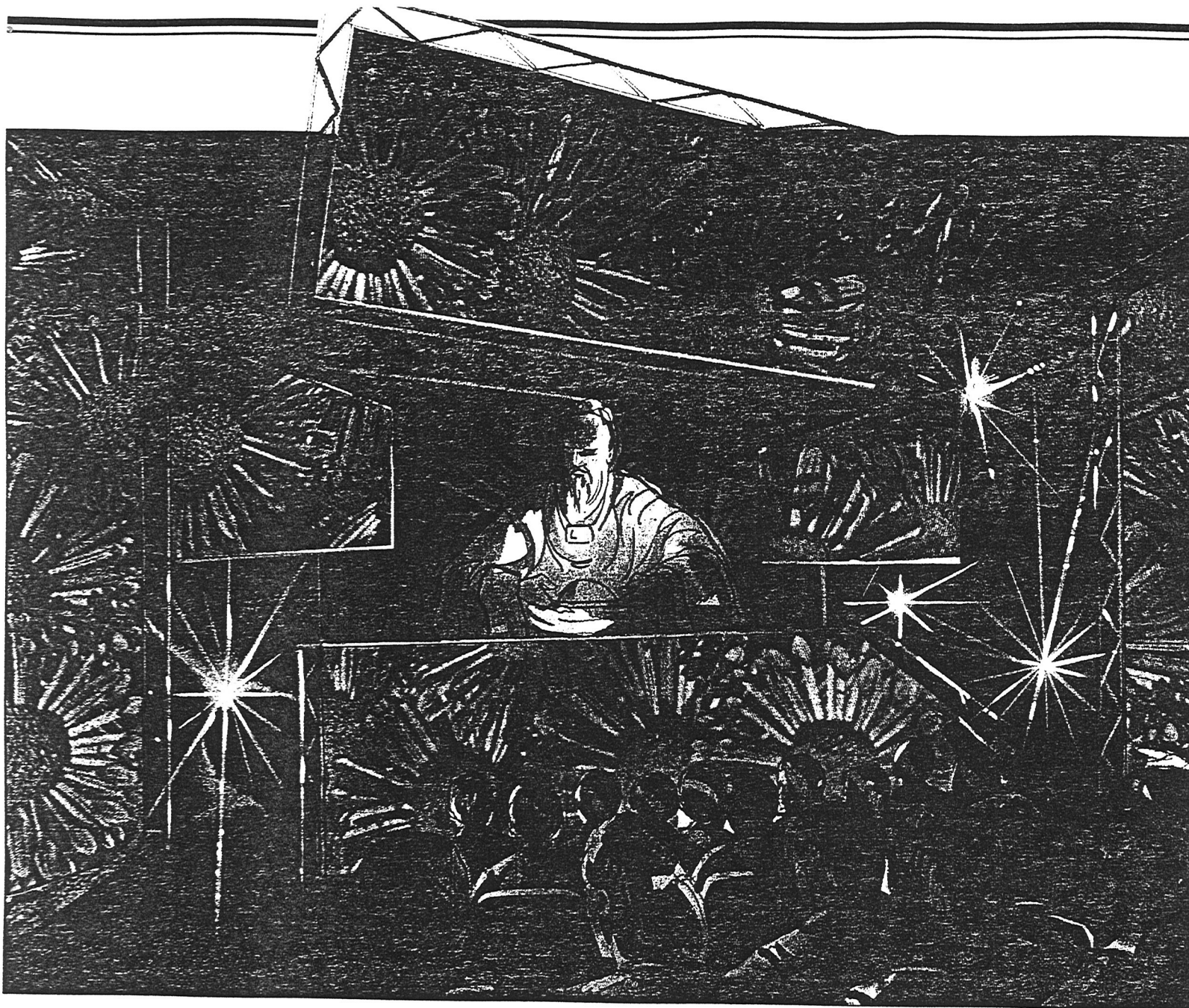
The show opens with a modern space rocket taking off amidst tremendous noise and light. Smoke fills the auditorium. Out of the mist, a Chinese temple appears with a monk seated outside grinding the components of gunpowder with a pestle and mortar. There are the sounds of chanting in the background. An explosion ... the room is filled with chrysanthemums.

The chrysanthemums are transformed into the flowers in a medieval monastery garden. Roger Bacon is seated at a desk writing his coded recipe for gunpowder. His voice is heard:

***“The crowd is unable to digest scientific facts,
which it scorns and misuses to its own detriment and that of the wise.
Let not pearls then, be thrown before swine.”***

Bacon's role in gunpowder's development will be explained. The view then shifts to the monastery wall which disintegrates as if under a bombardment; the monastery becomes a walled town under siege. Medieval paintings of besieged towns come to life as the attackers bombard the town. The sounds of warfare fade into Elizabethan church music - the composer Thomas Tallis was organist at Waltham Abbey in the 1540s.

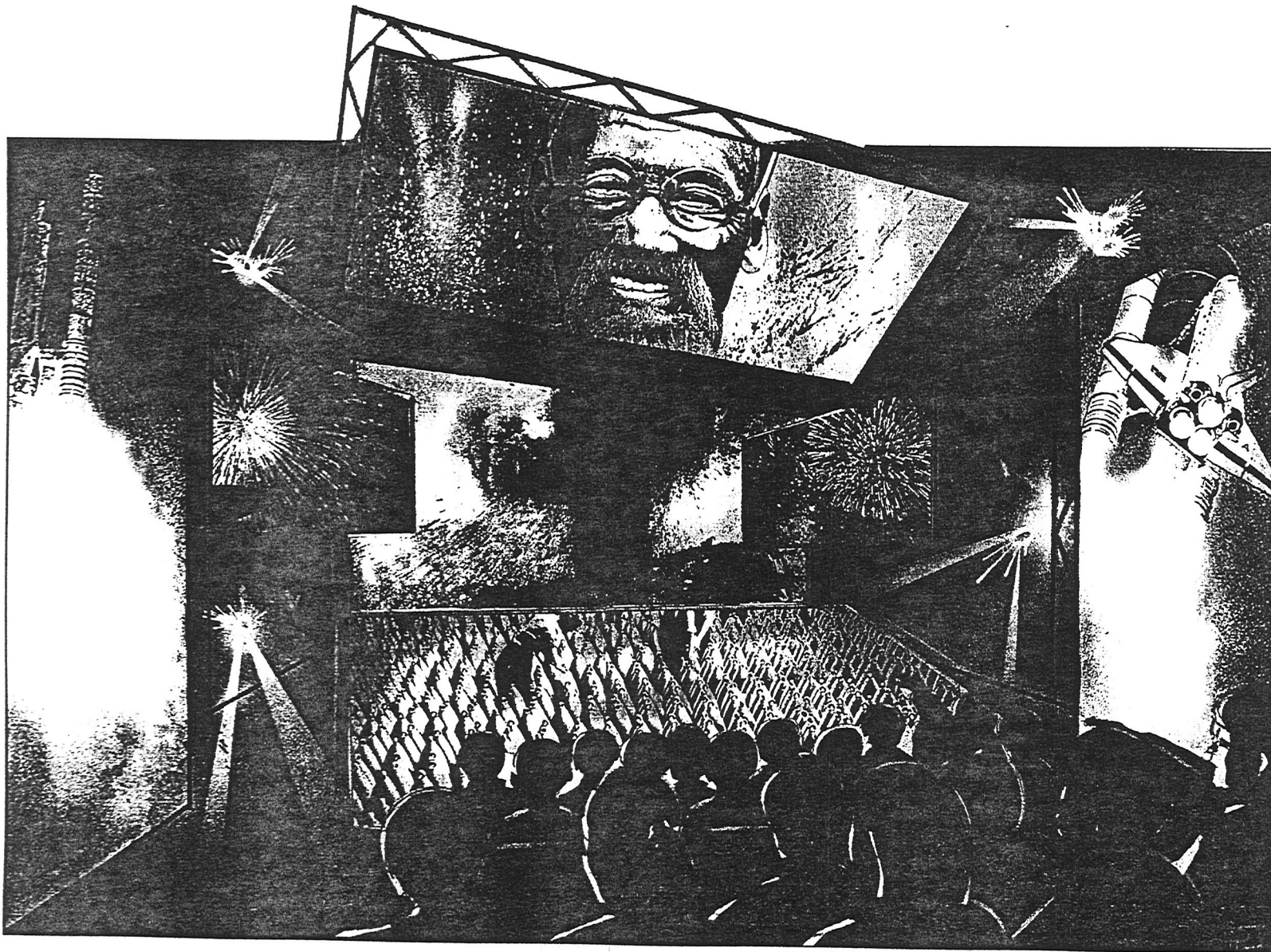
The mid-sixteenth century arrives and the first recorded gunpowder mill in England is established- an inconclusive argument takes place about creating an independent supply of gunpowder for England in a time of increasing military threat from the continent. Ships cannons begin to boom; the Armada is seen in the distance as smoke again fills the auditorium.



AUDIO VISUAL
SHOW

|

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

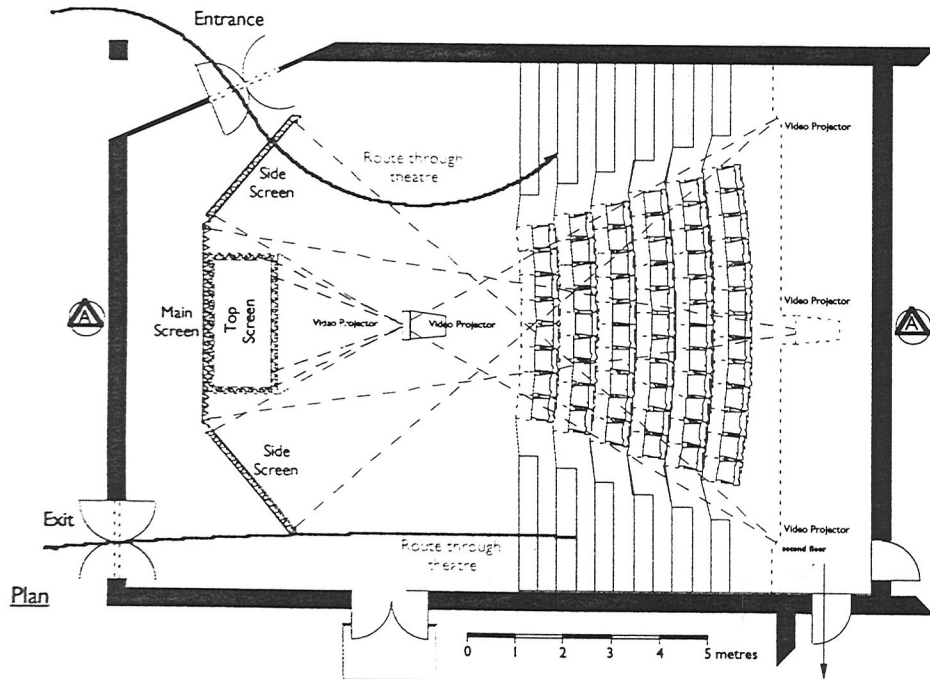
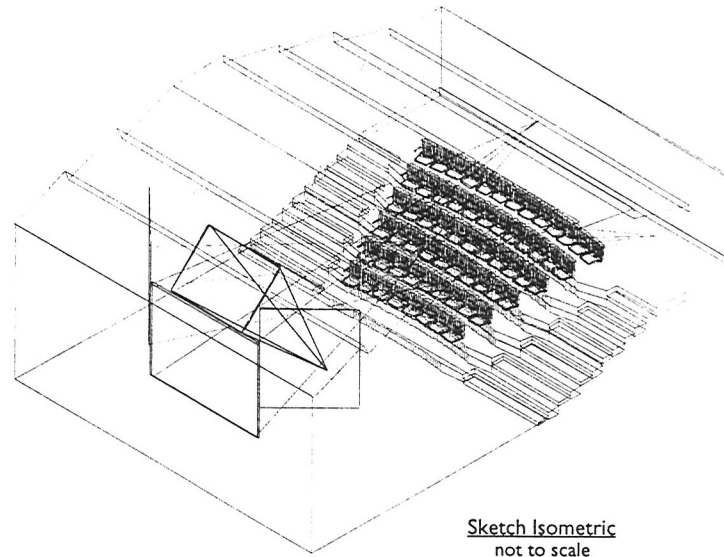
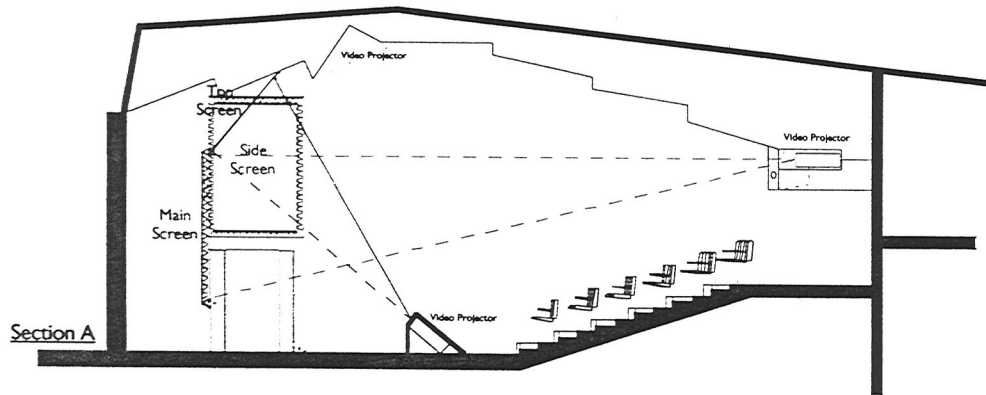


AUDIO VISUAL
SHOW

2

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

AUDIO-VISUAL THEATRE LAYOUT



Out of the smoke, early buildings at Waltham Abbey appear. Gunpowder is now produced in Britain for British soldiers serving all over the world. But at a cost - the first workers are killed at WARGM. An explosion at Waltham Abbey introduces Congreve Snr as Comptroller. Congreve Jnr. joins his father to argue the case for invention. He launches a rocket which lands in the middle of an American battlefield. Redcoats appear out of the mist, transformed from contemporary paintings of the battles. The battle is accompanied by a rendering of the 'Star Spangled Banner.'

As the mist clears, the dust of a quarry blast settles. The British Empire spreads across the globe, conquered by gunpowder both in war and for more peaceful uses - blasting in mines, quarries and to create railroads.

A dangerous rival to gunpowder: the advent of chemical explosives - nitro glycerine and gun-cotton. Nobel and DuPont symbolise the big business of explosives manufacture. Nobel is featured and his connection to Waltham Abbey explained. The chemical importance of his discoveries is illustrated with a recreation of the "Cordite Scandal" trial.

A fireworks display ushers in the twentieth century and symbolises the end of the road for gunpowder as a major military explosive, and its continued use as part of the spectacle of fireworks.

The armaments race to World War One begins. The story is told by women workers making cordite. The atmosphere of WARGM, with the massive influx of female workers, is contrasted with archive film of guns and shells exploding over the trenches on the Western Front.

The technology of war expands, with many more uses for cordite: torpedoes and machine guns are seen in action. There will be an opportunity here to feature H G Wells' "War of the Worlds" to symbolise the awareness of space but linking this to Waltham Abbey.

World War Two is represented by film of the bouncing bombs, filled with RDX and a recreation in Newton's Pool; the sound-track could be Dambusters theme tune and excerpts of Churchill's speeches. V2 rockets and German scientists: film of V2's descending on London in the final months of the war and perhaps of German launch sites on the Continent.

The post-war years - propellants research - the range of weapons to which WARGM contributed in these years, concentrating on times of war - Korea, the Falklands and the Gulf.

In conclusion, a corridor of filing cabinets show that Waltham Abbey is still secret... The film travels through the corridor of filing cabinets to views of the Waltham Abbey site today. The Chinese monk is seated in a Press House with his original gunpowder, surrounded by trees and rural tranquillity. We have come full circle.

THE ECOLOGY EXHIBITION

A unique interaction between man-made processes and nature can be seen clearly at the Royal Gunpowder Mills. Trees planted to provide charcoal for the gunpowder manufacturing process, and acting as blast screens, combine with aquatic environments in the existing rivers and canals to create a unique series of habitats sheltering a number of important species. The site's ecological importance is reflected in the designation of the northern part as a Site of Special Scientific Interest (SSSI).

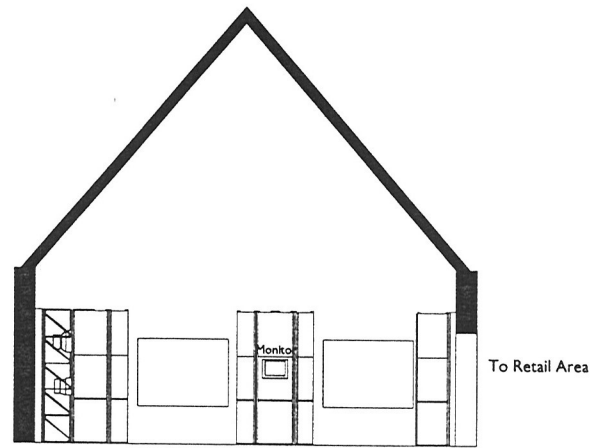
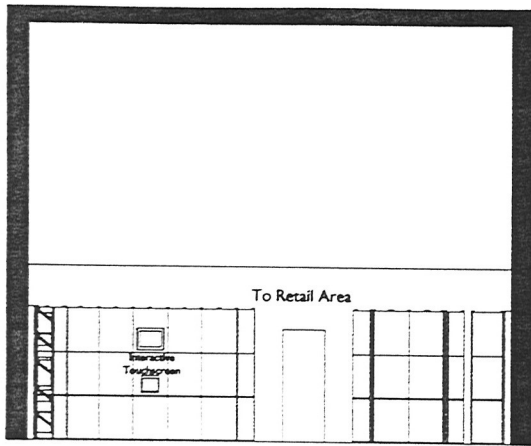
Our present concern for the environment is a relatively new one, dating largely from the years since World War Two. Consequently it would be artificial to impose modern ecological concerns on those who worked at Waltham Abbey in the past. The natural world as it relates to the manufacture of gunpowder will be dealt with as part of the main interpretative exhibition in Building A203. However, we propose to create a specific exhibition about the ecology of the site in Building 201.

The site is to be managed in order to enhance its special wildlife features while allowing controlled access for interpretative purposes. It is important that visitors be made aware of the sensitivities of the site in order that they behave in an appropriate manner during their visit.

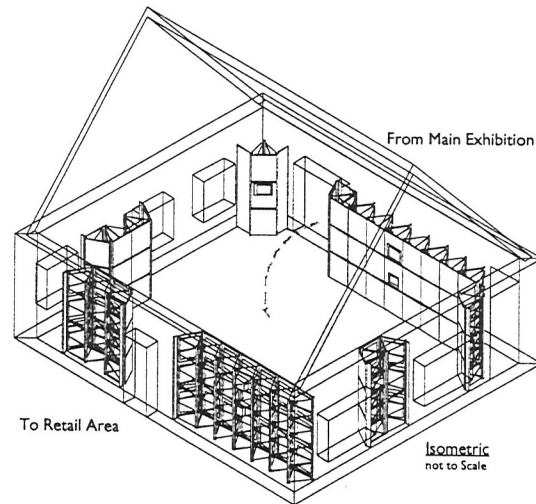
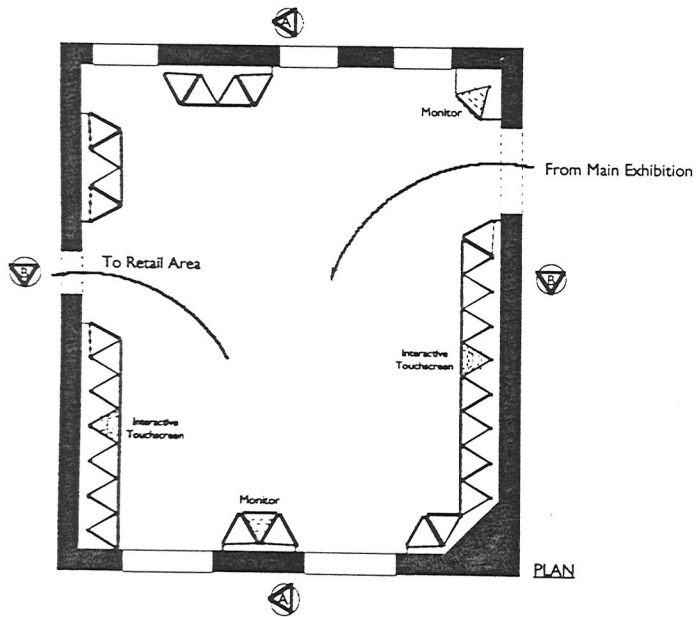
We envisage that specialist groups and schools may come to the site specifically to view the natural environment. A separate ecology exhibition would be useful to meet their needs. The exhibition space will have enough room to allow a warden or teacher to talk to a class. The exhibition is designed to be flexible and capable of change so that, as nature management alters the site, it can be updated. Particular site features can be isolated and given special focus, for example an explanation of the detrimental effects of sycamores on certain areas of the site and the need to remove them in particular instances.

The protected fauna of the site, including the herons, otters, bats, grass snakes and shiny ramshorn snails, will be given special mention. The existence of rare plant species and over-wintering birds will also be included. Some care will be needed to ensure that visitors are not directed to the places where rare fauna and flora are to be found. The diversity and seclusion of the site are its main attractions; it is these themes which will be the core of the presentation. Visitors will be encouraged to play their part in preserving the unique ecological features of Waltham Abbey by keeping to designated walking routes and respecting the natural inhabitants of the site.

ECOLOGY EXHIBITION LAYOUT



0 1 2 3 4 5 metres



EDUCATION

Education can be separated into two strands - formal education - centred on children up to the age of eighteen, usually based around school visits and directly related to the National Curriculum, and informal education, applying equally to adults as well as children and often taking place within a family visit. PRC predictions are that between ten and fifteen percent of the visitors to WARGM will be made by school parties. School parties are not only important in themselves: often families visit on the recommendation of a child in that family who has visited with their school.

The scope for interpretation at Waltham Abbey can be related to all of the National Curriculum core and foundation subjects; however it seems best suited to provide particular insights into History, Science and Technology and Geography. There are also many themes which are cross curricular.

However, a visit to WARGM should not be regarded as "work". It must prolong and stimulate the natural curiosity of children so that they come to enjoy learning, whether that knowledge falls within the parameters of formal education or not. Activities for children are often developed as an addition in exhibition design, rather than as an integrated part of the experience. At Waltham Abbey there is the opportunity to address this issue and make formal and informal education an intrinsic part of any visit.

History

The manufacture of explosives has been carried out at Waltham Abbey for more than three centuries and the landscape and surviving buildings provide dramatic visual evidence of this history. As a government establishment, it is an extremely well- documented, and in the last century, well-photographed site. The combination of these two factors will facilitate educational interpretation and provide a wealth of interesting stories and characters, such as the Congreves, which help to illustrate the story of the site. Running alongside this story is a broader history of politics and wars which are given a dramatic interpretation in the AV-show.

To take Key Stage 2 as an example, the National Curriculum requires that 8-11 year olds “distinguish between different kinds of historical change” and “comment on the usefulness of an historical source” - the historic buildings at Waltham Abbey could be used to serve both these requirements. Historical change can be traced through the re-use of the buildings for different manufacturing processes and the expansion of the factory over time. The buildings themselves, and the archives which are associated with them, can be used to demonstrate to children the many different kinds of historical records which have been left and their relative strengths and weaknesses for constructing a vivid picture of the past.

Science

There is a strong demand from schools for science and technology based visits which Waltham Abbey can meet. Both natural history and technology can be illustrated through the interpretation of the site. The gunpowder and cordite interactive “factories” in the interpretation centre enable children to relate their knowledge and understanding of basic chemical principles to manufacturing processes and their products (as required in Key Stage 3) while the interpretation of the individual buildings allows an understanding of how WARGM functioned as a working factory. In the ecology centre and on the site itself, children can gain an understanding of the particular species which live in the different habitats at Waltham Abbey and look at how humans and nature have interacted, both in a positive and negative way. This ties in with Key Stage 1, which specifies that children “know that different kinds of living things are found in different locations”, Key Stages 2 and 3 and Key Stage 4 which requires that children “understand how materials for growth and energy are transferred through an ecosystem.”

Geography

Attainment Targets for Key Stages 1 and 2 in Geography require that children can follow routes using a plan and recognise the ways in which people have changed the environment while at Key Stage 3 pupils must be able to explain “the effects on selected economic activities of developments in communication and transport systems.” Key Stage 4 specifies that children should be able to “examine critically the concepts of sustainable development, stewardship and conservation.” Waltham Abbey is ideal for teaching children all these skills. Opportunities exist on the site itself, not least for observation, map work and recording activities, which can never be replicated indoors in a classroom.

WALKING ROUTES AND INTERPRETATION

Waltham Abbey is a large site and a key strategy in the orientation exhibition will be the identification of the different route options available for visitors. Visitors are given the choice of visiting the whole site or only part of it according to the time they want to spend walking. Each option is given a time scale, which can be added to the others, so that visitors know what their commitment is likely to be.

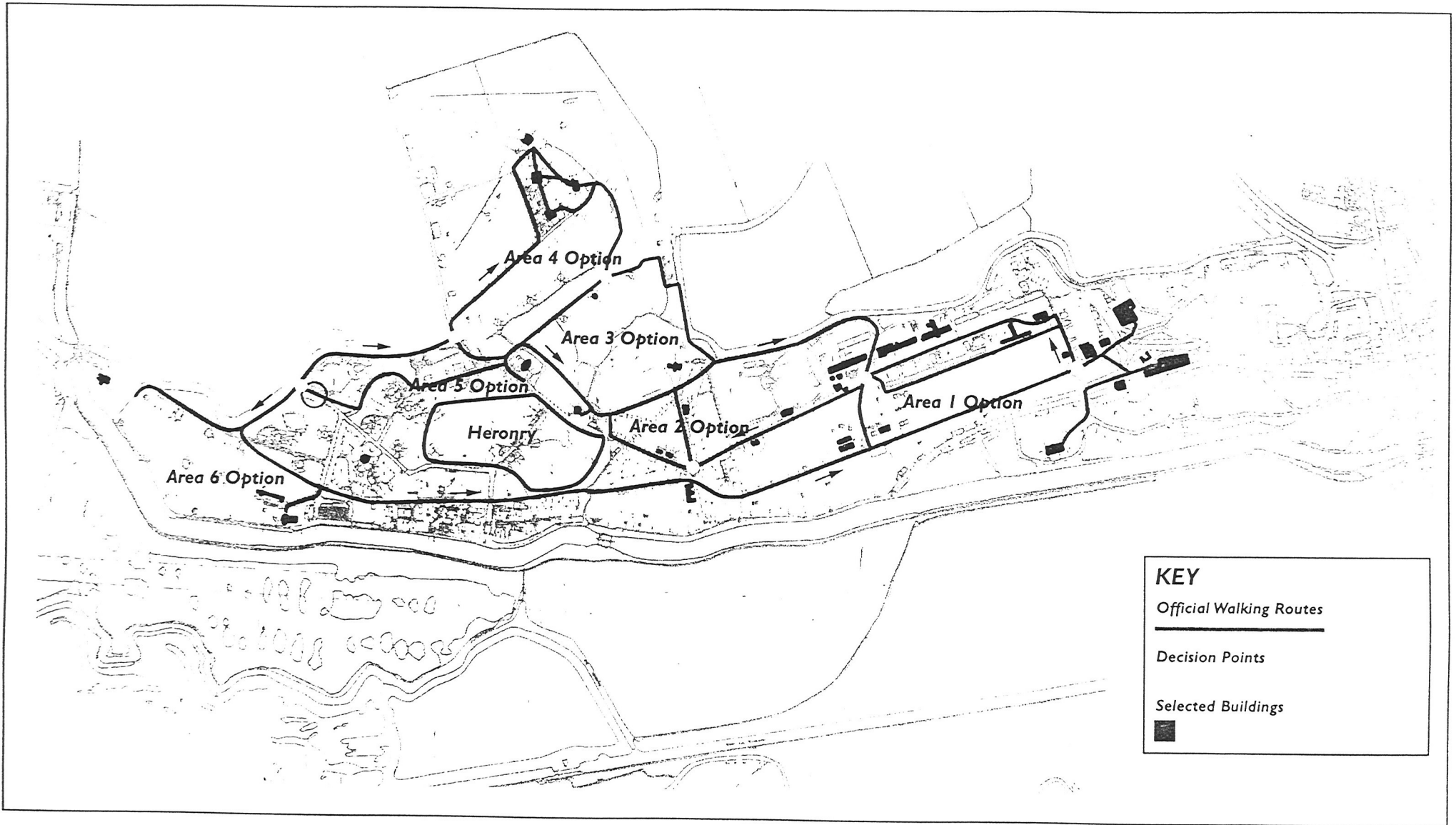
These options will appear on site maps which visitors will receive on arrival.

Option 1

Our interpretative approach recognises that the area around Queens Mead is the critical mass of attractions for interpretation. The first option takes visitors from the Interpretation Building A203 to the site of L169. The site of this building, demolished in an explosion in 1861, is landscaped to reflect the plan of the original building and an interpretative display tells visitors what happened there. The fact that it was destroyed by an explosion reminds visitors that what went on here was a dangerous activity.

Visitors continue from L169 to L157. This building will be largely accessible to visitors, who can walk along the original board-walk and look into the incorporating mill spaces. It is our intention to see one of these recreated as a gunpowder processing plant with the appropriate drive wheels, edge grinders and pans. We do not believe that visitors will understand the architecture and design of the buildings if later phases of production are recreated here. Wherever possible the reconstructions should use 'real' equipment, however, we recognise that some may have to be modern fabrications. A reconstruction of this kind will add immeasurably to visitors understanding of the process and the scale of the equipment used. The Steam Boiler area should be accessible as should the space to its rear. Here we propose to construct a simple graphic display, supported on a scaffolding-like structure, to tell visitors in more detail what went on there and the relationship of the incorporating mills to each other and the site. This will support the broad picture gained in the interpretative exhibition.

WALKING ROUTES



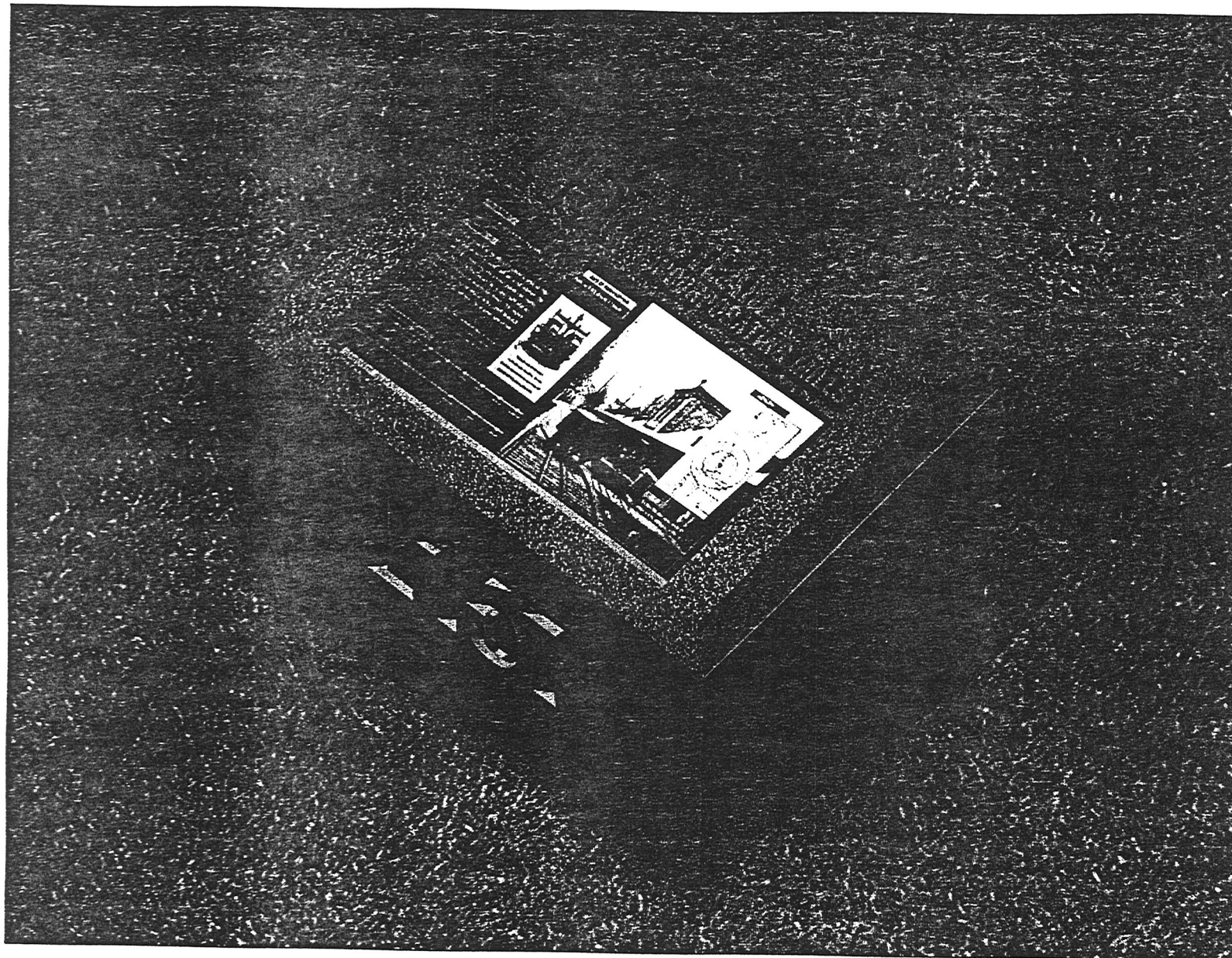
KEY

Official Walking Routes

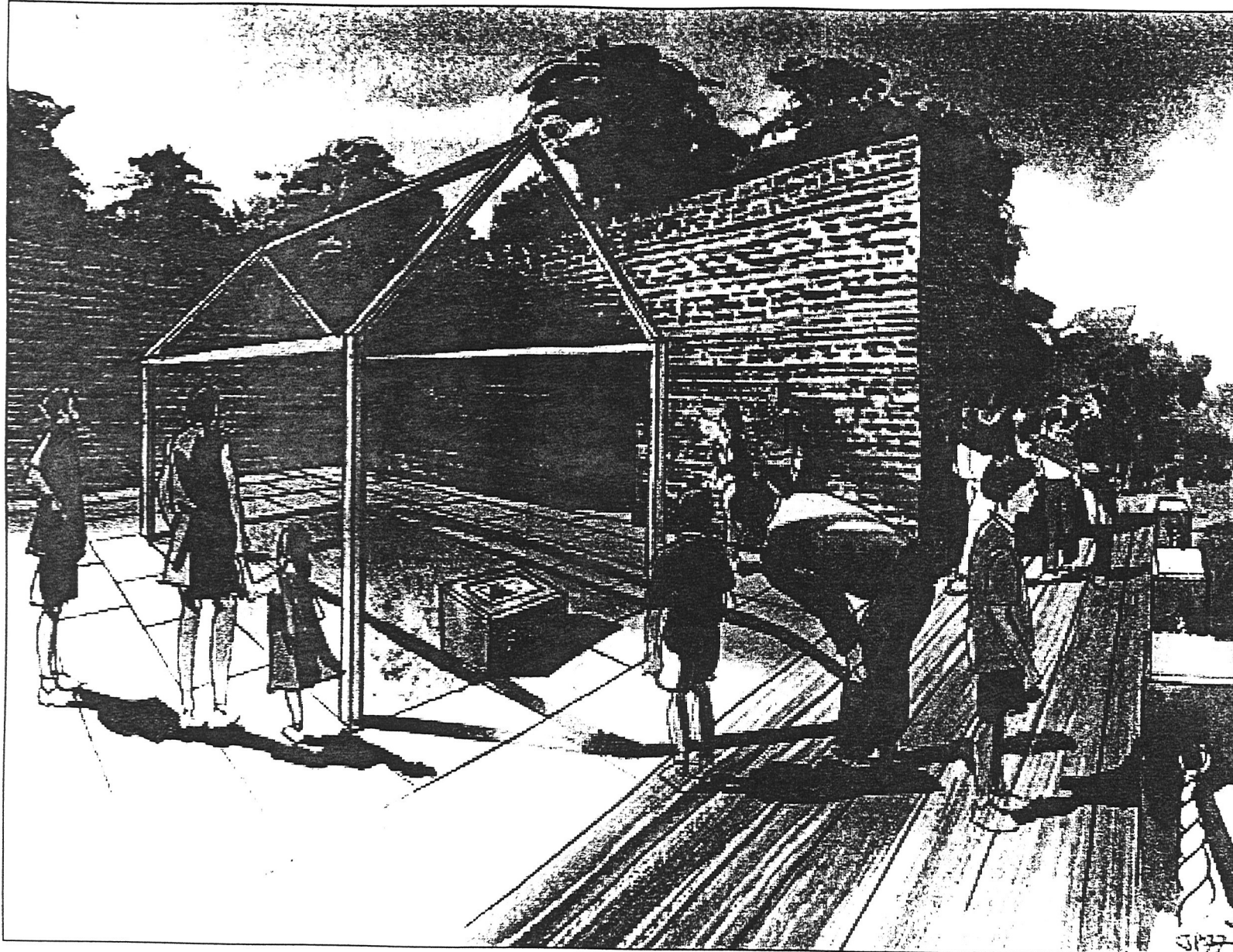
Decision Points

Selected Buildings

EXTERNAL GRAPHIC
SIGNAGE



WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS



EXTERNAL
INTERPRETATION

WALTHAM ABBEY
THE ROYAL GUNPOWDER MILLS

Visitors leave L157, walk to the back of the building and follow the line of the canal. An interpretative display explains the nature of the buildings that visitors can see around them. We recommend recreating a gunpowder barge to float in the canal, into which visitors can look to see the special way in which powder barges were constructed. Continuing along this route visitors will be directed to building L134 where a recreation of a cordite press will be located. Supported by graphic displays visitors will learn about the processes involved and the development of nearby buildings to undertake this new kind of work. Opposite, in part of Building L143, visitors can see a recreation of post-war laboratories supported again by graphic displays. All these spaces have considerable potential for future development but this is dependent upon having a supply of electricity. On popular days, all three recreated areas would lend themselves to first or third person interpretation.

Visitors can then visit the Accumulator Tower L136, and climb to the top to view a vista down the canal towards the 'Burning Ground'. Displays in the building will identify its function and relationship to the rest of the site. This will be the first major decision point for visitors. They can return to the reception building along Long Walk or decide to take up Option 2 that takes them along the route of the canal.

Option 2

Visitors follow the route of the canal along a new walkway towards the Burning Ground. An interpretative display along the route will focus on the interdependency of canals and process buildings. Visitors arriving at the Burning Ground will be guided by an interpretative display explaining the functions of the buildings around this area and its relationship to the canal system. The canal from Buildings RCHM 107/108 to 103/104 should be marked out and the roads at either end taken over it by bridges.

Visitors will be directed to Buildings RCHM 107 and 108. The interpretative display here will explain the function of these buildings as press houses and relate them to the adjacent buildings. It will also draw attention to the early use of concrete. The Burning Ground is another decision point for visitors; they can follow the line of the canal beneath the railway bridge RCHM 113 and there is the possibility of going as far as the viaduct RCHM 112. However, as this is at the corner of the heronry, site management will have to consider creating a barrier and directions pointing visitors back to the line of the railway. These visitors will then meet up with the route crossing the Burning Ground, heading east, to look at Press House RCHM 103. There will then be the opportunity to follow Option 3 or return to the reception building via Queens Mead. Other visitors may choose to turn back at Buildings RCHM 107 and 108 and return via the Long Walk.

All three Press Houses, Buildings RCHM 107/108, 103/104 and S31 (which is less accessible, due to the heronry) would be ideal locations for our proposed frame reconstructions defining the shape of the buildings that would have existed beside the blast walls or within the traverses.

Option 3

Visitors will be directed to the path on the south side of Press House RCHM 103/104, explaining on an interpretative display the early use of corrugated iron, before passing the gas raid shelter. A new footbridge will take visitors over the old River Lea on to a path leading past Buildings S46 -49. An interpretative display in one of the accessible buildings will explain their functions. Where possible, this building should be recreated.

Visitors are then taken on a path through the gun-cotton drying stoves RCHM 98a, 96a and 93a. RCHM 98a will be reconstructed with the remains of the metal drying stoves in their original position. Steam pipes will be recreated around the lower part of the space. An interpretative display will explain what these strange buildings were used for. A path from the right leads down from New Hill but visitors will not be encouraged to follow this route. At the end of the path, visitors see Building S30 and steps leading down into the canal floor.

Visitors can see inside S30 but are not allowed to walk towards the viaduct RCHM 112. At the path junction in front of S30, visitors can choose to follow Option 4, Option 5 or return to Queens Mead, passing Press House S31. Option 4 takes them to the Nitro glycerine Plant on New Hill, Option 5 takes them along the canal bed to Newton's Pool.

Option 4

Visitors enter New Hill from the bailey bridge over Cornmill Stream. They are directed to the right, away from the less attractive parts of the site, along the line of the railway until they reach a left turn. Visitors walk up the hill to the Nitrator S16. Here, interpretative displays explain the process of making nitro-glycerine and its place in the manufacture of cordite. They are made aware that they will follow the route of the nitro-glycerine, marked out by recreated leather-lined gutters. Interpretative displays will explain how each building functioned. Visitors will also be made aware that these buildings were important in post-war research and many of the structures that can be seen now date from this time. Visitors will follow the route downhill past the secured Flume House to a new footbridge over the Cornmill Stream. Visitors can make their way back to Press House RCHM 103/104 to rejoin the path to Queens Mead.

Option 5

Whereas Option 4 has the more sinister and dangerous aspect of Waltham Abbey, Option 5 offers a more romantic vision of the site. Visitors can follow the bed of the canal past Buildings S28 and RCHM 46a to cross over the Old River Lea on viaduct RCHM 250. Two problems exist here: the first is that the viaduct has been partially destroyed and secondly, the water is reappearing just beyond the viaduct. To overcome this, we propose that a footbridge be created across the damaged viaduct and a board-walk and steps be constructed on the far side to take visitors up the canal side. Passing over the viaduct gives excellent views of Newton's Pool. Visitors continue their route to the pool side. Subject to practical issues of management and cost, there may be refreshments available here at certain times of the year. A newly landscaped water edge will provide a picnic space. An interpretative display will explain what can be seen here and recall the early history of this area, including the presence of the Turnpike and Chequer Inn. The World War Two experimental wireway will be renovated. Visitors can walk around the pool and observe the wildlife.

Generally, most visitors will be discouraged from returning on the west side of the site. There are potentially hazardous structures on this part of the site, including the Grand Nitrator, and the cost of securing the buildings would probably be too high in this first phase. As a rule visitors will be encouraged to take up Option 4 or return along the roadway on the east side back to Queens Mead.

Option 6

This option is likely to attract those with a real interest in the site rather than a general member of the public seeking a pleasant day out. It includes the Grand Magazine, perhaps a rather overstated description, the Quinan Stove, the Teteryl Factory and the Grand Nitrator. As this last structure is relatively unsound, and no other buildings linked to it can be made public, the site on New Hill is more illuminating and exciting for the explanation of the nitro glycerine manufacturing process. This route also runs close to the heronry and we would wish to discourage visitors from using this way back. Interpretative displays will be provided for those who do pass this way.

In conclusion, the routes allow visitors to choose how much they want to see. The final routing of paths has been largely governed by the existence of the heronry. The routes available for visitors are likely to change as the heronry moves. The interpretative displays will be carefully structured to make links to the phases of each building, their place in each process and their relationship to other buildings on the site. They are designed to be interesting and informative walks that will add to visitors sum total of knowledge about the history of gunpowder, cordite, explosives and propellants.

VISITOR TRANSPORT

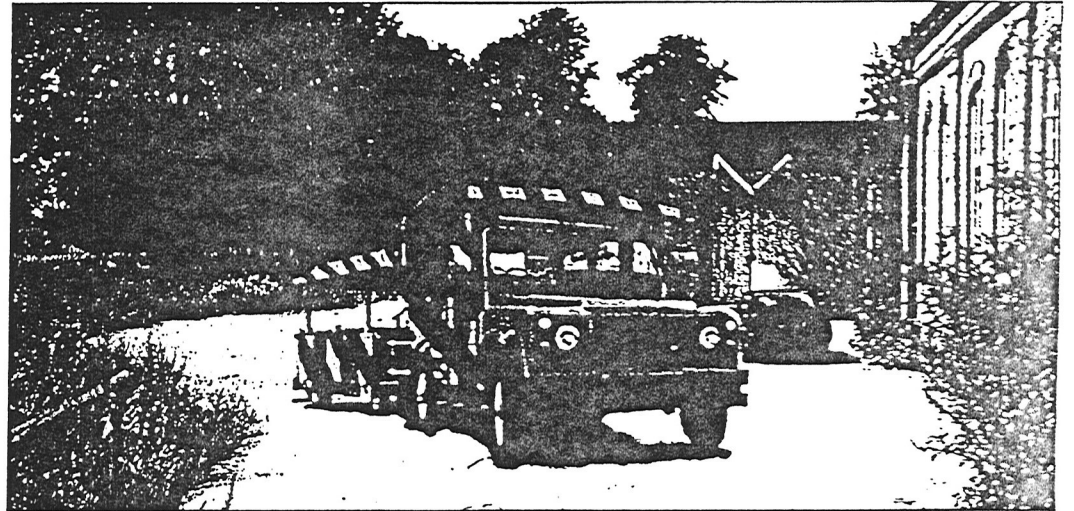
For the infirm, visitors with young children, nursing mothers and the physically disabled, access to Waltham Abbey Royal Gunpowder Mills is restricted. A site of this size is comparable to a theme park in area. The availability of some form of transport will be an essential requirement for many visitors. We reviewed the opportunities for a "stop and ride" system throughout the site and came to the conclusion that if this were possible, it should follow a loop around the site with a series of bus stops where visitors could wait for the service. The problem that became apparent was that the transport system would very likely interfere with the heronry. Although the birds are used to vehicles moving about, the danger was that the natural fall-off of visitors further north on the site, who would normally be deterred by the walking distances involved, would be reduced and more visitors would find their way into the sensitive areas of the site by using the transport system as a way of travelling further afield. A second problem was that, by following the intended transport route, visitors could end up on the less safe areas to the west of the site which we had previously wished to discourage.

The solution that has been agreed involves creating a transport system that can be used in a flexible manner and without detriment to the natural environment. The transport system should be based on a Land Rover modified to carry visitors. This would circulate around Queens Mead at regular intervals, at times decided by the management, to meet visitor demand. Any visitor in the Queens Mead area could ride back to the visitor reception or interpretative buildings. It would also help to get less able visitors from the reception to the interpretative buildings.

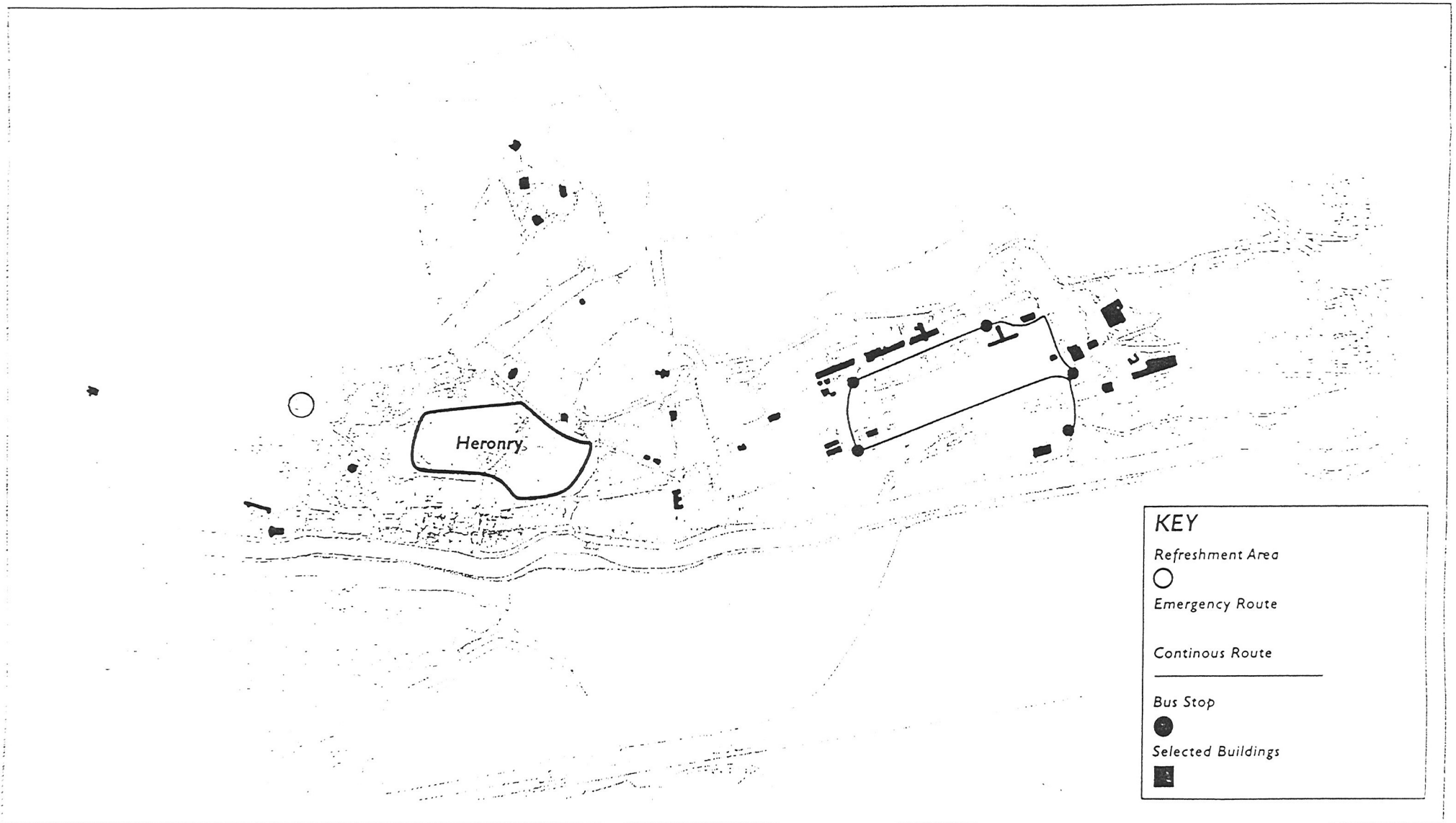
The use of the transport system elsewhere on the site would be associated principally with safety and security. There will be a need to check on the whereabouts of any visitors near to the site closing time; the Land Rover would collect them if they were too far away to get back in time. It would also be used as a rescue vehicle for any visitor who had overreached their ability and was too tired to make the journey back to the reception.

On Bank Holidays or at other popular times during the summer months, the Land Rover could be used to bring a refreshment trailer and a mobile toilet facility to Newton's Pool. The trailer would also act as an information point and give visitors access to an emergency telephone.

The Land Rover would undertake a more workaday role delivering crews and equipment to developing areas of the site.



VISITOR TRANSPORT ROUTES



THE NEXT STEPS

1. Validation of Concept Design

The Concept Design should be evaluated by members of the client team and by external expert consultees. The evaluation criteria should include:

- *Potential to attract and entertain the public*
- *Appropriate coverage of the subject*
- *Relevance to National Curriculum*
- *Potential for change and development*
- *Compliance with budget and programme*
- *Implications on building design*

The evaluation exercise may identify areas for further development, or Concept Design proposals which are likely to be unsuccessful. There will therefore be the need to refine the Concept Design in the light of the evaluation, possibly taking the plan to a further level of detail prior to its adoption by the client.

interpretative design process moves through detail design. Although final determinations on these elements is not made until the end of the detail design phase, a reasonable level of certainty can be achieved during the first few months.

The designer will begin to identify and work with a preferred list of suppliers and sub-contractors as the designs move into the final phases of detail design. Preference for local firms and adherence with any EU procurement directives will be taken into account. This will also allow us to modify the designs and specifications at a relatively early stage to accommodate local conditions and suppliers own creative input.

Summary of Deliverables at the end of Detail Design:-

- i. *Final script treatments for all attractions.*
- ii. *Detail design and specifications for floor plans, elevations, details, decorations, and finishes for all parts of the interpretation (exc. including graphics).*
- iii. *Detail design views of all essential interpretative elements.*
- iv. *Basic performance requirements and performance specifications for all interpretative elements.*
- v. *Basic mechanical, electrical and utility requirements for each element.*
- vi. *Schematic white model of the entire facility.*
- vii. *Finalised operational plan (capacities, flow, etc.)*
- viii. *Identification of preferred consultants and sub-contractors.*
- ix. *Exhibit database.*
- x. *Detailed cost estimate.*
- xi. *Design and implementation programme including milestones.*

The various work stages from this point forward begin to overlap as decisions are made concerning the selection of suppliers and sub-contractors.

Final design of all interpretative elements is completed during the detail design stage. Production and fabrication documents will then be developed to whatever level of detail is required by each individual supplier for each individual element.

The designer will provide project management and art direction for each of the suppliers and sub-contractors as the attractions move from the documentation stage to the actual production and fabrication stage. Such management and art direction will ensure the design integrity of the interpretation. Continual interface with architects and engineers throughout all the above stages is necessary to ensure as smooth an integration as possible with the attractions and the building.

The designer will supply the supervision for all interpretative elements and on-site art direction during the installation and testing stages.

4. *Costing and Sourcing*

As designs become increasingly more developed, costs can be predicted with a greater degree of accuracy. It is the responsibility of the designer, working closely with the client, to make modifications and adjustments to the various attractions within the Royal Gunpowder Mills in order to ensure that budget integrity is maintained. During the next phases of design, suppliers, consultants and sub-contractors will be identified to assist with the costing process for each element.

During the next phases of design, speciality design consultants in such areas as sound design, lighting design and media design will be identified as necessary. Every effort will be made to develop a process which is the most cost efficient and which maximises the utilisation of local resources. Sources within the worlds of theatre, motion pictures, television and special effects will be investigated in order to identify individuals and firms which will complement the design and production team.

5. Schedule

The designer's brief requires us to provide a schedule to the end of 1999. Some flexibility within the timetable can be accommodated in the latter stages.

The following schedule is recommended. It must be noted that the time from the final period of the detail design stage through installation contains many overlapping stages. Therefore, the following is merely an indication of general scheduling milestones.

<i>i.</i>	<i>Completion of concept design stage</i>	<i>12 November 1997</i>
<i>ii.</i>	<i>Validation and appointment to</i>	<i>2 January 1998</i>
<i>iii.</i>	<i>Completion of detail design stage</i>	<i>13 November 1998</i>
<i>iv.</i>	<i>Approval by client</i>	<i>13 - 30 November 1998</i>
<i>v.</i>	<i>Begin production and fabrication documents</i>	<i>1 December 1998</i>
<i>vi.</i>	<i>Approval by client</i>	<i>14 - 28 February 1999</i>
<i>vii.</i>	<i>Begin some production and fabrication</i>	<i>2 April 1999</i>
<i>viii.</i>	<i>Begin installation</i>	<i>1 July 1999</i>
<i>ix.</i>	<i>Complete exhibit fabrication and production</i>	<i>15 October 1999</i>
<i>x.</i>	<i>Complete installation and commissioning</i>	<i>15 November 1999</i>
<i>xi.</i>	<i>Training begins</i>	<i>15 November 1999</i>
<i>xii.</i>	<i>Ready for Opening</i>	<i>15 December 1999</i>

6. Maintenance

Design and manufacturer's handbooks and as-built specifications for the interpretative scheme identifying all equipment and maintenance requirements will be passed over to the client. The designer will ensure that appropriate staff are given instruction by manufacturers to ensure that equipment is properly maintained and faults located where they might occur.

7. Retention Period

The designer will continue to manage the project until the contractors' retention period is complete.