

## FAST TRACK TO GLORY

### THE CRYSTAL PALACE AND THE GREAT EXHIBITION OF 1851

**Presented by. Mr. Ernest Andrews, Past President  
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(Joint with the Institution of Operations Engineers)**

The Great Exhibition of the Industry of all Nations was conceived by a small group of members of the Royal Society of Arts as a result of their visits to French national exhibitions during the 1840's, and experience gained from the Society's own small art and manufactures exhibitions in London. This group led by the self educated man Henry Cole, Assistant Keeper of the Public Records Office, as well as being an arts magazine publisher, arts patron and designer, managed in 1849 to persuade Prince Albert to support their proposal to hold an international exhibition. He agreed to become its patron, and eventually the manager of the project. The Prince became very enthusiastic and persuaded the government to set up a Royal Commission to "*inquire into the general conduct of the exhibition, the most suitable site of the exhibition building, and the best way of determining the nature of the prizes and their impartial distribution*". He agreed to head the Commission and to take on the lead role on the understanding that finance would be by private subscriptions only. There should not be any call upon public funds. From January 1850 until the exhibition opened on the 1<sup>st</sup> May 1851 Albert worked long hours on the project and his main committee of 24 men from many walks of life met every week until the exhibition opened.

The proposal gained the support of renowned politician Robert Peel, engineers such as I.K. Brunell, Robert Stephenson and John Scott Russell, and architects Charles Barry, Owen Jones and others. However whilst these gave their support in principle they could not agree between themselves about much of the detail.

Cole and others from the Society toured the country encouraging support from possible exhibitors. Initially the response was weak but improved greatly when the Prince staked his reputation by giving his public support to the scheme and the fund raising efforts. Soon support from British manufacturers and other exhibitors demanded 400,000 sq.ft. of show space and it was estimated that the same area would be required to show foreign entries.

Despite much opposition in Parliament, and amongst the residents of London, Prince Albert's proposal that a suitable building to house the exhibition should be erected on a 26 acre site in Hyde Park at an estimated cost of £100,000 was finally accepted. Consequently a building committee, which met every 4 days, was set up to prepare a specification for a suitable building and arrange for its construction. The committee, including the above mentioned engineers and architects, after wasting time reconsidering the choice of site, decided that a building of 800,000 sq. ft. i.e. big enough to envelop several of the world's largest buildings ever known, needed to be the cheapest per unit volume ever achieved, and must be erected in weeks. In addition, they required that it must be taken away after use leaving the site as it was before construction began. Unaware how this might be achieved, in March 1850, the Committee issued an international invitation for "suggestions as to the general arrangement of the ground plan of the building", and required responses within 25 days.

None of the 233 proposals received met with the committee's approval. After the entries were put on public display two of them gained special mention but were rejected on the basis of time and cost. Both used buildings constructed of iron and glass. One was from a Dublin contractor who had recently completed the glass house at Kew, and the other from the designer of 'Les Halles' markets in Paris.

Having got no suitable submission the Building Committee decided to design a building themselves based on ideas gleaned from several of the entries. However they rejected iron & glass construction and under the influence of Barry (the architect for the Houses of Parliament), and Brunell, the building ended up as one requiring 17 million bricks, with a dome 200ft. diameter and 150ft. high (larger than either St. Pauls or St. Peter's in Rome). The number of bricks required were beyond the ability of the brick manufacturers to produce in time, and to meet the time table all the brickwork would have had to be laid over the winter months. Though this scheme when published received wide condemnation from press and public alike, the Committee stubbornly neglected this and in June 1850, invited tenders for its construction.

At this point Joseph Paxton became interested in the scheme. Paxton was another hard working self educated man with plenty of drive and imagination. He was made head gardener for the Duke of Devonshire at Chatsworth at the age of 23 and, two years later in 1826, became the manager of the estate. By 1849 he was a director of the Midland Railway, had founded the "Daily News" with Charles Dickens as the Editor, and designed and constructed two cast iron and glass buildings at Chatsworth incorporating folded plate roofs of glass mounted in wooden members supported off his patented structural wooden gutter. Both, one the Chatsworth Stove conservatory (277 feet long, 123 feet wide and 67 ft high), and the other, a smaller building to house a new "Victoria Regia" lilly, used cast iron columns, and composite timber and wrought and cast iron girders, gutters and arches. For both buildings Chance Brothers of Birmingham under pressure from Paxton produced in bulk panes of glass larger than anything previously manufactured.

Although he had not seen the Building Committee's scheme Paxton knew of the adverse reaction to it and told a fellow Midland Railway director, and Royal Commission member, of an idea he had for a building based on the latter buildings and was encouraged by him to present more details of it. He then took the opportunity during a Midland Railway meeting to sketch, on a piece of blotting paper, (now in the V & A) a cross section of his proposed building and then he and his staff at Chatsworth worked long

hours for 8 days to produce a set of drawings including a perspective of his proposal. During a chance meeting on a train to London these were shown to Robert Stephenson who was impressed and said that he would support their submission to the Building Committee. However this was not enamoured with Paxton's proposal and rejected the scheme out of hand. So Paxton used his influence to have his perspective published in the London Illustrated News. This resulted in his building receiving great public support and Cole, at Paxton's suggestion, persuaded the Building Committee to allow tenderers for its building to also submit their own alternative proposals.

With time to the proposed date of the exhibition opening (May 1<sup>st</sup> 1851) getting ever shorter and Prince Albert beginning to despair of the programme ever being met Paxton's proposal gained his and Queen Victoria's approval. So with this encouragement Paxton swiftly formed a contractual relationship with railway and general engineering contractors Fox Henderson of Smethick, and glass manufacturers Chance Brothers. Fox Henderson developed details for Paxton's building and submitted a tender for it. The tender for this was much cheaper than for the Building Committee's scheme (which they stated could not be built in time) and was £79800 (£5.6 million at 2002 costs) if it remained Fox Henderson's property.

Paxton's original proposal was for a building of constant cross section 1848ft (563m) long x 456ft (139m) wide with a central nave 64ft (19.5m) high. However, because of the worries of Fox Henderson about lateral stability, coupled with the Royal Commission's concerns about some large trees on the site, an arch roofed lateral transept was incorporated, and this added much to the external and internal aspects of the building. The whole of the building was of iron, wood and glass constructed on a 24ft (7.3m) grid using panes of glass 49" x 10". The 2658 girders for spans of 24 ft., 48 ft. and 72ft, were of either cast iron, wrought iron or wood or combinations of these. All were of the same depth and all used cast iron ends designed to slot into standard cast iron sections in the cast iron columns and held there by metal or oak keys. The whole building used 896,000 sq.ft. (400 tons) of glass, 700 tons of wrought iron, 3800 tons of cast iron and 600,000 cu.ft. of timber, 34 miles of gutter and 202 miles of sash bars. Including the galleries the building had a floor area of 23.4 acres and incorporated 8 miles of display tables. So huge and unique was the building, and so rapid was its construction that steps had to be taken to control visitors. This was done by making a charge of 5 shillings per head (£17.50 in 2002), the sums raised being distributed amongst all site workers. These averaged 200 in number with a peak of 2260.

Work on the site began in August 1850 and continued during the winter. Men worked long hours throughout on site erecting and making girders, sash bars and much timber work, using machines designed especially for the job driven by steam engines from small boilers. Pickfords ran a shuttle service between Euston and Hyde Park delivering as many as 50 cast iron girders and masses of columns daily. The 1074 cast iron base sections for all columns were set very accurately on concrete on the site gravel and the columns were then bolted to these at rates up to 310 per week. Concern about the load bearing capacity of the galleries led to a series of tests witnessed by both Queen Victoria and Prince Albert involving in one case 300 soldiers jumping up and down on a 24ft square section.

Architect Owen Jones designed balustrades to galleries and stairs, and a multicolour painting and decoration scheme which included the use of large coloured drapes. The effect of this scheme combined with the diffused light emanating from the roof glazing, shaded with canvas to prevent glare and overheating, was one of the buildings most striking features.

Construction, free of all but minor injuries, was rapid (even by today's standards) and exactly 4 months after site work began the interior was ready for reception of exhibits. The catalogue compiler set up his office on site on the 21<sup>st</sup>. January 1851 and the building was handed over to the Commissioners on the 1<sup>st</sup>. February. However painting, which had involved as many as 400 painters, was not quite complete and some rainwater leaks were being attended to. Both these tasks were still in being until the day before the opening.

Once the building was available Pickfords and others concentrated on bringing the 17000 exhibits to the site. Half of these were British the remainder being from a large number of countries and colonies. Some of these, requiring steam supplied from a separate boiler house with 4 boilers by Galloway of Manchester. included automated textile machinery, steam hammers and the like were large and required on-site erection. They proved to be extremely popular.

On the 30<sup>th</sup> April soldiers cleared the building of people and rubbish, and the cataloguer added his last items at 10pm. Next morning 10000 printed, bound and stitched catalogues were delivered including two for Victoria and Albert which were bound in rich morocco, lined with silk and gilded. Victoria opened the exhibition at 9.0 am. and it proved to be a great success. It was visited by 6million people, as many as 93,000 in the building at once, and raised £424,418. (£30 million) The greatest number of tickets sold cost 1 shilling (£3.50) and this price led to vast numbers of people coming on special outings from all over the country on the new railway system. Their influx into London, rather than cause the problems that were once feared, brought trade and led to the establishment of such firms as Harrods. It led to the construction of public toilets in London, a trend which other cities and towns soon followed.

After the exhibition closed in October 1851 the building was taken away by Fox Henderson who with Paxton set up a separate company to enlarge and rebuild it at Sydenham in an area now known as Crystal Palace. There it remained set in gardens of 120 acres until burnt down in 1936. But its benefit continues because the profits led to the establishment of the V&A, the Albert Hall, Imperial College, the Natural History Museum and the Royal College of Music. The Royal Commission still exists as an educational trust with funds which now total £34 million.

