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# CORNERSTONE

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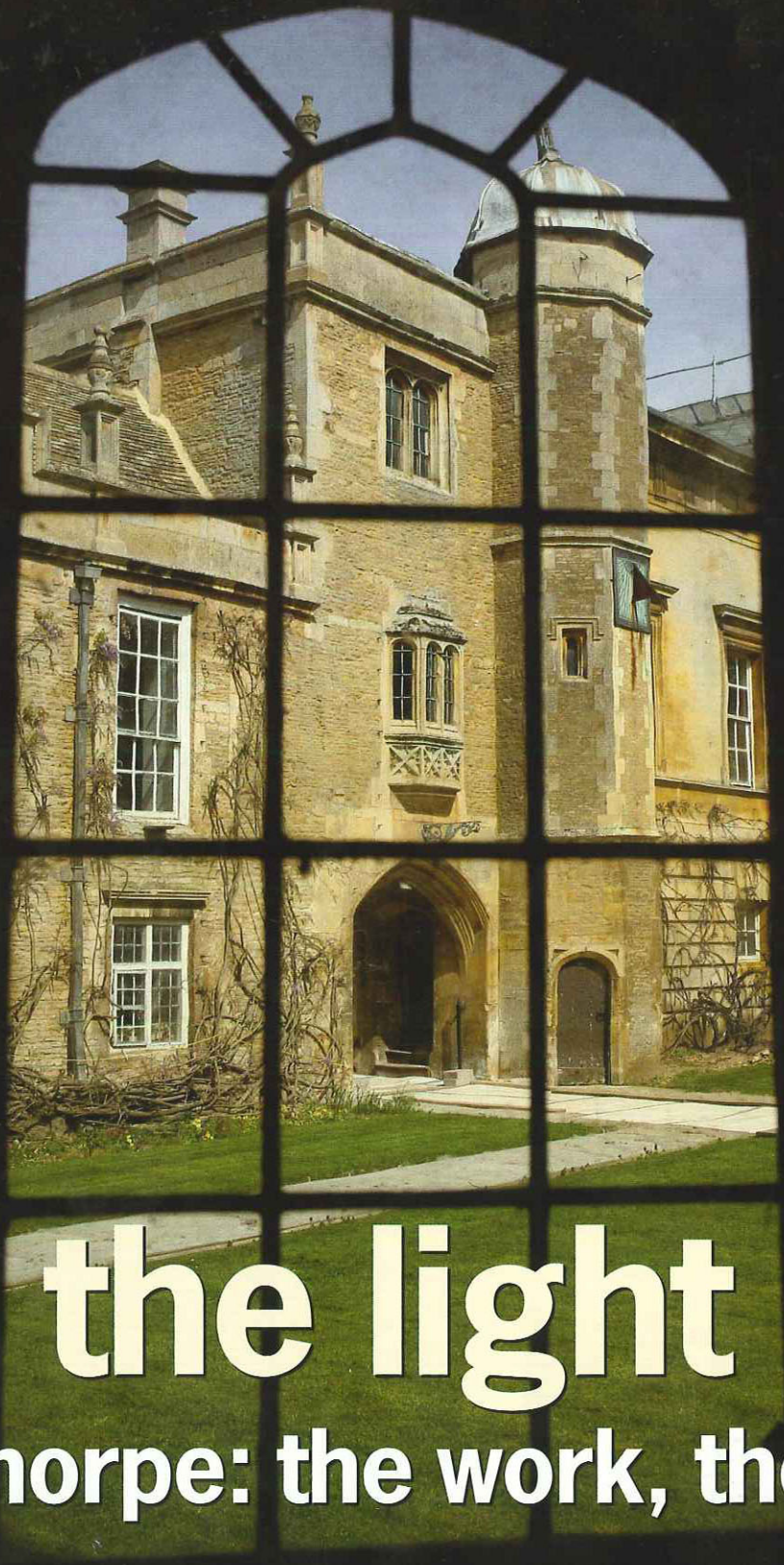

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# Apethorpe arising

ALL PHOTOGRAPHS: ENGLISH HERITAGE

**It is one of the largest single repair and refurbishment projects ever undertaken by English Heritage, calling on the skills of a wide variety of specialists and craftspeople. On page six of this edition of 'Cornerstone' we visit the site now, while here and on the following pages the experts tell of their work – after the momentous compulsory purchase in 2004 the vital second stage to save and prepare this Jacobean gem for an eventual new owner.**
**First, *Mark Balkham*, *Stephen Oliver* and *Stafford Holmes* of architects Rodney Melville & Partners**

Rodney Melville & Partners were appointed Architect for the Phase 1 repair programme in May 2005. Although not necessarily immediately apparent from the exterior, much damage had taken place internally due to leaking roofs and parapet gutters together with blocked sumps and rainwater downpipes. This had resulted in failed ceiling structures, floor structures and damaged plasterwork. To avoid the potential complete collapse of some of the most important decorative plaster ceilings, crash decks had been installed during previous Urgent Works below ceilings in most of the first floor East and South Range principal rooms including the Long Gallery. Plaster had fallen from the Long Gallery ceiling and sections of the highly decorative cornice had also fallen from the north wall of the Great Chamber. Temporary repairs to Collyweston roof slopes including "Flashband" repairs to leaking flat roof areas and gutters had also been carried out following the serving of several Urgent Works Notices. However, those urgent works carried out had a limited life expectancy.

**Left, Martin Stapleton of E Bowman & Sons repairs the Long Gallery panelling. Above, the East Range roof before repair**

It was recognised that a major scope of repairs was required to the Collyweston slated roof slopes over the East Range. With advice and guidance provided by both Terry Hughes (Slate and Stone Consultants) and David Ellis, Collyweston slater, proposals were developed for re-slating the East Range roofs. This was considered one of the biggest challenges as Collyweston slate is no longer quarried and new slate is currently unavailable. During the enabling works, trial areas of slate from the East Range were removed to establish the potential salvageable quantity of slates that might be achieved. The proposed removal of the 1950s Collyweston-slated Hunting Way semi-detached houses on the site provided the possibility of reusing Collyweston slates from the semis to make up any shortfall. Following trials, it was established that approximately 50 per cent of the Collyweston slates on the East Range were likely to be salvaged for reuse although expectations have been exceeded with approximately 70 per cent now being reused. Slates are being refixed and spot bedded and pointed using hydraulic lime mortars with provision for bat access. To provide added protection, slates have been fixed over a vapour permeable sarking felt. Sample areas of slating were carried out before proceeding to discuss and establish criteria in relation to quality of workmanship. The Collyweston slating is being carried out to a very high standard by E Bowman & Sons' own Collyweston slaters.

**Above, some of the lavish ceilings, this section in the Great Chamber, 1620s. Left, Collyweston slate being laid – work by Bowman's**

Failed lead linings to parapet gutters and lead sheet to flat roof areas are being replaced with new sand-cast lead to improved details. Where the leadwork has failed due to over-sized lead bays to parapet gutters and where the introduction of reduced lengths of lead sheet have not been possible, terne-coated stainless steel linings have been introduced to avoid potential future failure due to thermal movement. Damaged lead hoppers and downpipes to the East and South Ranges have been removed and repaired for refixing. Many of the hopper heads are finely detailed and some date from 1624. All the leadwork roofing and repairs are being carried out by CEL Ltd.

The House is built from King's Cliffe oolitic limestone. The stonework to the East and South Ranges is extremely high quality with very fine joints to the ashlar stonework. More than 850 examples of approximately 60 different masons' marks have been recorded. The marks reveal specialisation amongst the masons at Apethorpe.

Generally, the stonework is in good condition, although extensive areas of pointing had failed at high level, in particular to the chimneys, copings and other weathering details. In addition, some inappropriate cementitious pointing had been carried out to extensive areas of the coursed dressed rubble stonework to the South Range. Large areas of pointing had fractured and had become detached from the stonework. Damage had also occurred through corroded iron fixings to some of the chimneys and gables.

As King's Cliffe stone is no longer quarried, extensive research was carried out to find suitable alternatives. English Heritage was fortunate in having a stock of Weldon stone (also now no longer quarried) at nearby Kirby Hall, some of which has been used for the repairs. Clipsham stone has been used for repairs to weathering details. A range of lime mortars were prepared for matching and selection. Different mortar strengths with varying aggregate sizes have been used to suit joint sizes and exposure. Repairs to damaged stonework have included isolated replacement, piecing-in and mortar repairs depending on the detail, location and severity of the decay. Masonry repairs are carefully being carried out by Bowman's own masons.

Leaded light windows to both the East and South Ranges were damaged. Some of the leaded lights had previously been replaced by single plate glass panels with "stuck on" lead cames. Some of the joinery sections to the dormer windows to the East Range and sash windows to the South Range had decayed and paint finishes had failed. Extensive repairs to the leaded light windows, metal casements and timber windows have now been


**Far left, one of Bowman's stonemasons repoints the East Range gable. Left, one of more than 800 masons' marks found at Apethorpe, this one on a fireplace**

carried out using a variety of techniques. Damaged leaded lights have been removed and repaired in the workshop. Modern plate glass panels have been removed and replaced using Polish cylinder glass and "proper" lead cames introduced to match the original details. Damaged timber sections to the dormer windows and sash windows have been repaired by using piecing-in techniques. The leaded lights and metal casement windows have been repaired by Chapel Studios. Timber window repairs have been carried out by Bowman's own joiners on site.

The decorative plasterwork ceilings at Apethorpe Hall are among the most important in the country. Dr Clare Gapper's report to English Heritage on the history of the ceilings commences by noting that the first three decades of the 17th century witnessed the full flowering of the English style of plasterwork. This had emerged during the course of the previous century and steadily developed until the height of its elaboration in the 1620s. Apethorpe is one of the few houses that survive with a nearly complete sequence of decorative plasterwork dating from the 17th century. Blickling Hall, Norfolk; Albyns, Essex; and Aston Hall, Birmingham, provide the closest parallels to Apethorpe.

Defects to the ceilings at the time of acquisition by English Heritage were directly related to the normal decay mechanisms associated with water ingress from failing roof finishes and gutters. These defects included timber decay to wall plates, joist ends, beams, ceiling laths and cornice brackets. The majority of serious defects were located close to or at ceiling-to-wall junctions. The most serious failures were to the north cornice of the Great Chamber and the Long Gallery ceiling adjacent to the west cornice and at the north end of the Long Gallery, below a failed beam. These areas had suffered partial collapse and some loss of original material.

A detailed investigation and survey of the ceilings' precise condition was carried out in conjunction with expert plasterer Jeff Orton in order to prepare a general specification for tender purposes. This was followed by particular specifications as the crash decks were removed and temporary supports installed. Failed and defective areas were examined, recorded in detail and scheduled. Research into the existing plasterwork was carried out and included chemical and particle size analysis to determine the type and composition of aggregates and binders. Research, analysis and development of the lime plaster mixes were informed by the earlier research for the lime mortar repairs. There is a long history and clear evidence of the extensive use of limestone in the area for the full range of building types, construction and finishes. It is not surprising therefore that crushed local oolitic limestone particles, appropriately graded, proved to be the best aggregate for matching the majority of the original plaster and mortar mixes.

Extensive removal of thick layers of modern paint was led by Bowman's conservators, following paint analysis. Philip Gaches was appointed to carry out the major programme of plaster repairs. Specialist conservation was required in many areas, in particular to the west side of the Long Gallery where ceiling laths needed strengthening, extending and additional support which was provided by purpose made hangers.

The partial collapse and detachment of the Great Chamber north cornice was a major conservation and repair challenge. The option of reforming new support brackets and running a new cornice to replace the fallen section was considered. Following trials, however, it was found possible to salvage and conserve the majority of the original cornice despite the absence of the timber support brackets which had been lost due to decay. Reconstructing the brackets in full was not an option as conservation of the run and embellished cornice precluded lathing up and running new. Refixing and making good the original cornice fragments was a delicate task involving the careful and accurate insertion of stainless steel rods through pre-drilled holes to support the replaced cornice sections.

The overall pattern and uniformity of finish to the ceilings was completed by hand modelling and repairs, with great attention to detail using plaster mixes and techniques which closely matched the varying periods and styles of the original. *Continues on page 38.*

*Continues from page 35*

The oak panelled Long Gallery occupies almost the whole of the first floor of the East Range. The walls are lined in full height oak panelling, divided into sections by Corinthian pilasters. It was apparent that many of the upper panels had been crushed by the distortion of the ceiling above. Some areas were affected by timber decay and death watch beetle due to leaks through the roof above, and many of the panel fixings were unsound.

All the panels and pilasters have been carefully taken down to enable recording, inspection and repair. This had to be carefully co-ordinated with the main sequence of working to repair the floor and ceiling above, and manhandling of the panels was a particular challenge until the crash deck and its scaffold base had been removed. Conservative repair techniques were used, following a masterclass held in the Long Gallery with Ray Stevens, the National Trust's joiner at Hardwick Hall and a former William Morris Craft Fellow. The aim of these techniques was to reduce the amount of historic timber lost when carrying out conventional piecing-in repairs. Stainless steel patch plates, thin enough to be bent to suit the irregular shape of the rear face of the panelling members, were used to reinforce failed mortice and tenon joints. They have also been used, with oak packers, to gently push the crushed upper panels back into shape, so that the split ends of timbers could be woven back together without the need for glue.

Examination of the rear of the panels showed evidence of the former arrangement where the centre of each panel was occupied by an oil painting. These had been skilfully infilled with matching panelling as part of Sir Reginald Blomfield's work. Later repairs in oak-faced plywood had not been as sympathetic, and these have been replaced with properly constructed oak panels. Work is underway to polish the panelling and pilasters, following repair, using French polishing techniques to tone new work in with the old.

It has been, and continues to be, a privilege to work with English Heritage on this project. The efforts of E Bowman & Sons, main contractor for the Phase 1 repairs, have made a major contribution to the revitalisation of a most important building.

**The Long Gallery – some 33m, in fact – under repair last year. Structural problems had to be rectified before plasterwork could be cleaned and conserved**

## Roof structure repair

### Richard Swift, Structural Engineer, SFK Consulting

The Long Gallery in the East Range, is 33 metres in length and has a very fine Jacobean ceiling, which is fixed directly to the underside of the second floor dormer roof structure. Failures in the roof covering and deflection of the main supporting beams led to several leaks through this fine ceiling. There are 18 primary horizontal timber beams supporting the second floor over the Long Gallery and other principal rooms. These oak beams are approximately 325mm square and span 7m and support the second floor accommodation and the heavy Collyweston roof covering.

The roof structure is of an unusual form in that the principal roof frames do not always correspond with the primary horizontal timber beams. On the east slope of the roof, the principal rafters incorporate a knee joint to a vertical post so that space is available for a walkway behind the parapet gutter.

The main point of weakness of this roof therefore is the knee joint of the east slope of the principal rafters. Most of these joints have failed and the roof frames slumped sideways toward the east. The horizontal movement of this joint is up to 180mm. As a consequence of this movement, many of the roof frame joints have opened and the ridge has dropped. The eaves line also varies greatly. These fractured knee joints in the principal rafters on the east slope have now been strengthened by the insertion of steel flitch plates.

A second weakness of the roof structure is the deflection of the main floor beams at second floor level under the weight of the floor and roof loading. Two of the 18 beams had failed and the remainder have very significant deflections in them. As a result of the deflection in the second floor, the roof frames have dropped. The strengthening of the main floor beams at second floor level has been achieved by cutting flitch slots for the full length of each of the main beams and introducing steel stiffening plates. The flitch slots were cut


**All is revealed: East Roof repairs in 2005. Embedded timber wall plates on the East Range had deteriorated**

by means of a chain morticer. The steel plates were fabricated to the deflected profile of the beam. Rotafix resin was used as a void filler and adhesive and bolts at regular centres connected the timber to the steel flitch plates.

A further consequence of the failure of the East Range gutters and roof coverings was the deterioration of embedded timber wall plates. This led to the leaning of two of the three gables on the west side. The lean was approximately 300mm in the height of 4.5m, and collapse of the gables was only prevented by the buttressing action of the adjacent roof slopes. In order to strip and re-fix the roof slates, it was necessary to temporarily restrain the gables. A system was devised using RMD Kwikform. This provided the opportunity to restore the gables to the vertical. Using Superslim Soldier support frames and two adjustable push-pull props, the gables were eased back to the vertical. This avoided the loss of historical detail which would have resulted from taking down and re-building the gables.

On the South Range, alterations were made in 1904 when the external walls were raised at second floor level. The existing 17th-century roof frames were cut off at collar level and a floor added. A new softwood roof structure was constructed over the newly raised walls. The truncated roof trusses, now at second floor level, support the fine ceilings of the State Rooms below and had supported heavy gypsum plaster floors before these were removed by the previous owner. The decision has been taken to provide a new separate floor structure, just above the truncated medieval roof, to support future floor loads. The surviving truncated 17th-century roof frames now only support the ceilings. ■

## Cost planning and control

**Adrian Stenning, Quantity Surveyor, Bare, Leaning and Bare**

Cost planning and control is important on any project, but having advised on costs throughout the compulsory purchase process the onus on the quantity surveyor was perhaps stronger than usual.

Despite obvious pressures to advance work speedily after years of little maintenance at the Hall, English Heritage recognised that to plan cost-effectively and achieve cost control a full and thorough understanding of the project was needed. Too often, inadequate time is provided pre-contract to gather this important knowledge.

In this particular instance the Repairs Notice process had allowed a reasonably thorough knowledge to be gained, but the emphasis for this had been different and some of the Urgent Works undertaken before it now in fact meant that achieving definitive knowledge was nigh impossible.

An example is the plaster ceiling of the Long Gallery. Before the acquisition the instability of the ceiling had been identified, it was badly cracked and parting company from its structure and so to ensure a major loss did not occur a crash deck had been erected. The crash deck now prevented detailed inspection to ascertain exact repair requirements.

So at Apethorpe Hall we were presented with not only the problems that one encounters with any historic property, ie that there must remain some elements that cannot be ascertained in full until the works are underway, but also those, albeit unavoidably, self inflicted!

It was not worth the risk nor cost-effective to take down the crash deck to enable close inspection. It had also to be borne in mind that even if this were to be done in a single section, with many layers of decorative finish intact, it would still be difficult to be definitive (such finishes sometimes even acting as structural membranes). Furthermore, no matter how careful the selection, the problems of one "small" area would almost certainly not be typical of the ceiling as a whole.

Obviously, works had been established initially that had necessitated the erection of the crash decking so there was not a need to "start from scratch". In order to establish and control costs, a schedule of likely works was prepared that added to those works known to be required. Mechanisms for early identification and agreement of costs were put in place to ensure accurate cost reporting that would then enable adjustment of the overall works to the fixed and limited Phase 1 budget. *Continues overleaf*

The repair of the plaster ceilings was not the only such area where it was not possible to establish a definitive list of works at the outset. The timber panelling of the Long Gallery is another case in point. Without removal at the outset it was not possible to establish a full set of repairs as each panel presents a different set of problems with different failings and/or different repairs undertaken previously over its life. Experienced craftsman techniques were brought in and demonstrated, providing exemplars that were then followed by Bowman's craftsmen.

Accuracy of the descriptions of the scheduled works is crucial in allowing a contractor to price and undertake works with certainty to the required high quality. However, flexibility and speed of communication is also a necessity if good cost control is to be achieved. There is much one can do through quality documentation to achieve this, as has been done at Apethorpe Hall, but establishing a team spirit is perhaps more important. At Apethorpe we have been able to do that. Without it, despite the difficulties presented by dealing with the unknowns such as the plaster and panelling repairs, the maximisation of the budget would almost certainly not have occurred.

**A peacock motif in the Great Chamber ceiling, showing cracking prior to repair and conservation**

## Challenges and solutions

### Paul Gibbons, Contracts Director, E Bowman & Sons Ltd

E Bowman & Sons, like many others, have followed recent events at Apethorpe with great interest. Having worked at the Hall for more than 50 years and experienced the frustration of seeing its steady decline, it is a privilege to be involved with the current works. Using local tradesmen (and women) to repair this treasure adds to the satisfaction of a rewarding project.

From the very start there were challenges, not least of all, arriving at a tender figure. Estimating the cost of shoring and restoring stone gables to their upright; installing steel flitch plates to beams above the 400-year-old ceilings; repairing and restoring, *in situ*, full-height oak panelling, all relied upon a wealth of experience to arrive at a tender figure. A pricing book was of little use for this project!

We have to say that some costs were more accurate than others. We certainly hadn't expected the oak beams to be as hard as they proved to be. Replacing a burnt-out chain morticer and new chains into double figures had not been allowed for!

Practical tasks have proved just as difficult. Lifting and manoeuvring steel beams for the new floors relied upon teamwork between designer and contractor. Some 600sq m of Collyweston slate had to be removed and stored within a very short period of time, to avoid disturbance to the routine of the resident bats. Working under the huge temporary roof during summer months meant that drinks stations and circulating fans had to be installed, to ensure a comfortable working environment.

Working and laying lead up to code 10 in thickness has provided challenges to the lead plumbers (CEL Leadwork), not least of all due to the stringent constraints upon hot works. The plaster conservator (Phil Gaches) had a difficult enough task without having to work around acrow props, carpenters installing flitch plates to beams, bricklayers replacing rotten wall plates and joiners removing and repairing the adjacent oak panelling. All works had to be carefully phased, with some being carried out side by side. Our site manager, Brian Morrell, played a key role.

Arriving at the most effective method of stripping the modern finishes from the ceilings has taken careful consideration, given the numerous constraints of the environment. Following on from initial trials carried out by Devereux Decorators, our conservator, Alex Carrington, has devised a very successful method of stripping using a poultice and avoiding unnecessary saturation of the plasterwork. Washing down has been kept to a minimum and tests show virtually neutral pH levels.

Despite the many challenges, the project remains ahead of programme, with everyone looking forward to the imminent removal of the huge temporary roof. ■

*See www.english-heritage.org.uk for details.*

Right, protected during conservation, a 1620s statue of James I. It was originally located over the main doorway into the State Apartment. Below, the very dilapidated arcade in the East Range in 2000