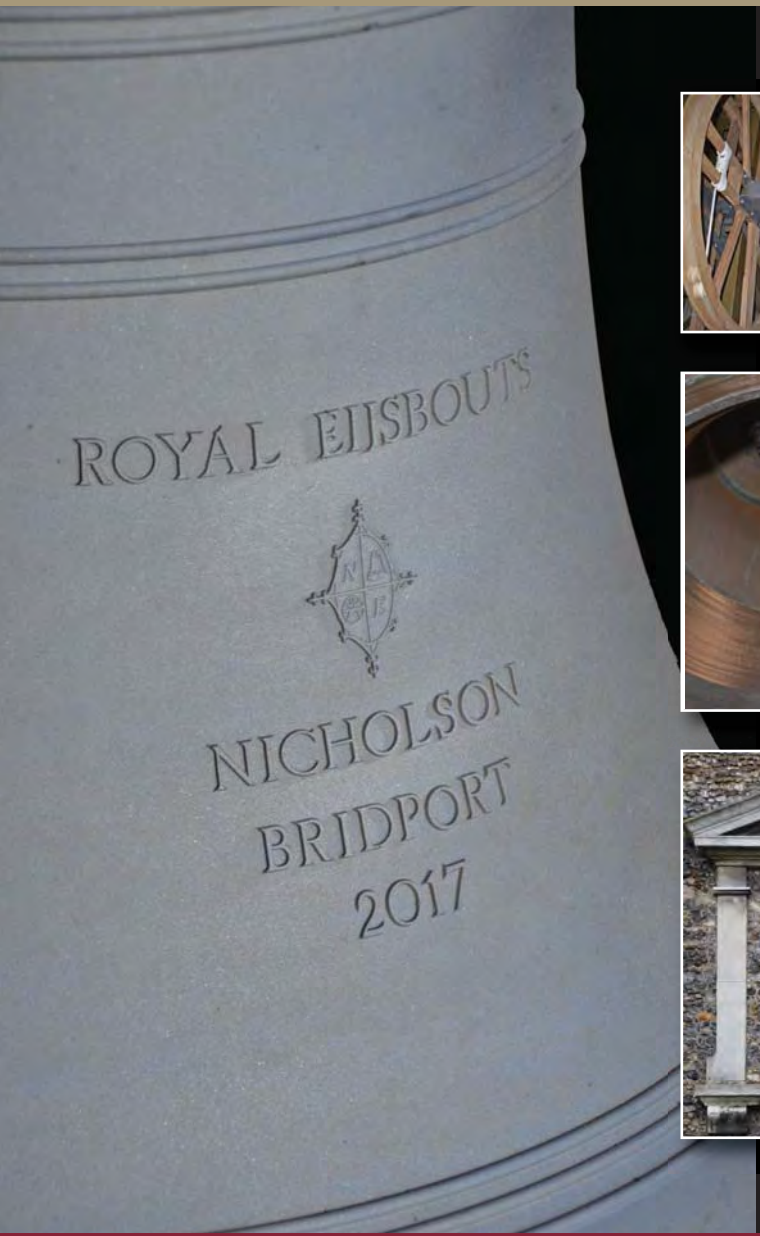
St. Margaret's Church
IPSWICH

THE BELLS AND CLOCK

of St Margaret's Church, Ipswich



The Church

A church has stood on this site for some seven hundred years. Earlier, in about 1133, the Augustinian Canons built Holy Trinity Priory where Christchurch Mansion is today. Their church was the local parish church until the growth of the congregation forced the canons to build a new church next door in about 1300. This was dedicated to St Margaret of Antioch and came to serve what was the largest parish in Ipswich.

The Tower

The west tower was first built about 1400. It was constructed mainly of flint with some limestone dressings. Internally, a musicians gallery was added in 1754. This was replaced in 1844 by a stone gallery, which jutted out into the nave, for the choir and an organ. Within two years the gallery and organ were removed “in consequence of the irreverent conduct of the individuals who occupied it”.

The top of the tower was rebuilt in 1871 in a grander style than before and raised by 3.4m (11ft). The tower now stands 26.5m (87ft) high.

Cracks were found in the tower in 1956 which led to the bells being rehung in 1958. Additional work was undertaken in 1966 to stiffen the tower but the problems persisted, and measurements showed that the tower still moved when the bells were rung. Substantial concrete ring beams were installed in 1986 to further strengthen the tower.

In 2018 the bells were lowered in the tower to reduce the strain on the structure. A new ringing gallery was built within the tower area at the level of the old stone musicians gallery and level with the base of the west window.

The Bells

The first mention of bells at St Margaret's is in 1553 when four were noted "in the stepyll" in the Inventory of Church Goods in the County of Suffolk ordered by Edward VI. An earlier Inventory in 1547 had made no mention of any bells in the church. The 1553 Inventory also noted that the churchwardens had sold a fifth bell to John Brend. It was said to weigh 303 Quarters, 26 pounds and raised £5 6s. 8d. (£5.33 or £1,500 in today's money). The money was used to repair the fabric of the church. The weight will have been an estimate and it is unlikely that it would actually have weighed over 75cwt. It is known that there was a merchant in Ipswich at this time who was buying bells from churches in East Anglia, but it is not clear whether the John Brend mentioned in the Inventory was a member of the Brend bell founders of Norwich, who are known to have started casting bells by 1564.

In 1630, Miles Graye I of Colchester cast a new peal of five bells and in 1655 Miles Graye III

cast a further Treble bell to complete a ring of six. It is however possible that this Treble had been cast earlier by Miles Graye I and was recast by Miles Graye III.

In 1899 a further two bells, which became the Treble and second of the enlarged ring of eight, were cast by Mears and Stainbank of Whitechapel and all the bells were then rehung, by Bowell of Ipswich, higher in the newly raised tower, at the level of the louvres. The frame was principally of oak with the pit ends and dividers being made of cast iron. All the

bells were placed so that they swung in the same direction (East – West). This arrangement loaded the tower unevenly causing it to sway when the bells were rung.

This arrangement of the bells also meant that, in order to provide a reasonable rope circle for the ringers, the ropes for all but the sixth bell were very severely drawn away from the vertical, making the ringing of the bells more difficult.

In 1925 Bowell recast the Treble and also the fourth bell of the peal, which was cracked.

As a consequence of the structural problems, in 1958 the bells were rehung by Mears & Stainbank of Whitechapel with mainly new fittings. The old wheel spokes were reused but the rims were rebuilt. They also retuned them.

In 2005 the church commissioned a report on the state of the bells, the frame and the tower. It concluded that there would be benefit in a major project to lower the bells, rehang them in a new frame and build a new ringing gallery in the church.

Acoustic analysis carried out at the same time showed that tonally the five C17th bells were significantly better than the more modern bells with the newer Treble being significantly sharp relative to the rest of the ring. Given these results it was also decided that the Treble, second and fourth bells would be replaced by new bells.

In July 2015, the church began a bid to the Heritage Lottery Fund, which culminated in a grant towards a substantial part of the cost by the end of 2016. Together with a grant from the Suffolk Guild of Ringers and various donations this enabled the church to commission Nicholson Engineering, a bellhanging company, to begin the work.

In 2017 the three new bells were cast by the Royal Eijsbouts bell foundry in

the Netherlands to match the profile of the C17th bells of the Graye foundry. All eight bells were tuned by Nigel Taylor, an expert in the field. The bells were then returned to the church by Nicholson Engineering in 2018.

Photoelectric cells were placed on all the bell wheels to enable "silent ringing" to be used when appropriate, with the bell sounds reproduced electronically within the ringing chamber, but with no sound emanating from the tower.

Beneath the new gallery within the new heritage area and in the ringing chamber TV screens have been positioned, so that the bells can be viewed as they are being rung.

The Work Undertaken in 2017-18

The work to lower the bells began in May 2017. This was carried out by Nicholson Engineering with help from R & J Hogg, the builders associated with the project, and a band of volunteers led by Tower Captain John Girt.

With some trepidation about whether the Tenor would fit through the modern hatch and framework, the project began. The bells were manoeuvred easily, using two winches played off against each other, and the Tenor appeared in the body of the church, landing safely on a pallet ready to be moved. After this, the remaining seven were lowered within the day.

Following the removal of the bells a great deal of structural work was carried out. A sub-frame was installed lower in the tower in November 2017, and, after a suitable curing time, the frame for the bells was added to the structure in January 2018. Being lower in the tower, there was less space to work in and the bells are now much closer together, swinging in different directions to equalise the stress loading.

A new ringing gallery was also built within the body of the church. This consists of an oak beam floor with a clear glass balustrade at the base of the west window. The ringers are now visible and can be seen by members of the congregation.

In March 2018 the bells returned to the church and were garlanded with flowers, as is the custom. The bells were blessed during the Sunday morning service on March 4th.

The bells were then hoisted into the tower starting with the Tenor. All went smoothly with the bells being placed in the correct position and lightly attached to the frame. The wheels were also attached to the headstocks. The art of double stacking bells on separate hoists was required to get the Treble and second high enough into the chamber to enable the hatch to be closed and the frame completed, before they were lowered into position. The next day everything was secured in place ready for the clappers to be added to the bells. Each clapper was placed precisely to ensure its flight was correct, and that it hit the bell on either side at the correct point in the swing. Sliders were adjusted and the wheels were rigged with the new bell ropes.

The whole installation took five days and culminated in a commissioning ring of the bells by members of the Suffolk Guild of Ringers.

Inscriptions on the Bells

As is usual for church bells each has an inscription recording the maker and each subsequent recasting. Note that the third bell of the eight was originally the Treble of the six bells of the C17th.

The Tenor has a couplet that is of interest and is the reason why it is a listed bell.

The inscriptions are shown below:

TREBLE Cast 1899 Recast 1925 Alfred Bowell Founder Ipswich Royal Eijsbouts Nicholson Bridport 2017	**SECOND** Mears & Stainbank, Founders, London The two smaller bells were added March 1899 Rev Percival Smith, M.A. Vicar Frederick Turner) Frederick Corder) Churchwardens William Motts, Steeple-keeper Royal Eijsbouts Nicholson Bridport 2017
THIRD Miles Graye made me 1655	**FOURTH** Miles Graye Made Me 1630 Robertus Richmond Recast by Alfred Bowell Ipswich 1925 Royal Eijsbouts Nicholson Bridport 2017
FIFTH Miles Graye Made Me 1630	**SIXTH** Miles Graye Made Me 1630
SEVENTH Miles Graye Made Me 1630	**TENOR** Miles Graye Made Me 1630 The living to the church, the dead into the grave That's my onely calling and propertie I have

The Founders and Bellhangers

Limited information is available about most of the people who have cast or worked on the bells over the years.

Nothing is known of the people who cast the first set of bells recorded in the 1553 “Inventory of Church Goods”.

The 17th Century

Miles Graye, who had a foundry in Colchester, named his bells in strong Roman lettering with his name almost invariably given in full and in English.

He was known as a prince among workmen. Most of his bells, which are said always to be of excellent quality, are found in Essex and neighbouring counties but his most distant work was a Tenor at Newcastle-upon-Tyne, noted by Rev. J. J. Raven in The Church Bells of Suffolk published in 1890.

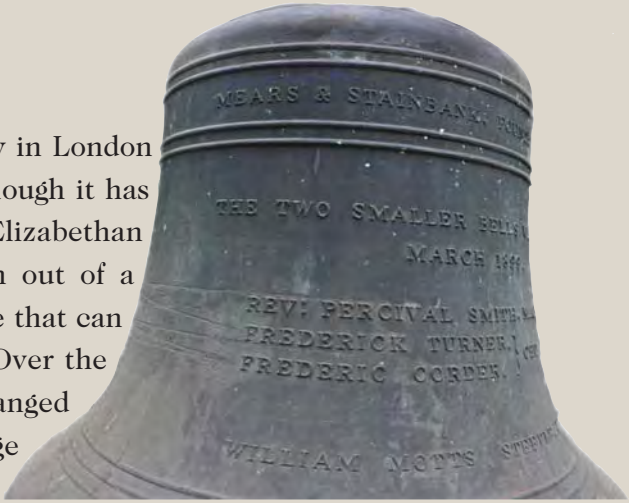
He was greatly affected by the Civil War. His foundry, which was situated below Headgate in Colchester, was burned down in the attack on the town by Thomas Fairfax, the Parliamentary commander-in-chief.

Having endured the horrors of the siege he “set his house in order” in his Will dated on the seventeenth day of May, 1649, “weak in body and crased with age, but yet in p’fect mind and memory,” and was dead within a month.

His son, Miles Graye II, was born about 1599 and is known to have worked in Saffron Walden casting bells there between 1629 and 1641.

Miles Graye III, the son of Miles II, was born at Colchester in 1628 and carried on the bell-founding business after the death of his grandfather in 1649 continuing to cast bells until his death in 1686.

The 19th Century



The Whitechapel Foundry in London began in about 1570, although it has been suggested that the Elizabethan establishment had grown out of a foundry in nearby Aldgate that can be traced back to 1363. Over the years the foundry changed hands and in 1865 George Mears was partnered by Robert Stainbank. Thereafter the business traded as Mears & Stainbank up to 1968. Arthur Hughes became the foundry manager in 1884 and took charge of operations in 1904. The Hughes family continued running the foundry until it closed in May 2017.

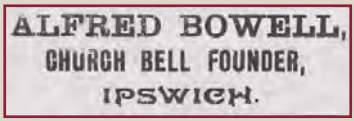
In 1899 Mears & Stainbank cast two new bells for St Margaret's to bring the peal up to eight bells, at a cost of £55 8s 0d with an additional £2 10s 0d for two clappers. The cost of transporting them to Ipswich by Great Eastern Rail was £1 7s 11d.

General building work cost just under £27 and H Bowell & Son were paid £148 14s 0d for the construction of the new frame, bell hanging and clock work.

The 20th Century

Henry Bowell (previously a ship's carpenter), his son Alfred and later his Grandson Frederick had a foundry in Wykes Bishop Street, Ipswich. Between 1896 and 1939 they cast about 400 bells and maintained many bell frames in the area. Alfred is recorded as working as far away as Bishops Castle in Shropshire where he rehung the bells on new fittings in 1912.

During the First World War no bells were allowed to be cast and instead the output of the foundry was diverted to munitions work.



In 1925 Alfred presented a bill to St Margaret's for the overhauling of the fittings of the eight bells £35, to recasting the fourth bell £25, for taking down the small bells for tuning £5 and for recasting the Treble £15 – a total of £80.

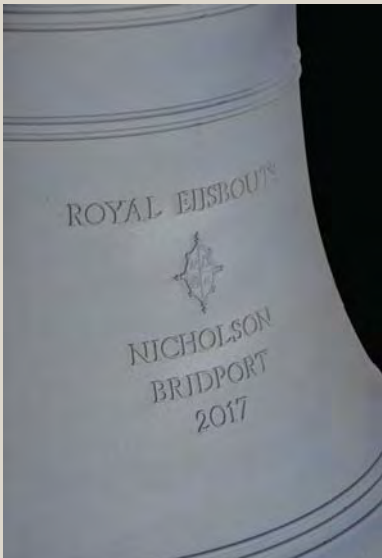
The last bell was cast at their foundry in 1939 and, whilst the foundry remained in use for munitions and general engineering for a while, it closed in 1950.

The 21st Century

Bonaventura Eijsbouts from Asten in the Netherlands laid the foundations for the present day Royal Eijsbouts Foundry in 1872. In 1893, the company began selling striking and swinging bells which they purchased from reputable foundries abroad. An in-house bell foundry was installed in 1947.

In the late C20th they introduced computer technology as a tool in designing bells. This enabled an exact prediction regarding the most important features of the bell's sound to be made in the design phase. This is important because when historical peals are restored, as is the case at St Margaret's, it is critical to ensure that newly cast bells harmonise extremely accurately with the existing bells.

Andrew Nicholson began working on bells as a hobby in the early 1980s, although there is a direct relationship with the long-gone firms of the C18th bellfounder Edward Arnold and the early C20th bellhanger John Sully. Nicholson Engineering was formed as work increased. It moved to larger premises in Bridport in 1993. Since then it has become established as the largest bellhanging company in the UK and with work carried out abroad it is one of the largest in the world.



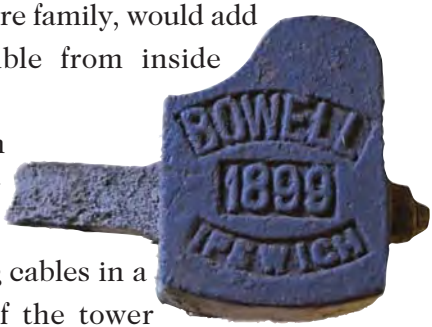
The Clock

In the 1730s a classical frame was made on the south side of the tower to form a space for a clock dial. It is not known whether a clock was installed at this time.

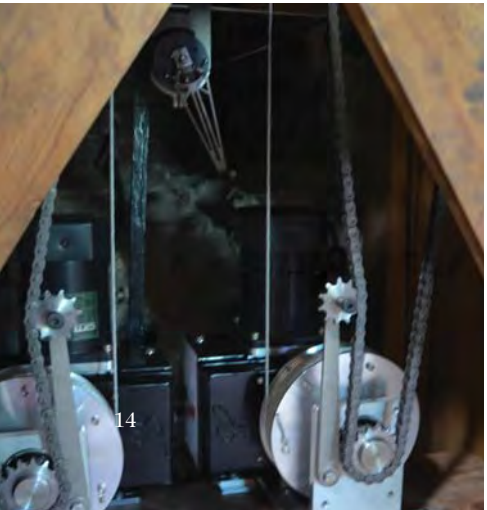
The current clock was built by Moore of Ipswich and is dated 1st January 1778. As the celebrated horologist Thomas Moore died in 1762, this clock was probably constructed by his sons Edward and Hartley Moore and is the only known turret clock made for the outside of a public building by this firm.

It is one of the oldest surviving public clocks in Ipswich and has been manually wound and adjusted to the correct time on a weekly basis throughout its 240-year life. It sits on the south side of the tower in a purpose-built C19th wooden case in the old ringing chamber.

The clock's construction is described as "plate and spacer" and is typical of the period. However, the particular shape of the "pagoda frame" is distinctive and quite unusual. There are only around thirty-six of them known and limited research suggests that Charles Penton or William Smith of Moorside probably made them in London. Local makers who installed them, such as the Moore family, would add their names to the dial or a plate visible from inside the church.



It is very solidly built in a cast iron frame with countwheel striking, and anchor escapement controlled by a "1¼ second" pendulum. Its weights used to hang on long cables in a wooden shaft in the south-west corner of the tower



down to the ground level. The hourly strike mechanism originally operated using a hammer striking the Tenor bell via a series of pulleys, levers and wires.

In 2018 David Bearcroft Clocks of Ipswich, a specialist in turret clocks, overhauled the mechanism. In addition, working with the Cumbria Clock Company, two epicyclic auto-winders, one for the time and one for the strike were fitted to the underside of the wooden frame on which the clock sits, meaning that no longer will the clock need to be wound by hand twice a week. An auto-regulator unit was also fitted which can adjust the clock to ensure it shows the right time, and automatically changes the hour when the clocks go forward in the Spring from GMT to BST and in the Autumn when they return to GMT.

The new lighter weights hang directly below the clock. The new hammer, though still operating on the Tenor bell, is controlled electronically and can be made to move into or out of position by an electronic switch within the ringing chamber.

Technical Details

The diameter and weight of the bells is shown in the charts below. The bells before 2016:

BELL	Diameter *Inches (cm)*	Weight *Cwt-Quarters-Pounds (Kg)*	Note	Date	Founder
Tenor	45 1/4 (114.9)	14-2-23 (747)	F	1630	Miles Graye I, Colchester
Seventh	40 7/8 (103.8)	11-1-13 (577)	G	1630	Miles Graye I, Colchester
Sixth	36 3/4 (103.8)	8-0-23 (417)	A	1630	Miles Graye I, Colchester
Fifth	33 3/8 (103.8)	6-0-16 (312)	Bb	1630	Miles Graye I, Colchester
Fourth	31 5/8 (103.8)	6-0-22 (315)	C	1925	Alfred Bowell, Ipswich
Third	29 1/4 (103.8)	4-3-1 (242)	D	1655	Miles Graye III, Colchester
Second	28 1/2 (103.8)	4-2-13 (235)	E	1899	Mears & Stainbank, Whitechapel
Treble	27 3/4 (103.8)	5-1-18 (275)	F	1925	Alfred Bowell, Ipswich

It can be seen that the grading of the weights of the bells was not ideal, with the Treble and fourth being oversize and the second slightly oversize.

The bells following the 2018 retuning and recasting work:

BELL	Diameter *Inches (cm)*	Weight *Cwt-Quarters-Pounds (Kg)*	Note	Date	Founder
Tenor	43 9/16 (110.7)	14-0-11 (716)	F	1630	Miles Graye I, Colchester
Seventh	39 11/16 (100.8)	10-3-17 (554)	G	1630	Miles Graye I, Colchester
Sixth	35 3/4 (90.6)	7-3-20 (395)	A	1630	Miles Graye I, Colchester
Fifth	32 11/16 (83.0)	5-3-8 (296)	Bb	1630	Miles Graye I, Colchester
Fourth	31 1/8 (78.9)	5-2-4 (281)	C	2017	Eijsbouts, Asten, The Netherlands
Third	28 3/4 (73.0)	4-1-23 (226)	D	1655	Miles Graye III, Colchester
Second	27 11/16 (70.3)	4-1-11 (221)	E	2017	Eijsbouts, Asten, The Netherlands
Treble	26 11/16 (67.8)	3-3-17 (198)	F	2017	Eijsbouts, Asten, The Netherlands

An analysis of the frequencies (in Hz) of the bells

The analysis before tuning in 2018 (in Hz):

BELL	Hum	Fundamental	Third	Fifth	Nominal
Tenor	179	333.5	416	516	688
Seventh	204.5	380.5	472	564	774
Sixth	226	430	528.5	Not known	860
Fifth	240.5	460	564	723.5	919.5
Fourth	271.5	483.5	623.5	796.5	1039.5
Third	301	561	699.5	860	1160.5
Second	354	587.5	781.5	976.5	1296
Treble	362	637	827.5	1111.5	1396

The analysis after tuning in 2018 (in Hz):

BELL	Hum	Fundamental	Third	Fifth	Nominal
Tenor	171.5	343.5	414	505	686.5
Seventh	192	384.5	464	564.5	769
Sixth	215	430	521	631.5	860
Fifth	229.5	458.5	555	682.5	918
Fourth	256.5	513.5	614	762	1026.5
Third	287.5	574.5	693.5	860	1149
Second	321.5	643.5	773	957.5	1287.5
Treble	343.5	687.5	828.5	1016.5	1375

Tuning Bells

The pitch of a bell is, in the main, determined by its size, diameter and weight. It is possible to tune the pitch by removing metal from the bell in a controlled manner. This is usually done on a lathe.

Each bell has a Prime or fundamental note. There are then a number of other harmonics, or additional notes, sounded by the bell. There is a relationship between the Prime and these other notes, for

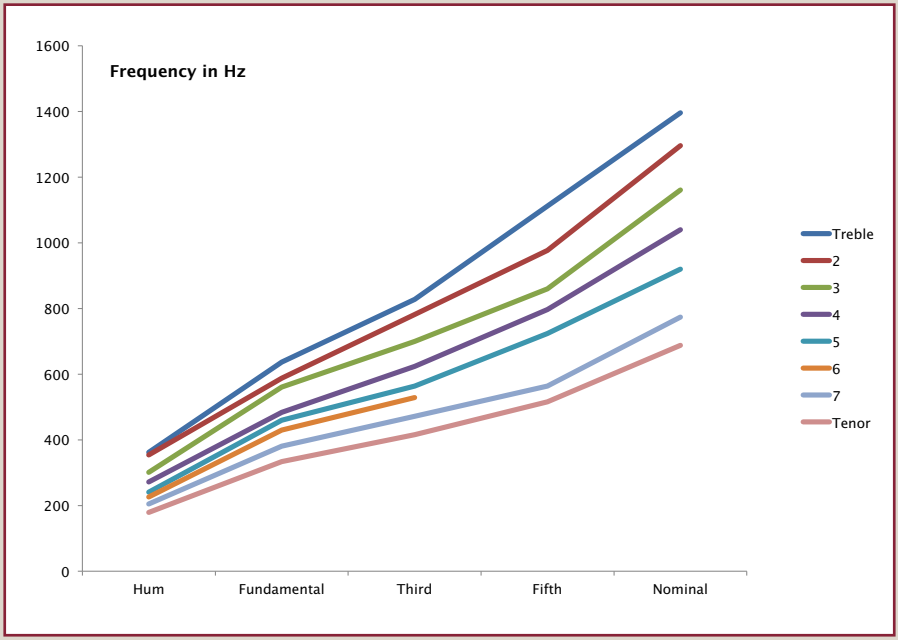
example the hum is half the frequency of the Prime, the nominal is an octave higher than the Prime and so on. These notes should be tuned, or matched, both within each bell and across all the bells.

When all bells in a peal are tuned to each other, a more pleasing sound is heard when they are rung. The bells of St Margaret's are tuned to the scale of F major.

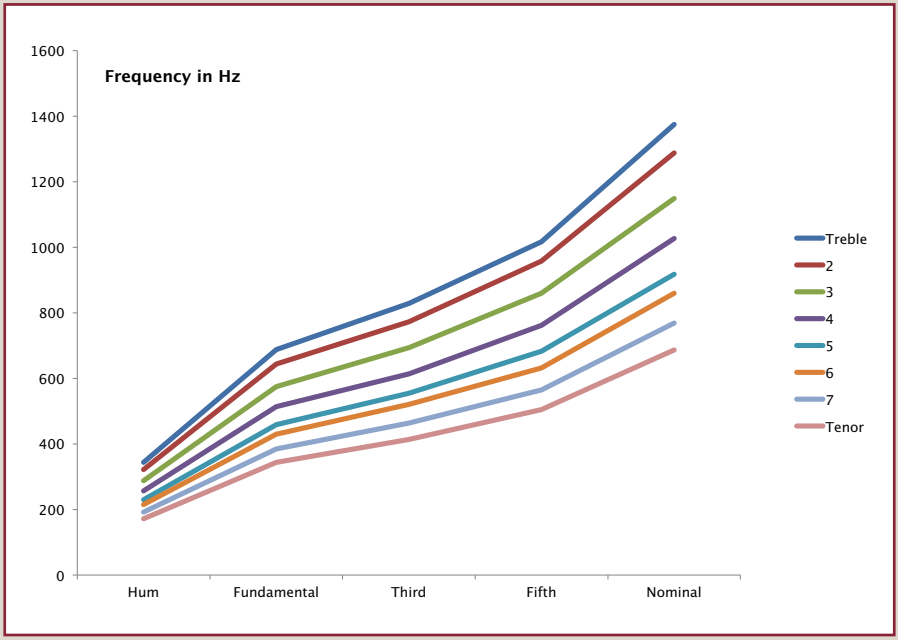
These graphs show the wavelength (Hz) of the notes within each bell as points joined by straight lines. It can be seen that for the old bells these lines were not matched between the bells, whereas the lines for the newly tuned bells are well matched, leading to the pleasing sound heard by the listener.

A graphical representation of the frequencies (in Hz) of the bells

The representation before tuning in 2018:



The representation after tuning in 2018:



Peal Records

Peals have always been rung on church bells in England. Originally a peal referred to a sequence of changes in the order of ringing of any length. Following the invention of the ringing method known as Grandsire Doubles, the term peal or "full peal" has been applied only to the ringing of sequences including each possible permutation of the set of bells exactly once.

Peals, which have over 5,000 changes in the order of the bells, can be described as Major (rung on eight bells) or Triples (rung on seven bells).

There are varying arrangements of the order in which the bells are rung which give different patterns of sound. Each pattern has a distinctive name. No records exist of the peals rung at St Margaret's before the augmentation of the bells in 1899. However, since then a

record has been maintained and is shown in the following table. Several of these are recorded on "Peal Boards" hung within the old ringing chamber.

A total of 200 peals have been rung. The fastest for Triples is 2 hours 28 minutes, for Major 2 hours 35 minutes and the longest (6000 changes) was completed in 3 hours 20 minutes.

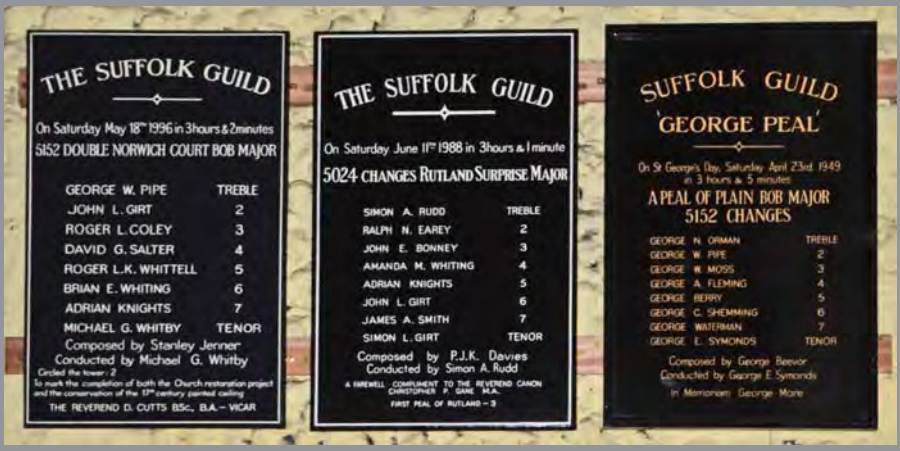
The descriptive list of these peals is shown below:

Triples	
Grandsire	**8**
Plain Bob	**1**
St Edmundsbury	**1**
Stedman	**22**
TOTAL	**32**

Major Peals	
Double Norwich CB	**43**
Kent & Oxford Combined	**1**
Kent Treble Bob	**28**
Oxford Treble Bob	**15**
Plain Bob	**19**
TOTAL	**106**

Surprise variant	
Bristol	**2**
Cambridge	**20**
Fordcombe	**1**
Ipswich Surprise	**1**
Islay	**1**
Lincolnshire	**3**
London	**7**
New Cambridge	**2**
Ruby Surprise Major	**1**
Rutland	**1**
Superlative	**14**
Yorkshire	**7**
Zurich	**1**
4 Spliced Superlative	**1**
TOTAL	**62**

The first peal on the restored bells, a Double Norwich Court Bob Major consisting of 5152 changes, was rung on 4th August 2018 in 2 hours 53 minutes by members of the Suffolk Guild.



Text: David Evans
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Design: Type Technology, Ipswich

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