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Horace Edward Stafford Dall, 1901–86

E. J. Hysom

With the death of Horace Dall on 1986 May 9 the BAA lost one of its all-time greats. He epitomised the best of amateur astronomy: an outstanding maker and developer of instruments, he applied them, especially, to solar, lunar and planetary photography.

Horace Edward Stafford Dall was born on 1901 January 5 (thus just missing the nineteenth century). At that time his parents were living at Chelmsford. His father was an instrument maker in the small team that Marconi had put together during his experiments with wireless.

Horace Dall's early upbringing was anything but smooth. His mother died when he was three; his father left Marconi and went to work 'up north', putting Horace and his brother out on various relations. As a result, Horace had twelve different addresses before he was six years old. Horace and his father were reunited when Mr Dall remarried and found a job at George Kent Ltd of Luton.

At school Horace was diligent, as can be seen from some of his workbooks that survive. It is not surprising to find that he gained excellent marks at science and mathematics, but he also proved to be skilled with a pencil, both at draughtmanship and at free-hand work. This skill was to be most useful when he started work. He commenced with Hewlett & Blondeau, the aircraft manufacturers, on 1914 December 27, just before his fourteenth birthday, and he was to stay there for the next three years. Most of the time he was in the drawing office. He was clearly fast and accurate, for on one occasion when a copy of a drawing of a new Rolls Royce engine had to be made in one day the task was entrusted to Horace.

It was during his period at Hewlett & Blondeau that Horace Dall got his first telescope, a spyglass of one-inch (25mm) aperture which he soon modified to give a higher magnification. This was followed in quick sucession by a spectacle-lens refractor with a cardboard tube, and a $2\frac{1}{2}$-inch (60mm) achromat which he used to make planetary drawings. He had other optical interests at this time. At the age of sixteen Horace had acquired a second-hand Baker microscope, and, a year later on a cycle trip to Clacton, he had his first view of a camera obscura. It was a bright and sunny day, and the view on the table of the camera obscura was so beautiful that he promised himself that he would make one of his own. He was active in the local scientific society and chummed up with a musician: together they purchased an $8\frac{1}{2}$-inch (215mm) George Calver reflector from William Porthouse, a Manchester amateur. Later Horace was to buy out his friend's share, and part of this telescope was eventually incorporated into the $15\frac{1}{2}$-inch reflector, the telescope for which he is best known.

Horace had continued his education at night-school (at the Luton Technical College). With a recommendation from one of his tutors, he moved to George Kent Ltd in 1918 January. He was to stay at Kent's for the rest of his working life, until he retired in 1965. The company made a variety of meters, especially for the measurement of fluid flow. Horace Dall worked in the research and development department, and he was soon to prove his worth: in fact he became so valuable to the company that he was allowed a say in fixing his hours of work and his holidays. His inventive mind led to a number of patents. It is no exaggeration to say that the name 'Dall' is as famous in the field of water engineering as 'Hoover' in vacuum cleaning.

His flexible hours were a great help with the astronomy. On a fairly typical day, Horace would start work at 10 am; and, twelve hours later when most men were leaving the pub or getting ready to go to bed, he would pack up at work in order to start a session of observing, or – if cloudy – some microscopy, or instrument development. His twin loves were his home workshop and being outside in the countryside. Even before his teens he would tramp 20 miles (30km) from Limehouse to Epping Forest or Greenwich Observatory. Later, a bicycle allowed him to extend the range considerably, to the seaside and, eventually, to Oxford to pore over William Herschel's notes on mirror making.

Horace Dall joined the BAA in 1925, the year he started making optics. He said that he "took to mirror making like a duck does to water", and he could soon claim that his mirrors were up to the same standard as Calver's. He made eyepieces as well, and by 1927 he was advertising in *Scientific American, Popular Astronomy*, and the BAA *Journal*. Soon he was corresponding with people worldwide, and as a result made many friends. Captain M. A. Ainslie, then the Director of the BAA's Instruments and Observing Methods Section, compared the quality of Dall's eyepieces to the best obtainable anywhere. Within five years of starting his optical work, Horace had made a 6-inch (150mm) f/3.3 Cassegrain telescope with a spherical (rather than hyperboloidal) secondary and a transfer lens – a design that solved many of the objections to classical Cassegrains. This prototype, worked out while he was still in his 20s, was to be the basis of Horace's later portable models – telescopes so light that they could be carried in his pockets.

Horace disliked the English winter, so every Easter he would be off to Switzerland, to walk and scramble among the high hills. His main holiday, later in the

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1987JBAA...97...76H



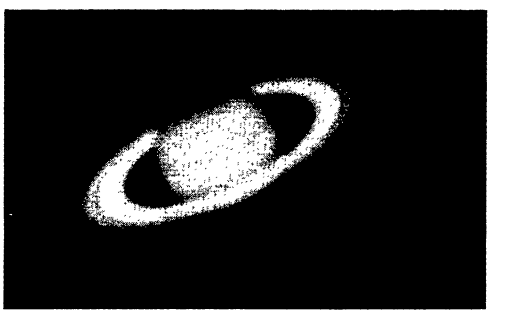
year, would be more adventurous. He explored as far as the transport of the day would allow. There was a 19-day trip cycling across the North Cape and down into Lappland. On another occasion, ten years after Lawrence of Arabia had set them, he found some unexploded charges attached to a railway line in the Middle East; these Horace left strictly alone, knowing that the explosive was by then probably unstable. A favourite area was the High Atlas and the fringes of the Sahara.

In reply to a question about the dangers of these trips, Horace said that he had very little trouble with people. Once he had been fired at by dissentient tribesmen, but "I wasn't over-worried as I knew their guns were very worn and of low accuracy" – and he soon scooted away. He was in more danger when caught out on a high plateau during a violent electrical storm, when he and his bicycle were the highest points. Returning from one trip in the open cockpit of an aeroplane, the pilot warned him to hold on tight because on a previous flight the aircraft had hit an air pocket and passenger and aircraft had become separated!

In 1932 Horace made his first trip to Iceland. The following year he returned, to make the first wheeled crossing of the Icelandic desert (Europe's largest) on his bicycle; the going was so rough that he could only cycle about 20% of the way. In 1934 he married his first wife, Vivien (*née* Andrews), and together they would revisit his favourite European hills and mountains. There were no children – a matter of regret to them both.

Horace, in conjunction with an architect, planned his house on a carefully chosen site overlooking Luton. The roof was built deliberately high in order to incorporate a camera obscura of exceptional quality and performance. One could use it as the equivalent of a near-perfect pair of vibration-free binoculars for [illegible] viewing simultaneously. In the high-power mode, a 7-foot (2m) image of the Sun could be projected; or, if the observer wished to view the Moon, an eyepiece was available that gave × 135 magnification and just encompassed the whole disc. The image was flat, sharp to the edge, and seemed totally free of false colour: it was an awe-inspiring visual experience. After the completion of the camera obscura, Horace went on to build an observatory and equipped it with a $15\frac{1}{2}$-inch (390mm) modified Cassegrain reflector. It was with this telescope that he took his outstanding lunar and planetary photographs. The telescope was equipped with a dispersion corrector, which allowed good definition to be obtained even when viewing objects near to the horizon.

Horace had struck up a friendship with Albert Ingalls, who edited the telescope-making column in *Scientific American*, so it was to Ingalls that he often gave descriptions of his latest developments. It was Ingalls who gave the name 'Dall-Kirkham' to the form of Cassegrain employing a prolate ellipsoidal primary and spherical secondary – independently discovered by Alan Kirkham. By the end of the 1930s Horace was probably better known in the United States than in the UK. Other friends in the USA included Prof. John



One of Horace Dall's superb planetary photos, taken with his 390mm Dall-Kirkham on 1976 January 28.

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1987JBAA...97...76H

Strong, the inventor of the aluminising process, and Roger Hayward, the Pasadena architect. Strong and Hayward were part of a group of friends who were constantly vying with each other to see who could develop new instruments: Horace became their 'foreign correspondent'.

Around 1939, when he had perfected his optical techniques, Horace heard of an Englishman who had written with a diamond splinter, on glass, letters so small that the contents of 5 bibles could be fitted on a square inch (645mm²). This was a challenge! He invented a new method – elegant in its simplicity – with which he was to fit the equivalent of 50 bibles to the square inch: with further development, he reached 280 bibles/square inch. This was his first world record. Eventually Horace captured others, including the most accurate spherometer (a mechanical device capable of detecting a change in shape as small as 1/40 the wavelength of visible light) and a barometer capable of showing a change when raised or lowered the height of a thick book. Having gained skill working with diamond, he went on to use diamond dust for polishing tiny lenses made from jewels. He mounted these as microscope objectives, achieving a numerical aperture* of 1.92 – another world record.

During the Second World War, when British scientists did not have access to German optical works, Horace repaired all the broken Leitz microscope objectives – a task that involved making hundreds of lenses. The camera obscura was also turned to good use. Horace spotted exploding bombs and was able to give the authorities instant impact positions. As an expert on gas flow he formed part of a team which examined a German V2 rocket engine. By measuring the jets, chamber shape, and so on, it was possible to work out the distance that the V2 had flown: the rocket had fallen in Sweden – and Peenemünde, on the Baltic coast of

*The numerical aperture gives the resolving power of a microscope objective, and is about 1.4 for the best commercially available objectives.

REPORT OF THE MEETING. [42, 9. JULY 1932.]

Mr. H. E. Dall then described a 6-inch reflector of Cassegrain type, constructed chiefly for terrestrial use, which he had brought with him to the meeting. In answer to a question, he stated that the loss of light as compared with a Newtonian of the same aperture, due to the triple achromatic lens in the optical system, was not more than about 10 per cent.

Instr.-Capt. Ainslie said that he would like to congratulate Mr. Dall both on the design of his telescope, and also on its execution.

He would like also to draw the attention of members to the fact that the aperture ratio of the large speculum was only 3·2 to 1: this meant considerable difficulty in figuring, and the fact that Mr. Dall had been able to do it argued very high skill on his part ; he (the speaker) knew from experience the difficulty of figuring a mirror of ratio 7 to 1, and Mr. Dall had done something far more difficult.

Mr. Dall's telescope was certainly the most compact he had ever seen of its aperture; and the fact that the weight had been kept down to something like 5½ pounds for a 6-inch aperture was, in itself, a very remarkable feat.

1947 November *Papers Communicated to the Association* 201

PAPERS COMMUNICATED TO THE ASSOCIATION

A Null Test for Paraboloids

By H. E. Dall

COMMUNICATIONS TO THE ASSOCIATION

VISUAL ASTRONOMY IN THE ULTRA-VIOLET

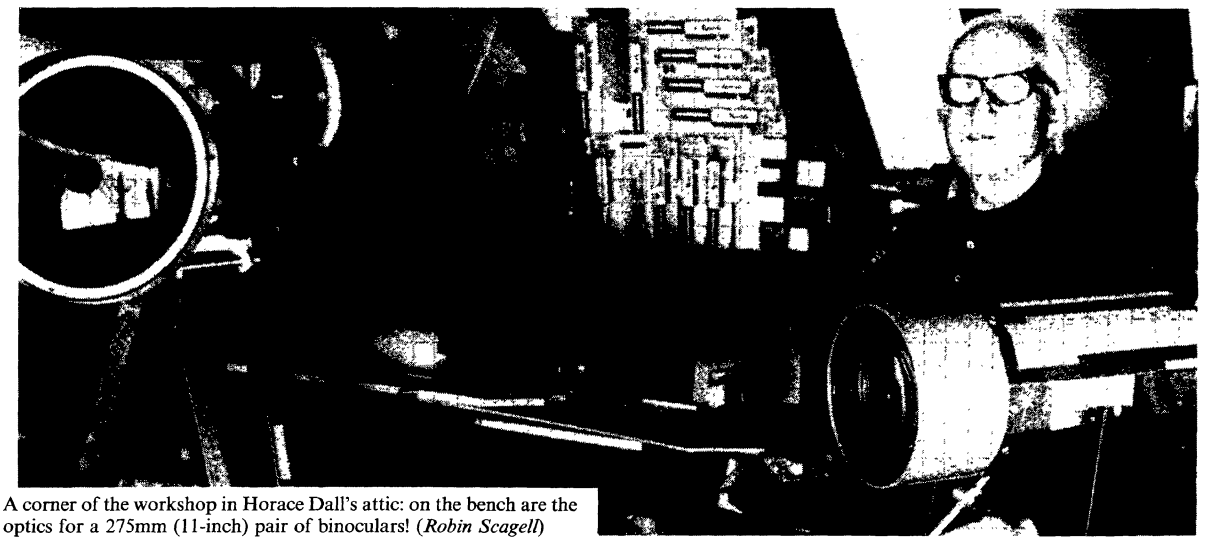
H. E. DALL

The title appears to be a contradiction in terms. How can one carry out visual observation by means of light from the invisible part of the spectrum?

Even if the spectroscope is capable of showing the ultra-violet, very few adults can see appreciably beyond the Mercury violet line at 4 047 Å.

I happen to be one of those adults and can now see right into the ultra violet to a wavelength of about 3 300 Å or one-third of a micron because the so-called crystalline lenses of my eyes have been removed in normal cataract operations.

Incidentally, although the violet line at 4 047 Å appears to me as a vivid violet, the ultra-violet line of Mercury vapour at 3 655 Å appears as blue rather than as violet, indicating an unsuspected kind of fold in colour vision sequence.



A corner of the workshop in Horace Dall's attic: on the bench are the optics for a 275mm (11-inch) pair of binoculars! (*Robin Scagell*)

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1987JBAA...97...76H



Horace unfolds a 150mm (6-inch) pocket telescope (*Robin Scagell*)

Germany, was at the correct distance... Ten days after the war was over, Horace was at the rocket factory in Peenemünde helping to assemble a V2 rocket which was launched on a test flight into the North Sea.

The year 1947 saw a paper in the BAA *Journal* on the null testing of paraboloids – a real gem! This one test has been so developed by Horace and others that it greatly simplifies the making of most of the conic surfaces that the amateur needs. Horace's papers and notes on optical matters are classics: they are precise, simple to understand, and brief.

After the Second World War Horace Dall was kept very busy at work, sometimes being sent abroad, for example to sit on some international committee. This did not stop his experiements in optics. Following the work of Gabor, Bowers, and Maksutov on catadioptric systems, he soon developed his own version of what is now known as the Maksutov design of telescope. Horace combined the Maksutov meniscus shell and his Dall-Kirkham (with transfer lens) to produce a very compact instrument. Over the years he produced dozens of these telescopes, including a $2\frac{1}{4}$-inch (57mm) instrument that would fit into his jacket pocket – stand and all!

With the introduction of cheap airfares, Horace expanded his adventure holidays to include the whole world. Long-standing friendships were renewed, and new friends made. Horace did not enjoy standing up in front of a crowd: in fact friends sitting next to him at BAA meetings would often have whispered into their ears "Someone really ought to tell them..." One knew one's duty – and passed on the message. In the company of a few close friends however he really relaxed, bubbling over with enthusiasm with the latest news, or demonstrating the current project. He never seemed to stop. Horace would remark "Life's too short to spend it sleeping"; and in his early days he trained himself to make do with only five hours sleep per night. In later years he supplemented this with 40 minutes in the afternoon, but used an alarm clock to make sure he didn't overdo it! There were just too many exciting projects to get on with.

Retirement from George Kent Ltd came in 1965, a year after Vivien had died, but he carried on as a consultant for a time. He was also an *ad hoc* consultant to various telescope companies around the UK – for example in the early days of Cox, Hargreaves & Thomson Ltd, Horace did much ray-tracing for Hargreaves. Amateur astronomers would turn up at his home in their droves, often with objectives that needed testing or reworking. And then there was the correspondence: he must have answered not hundreds but thousands of letters every year. This inevitably led to more visitors from abroad, and more places to visit when overseas.

Horace remained tremendously fit. On a visit to Tenerife during his mid-sixties he recalled "On the first day I did $6\frac{1}{2}$ miles overland, and came back aching all over: but a hot bath and early to bed. Then the following day I did 25 miles and didn't feel a thing!"

The bicycle had been pensioned off when Horace was in his fifties, and was replaced by a Vespa motor scooter. On retirement from Kent's he flew to Australia, bought a Vespa, and proceeded to ride all the way round the continent, on a trip that took some months. He had with him his pocketable 6-inch Cassegrain. In 1968 he determined to travel the whole length of South America, and while he was in Patagonia he met Helena (*née* Thurley), who was to become his second wife. She was a kindred spirit, who had also lost her spouse about three years earlier; they were married later that year. Suddenly Horace gained a family: Helena had a son, two daughters, and several grandchildren.

It was a happy time. Horace had the knack of knowing instantly what level to communicate at, and it was rare for anyone to feel after a conversation with Horace as baffled as before. Maybe not all was

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Horace Dall, microscopist, at work. (*Photos on this page and p. 77 by David Jackson*)

revealed, but one felt as though one had been shown the way. Children delighted in being shown around the workshop, with its host of interesting things. Memories of a visit were likely to last for decades, as I know from my own children's recollections.

Soon Horace and Helena were off on trips that people half their age would have felt too ambitious. There was an expedition to southern Africa, where Horace pursued a rhino into the bush, determined to get his photo. There was the time when they visited a monastery in the foothills of the Himalayas and stayed overnight, after the rest of the party had left; the following morning they walked the 18 miles (29km) back to the hotel, along forest tracks. One winter Helena attended the local college in Luton and learnt enough Russian for them to cope with a trans-Siberian trip to Mongolia. The final major expedition, undertaken when Horace was about 80, was too much: it involved going to South America, California, Vancouver, Toronto, and then home. He was bitten by a tropical insect – which he duly mounted up, and delighted in showing to visitors through a stereo microscope. A minor heart problem developed, but he recovered; then throat problems had to be overcome. Finally, however, in 1986 March, while repairing a friend's microscope objective, Horace suffered a stroke, which proved to be fatal. He died on May 9.

Horace always refused to be BAA President, but he did serve for many years on the Council, for several sessions being a Vice-President. He was the Walter Goodacre medallist in 1967. Even when he had to stand down from Council he would continue to referee papers for the *Journal*.

In 1977 the Institute of Measurement and Control awarded Horace Dall their Callender Silver Medal; as a measure of this honour, it is worth noting that by far the majority of previous recipients had been Fellows of the Royal Society. In the same year, Horace joined the Queckett Microscopical Club, who meet at the Science Museum, and it was here that he would exhibit his latest techniques for increasing contrast. After a cataract operation he found that he could see into the near ultraviolet; this allowed him to focus directly his high-power microscopes in order to photograph detail which had rarely, if ever, been recorded before with a light microscope.

The Science Museum now has much of Horace's instrumentation, notebooks, files and correspondence: Dr Jon Darius is preparing an archive. This obituary article can only highlight some of Horace Dall's achievements; it would require a book to do him full justice. Readers may wish to know that another obituary has appeared in *Microscopy*, The Queckett Club's biannual journal (issue of summer 1986), by Reg Taylor. There has also been an appreciation by Brian J. Ford, followed by a description of his gemstone working techniques by Peter Evennett, in *Proceedings of the Royal Microscopical Society*, **19**(2), 98 (1984).

To many of my generation Horace was a father figure whose great help and many kindnesses will be sorely missed. We extend to Helena and her family our condolences at their great loss.

Acknowledgements

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