

## Obituaries

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### DONALD HARRY SADLER, O.B.E. (1908–1987)

Donald Harry Sadler was born in Dewsbury, Yorkshire, on 1908 August 22. He was the second son of James Wright Sadler, a master tailor, and Gertrude Jane (née Needham), formerly a schoolteacher. From 1919 to 1926 he attended the Wheelwright Grammar School in Dewsbury, where the headmaster, Leslie Sadler (no relation), was a very good mathematician and teacher. Donald won an Open Entrance Exhibition to Trinity College, Cambridge, where he was awarded a Senior Scholarship on the result of the second-year examinations. He obtained a B.A. degree with first-class honours in mathematics in 1929. He spent a further year in Cambridge and worked primarily in mathematical statistics under the guidance of G. Udney Yule, but he also kept up his earlier interest in celestial mechanics. He was awarded his M.A. degree in 1933.

Sadler was appointed as a Temporary Assistant at a salary of £6 per week in HM Nautical Almanac Office (NAO) on 1930 October 13. At that time the Superintendent was L.J.Comrie, who was a pioneer in the use of commercial calculating machines for scientific computations and a master craftsman in the design and production of mathematical and astronomical tables. Sadler learnt much from him, and he was established and appointed Deputy Superintendent in 1933. The NAO was then based in the Royal Naval College at Greenwich, and Comrie reported directly to the Board of Admiralty. Comrie was suspended at short notice on 1936 August 19 and Sadler became Acting Superintendent. The Board decided that the NAO should become a part of the Royal Observatory, Greenwich, and Sadler became a Chief Assistant to the Astronomer Royal, then H.S.Jones (later Sir Harold Spencer Jones); his appointment as the seventh Superintendent of the Nautical Almanac was confirmed on 1937 July 27. (The first person to hold this title was Thomas Young, who supervised the work of home-based computers and comparers as there was then no ‘office’.) Sadler carried through to a successful conclusion several projects that had been initiated by Comrie, and new publications included *Planetary Co-ordinates for 1940–1960*, *Interpolation and Allied Tables*, the first *Air Almanac* (for the end of 1937), a 16-volume set of *Astronomical Navigation Tables* (AP 1618), and *Apparent Places of Fundamental Stars* (for 1941).

During the Second World War the NAO was based in Bath with many other departments of the Admiralty, and its activities and staff were considerably expanded. The NAO produced tables and diagrams for use by the Army and the Air Force as well as for the Royal Navy; examples were corrections for gun-sound ranging, bomb-ballistic tables, and night-illumination diagrams. In all such projects Sadler played a major role in design, planning and execution. From 1941 to 1946 the NAO acted as the computing centre for the Admiralty Computing Service (ACS), of which the

head, J.T.Todd, was based in London. Sadler had to plan and supervise all the computational work for a large number of special projects as well as for the astronomical and navigational almanacs and tables. The ACS produced over 100 reports; Sadler wrote some of them and edited them all. One of the major tasks undertaken during this period (and for many years after the end of the war) was the calculation of coordinates for use in plotting hyperbolic lattices on charts for the newly developed top-secret DECCA navigation system, which was first used on D-Day.

Sadler's considerable wartime services to the nation were recognized by the award of the Order of the British Empire in 1948; and he also received the Thurlow Award of the US Institute of Navigation in the same year. He was elected Membre Correspondant du Bureau des Longitudes, Paris in 1950.

The strong team of NAO and ACS staff that Sadler had built up was eventually split when a Mathematics Division was formed in the National Physical Laboratory in 1946. Sadler remained the Superintendent of the NAO, and so astronomy and navigation continued to benefit from his technical skills and leadership abilities. There was some cooperation between the NAO and the NPL over the next decade, but it is clear that the benefits to the nation would have been much greater if the team had formed the nucleus of a central computing facility for Government Departments in a National Mathematical Laboratory as Sadler and Todd had proposed.

The post-war years saw other major changes in the NAO: the introduction of a new staff complement and grading structure within the Scientific Civil Service; the move from Bath to Herstmonceux to join some other departments of the renamed Royal Greenwich Observatory (RGO) in 1949; the acquisition of punched-card machines for computation and copy preparation; and the development of closer ties with the NAO of the US Naval Observatory in Washington. As a consequence of Sadler's shrewd judgement, strong determination and careful attention to detail, all these changes took place smoothly and the regular production work for the almanacs continued without apparent disruption. Sadler became strongly involved in the general administration of the RGO and in the promotion of greater international cooperation in the production of the almanacs, and yet he also made major contributions to the improvement of the almanacs, to the design of new auxiliary tables for astronavigation, and to the preparation of other new publications. For example, he made major contributions to: *The Star Almanac for Land Surveyors* (first published for 1951), *The Abridged Nautical Almanac* (completely redesigned in principle and layout for 1952), *Interpolation and Allied Tables* (completely new edition in 1956), *Planetary Co-ordinates for 1960–1980* (1958), *Subtabulation* (1959), *The Astronomical Ephemeris for 1960* (with its many changes from *The Nautical Almanac and Astronomical Ephemeris for 1959*), and *The Explanatory Supplement to the Astronomical Ephemeris* (1961).

Sadler was the driving force behind a great deal of rationalization of the computation and publication of navigational and astronomical ephemerides. Some computations had been shared between the principal ephemeris offices for many years (even during the war), but the almanacs were still printed separately in many countries, with different layouts as well as in different languages. Sadler stressed the advantages of the use of camera-ready copy

that could be prepared in one country and then distributed to other countries for use in the final printing process. This obviated much computation and proof-reading, and also meant that navigators and astronomers in many countries could use the same high-quality material. The initial step in this project was to unify the navigational almanacs and tables of the UK and USA; this involved an enormous amount of correspondence and delicate negotiations. Fortunately, Sadler established a very good working relationship with the Director of the Nautical Almanac Office of the US Naval Observatory, Dr G.M.Clemence. The first example of this approach was the *Air Almanac*, but the outstanding example is still the *Nautical Almanac*; the copy was prepared by using a card-controlled typewriter at Herstmonceux and this was copied photographically and distributed to eight countries by Her Majesty's Stationery Office. It was estimated that the NAO figures were used on a quarter of a million ships and boats throughout the world.

Sadler was very disappointed that he could not get agreement to the introduction of an 'international fundamental astronomical ephemeris' based on a similar approach; in this case, Clemence was unable to get approval to change the name of the *American Ephemeris and Nautical Almanac* and so from 1960 until 1980 the British and American astronomical almanacs had identical contents but different covers and title pages. Sadler did, however, convince Professor W. Fricke, Director of the Astronomisches Rechen Institut (ARI) at Heidelberg, of the value of this approach; the ARI stopped the publication of the *Berliner Jahrbuch* and took over from the NAO the production and publication of *Apparent Places of Fundamental Stars* from 1960.

Throughout his career Sadler was involved in the activities and administration of several astronomical, mathematical and navigational organizations. In the early 1930s he was an active member of the Computing Section of the British Astronomical Association. He became a Fellow of the Royal Astronomical Society in 1931 and a member of its Council in 1937. He was one of its Secretaries from 1939 to 1947; in this capacity he played a major role in the running of the affairs of the Society during the Second World War. He has written an account of the decade 1940–1950 in Vol. 2 of the *History of the Royal Astronomical Society*. With characteristic modesty he has emphasized the contributions of others during this very difficult period, when he was working in Bath, the Society's office was in Oxford, and the meetings were held in London. His election to President for the period 1967–69 recognized his personal contributions to the Society as well as his scientific achievements. He was a member of the Council for a total of 20 years, and he was a very regular attender at the dinners of the Royal Astronomical Society Club. He served British astronomy in many other ways; as Superintendent of HM Nautical Almanac Office he was an ex officio member of the British National Committee for Astronomy and he was also a member of the Joint Permanent Eclipse Committee of the Royal Society and Royal Astronomical Society.

The Royal Institute of Navigation also owes much to Sadler's participation in its affairs; he was a member of the Steering Committee, the Preliminary Council and the first Council, which was elected in 1947 with (at Sadler's suggestion) the Astronomer Royal, Sir Harold Spencer Jones, as its President.

He himself was President of the Institute from 1953 to 1955, and he was chairman of the Membership and Fellowship Committee for many years. He was awarded the Gold Medal of the Institute in 1957 and Honorary Membership in 1973. His presidential addresses to the RIN, and later the RAS, covered the relationships between astronomy and navigation and the astronomical measurement of time. He continued to contribute to the *Journal of Navigation* to the end of his life; his main interest was in astronavigation, but he also participated in the discussions on the rules for the avoidance of collision at sea and other aspects of navigation.

Sadler was one of a small group of specialists who served on the Mathematical Tables Committees of the British Association for the Advancement of Science (from 1933 to 1948) and then of the Royal Society (to 1965). He made special contributions to the volumes on Emden functions (then of great importance for the development of astrophysics) and on Bessel functions, but he also took part in the planning, proof-reading and other editorial work for many of the other volumes. The computations, including the running checks and final independent checks, had to be carefully planned so that they could be carried out efficiently by human computers using desk calculating machines, and the tables had to be designed so that they were economical of space (and hence in cost) and yet could be used with reasonable ease. Sadler became an expert in both these fields to the benefit of both astronomy and navigation.

The post of Superintendent of HM Nautical Almanac Office was graded at the level of Senior Principal Scientific Officer, but on Woolley's nomination Sadler was given in 1959 a Special Merit promotion to Deputy Chief Scientific Officer; in this case, the rules had to be bent rather than broken as it was clear that Sadler would not be able to devote all his time to research, rather than to administration. During the 1960s he had to delegate more of the responsibility for the work of the NAO to other members of the staff, but nevertheless he kept a strong interest in all of the work. During the negotiations for the transfer of responsibility for the RGO to the proposed Science Research Council, the future of the Office came into question, but Sadler argued successfully that it should stay as part of the RGO and not be retained in the Ministry of Defence. He was, however, horrified when he found that the bureaucracy in SRC was much more intrusive than that of the Admiralty. He recalled that the estimates for the work of the NAO could usually be settled each year by a short telephone call, but the SRC refused to accept his estimate of the cost of the 'defence' portion of the work of the Office. Instead, the SRC sent a three-man team that spent 3 days at Herstmonceux and eventually arrived at a figure that was within a few hundred pounds of the estimate that had taken him only a few minutes to derive.

The international character of the work of the NAO meant that Sadler was strongly involved in the activities of the International Astronomical Union. His first introduction to the administration of the Union came in 1948 when he was the UK representative on the Finance Committee. He was President of Commission 4 on Ephemerides from 1952 to 1958 and did much to encourage greater cooperation between the ephemeris offices and other related organizations throughout the world. In 1957 Andre Danjon, then



President of the Union, invited him to become the next General Secretary; at first he declined, but he later accepted after Woolley (then Astronomer Royal) had been persuaded to put pressure on him and had agreed to make available some assistance from the RGO. He was General Secretary from 1958 to 1964, and so was responsible for the organization of the General Assemblies in Berkeley in 1961 and in Hamburg in 1964. During that period he did much to systematize and document the very large number of jobs that had to be done at the appropriate times in order to ensure both the smooth running of the meetings and the publication of the triennial reports on astronomy and of the proceedings of the Assemblies. His influence can still be seen in the procedures that are in use today.

Sadler felt very strongly that the activities of all such organizations, whether a local sports club or an international scientific union, should be conducted in accordance with an appropriate set of rules. He not only took time to draft new or improved rules, but he would also draw attention to situations where he felt that the rules were not being followed correctly; to some this appeared pedantic, but he was only too well aware of the difficulties that can arise when such rules are broken.

After his period as General Secretary, he continued to assist the Union in various ways; for example, he represented the Union on the Council of the Federation of Astronomical and Geophysical Services, and he became its Vice-President (1965–68) and then its President (1968–70). The Royal Society invited the IAU to hold its fourteenth General Assembly at Brighton in 1970, and Sadler was appointed as chairman of the Local Organizing Committee. He tried, with a high degree of success, to anticipate all the requirements of the participants and to ensure that information about the meetings and facilities was readily available to all. Again, many of his ideas have been adopted in later Assemblies.

Several countries in Europe formally recognized the value of his work: he was elected a Foreign Member of the Société Royale des Sciences de Liège in 1964; he was granted an Honorary Doctorate by the University of Heidelberg in 1970; and he was awarded the Adion Medal by the International Observatory at Nice in 1969 and the Prix Jannsen by the Société Astronomique de France in 1972.

The year 1967 saw the bicentenary of the publication of the first Nautical Almanac and hence a revival of interest in the method of lunar distances. Although he was heavily engaged in the preparation of new sight reduction tables for marine navigation, Sadler quickly wrote the text for the booklet *Man is not lost*, which was issued in conjunction with a special exhibition at the Old Royal Observatory at Greenwich. He also developed the concept of a hands-on exhibit (sometimes referred to as the ‘sadlerium’) to illustrate the taking of a lunar distance, but the realization by the National Maritime Museum did not stand up to the hard use that it was given.

Sadler made major contributions to the formation of the International Association of the Institutes of Navigation. First of all he had discussions with R.L.Duncombe, then President of the American Institute and a former Director of the (US) Nautical Almanac Office; these discussions led to a joint proposal for the Association. He later took part in the detailed planning and encouraged Michael Richey to be the first secretary of the Association in

1972. Sadler was elected an Honorary Member of the US Institute of Navigation in 1979.

At the beginning of 1970, he was formally seconded to work on the organization of the IAU General Assembly in Brighton, and he gave up his day-to-day responsibility for the work of the NAO. He did not take back this responsibility after the Assembly, although he retained the title of Superintendent of the Nautical Almanac until he was disestablished in February 1971. He remained on the staff of the RGO for a further year. Unfortunately, Sadler suffered from angina, and so he did not feel able to accept an invitation to be nominated as the General Secretary of the International Council of Scientific Unions. As a consequence, after his retirement from the RGO in 1972 he was able to keep up his interest in time and navigational matters, and he started to write a history of the NAO. He abandoned this when he became convinced that the archived documents about the activities of the previous Superintendents were too limited in their scope, but he did write from memory 'a personal history of H.M. Nautical Almanac Office 1931–1972', which contains much fascinating detail about the background to the formal record and about his own wide-ranging activities.

During his retirement Sadler planned the astronavigation section of the new *Macmillan and Silk Cut Nautical Almanac*, and he later designed the sight reduction tables for the *Macmillan and Silk Cut Yachtsman's Handbook*. He continued to argue for the retention of the name Greenwich Mean Time (GMT) for navigational purposes, and it is said that he always wore a black tie on those occasions when a leap second was to be inserted in the time-scale and hence in the BBC six-pips signal for GMT. His 1978 review paper (in this journal) about GMT describes the controversial changes that were made in 1925 and 1972, and the RGO archives contain an unpublished note giving additional detail. The centenary celebrations of GMT in 1981 and of the Prime Meridian Conference in 1984 gave him further opportunities to comment on these matters.

Sadler had the reputation in the RGO of being a strict disciplinarian, and there is no doubt that he expected high standards of work from the staff of the NAO. Nevertheless, those who came to know him better realized that he was always scrupulously fair, and that he would go to a great deal of trouble to try to ensure the well-being of his staff. This is perhaps best illustrated by a tribute which was written by one of his wartime secretaries and which was unexpectedly published in *IUGG Chronicle* in 1988; she 'knew him as a kindly, courteous and modest man'. To the staff of the NAO he was known as 'DHS' as the use of initials in internal memoranda was the accepted practice, regardless of rank. The loyalty that he engendered in his staff, especially those that worked long hours with him during the war, is shown by the high attendances at the NAO Reunions that were held in 1963, 1973, 1982 and 1987.

In 1954 Sadler surprised most, if not all, of his colleagues and friends by marrying Flora McBain, who had been a vacation student in the NAO in 1935 and a member of the staff since 1937. Flora had also served as a Secretary of the RAS, and she was in charge of the Occultation Section of the NAO at the time of their marriage. At first they lived in Flora's flat in Bexhill,

but they soon moved to a house in Cooden that became well known to many astronomers from many different countries. Their dinner guests sometimes included vacation students, and at least one astronomical couple admits to meeting on such an occasion.

Sadler was a great competitor, and he took part in a variety of both outdoor and indoor sports and games. He was particularly keen on hockey and tennis, and he was also a useful cricketer and a member of the 'RGO Stars' table-tennis team in the early years at Herstmonceux. He also enjoyed billiards, snooker and darts, and he won the Spencer Jones Indoor Sports Trophy in the RGO Club in 1954; he used to organize a billiards match between the UK and the USA at IAU General Assemblies. He was a good chess player, winning tournaments in town clubs as well as in the RGO, and he enjoyed bridge and any other game or puzzle that required skill or intellectual effort.

Although he made no major scientific discovery, Sadler contributed a great deal to astronomy and navigation, and it is probable that other fields of science have benefited from his diverse activities, particularly in the publication of mathematical tables. It must also be recognized that many young people gained valuable training and experience while working in the NAO under his general supervision and that they have subsequently gone into other jobs in many different fields. Many other people have benefited from working with him in societies and international organizations, and those who came to know him as a friend will remember him with pleasure.

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