

war. 'I have spent my life in Navigation,' he said (and quoting the long dead John Seller): 'it being indeed the beauty and bulwark of England, the wall and wealth of Britain, and the bridge that joins it to the Universe'. Like John Seller, his predecessor in instrument-making by three centuries, Arthur Joseph Hughes will not be forgotten by navigators whom he served.

E. G. R. Taylor

CHARLES SUMNER DURST, O.B.E.

CHARLES SUMNER DURST, meteorologist and a Fellow of the Institute and sometime member of its Council, died on Christmas day 1961. His work in meteorology began at the age of thirty-one when he joined the Meteorological Office after service in the first world war, and continued without interruption until his death over forty years later. Throughout this period he was remarkable for a profusion of original ideas on whatever aspect of meteorology he came into contact with, and he pursued many of these ideas over long years, or returned to them as opportunity permitted. In the earlier part of his career his official duties included periods of work on marine meteorology, examination of candidates for flying and navigational licences, and weather forecasting, as well as other branches of meteorology. Early in the second world war he was put in charge of a new branch of the Meteorological Office which had been formed to deal with enquiries from military planning staffs and others, and was later promoted to Assistant Director. In this position he himself wrote, or supervised the production of, a large number of detailed aviation reports covering practically the whole theatre of military operations; his climatological knowledge in this respect was unrivalled and among other papers it led to his contribution to the *Compendium of Meteorology* (American Met. Soc., Boston, 1951). Another subject to which he gave much attention at this time was the meteorology of airfields, a summary of which was published under that title (H.M.S.O., 1949).

As regards his impact, both on meteorology itself and on matters relating to air navigation, he will perhaps be best remembered for his pioneer work in relation to wind. An early example of this interest is contained in his part in the research on wind structure carried out by Meteorological Office staff at the Royal Airship Works, Cardington, Beds., the results of which were published in *Geophysical Memoir* No. 54 (H.M.S.O., 1932). Well before the end of the second world war enquiries began to come in from civil aviation sources regarding the effect of wind on the operation of long distance transport aircraft. In cooperation with the late C. E. P. Brooks and others Durst developed the statistics of wind and their application to air-route planning. Fundamental for this work was the representation of the three-dimensional field of wind over the globe by means of only two parameters—the mean vector wind at any point over a month or season, and its standard vector deviation. Durst had for long protested against the unrepresentativeness of pilot balloon observations, which can be made only in clear weather, and it was not until about 1940 that this method began to be superseded by the present radio methods. These made possible the accurate mapping of upper winds on a world-wide scale, in which Durst himself played a large part. In addition to the application to route planning, Durst also investigated the variation of wind in space and time. For this purpose it was necessary to develop the theory of the correlation of vectors, which was done in collaboration with G. H. Gilbert. Another of his interests was the forecasting of

winds by statistical methods; closely related to this are the accuracy of forecasts of winds on air routes and considerations of errors in navigation, both of which were tackled from a statistical point of view. Most of the results of those studies were published in a series of papers in the *Journal* of this Institute within the last decade of his life.

Durst's work was recognized by the award of the Royal Meteorological Society's Buchan Prize in 1937, the Air Ministry's Grove Memorial Prize for Meteorology in 1949, and this Institute's Bronze Medal in 1950 and again in 1956.

A. F. Crossley

J. E. D. Williams writes :

Nearly a decade ago Durst remarked rather diffidently that he thought he understood the problem of D.R. navigation and would like to do a paper on it. As D.R. navigation had been with us for a long time and many able scientists and navigators had tried to put it on a logical basis, there was little reason to think that the meteorologist, however distinguished in his field, would do more than add to the multitudinous, competent papers on the subject. One should have known Durst better. In the event, his paper 'The Accuracy of Dead Reckoning in the Air' read to the Institute on 17 December 1954, is the classical and definitive analysis of the subject. The full practical and procedural implications of this work have not been fully developed, largely because, for quite other reasons, D.R. navigation in its fullest sense was already on the way out; had it been otherwise Durst would have been the father of modern D.R. navigation.

His work, with others, on the statistics of wind have found an important application in route analysis and operation planning quite essential to the economic development of modern air transportation. In more recent years, and right up to his death, his interest turned to the matter of aircraft separation criteria on which there was every indication his contribution would have been unique, characteristic and invaluable.

Durst's modest humour never hid the powerful analytical qualities of his intellect but his most stimulating quality was an uncanny grasp of the true nature of the operational requirement. The Institute is fortunate that he chose to publish since 1949 a dozen papers in the *Journal*. All of them were a worthwhile contribution to navigation and an impressive proportion remain important.
