Recent Aeronautical Research

THE annual report for 1934–35 of the Aeronautical Research Committee* summarises the progress made in the investigation of scientific questions and the dissemination of the knowledge made available during that period. The report takes the usual form of a general survey of the whole field with fourteen detailed supplements upon various divisions.

The outstanding technical achievement of the year is considered to be the designing of the *D H* Comet, which flew and won the race from Mildenhall to Melbourne, a distance of 11,300 miles, in less than three days. This performance was not due to any particular discovery made during that year, but simply to having put into practice principles that scientific research has gradually established over a period of many years. Among these are the necessity for clean design, avoidance of mutual interference of parts, use of variable pitched airscrews and retractable undercarriages, the application of reduced speed landing devices, engine-cooling with minimum drag, etc.

The report visualises further possible increases in aircraft performance due to the steadily maintained improvement in aero-engines, progress in engine cooling, fuller appreciation of the aerodynamic causes and effects of skin friction and the development of lighter methods of construction. When this increased efficiency is directed towards higher speeds, the possibilities of flutter of certain parts developing is increased, and it is suggested that a criterion for stiffness to limit this must rank of equal importance with that for structural strength. Also, high speeds necessitate the use of speed-reducing devices, such as flaps and slots, for landing, and while these are successfully used in an empirical manner, a more detailed knowledge of the flow of air over wings at slow speeds is needed before their behaviour can be understood and forecast.

Investigations into the meteorological conditions affecting aircraft, particularly the measurements of accelerations in gusts, have confirmed that, for average flying speeds of to-day, an additional loading equivalent to not more than twice the aircraft weight is the maximum likely to be met. Design strength regulations at present in use cover these cases sufficiently. Work is continuing on the design of instruments to be attached to high masts in order that a more comprehensive investigation into the velocity gradients extant upon the borders of large atmospheric disturbances can be completed.

The introduction of new research apparatus at the Royal Aircraft Establishment and the National Physical Laboratory appears to have resulted in a notable, although perhaps indirect, advance in knowledge. The explaining of certain apparent phenomena has led to a fuller investigation of the physical conditions of the experiments, which is reflected in the better co-ordination of the experimental results with actual practice.

Progress in certain directions has been made with regard to silencing of aircraft. Well-silenced engine exhausts, and the use of slow-running airscrews, has now reduced those sources of noise to an amount less than that due to the motion of the machine through the air. Thus the principal remaining cause of noise, air disturbances, will probably be reduced in time, as the efforts of designers towards aerodynamical efficiency result in machines that set up less disturbance in flight.

Investigations into the possibilities of large aircraft for civil aviation have led the Committee to the conclusion that there is no inherent difficulty in the construction of machines up to weights of two hundred tons. The flying boat or seaplane with six or eight engines appears to offer the most promising lines of development. Practical difficulties in the installation of such a large engine-power are to be expected, and the aerodynamic efficiency of a number of airscrews distributed along the wings will need investigation.

The most outstanding work in the engine section is that of reducing fuel consumption in flight by the perfection of an automatic mixture control functioning with altitude changes. Trials of this over extended periods have shown reductions up to thirty per cent in consumption. Apart from actual monetary saving, this will give greater air endurance for a given tankage, and relieve the pilot from the necessity of adjusting this control constantly, as is now necessary.

It has been discovered that ice formation in the carburettor can be prevented by the addition of alcohol to the petrol. A device has been produced for detecting automatically the need for, and supplying the necessary proportion of alcohol. There has been progress with compression-ignition engines, particularly with one of sleeve valve form, but as contemporary progress in the petrol engine more than keeps pace with this, there appears to be no immediate prospect of the adoption of this type, when the most important consideration is efficiency.

The supplements to the report deal with these and many other problems in greater detail.

The work of the Committee during the past year, as summarised in this report, has leaned towards consolidation and elaboration of detail, rather than anything leading towards new lines of thought.

* Aeronautical Research Committee. Report for the Year 1934–35. Pp. iv+74+4 plates. (London: H.M. Stationery Office, 1935.) 1*s.* 6*d.* net.

Mathematical Sciences in France a Century Ago

AT the annual public meeting of the Paris Academy of Sciences held on December 28, 1835, the president, Baron Charles Dupin, delivered a discourse on "Some Advance which the Mathematical Sciences have made in France since the Year 1830". A translation of this afterwards appeared in the *Magazine of Popular Science*, vol. 2, from which the following notes and extracts have been taken:

Commencing with references to the work of Fourier and Legendre, who had died in 1830 and 1833 respectively, Baron Dupin went on to speak of the researches of Poisson, of Poinsot, "the creator of the theory of couples which has so changed the face of statics and dynamics", of the young geometers Coriolis, Duhamel, Liouville and Sturm; of Prony, Poncelet and Morin, and also of the work of Pontecoulant and other French astronomers.

Turning to "those noble undertakings which are destined to describe mathematically the coasts, the territory and the soil of France", Dupin said: "After having undertaken and completed under the Empire, the hydrography of the coasts of Belgium, and of Holland, and next that of the shores of the ocean from Ushant to Spain, M. Beautemps-Beaupré, our colleague, is now continuing, on the same plan, the

hydrography of the shores of the Channel, and which will be followed by that of the Mediterranean. . . . A word will be sufficient to enable us to appreciate the magnitude of the undertaking. Two hundred thousand pounds, thirty years labour of the hydrographical corps, one half the life of its chief, and four hundred and fifty quarto volumes of observations and calculations, have been necessary to accomplish the hydrographical surveys of the coasts of France, to complete them in their two-fold relation to commerce and the naval interests, and to adapt them to the preparation of the grand atlas of the 'Pilote Français' ".

"The application of the mathematical sciences to those which are designated the natural ones—to the wants of the productive arts—to public works, of which we have presented such fine examples from works over which the Academy presides, forms the most remarkable characteristic in the actual progress of human knowledge. . . . The theory of heat promulgated by Fourier still excites attention. It has been made the subject of a large work by M. Poisson. . . . Effects which the reduction of heat by chemical means cannot produce are now accomplished by mechanical agency. In 1830 the Academy rewarded the gas compressing machine of M. Thilorier. A corresponding member of the Academy, M. Melloni, has communicated to us new facts relating to radiant heat."

From the midst of those philosophers devoted to electricity, "M. Becquerel has opened a path for himself. He has attacked chemistry with weapons of his own preparation, to subdue her to the dominion of mathematical laws. . . . Gifted by nature with extreme delicacy of the organs of sense, and exquisite power of observation, we may justly entitle him the Wollaston of France".

In other branches of investigation, "M. Majendie has borrowed from mechanical laws his explanation of the sounds of the human heart. . . . M. Flourens seeks in the mechanical pressure exercised upon the brain, an explanation of the condition of those persons who undergo the operation of trepanning . . . and M. Dutrochet who has communicated to us so many facts, the fruit of his ingenious observations on the internal dynamics of vegetables, has pushed his investigations into the mechanism of the respiration of insects, both aquatic and aerial".

In concluding his discourse, Baron Dupin said: "I am far from having enumerated all the recent modes in which mathematics have been applied to natural science. I have not even hinted at its application to that of politics, and of social economy, nor to the subject of population. Having individually taken a part in these discussions I shall pass them unnoticed".

"But in this sketch rapid, incomplete, imperfect, I ask with confidence, Do you not recognise the ever-increasing utility of science, the extent of her benefits, the sublimity of her titles, even during the short, embarrassed and turbulent period to which I have confined myself? The sciences must have therefore of necessity, a vital energy peculiar to themselves; a progressive power, superior to the obstacles of time, of things, and of man. Human passions, vulgar ambitions, and party-interests, pass away, but the labours of science, the sacrifices made for her sake, the victories borne off in her name, remain, and contribute to the enlargement of that splendid and profitable heritage on which, at the present day, is based her real grandeur."

Societies and Academies

PARIS

Academy of Sciences, November 25 (*C.R.*, 201, 997–1072). LUCIEN DANIEL: An accidental crossing of the bean. A detailed account of a hybrid bean, the descendants of which do not appear to be in agreement with the Mendel scheme. DIMITRI RIABOUCHINSKY was elected *Correspondant* for the Section of Mechanics in the place of the late M. de Sparre. NICOLAS KRYLOFF and NICOLAS BOGOLIOUBOFF: Some theorems of the general theory of measure. PAUL VINCENSINI: The curvature of congruences of spheres. ENRICE BOMPIANI: A system of curves of a surface invariant by projectivities. D. VAN DANTZIG: The idea of the derivative of a functional. DAVID WOLKOWITSCH: The theoretical problem of balancing rotating parts. ALFRED ROSENBLATT: Certain classes of movements symmetrical with respect to an axis of an incompressible viscous liquid. ANDRÉ AURIC: A cosmogonic hypothesis. CHARLES VALLOT: A new map of the Mont Blanc massif by Henri, Joseph and Charles Vallot on the scale of 1 : 20,000. PIERRE MARTI: A gravimetric cruise of the submarine *Fresnel* in the north-west part of the Mediterranean basin in 1933–34. Work done with the Vening-Meinesz apparatus for the determination of g at sea on the coasts of France, Spain, Corsica and the Balearic Islands. An outline of the results, with a chart, is given: a full account of the results will be published elsewhere. REZA RADMANECHE: The action of the ultra-violet rays on the electrical conductivity of quartz. The experimental results are summarised in a diagram. MAURICE LAMBREY: A system of transformation with logarithmic argument for continuous current. JEAN LAGRULA: An error in photographic photometry. Discussion of the effect of the inequality of the surfaces of the photographic plates and means of avoiding the errors thus produced. LOUIS D'OR: The absorption spectra of sulphur vapour. The author concludes from his experiments that sulphur vapour contains at least four species of molecules, excluding S_1. The spectrum described by Graham, Dobbie and Fox, and by Rosen is not due to S_8 (Graham) or S_2 (Rosen) but to an intermediate molecule, probably S_4. JEAN TERRIEN: The rotation structure of the D and E systems of bands of cuprous chloride. MICHEL KANTZER: The influence of pressure and of foreign gases on the optical absorption of chromyl chloride. A. VILA and F. TESSON: The measurement of the mechanical properties of plastic films. JACQUES BANCELIN and YVES CRIMAIL: Substances inhibiting the corrosion of iron by acids. A comparison of the effects produced by the addition of rhodamine and of thiourea to the acid solution showed that whilst the anti-corrosion effect of rhodamine increased with the concentration, there was a certain concentration of thiourea for which the corrosion of the iron was a minimum. O. BINDER: The decomposition of pentahydrated copper sulphate by heat. Crystallised copper sulphate heated to 650° C. gives a basic sulphate $2CuO.SO_3$, proved by chemical analysis and by a study of the X-ray spectrum to be a definite compound. EMILE CARRIÈRE and MLLE. LUCY FAYSSE: The comparative action on sodium thiosulphate of oxygen compounds of chlorine and of the corresponding oxygen compounds of iodine. JOSEPH MAGROU: Attempts at the culture of mycorrhizal fungi. ANTOINE DE CUGNAC: Remarks