6d. net). The Panel was under the chairmanship of Sir Arthur Fleming, who has an intimate personal knowledge of the employment of professional electrical engineers in manufacturing industry extending over a long period.

The scope of the investigation covered the assessment of the requirements of the main divisions of the profession and a comparison of this estimate with the existing supply. The estimated annual demand over the next five years is summarized as follows.

Public service (including the Armed Forces, government departments and public bodies such as the National Coal Board and British Electricity Authority)	660
Industry (including research associations)	900
Teaching (universities and technical colleges)	50
Consultants	10
Emigration and miscellaneous	50
	<hr/> 1,670

The annual supply up to 1950 is estimated at 1,550, made up as follows.

University output	500
From full-time courses in technical colleges	150
Higher National Certificates (credit standard)	600
Miscellaneous (including entry by the examinations of the Institution of Electrical Engineers)	300
	<hr/> 1,550

There is thus an estimated annual deficiency of the order of ten per cent. It is concluded that, as there is good ground for expecting an increase of output from the universities and technical colleges, resulting in the main from the substantial building programme which is in progress and the increase in the number of available scholarships, the deficiency is likely to be met by the provisions already in hand. The opinion is expressed that the requirements of industry generally "tended to be higher in the immediate future than was likely to be the case in subsequent years".

While the report is concerned specifically with professional engineers, an interesting incidental comment is made in regard to technicians. In general terms, the distinction between the professional engineer and the technician is made in respect of the professional engineer's ability to take personal responsibility for development in electrical engineering, while the technician will normally carry out technical work in accordance with established practice or under direction. It is estimated that the average ratio of the number of technicians to the number of professional engineers will be of the order of five to one. The report does not consider the adequacy of the supply of technicians, but it may be remarked in passing that there is evidence of a distinct shortage of this class of personnel.

While, as the report points out, no claim can be made for the accuracy of the estimates given, this document constitutes a valuable summary of informed opinion upon an important subject.

CORRECTED KRYPTON WAVE-LENGTHS

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I USED a reflecting echelon to measure vacuum wave-lengths of thirty-one lines in the arc spectrum of krypton in terms of the cadmium red standard¹. The dispersion formula of Barrell and Sears² and of Perreau³ for pure air and carbon dioxide respectively were used to calculate the wave-lengths in 'normal' air (air at 15° C. and 760 mm. pressure containing

0.03 per cent carbon dioxide). These were found to differ appreciably from those recommended by the International Astronomical Union, although very close agreement was obtained when the dispersion formula due to Kosters and Lampe⁴ or Perard⁵ was employed. Barrell and Bruce have pointed out that this discrepancy lies outside the error which could be attributed to difference between the three dispersion formulae, and further examination has revealed an arithmetical error in the application of the dispersion formula of Barrell and Sears.

The amended wave-lengths in 'normal' air are tabulated herewith, being calculated by each of the three dispersion formulae. Where the International Astronomical Union wave-lengths are not available, Jackson's⁶ are quoted and marked (J) accordingly. For simplicity, only fractional portions of wave-lengths are given in the last three columns. Each formula leads to a slightly different primary vacuum wave-length standard, since the wave-length of the cadmium red line 6438.4696 is specified in 'normal' air. Corresponding changes appear in the vacuum wave-lengths, and these are used in calculating the 'normal' air wave-lengths appropriate to each formula.

It will be observed that when the calculation is carried out in this way, differences between 'normal' air wave-lengths obtained by each of the three dispersion formulae do not differ by more than three in the fourth decimal place of an Angstrom unit. The mean difference between these wave-lengths and those of the International Astronomical Union is +0.0003 Å., which is the order of the standard deviation of the vacuum wave-length measurements.

This work is being repeated using a more refined technique and at the same time being extended into the near ultra-violet. I am most grateful to Mr. H. Barrell, of the National Physical Laboratory, Teddington, and to Mr. C. F. Bruce, of the Australian National Standards Laboratory, Chippendale, N.S.W., for their assistance in this matter.

International Astronomical Union	Barrell and Sears	Kosters and Lampe	Perard
4273.9700	0.9703	0.9703	0.9704
4282.9683	0.9681	0.9681	0.9682
4286.4873	0.4869	0.4869	0.4870
4300.4877	0.4861	0.4861	0.4862
4318.5525	0.5528	0.5528	0.5529
4319.5797	0.5805	0.5805	0.5806
4351.3607	0.3603	0.3604	0.3605
4362.6423	0.6420	0.6422	0.6423
4376.1220	0.1226	0.1227	0.1229
4399.9670	0.9673	0.9674	0.9675
4425.1906 (J)	0.1904	0.1905	0.1906
4453.9179	0.9183	0.9184	0.9185
4463.6903	0.6906	0.6908	0.6909
4502.3547	0.3549	0.3550	0.3552
4562.2257	0.2279	0.2280	0.2281
4570.2895	0.2902	0.2903	0.2904
4580.388 (J)	0.3888	0.3890	0.3891
4649.5628	0.5627	0.5628	0.5629
4672.4519 (J)	0.4512	0.4514	0.4515
4707.512 (J)	0.5127	0.5128	0.5129
4832.859 (J)	0.8599	0.8600	0.8601
4866	0.7514	0.7514	0.7515
4870.9158	0.9168	0.9169	0.9170
4879.9000 (J)	0.9003	0.9005	0.9005
4993.8503	0.8513	0.8514	0.8515
6012.1570 (J)	0.1569	0.1571	0.1571
6056.1280 (J)	0.1274	0.1275	0.1276
6082	0.8629	0.8630	0.8630
6236.354 (J)	0.3519	0.3520	0.3521
6421.029	0.0285	0.0285	0.0285
6456.291	0.2910	0.2910	0.2910

¹ Littlefield, T. A., *Proc. Roy. Soc., A*, **187**, 220 (1946).

² Barrell, H., and Sears, J. E., *Phil. Trans., A*, **238**, 1 (1939).

³ Perreau, *Ann. Chim. (Phys.)*, (7), **7**, 289 (1896).

⁴ Kosters, W., and Lampe, P., *Phys. Z.*, **35**, 223 (1934).

⁵ Perard, A., *Trav. Bur. Int. Poids et Mes.*, **19**, 66 (1934).

⁶ Jackson, C. V., *Phil. Trans., A*, **236**, 1 (1936).