Canada (see Basham et al., 1970, and Weichert, 1970). Both the methods and the conclusions differ among these studies. The Japanese and U.S.S.R. methods use measurements from visual seismograms; the United States and Canadian methods use Fourier analysis of digital array data.

The conclusions of the U.S.S.R. and Japanese studies, that the frequency content of P waves of earthquakes and explosions are sufficiently different so as often to be apparent on visual seismograms, are quite valid, but the method is not sufficiently rigorous and their statistics too poorly defined to be of value to a discussion of world-wide identification. Most seismologists have observed this characteristic of earthquake and explosion P waves: we require here a rigorously defined quantitative measure of this difference in frequency content and, therefore, will confine discussion to the United States and Canadian results.

The spectral ratio used for the LAO phased beam (Lacoss, 1969b) is the ratio of energy in a high frequency band (1.45 - 1.95 Hz) to the energy in a low frequency band (0.35 - 0.85 Hz), applied to P waves of both 10 and 20 seconds duration. The process applies a strict signal-to-noise ratio criterion in each frequency band. When plotted as spectral ratio versus LAO P wave magnitude, a suite of 82 earthquakes (with $h < 100$ km) and 33 explosions in Asia has the two populations separated nearly completely by a decision line which is a smooth function of magnitude; the exceptions are five earthquakes which appear on the explosion side of the decision line. Four of these earthquakes can be identified as such by the application of other discrimination criteria, an important point in itself which demonstrates the multivariate nature of the discrimination problem. Thus, for the process as defined, the spectral ratio at LAO has a high (but undefined) probability of correctly identifying both earthquakes and explosions in Asia.

Lacoss (1969a) presents some data on interval probabilities that the spectral ratio can be applied to a P wave. There is a 50 per cent I.P. of applying the spectral ratio at about m4.5 , which is about $\delta$m0.6 greater than the magnitude of m3.9 at which there is a 50 per cent I.P. of LAO detecting the P wave.* Here, we cannot extrapolate this LAO success to other regions or to other short period arrays and can state only that LAO has a 50 per cent I.P. of identifying Asian events at the m4.5 level. Using either the I.P. distribution of Lacoss or adapting equation (6) for this purpose, LAO spectral ratios will have a 90 per cent I.P. of identifying Asian events at about the m4.9 level.

The reason that these results cannot be extrapolated to other SPZ arrays or to a general world-wide coverage is that no other P wave spectral ratio study has yet shown equal success in identification. Basham et al. (1970) using YKA data show complete separation between small NTS explosions and aftershock earthquakes of large NTS explosions,

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* Note that in section 3.2 we assumed that the 50 per cent I.P. of LAO of a P wave was m3.8 , using the SIPRI reference. The difference $\delta$m0.1 is due to a greater distance to KAZ than assumed to apply at mid-third zone distances in section 3.2.