Reply by the Authors to H. S. Ribner

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THE comments expressed by Ribner on the paper by Barre et al.[1] concerning the nondimensionalization of the turbulence power spectral densities and wave numbers across the shock were, for us, quite instructive. That is why we will present, in this Reply, the results obtained with the data reduction method proposed by Ribner. From Ribner's Comment it appears that perhaps the turbulence frequency can be the good reduction parameter because the product velocity times the wave number preserves the invariance of frequency in a shock-fixed frame. Assuming that, we can then compare the two spectra expressed vs the upstream wave number. This is done in Fig. 1. This new figure may replace Fig. 15 of the original paper.[1] We can see a strong difference between the present and the previous version. The postshock spectra are then shifted left by dividing the plotted wave number by the mean flow velocity ratio across the shock. In the new version, the postshock spectra are represented with an area that is 1.5 times the preshock spectra area. This ratio corresponds to the longitudinal turbulent energy amplification across the shock. This was not the case in the original paper, where the two spectra were represented with the same area. This presentation, taking into account the amplification ratio, is also Ribner's suggestion, which allows us to immediately visualize the evolution of the energetic repartition across the shock. Figure 2 (which may replace Fig. 16 in the original paper) represents the ratio of the two spectra as they are presented in Fig. 1 with the new data reduction method. It is clear that the amplification rates are lower then in the initial version.

All of these modifications in the data reduction method do not change the conclusions of this work. It is always found that the small scales are more amplified than the large one. We then obtain a maximum amplification ratio of 3.5 for wave numbers in the range of 1300 m^{-1}. This wave number value corresponds to about 4.5 times the preshock longitudinal integral scale wave number. As Ribner suggested in his Comment, the present experimental results are now in quite good agreement with his theoretical results.[2]

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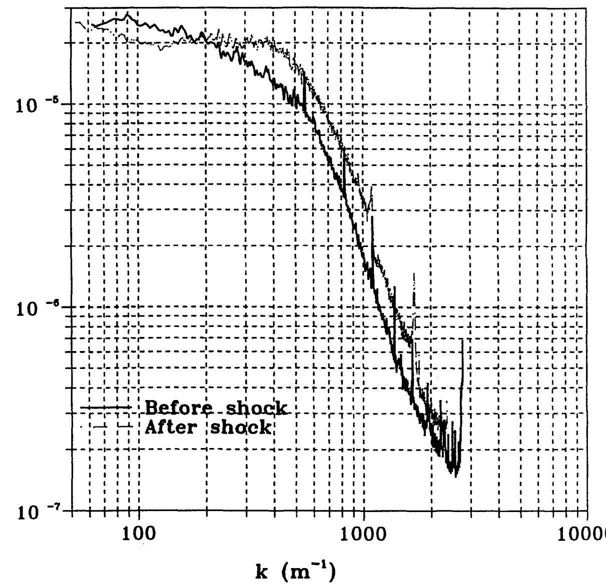

Fig. 1 Hot-wire spectra just before and 11 mm (∼two mesh grid sizes) downstream of the shock wave: before shock, area = 1 and after shock, area = 1.5.

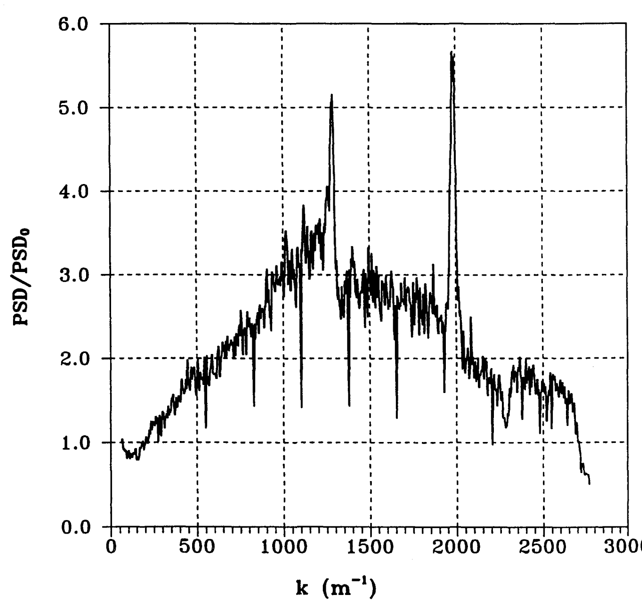

Fig. 2 Ratio of hot-wire spectra of Fig. 1 just before and 11 mm (∼two mesh grid sizes) downstream of the shock wave.

References

[1]Barre, S., Alem, D., and Bonnet, J. P., "Experimental Study of a Normal Shock/Homogeneous Turbulence Interaction," *AIAA Journal*, Vol. 34, No. 5, 1996, pp. 968–974; Errata, Vol. 34, No. 7, 1996, p. 1540.

[2]Ribner, H. S., "Spectra of Noise and Amplified Turbulence Emanating from Shock/Turbulence Interaction," *AIAA Journal*, Vol. 25, No. 3, 1987, pp. 436–442.

F. W. Chambers
Associate Editor