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Sonic-boom noise under a wavy air-water interface

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Recent investigations of the underwater sound field produced by sonic booms show that the latter's interaction with surface waves can strongly alter the sound level, frequency range and signal waveform reaching the deeper part of the ocean. Unlike conclusions from studies based on the flat-ocean model of Sawyers [1] which indicate little effects at depth beyond one signature length, the interaction of sonic-boom waves with a surface-wave train can generate non-evanescent, down-ward propagating waves which, owing to their lower spatial-attenuation rate, overwhelm the otherwise primary (flat-ocean) wave field. Theoretical results [2] substantiate and elucidate the significant differences between flat and wavy surfaces in waveform characteristics and their audibility in deep, and moderately deep water. Here we report on an extensive series of laboratory experiments performed specifically to validate this theoretical model and to ascertain the distinct differences in wave-field characteristics between a wavy and flat interface. The experimental measurements confirm the theoretical findings, showing the predicted differences between the sound fields measured under wavy and flat air-water interfaces stimulated by a passing sonic boom.
[1] Sawyers, K. H. J. Acoust. Soc. Am., vol. 44, no.2, pp.523 - 524, (1968) [2] Cheng, H. K. and Lee, C. J. (2004), J. Fluid Mech. vol 514, pp 281-312