Summary

Examples of sonic boom noise field under wavy water are studied, based on the theory of Part I, to ascertain the surface-wave influence on sound level, frequency and waveform of the perceivable sonic boom disturbances generated during supersonic aircraft and space launch operations. The study substantiates that, owing to the much lower attenuation rate, the time-dependent disturbances produced by the interaction of incident sonic-boom waves with a sinusoidal surface-wave train can be comparable to and overwhelm the otherwise flat-ocean (Sawyers) wave field at large as well as at moderate depth levels, depending on the surface-wave number k, the Mach number above water M_A, and the maximum surface-wave slope, δ. Examples of calculations indicate that audible disturbances from aircrafts at levels of 120-130 dB (ref. 1 μ Pa) can reach a depth of 1000-1500 ft. (300-450 m) where the waveform turn itself into a packet of wavelets with carrier frequency 20-40 Hz. Same dB levels are expected also at comparable depth (200-400 m) for the rocket space launch, but mainly in the low infrasound (1-10 Hz) range. Significant differences between sonic booms from supersonic aircraft and from rocket launch operations in noise characteristics underwater are discussed. Results are obtained for examples in which the surface-wave vector (propagation direction) does not align with the flight track and for examples involving multiple surface-wave trains. As an extension in the theoretical development, the series solution for a non-sinusoidal, periodic surface-wave train is developed, its convergence, and its far-field behavior (under $kz \gg 1$) are established. Importance of the sea-floor presence and the potential for excitation of sediment-interface waves are examined with the model of a shallow sea.