

**AIR-BLAST WAVES AND SECONDARY SHOCKS FROM  
LARGE OUTDATED AMMUNITION DETONATIONS  
OBSERVED AT LOCAL SEISMIC STATIONS**

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Air-blast waves from past large-scale surface experimental explosions were observed and analyzed not only at near-source pressure gauges, but also at seismic sensors located at several dozens km. Recent analysis revealed secondary shocks at these seismic records.

It was shown that the delay between the main and secondary shocks (SS) depends on the explosion yield, the distance and also on the explosion type (expressed by detonation velocity). An appropriate relationship was developed facilitating the yield estimation based on the measured SS delay.

Ground Truth information for 18 latest detonations of outdated ammunition at Sayarim Military Range in Israel, was collected, including explosives weights (from 9 to 20 tons), accurate coordinates and detonation times. Several stations of the Israel Seismic Network, located at distances up to 45 km, recorded strong acoustic phases from arrivals of air-blast waves, where secondary shocks could be identified. Measured SS delays correlate with explosion charge size, where an equivalent average detonation velocity for multi-unit ammunition charges should be analyzed and accounted for.

The presented method can be useful for prompt analysis of explosion accidents or missile/bomb hits, especially in cases where only records at local seismic stations, which contain arrival times of seismic waves and main and secondary air-blast shocks, are available. This data can provide estimation of explosion location, detonation time, equivalent yield and indication of an explosives type.