SIMULATION OF LARGE-SCALE-EXPLOSIVE CRATERING AND GROUND SHOCK USING A 600-G GEOTECHNIC CENTRIFUGE

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A necessary requirement of any subscale geotechnic simulation experiment is that it be performed at elevated gravity. When the same soil material is used in the centrifuge, the linear geometric scale factor is the reciprocal of the gravity field strength. Hence the product gL (gravity x characteristic dimension) must be equal in the model and in the prototype. Volume scales with the cube of the gravity as does the energy. The consequence ' of this type of scaled experiment is the ability to simulate very large prototype yield. The sufficiency of this type of scaling lids been demonstrated by two types of experiments.

A series was conducted using Ottawa Sand for which charge size was varied at fixed gravity arid then gravity was varied for fixed charge size. The results of this set of experiments versified that the cratering efficiency and crater configuration was a function solely of a single non-dimensional parameter ga/Q where a is the charge radius arid Q is the energy density.

This concept of an equivalent charge was then used to simulate a nuclear cratering event. A subscale experiment at 345 G's using 1.25 grams of PETN provided a simulation of the 500 Ton JOHNIE BOY that was equally as good as that produced by MINE THROW full scale event.

Further consequences of this type of scaling can be shown to include com-plete dynamic similarity of the flow field following the early time energy coupling phase. This includes not only the velocity field but the attendant stress field as well. That is, at homologous points for the model and the prototype, the velocity, the stress, the strain and the internal energy are equal. This provides a very power ful laboratory tool to explore crater formation and ground shock dependence upon soil type, Moisture content, stratigraphy based upon ability to model same, charge size and geometry, depth of burst arid effects upon buried structures.