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THE DEFENCE RESEARCH ESTABLISHMENT SUFFIELD CRATERS

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A Summary of Research on Large-Scale Explosion Experiments, Defence Apllications and Analogues for Planetray Impact Craters1

During the 1960's, the Defence Research Establishment Suffield (DRES) in southern Alberta, Canada, hosted a wide range of high-yield explosion cratering research programs important to both the defense and scientific communities. These trials, under the auspices of The Technical Cooperation Program (TTCP), were intended to provide technical information applicable to the detonation of nuclear weapons. Participants in these large trials included Canada. United States, Great Britain, New Zealand, and Australia.

Important new results on large-scale explosion cratering at DRES were produced in the highest-yield trials (20-500 tons). Crater studies demonstrate that, as size and yield increase, there is a well-defined progression in crater morphologies, sub-surface deformation. and formational processes. For example, as size increases, crater morphologies go from simple bowl'-shaped to flat-floored with central uplift to flat-floored with multiple rings. This sequence had not been previously recognized in either HE or nuclear cratering studies. More recently and equally remarkable, the same cratering features with progression in increasing size have been identified for large-scale asteroid/comet impact craters on the Earth, Moon, and the other hard-surfaced planets and satellites in our Solar System. The conclusion is that both large-scale explosion and impact cratering processes share much in common and that each crater type can provide valuable information to help interpret its counterpart formed by the other source.

These conclusions would not have been reached easily, either for defense or impact research, without the series of high-yield cratering trials conducted at DRES. It is now clear that several unique conditions associated with the DRES series greatly enhanced the results. For example, DRES has a target medium of extensive alluvium with relatively uniform material and strength characteristics. Furthermore, a range of ground water environments exist such that dry, wet, saturated, or mixed moisture conditions were available for each of the trials. In addition, high-quality TNT charges with extensive instrumentation were common to all of the trials and the same charge configurations were used at different as well as identical yields to test and compare energy coupling and cratering responses in detail. These conditions, including use of the same charge configurations at different yields, played an important role in permitting direct comparisons between each of the trials.

The high cost of such trials in the future, either for defense or planetary research, most likely precludes extensions of these events in full-scale field environments. Consequently, a serious effort to collect, analyze, report, and archive the DRES cratering data is in progress.