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Effects of Nuclear Earth-Penetrator and Other Weapons Nuclear Earth Penetrator Weapons Bunker Busters: Robust Nuclear Earth Penetrator Issues, FY2005-FY2007 Nuclear Weapon Initiatives "Bunker Busters" Crs Report for Congress Nuclear Weapon Initiatives Finite-Difference Code Analyses of Earth Penetrator Dynamics in Rock Media Bunker Busters Bunker Busters Structural Response of an Earth Penetrator. [Structural Response Calculation of an Earth Penetrator Using the HONDOV Finite Element Code]. Earth Penetrator Technology Robust Nuclear Earth Penetrator Budget Request and Plan Earth Penetrator Design Study Program Subscale Ballistic Penetration Tests Locating a Buried Earth Penetrator Evaluation of Empirical and Analytical Procedures Used for Predicting the Rigid Body Motion of an Earth Penetrator Stress Wave Measurements in Earth Penetrator Experiments Testing of a Lithium Battery for Use in an Earth Penetrator Ground Shock from Multiple Earth Penetrator Bursts Udlæggelse af Romerbrevets 12te Kap. 4-8 Vers Numerical Analysis of DNA Earth Penetrator Experiment at DRES. High-G Accelerometer for Earth-penetrator Weapons Applications. LDRD Final Report Methods of Force Identification for Earth Penetrators Alaskan Frozen Soil Impact Tests of the B83-C/S and Strategic Earth Penetrator A Method of Preliminary Design Analysis for Normal Impact of Earth Penetrators Space Weapons Earth Wars Calculations of Earth Penetrators Impacting Soils Monitoring Nuclear Weapons and Nuclear-Explosive Materials Does the United States Need to Develop a New Nuclear Earth Penetrating Weapon? Instrumentation System Modeling and Error Assessment in Earth Penetrators ASC-AD Penetration Modeling FY05 Status Report Exploration of Near Earth Objects Depth and Motion Prediction for Earth Penetrators Feasibility Study of an Earth Melting Penetrator System for Geoprospecting Tunnel Right-of-ways Numerical Analyses of Penetration Dynamics in Support of Investigations of Scaling Relations for Earth Penetrators The Shock and Vibration Bulletin Impact and Penetration Technology Program Parametric Study Department of Defense Appropriations for Fiscal Year 2005 How the End Begins Terradynamic Analyses for Candidate Earth Penetrators

Numerical Analyses of Penetration Dynamics in Support of Investigations of Scaling Relations for Earth Penetrators Mar 19 2020 Two finite-difference WAVE-L code solutions of projectile penetration have been conducted to assess the effect of projectile sectional pressure (W/A) on penetration dynamics. The results are being used in an investigation of penetration scaling relations underway at the Waterways Experiment Station. The penetrator problems consisted of the normal impacts of rigid-body projectiles into sand targets at a velocity of 200 ft/sec. The projectiles were 6 in. in diameter with a 6-in. long, ogive nose (CRH = 1.25). Two penetrator weights were selected, 141.4 lb (Case 1) and 424.1 lb (Case 2), to give projectile sectional pressures of 5 psi for Case 1 and 15 psi for Case 2. Detailed results of the numerical solutions, including time histories of the penetration dynamics variables, force loading distributions, and field plots of the target response, are presented in the report.

Impact and Penetration Technology Program Parametric Study Jan 17 2020 A series of parametric studies are performed to predict the influence of variations in media, velocity, orientation, W/A and L/D on terradynamic impact and penetration performance for representative earth penetrator configurations. The parametric study was performed using an Avco-developed differential force law. The basic equations used are presented and discussed. The results of the parametric studies are presented in summary form and the significance of the data discussed. (Author).

Department of Defense Appropriations for Fiscal Year 2005 Dec 16 2019

Monitoring Nuclear Weapons and Nuclear-Explosive Materials Oct 26 2020 In this study, CISAC tackles the technical dimensions of a longstanding controversy: To what extent could existing and plausibly attainable measures for transparency and monitoring make possible the verification of all nuclear weaponsâ€"strategic and nonstrategic, deployed and nondeployedâ€"plus the nuclear-explosive components and materials that are their essential ingredients? The committee's assessment of the technical and organizational possibilities suggests a more optimistic conclusion than most of those concerned with these issues might have expected.

Nuclear Weapon Initiatives Nov 19 2022 The Bush Administration completed its Congressionally-mandated Nuclear Posture Review in December 2001. The review led to major changes in US nuclear policy. It found that the Cold War relationship with Russia was 'very inappropriate' and that this nation must be able to deal with new threats. It planned to retain Cold War-era nuclear weapons, which would suffice for many contingencies, though at reduced numbers. To complement these weapons so as to improve US ability to deal with new, more dispersed threats in various countries, the Administration sought to explore additional nuclear capabilities. These initiatives are controversial. Supporters claim that the first three initiatives would enhance deterrence, thereby reducing the risk of war, and that some weapons that might result from the initiatives could enable the United States to destroy key targets in nations that may pose a threat. Critics are concerned that these initiatives would lead to nuclear testing, increase the risk of nuclear proliferation, and make US use of nuclear weapons more likely. Regarding enhanced test readiness, the Administration argues that nuclear testing might be needed, for example, to check fixes to weapon types with defects, and that 24 to 36 months is too long to wait; critics are

concerned that shortening the time to test could signal a US intent to test, and that renewed testing could lead to a renewed interest in testing by other nations. CONTENTS: Preface; The Broader Context for the Four Initiatives; R & D on Low -- Yield Nuclear Weapons; Advanced Concepts Initiative; Robust Nuclear Earth Penetrator; Nuclear Test Readiness; Concluding Observations; Index.

Earth Penetrator Technology Mar 11 2022

Depth and Motion Prediction for Earth Penetrators May 21 2020 Empirical equations of motion have been developed for projectile penetration in soil and rock. The soil penetration analysis uses Young's S- number as the penetrability index. The rock penetration analysis calculates resistance-to-penetration using density, strength, and Rock Quality Designation. Closed-form equations are obtained for final penetration depth in single-layer targets of soil or rock. Numerical solutions are obtained for multiple-layer targets. For targets with accurately known properties, the final-depth results are accurate within + or - 20 percent. (Author).

Bunker Busters Jun 14 2022 Earth penetrator weapons, often called "bunker busters," burrow into the ground some tens of feet before detonating, greatly increasing their ability to destroy buried targets. In 2006 the U.S. had several types of conventional earth penetrators. The then-current U.S. nuclear earth penetrator, the B61-11 bomb, could not penetrate certain types of terrain in which hardened underground facilities may be located, so the Air Force and the National Nuclear Security Admin. (NNSA) were studying a more effective penetrator, the Robust Nuclear Earth Penetrator (RNEP). While Secretary of Defense Rumsfeld said in 2003 that RNEP was a study, NNSA's FY2005 budget document showed a five-year total of $484.7 million if RNEP were to proceed beyond the study phase. NNSA said no decision had been made to proceed, and out-year figures were shown to meet congressionally-mandated budgeting requirements and were not a request. RNEP requests were subject to congressional approval, rejection, or modification. The five-year figure sparked congressional debate. Contents of this report: Background; Developments in the FY2005 Budget Cycle;Developments in the FY2006 Budget Cycle; Developments in the FY2007 Budget Cycle. This is a print on demand report.

Udlæggelse af Romerbrevets 12te Kap. 4-8 Vers Jul 03 2021

Nuclear Weapon Initiatives Aug 16 2022 The Bush Admin. completed its congressionally-mandated Nuclear Posture Review in Dec. 2001. The review led to major changes in U.S. nuclear policy. It found that the Cold War relationship with Russia was "very inappropriate" and that the U.S. must be able to deal with new threats. It planned to retain Cold War-era nuclear weapons, which would suffice for many contingencies, though at reduced numbers. To complement these weapons so as to improve U.S. ability to deal with new, more dispersed threats in various countries, the Admin. sought to explore additional nuclear capabilities. Accordingly, the FY2004 request included four nuclear weapon initiatives. Contents of this report: The Broader Context for the Four Initiatives; R&D on Low-Yield Nuclear Weapons; Advanced Concepts Initiative; Robust Nuclear Earth Penetrator; Nuclear Test Readiness; Concluding Observations. Figures. This is a print on demand report.

A Method of Preliminary Design Analysis for Normal Impact of Earth Penetrators Jan 29 2021 A simplified method of analysis for use in preliminary design of earth penetrators has been developed. The objectives have been simplicity, rapid turnaround and low cost, in addition to sufficient accuracy for adequate prediction of primary physical processes and associated variables. Based upon a stress wave transmission approach, the method applies to axisymmetric response of projectiles of revolution due to normal impact events in its current state of development. Results are presented for strain and acceleration time histories on a penetrator that has been impact tested. Analysis predictions and available experimental data are in excellent agreement, which indicates that the method is effective as well as efficient. (Author).

Calculations of Earth Penetrators Impacting Soils Nov 26 2020

Structural Response of an Earth Penetrator. [Structural Response Calculation of an Earth Penetrator Using the HONDOV Finite Element Code]. Apr 12 2022 The structural response of an earth penetrating warhead is calculated using the HONDOV finite element code. The model simulates a Defense Nuclear Agency (DNA) reverse ballistic test in which a sandstone target is propelled at the penetrator with a velocity of 1800 ft/s. The HONDOV model uses "slide lines" to partially decouple the interior payload and structural case in an effort to access the effect of impacting surfaces on the overall structural response.

Robust Nuclear Earth Penetrator Budget Request and Plan Feb 10 2022 "This report explains the budget request and plan, and will be updated as needed"--Summary.

Nuclear Earth Penetrator Weapons Jan 21 2023 The Administration's Nuclear Posture Review considered nuclear earth penetrator weapons (EPWs), which would burrow tens of feet into the ground before detonating to improve their ability to destroy buried facilities. The FY2003 Department of Energy (DOE) budget request included $15 million to begin a study on a Robust Nuclear Earth Penetrator (RNEP). The request led to congressional and public debate because EPWs involve such policy issues as circumstances under which the United States would use nuclear weapons, military value of EPWs, and nonproliferation. This report provides background, pros, and cons. It will be updated as needed.

High-G Accelerometer for Earth-penetrator Weapons Applications. LDRD Final Report May 01 2021 Micromachining technologies, or Micro-Electro-Mechanical Systems (MEMS), enable the develop of low-cost devices capable of sensing motion in a reliable and accurate manner. Sandia has developed a MEMS fabrication process for integrating both the micromechanical structures and microelectronics circuitry of surface micromachined sensors, such as silicon accelerometers, on the same chip. Integration of the micromechanical sensor elements with microelectronics provides substantial performance and reliability advantages for MEMS accelerometers. A design team at Sandia was assembled to develop a micromachined silicon accelerometer capable of surviving and measuring very high accelerations (up to 50,000 times the acceleration due to gravity). The Sandia integrated surface micromachining process was selected for fabrication of

the sensor due to the extreme measurement sensitivity potential associated with integrated microelectronics. Very fine measurement sensitivity was required due to the very small accelerometer proof mass (

Evaluation of Empirical and Analytical Procedures Used for Predicting the Rigid Body Motion of an Earth Penetrator Nov 07 2021

Numerical Analysis of DNA Earth Penetrator Experiment at DRES. Jun 02 2021 A finite difference Lagrangian code calculation for the firing of an earth penetrator into a soft soil site has been carried out. The penetrator was a 400-lb, 6.5-in. diameter steel projectile with an initial velocity of 500 ft/ sec. The field tests were conducted in July 1974 at the DRES Site in Canada. The penetrator was treated as a ridig body in the code solution. A four-layer idealization of the target site was used.

Terradynamic Analyses for Candidate Earth Penetrators Oct 14 2019

ASC-AD Penetration Modeling FY05 Status Report Jul 23 2020 Sandia currently lacks a high fidelity method for predicting loads on and subsequent structural response of earth penetrating weapons. This project seeks to test, debug, improve and validate methodologies for modeling earth penetration. Results of this project will allow us to optimize and certify designs for the B61-11, Robust Nuclear Earth Penetrator (RNEP), PEN-X and future nuclear and conventional penetrator systems. Since this is an ASC Advanced Deployment project the primary goal of the work is to test, debug, verify and validate new Sierra (and Nevada) tools. Also, since this project is part of the V & V program within ASC, uncertainty quantification (UQ), optimization using DAKOTA [1] and sensitivity analysis are an integral part of the work. This project evaluates, verifies and validates new constitutive models, penetration methodologies and Sierra/Nevada codes. In FY05 the project focused mostly on PRESTO [2] using the Spherical Cavity Expansion (SCE) [3,4] and PRESTO Lagrangian analysis with a preformed hole (Pen-X) methodologies. Modeling penetration tests using PRESTO with a pilot hole was also attempted to evaluate constitutive models. Future years work would include the Alegra/SHISM [5] and AlegrdEP (Earth Penetration) methodologies when they are ready for validation testing. Constitutive models such as Soil-and-Foam, the Sandia Geomodel [6], and the K & C Concrete model [7] were also tested and evaluated. This report is submitted to satisfy annual documentation requirements for the ASC Advanced Deployment program. This report summarizes FY05 work performed in the Penetration Mechanical Response (ASC-APPS) and Penetration Mechanics (ASC-V & V) projects. A single report is written to document the two projects because of the significant amount of technical overlap.

Instrumentation System Modeling and Error Assessment in Earth Penetrators Aug 24 2020

Space Weapons Earth Wars Dec 28 2020 This overview aims to inform the public discussion of space-based weapons by examining their characteristics, potential attributes, limitations, legality, and utility. The authors do not argue for or against space weapons, nor do they estimate the potential costs and performance of specific programs, but instead sort through the realities and myths surrounding space weapons in order to ensure that debates and discussions are based on fact.

Stress Wave Measurements in Earth Penetrator Experiments Oct 06 2021

Bunker Busters: Robust Nuclear Earth Penetrator Issues, FY2005-FY2007 Dec 20 2022 Earth penetrator weapons, often called bunker busters, burrow into the ground some tens of feet before detonating, greatly increasing their ability to destroy buried targets. The United States has several types of conventional earth penetrators. The current U.S. nuclear earth penetrator, the B61-11 bomb, cannot penetrate certain types of terrain in which hardened underground facilities may be located, so the Air Force and the National Nuclear Security Administration (NNSA) are studying a more effective penetrator, the Robust Nuclear Earth Penetrator (RNEP).

Locating a Buried Earth Penetrator Dec 08 2021 The purpose of this work was to assist the recovery of a buried earth penetrator by locating the vertical projection of the penetator upon the surface within a horizontal radius error of one meter. The penetrator will carry a small coil which is driven by an alternating current to form a magnetic dipole. Five measurements of the magnetic field vector upon the surface of the earth are shown to be sufficient for determining not only the xyz-coordinates of the dipole, but also the orientation of the dipole axis. The theory, computation process, and field tests are comprehensively described. Results of 26 field tests with the dipole at 9 different combinations of location and orientation are given. Average radial and vertical location errors are 0.27 m and -0.05 m, respectively, while the mean errors in the tilt and orientation angles of the dipole axis are 3 degrees and 8 degrees, respectively. The results are applied to the design of a locating system for a Pershing II penetrator which contains a recessed, rear-mounted coil.

Finite-Difference Code Analyses of Earth Penetrator Dynamics in Rock Media Jul 15 2022 Numerical analyses of penetration dynamics have been performed in support of a program to develop technology for earth penetrating weapons. The emphasis in this program has been to apply calculational techniques to the analysis of projectile penetrations in rock media. Observations from penetrator firings into rock show that there is a region of highly comminuted rock surrounding the penetrator and the penetrator cavity. Since the penetration dynamics are sensitive to the physical properties of the material next to the penetrator, it becomes important to account for the breakup and fracture of the rock in the analysis techniques. Accordingly, material models were developed that included fracture and a post-fracture process which degrades the physical properties to that of a comminuted rock. The penetration analyses were performed with WAVE-L, a two-dimensional Lagrangian finite-difference code. A decoupled calculational method is employed, wherein the penetrator is treated as a rigid body to compute the penetration dynamics. Using the force loadings on the penetrator obtained from this solution, subsequent analysis may be made of the interior response of the penetrator. To test and demonstrate the code, pre-event calculations of a specific rock penetration field test were made. The field experiment consisted of the vertical firing of a 400 pound steel penetrator into a massive welded tuff site at a velocity of 1500 ft/sec. (Author).

Ground Shock from Multiple Earth Penetrator Bursts Aug 04 2021 Calculations have been performed with the HULL

hydrocode to study ground shock effects for multiple earth penetrator weapon (EPW) bursts in hexagonal-close-packed (HCP) arrays. Several different calculational approaches were used to treat this problem. The first simulations involved two-dimensional (2D) calculations, where the hexagonal cross-section of a unit-cell in an effectively-infinite HCP array was approximated by an inscribed cylinder. Those calculations showed substantial ground shock enhancement below the center of the array. To refine the analysis, 3D unit-cell calculations were done where the actual hexagonal cross-section of the HCP array was modelled. Results of those calculations also suggested that the multiburst array would enhance ground shock effects over those for a single burst of comparable yield. Finally, 3D calculations were run in which an HCP array of seven bursts was modelled explicitly. In addition, the effects of non-simultaneity were investigated. Results of the seven-burst HCP array calculations were consistent with the unit-cell results and, in addition, provided information on the 3D lethal contour produced by such an array.

Bunker Busters May 13 2022

Feasibility Study of an Earth Melting Penetrator System for Geoprospecting Tunnel Right-of-ways Apr 19 2020

Methods of Force Identification for Earth Penetrators Mar 31 2021 A procedure is developed for identifying the forces on the nose of a penetrator vehicle from strain time histories at selected points in the vehicle in off-normal impact of the vehicle. The vehicle nose is idealized as a rigid body, the remainder as a deformable rod. The following forces are considered: axial forces, transverse forces in two planes, and bending moments. The deformation response of the vehicle is assumed to be linear. The identification is separated into the identification of the flexural forces and axial forces.

Does the United States Need to Develop a New Nuclear Earth Penetrating Weapon? Sep 24 2020 Potential adversaries of the US have hard and deeply buried targets (HDBTs) that prevent their centers of gravity from being held at risk. All US services currently have programs aimed at defeating these HDBTs. Both conventional and unconventional techniques have shown promising results. Despite these efforts, nothing in the US inventory, to include nuclear penetrators, can defeat the hardest of deeply buried targets. The current administration has taken steps that open the possibility of developing a new nuclear weapon. Critical nuclear research programs, DOE national laboratories and testing infrastructure, as well as DOD nuclear supporting facilities, have received large funding increases. The National Security Strategy and the Nuclear Posture Review both support this end. Furthermore, a feasibility study has been proposed to Congress to investigate a robust nuclear earth-penetrating weapon. This thesis analyzes the primary thesis question using a strategic policy test incorporating feasibility, acceptability, and suitability. The determination is that the US does need a new nuclear earth-penetrating weapon and offers recommendations for the path forward.

How the End Begins Nov 14 2019 An alarming, deeply reported analysis of how close--and how often--the world has come to nuclear annihilation, and why we are once again on the brink.

Earth Penetrator Design Study Program Subscale Ballistic Penetration Tests Jan 09 2022

Crs Report for Congress Sep 17 2022

"Bunker Busters" Oct 18 2022 Earth penetrator weapons, often called "bunker busters," burrow into the ground some tens of feet before detonating, greatly increasing their ability to destroy buried targets. The United States has several types of conventional earth penetrators. The current U.S. nuclear earth penetrator, the B61-11 bomb, cannot penestrate certain types of terrain in which hardened underground facilities may be located, so the Air Force and the National Nuclear Secruity Administration (NNSA) are studying a more effective penetrator, the Robust Nuclear Earth Penetrator (RNEP).

Alaskan Frozen Soil Impact Tests of the B83-C/S and Strategic Earth Penetrator Feb 27 2021

Testing of a Lithium Battery for Use in an Earth Penetrator Sep 05 2021

The Shock and Vibration Bulletin Feb 16 2020

Effects of Nuclear Earth-Penetrator and Other Weapons Feb 22 2023 Underground facilities are used extensively by many nations to conceal and protect strategic military functions and weapons' stockpiles. Because of their depth and hardened status, however, many of these strategic hard and deeply buried targets could only be put at risk by conventional or nuclear earth penetrating weapons (EPW). Recently, an engineering feasibility study, the robust nuclear earth penetrator program, was started by DOE and DOD to determine if a more effective EPW could be designed using major components of existing nuclear weapons. This activity has created some controversy about, among other things, the level of collateral damage that would ensue if such a weapon were used. To help clarify this issue, the Congress, in P.L. 107-314, directed the Secretary of Defense to request from the NRC a study of the anticipated health and environmental effects of nuclear earth-penetrators and other weapons and the effect of both conventional and nuclear weapons against the storage of biological and chemical weapons. This report provides the results of those analyses. Based on detailed numerical calculations, the report presents a series of findings comparing the effectiveness and expected collateral damage of nuclear EPW and surface nuclear weapons under a variety of conditions.

Exploration of Near Earth Objects Jun 21 2020 Comets and asteroids are in some sense the fossils of the solar system. They have avoided most of the drastic physical processing that shaped the planets and thus represent more closely the properties of the primordial solar nebula. What processing has taken place is itself of interest in decoding the history of our solar neighborhood. Near-Earth objects are also of interest because one or more large ones have been blamed for the rare but devastating events that caused mass extinctions of species on our planet, as attested by recent excitement over the impending passage of asteroid 1997 XF11. The comets and asteroids whose orbits bring them close to Earth are clearly the most accessible to detailed investigation, both from the ground and from spacecraft. When nature kindly delivers the occasional asteroid to the surface of Earth as a meteorite, we can scrutinize it closely in the laboratory; a great deal of information about primordial chemical composition and primitive processes has been gleaned from such objects. This report reviews the

current state of research on near-Earth objects and considers future directions. Attention is paid to the important interplay between ground-based investigations and spaceborne observation or sample collection and return. This is particularly timely since one U.S. spacecraft is already on its way to rendezvous with a near-Earth object, and two others plus a Japanese mission are being readied for launch. In addition to scientific issues, the report considers technologies that would enable further advances in capability and points out the possibilities for including near-Earth objects in any future expansion of human exploration beyond low Earth orbit.