DEFENSE NUCLEAR AGENCY

Submission of proposals

The Defense Nuclear Agency is seeking small business with a strong research and development capability and experience in nuclear weapons effects, phenomenology and operations. (Note: we are not interested in nuclear weapon design or manufacture.) DNA invites the small business community to send proposals directly to the following address:

Defense Nuclear Agency
ATTN: AM/SBIR
6801 telegraph Road
Alexandria, Virginia 22310-3398

The proposals will be processed in the Acquisition Management office and be distributed to the appropriate technical office for evaluation and action. Questions concerning the administration of the SBIR program and proposal preparation should be directed to:

Defense Nuclear Agency
ATTN: AM, Ms. P. Brooks
6801 telegraph Road
Alexandria, Virginia 22310-3398

DNA had identifies 20 technical topics, numbered DNA91-001 through DNA91-020, to which small businesses may respond in this solicitation (91.1). Please note that these are the only topics for which proposals will be accepted. A list of the topics currently eligible for proposal submissions (followed by full topic descriptions) is included below. The topics were initiated by DNA technical offices. Questions concerning the research topics should be submitted to:

Defense Nuclear Agency
ATTN: PRAS, Mr. J. Gerding
6801 Telegraph Road
Alexandria, Virginia 22310-3398
Tel. (703) 325-1217

DNA selects proposals for funding based upon technical merit, critically of the research, and evaluation criteria contained in this solicitation document. As funding is limited, DNA reserves the right to select and fund only those proposals considered to be superior in overall technical quality and most critical. As a result, DNA may fund more than one proposal in a specific topic area of the technical quality of the proposals in question, if deemed superior, or it may fund no proposals in a topic area. Proposals which cover more than one topic need only be submitted once.

Defense Nuclear Agency

FY 1991 One Line Topic

DNA91-001	Nuclear Weapon Effects calculation
DNA91-002	Response of Materials to nuclear Weapon Effect
DNA91-003	Nuclear Weapon and Neutral Particle Beam Effects on Electronics and Communications
DNA91-004	Nuclear Weapon Effects Simulation
DNA91-005	Instrumentation
DNA91-006	Directed Energy effects
DNA91-007	Security Hardening and Survivability
DNA91-008	Security of Nuclear Weapons
DNA91-009	Theater Nuclear Forces (TNF) survivability
DNA91-010	Operational Planning and Targeting
DNA91-011	Underground Nuclear Testing
DNA91-012	verification Technology Development
DNA91-013	Nuclear Weapon Effects on Propagation
DNA91-014	tactical Application of pulsed Power technology
DNA91-015	Advances in Pulsed Power Technology
DNA91-016	X-Ray Nuclear Weapon Effects Source Development
DNA91-017	Response of Insitu Rocks to Nuclear Weapon Effects
DNA91-018	Draft Tube Rise-Time Enhancement
DNA91-019	Rise-time Enhancement for Flash Gamma Ray Simulators
DNA91-020	Structural Response to Nuclear Weapon Effects

DEFENSE NUCLEAR AGENCY
FY 1991-TOPIC DESCRIPTIONS

DNA91-001 TITLE: Nuclear Weapon Effects calculation

CATEGORY: Exploratory Development

OBJECTIVE: Improve the accuracy, runtime and or visualization of output of nuclear weapon effects calculation

DESCRIPTION: Accurate and efficient calculation of nuclear weapon effects and display/presentation of such calculations are of major concern to DNA. Areas of interest include more accurate calculations, faster running calculations, microcomputer versions to enable use by a wide audience, and new and improved ways to enable users (be they advanced nuclear weapons effects researchers, weapon systems developers, or managers with limited nuclear weapons effects experience) to calculate, estimate, and appreciate nuclear weapon effects snd the survivability/vulnerability of structures and equipment to these effects. Nuclear weapon effects include airblast; ground shock; water shock; redout; dust cloud formation; and the effects of these on personnel, materials and structures. Structures of interest include deep underground, land based, sea based, and aerospace structures.

DNA91-002 TITLE: Response of Materials to Nuclear Weapon Effects

CATEGORY: Exploratory Development

OBJECTIVE: measure the response of new and existing materials to nuclear weapons effects and develop methods to improve the survivability of these materials.

DESCRIPTION: of interest to DNA is the response of materials, structures, and systems to nuclear weapons effects. Materials of interest include metals, ceramics and composites. New materials capable of being used as structural members for aircraft, missiles, ships, submarines and military vehicles are of particular concern. The response of underground structures such as missile silos, command and control facilities and communications facilities are specially important. Concepts and techniques which will improve the survivability (decrease the response) of these types of systems to nuclear weapons effects are required. New materials with enhanced electromagnetic shielding properties are also of interest.

During phase I, testing plans and feasibility studies on the material will be completed.

During Phase II, the material will be tested and conclusions from the test results will be drawn.

DNA91-003 TITLE: Nuclear Weapon and neutral Particle Beam Effects on electronics and Communications

CATEGORY: Exploratory Development

OBJECTIVE: Explore the effect of nuclear weapons and neutral particle beams on electronics and communications.

DESCRIPTION: The nature and magnitude of nuclear of the effects produced by the interaction of nuclear weapon produced radiation and neutral particle beams on electronics, electronic systems, opto-electrical devices and sensors in the phenomenology areas of:

a) Transient Radiation Effects on Electronics (TREE)
b) Electromagnetic Pulse (EMP)
c) System Generated EMP (SGEMP) are of interest to DNA.

Particular areas of concern include; methods by which designers of space, strategic and tactical systems can assess their susceptibility to TREE, EMP and SGEMP; hardening technology to reduce the susceptibilities of electronic systems and devices (especially those with submicron feature sizes) to acceptable levels; and methods to

demonstrate survivability under specified threat criteria. Concepts and techniques to improve the survivability (decrease the response) of systems against these nuclear weapons effects and neutral particle beam required.

During Phase I, initially feasibility studies will be completed to demonstrate the viability of the proposed approach.

DNA91-004 TITLE: Nuclear Weapon Effects Simulation

CATEGORY: Exploratory Development

OBJECTIVE: Improve the state-of-the-art in nuclear weapon effects simulation

DESCRIPTION: Simulators are needed: (1) calibrate gauges; (2) use for developing new gauges; (3) provide experimental data for development of numerical simulations of nuclear weapons effects; (4) simulate one or more nuclear weapons effects laboratory size scale; (5) predict what will occur during an underground nuclear test; and (6) simulate gravity in small scale water shock and dust lofting tests (centrifuges).

Existing large scale simulators are often expensive and time consuming to operate, and require travel to an explosive test site. Small scale simulators are needed to provide extensive data to supplement the limited data from the large scale simulators. Innovative simulators are needed which are economical and simple to operate. Innovative ideas are needed to use very small scale simulators to produce useful information. A joint proposal with a government laboratory may be helpful because the simulator can then remain at the government laboratory where it will be readily available for future use.

During Phase I, build the basic simulator and demonstrate that it functions properly.

During Phase II, use the simulator to produce useful data and improve the simulator as necessary.

DNA91-005 TITLE: Instrumentation

CATEGORY: Exploratory Development

OBJECTIVE: develop new instrumentation or make improvements to existing instrument used in nuclear weapon effect simulators and in underground nuclear testing.

DESCRIPTION: Instrumentation is used for measuring nuclear weapons effects, phenomenology parameters and the response of test items exposed to real or simulated nuclear weapon effects. The instrumentation should be capable of operating under very harsh conditions, such as might be encountered in underground nuclear test, high explosive tests, or test involving higher levels of x-ray, gamma, or neutron radiation. The instrumentation should survive long enough to record the needed data. Instrumentation is needed for the following types of tests: airblast, dusty flow, dust lofting, water shock, shock propagation in rock, HE, thermal radiation and underground nuclear test. Calibration facilities are needed to calibrate existing gauges in every environment where the gauges could be used.

During Phase I, build a prototype instrument and demonstrate that it functions properly using laboratory tests.

During Phase II, demonstrate that the instrumentation can record useful data in its working environment. This will involve coordination with DNA to schedule testing in a simulator or underground nuclear test.

DNA91-006 TITLE: Directed Energy Effects

CATEGORY: Exploratory Development

OBJECTIVE: Investigate the effects of directed energy and identify materials which may survive effects of directed energy weapons.

DESCRIPTION: The effects of directed energy sources on materials, structures and systems are of interest to DNA. Of particular interest is the establishment of the correlation between nuclear weapons effects and directed energy effects, the identification of materials which are capable of withstanding both nuclear weapons effects and directed energy effects, and mechanisms by which the directed energy sources actually interact with target materials/structures.

During Phase I, demonstrate the feasibility of the proposed investigation.

During Phase II, characterize the effects of directed energy on materials, structures, etc.

DNA91-007 TITLE: Nuclear Hardening and Survivability

CATEGORY: Exploratory Development

OBJECTIVE: Develop techniques to improve the nuclear hardening and survivability of system.

DESCRIPTION: Techniques for nuclear hardening and survivability of systems, structures, or personnel against nuclear weapons effects and, where compatible, directed energy effects are required. These techniques should protect the structure or system against the combined effects of blast, thermal, nuclear radiation, and in the cases of structures or materials, and should also provide protection against electromagnetic and radiation effects wherever any electronic capabilities are involved. In particular, the ability to harden communications facilities and surveillance sensors against electromagnetic pulses is required. Systems include planned and operational strategic and tactical ground mobile systems, missiles, aircraft, spacecraft and their subsystems and components.

During Phase I, demonstrate the feasibility and usefulness of the proposed antique.

During Phase II, fully develop the proposed technique and characterize in usefulness in both technical and cost terms.

DNA91-008 TITLE: Security Nuclear Weapons

CATEGORY: Exploratory Development

OBJECTIVE: Improve the Security of US nuclear weapons against all types of threats.

DESCRIPTION: Measures to improve the security of nuclear weapons against all possible threats are required. These methods are expected to include weapon storage facility designs, transportation facility designs, new security sensors and sensor system development, methods to improve the secure handling of nuclear weapons, and methods to improve the effectiveness and efficiency of nuclear weapon security operations. Proposals should describe how they will improve protection against known and predicted threats and should emphasize weapon concealment where appropriate.

During Phase I, demonstrate the feasibility and potential usefulness of the proposed security measurements.

During Phase II, fully develop the proposed security measures so they can be compared to existing techniques.

DNA91-009 TITLE: Theater Nuclear Forces (TNF) Survivability

CATEGORY: Exploratory Development

OBJECTIVE: Improve the survivability of US nuclear weapons.

DESCRIPTION: The prelaunch survivability (PLS) of the TNF is of vital concern. New and innovative concepts to improve PLS are needed to retain a viable nuclear strike capability and to enhance deterrence. The threats to the TNF include enemy forces conducting unconventional, conventional, chemical and nuclear warfare during periods of peacetime, transition to war, and war. Long range program thrusts include peacetime and field storage, deceptive/OPSEC practices, theater nuclear force movements, and operational survivability of theater nuclear systems (aircraft, missiles, and cannon systems). Survivability concepts are warranted for the period of the 1990's and beyond. Concepts should employ innovative ideas and make use of new and emerging technologies.

During phase I, demonstrate the feasibility and potential usefulness of the proposed survivability measures.

During Phase II, fully develop the proposed survivability measures so they can be compared to existing techniques.

DNA91-010 TITLE: Operational Planning and Targeting

CATEGORY: Exploratory Development

OBJECTIVE: Improve the ability of US nuclear commanders to plan for nuclear engagements and target their nuclear weapons.

DESCRIPTION: The nuclear employment planning capabilities of operational commanders in tactical, strategic and planning systems, techniques to determine target damage objective and criteria, post strike target damage assessments capabilities, and automated nuclear weapon employment codes. Techniques to account for electromagnetic effects in operational planning and exercise are desired.

During Phase I, develop the proposed technique in sufficient detail to demonstrate its feasibility.

During Phase II, continue the development of the proposed technique to the point it can be incorporated into existing planning/targeting methodologies.

DNA91-011 TITLE: Underground Nuclear Testing

CATEGORY: Improve design, execution, and evaluation of underground nuclear tests.

OBJECTIVE: Improve the design, execution, and evaluation of underground nuclear tests.

DESCRIPTION: Underground nuclear effects tests are used in situations for which no suitable above ground simulator exists. Areas of interest include improvements in the design and execution of tests (horizontal/vertical line sight and cavity), the design of new experiments which extend the capability of current test beds, and innovative test concepts to meet future needs. To improve our understanding of the results improvements to the mathematical methods of characterizing existing materials which are used in critical portions of the test bed (such as the A box) and new materials for such applications, new approaches to the geological problems encountered in the construction of the test beds, and new methods for all test activities (excavation, fabrication, assembly in the tunnel complex, recording data, transmission of data) are also of interest to DNA.

During Phase I, demonstrate the feasibility of the proposed test/experiment improvement. This will be done using laboratory and/or above ground testing.

During Phase II, demonstrate the proposed techniques with underground nuclear testing and/or above ground testing.

DNA91-012 TITLE: Verification Technology Development

CATEGORY: Advanced Development

OBJECTIVE: Improve/develop US technical capability to verify/monitor compliance with existing and potential future arms control treaties, e.g., START, INF, CW, CFE, and SNF.

DESCRIPTION: New arms control measures are being negotiated which could drastically alter existing inventories of nuclear weapons. New verification technologies and methods will be required to accurately monitor compliance to the provisions of any treaties or agreements that could result from the on-going negotiations. The problem will basically involve being able to distinguish between permitted activities where the technical signatures between the two could be very minor.

Phase I- Demonstrate the feasibility of the proposed technology.

Phase II-Develop a proof of design to demonstrate the proposed technology.

DNA91-013 TITLE: Nuclear Weapon Effects on Propagation

CATEGORY: Exploratory Development

OBJECTIVE: Investigate the effects of nuclear weapon explosions on radio signals and the subsequent performance of communication and radar systems. Investigate the effects of nuclear weapon created optical clutter backgrounds on optical sensor systems.

DESCRIPTION: The Defense Nuclear Agency is interested in the basic physical processes which describe the interaction of nuclear weapons with the atmosphere, which creates environments that degrade the propagation of communication and radar signals and that contain optical clutter backgrounds which degrade optical sensor systems. Part of DNA's mission is to predict effects on and determinate mitigation methods for DoD systems such as satellite communications, VLF/LF communications, HF/VHF communications, radar systems, and optical sensor systems. Areas of interest include mechanisms for the coupling of nuclear weapon energy to the atmosphere; the development of structure in weapon produced plasmas and molecular emitters; the chemical processes which give rise to the optical emissions; the transport and final deposition of nuclear debris; the effect of degraded signal propagation on the performance of communication systems and radars; and the prediction of the effects of degraded signal propagation on the performance of optical sensor systems.

During Phase I, demonstrate the feasibility of the proposed investigation to advance the understanding in any of the areas described above.

During Phase II, continue the investigation to the development of a product or results that can be incorporated into the existing technology base.

DNA91-014 TITLE: Advances in Pulsed Power Technology

CATEGORY: Exploratory Development

OBJECTIVE: Development of new applications of existing pulse power technology

DESCRIPTION: Recent advances in energy storage and switching now make possible the application of DNA pulsed power technology to such areas as armor/anti-armor; electromagnetic/electrothermal guns; mine-countermine; air, surface, and subsurface systems; high power microwave weapons; etc. Concepts proposed should be highly innovative and make full use of the emerging pulse power technology.

During Phase I, demonstrate the feasibility of the proposed pulsed power application.

During Phase II, continue the development of the concept to an engineering model and conduct tests of the effectiveness of the idea.

DNA91-015 TITLE: Advances in Pulsed Power Technology

CATEGORY: Exploratory Development

OBJECTIVE: Dramatic improvements in energy storage, switching, and power conditioning state of technology

DESCRIPTION: Future requirements for systems employing pulsed power will necessitate improvements in efficiency, energy density, reliability, and performance. Innovative approaches for component or subsystem development are sought to meet the needs of radiation simulators and tactical applications requiring operation at kilovolts to megavolts, kilooamperes to megaampers, and repetition rates from single pulse to 10 kilohertz.

During Phase I, demonstrate the feasibility of the proposed concept.

During Phase II, develop, test, and evaluate proof-of-principle hardware.

DNA91-016 TITLE: X-Ray Nuclear Weapons Effects Source Development

CATEGORY: Exploratory development

OBJECTIVE: Innovative concepts for the production of x-ray radiation used in nuclear weapon effects testing.

DESCRIPTION: Future requirements for x-ray nuclear weapon effects testing will require vast improvements in existing radiation source capability as well as new concepts for producing soft x-rays (1-5 kev), warm x-rays (5-15 kev), and hot x-rays (> 15 kev). Soft x-rays are used for optical coatings effects testing. Warm x-rays are used for the thermomechanical and thermostructural testing; and hot x-rays are used for electronics effects testing. The proposer should be familiar with the present capability to produce x-rays for weapon effects testing.

During Phase I, demonstrate the feasibility of the proposed concept.

During Phase II, develop, test, and evaluate proof-of-principle x-ray source capability.

DNA91-017 TITLE: Response of Insitu Rocks to Nuclear Weapons Effects

CATEGORY: Exploratory development

OBJECTIVE: Development methods to measure material properties of insitu rock and the incorporation of this data in ground shock/ground motion models.

DESCRIPTION: techniques are requires to measure the stress history that corresponds to a spherically diverging stress wave in medium –strength-rock. The transducer must survive long enough to measure the stress history through the positive phase for peak radial stresses between 0.2 and 2.0 kbar (20 and 200 Mpa0.

During Phase I, conduct feasibility analyses to demonstrate viability of the proposed with special emphasis on sedimentary rocks.

During Phase II, implement the proposed techniques small scale field explosive experiments.

DNA91-018 TITLE: Drift tube-Time Enhancement

CATEGORY: Exploratory development

OBJECTIVE: Improved calculational capability to predict rise-time sharpening effects using drift tubes in x-ray simulators.

DESCRIPTION: the use of drift tubes containing low pressure gas to sharpen the rise-time of electron beams in x-ray simulators for improved fidelity is of interest to DNA. Empirical evidence exists to substantiate the concept; however, accurate calculational capability is required to exploit and guide the experimental program. Important variables include interest for the secondary electrons. Methods to accurately predict the time dependence and phase space of the primary electron beam on target are required.

During Phase I, demonstrate the feasibility of the proposed methodology through calculations against experimental data.

During Phase II, fully develop the proposed methodology and implement it in appropriate codes.

DNA91-019 TITLE: Rise-Time Enhancement for Flash Gamma Ray Simulators

CATEGORY: Exploratory Development

OBJECTIVE: Identify and develop new techniques for substantial reduction of radiation pulse rise-time on flash x-ray simulators.

DESCRIPTION: High fidelity simulation of tactical source region electromagnetic pulse (SREMP) is required to test the vulnerability of critical military systems. To achieve higher performance and versatility than presently available a substantial reduction of the electron rise-time at the converter is required. DNA is seeking innovative approaches which offer significant improvement over existing techniques without reducing dose rate. Hardware reliability and survivability in the harsh sirmostructural response testing; and hot x-rays are used for electronics effects testing. The proposer should be familiar with the present capability to produce x-rays for weapon effects testing.

During Phase I, demonstrate the feasibility of the proposed concept.

During Phase II, develop, test, and evaluate proof-of-principle x-ray source capability.

DNA91-020 TITLE: Structural Response to Nuclear Weapon Effects

CATEGORY: Exploratory development

OBJECTIVE: Improve the design and hardness assessment of structures to nuclease weapons effects.

DESCRIPTION: improved designs of hardened structures are needed as well as a better understanding of failure mechanisms of structures. Type of structures include deep underground, land-based (fixed and mobile), sea-based (floating and submerged) and aerospace structures. Designs are needed for analysis and model testing of structures to large deflection and collapse damage levels. Models are required for energy deposition and thermomechanical response of the heterogeneous and anisotropic composite materials subjected to X-ray exposure. The models for material behavior must be compatible with conventional structural dynamics computer codes.

During Phase I, the research demonstrate the feasibility of the proposed designs/methodology to determine structural response to nuclear weapon effects.

During Phase II, the research concept developed in Phase I will be further be developed where, if appropriate, the concepts will be incorporated into other existing methodology/codes.