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Sandia National Laboratories Interactions with Organizations in the Former Soviet Union

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Abstract

This document describes Sandia National Laboratories involvement with scientists and engineers at various organizations within the states of the Former Soviet Union (FSU). The purpose of these interactions is twofold: first, to acquire technical information to enhance United States technology and second, to assist FSU states in converting their defense-oriented industry to civilian, market-oriented business.

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Nomenclature

ABC	Accelerator Based Conversion
ATW	Accelerator Transmutation of Waste
COE	Corps of Engineers
DNA	Defense Nuclear Agency
DoD	Department of Defense
DOE	Department of Energy
DOE/AL	Department of Energy/Albuquerque Operations
DOE/HQ	Department of Energy Headquarters
DP	Defense Programs
EM	Environmental Restoration and Waste Management
FRE	Fire-Resistant Enhancement
FSU	Former Soviet Union
HEU	Highly Enriched Uranium
IS	Intelligence and Security
ISO	International Standards Organization
ISTC	International Science and Technology Center
KRI	Khlopin Radium Institute
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
MAYAK	Russian organization
MC&A	Material Control and Accountability
MRO	Missouri River Office
OPAC	Operations (Office for) Arms Control
PIVS	Portable Integrated Video System
POS	Plasma Opening Switch
PRA	Probabilistic Risk Assessment
R&D	Research and Development
RHEPP	Repetitive High Energy Pulsed Power
RPF	Rigid Polyurethane Foam
SAB	Soft Armored Blanket Program
SAGSTRAM	Standing Advisory Group on Safe Transport of Radioactive Materials
SAIC	Science Applications International Corp.
SNL	Sandia National Laboratories
SMPC	Specialty Metals Processing Consortium
SPC	Statistical Process Control
SSD	Safety, Security, and Dismantlement
TAD	Transatlantic Division
TBD	To Be Determined
USA	United States of America
VO VNIPIET	Russian organization

Sandia National Laboratories Interactions with Organizations in the Former Soviet Union

Summary

Sandia National Laboratories (SNL) is dynamically involved in several technological activities with scientists and engineers at various laboratories and institutes within states of the Former Soviet Union (FSU). This involvement is usually directed toward the acquisition of technical information and data that will complement or enhance the technology of the United States (US). Some of these activities support the US government programs in assisting the FSU states in solving their environmental or nuclear weapon dismantlement problems.

The following summary chart and project descriptions concur with the format mutually agreed upon by Department of Energy Headquarters (DOE/HQ), Los Alamos National Laboratory (LANL), and Lawrence Livermore National Laboratory (LLNL). The summary chart provides the title of the project, the institute or institutes within the FSU, the status of the project, the DOE/HQ sponsoring organization, the funding level, and some supporting comments. The project descriptions provide more information, including the Sandia point of contact, a written summary of the project, and a written description of the current status of the project.

The information presented is usually sufficient for most inquiries; however, if additional information is required concerning any of the projects, please contact the Sandia point of contact listed in the project descriptions or call K. D. Nokes at (505) 844-3744.

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**Summary Chart on
Interactions with the FSU**

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Summary Chart on Interactions with the FSU
(Sandia National Laboratories [SNL]—Revised February 1994)

Short Title	Institute(s) in FSU	Status	DOE HQ Sponsor Org	Funding Level	Comments
Safety, Security, and Dismantlement (SSD) of Nuclear Weapons					
Russian Railcar Modification	Ministry of Atomic Energy Ministry of Defense	Active	Department of Defense (DoD)	\$20,000,000 \$1,500,000 Increased for added req.	SNL Orgs 9561, 9533, 5801
Soft Armor Blanket Program	Ministry of Atomic Energy Ministry of Defense	Active	DoD	SNL - \$435,000 Total \$5,000,000	SNL Org 9611 Project completed July 1993
Russian Fissile Material Storage Facility	Ministry of Atomic Energy VO VNIPIET	Active	DoD	SNL - \$850,000 Total \$15,000,000	SNL Orgs 5091 and 5821; Design at 30% Level
Material Control and Accountability (MC&A) and Physical Protection Assistance	Ministry of Atomic Energy	In Process	Intelligence and Security (IS)	To Be Determined (TBD)	SNL Orgs 9208 and 5821
MC&A Technical Assistance and Physical Protection in the US-Russian Highly Enriched Uranium (HEU) Purchase	Ministry of Atomic Energy	In Process	IS	TBD	SNL Orgs 9208 and 5821
Fissile Material Storage Containers	Arzamas-16	Active	DoD	\$3.1M (SNL) \$50M (Total Pgm)	SNL Org 5161 Design and Development
Emergency Response Equipment (Portable Integrated Video System)	Ministry of Atomic Energy	Active	DoD	\$1.9M (SNL) \$15M (Total Pgm)	SNL Orgs 12331 and 9567 for Russia and Belarus
Accelerator Based Conversion (ABC) and Accelerator Transmutation of Waste (ATW)					
Basic Energy Science and Technology					

**Summary Chart on Interactions with the FSU, continued
(Sandia National Laboratories [SNL]—Revised February 1994)**

Short Title	Institute(s) in FSU	Status	DOE HQ Sponsor Org	Funding Level/ Contract Number	Comments
Computers and Computational Science					
Systems and Application Software for Parallel Computing	Arzamas-16	In process	Defense Programs (DP)	\$7,000	SNL Org 1422 in collaboration with LLNL and LANL
Models of Material Strength, Fracture, and Failure	Chelyabinsk-70	In process	DP	\$7,000	SNL Org 1431
Methods of Equation-of-State Construction	Chelyabinsk-70	In process	DP	\$7,000	SNL Org 1431
Methods of Advection	Arzamas-16 and Chelyabinsk-70	In process	DP	\$7,000	SNL Org 1431
Parallel Computer Software Tools	Arzamas-16 and Chelyabinsk-70	In process	DP	TBD	SNL Org 1431 in collaboration with LANL and LLNL
Environmental Monitoring, Characterization, and Remediation					
International Separations Project	Khlopin Radium Institute	Active	Environ- mental Restoration and Waste Manage- ment (EM)	\$400,000	SNL Org 6907 with SAIC
Technology Evaluation Pilot Projects	Institute of Physical Chemistry Khlopin Radium Institute and other Russian institutions (yet to be defined)	Active	EM	\$160,000	SNL Org 6907 with SAIC
High-Energy Density Science and Technology					
Repetitive Cathode Research, Development, and Design	Institute of High Current Electronics	Completed August 1993	DP	\$24,990/AF0416	SNL Org 1243
R&D, Surface Flashover Cathodes	Institute of High Current Electronics	Active	DP	\$24,000/AF0417	SNL Org 1243

**Summary Chart on Interactions with the FSU, continued
(Sandia National Laboratories [SNL]—Revised February 1994)**

Short Title	Institute(s) in FSU	Status	DOE HQ Sponsor Org	Funding Level/ Contract Number	Comments
Theoretical and Experimental Design Work (Z-Pinch)	Institute of High Current Electronics	Active	DP	\$9,430/AF0659	SNL Org 1273
Plasma Opening Switch (POS) Experimental Design Work	Institute of High Current Electronics	Active	DP	\$31,600/AF0660	SNL Org 1273
Gas Nozzles and Characterization	Institute for Applied Physics and High Technology	Active	DP	\$20,500/AF0655	SNL Org 1273
Inner Liners and Characterization	Institute for Applied Physics and High Technology	Active	DP	\$20,500/AF0656	SNL Org 1273
Plasma Opening Switch Experiments	Institute of Electrophysics	Active	DP	\$31,500/AF0661	SNL Org 1273
Experiments on Double Shell Liner Implosions	Institute for Applied Physics and High Technology	Active	DP	\$55,000/AF0657	SNL Org 1273
Angara-5 Design and Diagnostics	Institute for Applied Physics and High Technology	Active	DP	\$50,000/AF0658	SNL Org 1273
Fabrication of Liners	Institute of Applied Physics and High Technology	Completed	DP	\$5,500/AF5003	SNL Org 1273
Life Sciences and Technology					
Materials Science and Technology					
Growth of Crystalline Inorganic Layers on Silicon Substrates Using Langmuir-Blodgett Film Templates	Institute of Crystallography	Completed September 1993	SNL Research Funds	\$19,600	SNL Org 1841
High Temperature Spall of Metals	High-Energy Density Research Center	Active	DP	\$24,998	SNL Org 1433
Acquisition of Materials Technology	Dnepropetrovsk Metallurgical Institute, Ukraine	Active	DP	\$150,000	SNL Org 1833
Acquisition of Materials Technology	Institute for Foundry Problems, Kiev, Ukraine	In process	DP	\$18,000	SNL Org 1833

Summary Chart on Interactions with the FSU, continued
(Sandia National Laboratories [SNL]—Revised February 1994)

Short Title	Institute(s) in FSU	Status	DOE HQ Sponsor Org	Funding Level	Comments
Acquisition of Materials Technology	Paton Institute, Ukraine	In process	DP	\$200,000	SNL Org 1833
National Security, Nonproliferation, and Counter-Terrorism					
International Vibration Standard for Radioactive Material Packaging	VNIIEF	In Process	DP	\$33,000	SNL Org 5161
Small Sample Properties of Adaptive Filter in Process Control Applications	Arzamas-16	In Process	DP	\$11,000	SNL Org 12323
Numerical Model to Predict Organic Material Decomposition and Burn Process	Arzamas-16	In Process	DP	\$21,000	SNL Org 1513
Contamination from Accidental Dispersal of Radioactive Material	Chelyabinsk-70	In Process	DP	\$26,000	SNL Org 12333
Acceptable Risk Criteria—VNIITF	Chelyabinsk-70	In Process	DP	\$25,000	SNL Org 6411
Acceptable Risk Criteria—VNIIEF	Arzamas-16	In Process	DP	\$25,000	SNL Org 6411
Data Bank Development for Risk Calculations	Chelyabinsk-70	In Process	DP	\$21,000	SNL Org 12333
Neural Networks to Process Systems Response Data	Chelyabinsk-70	In Process	DP	\$21,000	SNL Org 1513
Russian Probabilistic Risk Assessment Methods	Chelyabinsk-70	In Process	DP	\$46,000	SNL Orgs 6411 and 12333
Glossary of Terminology in Surety Technology—VNIIEF	Arzamas-16	In Process	DP	\$12,000	SNL Org 5091
Glossary of Terminology in Surety Technology—VNIITF	Chelyabinsk-70	In Process	DP	\$12,000	SNL Org 5091

**Summary Chart on Interactions with the FSU, continued
(Sandia National Laboratories [SNL]—Revised February 1994)**

Short Title	Institute(s) in FSU	Status	DOE HQ Sponsor Org	Funding Level	Comments
Full-Scale and Sub-Scale Aircraft Crash and Fire Test—VNIIEF	Arzamas-16	In Process	DP	\$16,000	SNL Orgs 1513 and 1562
Full-Scale and Sub-Scale Aircraft Crash and Fire Test—VNIITF	Chelyabinsk-70	In Process	DP	\$16,000	SNL Orgs 1513 and 1562
Ground Transportation Test Data Documentation	Arzamas-16	In Process	DP	\$25,000	SNL Orgs 1513 and 12333
Actively Cooled Calorimeter	Arzamas-16	In Process	DP	\$48,000	SNL Org 6642
Wood Impact Limiters (Dampers)—VNIITF	Chelyabinsk-70	In Process	DP	\$20,000	SNL Org 6642
Wood Impact Limiters (Dampers)—VNIIEF	Arzamas-16	In Process	DP	\$20,000	SNL Org 6642
Penetration Technology	Chelyabinsk-70	In Process	DP	\$20,000	SNL Orgs 1562 and 9614
Impact Limiter Materials Aging Study	Arzamas-16	In Process	DP	\$11,000	SNL Org 5161
Seals Testing. Dynamic and Static—VNIITF	Chelyabinsk-70	In Process	DP	\$20,000	SNL Org 6642
Seals Testing. Dynamic and Static—VNIIEF	Arzamas-16	In Process	DP	\$39,000	SNL Org 6642
Safety During Rail Transport of Hazardous Cargo	Chelyabinsk-70	In Process	DP	\$28,000	SNL Orgs 4111 and 4112
Simulations for Structural and Thermal Benchmark Problems—VNIITF	Chelyabinsk-70	In Process	DP	\$12,000	SNL Orgs 1513 and 1562
Simulations for Structural and Thermal Benchmark Problems—VNIIEF	Arzamas-16	In Process	DP	\$12,000	SNL Orgs 1513 and 1562
Temperature and Heat Flux in Fires	Arzamas-16	In Process	DP	\$30,000	SNL Org 2761

Summary Chart on Interactions with the FSU, continued
(Sandia National Laboratories [SNL]—Revised February 1994)

Title	Institute(s) in FSU	Status	DOE HQ Sponsor Org	Funding Level	Comments
Fuel-Fire Characterization and Object Response	Chelyabinsk-70	In Process	DP	\$40,000	SNL Orgs 1513 and 2761
Explosion-Resistant Container Development	Arzamas-16	In Process	DP	\$30,000	SNL Orgs 5202 and 5365
Security Tag and Seal for Fissile Material Container	Arzamas-16	In Process	DP	\$20,000	SNL Org 9249
Nuclear Reactor Safety and Radioactive Material Processing					
Space and Atmospheric Physics					

Safety, Security, and Dismantlement of Nuclear Weapons

The Safety, Security, and Dismantlement of Former Soviet Union nuclear weapons was identified and authorized by the Soviet Nuclear Threat Reduction Act of 1991 (Nunn-Lugar Bill). Sandia was asked to design and develop hardware under this program in those areas of Sandia expertise. In this respect, Sandia serves our national interest in enhancing the safety and security of Russian nuclear weapons during dismantlement phases. Sandia's portion of this effort is nearly completed.

There are seven projects in this category. One (armor blankets) has been completed, one (storage facility design) is on hold, and three are active (railcar modification, emergency response equipment, and fissile material storage containers). The remaining two (material control and accountability [MC&A] and physical protection of nuclear materials) are in negotiations at the present time. Sandia's budget for these projects is about \$27M.

No future programs are anticipated under this category.

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Title:

Russian Railcar Modification

Point of Contact:

Lyle W. Kruse, Sandia National Laboratories, 9561, Project Leader, (505) 844-6022
Donald C. Hanson, Sandia National Laboratories, 9533, Project Manager, (505) 844-4962
K. David Nokes, Sandia National Laboratories, 5801, Program Manager, (505) 844-3744

Summary:

This project will address selected steps to accomplish the modification of 100 Russian railcars and 15 Russian guard cars to assist the Russian Federation in the safeguarding of nuclear weapons in transit, in association with their eventual destruction. This requirement was identified in US-Russian official exchanges of the Safety, Security, and Dismantlement (SSD) of the Nuclear Weapons Working Group. The project comprises four phases: design, prototype, training and procurement, and support.

Time Frame:

The design phase of the project started in August 1992 during technical exchanges with the Russian team. The design was completed in early FY93, and the modification of the prototype railcar in Albuquerque began in December 1992. Prototype construction was finished in August 1993. Material required for the modification of three additional cargo cars and one guard car has been shipped to Russia. During the months of October and November 1993, the US expects to receive and inspect the kit materials and the prototype railcar at the railcar factory in Tver, Russia. The Russian modified cars are expected to be complete during early 1994. The Russian modified cars will be used along with the prototype in a joint test program during early 1994. The project is expected to be completed in FY94, and funding estimates are based upon that completion date.

Funding Level:

Funding has been supplied for phases 1, 2, and 3 in the amount of \$3.5M. Funding for phase 4 has been supplied in the amount of \$16.5M with \$8.0M committed as of September 1993. An additional \$1.5M will be supplied for railcar floor insulation materials to be included with each railcar kit.

Institutes and Individuals Involved:

Boris Y. Lyubovin, MINATOM, Deputy Head of Department
Vitalii Nikolaevich Yaklovlev, Ministry of Defense, Deputy Head of Administration
Andrei Borisovich Kokurin, Ministry of Defense, Section Chief

Current Status:

Phases 1, 2, and 3 have been completed. Work has begun on phase 4.

References:

Agreement between the DoD of the United States of America and the Ministry of the Russian Federation for Atomic Energy concerning the safe and secure transportation of nuclear weapons material through the provision of cargo and guard railcar conversion kits.

Last Update:

October 1993

Title:

Soft Armor Blanket Program

Point of Contact:

Lt. Col. Gary Fowler, DNA/HQ (OPAC,SSD), (703) 325-1307

John W. Kane, Sandia National Laboratories, 9503, (505) 844-4183

Steven H. Scott, Sandia National Laboratories, 9611, (505) 845-8149

Summary:

In April 1992, Sandia hosted a series of Safety, Security, and Dismantlement (SSD) meetings in Albuquerque, New Mexico. One of those meetings was to discuss the usage of flexible armors to protect Russian nuclear weapons during the transportation and dismantlement process. The SSD delegation agreed that the United States of America would supply the Russian Republic with two types of flexible armored blankets. The first shipment occurred in the fall of 1992 and comprised approximately 200 ballistic nylon blankets. The second type of blanket was to be a Kevlar lightweight design procured by the US Government and supplied to the Russian Republic at a later date. On June 6, 1992, then-President George Bush signed an agreement with Russian President Boris Yeltsin to provide the aid previously agreed to by the SSD participants.

Funding for the Russian aid was provided by House Resolution (H.R.) 3807 (Title II), as referenced in Public Law 102-229. The appropriations were distributed to the Defense Nuclear Agency (DNA), which was also granted program manager status for the Soft Armored Blanket (SAB) program. Based upon the April 1992 work performed by Sandia, we were requested to assist DNA with blanket procurement by defining the blanket specifications, evaluation criteria, test specifications, First Article and quality assurance testing technical information for a Russian operations and maintenance manual, and producing a final project report. Additional technical exchanges were held with the Russians on December 17-18, 1992, and April 7-9, 1993.

Time Frame:

The program began in April 1992 and was completed in July 1993.

Funding Level:

Funding received to date is \$435K. Cost-saving features implemented during the program allowed Sandia to return \$84K deobligated funds to DNA in August 1993.

Institutes and Individuals Involved:

German Alekseevich Smirnov, Russian Institute of Automatics

Aleksandr Vladimirovich Fagotov, Ministry of Defense

Boris Lyubovin, MINATOM

Vitalii Yakovlev, Ministry of Defense

Ivan Petrovich Bondarenko, Office of the Joint Chiefs of Staff - Russian Federation

German Alekseevich Plaksitskiy, Ministry of Atomic Energy

Current Status:

All design and testing for the program are complete. The final project report, which is our last deliverable to DNA, was completed and provided to DNA in July 1993.

References:

Monthly progress reports dated September 1992 through May 1993, John W. Kane to DNA/HQ.
Specifications for Soft Armor Blankets, prepared by SNL, August 6, 1992.

Revised First Article Test Results, Kane to Lally, February 8, 1993.

Draft version, technical information for the Russian Operations and Maintenance Manual (cover letter), Scott to Fowler, March 11, 1993.

Early Production and Pre-Russian Testing, Kane to Glowaski, March 29, 1993.

United States/Russian Joint Testing, Kane to Glowaski, April 27, 1993.

Quality Assurance Testing of Flexible Armored Blankets, Kane to Glowaski, May 27, 1993.

SNL Drawing Number R39245, Soft Armor Blanket, April 5, 1993, SNL.

Drawing Number R41468, Soft Armor Blanket, Russian version, April 6, 1993.

Last Update:

October 1993

Title:

Russian Fissile Material Storage Facility

Point of Contact:

K. David Nokes, Sandia National Laboratories, 5091, (505) 844-3744

Douglas E. McGovern, Sandia National Laboratories, 5821, (505) 844-1542

Summary:

The US Army Corps of Engineers (COE), Transatlantic Division (TAD), has the program management responsibility for assistance to the Russians. DOE/Albuquerque Operations (AL), working with Sandia National Laboratories and Los Alamos National Laboratory, is tasked with helping the COE complete all actions required for the development of design criteria/requirements, risk assessment, safety analysis, process flow analysis, MC&A analysis, physical protection, thermal analysis, radiation analysis, fire protection, ventilation, and other assistance in support of the design. Attendance at meetings being conducted at various locations, including Russia, and reports of meetings are also included.

Sandia is principally responsible for providing information to the US Army COE, Missouri River Office (MRO), about physical security components and systems. In addition, Sandia acts as a design review agent. Some assistance is also being provided in material handling, based on the ongoing work Sandia is performing for the DOE dismantlement effort.

A recently added task is the design of pallet carrying equipment for periodic inventories of stored containers. This pallet will be self-contained and will carry all equipment for reading and logging identification information for the fissile material containers stored in each bay of the facility. The pallet would be carried on an automatically guided forklift. This system allows stored containers to be inventoried without personnel entering a high-radiation area.

Time Frame:

Work initiated during FY93 included the development of conceptual designs. It is anticipated that work will continue at least through completion of the design, scheduled for January 1994. Activities beyond that point will depend on US/Russian agreements regarding facility construction.

Planning for the inventory pallet design work has been completed through the second quarter of FY94, when a draft requirements document will be completed. Planning is in process that would include work through FY96.

Funding Level:

Total project funding, including all COE activities, is set at \$15M. Sandia project funding is approximately \$850K.

Institutes and Individuals Involved:

Gennadiy Kozko, MINATOM

Anatoly A. Rogozin, VO VNIPIET

Vladimir Yuferov, Arzamas-16

Ben Wood, Bob Schaible, US Army COE/TAD

John Trout, US Army COE/MRO

Steve Goodrum, DOE/AL

Kirk Ellard, Los Alamos National Laboratory

Current Status:

Work is in process. The design is 30% complete.

References:

COE/DOE Statements of Work; Meeting Summary Notes for mutual exchanges in Omaha (August 1992), St. Petersburg (October 1992), Albuquerque (December 1992), St. Petersburg (March 1993), Omaha (June 1992).

Last Update:

December 1993

Title:**Material Control and Accountability (MC&A) and Physical Protection Assistance to FSU****Point of Contact:**

Dennis L. Mangan, Sandia National Laboratories, 9208, (505) 845-8710

Douglas E. McGovern, Sandia National Laboratories, 5821, (505) 844-1542

Gerald F. Rudolfo, Sandia National Laboratories, 5821, (505) 844-6701

Summary:

Under the protection of the US initiative for nuclear weapons safety, security, and dismantlement (SSD), the US Department of Energy and the US Nuclear Regulatory Commission are engaged in establishing bilateral technical assistance programs with FSU states in nuclear material safeguards. The overall objective of US assistance is to help the FSU states improve their capabilities to effectively safeguard and protect nuclear material. The assistance will be carried out under bilateral agreements for cooperation and be supported by funds authorized by Congress in the Soviet Nuclear Threat Reduction Act of 1991 and successive legislation, such as the Freedom Support Act (1992).

Time Frame:

FY93 and beyond

Funding Level:

To be determined, based on successful negotiations with the Russian counterpart.

Institutes & Individuals Involved:

V. A. Gubanov, MINATOM

O. A. Sapunov, MINATOM

Y. G. Volodin, GOSATOMNADZOR

M. I. Moskalenko, MoD

Y. Y. Belobrov, MFA

Current Status:

An agreement has been reached between the US and Russia for a bilateral assistance program to enhance nuclear material safeguards. The US representatives have formulated a program plan for this assistance program. DOE and DNA concur with the plan, and DNA has provided \$10M to fund plan activities. The US proposed a Technical Working Group meeting for the first week of November 1993, to present the plan to the Russians and secure their concurrence. At this time, the US is awaiting a reply from the Russians. The planned program will establish a national regulatory program (including an inspection function), implementation of an information system for material accounting, technical support, and installation of MC&A and physical protection systems at two facilities.

Discussions with officials from Ukraine, Belarus, and Kazakhstan have been held to explore the possibilities of establishing similar safeguards enhancement programs in these countries. An agreement has been initiated with Kazakhstan, but formal approval is still pending. Discussions are proceeding with the other countries.

References:

Program Plan, September 1993; various trip reports.

Last Update:

October 1993

Title:**Material Control and Accountability (MC&A) Technical Assistance and Physical Protection in the US-Russian Highly Enriched Uranium (HEU) Purchase****Point of Contact:**

Dennis L. Mangan, Sandia National Laboratories, 9208, (505) 845-8710

Douglas E. McGovern, Sandia National Laboratories, 5821, (505) 844-1542

Gerald F. Rudolfo, Sandia National Laboratories, 5821, (505) 844-6701

Summary:

The objective of this project is the design and development of MC&A and physical protection systems at facilities in Russia associated with the US-Russian HEU purchase. As appropriate, assistance in implementation of such systems is also included. This work will be carried out in close cooperation with the Russians with the intent to implement transparency and access measures between the US and Russia. The facilities expected to be involved in the US-Russian HEU purchase are dismantlement, storage, conversion, and blending facilities. This project will focus on the conversion and blending facilities. It may also include the output of the dismantlement facility and then transportation to the conversion facility or facilities, but this depends on the outcome of negotiations.

Time Frame:

FY93 and beyond

Funding Level:

To be determined, based on successful negotiations with the Russian counterpart.

Institutes and Individuals Involved:

Vladislav G. Balamoutov, MINATOM

Vitali F. Kornilov, Plant Manager

Current Status:

Proposals and draft agreements are being discussed with the Russian counterpart.

References:

Program planning documents, trip report (Moscow, May 1993).

Last Update:

October 1993

Title:**AT-400R Fissile Material Container Design Requirements, Testing, and Certification****Point of Contact:**

John A. Andersen, Sandia National Laboratories, 5161, (505) 844-0391

Robert E. Glass, Sandia National Laboratories, 5161, (505) 845-8742

Summary:

This program has resulted in the development of a package for the transportation and storage of fissile materials for the Russian nuclear weapon dismantlement program. The package must meet the requirements of the International Atomic Energy Agency as well as Russian-specific transport and storage requirements. The DNA has now contracted for a minimum of 30,000 containers, manufactured by US industry.

In addition to fulfilling the requirements of international agreements, the development of this project at Sandia provided the technological basis for the current Sandia development of a US fissile materials container at minimum additional cost.

Time Frame:

1992 - 1995

Funding Level:

\$0.5M FY 1992

\$1.7M FY 1993

\$0.9M FY 1994

Institutes and Individuals Involved:

Maj. M. Hall, DNA

Maj. R. Nelson, FC/DNA

J. A. Andersen, SNL

R. E. Glass, SNL

P. G. Seamster, DOE

R. I. Il'kaev, Arzamas-16

B. P. Barkanov, Arzamas-16

Current Status:

Design and test requirements were agreed to between Sandia and Russia, with DOE and DNA cognizance. Development testing is to be completed in December 1993. The complete design was released to DNA and was contracted to US industry for mass production. First article manufacturing is scheduled for first quarter CY94. Compliance testing is to be accomplished early in CY94. Container shipments to Russia are scheduled to begin mid-1994.

References:

AT-400R Requirements Document, August 1993; AT-400R Test Plans, August 1993.

Last Update:

December 1993

Title:**Emergency Response Equipment (Portable Integrated Video System)****Point of Contact:**

Stanley D. Spray, Sandia National Laboratories, 12331, (505) 844-3135

David Shirey, Sandia National Laboratories, 9567, (505) 844-9790

Summary:

The Defense Nuclear Agency, working through DOE/AL, has the responsibility to provide emergency response equipment to the Former Soviet Union. To support this objective, the Sandia-New Mexico facility will provide four sets of equipment that constitute the Portable Integrated Video System (PIVS). PIVS was designed and developed at Sandia in support of the Accident Response Group activities. In addition to the hardware, Sandia has produced an operator's manual and a training manual and has conducted at the Albuquerque facility preliminary training sessions. A final training session will be held in Moscow from October 25 through November 5, 1993.

Time Frame:

Work was initiated in FY93 and is scheduled for completion during FY94.

Funding Level:

\$1,817M.

Institutes and Individuals Involved:

German Plaksitskiy, MINATOM

COL M. K. Evenson, HQDNA

Dr. James M. Turner, HQDOE

Stuart V. Rogers, DOE/AL

Current Status:

All four PIVS units, as well as associated spares and expendables, were procured, built, and shipped by October 15, 1993. Training in Russia will take place October 25 through November 5. A follow-up training session is projected for the summer of 1994.

Last Update:

October 1993

Computers and Computational Science

Sandia has teamed with Los Alamos and Lawrence Livermore National Laboratories in the area of computers and computational science. It is Sandia's objective to identify those "centers of excellence" in the Former Soviet Union (FSU) computer and computational science fields and enter into collaborations with those institutes and/or individuals. Russian researchers, for example, have valuable, practical experience in applying parallel computer processing to a wide variety of mathematical computational problems, and the national laboratories and US industry have a very high, immediate interest in applying this technology here in the US. Similarly, Russian researchers have had extensive experience in developing advection methods and constructing equations of state. Four contracts, for a total of \$28K, are in place for the Russians to provide reports and guidance in these selected areas.

It is Sandia's intent to continue to search out additional centers of excellence and work with the FSU researchers to obtain and understand the computational methods they use.

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Title:**Systems and Application Software for Parallel Computing****Point of Contact:**

Bruce Hendrickson, Sandia National Laboratories, 1422, (505) 845-7599

Harold Trease, Los Alamos National Laboratory

Randy Christensen, Lawrence Livermore National Laboratory

Summary:

The national laboratories and US industry have an immediate interest in applying parallel processing to a wide variety of problems in mathematical computation. Russian researchers have valuable, practical experience in this area that would be of immediate benefit.

Russian researchers will prepare several reports of their accomplishments in the area of parallel processing that have not been generally available to their US counterparts. They will report the results of work on three tasks:

- Strategy for parallellization of calculation of the diffusion equation as exemplified by the Ramzes methodology and the Mimosa methodology.
- Strategy of parallel implementation of the Medusa methodology; clusterization of data and dynamic load balancing.
- Requirements of software to test communication characteristics of multiprocessors.

Time Frame:

To be determined

Funding Level:

\$7K

Institutes and Individuals Involved:

V. Gribov and I. Sofronov, Arzamas-16

Current Status:

In negotiation

References:

None

Last Update:

October 1993

Title:**Models of Material Strength, Fracture, and Failure****Point of Contact:**

Michael McGlaun, Sandia National Laboratories, 1431, (505) 845-8236

Thomas Adams, Los Alamos National Laboratory

Don Burton, Los Alamos National Laboratory

Summary:

Dynamic processes involving solids are dominated by material strength effects, such as plastic yielding and fracture. To treat these effects in advanced computer codes requires three tasks: (1) development of theoretical models, (2) the implementation of these models in numerical algorithms, and (3) determination of material constants from experimental data. The basic code algorithms should have sufficient accuracy in order to prevent the introduction of spurious numerical effects.

Researchers at VNIITF (Chelyabinsk-70) have developed advanced material models including fracture. They have applied these models in codes to predict rock breakage and ground shock propagation resulting from contained underground nuclear explosions. The predictions are apparently in agreement with the results of the experiments.

Time Frame:

To be determined

Funding Level:

\$7K

Institutes and Individuals Involved:

Valentin Kouropatenko and Vladimir Bichenkov, Chelyabinsk-70

Current Status:

In negotiation

References:

None

Last Update:

October 1993

Title:
Methods of Equation-of-State Construction

Point of Contact:

Michael McGlaun, Sandia National Laboratories, 1431, (505) 845-8236

George Zimmerman, Lawrence Livermore National Laboratory

Richard More, Lawrence Livermore National Laboratory

Summary:

Equation-of-state questions are of mutual interest to the nuclear centers of both Russia and the US. Historically, a great deal of difficulty has existed in merging various equation-of-state theories and experimental data in a manner that preserves thermodynamic consistency.

This contract will introduce American scientists to the current state of expertise on methods of construction equations-of-state in Russian nuclear centers. We will then meet with Russian counterparts to discuss further collaboration in this area.

Time Frame:

To be determined

Funding Level:

\$7K

Institutes and Individuals Involved:

Valentin Kouropatenko and A. Sapozhnikova, Chelyabinsk-70

Current Status:

In negotiation

References:

None

Last Update:

October 1993

Title:
Methods of Advection

Point of Contact:

Michael McGlaun, Sandia National Laboratories, 1431, (505) 845-8236

Doug Kothe, Los Alamos National Laboratory

Randy Christensen, Lawrence Livermore National Laboratory

Summary:

Many key application areas of interest to industry involve multidimensional flows with large deformations. Russian researchers have had extensive experience in developing the advection methods used to address this type of flow in numerical simulation codes.

Reports, including examples from existing codes, will be generated that describe Russian research and accomplishments in this important algorithmic area.

Time Frame:

To be determined

Funding Level:

\$7K

Institutes and Individuals Involved:

Lyudmila Nesterenko, Arzamas-16

Valentin Kouropatenko, Chelyabinsk-70

Current Status:

In negotiation

References:

None

Last Update:

October 1993

Title:
Parallel Computer Software Tools

Point of Contact:

Mike McGlaun, Sandia National Laboratories, 1431, (505) 845-8236
Rick Wallace, Los Alamos National Laboratory, X-DO (B218), (505)-667-7681
Dave Nowak, Lawrence Livermore National Laboratory

Summary:

Parallel computers hold the promise of providing orders of magnitude improvements in memory size and processing speed. Software tools are needed to make it easier to program parallel computers. This project will fund development, analysis, and debugging tools for parallel software development, nonprocedural languages, file management, post-processing, and applications.

This work, to be performed by scientists at Arzamas-16 and Chelyabinsk-70, will develop tools for developing, maintaining, and using parallel computers.

Time Frame:

Three years from time of start. Expected start is FY94.

Funding Level:

To be determined

Institutes and Individuals Involved:

I. D. Sofronov, Arzamas-16
V.F. Kuropatenko, Chelyabinsk-70

Current Status:

In discussion

References:

This project is based on a proposal given to SNL at the Second Joint Conference on Computational Mathematics held at Arzamas-16, September 6 through 11, 1993.

Last Update:

December 1993

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Environmental Monitoring, Characterization, and Remediation

Many environmental releases of radioactive and hazardous chemicals have occurred over the past forty years at the Mayak complex, which was the major site of nuclear weapon production in the Former Soviet Union. The US nuclear weapon complex shares this experience, although to a lesser degree. This situation poses immediate and long-range risks to the population of Russia and the rest of the world through potential direct exposure as well as through groundwater and surface-water discharge to the Arctic Ocean. With similar situations existing in both the US and Russia, a unique opportunity exists for cooperation on environmental restoration of the environment. Sandia projects will assess the degree of damage, use existing technologies to start the restoration process, develop technologies where needed, using FSU scientists, and establish demonstration projects.

To date, Sandia has two environmentally related contracts with the FSU for a sum of \$560K. Over thirty additional projects have been identified for future implementation, which are limited at the present time by the lack of funds.

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Title:

International Separations Project

Point of Contact:

Ken Bergeron, Sandia National Laboratories, Program Manager, 6907, (505) 844-2507
Thomas E. Albert, SAIC, Vice President, (813) 530-4000

Summary:

Reprocessing of high-level defense wastes stored in tanks is an urgent problem for both the US and Russia. The need for reprocessing and ultimate disposal of accumulated wastes is exacerbated by the hazard of long-term storage of liquid high-level waste. The nature of the hazard is the potential release of radioactivity into the environment. Such a situation could arise if the storage facilities suffered damage as a result of either a natural catastrophe or aging. It is also expedient to reprocess high-level waste stored in tanks because of the potential economic benefits resulting from reduced quantities of vitrified wastes.

A contract involving a previously unknown Russian separations technology (cobalt dicarbollide) was established between SNL, SAIC, and the Khlopin Radium Institute (KRI) in the summer of 1992. The work, specifically directed to the treatment of Hanford wastes, was completed successfully in September 1992.

The work now under way has been broadened in scope. It now includes investigation of the feasibility of using this method of treatment on a variety of US radioactive wastes, including Hanford, Idaho, and Savannah River. Special emphasis has been placed on the Idaho waste forms. The KRI will perform laboratory testing and dynamic hot cell testing using Russian technology on simulated uranium radioactive wastes over a 12-month period. Overall feasibility of the Russian technology by the KRI will occur over a period of 2 to 3 years to determine its viability for use on actual US radioactive wastes.

Time Frame:

The project began as a pilot project in August 1992. Following successful completion of the pilot phase, the project was transitioned in March 1993 to a more in-depth study to determine the feasibility of using the cobalt dicarbollide project in treatment of various DOE tank wastes.

Funding Level:

\$400K (FY94)

Institutes and Individuals Involved:

Valeriy Romanovskii, Khlopin Radium Institutes, St. Petersburg and Gatchina, Russia
Minatom Production Association MAYAK

Current Status:

All work is on schedule and proceeding in accordance with the contract. Dynamic tests involving the simulated Idaho waste samples are now under way. DOE and laboratory personnel conducted a thorough review of the status early in August 1993.

References:

Sandia National Laboratories Purchase Order No. 874331

Report on the Project Applicability of the Russian Separation Technology to Reprocessing of the USA Radioactive Wastes, V.G. Khlopin Radium Institute

Last Update:

December 1993

Title:

Technology Evaluation Pilot Projects

Point of Contact:

Ken Bergeron, Sandia National Laboratories, Program Manager, 6907, (505) 844-2507
Thomas E. Albert, SAIC, Vice President, (813) 530-4000

Summary:

A strategy was developed in FY92 to make more cost-effective use of Russian capabilities for the identification and initial evaluation of candidate technology transfer projects. The approach was to establish a small pilot technology project with an appropriate Russian institute and use Russian scientists to evaluate the potential applicability of an identified technology to DOE/EM technology requirements. The first of these pilot projects involved Russian separations technologies and was established among SNL, SAIC, and the Khlopin Radium Institute (KRI) in the summer of 1992. The work, directed toward the application of the cobalt dicarbollide process to the treatment of Hanford waste, was completed successfully in September 1992. Based on the initial success of this approach, an expanded pilot technology evaluation program has been authorized for FY93 carrying into FY94.

The four principal benefits of the pilot technology evaluation projects as one approach for technology identification and screening are

- Provides leverage for the equivalent of billions of dollars invested by the Former Soviet Union over the past 40 years in independent research in environmental remediation and waste management technologies
- Takes advantage of cost-effective Russian labor rates for initial technology screening
- Provides direct access to Russian technology; minimizes risk by providing an opportunity to evaluate the capabilities and credentials of key Russian scientists and institutes before making commitments for more significant technology demonstration projects
- Contributes toward US objectives to assist in the stabilization and conversion of the nuclear industry in the Former Soviet Union

Time Frame:

The project began as a pilot project in August 1992. Following successful completion of the pilot phase, the program was transitioned in March 1993 to a more in-depth feasibility study to assess whether the cobalt dicarbollide process could be used in treating various DOE tank wastes.

Funding Level:

\$160K (FY94)

Institutes and Individuals Involved:

Alexander A. Rimski-Korsakov, Khlopin Radium Institute

Vladimir M. Gelis, Institute of Physical Chemistry

Evgeniy G. Grozhko, MAYAK Production Association and Institute of Chemistry Technology

Other institutes yet to be identified

Current Status:

All work is on schedule and proceeding in accordance with the contract. The thrust for FY94 will encompass initiating up to eight (8), but not less than four (4), new pilot technology evaluation projects involving Russian ER and WM technologies that have high probability of application in the DOE complex cleanup activities. Each pilot project will be modest in cost (up to about \$10K per project) and will provide an initial assessment of technology status, suitability, and risk associated with possible use at the DOE sites. In addition, SNL is providing powerful workstations on loan to Russian institutes to run such analysis programs as Enviro-TRADE for the EM program.

References:

Sandia National Laboratories Purchase Order No. 87-4331

Last Update:

December 1993

High-Energy Density Science and Technology

Former Soviet Union pulsed power technology appears to be more advanced than that of the US in areas such as the production of high-temperature foams, magnetized fusion targets, repetitively pulsed Tesla generators, multiple plasma opening switch devices, and long-lifetime, repetitive, surface-flashover cathodes. Sandia has identified several leading scientists in these areas and has placed several contracts in an attempt to advance US programs in inertial confinement fusion testing and R&D. Several contracts have been completed on repetitive cathode research, history of the theoretical and experimental work on the stabilized Z-pinch implosions, development of gas nozzles, development of low-density inner liners, and experiments on inner-liner implosions. Research programs have been initiated to advance this technology to an even higher level. Total funding for these contracts is \$327K.

It is very probable that Sandia has identified only a small percentage of the pulsed power technology available in the FSU. We will continue to search for additional technology that can enhance our US program.

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Title:**Repetitive Cathode Research, Development, and Design; Surface Flashover Cathodes****Contacts:**

David L. Johnson, Sandia National Laboratories, 1243, (505) 845-7118

Eugene L. Neau, Sandia National Laboratories, 1243, (505) 845-7120

Summary:

Two contracts have been placed with the High Current Electronics Institute, Tomsk, Russia, to provide research on long-lifetime, repetitive, surface-flashover cathodes for the RHEPP (Repetitive High Energy Pulsed Power) Program. Each of the two contracts provides three deliverables. The first contract, AF-0416, provides: (1) a report, based on a literature search, on surface-flashover cathodes; (2) experimental data on the performance and lifetime of a rep-rate surface-flashover cathode; and (3) a preliminary design of a cathode for the 2.5 MV RHEPP accelerator. The second contract, AF-0417, provides: (1) the detailed design and drawings of the 2.5 MV cathode; (2) delivery of the cathode to Sandia; and (3) a follow-up report of analysis of the cathode performance based on data from the RHEPP accelerator.

Time Frame:

AF-0416 Completed August 15, 1993

AF-0417 Estimated completion May 1, 1994

Funding:

AF-0416 \$24,990

AF-0417 \$24K

Institutes and Individuals Involved:

Current: Sergei D. Korovin, High Current Electronics Institute

Status:

Sandia has received the final report for AF-0416. Sandia will approve the start of the second contract pending the outcome of a design review at Tomsk in November 1993.

Title:
Theoretical and Experimental Design Work (Z-Pinch)

Point of Contact:

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The object of this program is to develop a detailed history of the theoretical and experimental results of the work performed on the stabilized Z-Pinch implosions.

Time Frame:

Through December 1993

Funding Level:

\$9,430

Institutes and Individuals Involved:

Andre V. Luchinsky, Institute of High Current Electronics

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Plasma Opening Switch (POS) Experimental Design Work****Point of Contact:**

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The object of this program is to establish a research program with the Institute of High Current Electronics in cooperation with the institute of Electrophysics. The program will investigate the scaling of SNL's Plasma Opening Switch.

Time Frame:

Through January 1995

Funding Level:

\$31,600

Institutes and Individuals Involved:

Boris Kaval Chuk, Institute of High Current Electronics

Current Status:

In process

References:

None

Last Update:

February 1994

Title:
Gas Nozzles and Characterization

Point of Contact:

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The object of this program is to develop Xe and Ar gas nozzles for use on the Saturn accelerator. The program will define elements to optimize the production of radiation energy density for applications to x-ray laser research at SNL.

Time Frame:

Through 1993

Funding Level:

\$20,500

Institutes and Individuals Involved:

Andre V. Luchinsky, Institute for Applied Physics and High Technology

Current Status:

In process

References:

None

Last Update:

February 1994

Title:
Inner Liners and Characterization

Point of Contact:

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The object of this program is to develop low-density inner liners for use on the Saturn accelerator. The program will define elements to optimize the production of radiation energy density for applications to x-ray laser research at SNL.

Time Frame:

Through 1993

Funding Level:

\$20,500

Institutes and Individuals Involved:

Andre V. Luchinsky, Institute of Applied Physics and High Technology

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Plasma Opening Switch (POS) Experiments****Point of Contact:**

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The purpose of this project is to establish a research program with the Institute of Electrophysics in cooperation with Institute of High Current Electronics. The program will investigate the scaling of SNL's Plasma Opening Switch (POS).

Time Frame:

Through February 1995

Funding Level:

\$31,500

Institutes and Individuals Involved:

V. Vystritskii, Institute of Electrophysics

Current Status:

In process

References:

None

Last Update:

February 1994

Title:
Experiments on Double Shell Liner Implosions

Point of Contact:

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The purpose of this project is to establish a research program through the International Institute for Applied Physics and High Technology to be led by the Angara research team at the Trinitite Institute. The program will provide for a series of experiments at the Angara-5 accelerator to verify the recent results on double shell liner implosions.

Time Frame:

Through May 1994

Funding Level:

\$55,000

Institutes and Individuals Involved:

V. P. Snirnor and V. Tsaifin, Institute for Applied Physics and High Technology

Current Status:

In process

References:

None

Last Update:

February 1994

Title:
Angara-5 Design and Diagnostics

Point of Contact:

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The purpose of this project is to establish a research program through the International Institute for Applied Physics and High Technology to be led by the Angara research team at the Trinitite Institute, Troitsk, Russia. The program will provide for a series of experiments at the Angara-5 facility and support for the diagnostics from the US team.

Time Frame:

Through May 1994

Funding Level:

\$50,000

Institutes and Individuals Involved:

V. P. Smirnov, Institute of Applied Physics and High Technology

Current Status:

In process

References:

None

Last Update:

February 1994

Title:
Fabrication of Liners

Point of Contact:

Dillon H. McDaniel, Sandia National Laboratories, 1273, (505) 845-7494

Summary:

The purpose of this project is to purchase inner liners to be used and expended in Russia during tests.

Time Frame:

Through June 1993

Funding Level:

\$5,500

Institutes and Individuals Involved:

Institute of Applied Physics and High Technology

Current Status:

Completed

References:

None

Last Update:

February 1994

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Materials Science and Technology

Former Soviet Union (FSU) scientists in the Ukraine and Russia have developed unique technologies that, along with others yet to be identified, can enhance our US materials programs. Examples include high-quality electro-optic crystalline films, specialized high-resolution shock-wave data, porous metal technology, micro-structural characterization of hyper-eutectic alloys, high-temperature measuring technology, and high-powered gyrotron microwave generator technology. At Sandia, these technologies could greatly aid the specialty metals processing consortium (SMPC) program. To date, total funding for this category is \$399K.

Sandia believes that much extremely useful materials technology exists in the Former Soviet Union and will continue to explore various sources, including FSU scientific institutes, in an effort to identify additional technology.

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Title:**Growth of Crystalline Inorganic Layers on Silicon Substrates Using Langmuir-Blodgett Film Templates****Point of Contact:**

Joseph Cesarano, Sandia National Laboratories, 1841, (505) 272-7624

Alan J. Hurd, Sandia National Laboratories, 1841, (505) 845-8629

Summary:

This project attempts to develop a new technique to nucleate and grow oriented crystalline electro-optic materials on silicon substrates for possible microelectronics or sensor applications. The technique attempts to use two-dimensional crystalline Langmuir-Blodgett films to act as templates for the controlled growth of crystalline ceramic films. Essentially, experimentalists are trying to use organized organic molecules to control the growth of inorganic crystals much in the same way that bones grow in animals. If successful, the project will provide very high quality electro-optic crystalline films which may benefit the US microelectronics industry.

The success of the project depends primarily on two difficult tasks: (1) Langmuir-Blodgett film technology; and (2) characterization of the film structures using x-ray and neutron reflectivity and electron diffraction.

Time Frame:

The program began in January 1993 and was completed on September 15, 1993. Sandia would like to continue this collaboration and is searching for resources to do so.

Funding Level:

Sandia Organization 1841 allocated \$20K for the period from January through September 1993.

Institutes and Individuals Involved:

Professor Lev A. Feign, Institute of Crystallography, Russian Academy of Science, Moscow, Russia

Current Status:

This project is approximately 75% completed. The work has been very well done and the results are promising. Films have been fabricated and preliminary characterization analysis is being completed.

References:

Sandia Contract # AE-3528

Last Update:

October 1993

Title:

High Temperature Spall of Metals

Point of Contact:

Dennis E. Grady, Sandia National Laboratories, 1433, phone (505) 844-2799;
fax (505) 844-0918

Phillip L. Stanton, Sandia National Laboratories, 1433, phone (505) 845-8439;
fax (505) 844-0918

Summary:

As of April 12, 1993, a contract is in place with the Shock Physics Laboratory of the High-Energy Density Research Center in Moscow, Russia, to provide high-temperature and ultra-high strain rate shock-wave spall and fragmentation measurements on selected metals. This laboratory has unique capabilities for acquiring the necessary specialized high-resolution shock-wave data and an impressive history of providing such data. Sandia National Laboratories has a need for high-quality fracture and fragmentation data on special metals over an expanded range of thermomechanical states of matter, and particularly in the high-temperature solid and liquid state toward which this program is focused. Sandia programs that will benefit from this data include: (1) soft x-ray lithography research in which laser blow-off fragment debris represents a critical problem area; (2) nuclear weapon safety issues concerning nonnuclear dispersal of component materials; and (3) hypervelocity impact and bumper shield design of space assets.

Time Frame:

The program was organized for 9 months from start of contract. Follow-on efforts will be warranted if the initial study is successful.

Funding Level:

Funding of \$25K was provided by Sandia for the 9-month study.

Institutes and Individuals Involved:

G. I. Kanel, V. E. Fortov, A. V. Utkin, S.V. Razorenov, A. Z. Zhuk, High-Energy Density Research Center, Moscow

Current Status:

Funds have been transferred to the High-Energy Density Institute in payment for completion of Tasks 1, 2, and 3 of this five-task program. The investigators are continuing to work on the focal effort of the program, which is to provide critical experimental data on the dynamic spall properties of selected metals in the high-temperature solid and liquid state. This effort is proceeding without significant difficulties, and researchers indicate that program work is on schedule.

References:

Task 1—Program research plan, May 1993.

Task 2—Tin and lead samples for high-temperature spall measurements, July 1993.

Task 3—Elevated temperature spall data on selected metals, September 1993.

(Available from Sandia point of contact.)

Last Update:

December 1993

Title:**Acquisition of Materials Technology from the Dnepropetrovsk Metallurgical Institute in Dnepropetrovsk, Ukraine****Point of Contact:**

Frank J. Zanner, Sandia National Laboratories, 1833, (505) 845-3085

Summary:

Three projects will be contracted with at the Dnepropetrovsk Metallurgical Institute: (1) acquisition of porous metals technology; (2) development of pseudo-binary-phase diagrams for alloy 718 varying Nb and Ti at the expense of Cr; and (3) microstructural characterization of Al-Si hyper-eutectic alloys. The porous metal project will involve laboratory work in the Ukraine and the transfer of this technology to Sandia. The other projects are strictly research contracts to be conducted at the institute.

Time Frame:

The schedule for completing all of the above projects is 2 years from the time that orders are placed.

Funding Level:

Expenditures of \$80K for porous metals; \$52K for alloy 718; and \$20K for Al-Si alloys are planned.

Institutes and Individuals Involved:

Dnepropetrovsk Institute for this work; Vladimir Shapovalov for the porous metals; Polina Nizhnikovskaja for alloy 718; and Jurij Taran for Al-Si.

Current Status:

The contract on porous metals was placed in July 1993. Technical details have been worked out for the other projects, and contracts are under negotiation.

References:

All of these Ukrainian investigators are internationally known in these fields of work.

Last Update:

October 1993

Title:**Acquisition of Materials Technology from the Institute for Foundry Problems in Kiev, Ukraine****Point of Contact:**

Frank J. Zanner, Sandia National Laboratories, 1833, (505) 845-3085

Summary:

This Institute for Foundry Problems has developed a novel temperature measurement technology which consists of a sapphire window passing through the refractory of a furnace lining and the measurement of transmitted light with an optical pyrometer.

Time Frame:

Contract duration is 1 year from the time that the order is placed.

Funding Level:

Expenditures of \$18K for one unit and four sapphire windows are planned.

Institutes and Individuals Involved:

Segri Zatulovsky, Institute for Foundry Problems

Current Status:

Technical details have been completed, and the contract is under negotiation.

References:

None

Last Update:

October 1993

Title:**Acquisition of Materials Technology from the Paton Institute in Kiev, Ukraine****Point of Contact:**

Frank J. Zanner, Sandia National Laboratories, 1833, (505) 845-3085

Summary:

A 35-kW, 3-mm wavelength gyrotron microwave generator will be purchased from the Paton Institute in Kiev. The services of a Paton technical person will also be contracted to provide operational assistance at Sandia. This microwave generator will be used for a proprietary specialty metals processing consortium (SMPC) program. A contract will also be placed to purchase a fine-grain layer-by-layer alloy 720 disk for test and evaluation and for several test samples of Ti/TiAl composite materials. All of these materials will be evaluated for quality and performance at Sandia in Albuquerque.

Time Frame:

Contract duration is planned for 1 year from the time that orders are placed.

Funding Level:

Expenditures of \$91K are planned for a gyrotron tube, \$91K for a liquid helium cryostat and supporting hardware, \$10K for an alloy 720 disk, and \$10K for Ti composites.

Institutes and Individuals Involved:

Vladimir Skylarevich for the microwave generator and Boris Movchan for the alloy 720 and Ti composites, Paton Institute, Kiev.

Current Status:

The contract on the microwave generator was placed in July 1993. Technical details have been worked out for the other projects, and contracts are under negotiation.

References:

Both of these Ukrainian investigators are internationally known in these fields of work.

Last Update:

October 1993

National Security, Nonproliferation, and Counter-Terrorism

Sandia's only effort in this category at the present time is in the area of surety technology, i.e., the safety, security, and risk assessment associated with the nation's valuable assets. The program was proposed by the leaders of the two Russian nuclear weapons institutes in April of 1993, with the participation of the two Russian institutes, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories, and DOE DP 20.1. The program is structured to provide a forum to review the current status of surety technologies in the US and Russia, to identify Russian technologies and technical capabilities that complement US interests, and to identify work of mutual benefit for contracts, technical exchanges, and collaboration.

The program has conducted three symposia: Risk Assessment Technology and Accident Environment Technology, Accident Resistant Container and Transportation Surety Technology, and Hazardous Material Management Technology. Out of these symposia, approximately 300 topics have been identified for potential collaboration, ten contracts for \$310K have been signed, twenty contract proposals have been approved by DOE and are in negotiation, and twenty contract topics are in technical development.

Sandia will continue to identify proposals of mutual benefit, and will implement contracts and begin technical collaborations on most of the 300 topics identified in the first three symposia.

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Title:

Development of an International Vibration Standard for Radioactive Material Packaging

Point of Contact:

Robert E. Glass, Sandia National Laboratories, 5161, (505) 845-8742

John A. Andersen, Sandia National Laboratories, 5161, (505) 844-0391

Summary:

The objective of this program is to develop an international standard that defines the surface transportation vibration environment and provides test methods for demonstrating compliance with the transport requirements of the International Atomic Energy Agency.

Importance: This effort (1) continues the existing cooperative efforts between Sandia National Laboratories and the All-Russian Research Institute of Experimental Physics on the transport and storage of nuclear materials, (2) permits the resolution of transportation vibration environments and test methods that are of concern to both the Russian and US packaging communities, and (3) provides for an internationally accepted standard where none currently exists.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Compilation of Russian transportation environments and regulations	3	0.5
List of additional data needs	5	0.2
Test plans for additional data needs and benchmarks	8	0.5
Additional needs and benchmarking test procedures	10	0.5
Draft vibrations environment envelope	24	0.5
Methodologies test plan	26	0.5
Methodologies test procedures	28	1.0
(continued)		

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Methodologies test report with benchmark comparisons	32	1.0
Draft test methodologies recommendations	36	0.5
Draft ISO standard	40	1.0
Participation in International Standards Organization/Standing Advisory Group on Safe Transport of Radioactive Materials (ISO/SAGSTRAM)	40 to 60	2.0

Equipment Required and Estimated Cost:

None required at this time.

Funding Level:

7.7 Russian man years: \$33K

Institutes and Individuals Involved:

Boris P. Barkanov, VNIIEF - All-Russian Research Institute of Experimental Physics, 831-30 5-68-49

Capability of Russian Lab:

VNIIEF has the capability to summarize current Russian standards and to provide the engineering required to support the test program and data analyses.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Determination of Small Sample Properties of an Adaptive Filter in Low-Volume Statistical Process Control Applications****Point of Contact:**

Stephen V. Crowder, Sandia National Laboratories, 12323, (505) 844-0322

Robert G. Easterling, Sandia National Laboratories, 12323, (505) 844-5997

Summary:

This work provides a technical basis for new methods of statistical process control in low-volume production environments. In particular, the small-sample properties of "filtered" estimators of a process mean and variance are evaluated. After each measurement of a process characteristic, these estimators provide an estimate of the current mean and variance. They also provide updating estimates of the process mean and variance at previous measurement times. The objective of this work is to evaluate the effect of these estimation errors on estimates of the process means and variance. This evaluation will be analytical, to the extent possible; otherwise, computer simulation will be used. The proposed research addresses univariate and multivariate process measurements.

Importance: Many modern manufacturing situations require the production of a small number of specialty-design items. Traditional statistical process control methods (SPC) are suited for large-volume production for which extensive data are available to estimate a process mean and variance. Thus, low-volume SPC methods are required and are the subject of considerable current research. In general, though, small-sample properties of these methods are not known and, consequently, it is not possible for a manufacturer to control the risks of failing to detect an important process shift (meaning degrading quality) or of falsely indicating an important process shift. The proposed work provides this capability and thus enhances the quality of low-volume manufacturing processes.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Report on current statistical process control processes in Russia, with emphasis on applications to low-volume production	2	0.1
Report on examples of the use of "error propagation" methods in Russia	2	0.1

(continued)

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Review "adaptive filtering" estimators and develop the mathematical framework for addressing error propagation in this context	3	0.2
Determine the scope of the investigation; sample sizes and parameter ranges	4	0.2
Determine the feasibility of an analytical evaluation of small-sample properties	4	0.2
If an analytical evaluation is not feasible, design a computer simulation experiment to do the evaluation	6	0.2
Conduct the evaluation and report the results	12	1

Equipment Required and Estimated Cost:

One PC system suitable for conducting Monte Carlo simulations and for providing typed reports, including tables of results: \$3K

The PC and software will be provided, if available, through obsolete equipment.

Funding Level:

2 Russian man years \$8K

PC equipment \$3K

Total \$11K

Institutes and Individuals Involved:

N. A. Bilyk, Arzamas-16

Capability of Russian Lab:

To be determined

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Development of Numerical Model to Predict the Decomposition and Burn Process of Organic Materials****Point of Contact:**

Jaime L. Moya, Sandia National Laboratories, 1513, (505) 844-7955

Summary:

The objective of this investigation is to develop a transient, physically based engineering model that can predict decomposition and burning processes of organic materials, as well as the associated heat transfer through the material. As a first step, this program will focus on developing a numerical tool to predict the thermal response of rigid polyurethane foam (RPF). The approach is to develop a tightly coupled numerical and experimental program that will characterize the dominant physical processes needed to develop a comprehensive predictive tool.

Importance: Over the last decade, RPF has been used to ensure the thermal integrity of numerous shipping containers. Since a comprehensive model that predicts the thermal decomposition and burning of these materials is not available, the success of these programs has relied heavily on costly experimental programs. Historically, to ensure the fire survivability of these foam-based systems, designers have relied on a costly iterative process of design, build, and test, followed by numerous re-designs, re-builds, and re-tests. The development of a satisfactory container design has been limited by the ability of a designer to formulate an effective testing program given the high costs of fabricating prototypes and conducting fire tests.

A tool to predict a priori the fire-induced response of these materials would greatly enhance the ability of a designer to develop a reliable, safe, and cost-effective thermal protection system for hardened containers. In addition, this analytical capability would reduce container development costs and risks by decreasing the programmatic dependency of design evaluation solely on a testing program. The state of knowledge currently requires 3 to 7 years to develop and certify a foam-based system. To meet the demands of designing these containers, the predictive tool proposed here could accelerate the development of these containers.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Program plan	3	1
Semi-empirical correlations for thermal physical properties	8	1.7
Results of large-scale experiments	10	0.8
Final report	12	0.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, data reduction, analysis, etc.: \$5K
The PC will be provided, if available, through obsolete equipment.

Funding Level:

Four Russian man years	\$18K
PC equipment	\$3K
Total	\$21K

Institutes and Individuals Involved:

M. Erzin, Arzamas-16

Capabilities of Russian Lab:

The Russian laboratories have been actively involved in developing thermal response models for energetic materials. Technology they have developed in this area is synergistic with the expertise required to develop a model capable of predicting the fire-induced thermal response of organic materials, as well as the associated heat transfer through material.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Experiments on the Contamination Resulting from Accidental Dispersal of Radioactive Material****Point of Contact:**

Richard Smith, Sandia National Laboratories, 12333, (505) 844-4476

Summary:

This work involves experimental investigation of environmental contamination as the result of an aerosol release from a simulated accident involving radioactive material (represented by a surrogate material) and high explosives in the proximity of the radioactive material. The program has two phases: (1) investigation of relevant historical data, experimental planning, and long lead item preparation for the experiments to be performed in phase 2 if funded; (2) actual execution of the baseline experiments and of experiments designed to mitigate dispersal consequences.

Importance: The benefit to SNL and to the US community that performs consequence analyses associated with radioactive material dispersal could be significant. These tests should provide unique data on aerosol dispersal cloud parameters such as amount of material involved, cloud size and shape, particle size distribution, ground contamination, etc. Because these tests are expensive and complex, they are rarely performed. The state of consequence prediction modeling could be significantly improved.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Report on investigation of historical environmental contamination data to include prior experimental data and applicable accident data if existing and available	6	0.5
Report on detailed experimental plans for baseline experiments	3	0.5
Report on ground contamination predictions from proposed baseline experiments	4 months after completion of experiments	0.8

(continued)

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Report on identification and preliminary analysis to investigate methods to reduce release of hazardous material from accidental explosion	9	0.4
Report on detailed experimental plans for release migration experiments	3 months after completion of experiments	0.4
Complete acquisition of long-lead-time equipment for phase 2 effort	6 months after delivery of report on detailed experimental plans	\$10K equipment
Final study report for phase 1 with conclusions and recommendations for subsequent work continuation in phase 2	2 months after complete acquisition of long-lead-time equipment	0.4

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment:

Experimental test/analysis equipment: \$10K

Funding Level: (phase 1 only)

3 Russian man years \$13K

PC Equipment \$3K

Experimental Equipment \$10K

Total \$26K

Institutes and Individuals Involved:

Ivan M. Blinov, Head of Laboratory, Designing Division, VNIITF (Chelyabinsk-70)

Sergi M. Ylyanov, Head of Scientific Group, Designing Division

Igor A. Melyokhin, Head of Scientific Group, Designing Division

This work has been discussed and developed with the VNIITF (Chelyabinsk-70) community at the C-70 conference. Status of the proposal was specifically pursued by VNIITF (Babin and Blinov) during the Albuquerque conference.

Capability of Russian Lab:

VNIITF is the laboratory that initiated the project proposal. They have a test site and process well defined to perform these tests. Tests would be done in the winter after a snow storm to ensure that the samples would not be contaminated.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Acceptable Risk Criteria—VNIITF

Point of Contact:

David D. Carlson, Sandia National Laboratories, 6411, (505) 844-8497

Summary:

This work provides the technical basis for establishing acceptable risk criteria for hazardous objects or processes, for example, nuclear power plants, explosive operations, and transportation of hazardous cargoes. The work addresses existing societal risks, identification of common elements of existing criteria, and the means by which we confirm that criteria are met. The work is a cooperative US-Russian effort, coordinated by members of Sandia National Laboratories, VNIIEF, and VNIITF.

Importance: The work provides perspective into Russian approaches to formulation of safety criteria. While the US has developed similar criteria for many operations, we are now considering the development of risk-based plutonium dispersal criteria for weapons transport, and we increasingly find risk-based perspectives being introduced into DOE Orders.

Deliverables/Time Frame:

The entire effort is expected to span 9 months, with delivery of a final report at that time.

Deliverable	Due Date (No. of months after contract award)	Estimated % of Contract
Formation of the coordinating group and determination of hazardous objects or processes to be considered	1	5
Analysis of existing societal risks, including risk from natural events and risk from accidents		20
Identification of common elements of existing criteria for hazardous objects		20
Summary of existing criteria for the hazardous objects under consideration	6	40
Summary of means by which we confirm that existing criteria are met	7	15

These deliverables will be reviewed by the coordinating group to form perspectives on the technical basis for establishing acceptable risk criteria.

Equipment Required and Estimated Cost:

1 PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

5 Russian man years \$22K

PC equipment \$3K

Total \$25K

Institutes and Individuals Involved:

Stanislav Fedorovich Babin, Chelyabinsk-70

Capability of Russian Lab:

To be determined

Current Status:

In process

References:

None

Last Update:

February 1994

Title: **Acceptable Risk Criteria—VNIIEF**

Point of Contact:

David D. Carlson, Sandia National Laboratories, 6411, (505) 844-8497

Summary:

This work provides the technical basis for establishing acceptable risk criteria for hazardous objects or processes, for example, nuclear power plants, explosive operations, and transportation of hazardous cargoes. The work addresses existing societal risks, identification of common elements of existing criteria, and the means by which we confirm that criteria are met. The work is a cooperative US-Russian effort, coordinated by members of Sandia National Laboratories, VNIIEF, and VNIITF.

Importance: The work provides perspective into Russian approaches to formulation of safety criteria. While the US has developed similar criteria for many operations, we are now considering the development of risk-based plutonium dispersal criteria for weapons transport, and we increasingly find risk-based perspectives being introduced into DOE Orders.

Deliverables/Time Frame:

The entire effort is expected to span 9 months, with delivery of a final report at that time.

Deliverable	Due Date (No. of months after contract award)	Estimated % of Contract
Formation of the coordinating group and determination of hazardous objects or processes to be considered	1	5
Analysis of existing societal risks, including risk from natural events and risk from accidents		20
Identification of common elements of existing criteria for hazardous objects		20
Summary of existing criteria for the hazardous objects under consideration	6	40
Summary of means by which we confirm that existing criteria are met	7	15

These deliverables will be reviewed by the coordinating group to form perspectives on the technical basis for establishing acceptable risk criteria.

Equipment Required and Estimated Cost:

1 PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

5 Russian man years \$22K

PC equipment \$3K

Total \$25K

Institutes and Individuals Involved:

Vladimir M. Gerasimov, Arzamas-16

Capability of Russian Lab:

To be determined

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Data Bank Development for Risk Calculations of Complex Technical Systems****Point of Contact:**

Richard Smith, Sandia National Laboratories, 12333, (505) 844-4476

Summary:

The main objective of this work is to develop a data bank or data base for risk calculations associated with the operational safety of complex technical systems such as transportation of hazardous cargo and high pressure tanks for hazardous materials.

Importance: The benefit to SNL is access to a broad scope of Russian accident experiences associated with transportation of hazardous materials and other hazardous operations. This effort as currently proposed is a modest man-year expenditure that could provide significant insight into Russian accident data and potentially significant follow-on work.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Report on data bank structure	4	1
Accident analysis report	7	0.8
Data bank report	10	0.8
Final report and briefing	12	0.4

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$8K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

3 Russian man years	\$13K
1 PC system	\$8K
Total	\$21K

Institutes and Individuals Involved:

V. D. Fomin, V. A. Strashel, and S. M. Ermakov, VNIITF (C-70)

Capability of Russian Lab:

VNIITF is the laboratory that was involved in the project proposal. This effort had strong self-initiated support by the Russian contacts.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Using Neural Networks to Process Systems Response Data for Probabilistic Risk Assessments

Point of Contact:

Jaime L. Moya, Sandia National Laboratories, 1513, (505) 844-7955

Summary:

The purpose of this investigation is to ascertain whether neural networks provide an advantage over interpolation schemes to process system-response data for probabilistic risk assessments. A neural network will be developed to simulate the highly nonlinear response of a system to a predescribed forcing function. The forcing function will consist of four independent variables, and the system response will be characterized by two dependent variables. The investigators will be required to predict the highly nonlinear system response given several nonuniform sparse data sets, which have increasingly greater densities. The data set will be continuous and finite. The system response will be unknown to the investigators. Coincident with the network development, the investigators will use an appropriate interpolation algorithm to process the system-response data. A comparison is to be provided between the network and the interpolation algorithm, and conclusions are to be drawn regarding the efficacy of the neural network. In addition, investigators will determine the feasibility of using a neural network to solve the inverse problem (i.e., given the output, what is the input?). To facilitate development of the network, SNL will provide the investigators with data and a personal computer.

Importance: A major problem in probabilistic risk assessment is our ability to populate event trees with meaningful responses. Neural networks may provide an effective technique to populate event trees with response.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)
Document in a letter report the current state-of-the-art of neural networks and their relevance to the stated objective	2
Deliver an interim report documenting preliminary evaluation of neural network	6
Deliver a working prototype of neural network	at end
Document in a final report the major accomplishments and their relevance to the stated objective	at end

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$8K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

3 Russian man years \$13K

PC equipment \$8K

Total \$21K

Institutes and Individuals Involved:

G. A. Novikov, Chelyabinsk-70

Capability of Russian Lab:

Not available

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Russian Probabilistic Risk Assessment (PRA) Methods

Point of Contact:

David D. Carlson, Sandia National Laboratories, 6411, (505) 844-8497

Richard E. Smith, Sandia National Laboratories, 12333, (505) 844-4476

Summary:

This work will provide Sandia National Laboratories a description of risk assessment techniques used in Russia, will identify areas for improvement in these risk assessment techniques, will summarize applications of risk assessment methods, and will characterize "lessons learned" from this experience.

Importance: This work will provide the foundation for understanding Russian capabilities in this field. Differences in approach will become apparent and may lead to improved US approaches as well as Russian improvements. Over the longer term, the basis for joint cooperation will be provided as we understand clearly how our approaches complement each other and areas in which collaboration is mutually beneficial.

Deliverables/Time Frame:

The entire effort is expected to span 12 months, with delivery of a final report at that time.

Deliverable	Date (Months after contract award)	Estimated % of Effort
Phase 1		
Summary of PRA methods used in Russia	6	30
Description of Russian PRA tools and data bases	6	20
Identification of areas for improvement in Russian and US PRA capabilities	9	10

(continued)

Deliverable	Due Date (No. of months after initiation of Phase 2)	Estimated % of Effort
Phase 2		
Summary of Russian applications of risk assessment techniques	1	20
Description of "lessons learned" from Russian PRA applications	3	10
Identification of potential joint US-Russian PRA applications	3	10

Equipment Required and Estimated Cost:

Two PC systems suitable for providing electronic typed reports, tables, etc.: \$6K
The PCs will be provided, if available, through obsolete equipment.

Funding Level:

Russian Labor Costs:

Phase 1: 4 man years	\$20K initial contract
Phase 2: 4 man years	\$20K follow-on contract
Equipment, 2 PCs	\$ 6K
Total	\$23K (each phase)

Institutes and Individuals Involved:

G. A. Novikov, Chelyabinsk-70

Capability of Russian Lab:

This work will be performed at Chelyabinsk-70, where there are active investigations into PRA methods and applications. The principal investigators head the PRA and transportation groups, respectively. The institute is fully capable of performing this work.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Proposal for Development of a Glossary of Terminology in Surety Technology by VNIIEF and Sandia National Laboratories****Point of Contact:**

Patricia Newman, Sandia National Laboratories, 5091, (505) 845-8151

Summary:

The purpose of this work is to develop a bilingual (Russian-English-Russian) glossary of terms used by Russian and US nuclear institutions engaged in the area of surety technology. The work will be designed for use primarily by translators and interpreters but will also benefit specialists in the field.

Importance: To facilitate efficient collaboration in this area, the Russian and US specialists must understand each other. This requires that the translators and interpreters who transmit the information from one side to the other understand the source language material and use correct terminology in the target language.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
List of Terms	1	0.25
Definitions in Russian	3	1.5
Bilingual definitions	6	0.35
Completed manuscript	9	0.15
Total		2.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

2.5 Russian man years	\$ 9K
PC equipment	\$ 3K
Total	\$12K

Institutes and Individuals Involved:

Lidia A. Il'kaeva, home phone (7-831) 301-1478
VNIIEF

Capability of Russian Lab:

VNIIEF has technical specialists in accident resistant containers and hazardous materials identification, handling, disposal, and storage and the linguistic expertise in its translation/interpretation section to gather terminology, draft definitions, and translate the results into English.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Proposal for Development of a Glossary of Terminology in Surety Technology by VNIITF and Sandia National Laboratories****Point of Contact:**

Patricia Newman, Sandia National Laboratories, 5091, (505) 845-8151

Summary:

The purpose of this work is to develop a bilingual (Russian-English-Russian) glossary of terms used by Russian and US nuclear institutions engaged in the area of surety technology. The work will be designed for use primarily by translators and interpreters but will also benefit specialists in the field.

Importance: To facilitate efficient collaboration in this area, the Russian and US specialists must understand each other. This requires that the translators and interpreters who transmit the information from one side to the other understand the source language material and use correct terminology in the target language.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
List of Terms	1	0.25
Definitions in Russian	3	1.5
Bilingual definitions	6	0.35
Completed manuscript	9	0.15
Total		2.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment

Funding Level:

2.5 Russian man years \$9K

PC equipment \$3K

Total \$12K

Institutes and Individuals Involved:

V. N. Ananiichuk, home phone (7-351) 723-3826

VNIITF

Capability of Russian Lab:

VNIITF has technical specialists in risk assessment, engineered systems in abnormal environments, and transportation surety and the linguistic expertise in its translation/interpretation section to gather terminology, draft definitions, and translate the results into English.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Full-Scale and Sub-Scale Aircraft Crash and Fire Test—VNIIEF****Point of Contact:**

Robert K. Thomas, Sandia National Laboratories, 1562, (505) 844-7450

Russell D. Skocypec, Sandia National Laboratories, 1513, (505) 845-8838

Summary:

The objective of this work is to obtain experimental data on full- and sub-scale cargo aircraft crashes including structural damage, fuel dispersal, and fire. This proposal is for only the first phase, which is to explore the feasibility and develop a test plan for these experiments.

Importance: Cargo aircraft crash and fire accidents have been identified as credible accident scenarios for hazardous cargoes. No instrumental test data is available, and it is not feasible to conduct a sufficient number of tests from which empirical data can be obtained. Thus, current probabilistic risk assessment (PRA) studies rely on numerical simulations of these highly nonlinear events. Our structural and thermal computer codes, however, have not been validated with full-scale test data. DNA and SNL wanted to run these tests for the MMIII/W78 and fire-resistant enhancement (FRE) studies, but the cost was prohibitively expensive. This proposal identifies a unique opportunity to acquire the needed data at a feasible cost. By becoming a leader in crash and fire modeling, SNL can apply this technology to future system studies, in addition to other studies for advanced transportation and manufacturing. This work is divided into two parts. Phase 1 is devoted to developing a detailed test plan, and phase 2 is devoted to acquiring hardware and conducting the tests. This proposal addresses phase 1 activities only. DNA is interested in participating and contributing funds for phase 2. Therefore, SNL's investment will be leveraged.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Conceptual Test Plan	4	2
Preliminary Test Plan	6	1

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

(Phase 1 only)

3 Russian man years \$13K

Equipment \$3K

Total \$16K

Institutes and Individuals Involved:

S. A. Novikov and A. Mikhailov, VNIIEF (Arzamas-16)

Capability of Russian Lab:

Instrumented aircraft crash tests of this type and magnitude have not previously been done in the US or Russia. The Russians have conducted large-scale, complex tests in facilities similar to ours. Their expertise and experience are similar to ours. We may have differing thoughts on instrumentation, but together we can develop an achievable test plan.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Full-Scale and Sub-Scale Aircraft Crash and Fire Test—VNIITF****Point of Contact:**

Robert K. Thomas, Sandia National Laboratories, 1562, (505) 844-7450

Russell D. Skocypec, Sandia National Laboratories, 1513, (505) 845-8838

Summary:

The objective of this work is to obtain experimental data on full- and sub-scale cargo aircraft crashes including structural damage, fuel dispersal, and fire. This proposal is for only the first phase, which is to explore the feasibility and develop a test plan for these experiments.

Importance: Cargo aircraft crash and fire accidents have been identified as credible accident scenarios for hazardous cargoes. No instrumental test data is available, and it is not feasible to conduct a sufficient number of tests from which empirical data can be obtained. Thus, current probabilistic risk assessment (PRA) studies rely on numerical simulations of these highly nonlinear events. Our structural and thermal computer codes, however, have not been validated with full-scale test data. DNA and SNL wanted to run these tests for the MMIII/W78 and fire-resistant enhancement (FRE) studies, but the cost was prohibitively expensive. This proposal identifies a unique opportunity to acquire the needed data at a feasible cost. By becoming a leader in crash and fire modeling, SNL can apply this technology to future system studies, in addition to other studies for advanced transportation and manufacturing. This work is divided into two parts. Phase 1 is devoted to developing a detailed test plan, and phase 2 is devoted to acquiring hardware and conducting the tests. This proposal addresses phase 1 activities only. DNA is interested in participating and contributing funds for phase 2. Therefore, SNL's investment will be leveraged.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Conceptual Test Plan	4	2
Preliminary Test Plan	6	1

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

(Phase 1 only)

3 Russian man years \$13K

Equipment \$3K

Total \$16K

Institutes and Individuals Involved:

I. M. Blinov and S. F. Babin, VNIITF (Chelyabinsk-70)

Capability of Russian Lab:

Instrumented aircraft crash tests of this type and magnitude have not previously been done in the US or Russia. The Russians have conducted large-scale, complex tests in facilities similar to ours. Their expertise and experience are similar to ours. We may have differing thoughts on instrumentation, but together we can develop an achievable test plan.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Ground Transportation Test Data Documentation

Point of Contact:

Richard Smith, Sandia National Laboratories, 12333, (505) 844-4476

Jaime L. Moya, Sandia National Laboratories, 1513, (505) 844-7955

Summary:

This work will develop an increased understanding of the severity of potential accidental environments associated with ground transportation of hazardous materials through full-scale and other experiments. A multitask effort will consist of (1) identifying and documenting existing experiments that involve crashes, fires, and other accident environments, and (2) identifying future experiments that would be of mutual benefit to both the US and Russia. Specific future experiments would be identified through a subsequent proposal.

Importance: This work will give SNL a significant understanding of the existing Russian full-scale abnormal-environment test capability as well as a complete set of technical reports on their full-scale and component safety tests to date. They have already had up to a dozen full-scale tests. These tests are typically quite expensive and will provide SNL unique data on extreme abnormal accident environments associated primarily with rail transportation or hazardous cargo. For example, one test resulted in a 12-hour fire. In addition to the direct data, we will be better able to determine their capabilities of performing other tests, such as aircraft crash tests, and to direct their test program to benefit SNL's safety needs.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
A letter report documenting the existing full-scale abnormal-environment tests on ground transportation systems	4	2
A letter report documenting existing sub-scale and component abnormal-environment tests on ground transportation systems	6	2
A letter report identifying potential future tests for the ground transportation of hazardous cargoes	8	0.8
A briefing on the first 3 deliverables at a location to be determined	9	0.2

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

5 Russian man years	\$22K
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1 PC system	\$3K
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Total	\$25K
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Institutes and Individuals Involved:

Anatoli L. Mikhajlov, VNIIEF (Arzamas-16); Phone: 831-30 5-65-09; Telex: 151109 ARSA;

Fax: 831-30 5-45-65

Capability of Russian Lab:

Arzamas-16 is the laboratory that has actually performed full-scale railcar safety tests. These tests may have been joint with or for Russian equivalent of the Dept. of Defense.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Actively Cooled Calorimeter

Point of Contact:

Jorman A. (Joe) Koski, Sandia National Laboratories, 6642, MS 0717, (505) 845-9572

Summary:

About half of the shipping containers that are exposed to fire testing at SNL require some retesting. The goal of this proposal is to reduce the need for expensive retesting by providing accurate engineering models of the fire environment for design purposes. The proposed calorimeter measures heat transfer to cylindrical shapes that are typical of many shipping containers. The active cooling approach has several advantages over previous inertially cooled calorimeters in that accurate measurements of heat transfer are possible for constant temperature surfaces at various heights and orientations. In addition, long-term fire trends can be observed and evaluated.

Importance: This proposal provides an opportunity to obtain, at relatively low cost, a valuable piece of experimental equipment that will benefit several Sandia programs in both the defense and environment areas. The proposed equipment fits nicely with existing Sandia fire research programs and will provide a basis for several joint Sandia-Russian publications in the fire physics literature.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Summary of existing Russian equipment and procedures	1	0.1
Fabrication of prototype fire sensor	2	0.1
Test of prototype fire sensor	3	0.2
Design of calorimeter	5	0.7
Design and drawing review	6	0.1
Fabrication of final calorimeter, sensors, and support equipment	11	4
Final thermal test of calorimeter, sensors and support equipment	12	0.2

Equipment Required and Estimated Cost:

2 IBM PC compatible computers, one requested by Erzin, the other for data acquisition: \$5K
The PC will be provided, if available, through obsolete equipment.

Funding Level:

5.4 Russian man years	\$23K
Russian Equipment Fab.	\$20K
PC equipment	\$5K
Total	\$48K

Institutes and Individuals Involved:

Marat E. Erzin, Deputy Head of Scientific Research, Arzamas-16, 831-30 5-75-85

Capability of Russian Lab:

During the discussions, the Arzamas-16 representative showed both more interest and experience in the fire diagnostics area than did the Chelabinsk-70 representative. During the poster session Arzamas showed two examples of their experimental fire measurement techniques. Our judgment was that while Chelyabinsk-70 had more fire testing facilities, Arzamas-16 had more interest in understanding the basic fire physics. This led to our recommendation of Arzamas-16.

Current Status:

In process

References:

None

Last Update:

February 1994

2

of

2

Title:
Wood Impact Limiters (Dampers)—VNIITF

Point of Contact:

Wayne M. McMurtry, Sandia National Laboratories, 6642, (505) 845-8502

Summary:

Extreme interest has been exhibited by both Russia and the US in using woods as "impact limiters" (US terminology) or "dampers" (Russian terminology) in container and transportation applications. An expanded data set and an improved behavioral model are needed to further analyze the suitability of these woods as impact limiters. It is desired to issue a contract to the Russians to study US redwood and other types of Russian woods with similar characteristics for use as impact limiters.

Importance: The work would establish mechanical and physical characteristics for the woods—such as crush strength under varying load rates, temperature, moisture content and grain angle—and incorporate this information into an improved model. The benefit to SNL and to the US community that designs and tests containers could be significant, considering the increasing need for materials of this type that can demonstrate compliance with the stringent regulatory requirements.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Preparation of preliminary report on any work completed in subject area	3	0.1
Preparation of technical proposals detailing experimental plan	3	0.3
Construction of test apparatus and preparation of data analysis system	5	0.2
Execution of experiments and data analysis	16	2.5
Development of suitable model capable of being used to predict limiter response under accident conditions	17	0.3
Preparation of final report to include all experimental data and analysis and details associated with behavioral model	18	0.1

Equipment Required and Estimated Cost:

One PC system: \$3K

The PC will be provided, if available, through obsolete equipment.

Miscellaneous materials and laboratory supplies: \$2K

Funding Level:

3.5 Russian man years \$15K

PC Equipment \$3K

Laboratory Supplies \$2K

Total \$20K

Institutes and Individuals Involved:

Ivan M. Blinov, Head of Laboratory, VNIITF (Chelyabinsk-70)

Capability of Russian Lab:

VNIITF is believed to have testing capability in this area.

Current Status:

In process

References:

None

Last Update:

February 1994

Title: **Wood Impact Limiters (Dampers)—VNIIEF**

Point of Contact:

Wayne M. McMurtry, Sandia National Laboratories, 6642, (505) 845-8502

Summary:

Extreme interest has been exhibited by both Russia and the US in using woods as "impact limiters" (US terminology) or "dampers" (Russian terminology) in container and transportation applications. An expanded data set and an improved behavioral model are needed to further analyze the suitability of these woods as impact limiters. It is desired to issue a contract to the Russians to study US redwood and other types of Russian woods with similar characteristics for use as impact limiters.

Importance: The work would establish mechanical and physical characteristics for the woods—such as crush strength under varying load rates, temperature, moisture content and grain angle—and incorporate this information into an improved model. The benefit to SNL and to the US community that designs and tests containers could be significant, considering the increasing need for materials of this type that can demonstrate compliance with the stringent regulatory requirements.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Preparation of preliminary report on any work completed in subject area	3	0.1
Preparation of technical proposals detailing experimental plan	3	0.3
Construction of test apparatus and preparation of data analysis system	5	0.2
Execution of experiments and data analysis	16	2.5
Development of suitable model capable of being used to predict limiter response under accident conditions	17	0.3
Preparation of final report that is to include all experimental data and analysis and the details associated with the behavioral model	18	0.1

Equipment Required and Estimated Cost:

One PC system: \$3K

The PC will be provided, if available, through obsolete equipment.

Miscellaneous materials and laboratory supplies: \$2K

Funding Level:

3.5 Russian man years \$15K

PC Equipment \$3K

Laboratory Supplies \$2K

Total \$20K

Institutes and Individuals Involved:

S. Novikov, Head of Scientific Research, VNIIEF (Arzamas-16)

Capability of Russian Lab:

VNIIEF is the lead Russian lab on the container design and production effort under the SSD exchange. Their experience with containers and wood dampers seems to be extensive.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Penetration Technology

Point of Contact:

Robert K. Thomas, Sandia National Laboratories, 1562, (505) 844-7450

William F. Hartman, Sandia National Laboratories, 9614, (505) 844-6937

Summary:

The objective of this work is to generate experimental data and develop empirical models of the penetration of the representative container cross sections by both small arms projectiles and penetrator probes typically generated in ground transportation and aircraft crashes. This work will gain SNL access to Russian test data and models on bullet and fragment penetration.

Importance: SNL currently does not have a model to determine vulnerabilities to small arms fire, and each cross section must be individually tested. In both the W76 and W78 probabilistic risk assessment (PRA) studies, penetration by probes was found to be a credible abnormal accident. Only a few probe penetration experiments have been conducted even though this data is critical to validating the structural computer codes. Currently, there is no funding in the NSAFE and weapon container budgets for FY94 to conduct these types of tests.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Document existing Russian data and models on bullet and fragment penetration	3	1
Conduct 10 to 12 bullet tests on US container cross sections	7	1
Conduct 6 probe tests on US container cross sections	12	1.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

3.5 Russian man years	\$15K
PC Equipment	\$3K
Material	\$2K
Total	\$20K

Institutes and Individuals Involved:

Ivan Blinov, Chelyabinsk-70

Capability of Russian Lab:

The Russian laboratories have conducted bullet penetration tests for many years and have accumulated a sizable data base. Because the probe experiments are closely related, there is a high probability this effort will be successful.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Impact Limiter Materials Aging Study

Point of Contact:

Robert E. Glass, Sandia National Laboratories, 5161, (505) 845-8742

John A. Andersen, Sandia National Laboratories, 5161, (505) 844-0391

Summary:

This proposal provides the basis for extending the package-specific aging studies being performed on the AT-400R Russian Fissile Material Container to a broad range of impact limiting materials that could be considered for use in radioactive-material packages by either Russia or the US. The study will develop methodologies for direct experimental correlation between accelerated aging and normal aging results for these materials. It will lead to a long-term experimental program addressing specific aging characteristics of packaging materials. By incorporating these studies in a bilateral cooperative effort, this work should enhance the mutual acceptability of packages developed in each country.

Importance: This effort (1) continues the existing cooperative efforts between Sandia National Laboratories and the All-Russian Research Institute of Experimental Physics on packaging-specific issues, (2) permits resolution of the aging issue that is of concern to both the Russian and the US packaging communities, (3) will lead to definition of methods for extending data available on the aging of materials that are being used in the design and licensing of radioactive-material packaging, and (4) provides a direct correlation between normal and accelerated aging techniques.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Draft test methodology proposal	3	0.75
Test procedures for accelerated aging	9	0.75
Test plans and procedures for normal aging testing	9	0.5
Final report	18	0.5

Equipment Required and Estimated Cost:

None

Funding Level:

2.5 Russian man years \$11K

Institutes and Individuals Involved:

Boris P. Barkanov, Arzamas-16

Capability of Russian Lab:

VNIIEF has the capability to subject the range of materials to the environments that are specified in the statement of work. Further, VNIIEF has been instrumental in defining these environments in joint work with Sandia National Laboratories.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Seals Testing, Dynamic and Static—VNIITF****Point of Contact:**

Wayne M. McMurtry, Sandia National Laboratories, 6642, (505) 845-8502

Summary:

An interest has been expressed both by the US and Russia to address two significant issues associated with the seals for containers and other assemblies: (1) the need to dynamically establish the spring modulus of several types of elastomers that are used as "O-ring" seals and to use this spring modulus data in the development of an appropriate model of O-ring seal behavior; (2) the need to determine experimentally what level of assault during an accident would result in leakage past an O-ring seal and to compare this behavior with predictions from the model of O-ring seal behavior.

Importance: These tests should provide unique data on the physical and mechanical behavior of O-rings and a resulting unique behavioral model. Bringing together the resources and expertise of SNL, VNIIEF (Arzamas-16), and VNIITF (Chelyabinsk-70) to address these issues is an unusual opportunity to truly advance the state of knowledge for this technology.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Preparation of preliminary report on any work completed in subject areas	3	0.1
Preparation of technical proposals detailing experimental plans	3	0.2
Construction of test apparatus and preparation of data analysis system	5	0.3
Execution of experiments and data analysis	16	2.5
Development of suitable model capable of being used to predict O-ring response under accident conditions	17	0.3
Preparation of final report to include all experimental data and analysis and details associated with behavioral model	18	0.1

Equipment Required and Estimated Cost:

One PC system: \$3K

The PC will be provided, if available, through obsolete equipment.

Miscellaneous materials and laboratory supplies: \$2K

Funding Level:

3.5 Russian man years \$15K

PC Equipment \$3K

Laboratory Supplies \$2K

Total \$20K

Institutes and Individuals Involved:

Viktor Borisovich Skrynnikov, VNIITF (Chelyabinsk-70)

Capability of Russian Lab:

VNIITF is believed to have considerable testing capability in this area.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:
Seals Testing, Dynamic and Static—VNIIEF

Point of Contact:

Wayne M. McMurtry, Sandia National Laboratories, 6642, (505) 845-8502

Summary:

An interest has been expressed both by the US and Russia to address two significant issues associated with the seals for containers and other assemblies: (1) the need to dynamically establish the spring modulus of several types of elastomers that are used as "O-ring" seals and to use this spring modulus data in the development of an appropriate model of O-ring seal behavior; (2) the need to determine experimentally what level of assault during an accident would result in leakage past an O-ring seal and to compare this behavior with predictions from the model of O-ring seal behavior.

Importance: These tests should provide unique data on the physical and mechanical behavior of O-rings and a resulting unique behavioral model. Bringing together the resources and expertise of SNL, VNIIEF (Arzamas-16), and VNIITF (Chelyabinsk-70) to address these issues is an unusual opportunity to truly advance the state of knowledge for this technology.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Preparation of preliminary report on any work completed in subject areas	3	0.2
Preparation of technical proposals detailing experimental plans	3	0.5
Construction of test apparatus and preparation of data analysis system	5	0.5
Execution of experiments and data analysis	16	5.0
Development of suitable model capable of being used to predict O-ring response under accident conditions	17	0.5
Preparation of final report to include all experimental data and analysis and details associated with behavioral model	18	0.2

Equipment Required and Estimated Cost:

One PC system: \$6K

The PC will be provided, if available, through obsolete equipment.

Miscellaneous materials and laboratory supplies: \$3K

Funding Level:

6.9 Russian man years \$30K

PC Equipment \$6K

Laboratory Supplies \$3K

Total \$39K

Institutes and Individuals Involved:

Boris P. Barkinov, Deputy Chief, VNIIEF (Arzamas-16)

Capability of Russian Lab:

VNIIEF is the lead Russian lab on the container design and production effort under the safety, security, and dismantlement (SSD) exchange. Their experience with containers, and thus components such as seals, is believed to be extensive.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Analysis of Safety During Rail Transportation of Hazardous Cargo****Point of Contact:**

Keith Almquist, Sandia National Laboratories, 4111, (505) 844-2606

Robert Huelskamp, Sandia National Laboratories, 4112, (505) 844-0496

Garry Brown, Sandia National Laboratories, 4111, (505) 844-3646

Summary:

To develop a data base and a better understanding of accidents on the Russian rail system involving the shipment of hazardous cargo.

Importance: This work will help SNL (1) evaluate the relative importance of current safety, security, and dismantlement (SSD) activities and (2) define and understand other steps that can be taken to improve the safety of any radioactive shipments in the future.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Narrative of operations	3	1
Preliminary data	3	0.25
Complete data base	10	2.5
Probability density function	10	1.0
Analysis	10	1.0

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

5.75 Russian man years \$25K

PC Equipment \$3K

Total \$28K

Institutes and Individuals Involved:

Gennady Novikov and Stansily Babin, Chelyabinsk-70

Capability of Russian Lab:

Chelyabinsk-70 is believed to have done considerable work of this type in the past.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**2-D and 3-D Numerical Simulations for Structural and Thermal Benchmark Problems—VNIITF****Point of Contact:**

Robert K. Thomas, Sandia National Laboratories, 1562, (505) 844-7450

Russell D. Skocypec, Sandia National Laboratories, 1513, (505) 845-8838

Summary:

The objective of this work is to benchmark 2-D and 3-D numerical simulation codes used at Russian and US laboratories. The codes of interest are those used for nonlinear, numerical simulation of abnormal environments involving crash dynamics and fire.

Importance: This project is a cooperative effort among VNIITF, VNIIEF, and the three US labs. This work offers the US a unique opportunity to evaluate Russian technology in the areas of analytical methods, code architecture, and numerical algorithms. The Russians are known to have expertise in analytical and empirical solutions to structural and thermal problems; these solution methods would enhance our simulation capability as well as provide insight into simplified models for probabilistic risk assessment (PRA) of weapon systems.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Project Plan	3	0.5
Structural benchmark problems	6	0.5
Thermal benchmark problems	9	0.5
Complex problem set	12	0.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

2 Russian man years	\$9K
PC equipment	\$3K
Total	\$12K

Institutes and Individuals Involved:

Leonid Shibarshov, Chelyabinsk-70.

Capability of Russian Lab:

The Russian laboratories are fully capable of conducting numerical simulations of structural and thermal problems. We do not know the capability of their codes to conduct detailed, complex crash dynamics and fire modeling. We will start with simplified geometries and material models, and then extend the models to include nonlinearities. No software will be exchanged between Russian and US laboratories.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**2-D and 3-D Numerical Simulations for Structural and Thermal Benchmark Problems—VNIIEF****Point of Contact:**

Robert K. Thomas, Sandia National Laboratories, 1562, (505) 844-7450

Russell D. Skocypec, Sandia National Laboratories, 1513, (505) 845-8838

Summary:

The objective of this work is to benchmark 2-D and 3-D numerical simulation codes used at Russian and US laboratories. The codes of interest are those used for nonlinear, numerical simulation of abnormal environments involving crash dynamics and fire.

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Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Project plan	3	0.5
Structural benchmark problems	6	0.5
Thermal benchmark problems	9	0.5
Complex problem set	12	0.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

2 Russian man years \$9K

PC equipment \$3K

Total \$12K

Institutes and Individuals Involved:

Viktor Markelov and Vitali Vetveyev, Arzamas-16.

Capability of Russian Lab:

The Russian laboratories are fully capable of conducting numerical simulations of structural and thermal problems. We do not know the capability of their codes to conduct detailed, complex crash dynamics and fire modeling. We will start with simplified geometries and material models, and then extend the models to include nonlinearities. No software will be exchanged between Russian and US laboratories.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Measurements of Temperature and Heat Flux in Fires****Point of Contact:**

Ned Keltner, Sandia National Laboratories, 2761, (505) 845-3189

Summary:

The objective of this program is to improve our understanding of thermal measurements in abnormal-environment fires. A coupled experimental analytical program is proposed to: (1) measure temperatures, heat fluxes, and velocities in pool fires and heat transfer to a calorimeter that is similar in size to smaller shipping containers; (2) evaluate the factors that introduce the largest uncertainties into the measurements; and (3) develop correlations between temperature and heat flux that are suitable for use in probabilistic risk assessments (PRAs).

Importance: There is a continuing need to improve our understanding of abnormal environments and how they can affect safety. SNL has ongoing programs related to this activity, and DNA has a related large program on fire safety assessment.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Develop draft program plan	3	0.2
Letter report that describes the experimental program along with the experimental data and pictures of the test setup	9	1.9
Final report with a detailed description of both the experimental and analytical programs and their results; hard copy and electronic media formats of experimental data along with any analyses of this data	12	1.0

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, tables, etc.: \$3K
The PC will be provided, if available, through obsolete equipment.

Funding Level:

3.1 Russian man years	\$13K
Materials (consumable)	\$14K
PC Equipment	\$3K
Total:	\$30K

Institutes and Individuals Involved:

M. Erzin, VNIIEF, (Arzamas-16), 831-30 5-57-85

Capability of Russian Lab:

VNIIEF conducts pool fire tests of shipping containers. Based on two symposium posters, they have developed integral equation and inverse heat conduction techniques for evaluating and comparing different fire environments. This work is complementary to work at SNL.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:

Fuel-Fire Characterization and Object Response

Point of Contact:

Russell D. Skocypec, Sandia National Laboratories, 1513, (505) 844-8838

Jaime L. Moya, Sandia National Laboratories, 1513, (505) 844-7955

Ned Keltner, Sandia National Laboratories, 2761, (505) 845-3189

Summary:

This program will: (1) characterize the thermal environment in the VNIITF fire test facility, (2) generate experimental data to validate and further develop fire models, (3) compare experimental data to open-pool-fire test data, and (4) quantify the thermal response of simulated inert shipping containers and containers with high explosives immersed in a fire.

The work will be conducted in three phases (three years). The first phase of the program focuses on development of fire diagnostics, experimental characterization of the fire, and fabrication of several simulated shipping containers. The simulated shipping containers will be tested after characterizing the fire environment. The first set of containers will be designed to facilitate the quantification of the relative thermal performance of various impact/thermal mitigating materials (redwood, ceramic fiber insulation, and polyurethane foam) currently used in the design of hardened shipping containers. The second set of containers (containers with high explosives) will be designed, fabricated, and tested during the second and third years of the program, respectively. These containers will contain both nondamaged or mechanically damaged explosives.

Importance: This integrated program provides SNL with an opportunity to obtain crucial and unique experimental data for the ongoing development of fire models, the evaluation of impact/thermal mitigating materials used in hardened containers, and the characterization of the fire-induced response of energetic materials. This crucial data can be obtained inexpensively at the Russian facility.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Program plan	3	1
Characterizing the fire environment	10	3
Fabrication of simulated containers	11	3
Final report	12	0.5

Equipment Required and Estimated Cost:

One PC system suitable for providing electronic typed reports, data reduction, analysis, etc.: \$5K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

7.5 Russian man years \$35K

Equipment \$5K

Total \$40K

Institutes and Individuals Involved:

V. Modin and S. Subbotin, VNIITF (Chelyabinsk-70)

Capabilities of Russian Lab:

The VNIITF enclosed, large, fire-testing facility is capable of testing objects weighing up to 2 tons and containing up to 200 kg of high explosives. Temperatures between 600°C and 1000°C can be achieved by varying the fuel mass rate into the facility. Fire test data from this facility complements that which can be obtained at SNL.

Current Status:

In process

References:

None

Last Update:

February 1994

Title: **Explosion-Resistant Container Development**

Point of Contact:

Donald J. Bohrer, Sandia National Laboratories, 5202, MS9006, (510) 294-3111

Kevin E. Carbiener, Sandia National Laboratories, 5365, MS9035, (510) 294-2694

Summary:

This project will develop designs for explosion-resistant containers for safe handling and transportation of generic conventional explosive devices. The goal of these designs will be complete containment of both the explosive force and any hazardous byproducts of the unknown explosive.

Importance: This project will use the experience and expertise of the Russian Research Institute of Experimental Physics to develop a class of explosive containers not common to the experience of the US National Laboratories. It will develop this technology at a low cost and will fit well with Sandia responsibilities for transportation safety and accident-resistant containers. Whereas there are potential uses within Sandia for the container designs developed in this project, the greatest potential applicability would be for commercial and local government uses, which gives Sandia additional technology transfer opportunities.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Conceptual design presentation	2	0.9
Preliminary design report	6	1.1
Feasibility study results	10	2.0
Test plan	11	0.5
Final project report	12	0.6

Equipment Required and Estimated Cost:

One PC system suitable for simple finite-element calculations and for providing electronic typed reports, tables, etc.: \$3K

The PC will be provided, if available, through obsolete equipment.

Funding Level:

5.1 Russian man years	\$22K
Scale Model Test Hardware	\$5K
PC Equipment	\$3K
Total	\$30K

Institutes and Individuals Involved:

Anatoli L. Mikhailov, Deputy Head of Gas Dynamics Div., VNIIEF (Arzamas-16),
Phone 831-30 5-65-09, Fax 831-30 5-45-65

Anatoli G. Ivanov, Head of Dynamics Strength Dept., VNIIEF (Arzamas-16),
Phone 831-30 5-65-09, Fax 831-30 5-45-65

Capability of Russian Lab:

During the discussions, both Arzamas-16 and Chelyabinsk-70 showed interest in this project and indicated capabilities in container design. However, Arzamas-16 was most involved in discussing the details of this particular project, and their papers presented at the Albuquerque symposium indicated a greater depth of experience in designing containers similar to those in this project.

Current Status:

In process

References:

None

Last Update:

February 1994

Title:**Security Tag and Seal for Fissile Material Container****Point of Contact:**

John C. Matter, Sandia National Laboratories, 9249, (505) 845-8103

Summary:

The objective of this project is to develop a security tag and seal system for application to fissile material containers.

Importance: Fissile material containers are used for the safe transport and secure storage of a variety of fissile materials. Material owners and custodians need assurance that no one has tampered with the material during unattended periods. Security tags and seals are an important element of a verification system.

Deliverables/Time Frame:

Deliverable	Due Date (No. of months after contract award)	Russian Effort in man years (US Estimate)
Project plan	1	0.2
Requirements document	2	0.2
System design	4	1.0
Design review	5	0.2
Manufacturing instructions	6	0.5
Test plan	6	0.2
Test results	9	0.5
User manual	11	0.2
Demonstration	11	0.2
Final report	12	0.2

Equipment Required and Estimated Cost:

One fissile material container: \$2K
Materials for tag, seal, verifier: \$3K

Funding Level:

3.4 Russian man years	\$15K
Equipment and Material	\$5K
Total	\$20K

Institutes and Individuals Involved:

Boris Barkanov, Arzamas-16

Capability of Russian Lab:

In discussions with the Russians, SNL personnel have been told that Arzamas-16 staff have designed secure bolts and locks for specific containers.

Current Status:

In process

References:

None

Last Update:

February 1994

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