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FY91 through FY93
PROCESS DEVELOPMENT PLANS AND BUDGETS

ADVANCED DEVELOPMENT
MANUFACTURING DEVELOPMENT

September 1990

DEPARTMENT OF ENERGY UCNI REVIEW

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INTRODUCTION

The Process Development Program is defined as technology acquisition efforts that are required to: (1) develop jointly identified technologies that are expected to be used for weapons production and to insure that these technologies are successfully transferred to production, (2) improve current weapons production processes which includes supporting feasibility/demonstration studies for selected manufacturing technologies, and (3) maintain technologies, jointly identified with the design agencies, that are unique to the production plants.

ADVANCED DEVELOPMENT

This category of activities supports development and acquisition of new technologies for pre-Phase 3 weapon programs (GB-03-04), and weapons research (GB-01-03). Technical guidance for these activities is provided by the design laboratories. The criteria for the GB-03-04 activities are: (1) to develop those advanced technologies whose lead time to production is longer than that normally provided in a Phase 3 engineering development program, (2) to provide feedback to design laboratories regarding feasibility of possible new production materials and processes, (3) to allow AL to have early planning information regarding facility requirements and operating costs for new Phase 3 programs, and (4) to develop high priority, new technologies such as joining, coating, nondestructive testing and machining that will be associated with future, but as yet unspecified weapon programs and that have been designated as multiprogram technologies by the design laboratories.

The criteria for the GB-01-03 activities are nuclear weapons research and development work of an exploratory or investigative nature related to nuclear materials or nuclear components. While this definition is not restricted to uranium, lithium, plutonium, and tritium, fundamental investigation of the chemistry or metallurgy of these materials should be considered as preferred candidates for funding under this category.

WEAPON SYSTEMS DEVELOPMENT

This category of technology acquisition supports development activities associated with weapon systems programs (Phases 3 - 5) and with specified components for production programs (Phase 6). The criteria for these activities are: (1) to develop production processes for the specific new materials or processes associated with new weapon components with low producibility assessments, and (2) to ensure that these technologies have been adequately demonstrated and successfully transferred into production.

MANUFACTURING DEVELOPMENT

This category of technology acquisition supports development activities associated with the improvement of existing production processes and general plant operations. The criteria for these activities are: (1) to improve productivity, (2) to reduce the impact on existing production operations due to changes in Federal/State regulations, and (3) to advance the state-of-the-art of current production technologies.

ADVANCED MANUFACTURING FEASIBILITY STUDIES

These studies are Manufacturing Development activities that represent higher risk, longer range projects. These factory of the future studies are based on long-range manufacturing goals and objectives that could provide substantial benefits to the weapons complex.

In all process development categories, the plants will develop methods and technologies that comply with applicable federal, state and local laws regarding safety, health, and the environment.

ADVANCED DEVELOPMENT

MAIN CHARGE

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
1	[redacted]	LL-PX-011-AD-91	-	FY91	3.4	207	A. G. Osborn	E. H. Von Holtz, K. J. Scribner/LLNL
				FY92	3.2	225		
				FY93	3.4	251		

DOE (b)(3)

PURPOSE AND STATUS

[redacted]

DOE (b)(3)

NARRATIVE

- Develop small- and intermediate-scale processing techniques as candidate compositions are provided by Lawrence Livermore National Laboratory (LLNL) (FY91).
- Develop compositional analysis techniques (FY91).
- Develop pressing techniques for obtaining high density (> 99% of TMD) (FY91).
- Begin testing to IHE acceptance criteria (FY91).
- Characterize for energy, sensitivity, and physical properties, including tensile, compressive strength, and irreversible growth (FY92).
- Obtain final IHE certification from DOE Explosive Safety Committee (FY93).
- Scale up proposed formulation(s) and characterize for composition, particle size distributions, thermal stability, mechanical sensitivity, and physical properties (FY93).

UC

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
2	[redacted]	LA-PX-605-AD-90	-	FY91 FY92 FY93	1.7 1.6 1.7	101 125 127	T. L. Stallings	T. Rivera, R. D. Steele, G. W. Taylor/LANL

DOE b)(3)

PURPOSE AND STATUS

DOE b)(3)

[redacted]

The benefit of this project is improved safety of HMX PBXs.

DOE b)(3)

[redacted]

NARRATIVE

- Continue establishing of the large-scale gap and plate dent depth test capabilities using PBX 9501 for standardization (2nd quarter FY91).
- Continue development and evaluation of improved mixing methods for improving the pressed density [redacted]
- Evaluate slight modifications in binder content to adjust the coating thickness on HMX particles (FY91).
- Evaluate the modification of PBX by use of other binders and processes (FY91 to FY93).
- Conduct large-scale gap, plate dent depth, skid, rifle bullet, and thermal evaluation tests on materials as they become available (FY91 to FY93).
- Investigate feasibility of using ultrasonics for improving mixing (FY92 and FY93).

DOE (b)(3)

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
3	Snowball, Divergence Test for LX-17-1	LL-PX-001-AD-91	-	FY91	1.4	88	P. E. Kramer	K. L. Ball,
				FY92	1.3	100		W. G. Von Holle/LLNL
				FY93	2.3	180		

PURPOSE AND STATUS

The purpose of this new project is to establish a divergence test for production lots of IHE which is not as sensitive to density gradients as the Pantex Corner Turning Test.

NARRATIVE

- Vary thickness of LX-10 hemispherical shell booster to obtain partial divergence with the first production lot of LX-17-1 (FY91).
- Test current lots of LX-17-0 and LX-17-1 to establish a database for comparison (FY91).
- Publish report on test development and experimental results (FY91)
- Continue testing new lots and blends of LX-17-1 and investigate potential correlations with lot characteristics such as particle size (FY92 through FY93).
- Transfer tests to production (FY93).

UCNI

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
4	Supercritical Chromatography of High Explosives and High Explosive Formulations	LA-PX-601-AD-91	-	FY91 FY92 FY93	1.2 2.4 3.4	71 190 261	E. Kohn	E. D. Loughran, R. D. Steele/LANL

PURPOSE AND STATUS

DOE (3)

NARRATIVE

- Determine the feasibility of analyzing HEs such as HMX, RDX, and HNS by SFE/SFC (FY91).
- Explore mobile phases, columns, and detection systems (FY91).
- Evaluate analytical methods for HEs, using SFE/SFC techniques and determine types of impurities and concentrations which can be detected and analyzed (1st and 2nd quarters FY92).
- Evaluate analytical methods for complete analysis of PBXs, including binder analysis and molecular weight composition (3rd and 4th quarters FY92, 1st quarter FY93).
- Identify supercritical system for dissolving TATB (FY93).
- Observe the dissolution and precipitation of HEs such as RDX, HMX, HNS, and PETN from SFE operations and identify desirable particle sizes and morphologies (FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
5	Mechanical Properties Testing	LA-PX-603-AD-90	-	FY91	2.5	177	H. D. Johnson	R. V. Browning/LANL
		LA-PX-604-AD-90		FY92	2.4	163		
				FY93	3.0	214		

PURPOSE AND STATUS

Creep Testing

The purpose of this project is to develop a relatively inexpensive creep frame system in which several tests can run concurrently rather than serially, thereby reducing testing time and cost per specimen. Tensile and compression static creep tests are expected to provide the best insight into the time-dependent behavior of high explosives.

The benefits of this project are twofold. First, it can provide a mechanism for acquiring specialized physical properties information that can be used in the design of future weapons and the evaluation of material manufacturing variables. Secondly, it can be accomplished using very cost-effective tooling when compared to commercially available equipment.

The second generation prototype creep frame which incorporated knife edge bearings significantly reduced bearing friction. The reduced bearing friction caused a significant increase in the creep frame sensitivity to external vibrations. Techniques to isolate the creep frame from external vibrations (chamber fan motor, compressor motor, shock loading from adjacent frames, etc.) will be investigated.

High Strain Rate Testing

The purpose of this study is continued development of techniques and procedures for intermediate strain rate testing on existing equipment.

Work is currently being conducted on several weapon designs where relatively high strain rates in the range of 10 to 100 per second are encountered. Methods are needed to directly measure properties at these rates or at least to establish a correlation between the high rate properties and the conventional tests done at strain rates around 0.0001 per second. With this data, appropriate quality control tests can be devised for the HE used in production.

DOE (b)(3)

The initial test data suggest localized reinforcement because of strain gage bonding. Additional mock and HE specimens were gaged using several different gages and bonding adhesives. These specimens (10 each) were tested at ambient temperature (22°C) at speeds from 0.0021 to 787 mm/s. The test results show that the localized reinforcement on mock and HE specimens can be eliminated using bonding adhesives with high elongation (> 10%) capability. There have been several safety and operational modifications to the new high speed tooling.

NARRATIVE

Creep Testing

- Reduce creep frame response to environmental-chamber vibration (1st quarter FY91).
- Establish system response (noise, drift, temperature stability, etc.) (1st quarter FY91).
- Test mock compression and tensile samples to proveout overall system (2nd quarter FY91).
- Commence testing of one lot of PBX 9502 compression samples at temperatures of -54, 21, 50, and 74°C (3rd quarter FY91).
- Obtain additional creep frames (FY92).
- Complete compression testing of PBX 9502 (FY92)
- Commence testing of one lot of PBX 9502 tensile samples at temperatures of -54, 21, 50, and 74°C (1st quarter FY92).
- Complete tensile testing of PBX 9502 (FY93).

High Strain Rate Testing

- Make additional modifications to the new compression tooling to eliminate the alignment/friction problem (1st quarter FY91).
- Fabricate additional mock and PBX 9502 compression specimens and test at strain rates up to 700 mm/s at 21 and -54°C (4th quarter FY91).
- Evaluate the existing MTS Systems Corporation IMPAC 1212 tester and gas gun to extend the testing velocity up to 4000 mm/s (FY92).
- Investigate new equipment capabilities to extend testing rates (FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
6	Compatibility Testing - HMX-based PBXs	LA-PX-808-AD-90	-	FY91 FY92	1.7 0.8	101 60	P. A. Foster	G. F. Mortensen, G. W. Taylor/LANL

PURPOSE AND STATUS

The purpose of this project is to compare [redacted]

The benefit of this project is to provide aging data on two alternate explosives [redacted]

DOE (b)(3)

DOE (b)(3)

DOE (b)(3)

NARRATIVE

- Establish a method for the molecular weight characterization [redacted] (2nd quarter FY91).
- Make compressive strength parts using Los Alamos National Laboratory (LANL) and Pantex dimensions and test varying temperature, humidity, and speed rate to be able to standardize the results (2nd quarter FY91).
- Compile data from the DMSO study and compare to a similar study at LANL (3rd quarter FY91).
- Complete testing and write final report (FY92).

DOE (b)(3)

X

BOOSTER

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
7	Booster Materials	LA-PX-804-AD-90 LA-PX-805-AD-90	-	FY91 FY92 FY93	1.7 4.0 4.3	111 275 309	T. L. Stallings	J. A. Sanchez/LANL

PURPOSE AND STATUS

DOE b(3)

The purpose of this project is to provide booster material(s) [redacted]

DOE b(3)

NARRATIVE

- Complete evaluation of the X-0433 booster material by compositional analysis, drop hammer impact sensitivity, Differential Scanning Calorimetry (DSC), Chemical Reactivity Test (CRT), Thermogravimetric Analysis (TGA), sieve analysis, friction sensitivity, XTX-8003 corner turning test, and diametric disc testing (2nd quarter FY91).
- Continue evaluation of scaled up X-0407 batches, including E-Det initiation sensitivity; compositional analysis; sieve analysis; drop hammer impact sensitivity; DSC, CRT, TGA, and Accelerating Rate Calorimetry (ARC) thermal sensitivity; and friction sensitivity tests (FY91).
- Continue evaluation of other solvents for formulating X-0407 which do not change the PETN particle size distribution from the input material (FY91 and FY92).
- Develop pressing techniques to produce high-quality booster pellets for potential weapon applications (FY92 and FY93).

COMPONENTS

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
9	Extrusion Cast Explosives	SA-PX-003-AD-91	20	FY91	2.5	159	A. G. Osborn	R. G. Jungst,
				FY92	2.4	170		J. G. Harlan/SNLA
				FY93	4.4	330		

PURPOSE AND STATUS

DOE (b)(3)

NARRATIVE

DOE (b)(3)

- Characterize formulations for explosive performance in PLSC hardware (FY91).
- Evaluate new HNS extrudables as they become available (FY91).
- Evaluate new candidate binder materials as they become available (FY91 through FY93).
- Evaluate other explosives, as material becomes available (FY92).

DOE (b)(3)

- Develop reproducible manufacturing capability for formulations of interest (FY93).
- Continue evaluation of formulations of interest for component applications, including compatibility and performance studies, as directed by Sandia National Laboratories Albuquerque (SNLA) (FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
10	Fluorosilicone XTX	LA-PX-806-AD-90	-	FY91	1.7	101	P. A. Foster,	L. B. Chapman/LANL
				FY92	1.9	131	A. G. Osborn	
				FY93	2.6	194		

PURPOSE AND STATUS

The purpose of this project is to evaluate CF6-3500 fluorosilicone

DOE (b)(3

DOE (b)(3

NARRATIVE

- Evaluate effect of inhibitor to increase shelf life (FY91).
- Continue 5-year aging study (FY91 through FY93).
- Investigate binder effect on shelf life (FY92).
- Investigate effect of process variables on performance (FY93).

DOE (b)(3)

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
12	[redacted]	SA-PX-007-AD-91	10	FY91	2.5	154	N. O. Rhoton	A. J. Grimley,
				FY92	3.2	220		J. G. Harlan/SNLA
				FY93	3.4	246		

DOE (b)(3)

PURPOSE AND STATUS

[redacted]

DOE (b)(3)

NARRATIVE

- Fabricate additional dielectric switches and drivers, and perform evaluation studies for final design (FY91).
- Evaluate the driver switch component for aging and mechanical integrity (FY92).
- Establish outside vendors for manufacture of the switch elements (FY92).
- Transfer to production (FY93).

UCN

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
13	Boron Loaded Potting	LA-PX-501-AD-90	-	FY91	1.7	106	S. G. Hallett	C. W. Sandoval/LANL
				FY92	1.6	112		
				FY93	1.8	123		

PURPOSE AND STATUS

The purpose of this project is to provide boron loaded composite material and processing technology for use as neutron flux shielding in weapon applications.

The potential benefits to be derived from this project include development of a cast-in-place shield material and introduction process that will replace the current need for separate shield production and component assembly operations. In addition, a material injection method of shield introduction potentially allows shielding capacity in small regions currently unshielded.

A customized, low-molecular weight silicone polymer has been selected as the binder for this material. It is currently being thoroughly characterized. The effect of boron volume loading and particle size distribution on flow characteristics have been studied. Analytical techniques to evaluate lab-scale shield formulations have been identified. Shield material injection parameters are being optimized using test fixtures.

NARRATIVE

- Optimize shield material injection parameters (FY91).
- Coordinate process with Allied Signal KC to ensure smooth transition and compatibility with existing processes (FY91).
- Evaluate shield/system material compatibility issues (FY92).
- Examine in-place shield inspection techniques (FY92).
- Examine environmental aging effects, including radiation (FY93).
- Optimize parameters and processes and scale-up for production applications (FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
14	Miniature Wedge Test	LA-PX-901-AD-91	-	FY91	0.8	48	N. O. Rhoton	J. E. Kennedy/LANL
				FY92	0.8	60		

PURPOSE AND STATUS

[redacted]

DOE (b)(3

NARRATIVE

- Develop techniques for fabricating the explosive mini-wedge (FY91).
- [redacted]

DOE (b)(3

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
15	Paste Explosive Compatibility	SL-PX-001-AD-91	-	FY91 FY92	2.5 3.2	149 230	P. A. Foster	B. E. Mills, J. R. Spingarn/SNLL

PURPOSE AND STATUS

DOE b)(3)

[redacted]

NARRATIVE

DOE (b)(3)

- Establish materials [redacted] to be tested with the PEX (1st quarter FY91).
- Determine test matrix and tests to be performed on the materials (1st quarter FY91).
- Obtain materials for the study (2nd quarter FY91).
- Start compatibility study (3rd quarter FY91).
- Continue study and write final report (FY92).

DISASSEMBLY

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
16	Real-time Environmental Monitoring	LA-PX-809-AD-91	-	FY91	0.8	98	P. A. Foster	G. W. Taylor/LANL
				FY92	1.6	110		
				FY93	1.7	125		

PURPOSE AND STATUS

The purpose of this new project is to establish a comprehensive, continuous, and realistic environmental database for weapon igloos, chemical storage igloos, buildings that house various chemical standards, and buildings that contain compatibility studies. Knowing the exact environmental conditions that the materials have seen will allow modeling of the chemical changes occurring in the stockpile.

The benefits are improved stockpile safety and reliability.

NARRATIVE

- Establish the locations for the dataloggers (1st quarter FY91).
- Obtain the dataloggers and necessary sensors (1st quarter FY91).
- Start 10-year data collection (2nd quarter FY91).
- Complete 1st year of study (2nd quarter FY92).
- Complete 2nd year of study (2nd quarter FY93).

UNC

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
2	X-0463 Hemishell Surveillance	LA-PX-807-AD-90	-	FY91	1.2	50	S. G. Doak	E. D. Loughran,
				FY92	1.2	50		L. E. Hetler/LANL
				FY93	1.4	84		

PURPOSE AND STATUS

[redacted] DOE (b)(3)

NARRATIVE

[redacted] DOE (b)(3)

- Place pressings in an environmental chamber for a period of approximately 1 year. The chamber will be operating in the temperature range of -65 to 165°F and the cycle is repeated every 24-hour period. Re-inspection of the parts using radiography and dimensional checks will occur each month for the first 3 months of thermal cycling and then at 3-month intervals for the remainder of the year. The final inspection will include radiography, dimensional measurement and dye penetrant tests to check the integrity of each pressing (2nd quarter FY92).

UC

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
3	Improved High Explosive Machining Safety Systems	LL-PX-012-MD-91	-	FY91 FY92	0.2 0.2	111 12	M. L. Dworzack	W. M. Robeson/LLNL R. A. Hildner/LANL

PURPOSE AND STATUS

The purpose of this project is to enhance HE machining safety and to develop commonality in machine controls between LLNL, LANL, and Pantex.

The benefits of this project are enhanced safety and reduced development costs.

This new project is a cooperative effort between the design labs and Pantex to provide an efficient way of implementing HE machining safety. It will reduce duplication and promote standardization.

Provisions for common operator interface screens for IBM controller has been done. Provisions for common machine environment monitoring has been done.

NARRATIVE

- Develop specification criteria for in-process control software (FY91).
- Analyze in-process gauging capabilities jointly with LANL and LLNL (FY91).
- Improve current multi-axis tool force monitoring systems (FY92).

COMPONENTS

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
4	HNS Manufacture	SA-PX-005-MD-91	10	FY91	2.5	159	A. C. Teter	R. G. Jungst,
				FY92	2.4	165		J. G. Harlan,
				FY93	1.7	135		S. G. Barnhart/SNLA

PURPOSE AND STATUS

The purpose of this project is to develop reproducible processes for the manufacture of HNS I, HNS IV, and HNS DT.

The benefits of this project are the production of controlled morphology explosives with reduced levels of foreign particles and lower costs.

A reproducible process for controlling the surface areas of HNS IV and HNS DT was successfully developed.

NARRATIVE

- Optimize the critical parameters affecting the surface areas and the purity of the products (FY91).
- Establish a formal HNS I quality improvement program (FY91).
- Determine the reproducibility for the processes on the Pilot Plant scale (FY91).
- Develop improved methods for the reduction of foreign particles in each of the processes (FY92).
- Complete evaluation of ultrasonics for producing high surface area HNS (FY93).

UC

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
5	Explosive Particle Morphology	SA-PX-002-MD-91	20	FY91	1.2	71	A. A. Duncan	R. G. Jungst,
				FY92	1.1	75		J. G. Harlan/SNLA
				FY93	1.2	82		

PURPOSE AND STATUS

The purpose of this project is to establish, maintain, and improve methods used to characterize the particle morphology of explosives.

The benefit of this project is improved understanding of detailed relationships between particle properties of explosives and their performance. This will enable better control of manufacturing processes, result in a more uniform product, and enhance component reliability.

In FY90, light scattering techniques for characterization of powders were studied. A Spectrex Laser Particle Counter has been implemented for measuring the particle size of explosives. This instrument can be used to detect and count the number of particles, above a manually set threshold between 1 and 100 µm, in a bottle filled with liquid. The benefit of this system is rapid means of analyzing process control samples.

Upgrading of the scanning electron microscope for wavelength dispersive x-ray spectroscopy has been accomplished. In conjunction with this upgrade, the image analysis system has also been upgraded. Upgrading of the image analysis technique consist of implementing a Stored Image Analysis Program. This program is designed to perform image processing, particle sizing, and chemical characterization on irregular shaped and overlapped particles. The benefit of this capability is the measurement of irregular shaped particles and the identification of chemical contaminates, decomposition products, and unknown impurities in powders and on solids.

NARRATIVE

- Continue investigation of light scattering and image analysis techniques for characterization of explosive powders (FY91).
- Develop procedures for chemical characterization of thin film contaminates, formulations, and surface impurities (FY91).
- Develop procedures for measuring particle size distributions (FY91).
- Continue development of improved particle characterization methods (FY91 through FY93).
- Develop procedures for measuring the permeability of compacted explosives (FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
6	Flying Plate Sensitivity Test	SA-PX-004-MD-91	50	FY91	2.2	151	N. O. Rhoton	R. G. Jungst/SNLA
				FY92	1.6	120		
				FY93	1.7	145		

PURPOSE AND STATUS

The purpose of this project is

1. to measure the time related pressure input to explosive material [redacted]
2. to provide better simulation [redacted] and
3. to improve precision so that variation resulting from aging, process variations, and morphology can be evaluated.

DOE (b)(3)

DOE (b)(3)

The benefits of this project will be a better understanding of explosives used in weapon applications as related to reliability, aging stability, and explosive processing.

Dual matched firing sets were fabricated and checkout was begun. The systems were unstable and new capacitors were purchased and installed.

A quality improvement program was initiated for control of the fire set electrical characteristics.

NARRATIVE

- Evaluate the factors influencing the precision and accuracy of the test calibration (FY91 through FY93).
- Implement the quality improvements for materials gaging, test component fabrication, assembly, and testing (FY91 through FY93).
- Characterize the Kapton (0.015-inch diameter x 0.001-inch thick) flyer test to determine the effect [redacted] on flyer quality and pressure input at impact (VISAR) (1st quarter FY91).
- Continue to investigate new flyer and bridge material and sources (FY91 and FY92).

DOE (b)(3)

UC

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
7	General Computed Tomography for NDE	LL-PX-007-MD-91	-	FY91 FY92	1.0 1.0	42 42	J. P. Cassidy	H. E. Martz, P. B. Mohr, D. Schneberk/LLNL

PURPOSE AND STATUS

The purpose of this project is to establish a basic Computed Tomography (CT) capability at Pantex, with planned application on fireset evaluation.

The benefit of this project is development of an improved inspection technology beyond that available with current systems.

Components for a basic CT system have been received and assembly is in process.

NARRATIVE

- Complete assembly and begin checkout of the system (FY91).
- Investigate uses and characterize system performance (FY91 and FY92).
- Implement in production (FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
8	Test Fire Techniques	SA-PX-009-MD-91	40	FY91	5.0	317	P. E. Kramer,	J. G. Harlan/SNLA
				FY92	4.8	360	K. K. Kuhrts,	
				FY93	5.1	400	T. O. Meyer	

PURPOSE AND STATUS

The purpose of this project is to develop test-fire techniques that, in general, support component design and production test methods. DOE (b)(3)

The benefit of this project is to advance the state-of-the-art of test-fire technologies to insure adequate support for upcoming components and/or explosives. DOE (b)(3)

Equipment for the Modular VISAR has been purchased and installation and testing has begun. DOE (b)(3)

Conventional VISAR was used to measure particle velocities at the interface of an SIP gage rear surface and a plexiglas substrate for the case of a stainless steel flyer impact at the SIP gage front surface. Similar measurements were made at the interface of an 0.013-inch-thick polysulfone sheet and an aluminized plexiglas window with explosives detonated at the front of the polysulfone.

The gas gun and conventional VISAR were improved to allow characterization of phosphor coating materials.

NARRATIVE

- Characterize response of Polysulfone SIP gages in direct contact with explosives (FY91).
- Improve techniques for obtaining diffuse reflective surface on VISAR targets (1st and 2nd quarters FY91).
- Continue to assist SNLA in improving their soft X-ray capability (FY91).
- Utilize information from algorithms and contour plots to obtain better images of very small conical shaped charges (FY91).
- Continue development of Modular VISAR system (FY91).
- Investigate use of flash X-ray with electrically driven plastic flyers (FY91).
- Identify alternatives for Kodak DEF as a soft X-ray film (FY91).
- Pursue "unsharp mask" technique for enhancing flash X-ray images (2nd quarter FY91).
- Compare conventional and Modular VISAR systems (2nd quarter FY91 through FY92).
- Extend flash X-ray investigation to include hard X-rays (FY92 through FY93).
- Provide continuing assistance to QA test fire for implementing interferometer techniques (FY91 through FY93).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
9	Surface Science Techniques		-	FY91	0.8	58	B. R. Richardson	
				FY92	1.6	125		
				FY93	1.7	150		

PURPOSE AND STATUS

The purpose of this new project is to apply Auger electron spectroscopy, scanning Auger microscopy, and closely-related electron microscopy methods to characterize the surfaces of weapons components, high explosive impurities, and residue from waste streams.

The benefit of this project is to provide these state-of-the-art surface-sensitive techniques plantwide to solve a number of contamination and/or corrosion problems.

NARRATIVE

- Procure Auger electron spectrometer and begin evaluation of instrumental capabilities (FY91).
- Develop procedures to specifically support the RTG shelf-life study (FY91).
- Develop procedures and explore new applications (FY92 through FY93).

ASSEMBLY

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
10	Digital Imaging and Analysis	LL-PX-005-MD-91	-	FY91	0.2	11	J. P. Cassidy	J. J. Haskins,
				FY92	0.2	12		D. E. Perkins,
				FY93	0.2	12		P. B. Mohr/LLNL

PURPOSE AND STATUS

The purpose of this project is to expand digital image processing capability at Pantex and provide compatibility and adequate storage media for the NWC.

The benefits of this project are improved quality, reproducibility, and productivity of radiograph interpretations; digital storage of NDE data; and data linking to the design agencies.

NARRATIVE

- Define a system for image processing and data transfer (FY91).
- Obtain computer capability and software (FY92).
- Implement and evaluate system (FY93).

AMFS

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
12	Computed Tomography for Inspecting High Explosives	LL-PX-006-MD-91	-	FY91 FY92	0.2 1.8	111 77	C. L. Pratt	D. E. Perkins, H. E. Martz, P. B. Mohr/LLNL

PURPOSE AND STATUS

The purpose of this project is to determine if Computed Tomography (CT) can replace radiography, shadowgraphing, dye penetrant testing, density core sampling, and bulk density measurements with a single operation.

The benefits of this study are reduced number of manufacturing steps, improved safety, improved quality, and reduced costs.

A draft report on the small-scale experiments has been written and explosive billets for large-scale experiments have been fabricated.

NARRATIVE

- Continue large-scale experiments at LLNL (FY91).
- Develop specifications for large CT scanner (FY91).
- Complete final report (FY91).
- Transfer technology to production (FY92).

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
13	Magnetic Resonance Imaging of High Explosives		-	FY92	1.6	202	B. R. Richardson	
				FY93	1.7	216		

PURPOSE AND STATUS

The purpose of this project is to determine the feasibility of using magnetic resonance imaging (MRI) for characterizing pieces of high explosives.

The benefit of this project is the development of an alternate to X-ray examination for the detection of cracks, voids, and inclusions (metallic or otherwise) within pieces of high explosives. Such a program will reduce personnel exposure to X-ray radiation while improving the reliability to detect flaws within pieces of high explosives.

NARRATIVE

- Establish contacts with design agency personnel with MRI instrumentation and develop their interest in the project (FY91).
- Survey the literature and interview industrial/academic contacts to determine the state-of-the-art for abundant spin systems (e.g., ^{1}H, ^{19}F, ^{31}P) and rare spin systems (e.g., ^{13}C) (FY91 through FY92).
- If technique appears safe and non-destructive with high explosives, coordinate the MRI examination of several high explosives with the appropriate personnel (FY92 through FY93).
- Evaluate the results of the high-explosives examination in light of the quality of the data produced (FY93).
- Judge whether the results justify the prices of the MRI instrumentation (FY93).

UC

No.	Project Title	Lab Designators	Est. FY91 Reimbursables ($K)	FY	MY	TD $K	Plant Contact	Laboratory Contact/Lab
14	Plasma Induced HE Surface Modification		-	FY91	1.7	121	S. G. Hallett	
				FY92	1.6	152		
				FY93	1.7	166		

PURPOSE AND STATUS

The purpose of this project is to assess the feasibility of performing plasma induced surface chemistry modifications on finely divided HE particles and pellet surfaces.

The anticipated benefits of this project are

1. Improved formulation processes resulting in superior HE performance characteristics,

DOE (b)(3)

5. reduced solvent usage.

Safe operating regimes of chemistry and RF energy have been established for TATB and HNS powders. Methods of characterizing plasma-treated particle surfaces are being investigated.

NARRATIVE

- Identify acceptable analytical technique for use in characterizing treated explosives (FY91).
- Demonstrate particle surface modification feasibility for a variety of other explosive materials (FY91).
- Refine plasma treatment process (FY91).
- Conduct lab-scale experiments evaluating plasma-modified HEs with regard to handling, formulation, pressing, and adhesion applications (FY92).
- Optimize parameters and tailor treatments to specific material requirements (FY93).
- Begin to evaluate production-scale feasibility (FY93).

UC

FY91 THROUGH FY93 PROCESS DEVELOPMENT PLANS AND BUDGETS

COST AND MANPOWER SUMMARY TABLE

	FY91		FY92		FY93	
	MY	TD $K	MY	TD $K	MY	TD $K
Advanced Development Total	33.6	2115	36.0	2571	38.8	2854
Weapon Systems Development						
W89	5.0	278	4.9	264	1.4	84
B90	5.0	317	3.2	204	2.6	200
SRAM-T	1.7	111	1.6	102	1.7	136
Weapon Systems Development Total	11.7	706	9.7	570	5.7	420
Manufacturing Development						
Other	16.8	1119	18.4	1363	19.7	1517
AMFS	1.9	232	5.0	431	3.4	382
Waste and Hazard Minimization	7.2	544	13.1	973	13.5	1035
Manufacturing Development Total	25.9	1895	36.5	2767	36.6	2934
GRAND TOTALS	71.2	4716	82.2	5908	81.1	6208

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LABORATORY GUIDANCE CROSS

Lab Designator	Advanced Development Product Family/Project No.	Project Title
LANL		
LA-PX-501-AD-90	Components/13	Boron Loaded Potting
LA-PX-601-AD-91	Main Charge/4	Supercritical Chromatography of Explosives and High Explosive Formulations
LA-PX-602-AD-91	Booster/8	Fine-particle-size TATB
LA-PX-603-AD-90 LA-PX-604-AD-90	Main Charge/5	Mechanical Properties Testing t
LA-PX-605-AD-90	Main Charge/2	Desensitization of HMX-based PBX
LA-PX-804-AD-90 LA-PX-805-AD-90	Booster/7	Booster Materials
LA-PX-806-AD-90	Components/10	Fluorosilicone XTX
LA-PX-808-AD-90	Main Charge/6	Compatibility Testing - HMX-based nts/ st
LA-PX-809-AD-91	Disassembly/16	Real-time Environmental Monitor
LA-PX-901-AD-91	Components/14	Miniature Wedge Test
LLNL		
LL-PX-001-AD-91	Main Charge/3	Snowball, Divergence Test for LX
LL-PX-011-AD-91	Main Charge/1	High Energy Reduced Sensitivity d
SNLA		
SA-PX-001-AD-91 SA-PX-008-AD-91	Components/11	BTF Explosive Processing and Synthesis of Advanced Explosiv
SA-PX-003-AD-91	Components/9	Extrusion Cast Explosives
SA-PX-007-AD-91	Components/12	Solid Dielectric Switch
SNLL		
SL-PX-001-AD-91	Components/15	Paste Explosive Compatibility

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